The Future Smart-City: An Analysis of the Effects of Global and Technological Innovation on the Evolution of Economic Systems

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Abstract

In 21st century, the current economy is rapidly utilizing globalization to create a vastly different future. With the advent of new technology merging with entrepreneurs who effectively utilize that technology, the economic model is changing. Faster, sleeker, more effective forms of communication and information transfer drive the process of globalization. Production for a single product can happen in multiple countries, companies can operate virtually 24/7 through call centers halfway around the globe, and preliminary smart cities are beginning to emerge to give us a glimpse of the future world. A new category of businesspersons called “prosumers” is emerging and has created a new sharing and soon-to-be self-service economic structure. Analysis of the two drivers of economic change—globalization and technological innovation—will reveal how close civilization is to the city of the future.

Keywords: globalization, technology, economic restructuring, smart cities, prosumers

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Ronald Reagan, the great orator and beloved former president of the United States, once declared, “There are no great limits to growth because there are no limits of human intelligence, imagination, and wonder” (Hennessey, 2014, para. 3). This sentiment of continuous intrigued investigation and development encapsulates the drive needed to propel the world forward to new eras of politics, government, technology, economics, and the arts. Even so, some feats of science seem impossible despite human ingenuity. But are they? What if society already has the ability to contract time and space, enabling technological ubiquity that will result in a world drastically different from the one that exists now? What would this new future—one of which scientists have barely begun to scratch the surface—look like?

According to analysts, society is precisely in that transitional period of history, “defining new parameters and advancing the frontiers of economic connectivity” (Passaris, 2006, p. 3). The explosive rise of technology and increased globalization and adaptation are fundamentally changing the basic understanding of an economy that mankind has utilized for thousands of years. This new age will challenge the very idea of “daily life” and the structure of an economy as it currently exists.

History illustrates that nations and people-groups have consistently graduated from one form of an economy to another as intellectual and human capital have increased. From a barter economy through various industrial and technological revolutions, the definition of a “business” and its relationship to its consumers have molded to fit the times. An examination of the basic structure of an economy and

competitive advantage followed by an analysis of the evolution of the economy throughout history, focusing primarily but not exclusively on the United States, will lead to an understanding of the new economic model and the future of smart-cities.

The Structure of an Economy

Every economy requires four factors of production: natural resources, human resources, capital, and entrepreneurship ("Factors of Production"). These building blocks are used to produce goods and services which, when put on the market, propel economic activity. How these factors of production are managed and the proportions in which they comprise a nation's economy determines the economic prosperity and growth potential of a nation. For instance, every civilization in antiquity began with an agricultural economy focused on utilizing land and labor. With time, trade, and improved technology, these economies gained the ability to invest more in human and intellectual capital. Industrializing societies paved the way for more entrepreneurship, in turn creating more economic wealth. Thus, the economic structure and prioritization of certain market elements over others "indirectly affects the growth process" because certain "technology-intensive production structures are growth enhancing" while other models are more suitable to maintenance (Constantine & Khemraj, 2018, p. 9).

An understanding of this concept then begs the question: what gives a certain country or economic model a competitive advantage? In short, knowledge and innovation. These attributes can drastically move an economy from an agricultural society to industrial to technological and beyond. As Passaris (2006) eloquently declares, "The role of innovation as a catalyst that drives the engine of economic growth needs to be acknowledged as a fundamental postulate of the new global economy" (p. 2). Every

economic era of history that has seen great change has developed as a result of societal change and a newfound discovery.

The most notable period of economic transformation was the Industrial Revolution, which fueled the world into a new age. The Industrial Revolution was significant for its manufacturing advances and transitioned the U.S. economy (and other nation's economies as they followed suit) from a more agrarian society to a manufacturing hub. This restructuring resulted in an improved quality of life, better products, and explosive economic growth. Similarly, in recent years, much of the developed world has entered an Information Revolution, one that focuses on data gathering and processing and the application of human and artificial intelligence to achieve technological advances (Passaris, 2006, p. 3). These advances, in turn, provide more efficiency and, once again, improved quality of life and economic growth. Whichever country or society can best achieve and apply knowledge and innovation to its fundamental economic structure will obtain a competitive advantage over other nations. But before analyzing what the future economic model may look like, it is essential to determine how nations arrived at this "new global economy" and the effects of such globalization.

Globalization and the Evolution of Economies

Friedman (2007) pinpoints the history and future of globalization in economics. Highlighting how globalization has made the world "flat" by allowing fair competition between large and small companies, corporations and individuals, and countries and continents, Friedman (2007) gives insight into how the world has changed as a result of innovation and history colliding at the right time.

The Historical Concept of Globalization

In a broad sense, globalization "encompasses the international flow of ideas and knowledge" (Bang & Markeset, 2012, p. 233). More specifically, it is the "global integration of economies through trade and investment flows, as well as the production of goods and services in order to enhance international competitiveness" (Passaris, 2006, p 3). Every era of history progresses from the previous one. For the first time in history, the predominance of capitalism worldwide as well as the ability to communicate and coordinate easily across the globe have converged to provide the perfect breeding ground for a flat world.

