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Technology, Economics, and Politics

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Technology's primary engine is politics with a very close and necessary association with economics, and these three entities are so intertwined that technology itself cannot function well independently. The conceptual reality of each seems to imply separateness and distinctiveness, yet movement by politics and economics affects technology to an increasingly unusual and large extent. Technologies unforeseen just a few years ago have supplanted, and given rise to, newer and more functional instruments that serve a variety of purposes with a minimum of size, weight, components, and cost. What's ahead is anyone's guess, although change will come at in an ever-increasing pace.

Technology evolved from largely the arts, as did Gutenberg's printing, to become a craft as with Mergenthaler's linotype, and now a technology with computerized imaging that seemingly knows no limits. The same transformation can be seen in any and all other areas of modern society such as telecommunications where a cellular phone can be made the size of a writing pen—if anyone would want one that small. There are no apparent boundaries left to consider and all facets of technology are bound to change at increasing paces.

High technology's emergence began after World War II, when national defense outgrew the mechanical era and began to rely on more sophisticated materials and equipment based largely on electronic devices. The first hand-held calculators were large and relatively small in capacity, but calculators have now evolved to a throw-away status with much larger capacity in greatly reduced size and cost than the first efforts.

High technology is very cost-intensive, given that some of what is researched does not go into application immediately, if ever, but left in search of a product for its current use. High technology products are usually smaller, lighter, more reliable and energy efficient, less costly, and more readily available than were their predecessors. Television sets were first only in black-and-white, bulky, fairly unreliable, and relatively expensive. Today's sets are now in color, compact and portable, very reliable, safer, and relatively inexpensive. The same applies to radios, automobile electronic systems, music and video electronics, home temperature control and security systems, and a myriad of other consumer products.

Much of today's high technology is researched through major universities, large companies, and governmental facilities. Capital-intensive university research usually comes from governmental and private company funds since major universities are staffed with highly competent persons, usually with accompanying laboratory facilities provided by the universities for instructional purposes. Governmental research is eminent domain knowledge and thus applicable to widespread consumer applications. Universities are often the recipients of these monies since they have an abundance of knowledgeable faculty whose university research funding is greatly exceeded by governmental agencies and private industry. These funds also provide for additional equipment, faculty, and staffing that the university might not be able to afford from its internal budget. Company-sponsored research is proprietary for specific purposes and a closely guarded activity, although university faculty and laboratories are often involved because of the relatively low cost to the company.

The three primary means of attaining new technology are to pay for its research and development with private or government funds, buy a company that has the technology needed and spinning off what the purchased company has but not needed by the buyer, and through technology espionage. All three are utilized, but the latter although done, but is not readily acknowledged.

Economic systems still vary throughout the world from virtually nonexistent to highly complex forms. A global economy was a distant concern a generation ago; now, it's here to stay and will continue to expand. New cars now list the country of origin and the percent of parts made in the home country and other countries. A North American part may have been made in Canada, Mexico, or the USA, and the car itself may have been assembled in any of those countries. Manufacturing processes have become so refined and universal that parts made under license in various countries are virtually equal in quality.

The prevailing need of high technology is capital investment. Ideas can emerge from an individual, but capital is needed to bring the idea to fruition and production. This does not assure that a particular product will reach a market, but rather proceed through the research and development phase, then hopefully into a marketable product. Venture capital, by the hundreds of millions of dollars, is essential to high technology research and development. Other incentives, such as tax abatements and the provision of roads and other utilities by local and state authorities, are needed to entice companies to locate in a specific area. Lending institutions and private

investors are very attuned to their risks in high technology ventures and a host of other factors come into play before final decisions are made.

The Space Race was not funded by major companies with intent to capitalize on the eventual technology, but rather with the taxes gleaned from the vibrant economy of this country. USA taxpayer and corporate pockets were, and still are, the deepest in the world and the eventual results of this race were made available for consumer products, returning the original investment many times over to both producers and consumers. Consumer products provide advantages for high technology start-ups including the possibility of later property taxes, increased employment which yields income and property taxes, increased housing needs, added purchasing power of workers, greater dollar turnover in the community, and other related advantages. In turn, local school costs may rise, utility and road needs increase, and similar burdens on taxpayers emerge.

A major factor in global technology is the currency-rate fluctuation of major high technology countries. When a country's currency is strong against another country's, exports to the weak-currency country are curtailed because of the added cost of currency conversion by the weaker currency. Conversely, the weaker currency permits that country to export more to the stronger currency country because the conversion lets the stronger-currency country receive more goods for its currency unit. Governments can control the value of their currency, thus greatly affecting their exports that keep their economies functioning on an internal basis.

