THE EVOLUTION OF FOUR TECHNOLOGICAL CONCEPTS AND THEIR RAMIFICATIONS ON CURRENT & FUTURE WORLD MARKETS

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Abstract: We create and use technology to solve problems; this is our sole motivation. This is how we constantly evolve as a society that ultimately raises our overall quality of our life. Four main technology concepts form the basis in analysis of the role technology played, and continues to play, in the societal evolution of America: 1) Evolution of the core-affecting technologies, 2) Advancement of labor, 3) Progression of consumer goods from self-made to purchase, and 4) Movement from manufacturing to a service-based economy. Understanding our past as a developing nation in the late 1800s and early 1900s, can benefit other developing countries that desire a role participating in the world marketplace and being competitively successful in that endeavor.

Keywords: technology, technological, future, concepts, products, services, evolution, labor, America, economy.

Introduction

Technology is defined as the tools, techniques, and actions used to transform organizational inputs into value-added outputs. In business, we use a variety of technologies to create, develop, and deliver products/services; often technologies that are then used by others. The financial impact of using less than the best blend of technologies for your products/services hampers the ability to maximizing profits within a combination of aggressive pricing and minimal cost.

Technology defines us, evolves us, enables us, and in some cases hinders us!

Managing technology is the decision, direction, and deployment of all technology toward the constant improvement demands of your organization in terms of people, processes (operations), and products/services. Managers are constantly making technology decisions for a number of goals such as:

- Reduction of human error
- Faster operations
- Enhanced job satisfaction
- Skill improvement
- Obtain higher quality or greater output
- Meet customer requirements, and more.

Lastly, technology is one of the key elements that define a society or civilization. When we study past cultures, one method we use to determine their level of sophistication is by examining the technologies (tools) they created and used in their life. This is one reason our museums are filled with tools and other technologies to describe earlier cultures.

History is an excellent guide to help us evolve our future. Let us learn from the past and better understand our use of technologies to build successful products/services in the future. More specifically, I want to share with you some thoughts related to the past industrialization of America; the

most significant time in our history for the evolution of technologies and the resulting high levels of automation achieved and other benefits.

Evolution of Society Based on Technology

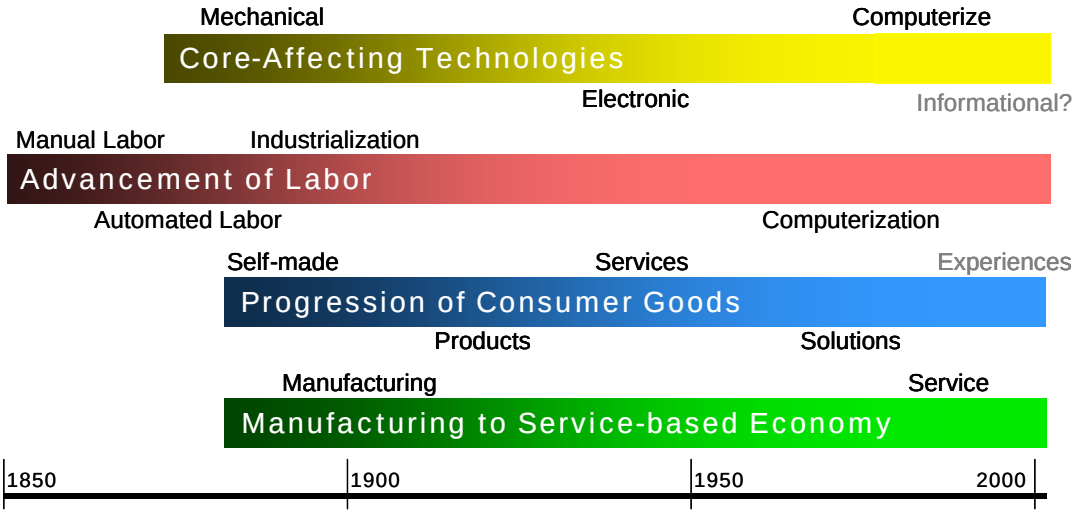
At its fundamental root, we create and use technology to solve problems; this is our sole motivation. Think about this for a moment to realize just how true this statement is. We are constantly seeking improvements in speed, capacity, quality, durability, and many other dimensions to address issues that have caused problems. This is how we constantly evolve as a society that ultimately raises our overall quality of our life.

Four main technology concepts form the basis in analysis of the role technology played, and continues to play, in the societal evolution of America:

- Evolution of the core-affecting technologies
- Advancement of labor
- Progression of consumer goods from self-made to purchase
- Movement from manufacturing to a service-based economy.

