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**A Brief History of the American Innovation Workforce
and the Pioneering Companies
of the Knowledge Economy**

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GENOMIC MAPPING ACROSS HISTORY – THE EVOLUTION OF THE KNOWLEDGE ECONOMY (THE THREE ERAS).

The Three Eras Map shows the historical evolution of the knowledge economy¹ across three eras: the Pioneer Era starting in 1852 where money center banks and information companies emerge; the Applied Knowledge Era starting in 1924, when knowledge tools and platforms are first built; and the Knowledge Liberator Era starting in 1980, when circuitry, networks and disruptive technologies set us free. The mapping is a pictorial and historical summary of the paradigm shift from the industrial age to the new economy based on the following brief history:

Pioneer Era (1852-1923)

- 1800's – The 13 Money Center Banks are founded, starting with Chase in 1799, setting the stage for global commerce.
- 1832 – The age of information is launched with the invention of the telegraph by Samuel Morse.
- 1847 – The California Gold Rush opens up new frontiers.
- 1852 – Wells Fargo (*William Fargo and Henry Wells*) is founded as a delivery system of information and money.
- 1863 – *Alexander Graham Bell* begins his career of inventions around acoustics and sound, eventually resulting in the telephone in 1876 (electronic circuitry).
- 1868 – *Thomas Edison* leaves Western Union as a telegraph operator, founds his lab in Menlo Park NJ (the precursor to Bell Labs), joins with Alexander Bell, and starts to invent new applications of electricity
- 1891 – *Leland Stanford Jr.* founds Stanford University.

Applied Knowledge Era (1924-1979)

- 1924 – IBM (*Tom Watson*) is founded to build machines to process information.
- 1939 – Hewlett Packard (*Bill Hewlett and David Packard*) is founded by two Stanford University electrical engineers to build electronic products and instrumentation (analytics machines).
- 1940's – The government, universities, and the private sector start to make compounding investments in R&D and new technologies during and after WWII.
- 1944 – The GI Bill (Servicemen's Readjustment Act of 1944) funds investment in a highly educated workforce, and in America's institutions of higher learning, as well as a subsidized mortgage market.
- 1946 – Stanford Research Institute (SRI) is founded by the Board of Stanford University and local business executives, and is committed to "discovery and the application of science and technology for knowledge, commerce, prosperity, and peace."
- 1950's – Massive amounts of data are analyzed to predict behavior across populations in the new field of population genetics, setting the stage for **biology** as the parent science of the knowledge economy (*Robert Allard at University of California, Davis*).
- 1950's – Workers are re-cast as assets, and corporations as human communities, calling for new business and leadership models (*Peter Drucker, Claremont Graduate University*).
- 1950's – A wave of well-educated scientific talent immigrates from Europe and hybridizes the Innovation Workforce.
- 1956 – Fair, Isaac (*Bill Fair, Earl Isaac*) is founded to build models to predict consumer behavior across populations (knowledge tools).
- 1960's – The open society engenders multiplicity, diversity, and "open source."
- 1960's – Computing power is freed from the mainframe by DEC.
- 1964 – Human capital is identified as the largest source of wealth in the developed world, and therefore becomes the new capital of competitive advantage (*Gary S. Becker, University of Chicago*).
- 1970 – *Dee Hoek* founds VISA on the self-organizing principles of evolutionary biology, and describes its product as coordination.

- 1975 – **Bill Gates** founds Microsoft as the original interpreter between the user and the computer, making computing power ubiquitous (operating platforms via software).
- 1976 – **Steve Jobs** founds Apple, thereby inventing the PC (personal creativity and connectivity).
- 1977 – **Larry Ellison** founds Oracle based on his intellectual passion for the knowledge-creation capacity of relational databases (data mining = the new gold ∞).
- 1978 – The **Silicon Valley** ∞ is named, and becomes the golden capital-centric model (CCC) for successfully sparking, then amplifying, innovation – a manifestation of the potent convergence of great universities, brilliant entrepreneurs, and capital with an appetite for risk (“hybrid vigor”).

