

Assessing The Value Of Technology Innovation

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Technology innovation and/or change may add value to both a company and an industry sector. Predicting that value is important to mitigate risks when investing, acquiring or selling a technology change. Interfacing technology change with industry sector will give an initial qualitative assessment of the degree of valued added.

Technology inventions and advances are the universal driver of economic growth and commercial value. There are several methods, approaches and tools for measuring and predicting the commercial value of a new technology. This article presents one more perspective for deeming if a new technology merits an investment to commercialize the technology, an expenditure to acquire the technology or a commitment of resources to sell the technology. It is a qualitative starting point for an important decision-making process.

Predicting the value of a new technology is determined by the answer to three questions: What value does the new technology add to products or services? Will the new technology be commercially accepted? What is the time to market for the products or services created by the new technology? A starting point for answering these three questions is an interface between the type of technology change and the status of the industry sector where the technology will be commercialized. This correlation can add efficiency to initially understand potential value of the new technology and predicting the outcome of an investment in that technology.

For purposes of this discussion, a new technology is defined as science and engineering knowledge for im-

proving existing products or services and/or creating new products or services. A newly created technology will either be:

- 1) an incremental change in an existing technology,
- 2) a breakthrough that significantly advances a technology field, or
- 3) a revolutionary advancement that creates an entirely new technology. It is assumed that the new technology is reproducible and has intellectual property protection.

Most new technologies are incremental changes of what already exists. For example, the fanjet engine added significant increase in size, speed, and fuel efficiencies for commercial aviation while reducing noise pollution. Going from propeller to jet was a breakthrough in aviation technology. The fanjet was an incremental improvement of commercial jet engines. There was a 20-year cycle for the fanjet to become the standard commercial aviation engine. It added incremental value to existing airplane manufacturers, jet engine manufacturers and commercial airlines. The fanjet itself did not create a new industry or new competitors for Boeing, Airbus, GE, Rolls Royce and the other industry leaders in commercial aviation.

Microsoft created a breakthrough technology. Its software design overcame barriers and provided new software approaches that systematically changed computer manufacturing and software development companies. This breakthrough technology became the industry standard for PC and desktop computing.

In 1973, scientists Stanley Cohen and Herbert Boyer successfully transferred deoxyribonucleic acid (DNA) from one life form into

another by “splicing” sections of viral DNA and bacterial DNA with the same restriction enzyme. They then spliced this recombinant DNA molecule into the DNA of a bacterium, thereby producing the first recombinant DNA organism. This was a revolutionary technology change now commonly known as gene splicing or recombinant DNA. Genentech Corporation was formed in 1976 based on these genetic engineering techniques and employed the methods to produce human insulin in *E-coli*. Genetically engineered insulin became the first biotechnology product approved for human use. The biotechnology industry was launched and the global pharmaceutical industry was forever changed by the products and services derived from the Cohen-Boyer technology.

How does the interface between technology change and industry sectors assist to qualitatively predict the value of the new technology? Technology change is defined as being either incremental, breakthrough or revolutionary. For comparison with technology change, industry sectors are defined as being either stable, evolving or totally dedicated to research and development (R&D).

Stable industry sectors are well established and slow in adapting commercially accepted technology changes. Leaders in stable industry sectors are usually among the Fortune 500 companies. The technologies that support stable industries are well established and conform to

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industry wide standards. Technology change, whether incremental or breakthrough will not launch a new company that competes with established leaders. For example, installing global positioning systems (GPS) in automobiles is an incremental technology change for the auto industry. A company that develops and produces GPS for the auto industry will not likely become a Fortune 500 company based on that single technology. Such a hypothetical company would not rise to the level of Delphi or Yazaki as a major auto component supplier by producing this single product. Technology changes, whether incremental or breakthrough in a stable industry will not create a Dell Computer, Amgen or Amazon.com.

Evolving industry sectors are in fact defined by technology change. The computer chip, biotechnology and software industries are examples of evolving industry sectors. The technologies that define an evolving industry sector are continually experiencing incremental and breakthrough changes. Evolving industries will more quickly embrace a new technology if it falls within accepted industry standards or establishes new industry standards. A breakthrough technology change can result in the emergence of a new company that challenges the current leaders in that evolving industry sector. Yahoo, Medimmune and Intel are companies that are among the leaders in their respective evolving industry sectors. Their products and services can be rapidly challenged by new competitive technologies. Breakthrough technologies can create significant value and provide a competitive advantage in an evolving industry.

