

The Four R's: Reading, Writing, Arithmetic, and Innovation

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The three R's, *reading*, *writing*, and *arithmetic* has been a pervasive idiom for two hundred years because it refers to basic skills comprising the foundation of education. Literacy, reckoning, and figuring are cornerstones of modern education representing skills deemed necessary in the modern world. It is time to update the idiom. This article argues changes in the world over the last forty years dictate the addition of a fourth "R" - *-innovation*. We propose calling the new idiom *the four R's*: reading, writing, arithmetic, and innovation. The ability to innovate is a critical skill in today's reality and we have found that it can be taught as fundamental skill. We think innovation should be taught throughout all levels of the educational system to prepare the rising generation for the information-based, globalized economy.

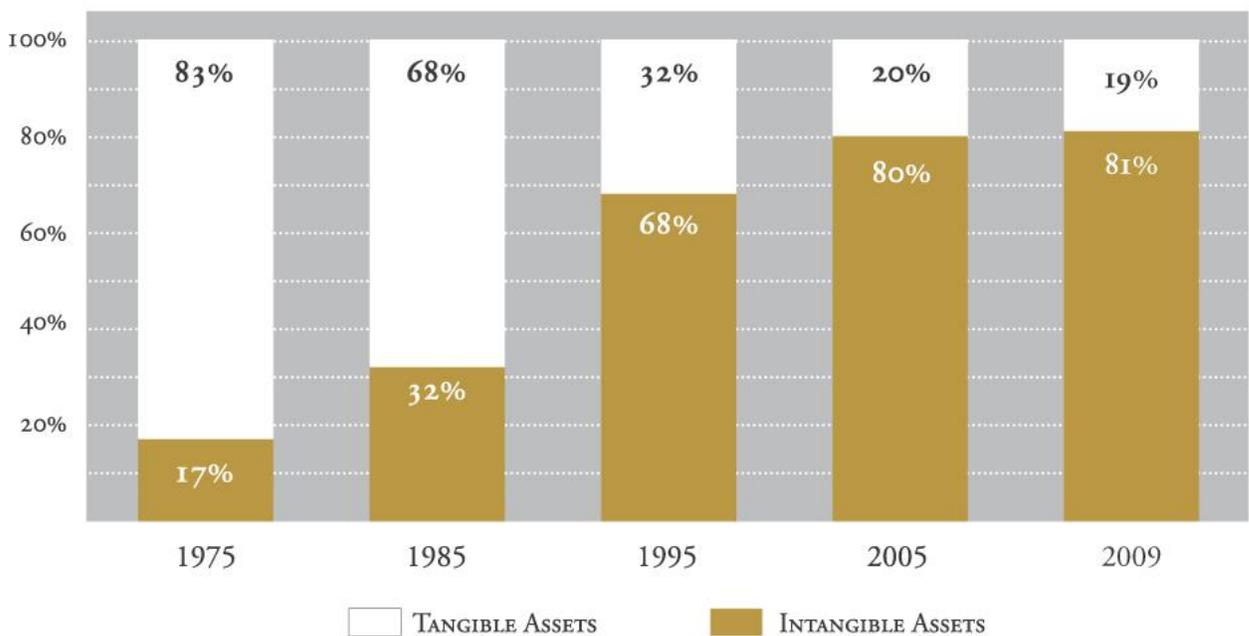
One constant about the world is that it changes. In the two hundred years since the three R's phrase was coined we have seen the United States economy go from being dominated by agriculture, through the manufacturing era, to the present service-oriented economy. We have witnessed the rise of the industrial age and we are now living in the computer age and information age. Many argue that the last ten years has dawned a new age future historians will likely call *the social age* due to the global use of the Internet, social networking, social media, and user-generated peer-to-peer content.

Before the 1980s, few people ever interacted with a computer. However, by the end of the 1980s, most office workers had a computer on their desk and many households had at least one computer. Local area networks, desktop-sized and economically-priced computers, and end-user office software began the transformation of the average office worker into an *information worker* meaning their daily work activities involved the use of electronic information processing technology. The 1990s brought the mainstream use of the Internet through the World Wide Web and email. We entered the 2000s, the beginning of the social age, with most office jobs dependent on the continual use of computers, the Internet. Over the last decade, we have seen the average person become dependent on handheld, wireless telecommunications technology such as cell phones and

texting. Also, the last decade has seen the transformation of the average person into a digital social animal through the use of social networking, Internet-based information retrieval, and on-demand digital entertainment (cable system and Internet). Today most households have multiple computers and both our personal and job-related lives are severely disrupted if we lose access to a computer or telecommunications.