We will discuss these concepts individually further in this paper, but let's take a brief look at all of them together and understand how they overlap. Since about 1850, we started moving beyond the application of manual labor. This change from manual labor as our common production methodology was the start for several concepts. Early on, our focus was on using mechanical technologies to manufacture products. As our highly mechanical and automated society evolved, we moved into other maturities of these concepts to where we are today. Understanding how these four technology concepts will change in the future will help in determining the ongoing needs of our society.

As seen here, as America's use of technology evolved from replacement of manual labor with rudimentary tools toward higher levels of sophistication, we saw two themes emerging: higher levels of automation and less dependency on human interaction. Automation helped us produce a greater volume of products with a high quality consistency. The same energy of work produced more product with less labor. We are continuing to advance levels of automation and less human interaction.



Understanding these technology concepts to their fullest benefits companies in the pursuit of marketing products and services in a global marketplace. Lessons learned from the past efforts of highly developed cultures can shorten the learning path required for other cultures who desire a place in this market.

> *Technology is one of three components along with people and skills that contribute to the success of the company and how well everything fits.*

Evolution of the Core-Affecting Technologies

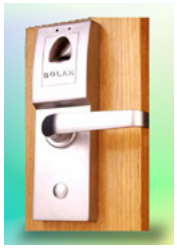
Core-affecting Technologies (CATs) are new technologies so significant in their impact that they change the very nature of our perspective of low technology versus high technology. Our high tech products are measured by the significant use of a current CAT. What may be a high technology today will in time become a low technology, yielding to another technology incorporating a newer CAT.

All of our products tend to start as mechanical products that are quickly replaced by a similar electronic product; and eventually by a computerized version. That is, the problem the mechanical product solved is improved with an electronic version, then further improved with a computerized version. The three known and one new future CATs are:

- Mechanical
- Electronic (solid-state)
- Computerize (chips)
- Informational (celldom).

Our society has fully experienced two CATs, mechanical and electronic, and are currently involved with the third (computerize). The future informational CAT is so new it is difficult to discuss, much less apply it. Let's take a look at a product that has been created in all of these CATs. In the beginning, typewriters automated writing with a mechanical device using individual engraved keys. Each key pressed through a ribbon to strike a print on paper. An electronic version was created to allow for faster typing with less effort on the users part. The electronic version added new features such as correction and the ability to save letters. When we computerized type we used word processing software and wrote on computers. Some day the way we write will use an informational product that will take advantage of the future CAT (informational).

The competitive advantage to a company is to recognize the benefits of getting your product into the latest CAT, and beat your competition to it. Products developed in the latest CAT often enjoy greater reliability, more features, higher-quality, and lower cost. For example, Japanese manufacturers were able to get a higher percentage of electronic products into their cars than the American and German manufacturers. The Germans held on to mechanical products the longest because they took pride in their mechanical accomplishments. Even today, the Mercedes-Benz is still very much a mechanical car, compared to other luxury cars. Simple things like changing the automatic door locks from mechanical levers triggered with a vacuum system storing pressure in a bladder to electronic solenoids provided the advantage of more reliable and quicker acting locks. Also, as is in most cases, the electronic door locks were cheaper to provide.



> *Mechanical door locks are still the current norm in mainland China because of their attractive price tags, but more suppliers are recognizing the inevitable. "Electronic models will ultimately replace mechanical units in the future," said Liu Ning of Shenzhen Intelligent System.*[1]

The most fascinating aspect of this progression through the CATs is the realization that a key technology from the previous CAT is responsible for the next CAT. For example, during our movement into the electronic CAT, borne from turning mechanical solutions into electronic solutions, the invention of solid-state circuitry particularly the transistor formed the basis for our computerize CAT. The microchip was the key technology that led to the informational CAT. The microchips ability to store, process, convert, communicate, and otherwise use information opened the door to the informationalization of America.

Clearly, every product cannot evolve to a newer CAT version, but advancements continue as companies strive to obtain new competitive advantages. Most recently, a company created a chip with a matrix of holes that when electricity is applied moves a small volume of air through the chip. This is a fan without moving parts. While the volume of air is small today, I'm sure it is just a matter of time before the volume is increased and we commercially use the component for cooling circuitry. Further advances could leave to moving other matter through the chip's holes, such as ink for a new form of ink jet printing.

We are now starting to see the dawn of a future CAT. The Informational CAT is so new to us we don't have many product/service examples; where a computerized product evolved to an informational product. The key technology that aligns the Computerize CAT with the Informational CAT is the modem. The modem will evolve to what I'm calling a celldom. A celldom is a universal communication technology that supports all medium, wire-based and wireless-based. Information products will have celldoms at the core, just like cars today are loaded with computer chips; same philosophy.

