

# The Long Game: Creating Revolutionary Change Through Radical Innovation

*Robert Shelton*

Innovation is like golf: there is a long game and a short game, and success depends on mastering and integrating both.

Putting, golf's short game, requires meticulous planning, measurement, precision, and control. Successfully maneuvering the ball across the surface of the green into the cup is tremendously difficult. Sinking the putt can win the hole or keep you in the game. Failure is clearly, painfully visible – long times perched over the ball, numerous putts on misread greens, highly visible errant trajectories or near-misses, bruised scores, and an embarrassed resolve to do it better next time.

Incremental innovation – improving the products and services in your current and emerging markets – requires similarly well-honed skills: careful planning, management of multiple variables, finesse, timing, and control. Incremental innovation keeps you in the game; without a strong capability in incremental innovation, your competitive position erodes and you go out of business. Like putting, incremental innovation has analogous signs of failure – long times to market, numerous launches in misread markets, projects that overshoot or fall short of the goal, missed opportunities, high costs, and after-the-fact management resolve to get it right next time.

The long game of golf, moving the ball from the tee to the green, is played with distances, forces, and uncertainties that dwarf the short game. You must loft the ball across, over, and through different types of hazards. Often you use one shot to set up the next, with the net effect that a great shot or a mistake can earn compounded interest. The tools of the long game (driver through wedge) require strength balanced with precision and the ability to know which one to use at any given time.

Radical innovation – redefinition of the business via revolutionary technologies and business models – is the long game of innovation. It requires driving large changes in business models and technologies, dealing with hazards (including the fear that it's a crazy, worthless idea), and piggybacking opportunities to create breakthroughs. Successful radical innovation creates an entirely new business context, new competitors with new ways of competing and significant competitive advantage.

Over the past 50 years, management of incremental innovation has received a great deal of attention, while the long game of radical innovation has received little. Today, however, there is an emerging understanding among leading innovative companies that there is a need to master the long game of innovation. In addition, it is becoming clear that radical innovation is fundamentally different from incremental innovation and that playing the short game well does not bring success in the long game.

This article draws on the experience of innovation leaders (including venture capitalists) and Arthur D. Little's extensive experience with leading-edge innovation to describe how to play the long game of innovation – creating and sustaining radical innovations.

## **Creating Revolutionary Change**

Radical innovation is a sought-after prize because it offers the innovator first-mover advantages:

- Significantly higher returns and revenue growth than the industry norm
- Strong influence in redefining the business model
- A clear vantage point to view the next set of changes
- Ability to set the competitive rules (for a while)
- Highest leverage of the breakthrough technologies, services, customers
- Recognition as an innovation leader
- Ability to attract and retain the best staff

Radical innovation is particularly attractive because incremental innovation seldom conveys such benefits.

Radical innovations are not limited to wildly new or disruptive technologies such as the personal computer. Radical innovations include changes to business models, such as providing new types of value to customers, serving new customers, and using radical new distribution approaches that create new business contexts. For example, Dow, DuPont, and Novartis changed the traditional agricultural chemicals market via radical innovation, creating a dynamic, new agrobiotech market in which biotechnology and chemicals have combined to form entirely new products (i.e., genetically engineered plants combined with selectively acting chemicals). In addition, the new competitive reality is that competitive advantage is tied to intellectual property in plant

genetics and new value to the customer (e.g., significantly better financial yield via an integrated crop management approach). Similarly, Dell's radical innovation was the introduction of direct consumer PC sales via the Internet; it changed the way the PC game is played, altered customer expectations of value, and is producing new competitive leaders – but it hasn't changed the PC technology.

Many companies seem to get into the radical innovation groove right away, only to lose it later. Others do very well at incremental innovation but can't get the radical innovation game started. A few do both very well. The keys to robust, sustained radical innovation are embracing experimentation as a mindset, managing the deal flow, and putting the project team in proximity to great partners.

## Experimentation

Successful radical innovation practitioners engage in ongoing experiments that test, refute, modify, and validate potential breakthrough concepts. The experiments provide a probing dynamic that gets into new technical and market spaces. Properly conducted experiments uncover hidden value and insight and provide learning that guides the radical innovation process by defining the right questions as well as the best answers.

Radical innovation experiments should address the four risks of innovation: technology, markets, financing, and people. Technology risks involve the feasibility of a technology or group of technologies delivering the required performance at a reasonable price. Market risks center on the existence or emergence of a sufficient market for the envisioned innovation, including the complicating effects of competitors, substitutes, regulators, and anything else that makes the actual market smaller than or different from the theoretical market. The financial risk is basically getting the needed funding at the right times and in the right amounts throughout the innovation process. The people risk – attracting, retaining, and motivating the right people at the right times in the innovation process – is often the most difficult.

In conducting radical innovation you have to deal with uncertain, unproven, nonnumerical data. Imagine the commercialization of the CAT scanner, the PC, or the Dell business model. Not only were there no good market data (i.e., the concept was ahead of the market), but the technology specs were extremely fuzzy and uncertain – because if you can't specify the market need, how can you spec the technology? This made attracting funding a problem („You want money for what?“). Finally, because the technologies and markets were radically new, identifying the right people to drive the innovation forward was also complicated.

