

YANKEE INGENUITY: STILL A VITAL TOOL

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Yankee Ingenuity

America became an economic power because we had a unique way of solving problems. In the past this problem-solving capability was called “Yankee Ingenuity.” Today we call it “Entrepreneurship.” But maybe these two concepts are not the same. Is there something inherent in Yankee Ingenuity that is not present in Entrepreneurship? Can we be better Entrepreneurs by examining Yankee Ingenuity? We think so.

Yankee Ingenuity was a combination of the following:

- \$ strong work ethic
- \$ free enterprise
- \$ abundant natural resources
- \$ clever business practices
- \$ innovative thinking to find technologically-based solutions

The products and processes that came from Yankee Ingenuity were often elegant in their simplicity and practicality. This led to a technical self-sufficiency in America that eventually allowed the U. S. to dominate world commerce. The early colonists needed self-sufficiency because they were so far away from world markets. Over the last hundred years this inherent strength emerged as a critical competitive advantage making America the world’s largest market.

Some of the outstanding Yankee innovators included Benjamin Franklin, Eli Whitney, and Thomas Edison. They capitalized on the free enterprise system in America. All three demonstrated the essential elements in Yankee Ingenuity.

Ben Franklin became a rich man on the basis of his printing business (with his key product being *Poor Richard's Almanac*) and added further profits from additional inventions (bifocal glasses, an efficient stove for heating a room, the lightning rod, etc.). These inventions gained instant acceptance because they met needs that Franklin observed on the American frontier. They were practical, technically-based, and solved problems.

His creative thinking went beyond invention to observation of natural phenomenon. Franklin won several prestigious scientific awards both in America and Europe. He demonstrated remarkable understanding of human nature, a knowledge of history and philosophy, and the political needs of his country. He was the mentor of Thomas Jefferson during the writing of the Declaration of Independence, the ambassador to France during the Revolutionary War, the negotiator of the Treaty of Paris ending the revolution, and a framer of the constitution. Franklin was a model of Yankee Ingenuity and he applied his talents in every facet of his life.

Eli Whitney, a New Englander, went to Georgia to become a teacher and he was amazed at the amount of labor needed to separate seeds from the hand picked cotton. Through his observations he conceptualized an idea for a combing and roller system that could mechanically separate the seeds from the cotton pods. Thus, the cotton gin was invented. (“gin” is taken from the word “engine.”) Whitney began to manufacture cotton gins but was having trouble producing sufficient quantity to meet the market demand. He learned of a system of manufacture

that was based on careful machining of individual, identical parts and he decided to adopt this concept in his cotton gin factory. (This was the recognition of a technical solution to the problem.) He later heard about a government contract for 10,000 muskets. He realized that he could use the profits from the government contract to buy the processing machines he needed for his cotton gin factory. He won the musket contract and, after several years of development, an inquiry was conducted by the war board examiners regarding his lateness in delivering the muskets. Whitney demonstrated his method to the war board by taking 10 disassembled muskets into the meeting room, dumping the parts on the table, and then having each of the examiners assemble a musket from the pile of parts. (A clever business practice!). This amazed the war board as muskets heretofore did not have interchangeable parts. Whitney, too, demonstrated his mastery of the traits required for Yankee Ingenuity.

Thomas Edison received more patents than any other person in US history. He had tremendous creativity and drive. Edison, and his team of technicians, created entire systems, as well as the individual components that would make new systems work. (He had a tremendous work ethic. One time he said that “Invention is 10% inspiration and 90% perspiration”). He had a vision of the needs of the country as the industrial revolution was in full swing. And, he had an uncanny ability to understand technology that could be applied to fill those needs. His good business skills eventually led to the development of General Electric and a large personal fortune. He too was a model of Yankee Ingenuity.