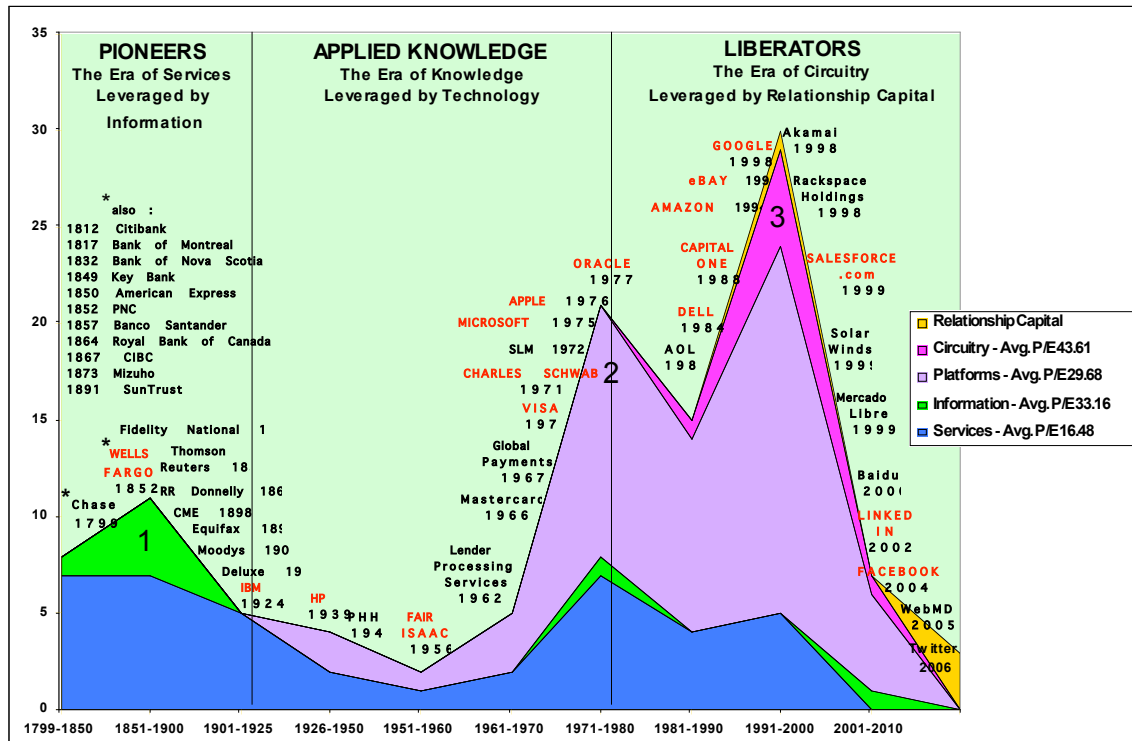
Knowledge Liberation Era (1980 – Present)