Friedman (2005) labels three distinct eras of globalization as 1.0, 2.0, and 3.0. He writes, "The dynamic force in Globalization 1.0 was countries globalizing and the dynamic force in Globalization 2.0 was companies globalizing, the dynamic force in Globalization 3.0 -- the thing that gives it its unique character -- is individuals and small groups globalizing" (Friedman, 2005). The first era of globalization began when Christopher Columbus discovered the Americas, opening trade routes between the New World and the Old. Countries began to see the advantages of trade and global interaction. The world was then drawn even closer in the following era of globalization with the emergence of faster and better transportation and communication and the industrialization of businesses (Schwab,

Figure 1. Globalization Visualized (Follett, 2016)

2019). Finally, in this new millennium, the power to affect change and join the global workforce is in the hands of individuals, thanks to incredible advances in technology and increased awareness of competitive advantage worldwide (Friedman, 2007, pp. 9-10).

The fast-paced changes that have occurred since early digitalization and increased international collaboration began in Globalization 3.0 have marked yet another defining shift. This new era, Globalization 4.0, is simultaneously being termed the "Fourth Industrial Revolution" (Schwab, 2019, para. 2). This revolution will involve "the complete digitization of the social, the political, and the economic" and is "tugging at the very fabric of society" while "fundamentally transform[ing]…the way that individuals relate to one another and to the world at large" (Schwab, 2019, para. 2). The primary driver of the future economic model is technological innovation and integration.

Known as Information and Communication Technology (ICT), innovations, starting from the development of the computer to the world-wide web to the computing power of a mobile phone, have revolutionized the world (Friedman, 2007). This new technology makes more information available to more people and allows companies to better streamline, process, and analyze data. Moreover, reliable communication mechanisms allow an individual to almost instantly transfer data to someone in another country. Used effectively, this process of outsourcing essentially generates 24/7 operations (Friedman, 2007).

Political events and business applications have greatly contributed to the creation and predominance of ICT. Removing barriers to global trade and political and economic freedom spearheaded the integrated economy present today, and the development of the PC and Netscape marked the beginning of the technological revolution (Friedman, 2007).

By making more information available to more people, these developments allowed companies to better streamline, process, and analyze data, changing how business operates.

One of the primary incentives that pushed forward global collaboration and integration was the Y2K computer crisis (Friedman, 2007). Essentially, as year 2000 came at the turn of the millennium, computer time clocks were only able to track calendar dates up to 12/31/99. When 01/01/2000 came, these clocks would resent to 01/01/00, presuming the 00 stood for 1900. In order to avoid a global crisis with computerized management systems shutting down with errors due to the time change, the internal clocks needed to be completely reset (Friedman, 2007). India stepped forward to assist America in the grunt work of the resets, and other countries soon followed suit in developing similar business partnerships. The same outsourcing and reliable communication and data transfer mechanisms that enabled large corporations to work with someone in another country soon became simple and accessible enough for small businesses and even individuals to use. The effects of globalization and technological innovation trickled down from large corporations and put the power in the hands of the individual to compete on the same level. Little by little, the increase in the capability and freedom of technology has reshaped the world to a different place for collaboration.

The acceleration of technological change allowed Information and Communication Technologies (ICTs) to spread quickly and become a part of everyday life. In fact, by the mid-1990s, researchers began to envision future cities where ICTs would be instrumental in city management and the influence of democracy (Angelidou, 2015). These same individuals believed man could one day blend “computing and

information processing into the objects of the everyday environment, to the level that they are not obvious any more to the human perception, known as 'ubiquitous computing'" or 'technological ubiquity,' a concept which will be discussed in more depth later (Angelidou, 2015, p. 98).

The Changing Business and Consumer Relationship

Thus far, the description of economic structures has been fairly theoretical. Now begins an examination of the practical effects on the users in an economy. Every economy has two prongs: development and integration. Take, for instance, the Industrial Revolution. The development of the economy was fueled by manufacturing and machine technology improvements, which were integrated into the economy by the rise of big businesses and consumer consumption. In current times, development is powered by a knowledge and innovation economy. The effects of this new knowledge and innovation economy are seen in the rise of the uncharted territory of a sharing and self-service economy. A new economic model, however, necessitates a different economic structure.

With each one of the different types of economic structures, there exists a changed relationship between businesses and consumers. Formerly, most economic transactions could be categorized into three primary relationships—Business-to-Business (B2B), Business-to-Consumer (B2C), and Consumer-to-Consumer (C2C) (Nemat, 2011). Business-to-Business comprises the largest number of transactions from barter and trade economies to industrialized nations because most processing and manufacturing occurs through B2B transactions with only the end product being sold B2C (Nemat, 2011). However, the rise of the global economy and the parallel rise in e-commerce in recent

years has been pushing the C2C relationship into the spotlight and changing the very definition of businesses and consumers.