From the beginning of this nation, technology was important in America’s economic progress. For example, the Pilgrims stepped from the Mayflower onto Plymouth Rock with a precious cargo – 102 tools (all carefully documented). The tools which they brought, and the

knowledge of how to use them, made the Plymouth Colony successful. The Pilgrims tamed the wilderness through technological innovation, utilized the natural resources, and laid the foundation for trade and economic growth.

Throughout the industrial revolution, America's rise to greatness was based on a cavalcade of new products – the reaping machine, typewriter, telephone, telegraph, and electric light system, just to name a few. Manufacturing innovations such as interchangeable parts and mass production gave us the production efficiencies that led to economic strength and competitive dominance. Hence, America's economic strength was based on superior technological knowledge in products and in manufacturing methods.

Manufacturing and the Information Age

Information age gurus believe that the “rules” for success from the industrial revolution don't apply today. We suggest that these gurus' perspectives are flawed in at least two fundamental ways. First, while information is critically important to success in today's world, manufacturing is still the heart of economic strength and sustained progress. Second, the creative imaginings found in Yankee Ingenuity are still needed today, especially by the modern entrepreneur.

A key question regarding today's economy and the methods to maintain its strength is: “What is the basis of an economy?” To make the question more relevant we (or you) could ask, “What should be the basis of my company for long term growth and to maximize profits?” We believe the answers are closely related and provide a basis for understanding the true nature of the strength of America's economy, and in fact the entire world's economy. This is not going to

be a heavy discussion of macro-economics as the answers are simple and straightforward. The answers emerge from the following fundamental points:

§ The (non-agricultural) economy can be divided into two major sectors – manufacturing and services. Manufacturing includes all companies whose primary function is to convert some unfinished material into a more valuable form. Service includes companies whose main task is making life easier or more productive.

§ The fundamental principle of health of an economy is to create value with work. Both manufacturing and service sectors can do this. For manufacturing the conversion is obvious. For example, you create value when fiberglass is coated with resin and molded into a useful shape. Value is also created when a bank lends you money to purchase equipment, but that is a service.

§ The economy, and your company, both thrive when jobs are created in the process of either manufacturing or serving. However, manufacturing is much more efficient at creating jobs than is servicing. Each new manufacturing job creates six additional jobs in the community while each new service job only creates two collateral jobs. (See “The Facts about Manufacturing” in the references.) Hence, as the population of a country, or size of a company grows, manufacturing is much better in creating prosperity. (It is interesting to note that Microsoft, the ultimate example of a service company, employs relatively few people and has relatively low sales in comparison to the value of its stock. Microsoft is about

number 400 on the Fortune 500 in sales, and even lower in terms of employment.)

(See *In Praise of Hard Industries* in the references.)

§ Manufacturing is capital intensive whereas service is not. Hence, manufacturing is harder to enter but, once entered, is easier to maintain position.

§ Manufacturing is better able to guard its proprietary technology than is a service company. Therefore, manufacturing takes time to develop technical knowledge, but once gained, the company is stronger and more difficult to dislodge. Service, even software, is relatively easy to copy (pirate) and very difficult to police.

§ Manufacturing usually creates higher value per employee, thus permitting higher wages to be paid in manufacturing than in service. Hence, manufacturing, especially highly technical manufacturing (more than just assembly), is more likely to be done in highly developed countries where wages are higher. This may seem counter to popular perspectives as so much is said about manufacturing plants moving to foreign countries to take advantage of low labor rates. The truth is, however, that sophisticated manufacturing is principally done in high tech locations such as Switzerland (number 1 in high tech manufacturing per capita) and other well-developed countries like Germany, Sweden, and Japan. (See *In Praise of Hard Industries* in the references).

§ Manufacturing is more important for long term stability and growth than services, but several countries are taking the lead away from the United States in manufacturing because they have not been misled by the Information Age propaganda with its attendant suggestion that long term success will come with

software and telecommunications. Even though the United States may have a lead in software and telecommunications, that lead can evaporate quickly. Many countries, such as India, have seen services as the way to bring short term prosperity to their countries without the need for capital investments, which they do not have. With strong governmental and educational support, those countries are rapidly emerging as strong competitors in services, especially software and telecommunications.