When the Japanese yen was near 80 per USA dollar, exports from the USA to Japan were much less costly to the Japanese consumers than when the rate was near 320 yen per USA dollar. The weak yen gave USA consumers less costly Japanese exported products and this contributes to the imbalance of trade in favor of the Japanese, and the strong yen made imported USA products less expensive for, Japanese consumers and reduced the imbalance of the USA trade deficit. Since multinational companies based in the USA must convert foreign currencies to dollars after sales, a weak foreign currency will generate fewer dollars than a strong foreign currency. Conversely, a strong foreign currency will generate more dollars for the USA company.

Global currency rates greatly affect technology in both the weak and strong currency countries, causing imports/exports, and profits or losses, to vary depending on currency rates. These variances cause fluctuations in employment, the processing of raw materials, energy usage, transportation, research and development, and many other factors that affect society in both specific and general terms.

High technology in an export-strong country continues to advance because of a robust economy fueled by research and development, a varied and competent labor force, the economical conversion of raw materials to produce usable products utilizing that labor force, thus contributing to a high rate of currency turnover throughout that particular society. Imports from weaker-currency countries increase because of the high discretionary income of the strong-currency countries. Weak currencies do not necessarily mean weak countries, but are advantageous to low natural resource/high technology production countries that must rely on a continual supply of in-and-out raw materials converted into finished goods for export.

The most important segment of any society, whether or not it is technologically advanced by today's standards, is its human capital. High technology is often evaluated by quantitative standards through formulae, charts, statistics, and other clear-cut criteria that make decision-making more justifiable and benign. Human capital is much more qualitative in that quantifiable criteria is absent and distinct judgement of its value must be made without supporting quantitative data.

Human capital is usually dependent upon education in general and substantial topical knowledge in specific. Dollar investment is easily evaluated after the fact by profit or loss, while human investment is difficult to assess because of its qualitative character. Part of a nation's wealth is in dollars, but more of its wealth is in human knowledge and application. Human capital is not bought and sold as are marketable products, but is an innate part of a country's infrastructure that is most important to technology, economics, and politics. People are the most important and critical part of any society, and their contributions to that society are dependent upon their continuing education. The breadth and scope of high technology is dependent, first and foremost, upon people: how well they are educated and how well they utilize their talents.

Political systems have existed in various forms since the time people first banded together for safety and sustenance. Some systems have evolved into a very high state of organization and continue to function with the accommodation of change, as does the political system of this country, while others struggle with the maturation process of becoming a republic.

Technology is not a separate entity that fuels itself regardless of any other determinates. It is the result of perceived needs that may be met by first a political decision to proceed, then economic funding to support a project to completion. Political decisions do not necessarily involve politicians *per se*, but may involve internal company decisions made after considering all facets of a proposed project. As with political decisions, there are invariably those to oppose and those who support particular proposals. The funding process requires planning, projections, and careful consideration of the profit-loss potentials, whether in the private or public sectors.

One of the most far-reaching political decisions that affected the emergence and growth of high technology was that of "sending a man to the moon and returning him safely." The evidence of this was an audiotape played with then-President Kennedy stating that "This is a political decision . . . . " It was made clearly and simply, and gave the world an entry into previously unknown technology

through government-funded research and development. All of the parts and pieces needed to send the Apollo spacecraft to its lunar destination and return safely did not exist at that time, but rather were researched, refined, and later produced: fuels, alloys, synthetics, miniaturized electronics, communication and life-support systems, and many other technological needs not in existence at the time of decision.

This decision was made not to promote science and technology, but rather a political decision to project the United States of America into the forefront of technology during the Cold War for political reasons. The spin-off from the Space Race is seen in today's consumer products in areas such as bio-medical, data acquisition, testing and measurement, remote sensing, materials and processes, electronic components, pharmaceuticals, and a multitude of other areas.

Technology, economics, and politics are now inseparable entities. An example of how these three entities work together is the emergence of high technology in cities that have both the state capitol building, with resident politicians, and the flagship state university, with resident professors. Three very important factors exist in these situations: political clout, attendant economic power, and highly knowledgeable faculty who are readily available for consulting without incurring the costs of permanent staff. An emerging or established technology company can utilize the brainpower of the university faculty on a short to long-time basis without costs such as insurance, vacation time, and other cost factors, and when a specific project has been completed, the contract agreements have been met and both entities can part company. If different competencies are required for other research and development activities, the same or other faculty can be contracted for that phase of the project.