R&D industry sectors exist to create and commercialize revolutionary technologies. An example is the recent emergence of scores of nanotechnology companies. The nanotechnology industry is ill defined with no clear pathway to commercialize products. Incremental and breakthrough technology changes may enable R&D industries like nanotechnology, but such changes

do not add the fundamental value for commercial success. By definition, revolutionary technology changes in stable and evolving industry sectors do not occur. If there is a revolutionary technology change that is accepted commercially, a new industry will emerge to supplant the stable or evolving industry sector. A commercialized revolutionary technology success can create enormous value and may spawn a new industry. However, there is a very high risk that a revolutionary technology will not be developed and/or will find its way into products and services.

The interface of technology change to industry sector provides a useful starting point in assessing technology value. Tables 1, 2, and 3 illustrate a starting point assessing value and risk when buying, selling or commercializing technology changes.

Technology Change Value Creation

The highest value will be added to existing and/or new products and services by breakthrough technology change in an evolving industry sector.

There is a higher rate of acceptance of technology change in evolving industry sectors.

Time to market for technology change occurs more rapidly in evolving industry sectors.

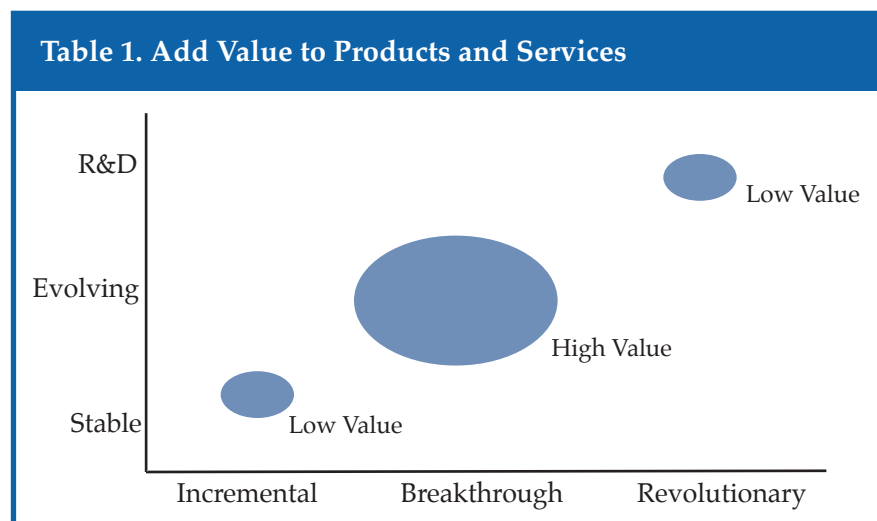
As indicated in Tables 1, 2, and 3, technology changes in stable industries

are likely to add only incremental value. Commercial integration of technology is a very slow process because of capital investment requirements and industry culture. Slow technology adaptation means longer time to market thus delaying even incremental value realization.

A revolutionary technology in the R&D sector has low current value. There are no products or services to be supported by the technology, thus no value is added. Similarly, commercial acceptance and time to market issues produce a low value rating for revolutionary technologies in the R&D sector.

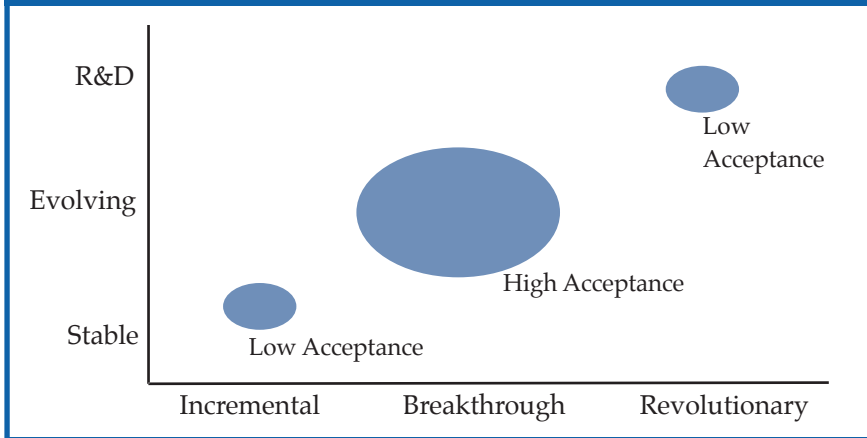
Where technology changes produce the highest value is in evolving industries. Products and services can more rapidly adopt (or be replaced) by new technologies. Commercial acceptance of technology change is more part of the culture of evolving industries. Better products and services move into the market more rapidly in an evolving industry sector. The greatest value is realized by commercializing breakthrough technologies. New companies can emerge and become industry leaders. New industries can emerge from breakthrough technologies in evolving industry sectors.