§ How does the Information Age tie into manufacturing? Manufacturing can be improved greatly by accepting the services offered by information. Profits, quality, productivity, and delivery can all be used by astute manufacturers who adopt the principles of using information. Therefore, the Information Age should be thought of as an important service which may have its greatest benefit within manufacturing, but information itself is not as strong a base for an economy as is manufacturing.

Entrepreneurs

We believe that entrepreneurs today need the same combination of critical skills that were prevalent in the early days of the nation, Yankee Ingenuity if you will. However, in today's Information Age, **we too often overlook the importance of technical skill and knowledge** in the mix of factors that contributed to Yankee Ingenuity. We can ask two questions: Just how important are technical skills and knowledge today? And, if they are important today, how are they best acquired?

A key to understanding the importance of technical skills and knowledge today is to examine the methods that are used to guard that technical knowledge. There are primarily two ways to do it. First, get a patent. This provides protection in some countries for a set period of time (usually 20 years). Companies realize the value of a patent and more patents are being issued today than ever before. The importance of patents might be gleaned from history. Some historians assert that the Industrial Revolution really began when the first patent law was created in England in 1624, thereby allowing inventors to personally profit from their inventions. (See *The Norton History of Technology* in the references.) The infant United States adopted a patent law in 1790, thus illustrating early recognition of the value of protecting technology and rewarding its development.

The second method of protecting technical skills is by keeping them a secret. These secrets are called “trade secrets” or “proprietary knowledge.” Trade secrets are almost impossible to keep with respect to product design and composition because once the product is being sold, it is relatively easy to reverse engineer it. However, technologies associated with the processes used to make the part can be protected. These are often the essence of trade secrets. Even after patents run out, the proprietary knowledge used to efficiently make the product can give long term competitive advantages.

Our forefathers used both protected technical knowledge (patents and trade secrets) and general technical understanding to solve the problems around them and gain profits. It is clear that this technological knowledge gave our ancestors a competitive edge. But, their technological knowledge was not necessarily gained through formal schooling. Rather, it was often derived from practical experience and acute observation of the world in which they lived.

In the 21st Century, with its higher level of technical complexity, can the entrepreneur still rely on practical experience and observation? Probably not. Does this technological complexity require successful entrepreneurs to be technically educated? No, but most entrepreneurs who do not have a technical background have had to wrestle with methods of getting some technical knowledge through personal training or by hiring that technical expertise. Although non-technically trained entrepreneurs are currently succeeding, we might ask whether the present system suffice in a future era of accelerating technological development and innovation?

Education model

We propose the following educational model (Figure 1) as the ideal base for obtaining the skill set required by the **future entrepreneur**. The model consists of three main facets of education – liberal education, business understanding, and technical knowledge. These provide, respectively, the breadth, the language/context, and the depth/innovation which will be needed to address the technical problems of the future.

First, a strong liberal education, often called the liberal arts, is required. Today, most universities provide this type of education in their General Education program. This liberal education provides the breadth and an educational base from which to see opportunities and problems in the world. It also helps us to understand how to synthesize new concepts and identify solutions to problems. A liberal education should liberate a person from set thinking patterns. It is the basis of making new connections between otherwise unconnected information.

However, we too often neglect to continue our liberal education. We should work hard to keep learning from our reading. Remember, the object of a liberal education is to liberate the

mind. That means that we should give the mind new concepts and adventures, allowing new connections to be made. The ability to make these associations is the essence of creative thinking, but more is needed to direct that creative thinking into useful paths.