Another way to utilize the existing university facilities and faculty is to award a carefully structured contract to the university for specific research that can yield the desired results for the company without additional costs of equipping laboratories, hiring people with needed competencies and then having to retain them even though their competencies may not be needed immediately. Contracts awarded to universities often permit the utilization of graduate research students by providing them with funds to remain in high technology graduate studies, and this in turn keeps enrollment up in costly science and technology degree programs.

All seem to win in these instances: The company gets what it needs at a relatively low cost, university faculty gain through consulting fees, graduate students are supported by company funds, academic programs keep enrollments high, and the university gains both from indirect funds and added prestige. Abuses can occur though, such faculty not teaching but conducting research, state-owned facilities being used for private gain, excessive work required of graduate students, and other related misuses.

The Swedish federal government established a policy after World War II of promoting a national champion in each technology area to eliminate *intranational* competition and foster international prowess for internal and export purposes. The country is too small and thinly populated for technology competition within its own borders, thus this policy has led to world-class quality products in nearly all technological areas such as Volvo trucks, cars and other power plants, (the car business is now wholly owned by Ford Motor Company), Saab aircraft and aerospace (the car business is now wholly owned by General Motors Corporation), Ericsson telecommunications, Electrolux white goods and appliances, Tetra Laval's processing, packaging and equipment for liquid foods, Pharmacia's pharmaceutical products (now merged with Upjohn), Absolut distilled spirits, IKEA wood products, Hasselblad optical and photographic equipment, ABB (a Swedish-Swiss engineering group), SKF bearings and lubricants, Sandvik metal cutting equipment, Sony Ericsson mobile communications, and many other examples.

This policy, a major political decision, has made Sweden one of the most diversified technological countries in the world with a minimum of intranational competition. Exports make up a very large portion of Sweden's gross national product and continue to support its social democracy, one of the most comprehensive and encompassing in the world. The world's best quality iron ore from Kiruna, abundant hydroelectric power, a highly educated technological work force, and a cohesive national policy provide a stable economy for this Scandinavian country.

One of the most effective means of conserving finite natural resources is to utilize the political tactic of finite resource pricing. This is pricing, through governmental action, puts the cost of the finite resource at a level that consumers will 'voluntarily' curtail the use of the resource and seek alternative means that meet their needs. The price of gasoline in many countries is comparatively very high to the USA, thus literally forcing consumers to seek other means of transportation such as public mass transit, walking, bicycling, car pooling, electric or hybrid cars, smaller cars with diesel engines, and other alternatives. The effect on technology is to spur greater research and development in alternative means of transportation. The crux is a political decision that forces the public to utilize new and emerging technology to alleviate the high cost of motor fuels.

The Western Rim of the Pacific Ocean is the new export/import-rich part of the world. Countries such as Japan, Taiwan, Korea, China, Singapore, Malaysia, Russia, Australia, New Zealand, Vietnam, Myanmar, Thailand, and neighboring countries have large populations, many with world-class technological expertise and increasing access to capital for research, development, and production. Ready access to cheap labor, underdeveloped legal structures to curb piracy and environmental controls, ease of exportation via oceanic travel, and the world's appetite for consumer goods makes this part of the world a trove of technological application. Political and

economic systems have accommodated the rapid growth of technology in these countries and will continue to increase their productive capabilities.

Conclusions are that technology grows and prospers from first political decisions, then accompanying economic factors. The most technologically advanced countries continue to expand politically, economically, and technologically, often leaving lesser countries further and further behind. This makes those countries become more and more reliant upon the technologically advanced countries, reducing their global effectiveness as separate entities, and literally forcing them into a colonial status to the detriment of global growth and democracy.

Political stability is the first requirement for a technological society. The United States of America is a republic with a democratic system of government and a capitalistic system of economics. Countries with a single system for both do not permit free and open research, development, and production of and for consumer products. These governments exist solely for the in-power group rather than the populace, and thus continue to lag further and further behind in the world's technological race. Natural resources may abound, but are often exported for short-term gain for a few, leaving the majority of the populace out of the technological loop. Political stability will bring economic viability from both internal and external sources.

The single most important segment of any society, technologically advanced or not, is its populace. People are the lifeblood of a republic and their knowledge and skills are needed to provide continuing growth in all phases of society. Education, both general and specific, is the key to every republic's continuing climb in an ever-increasing competitive world.