The message here is to examine your products and consider new products to determine how to evolve them to newer CATs. Be the first in your industry to gain the advantages offered by products created in newer CATs.

Advancement of Labor

In the late 1800s, the economy of America was largely based upon self-sufficient family units that made or grew what they needed and sold or bartered what they could not consume. At that time, local economies supported small-scale cottage industries in which both men and women produced goods in their homes while also tending to their farms and children.[2]

When America evolved into an industrial and urban nation, the new economic structure greatly altered the way work was managed and performed. Most notably, the home ceased to be the center of production. With the advent of Industrialization, production of consumer goods was centralized into factories. There, machinery enabled minimally trained workers to produce goods more efficiently and at a lower cost than skilled laborers had previously been able to do.[2]

This society, involved in the expression of manual labor for everything, innovated and created new technology to become more efficient. This original goal of automation eventually opened the door to our industrialization. Automation led to mass production accomplished through assembly line manufacturing and standardization on production.

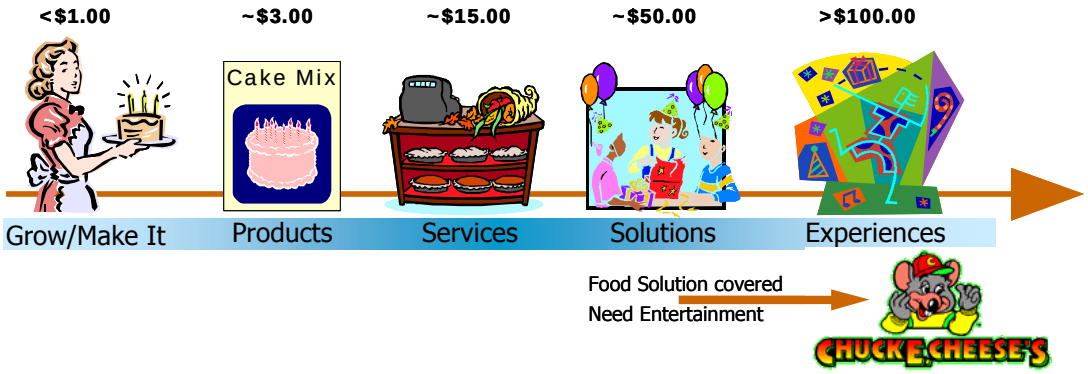
While America continued to innovate to advance to even higher levels of automation, other goals such as quality, performance, and knowledge appeared. The desire to innovate with computer technology opened the door to information as a value representation of labor, hence the birth of a service-based economy where the value of labor was recognized for services. Per-person productivity increased at a time that was crucial to America's growth. Automation and mass production helped America meet the demand for products/services with an adequate supply volume.

Labor is often the most expensive cost component. Reducing labor requirements and increasing the level of productivity is cost beneficial. Examine the labor efforts associated with production and delivery of your products and services.

Progression of Consumer Goods

Today's market is not about products, it's not about services, it's not even about solutions! We have experienced a succession of consumer goods that evolved from families growing/making their own products and bartering, to the sale of products, to delivery of services, to a combination of products and services referred to as solutions. Now we are moving beyond solutions to experiences. An "experience" leverages off of solutions to provide a more complete offering.

Let's look at a birthday cake analogy to better understand the relationship between products, services, solutions and experiences.



As a good, birthday cakes were made from scratch (Cost ~$1.00). Then, a manufacturer created a cake mix as a product; the cake was still made at home, but all ingredients came in the box (Cost ~3.00). The cake became a service provided when a store made the cake and sold it (Cost~15.00). The sold cake as a service became a solution when the store provided necessary items like plates and utensils with the cake as a package. At this point the food solution was covered. Realizing that most birthday cakes are associated with a birthday party with entertainment, the food solution evolved to an experience, with a single purchase for the entire birthday party.

Movement From a Manufacturing Environment to a Service-Based Economy

The industrialization of America formed a basis for massive product creation. Mass production formed the basis of manufacturing and industrialization providing a vast quantity of material goods never before available to such a large majority of population. The following table details the growth in industrialization in America from 1870 through 1913 as a percentage of worldwide industrialization. Clearly, manufacturing in America at the time experienced significant growth.