Second, a strong business background is a must. Business is a language that must be skillfully understood and spoken. This language involves accounting, finance, marketing, sales, operations, and leadership. In some companies, especially those in the service sector, these business skills also become the technical field that must be understood for success. In the manufacturing sector, business provides direction and a context for interpreting and applying technical knowledge.

Third, especially in product-based companies, a technical knowledge of the product and its application is critical. This technical understanding provides the depth of knowledge that is required for long-term competitive advantage. It also provides the ability to conceive of inventions upon which technical advantage can be based.

All managers need some technical understanding of their product and processes. This will allow them to make truly informed decisions and to see the situation with the broadest possible perspective. In large companies, the manager can employ technically-trained employees who can give extensive technical background, although the non-technical manager will always be at a disadvantage in confidence that the issues are fully understood. In smaller companies, this need for the manager to have a technical understanding increases, simply because the manager must do more tasks. Therefore, for the entrepreneur in a manufacturing company, a combination of technical understanding and business expertise is very important.

Gaining education in all three areas

How can all of these skills be obtained today? Like our ancestors, we may be able to obtain them by practical experience. But, in our highly specialized and complex world, we tend to look to universities to give us the needed educational foundation.

What about technology and business education? These are often obtained separately by majoring in either business or a technological field. Additional depth is often gained through a master's degree such as an MBA.

What if you obtained only a business degree or only a technical degree? Where can you go for additional training to gain further perspectives? One answer is, of course, back to school. Many are working toward advanced degrees or are enrolled in executive programs designed to enhance their knowledge.

It is also clear that training through professional societies and trade associations can be of great help in furthering both technical and business education. CFA, for instance, and many other technical societies conduct a full range of interesting tutorials and educational sessions at their conferences. You could attend these and gain perspective and new knowledge. These sessions are often directed specifically to the needs of others in your field who, like yourself, are trying to round out your education. You might even suggest topics for additional courses and tutorials.

If several people in your company might benefit from additional training in a particular field, you might contact CFA, or some other professional group, to identify a consultant who could deliver targeted technical or business training in your plant. Some companies (such as Saturn) have a requirement for a minimum of such education hours each month.

Linking technical and business education in universities

A new concept is gaining strong academic support that may prove to be very useful in preparing future employees. The concept is the combination of a technical degree with a minor in business. The language of business is learned, but so is the technical depth. An example of such a program is the Manufacturing Engineering Technology Program at BYU. Another is BYU's Construction Management program. Both programs offer a technically-based major with a business minor. These programs are not unique but are among the best of their kind in the country.

Another special program to bridge the gap between business and technical education has been established at BYU. This initiative is called the Manufacturing Leadership Forum (MLF) and it is designed to assure that manufacturing students are involved with business projects. It also helps business students in their understanding of technical issues in manufacturing. Faculty from both the School of Technology and the School of Business are brought together through the MLF to create joint classes, give joint seminars, provide guidance for projects and research in both areas, and promote integration of teaching and other associations between business and technical areas.

The introduction of technological thinking into the liberal arts curriculum is a new educational wrinkle that is also gaining wider support. (See articles by Waks and Custer in the references.) These authors advocate the use of technology to improve creativity (lateral thinking) and to ensure that the liberal arts have the understanding of technology that is so critical in today's world. As quoted in the Custer paper,

“No adult is truly civilized unless he is acquainted with the civilization of which he is a member, and the liberal arts curriculum of fifty years ago no longer

provides that acquaintance. The fact that it does not do so is reflected by the fact that one can no longer study even philosophy or history at a respectable scholarly level without some acquaintance with the modes of thought represented by analytical and technological skills.”

The combination of both breadth and depth gives a powerful capability to see and solve the problems of the marketplace. The acquisition of liberal, business, and technical knowledge might initially be gained in a university, but we live in an age of life-long learning. We must be ever learning to maintain currency and to become successful entrepreneurs in the Information Age. Yankee Ingenuity, with all its attendant attributes, must be fostered for us to maintain economic leadership in world markets.