Castro, Atkinson, and Ezell of the Information Technology and Innovation Foundation label this new, modern category of individuals as "prosumers." They explain, "In the old economy, for the most part, producers produced and consumers consumed…This dichotomy between producers and consumers is blurring…[because] digital tools are enabling consumers to become…'prosumers' who act at the same time as both consumer and producer" (Castro, Atkinson, & Ezell, 2010, p. 167). Evidence for the prosumer is most clearly noticed through sharing businesses like Uber or AirBnB where individuals can use the same service as either a consumer or as a driver, host, and producer. This new category and relationship between "businesses" and "consumers" denotes a shift towards the predominant economic model of the future.

Cost Structure and Market Expectations Influencing Increased Technological Integration

Cost structures are categorized into one of two proportions: either high variable costs and low fixed costs, or low variable costs and high fixed costs (Garrison, Noreen, & Brewer, 2018). Each cost structure has advantages and disadvantages; thus, the best choice for cost accounting and management will depend on the specific financial situation of the company and its future expectations.

High variable costs and low fixed costs result in a larger margin of safety and prove advantageous in financial or economic downturns. On the other hand, low variable costs and high fixed costs provide a larger contribution margin, leading to a greater increase in net operating income should sales increase (Garrison, Noreen, & Brewer,

2018). In general, “managers adjust cost structures in response to changes in risk-taking incentives…[and] increased uncertainty drives managers to prefer technologies with low fixed costs and high variable costs” (Aboody, Levi, & Weiss, 2017, pp. 423-424). The greater the risk or uncertainty of future profit, the more beneficial it is for a company to err on the side of caution and prioritize variable costs. If the company must harvest or divest certain divisions out of financial necessity, it is fairly simple to lay off employees or cut operations. However, it would take longer and be harder to remove fixed equipment. Conversely, the alternate cost structure of high fixed costs and low variable costs works because if the revenues generated from a one-time capital asset investment exceed its costs, the profit margin grows in the long-term.

These capital assets and fixed costs often reference new technology used in operations. Historically, the economy shows a consistent, upward growth trend. Although temporary periods of time may lapse into a recession, the economy always corrects, recovers, and continues to grow. Increasingly, technology is becoming a more prominent contributor to reducing costs and growing income. Automation tends to fall more in line with a “lower variable and higher fixed costs” cost structure that will increase the contribution margin in expectation of future revenue growth. It is innovative and can sometimes be risky, but successfully integrated technology can greatly decrease long-term costs. Since the economy is expected to grow, a higher fixed- and lower variable-cost structure is preferred, and technology majorly contributes to this economic development. Inventory management, supply-chain efficiency, overhead, direct labor, and direct materials are all affected through the installation of automated equipment (Garrison, Noreen, & Brewer, 2018).

The New Sharing and Self-Service Economy

The key phrase for the future economy is "technological ubiquity." What is technological ubiquity? Essentially, technology will become so intertwined in our daily lives—our purchasing methods, means of transportation, scheduling, city layout, personal recommendations from habit-tracking data—that we will fail to recognize it as a novelty anymore. Consider an elevator. In times past, elevators required an elevator operator to maneuver the lift to its proper floor. However, modern elevator technology was soon developed and seamlessly integrated into modern life through elevator buttons passengers press themselves. Now, hardly anyone remembers a time when elevators were not self-operated, and most people do not even consider an elevator ride a marvelous feat of technology.

Passaris (2006) summarizes the catalyst and goals of this new economy: "The fuel of the new economy is technology and its currency is human capital. The product of the new economy is knowledge and its market is the virtual marketplace of the internet" (para. 2). Technological ubiquity will undoubtedly lead towards the all-encompassing "smart-city" of the future, but even in current times the beginning applications of sharing and self-service technology has struck a positive cord with people.

Smart-Cities

Current definitions of a smart-city label it as a city that utilizes and integrates information and communication technologies to increase operational efficiency, decrease waste, collect data, and improve general welfare. A smart city is an urban area that "uses IoT sensors and technology to connect components across a city to derive data and improve the lives of citizens and visitors," often employing a mobile application as a

means of quickly spreading information and communicating with users (Maddox, 2018, para. 6).

