

## **Diabologic: Disruptive Technologies**

by Frank Dolinar

The term *disruptive technology* was coined by Joseph Bower and Clayton Christensen and introduced in their 1995 article *Disruptive Technologies: Catching the Wave*. (Bower and Christensen, *Harvard Business Review*, January 1995). A disruptive technology is a technological innovation, product, or service that eventually overturns the existing dominant technology or status quo product in the market. Disruptive technologies should not automatically be construed as something negative. They *are* harbingers of change.

In the early 1980s, when the first microcomputers – such as the Apple II, the IBM PC, and later the Macintosh – became available, the mainframe manufacturers dismissed them as toys, pointing instead to large, air conditioned rooms full of their state-of-the-art products and saying, “That’s a computer.” At the time, they were right. However, within a few years, when mainframe sales had declined dramatically in favor of desktop microprocessor systems, this position was reconsidered. One well-known company lost nearly half of its value before it decided that microcomputers might not be toys.

The surviving mainframe manufacturers of today constantly re-evaluate new technologies, re-design their products, incorporate evolving microprocessor technology throughout their product lines, and are generally much stronger and more flexible organizations. An additional benefit of this process is that the descendants of those mainframes of the early 1980s are themselves stronger, blindingly faster, more flexible computers, with vastly more data storage capability than their ancestors. These computers fit in the corner of a closet and don’t require air conditioning.

Disruptive technologies, by their nature, are new, typically more flexible and capable than the technologies and/or products they will (likely) supplant, and are often described as being more “powerful” (as in computers and consumer electronics) than their predecessors.

New, powerful, and flexible technologies are often “double-edged swords”, in which case they may bring along problems as well as the anticipated benefits. New technologies may also bring “unintended” consequences – widespread uses that were not envisioned by the inventors.

Here are some examples of disruptive technologies that came into being in the 20<sup>th</sup> century:

- Automobiles – cars, trucks, buses and their kin – have replaced horses for transportation in many places throughout the world. Tractors have replaced horses and other draft animals in agriculture. They have made possible the ability to travel great distances at will. But cars require a number of things in the infrastructure (roads, fuel, parts and repair facilities, to name just a few) that horses don’t. Cars also generate pollutants, choke the roads in big cities, and cost a major part of most people’s income to buy and maintain.
- Container Ships – in every major seaport in the world, cargo ships are now loaded and unloaded by giant cranes that move cargo in containers, replacing so-called “break-cargo” ships and stevedores. The smaller of these containers are the size of the trailers on the 18-wheel trucks that populate our interstate highways. The larger containers are the size of boxcars. The benefit is that it’s much easier to move large amounts of cargo in a single container. The downside is that these containers allow so much cargo to be transferred that it is no longer feasible to inspect every container – which potentially makes smuggling easier.
- Semiconductors (transistors, resistors, diodes, etc.) replaced vacuum tubes in electronics beginning the 1960s. For most people my age (let’s just say I’m a “Boomer”), our first introduction to semiconductors in any form was the Japanese transistor radio of that era. Little did we know, then, that semiconductor technology, with a little push from the space program, would drive the development of industrial and consumer electronics to bring us desktop and laptop computers, iPods, the Internet, instant worldwide communication, and the ubiquitous Star Trek communicator in the form of the cell phone.

- Desktop publishing has replaced traditional publishing in essentially every major publishing house in the world. Only small or specialty publishing organizations still use hand set type for printing. Adobe's industry standard PageMaker and FrameMaker products, among others, have made it possible for anyone with a computer and such software to produce documents that only the best publishers could have produced twenty years ago. Add to that the availability of high-quality color laser printers and it has become true that freedom of the press belongs to anyone and everyone. [The web makes it possible to distribute these documents to anyone, anywhere in the world.]
- Digital photography was initially developed to compete with instant photography products produced by Polaroid. Digital photography is increasingly replacing all chemical photography. The capabilities of digital cameras have grown quickly, with features that match or surpass the best that 35mm SLR cameras have to offer. Prices have dropped, as with so many technology-based products, to the point that for the casual photographer purchase of an inexpensive digital camera is the only reasonable choice. As with publishing houses, in 2007 only specialty photographic projects use film any more. Even motion picture studios have moved (or are moving) to digital cameras for most of their production. As a bonus, digital cameras have taught the casual photographer something that the pros have known for years. You have to take a lot of photos, and throw a lot of them away, before you find a few that are worth keeping.
- Cell phones have progressively replaced wired phones in all strata of society, making communication easy, mobile, and cheap. There is a growing trend for people to have a cell phone, but not a wired phone (known as a "land line") in their home. Sometime within the last six months, the number of cell phones in the US exceeded the number of land lines, and the US trails both Europe and Japan in this trend. The number of cell phones in the world is now about equal to half the population of the world, with many people owning more than one. What makes cell phones a premier example of a disruptive technology, however, is that it is bringing communication options to areas of the Third World that have never in living memory had any effective access to the world outside the local village.
- Nanotechnology – Though it is early days as yet, nanotechnology promises a portfolio of surprising breadth, capability, and flexibility – the basic recipe for a major disruptive technology. Its products are expected to cut across traditional lines of politics, economics, and geography. It will probably bring its own share of surprises, concerns, and problems.

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There is a continuous stream of new and potentially disruptive technologies making their way from research labs to products.

Disruptive technologies incrementally and progressively change our lives and change the rules.

They will continue to do so for the foreseeable future. We just don't yet know what new disruptive technology tomorrow will bring.

What's confusing us is the nature of the game.