Since we have all become information-based creatures both at home and at work, should it be so surprising that our economy has changed in a similar fashion? According to the premiere intellectual property firm, Ocean Tomo, LLC, 80% of the value of the S&P 500 companies is due to *intangible assets*.

COMPONENTS OF S&P 500 MARKET VALUE



Source: Ocean Tomo

An intangible asset is anything of value lacking physical substance including: patents, trademarks, service marks, know-how, business processes, business practices, trade secrets, etc. --the intellectual property (IP) of a company. The trend over the last forty years is striking. In 1975, intangible asset value was only 17% of the value of a company. Today, the ratio has completely inverted. Most of the value of a company is wrapped up in the *information* it maintains.

According to the United States Patent and Trademark Office (USPTO), IP-intensive companies are responsible for over 40 million jobs in the USA (28% of all jobs) and IP-intensive industries contribute \$5 trillion (35%) to the country's gross domestic product (GDP). Employment is increasing in IP-intensive sector 60%-140% faster than in tradi-

tional non-IP-intensive sectors and the average wage in the IP-intensive sector is 42% higher than other sectors. Clearly, IP is a major driving force in today's economy.

So this begins to beg a few important questions. How do we make or acquire more IP? How do we increase the value of our existing IP? How do we make our information more valuable than it is today? *Innovation* is an essential part of the answer to most of these questions. Innovation is the key to the growth of IP because it continually increases the value of information. Economist Joseph Schumpeter maintains industries must continuously innovate in a process he called "creative destruction." This, of course, is not new. Companies have always looked for better ways to serve their customers and entrepreneurs have always developed new products and new markets. What is new is the information-based, globalized context in which we find ourselves today. There are at least three differentiators.

First, is the value of information. As evidenced by the intangible asset value discussed above, information has become a unit of value that can be created, bought, sold, and traded. Working with information is much easier, faster, and cheaper than working with physical raw materials like steel and iron. Therefore, the pace of innovation in information-intensive industries is vastly accelerated. Second is the effect of the Internet and related technologies. Instantaneous person-to-person afforded by the Internet and wireless telecommunications enables the around-the-clock continuous global market. The one-to-millions communication ability by any individual on the planet levels the playing field competitively, culturally, and politically. Third is the revolution brought about by the use of social networking and peer-to-peer information exchange. The result is the emergence of an information-based, knowledge-intensive, globalized marketplace in which the barrier to entry is so low that anyone can compete with anyone else in the world, even against established leaders in an industry. In this environment, those unable or unwilling to accelerate the pace of innovation will lose. Those able to innovate continuously and effectively will win.

But who will do all this innovation? We tend to think the most innovative are one-in-a-million people with unusual powers of imagination, drive, and will. Do we have to wait around for enough creative geniuses to emerge to drive the economy forward into this new era? Fortunately, no. We have learned over the past several years innovation does not require a special genius. In fact, we can teach the basic principles of innovation just like we can teach reading, grammar, arithmetic, algebra, and calculus. We can teach innovation as a discipline.

For the past three years, at the University of South Carolina Upstate, we have been teaching an innovation technique in an undergraduate course entitled Systematic Innovation and will begin teaching a graduate course in the subject in 2013. The technique stems from TRIZ, an acronym for the Russian phrase "the theory of solving inventive problems," an effort begun nearly seventy years ago in the former Soviet Union. Hidden

in state secrecy behind the Iron Curtain, almost no one knew about TRIZ until the 1980s. But, over the last twenty five years, especially following the collapse of the Soviet Union, TRIZ has been spreading around the world. Over the last ten years, we have developed several Westernized courses teaching a post-Soviet modern extension of TRIZ called I-TRIZ. We have found that we can increase the analytical, critical, and inventive potential of anyone, even those who do not consider themselves as being creative. We have seen students able to innovate in virtually any domain without requiring domain-specific knowledge. This is because the systems analysis, problem analysis, and solution synthesis skills taught in the course are generic. This is a different approach than in current higher education where we teach students subject-matter expertise in a specific subject before we expect them to be innovators in that domain.

There has been much effort throughout education to teach critical thinking and lateral thinking. I-TRIZ differs in that at its heart is a vast knowledge base derived from the study of over two million patents over a period of more than forty years. Therefore, instead of a psychological approach, I-TRIZ is a knowledge-based discipline. The steps in the I-TRIZ technique are intellectually manageable, repeatable, and learnable. In short, we can teach anyone to innovate.

Currently, only a handful of courses in United States higher education teach innovation as a skill. Over the next ten years, we should diffuse the teaching of innovation as a fundamental skill throughout all levels of the educational system, even down to the kindergarten level. We should view the ability to innovate as fundamental as the ability to read and write. In fact, the information-based economy emerging globally demands that the next generation be equipped in the Four R's.