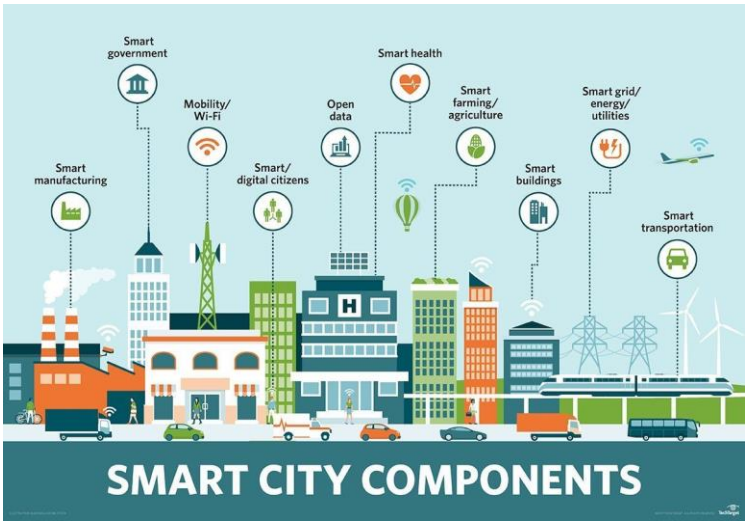

Figure 2. Smart City Components (Rouse, Shea, & Burns, 2017)
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The continued integration of new forms of technology continues to bridge gaps between producers and consumers, and if this technological integration progresses in the same manner it has been for the past few decades, the creation of smart cities is not too far in the future indeed. Smart cities are still a relatively new topic of research that is slowly gaining prominence in the academic community. Consequently, as analysts are working to define smart-cities through a "holistic interpretation…based on a progressive and human-centric perspective of ICT-driven urban innovation and development, and the balanced combination of human, social, cultural, environmental, economic, and technological aspect" (Mora, Deakin, & Bolici, 2017, p. 19). This well-rounded view of future daily life provides researchers with a common goal and clear directions for the urbanization and digitalization of cities.

Angelidou (2015) notes that the knowledge and innovation economy that grew with the rise of globalization was the critical foundation for the emergence of the smart city. As people in various countries could begin to share their work, research, and ideas, global collaboration increased general knowledge and allowed for greater technological

advances. It also allowed planners to consider the very definition of a smart city, how it ought to work, and what it can accomplish. Batty, Axhousen, Giannoti, Pozdnoukhov, Bazzani, Wachowicz, Ouzounis, and Portugali (2012) continue in explaining the significance of the smart city:

> Rather than letting the market dictate the way cities grow and sprawl, smart growth is a movement that implies we can achieve greater efficiencies through coordinating the forces that lead to laissez faire growth: transportation, land speculation, conservation, and economic development. (p. 486)

Economically speaking, a smart city is defined as "a new market for urban management" (Albino, Berardi, & Dangelico, 2015, p. 6). Future cities will have the technology and capability to coordinate "fragmented sub-systems" like energy and water (Albino, Berardi, & Dangelico, 2015, p. 6). Supply-chain logistics will minutely track what customers buy and automatically order and recalculate supply needs. E-commerce is estimated to continue growing at an annual rate of 28% (Smith, 2011). Mobile phones will become the central hub for life in the city, not by people individually using them for their own, separate purposes but by coordinating and condensing all city information and systems in a manner that services all equally. Schwab (2019) notes that "the twin trends of digitization and virtualization are creating an economy of near-unlimited mobility in which cyberspace is home to all data" (para. 10). Smart systems are now not only analytical but also predictive (Schwab, 2019).

We have already observed the emergence of QR codes for advertising or ticketing and the development of mobile-pay applications in lieu of wallets and physical money or credit cards. And some businesses have already recognized the economic value of

digitalizing with user-friendly interfaces. Following is an examination into developing technologies that are either already in-use or are soon-to-be in use and which will characterize the new economy and urban city.

Sharing economy: Uber and AirBnb. Before delving into the future of the self-service economy, it is important to evaluate the sharing economy currently dominating the market. In recent years, many entrepreneurs have noted the changing economic model and developed businesses that capitalize on prosumers. The sharing economy operates on its ability to create collaborative programs and spaces that allow users to create value. Uber and AirBnb are two fore-runners of service-sharing applications that allow a user to be both producer and consumer.

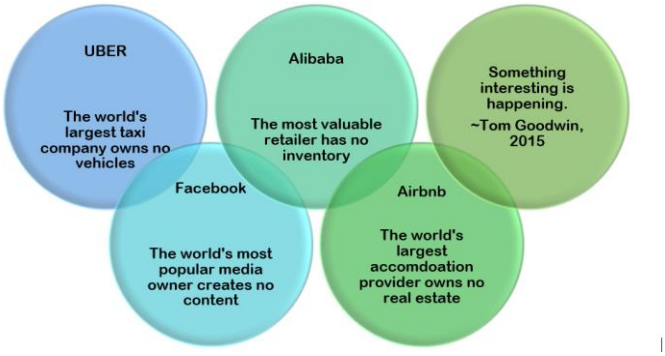

Figure 3. Illustrated Quote on the Changing Economic Model, created by author Shannon Wade