Acknowledgments

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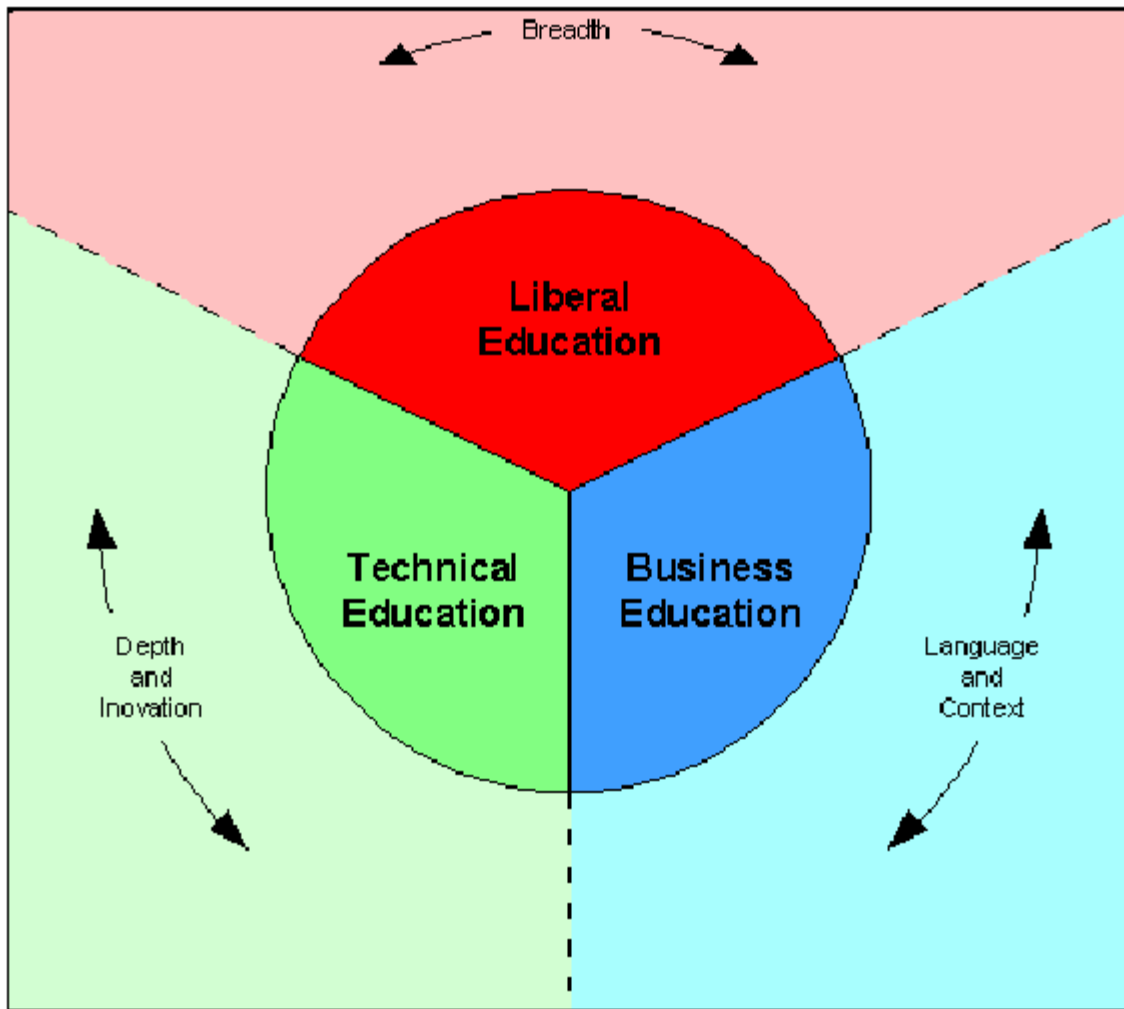


Fig.1 Educational Model