- 1980 – The Deposit Institutions Deregulation and Monetary Control Act of 1980 is passed, freeing financial institutions (and entrepreneurs) to compete and innovate.
- 1980 – Chase, American Express, Citibank, Wells Fargo, Bank of America and others start to hire biostatisticians and use models to predict behavior across consumer populations on a massive scale (iterative knowledge creation).
- 1980’s – A new wave of talent immigrates from Asia, earns advanced degrees at America’s best institutions of higher learning, then joins our most innovative companies as Expert Creators.
- 1983 – **Scott Cook** founds Intuit to use new technologies to make bill-paying easier (utility tools for the mass market).
- 1984 – **Michael Dell** founds Dell to sell PC’s direct-to-consumer (mass market customization).
- 1988 – **Rich Fairbanks and Nigel Morris** found Capital One on the IBS (Information Based Systems) business model (information, technology, testing and great people).
- 1989 – Worldwide Web protocol is defined.
- 1990’s – Experiments with disruptive technologies and convergence abound across the American economy, and especially in the Silicon Valley.
- 1992 – **Marc Andreessen** invents the Mosaic browser; commercialization of the internet begins, and so does the cloud.
- 1994 – **Jeffrey Bezos** founds Amazon.com to leverage the Internet’s unique ability to deliver huge amounts of information rapidly and efficiently (on-line marketplace).
- 1995 – **Pierre Omidyar** founds eBay as an on-line marketplace for individuals to connect (self-selecting communities).
- 1996 – **Charles Schwab** (founded in 1971) powers into a “company of consequence” (\$51BB in market capitalization in 1999) via instantaneous mass-market on-line trading (disruptive technology + disruptive pricing = mass market liberation).
- 1998 – **Sergey Brin and Larry Page** found Google to organize a seemingly infinite amount of information on the web (open networks and knowledge circuitry).
- 1999 – **Elon Musk** founds x.com/PayPal (now eBay) as an on-line electronic bank to move payments via email (payments innovation platforms).
- 1999 – **Marc Benioff** founds Salesforce.com to be the “end of software”, inventing software-as-a-service (SAAS) on the Salesforce cloud.
- 2002 – **Reid Hoffman** founds LinkedIn (>\$1BB, pre-IPO) as a social network for business relationship capital.
- 2004 – **Mark Zuckerberg** founds Facebook (>\$1BB, pre-IPO) as a student directory, which becomes a ubiquitous social network for personal relationship capital.
- 2010 – The Knowledge Index™ is created, historically tracking knowledge-using, knowledge-producing, and knowledge-liberating companies from diverse industries as one population (the Knowledge Sector). (see www.allardinstitute.com)

THE THREE ERAS MAP

The Three Eras Map displays the number of companies founded (y axis) over historical time (x axis) in colored bands based on the kind of knowledge company (services, information, platforms and knowledge tools, circuitry, and relationship capital). The Innovator companies are identified by name (in red) and founding date across the timeline, as well as selected peer companies from the dataset, thereby giving a historical and evolutionary context to the paradigm shift, and the lead role of the Innovator companies.

The Three Eras Map, by Type of Knowledge Company



The three peaks of Innovation demonstrate vividly how each emerging wave of new knowledge-technology is leveraged by American entrepreneurs² into a tsunami of compounding invention. Note how the market values knowledge-producing companies (information, platforms, and circuitry) above knowledge-using companies (services) as measured by the current average P/E ratio: services 16.48, platforms 29.68, information 33.16, and circuitry 43.61. A fourth peak of Innovation is predicted, to be driven by the golden coinage of relationship capital.