Uber revolutionized the personal transportation industry and challenged many taxi companies. Users of the app can request a ride anytime and anywhere and be picked up and driven to their chosen destination. Similarly, those same users can log in to the app and wait for an alert of someone nearby requesting a ride. It is consumers being consumers and producers in the same company. AirBnb is a similarly concept except applied to housing. Instead of reserving hotel rooms, individuals can search for AirBnbs to rent for a night or a vacation. The AirBnb, however, is typically either a room in someone's home or a guest house. Although not a traditional accommodation for

housing, AirBnb's success lies in understanding customer needs and satisfying those. Lower prices and flexibility are enticing features when prosumers act as consumers, and the ability to earn money on the side whenever one chooses is beneficial for prosumers acting as producers through the service. As the sharing economy continues to expand, individuals will increasingly search for those options that make daily life customizable—on-demand services, on-demand job opportunities, minimal hassle, but a comfortable return. Undoubtedly, this sharing economy trends towards a self-service economy that will only expand on its benefits.

Self-service kiosks. One of the most prominent pieces of self-service technology already integrated into daily life is the self-service kiosk. Wal-Mart has consistently been on the leading edge of supply-chain and operations management through the application of incremental changes and advancements through technology. One of the large changes Wal-Mart, and other chains like Kroger, has made to its stores in the past ten years has been the installment of more self-checkout machines. Most stores now have entire checkout sections devoted to self-service kiosks, and others have converted cashier lanes into computer-driven self-checkout. Similarly, McDonald's Corporation was one of the first notable, large fast-food chains to install self-ordering kiosks, which delivers lower costs in the long-term through the absence of more employees with wages and benefits. Other foods chains like Panera have followed suit in addition to providing a mobile pay-and-order option.

Information Technology and Innovation Foundation studies shows that self-checkout can reduce customer wait times by up to 40%, and currently, between 12%-30% of the daily sales volume in stores come from the self-checkout machines. Self-service

ordering also reduces wait times, streamlines food order preparation, and reduces mistakes caused by miscommunication. Customers find the technological option faster and more convenient, and customer satisfaction is key for a successful business (Castro, Atkinson, & Ezell, 2010). Additionally, the number of employees needed decreases as businesses no longer need one cashier per station but rather one attendant supervising four to six kiosks. However, while many people are concerned a self-service economy will put workers out of job, former Home Depot CEO Robert Nardelli explains the technology merely shifts job positions to other departments: "Using technology as an enabler to eliminate tasks, we've been taking those task hours and reallocating our labor hours to the selling floor in our stores" (Castro, Atkinson, & Ezell, 2010, p. 13). While this shift of job position will not always be possible, it represents just one of the many ways jobs available in the economy will change; further changes will be detailed shortly. Businesses will have an option to either lower costs by laying off employees or choosing the opportunity to focus labor less on the front-end and more on other necessary operations for the same overall cost of employees.

Part of business is handling human capital. However, whenever people are involved, there is typically a greater risk of theft or misbehavior and mistakes. In reference to employee theft in particular, in 2008, the retail industry lost a total of $15.9 billion because of employee theft (Castro, Atkinson, & Ezell, 2010). As self-checkout machines have improved in sophistication, they include countermeasures through security cameras and weighing scales tied to the weight of each item placed on the scanner or bagging area. These countermeasures have, thus far, resulted in no increase in customer

theft, but the use of self-service options instead of personal employees has reduced employee theft related to cash transactions (Castro, Atkinson, & Ezell, 2010).

However, self-service checkout is merely one part of a larger push towards and overall self-service economy. Hence, some giants have begun testing new ideas for fully automated or fully customer-processed businesses.

Amazon-Go stores. Amazon recently experimented with its "cashless, cashierless convenience store"—called AmazonGo—that allows customers to link their Amazon account to their phone. Customers can simply walk in, grab any item from the store, and walk out. Meanwhile, hundreds of cameras track all the customers and uniquely record any inventory taken to automatically charge to the customer's online Amazon account (Wingfield, 2018). The smart cities of the future will focus on eliminating wastage, enhancing user experience, and streamlining processes. This is only possible with efficient global interaction between businesses.

Virtual currency. According to Wolla (2018), money must fit three criteria to be effective in a society. First, it must be accepted as a medium of exchange for goods and services. Second, it must be a store of value, for which the stability of its value is critical. Third, money functions as a unit of account that assigns a specific, corresponding value to different goods and services (Wolla, 2018). As the functional model of the economy changes, so too will currency itself change.

The first step towards a technological ubiquity in payments is known as "contactless payments" ("Transit and Contactless Payments," 2006, p. 11). In essence, contactless payments are any financial transactions that do not require the direct transfer of cash or use of a physical credit or debit card; these payments utilize one's mobile

device and accounts to make a payment at a physical location ("Transit and Contactless Payments," 2006). Secure Tech Alliance lists three qualifications for when effective contactless payments should currently be used, namely for lower value transactions (less than $25), where consumers use cash for payment, and where transaction speed and customer convenience are critical ("Transit and Contactless Payments," 2006). ApplePay and GooglePay are two of the more well-known apps for mobile payments and allow higher transaction limits with a proper signature. They also serve as mobile wallets to streamline any financial transactions, whether from a consumer to a store or from one family member to another. Mobile pay drawing from bank accounts is the first step to virtual currency.