Table 4 provides examples of technology changes as a predictor of the degree of value the technology change will add to the industry



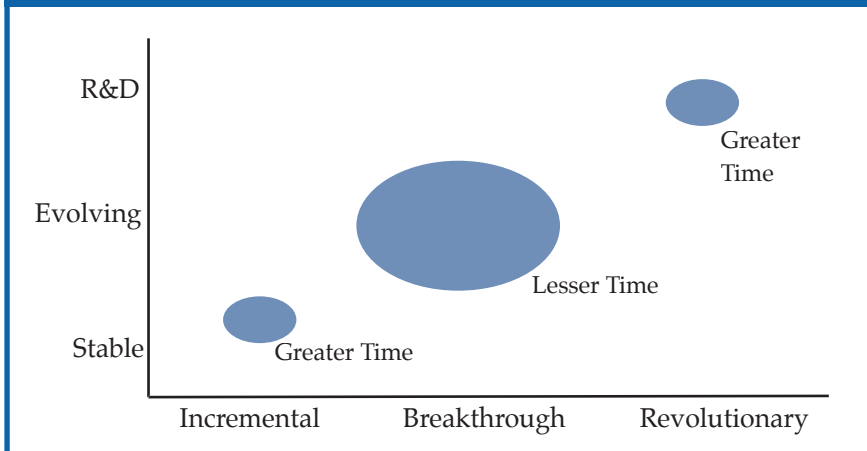
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Table 2. Commercial Acceptance



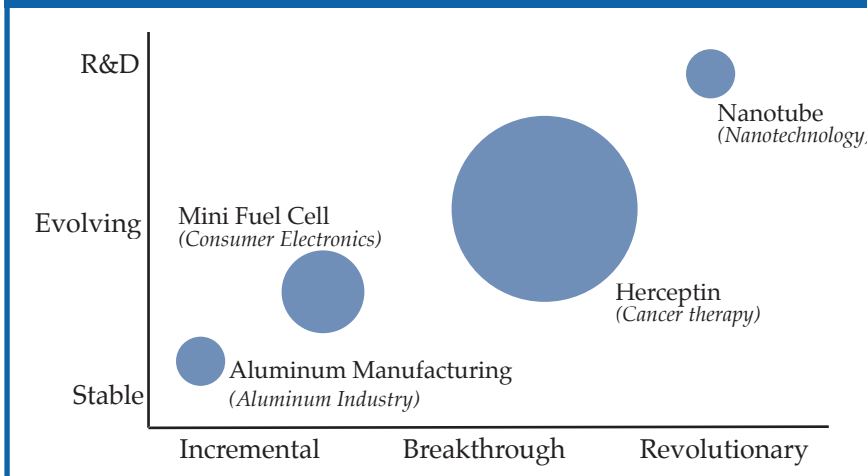
There is a higher rate of acceptance of technology change in evolving industry sectors.

Table 3. Time to Market



Time to market for technology change occurs more rapidly in evolving industry sectors.

Table 4. Value of Technology Change Examples



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sector. The examples are:

- Rolled Aluminum: Aluminum Company of America (Alcoa) has a new factory design which produces an estimated six times the amount of rolled aluminum produced by current factory designs. The new design requires less capital to build, is smaller in size and requires less labor costs to operate. (Low Value Added)
- Miniature Fuel Cells: Fuel cells that operate consumer electronic products, e.g. laptop computers, PDAs, electric razors, etc. will be on the market in two years. (Medium Value Added)

- Cancer Therapy: Herceptin is a breakthrough technology for treating breast cancer. The drug is applicable to about 30% of metastatic breast cancer where patients over express a certain protein. This is the first real step towards “personalized” medicine. (High Value Added)

- Nanotechnology: Nanotubes represent a revolutionary change in materials science. Ten atoms wide (10,000 times smaller than a human hair), the speculations on the application of nanotubes range from methods to purify and deliver drugs to transistors for computers that are 500 times smaller than silicon based transistors. (Low Value Added)

The methodology of interfacing the type of technology change and the status of the industry sector will not yield “the” answer to the value of a technology. However, this approach will be a starting point to identify key questions that must be addressed in establishing the value of technology innovation and change.