The inherent uncertainties of radical innovation make many incrementalists massively uncomfortable. Incremental innovation builds on data regarding established technologies and existing markets and uses the process of knowledge management and data mining to move forward. For radical innovation, forget knowledge management. You need ignorance management.

Ignorance management is the process of identifying the most important things the team does not know and designing an approach to help reduce that ignorance to a level that allows forward movement. Experiments are great ignorance management tools.

The most common radical innovation experiments involve prototypes. In their simplest forms, prototypes include spreadsheets, process maps, and simulations – anything simple that lets you visualize the issues to get a better handle on where ignorance exists. The team must be able to play with, change, and develop the prototype.

Successful prototyping requires attention to three rules:

**Rule 1: Think modularly.** Do not try to solve the whole problem all at once. Break the problem or opportunity into pieces. Build prototypes that provide insight into one or two key uncertainties. As good experimenters know, this provides valuable information into the nature of the problem as well as the potential solution.

**Rule 2: Fail fast and cheaply.** Define small practical tests that can be done on the cheap. Build a prototype and test it quickly. It is often best to work with a partner, such as a lead customer or a supplier, to share the costs, risks, and learning. Get the results and determine what was learned and what new questions were identified. Modify the prototype.

**Rule 3: Fail often in order to succeed faster.**

Use the „Ready, fire, aim... and then start over again“ approach. It is crucial to overcome the old „Ready, aim, aim, aim...“ syndrome. Remember that the plural of anecdote is data.

Several companies have successfully used prototypes and the „probe and learn“ approach to commercialize radical innovations: GE developed the digital ray that has revolutionized tomography and medical diagnosis, IBM developed silicon germanium devices, and Schwab created electronic trading. Look closely at a radical innovation and you will find a trail of prototypes.

In early prototypes, the focus should be on extreme simplicity and learning the basics. Later, you can switch to more robust, less modular representations of the innovation and continue with the probe and learn approach. The

best prototypes are the ones that provide designers, customers, and suppliers with the opportunity to make sequential and parallel improvements. The prototype focuses the team around a common evolving concept. It connects the team with a powerful model that clarifies both the problem and solution. Also, the prototype provides powerful clues as to the next steps of innovation.

Prototyping should be a core competency of the radical innovation team. Building, testing, refining, refuting, and corroborating prototypes are essential activities because they:

- Challenge the existing mental models of the team
- Identify the „out of bounds“ areas that have not been sufficiently explored
- Pull the team together and create a common, shared vision and language
- Generate a level of excitement that traditional means can't equal
- Generate new thinking that eventually becomes the radical innovation

A traditional, linear product-development process may support innovation by adding a framework of discipline to the process but, if too rigidly enforced, can lead to the swift death of any radical innovation experimentation. Traditional views of discrete product stages and gates, „hitting the target“ or „crossing the finish line“ – when mired in bureaucracy – are not appropriate frameworks for radical innovation. Radical innovation experimentation works best when it is allowed to swerve and twist along the development path in ways that don't always coincide with the traditional product/service development sequence.

### **Managing Deal Flow**

Radical innovation requires good deals. Innovation deals combine all the essential elements of an innovation business concept: the primary and enabling technologies, targeted markets and customers, suppliers and alliance partners, required partners for development and funding, and others. Innovation deals are like ventures – you can invest in them because you can envision the business and the potential value as well as the risks and unknowns.

Deals have buyers and sellers. Whether you can „sell“ a deal to internal and external funders is a test of the validity of the deal. The innovation team has to develop a deal that is sufficiently attractive to compete for funding from both inside and outside sources.

One of the key ingredients in an attractive deal is the leader or deal manager. His or her job is to understand the potential value and risk inherent in the deal – and to identify the next best steps to maximize its value. This requires weighing a range of options for each deal and selecting the best course of action. Deal options include:

- Accelerate investment in farther development or stop work altogether
- Bring in risk-sharing partners or sell the intellectual property and exit
- Buy most of the intellectual property or split the project and focus on the best parts
- Group several projects together and cross-fertilize or break up the deal, invest in the most promising pieces, and harvest the remainder
- Expand or contract resources

These are definitely not the typical „go/no go“ decisions that developers face in incremental development programs, where the goal is to move the project forward. Radical innovation deal options are dynamic, venture-driven, and aimed at producing the highest overall value.

Being a deal manager is a tough job that requires a mix of pragmatism and vision. Imagine being brought the following deal in April 1975:

- Three people say they have a great idea regarding a new form of information management that has never been tried before.
- None of the three has managerial experience or much, if any, business experience.
- The leader is a 21-year-old hippie who's used to walking away from the job when he gets the urge to wander.
- The technical guy is probably a genius but is not sure he wants to be part of something as weird as a company.
- The third has a career but no entrepreneurial capabilities.
- They have a prototype but no clue how to build or sell it.
- Their IT product concept has been cold-shouldered by the largest single group of potential stakeholders.