Another form of virtual currency is not merely current money in mobile form but rather an entirely new form of currency that can be used worldwide, which is known as cryptocurrency. Bitcoin is one of the most well-known forms of cryptocurrency at the moment; however, Bitcoin as an accepted medium of exchange is not yet widespread (Wolla, 2018). While Bitcoin can be viewed as the first prototype for virtual currency, many analysts debate its potential to be globally accepted as commonplace currency. Bitcoin does have inherent value due to the tedious and cost-intensive mining process and its relative scarcity, and it can be used as a unit of account (Wolla, 2018). Nevertheless, it is not yet refined or widely accepted and has recently had very volatile price fluctuations due to changing supply and demand for the coin. Indeed, some view Bitcoin as more suited as an asset investment than currency itself, but the forays into similar forms of digital currencies simply mark the beginning of a vast field yet to be explored.

Virtual currency falls directly in line with the goal of technological ubiquity. Current mobile pay options simplify international financial transactions, streamline daily interactions, reduce theft with proper security measures, and provide greater convenience to individuals. In fact, a study conducted by Chase Bank discovered that "using contactless payments reduces time at the point of sale by 30 to 40 percent" and that contactless transactions were 40 percent faster that swiping a credit or debit card and 55 percent faster that using cash (Castro, Atkinson, & Ezell, 2010, p. 27). Virtual currency offers similar savings, but it will take time before a proper form is fine-tuned and integrated into society. However, this information, amplified by the incredible growth potential in the e-commerce market, indicates a growing possibility of virtual currency as the money of the future.

Additive manufacturing: 3-D printing. Additive manufacturing is officially defined as the process of creating objects from a digital model by layering constituent materials from the bottom to the top (Tofail, Koumoulos, Bandyopadhyay, Bose, O'Donoghue, & Charitidis, 2018). This is as opposed to other industrial techniques such as forging or machining. 3-D printing is, perhaps, the most oft-associated form of additive manufacturing.

Additive manufacturing (AM) is quickly gaining widespread popularity due to its versatility. The technology can be used for small models as well as the creation of a large house (Tofail et al., 2018). One of the primary benefits of AM in the new economic model is its ability to produce goods on-demand. With the proper programming, AM can begin work as soon as a design is decided upon and without the need for advanced planning and project management. Furthermore, because AM creates the shape of the

object based on a digital model, it produces the desired end-result without the need for multiple stages of shaping and re-forming an item (Tofail et al., 2018). These features contribute to "zero waste manufacturing" initiatives, maximize materials usage, reduce manufacturing and supply-chain time, and hasten the time from development to the marketplace for more sales.

Big data city planning. City planning is the all-encompassing structural organization necessary to transition normal urban cities to the smart cities of the future (Angelidou, 2015). These smart cities require an "urban development model" that utilizes "human, collective, and technological capital" to create coordinated, intellectual hubs (Angelidou, 2015, p. 95). Urbanization and technology integration requires the use of big data to create interconnectivity. The official definition for "Big Data" is "the Information asset characterized by such a High Volume, Velocity and Variety to require specific Technology and Analytical Methods for its transformation into Value" (De Mauro, Greco, & Grimaldi, 2016, p. 130). In other words, big data is the mass collection of information from items of technology that is used for further analysis and research to improve applications.

SmartCards on city metros and subways track the entry and exit locations of each passenger. With aggregated information from thousands of users, planners will be able to customize wait times, number of trains, and routes to facilitate a better flow to and from the city. Eventually, this will trickle down to the individual level as mobile applications track a person's daily habits, communicated with the train station's kiosks, and preemptively purchase required tickets. It is not too far-fetched to presume that one day there will not even be a need to scan a ticket or card at the turnstiles, but merely by

walking in to the station with one's phone, information and communication technology will do all the work.

Subways are just one example, but to accomplish large-scale city planning that maximizes efficiency and ease of use and access for residents, big data pulled from existing technology will be essential. Several cities, including New York, London, and Barcelona, have already drawn up goals regarding city planning for computing ubiquity.