THE GREAT CAPITAL CENTRIC-CENTERS (CCC'S) OF THE EAST, SOUTH AND MIDWEST, AND THE THREE CALIFORNIA GOLD RUSHES

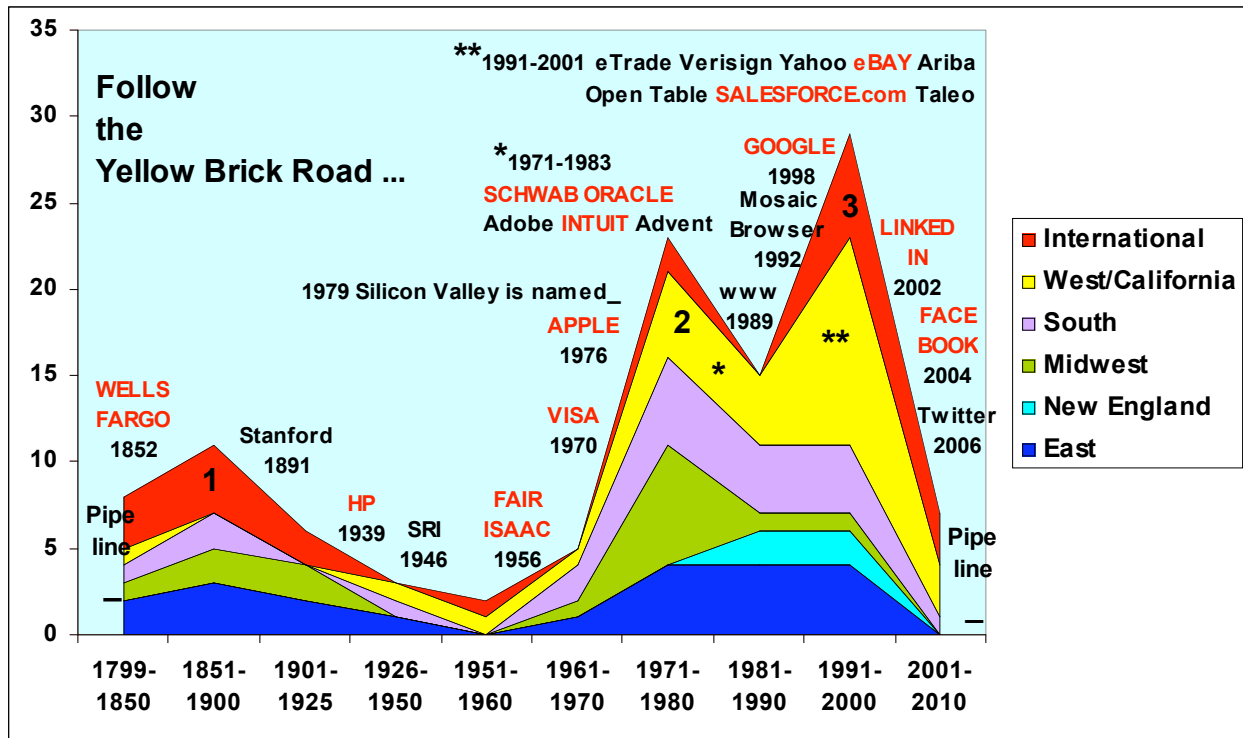
The Three Eras is remapped, this time by geography, to pictorially display the great American Capital-Centric Centers (CCC's). Capital-Centric Centers are defined as the convergence of great universities, ideas and entrepreneurs (Human Capital), and Investment Capital; those geographically-concentrated centers where new companies, technologies, industries, and business models are founded. The map shows the evolution over time of innovation by region, as well as the importance of international (red).

Note how the first peak is powered by the great companies of the South and Midwest, as well as New York and International (Money Center Banks). The knowledge industry emerges in the trough of 1924-1970, and then sparks a second peak of innovation, with new companies and industries being founded across the country. The

internet era emerges in the trough of 1978-1982, then crescendos to a third peak of innovation, from which lofty height we watch for the up-and-coming Innovators to put themselves “on the map” and re-chart the landscape of history.

Especially note the three California gold rushes – one starts in 1852 with the founding of Wells Fargo, the second starts in 1939 with the founding of Hewlett Packard fueled by Stanford University, while the third starts in 1978, with the naming of the Silicon Valley. A fourth California gold rush and the next big peak are predicted as the relationship capital industry comes on-stream, and liberates us all to new heights of creativity. A prediction: for the next new CCC, keep an eye out for Texas!

The Three Eras Map, By Geography, and the Three California Gold Rushes



**PARADIGM SHIFT DEFINED –
HOW THE KNOWLEDGE ECONOMY IS COMPLETELY DIFFERENT**

The Three Eras Analysis cannot be completed without first explicitly understanding the nature and magnitude of the paradigm shift we have experienced as we have moved from land, to capital, to human capital as the coin of the nation. Consider the five revolutionary facts below about the knowledge economy, and ponder their profound implications for the business ecology³ of the future.