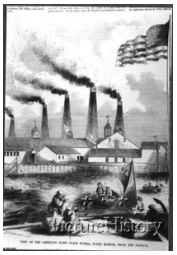
Country	**1870**	**1913**
USA	23.3	35.8
Germany	13.2	15.7
U.K.	31.8	14.0

France	10.3	6.4
Russia	3.7	5.5
Italy	2.4	2.7
Canada	1.0	2.3
Belgium	2.9	2.1
Sweden	0.4	1.0
Japan	0	1.2
India	11.0	1.1
Other Countries	0	12.2

Percentage Distribution of the World's Manufacturing/Production[3]

Of course other complimenting factors occurred during these times leading to significant growth. For instance, America's telephone system started in the late 1800s. It grew quickly in the 20th century to better benefit society, and was instrumental in America's industrialization. The telegraph, railroads, and ultimately the use of electricity led to the shift from a rural to industrial America. Also, urbanization was a direct result of the industrialization in America. Burgeoning factories were centralized in cities that offered a central location for resources and workers for production.[4]

Industrialization is central to economic development and improved prospects for human well-being. The benefits of industrial production can be seen in all aspects of life from the range of consumer goods available, to the efficiency of transportation systems, to the astounding advances made in computers and communications technology. Since the 18th Century, wealth in the developed countries has paralleled industrial growth, and developed countries continue to produce the lion's share of manufactured goods indeed, about 74 percent of the world's industrial output takes place in the developed world.[5]



Characteristic features of industrialization include the application of scientific methods to solving problems, mechanization and a factory system, the division of labor, the growth of the money economy, and the increased mobility of the labor force-both geographically and socially.[6]

Today, many developing countries are experiencing industrialization of their own, capturing an ever-increasing share of industrial growth. The pace of this newest cycle particularly in Asia far exceeds that of developed countries. In China, for instance, industrial growth between 1990 and 1995 reached 18.1 percent a year; East Asia and the Pacific and South Asia experienced growth rates of approximately 15 percent and 6.4 percent a year, respectively. By comparison, America's industrial output grew by only about 2.6 percent a year during the same period.[5] America experienced a 2.6 growth rate in the last year because they are fully industrialized. The economy is moving toward less emphasis in manufacturing and growth in services.

The Service Side

When America's attention turned away from product manufacturing toward services, the service-based economy was born. As a fully industrialized and mature nation, the quality of life in America improved greatly. This in turn, generated a level of wealth that sought the convenience of services. Purchasing services, gained the benefits of saving time and obtaining expertise in the form of specialist. To use the cake analogy presented earlier, the cake could be purchased from an expert baker. Quality of life improves once again with purchased services from experts in the given trades.

Also, the service-based economy made many luxuries of life more affordable. Early on, only the richest people could afford a staff to clean their house. This was seen as an extreme luxury in America. Around the mid 1900s, maids became more affordable because instead of working for one family every day, people paid for single days of maid service. This didn't disadvantage the maid because they could earn their wage from several different families if they cleaned one day every week or two. The cost was spread across several families making maid service more affordable for more people.

Conclusion

Many factors play a role in successful company market/product strategies. Companies will continue the tried and true efforts of differentiating their products through design and innovation, but adding the analysis presented in this paper of product/service evolution is an excellent method to obtain a decisive competitive advantage.

Understanding our history as a developing nation in the late 1800s and early 1900s, can benefit other developing countries that desire a role participating in the world marketplace and being competitively successful in that endeavor. If these technological concepts are closely examined as they relate to the products/services of a company, you can discover the potential of evolving your products/services toward the future. Focusing innovation in this direction is a strong contribution to cost reduction, rapid market acceptance, and maximum profit margins. Take this first step to offering world-class products, services, solutions and experiences to a world market.

References

[1] Mainland China: Electronic models ready to replace mechanical units; http://www.globalsources.com/MAGAZINE/SECURITY/0203/PDOOR02.HTM; Copyright © 2002 Trade Media Holdings Ltd.

[2] Women at Work: Manual Labor; http://www.library.hbs.edu/hc/wes/collections/labor/; Women, Enterprise, & Society magazine; Harvard Business School; Copyright © 2002 President and Fellows of Harvard College

[3] Modern History Sourcebook: Tables Illustrating the Spread of Industrialization; http://www.fordham.edu/halsall/mod/indrevtabs1.html; (c)Paul Halsall Aug 1997

[4] The Guilded Age Webquest: Documenting Industrialization in America; :http://www.oswego.org/staff/tcaswell/wq/gildedage/segment.htm#technology; 2001

[5] Changing Environments, Changing Health: Industrialization; http://www.wri.org/wr-98-99/002-ndus.htm; World Resources Institute; 1999