Figure 4. Outline of Barcelona's Vision for Becoming 'Smart' (Angelidou, 2015) ©ScienceDirect

In fact, one of the most advanced strategies for and examples of a smart-city was developed by the city of Barcelona in Spain, which began implementing integrated technology in 2012 (Ravindra, 2018). After recognizing the potential of the Internet of Things, Barcelona began to alter its technological infrastructure for everything from parking spaces to streetlights to waste disposal and bus transit systems. City planners used big data to optimize as many daily systems as possible and integrate them within the city. For parking spaces, the city employs a sensor system that is embedded underneath the asphalt and connects to a mobile application, which then automatically directs drivers to open parking spaces in the city (Ravindra, 2018). Similarly, new LED streetlights operate on a sensor system that sense "pollution, humidity, temperature, the presence of people, and noise" in order to automatically adjust light settings as needed, reduce heat waste, and improve safety (Ravindra, 2018). It even works to help direct pedestrians to certain parts of the city or areas of interest as needed. Using "smart bins," Barcelona's

waste disposal system vacuum-sucks garbage into an underground collection, which reduces smells and noise pollution and allows for optimal waste collection planning based on data collected of what underground storage areas require immediate attention (Ravindra, 2018). Due to these and many other changes, Barcelona has become the Mobile World Capital and a modern example of the smart-city that will eventually be implemented in urban development around the world (Ravindra, 2018).

Figure 5. Futuristic Image of Barcelona Smart City (Angelidou, 2015)

Smart cities seek to incorporate technology and design while encouraging greater knowledge sharing and innovation. As Angelidou (2015) notes, “Advanced technology and its large-scale deployment are no more an idea of fantasy; they are rather a reality and something achievable, and ‘the key question is no longer technological; as ever it is organizational’” (p 101). Information and communication technologies will be used to “improve urban function management in areas such as transport, energy, health care, water and waste” (Angelidou, 2015, p. 99). The changing and restructuring of the future economy includes physical city layouts as well as distinctly economic changes such as currency, sales, and manufacturing. But it is a new economic model with tremendous potential.

The Job Market in the New Economy

One of the concerns often voiced about a new, technologically-driven economy is: where will the jobs go? Due to globalization and the rise of technology, "the nature of work has undergone radical change from permanent, full-time with very few job changes, to part time, contract work, responding to private and public sector out-sourcing, and a large number of job changes during one's working career" (Passaris, 2006, p. 21). As advances in these fields continue to develop and take root, the nature of available work will continue to change. With many human labor job opportunities being replaced by digitalization through self-service options or more sophisticated machines, the job market will look drastically different with new industries and a greater focus on arts and culture, which require human touch and spirit.

The National Research Council (NRC) predicted the development of a new kind of technological industry with multinational companies that gather, not create, the multitude of advanced technology from around the world and offer it to buyers as a middleman (Muroyama & Guyford, 1988). This prediction was not far off in foreseeing the creation of this new industry, and in fact, there is still room for the growth of an industry middleman specializing in the global transfer of developing technology. Fundamentally, however, throughout history as the economic model changes, the job market adapts with the creation of new job positions.

According to Manyika (2017), "One-third of new jobs created in the United States in the past 25 years were types that did not exist, or barely existed, in areas including IT development, hardware manufacturing, app creation, and IT systems management" (para. 28). Automation itself benefits firm accounting by increasing profit margin due to

verified higher levels of output, increased efficiency, and fewer human errors. At first glance it may appear to displace many low-skilled workers, but researchers have found that the job creation stimulated by technological advances vastly pay off in the long-term. For instance, in 2011, McKinsey and Co. conducted a study on the introduction and use of the Internet in business operations in its Paris office. Analysts discovered that the internet "had destroyed 500,000 jobs in France in the previous 15 years—but at the same time had created 1.2 million others, a net addition of 700,000, or 2.4 jobs created for every job destroyed" (Manyika, 2017, para. 28). Increasing technological ubiquity and globalization will develop new industries with a greater demand for workers.

One of these new growth industries will be for statisticians and data analysts as big data plays and ever-increasing role in daily life. The legal field will also remain strong as new laws must be developed to deal with uncharted technological territory of privacy concerns, acceptable and unacceptable applications of technology, and intellectual and data property rights. Of course, STEM fields of science, technology, engineering, and mathematics will be indisputably vital to propelling ICT advances with a dedicated need for more computer scientists specializing in network protection and data security against internet hacking.

Many view the above industries as conducive only to the highly-skilled worker, but the majority of the job force are employed in blue-collar work—the jobs most likely to be replaced by technology. Interestingly, technology is already indicating new opportunities for less-skilled workers. This category, labelled "knowledge-enabled jobs," utilizes machines embedded with intelligence and knowledge. With basic training, the average worker can use the machines to fill needed positions.

To demonstrate, Google recently began its “Internet Saathi (Friends of the Internet) program” in India, which teaches rural woman about the Internet and trains them to use it. These women then receive Internet-enabled devices and return to their villages to work as “local distributors for telecom products (phones, SIM cards, and data packs), field data collectors for research agencies, financial-services agents, and paratechnicians who help local people access government schemes and benefits through an Internet-based device” (Manyika, 2017, para. 29). In more developed countries, digitalization provides the opportunity for more flexibility in work-from-home jobs. Passaris (2006) notes that innovative technology has “replaced the rigid, hierarchical, top-down structure with a more flexible, horizontal, integrated work place model” (p. 18). Additionally, as job-matching becomes more sophisticated through Internet services like LinkedIn, underutilized talent, which makes up 30-45% of the potential workforce, will decrease (Manyika, 2017). More jobs will be filled benefitting employers and employees.