**** Five Revolutionary Facts ****

1. Biology is the parent science of the knowledge economy, and new business paradigms (based on the principles of evolutionary biology, social neurobiology, and network and circuit theory) are replacing hierarchical organizations (based on laws and top-down control).
2. In the knowledge economy, information is more valuable than the original business; therefore companies are evolving away from old-economy sellers of products and services (organizations), and evolving into new-economy knowledge harvesters and collaborative learning communities (organisms).
3. Not driven solely by economic necessity and personal financial gain, learning communities are rather connected empathically via a self-seeking network of participants who are motivated by self-direction, shared purpose, emotional satisfaction, personal passion, and love of achievement (**virtuous cycles** ∞), thereby compounding relationship capital with every transaction.
4. Today's leaders are first and foremost Masters of the Self. They practice emotionally intelligent behaviors, and thus create an ecology of trust, where information-sharing, healthy risk-taking, continuous learning, and mental efficiency can flourish.
5. American and global productivity will surge. Self-adapting living systems are highly efficient ("nature's operating systems") and more stable (less risky), because they continuously and heuristically adapt to the changing environment. (Read all about it in "Nature's Operating Instructions – The True Biotechnologies", especially Biomimicry; Ecology as the Art of Restoring Relationships; Think Like a Prairie; The Industrial Evolution: Biology Meets Business; Natural Capitalism; and Spirituality as Political Consciousness).

SUMMARY OF THE THREE ERAS MAPPING

ERA:	PIONEERS	LEVERAGERS	LIBERATORS
Avg Date Founded:	1866	1967	1993
Avg P/E:	16.28	20.15	35.20
Economic Setting:	Global Commerce	Knowledge Industry	e-Commerce & e-Community
Currency:	Gold	Capital Markets	Relationship Capital
Power:	Labor	Education	CCC's
CCC's:	East, South, Midwest, International	East, South, Midwest and West	Silicon Valley influence compounds
Circuitry:	Physical	Wireless	Networked
Product + P/E:	Services ∞ / Information ∞ 16.48 / 33.16	Platforms ∞ 29.68	Circuitry ∞ / Relationship Capital ∞ 43.61 / too soon to tell
Science:	Physics	Biology	Neurobiology

DEDICATION

Susan Allard is Co-Founder and Chairwoman of Allard Institute Inc., a Bank of Intellectual Capital for the Knowledge Economy, which was founded by its Members in 1983. She is expert on the American Innovation Workforce, especially its highly educated Expert Creator segment.

*This paper, based on 27 years of research data, is dedicated to the author's father, Robert W. Allard, who founded the field of population genetics at the University of California, Davis in the 1950s. In population genetics, massive amounts of data are analyzed to predict behaviors (traits) of populations over time. Among the many honors and awards earned over his distinguished career, Dr. Allard was elected to the National Academy of Sciences in 1973, where his contributions focused on agriculture and sustainability; population, evolutionary and ecological genetics; plant breeding; and genetic resource conservation.
(http://www.nasonline.org/site/PageServer?pagename=MEMOIRS_A)*

FOOTNOTES

- ¹ See “Definition and Analysis of the American Innovation Workforce with Six Policy Recommendations” at www.allardinstitute.com.
- ² The word "talent" is derived from the Greek word *talanton*, which means "balance, sum, weight, value," and was a unit of weight, in gold and silver, which was used as a legal tender in early trading transactions (3,000 shekels = one talent). Talent entered into the Hebrew language and translated meant the word *kikar* (loaf or cake) suggests that the shape of the talent was circular like the bread of those times, even though some forms of the weight in later years were figurative in shape. According to Greek myth, *Atalanta* of Calydon, the virgin huntress, was famous for her swiftness, having the same value (as man). From the Online Etymology Dictionary it is understood that the word talent was originally an ancient unit of weight (Old English *talente*). The Medieval Latin and common Romanic sense developed from figurative use of the word in the sense of money. The meaning of special natural ability, or aptitude, developed in 1430, came from the parable of the talents in Matthew 25:14-30 "And unto one he gave five talents, to another two, and to another one..." Through the annals of history the word talent then denoted a special or innate skill, aptitude or ability, especially for the arts or music, etc., or a person or people with high general or mental ability. Therefore, talent literally started out as the coin of the realm, then as now.
- ³ See “A Key Measure You Need to Know to Grow (in the Knowledge Economy)” © September 2010, prepared for the Harvard Business Review at www.allardinstitute.com.