Finally, certain industries can never be replaced even with the advent of a smart-city. Namely, societal arts and culture will always remain the industry of people and human talent. Technology can digitalize music or art to an extent, but the demand to human-created culture will remain. The more technology can take over mundane tasks and simplify daily life, the more time people will have to create and innovate, exploring the God-given skills and talents they have through writing, music, and performances.

Economic Growth Achieved Through Smart-Cities

After the past discussion of the forces prompting a new economic model and what the future smart-city might look like, it is important to return to the initial motivation for this analysis. Namely, global and technological innovation affect the factors of

production that comprise and economy, and it is the manipulation of these factors that determines the economic prosperity, growth potential, and competitive advantage for a nation. As a result, one must ask, just how much economic growth, including quality of life, will be achieved through smart-cities?

Several statistics have already been presented on time savings, social benefits, and job creation. Consequently, the economic growth for the overall U.S. economy due to coming innovation also necessitates analysis without segmentation. Castro, Atkinson, and Ezell (2010) summarize, "If self-service technology were more widely deployed, the U.S. economy would be approximately $130 billion larger annually, the equivalent of an additional $1,100 in annual income for every household" (p. 4) To utilize online banking and mobile wallets decreases the cost per transaction from $4.25 to $0.20 (Castro, Atkinson, and Ezell, 2010). On a large scale, this has saved millions of dollars for the U.S. economy and with ongoing use and integration, continues to provide cost savings for producers and consumers alike.

This projected economic growth focuses on decreased costs and increased quality and sales from the self-service options currently known and in testing. However, it is just the beginning. By 2020, the global market for smart-cities is predicted to be $1.565 trillion (Glasmeier & Christopherson, 2015). By 2025, twenty-six cities are predicted to become smart-cities; half of these will be in Europe of North America (Glasmeier & Christopherson, 2015). By that same year, 58% of the world's population will live in an urbanized area with more developed countries clocking in an even higher percentage. As technological ubiquity becomes a reality, the future growth derived from more efficient city planning and even new technologies developed for daily life cannot yet be

determined, especially since there are non-monetary benefits as well, namely factors of competitive advantage comparative to other nation's economies as well as the social and personal benefits obtained from a new, self-service economy.

Conclusion

The evolution of cities with the spread of globalization and technology has changed the typical economic model and will continue to do so. No longer will the staple business model be business-to-business or business-to-consumer but rather it is gradually becoming direct-to-consumer and utilizing a new group of "prosumers." Currently, we are in a new era of a sharing economy, with businesses like Uber and AirBnb. Globalization and technology spearheaded the change of how businesses operate, primarily with the integration and development of information and communication technologies (ICT). With continued knowledge and innovation, entrepreneurs will soon present a new model of an economy.

This economic restructuring will change the understanding of what a business is and how it is conducted. Contactless payments, virtual currency, self-service ordering and payment, not to mention some full-scale automated restaurants and stores, and on-demand additive manufacturing are just a few features of the new economy. Smart cities will attempt to consolidate all of this computing ability and the shift towards a self-service economy by organizing city layouts for maximum efficiency and consideration of inhabitants' daily life. These new smart cities will provide more opportunities for individual entrepreneurs and drive economic growth and global interdependence. While technological ubiquity and digitalization will affect the types of jobs required in the future, if history is a guide, with adaptation these changes will result in greater overall

prosperity. The magnitude of structural economic transformation is unprecedented, and the cost-benefit analysis is only positive for this future economic model.

At the beginning of this thesis, the question was posed: what if society and technology already have the ability to contract time and space? The answer to that is it does. Globalization has scaled down the global economy to put the power in the hands of individuals. Information and communications technology has reduced time and waste and expanded the horizons of innovation. From this point forward, technological advances and integration are "defining the new parameters and advancing the frontiers of economic connectivity" (Passaris, 2006, p. 3). New is not always better, but nothing great was ever achieved without first breaking out of the mold.

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Appendix A –

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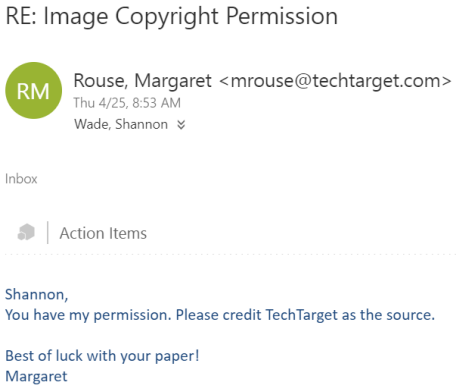
1. “Smart City Components” via TechTarget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