This was the Apple Computer deal and the three were Ron Wayne, Steve Jobs, and Steven Wozniak, who created

the world's first personal computer. Could you have seen the deal? What would you have done to manage the resident ignorance? What prototypes and experiments would you have used? Whom would you have pulled onto the team?

In addition to seeing the potential below the surface, the deal manager's job is to:

- Aggressively manage team ignorance.
- Experiment, probe, learn, and create new mental models.
- Create a technology road map that shows how the different technical pieces come together in a breakthrough product or service.
- Develop a robust understanding of customers' needs and how to deliver the highest value to them.
- Constantly work with the team to reorganize the pieces of the deal to form a more attractive radical innovation.

One of the key lessons from the venture capitalists in Silicon Valley is that a high rate of deal flow is important. The greater the deal flow, the greater the odds of achieving successful radical innovation, since not every deal is destined to be a winner. Deals need other deals with which to combine and fuse. A high rate of deal flow also produces „fluidization“: high rates of knowledge transfer among deals, enough deals to keep the initiative afloat even if some deals fail or disappear, potential combinations among the deals to produce better deals, high rates of learning among the deal managers, transfer of key people among projects, and organizational changes to match the changing needs.

### **Proximity to Greatness**

Some people envision undertaking radical innovation as something similar to „managing“ an artist or teaching creativity. This conjures up the unsettling image of a painter in front of a canvas with a manager at the artist's elbow. „Just leave them alone to do their thing“ is the preferred model for managing this situation.

But this is the wrong model for managing radical innovation. Instead, think of radical innovation as directing a movie: a complicated, multifaceted endeavor in which vision, hard work, improvisation, and a commitment to excellence are essential ingredients. Like a movie director, a radical innovation manager has sensitive artists to manage – some of whom are inevitably prima donnas. You also have to manage the equivalent of scripts, budgets, sponsors, people with hundreds of different skills, technologies, and much more. And everybody is expecting a blockbuster product that is on budget and on time.

Obviously, trying to manage all of this is not easy. On the one hand it requires leaving room for creativity and investigating the unknown. Just playing by the script is not going to produce the desired level of creativity. On the other hand, you can't improvise or rely on creativity for everything. The budget and schedule (as well as your funding agents) will require that you manage the complex systems in your „movie production“ using numerous direct and indirect controls. It is a tough integration act and requires a robust set of skills. But great radical innovation deals – like great movies – are something to behold.

We have learned from successful radical innovation deal managers, as well as from great movie directors, that you must discover greatness – the best minds, resources, technologies, funding, and markets – wherever it is in the world, and then get close to it and make it part of your team. The radical innovation initiative must first pull together a high-yield team and create suitable space, including some degree of isolation, in which that team can work. Then, create the death of distance.

**The High-Yield Team.** The high-yield team or network should include a contingent from within the company that has strong links with outside players. Sometimes, as much as 90 percent of the innovation network resides outside the host company. These sources combine to form a high bandwidth of capabilities. Contributing organizations might include venture capitalist firms; universities, with connections to start-ups, professors, staff, and recent grads; and business incubators with their scientists, innovators, and engineers – even groups such as Arthur D. Little's Technology Development Practice. In that regard, successful radical innovations come from communities, not departments. The team dynamics must center on continuous, collaborative experimentation and learning. The highest yields occur when the team works in concert to test and refine prototypes and create improved deals. The constantly evolving prototypes, deals, and mental models of the business are an important indicator of the health of the radical innovation. A drop-off in the rate of change or a decline in the deal flow is a symptom of a major problem within the team. In addition, the team must be fluid, changing with the evolving reality of the deal. Organizational inflexibility is death for radical innovation teams.

**Isolation.** While these teams should be submerged in the external flow of ideas, they must be allowed to operate in isolation from the company and its traditional business scrutiny. In other words, the teams must be allowed to perform, much as Lockheed's famed skunkworks did when making radical advances in spy planes in the 1940s, as separate workgroups unencumbered by corporate restrictions. Today, companies such as

DaimlerChrysler, Matsushita, and Microsoft have isolated their teams in Silicon Valley. Being isolated allows and encourages the team to break the rules and, most importantly, protects it from the „organizational antibodies.“

Like any complex living being, a business entity develops mechanisms – organizational antibodies – to protect itself from anything that threatens to make the organization deviate from what currently exists. The trouble is these antibodies don't differentiate between a bad idea – some far-out, new management guru philosophy – and a brilliant one that would permanently alter the company's market position. Organizational antibodies can crop up anywhere from the company's legal, EHS, or human resources policies („We don't have a career path for that“), to its budgeting („We can't allocate funds for a market that doesn't exist“). Strategic and business plans are among the most dangerous forms of organizational antibodies. As Lawrence T. Babbio, President and COO of Bell Atlantic, said at a recent Arthur D. Little innovation conference, „The five most dangerous words for innovation are: ‘Show me the business plan.’“

The teams need more than isolation from corporate antibodies – they need the appropriate space in which to create and the right materials to be creative. There is a huge variation in what works as creative space, but it is clear that traditional buttoned-down corporate offices are not conducive to innovation.

**Death of Distance.** A high-yield team, working in isolation from the company, functions best when the death of distance has been effected. In a company's quest for radical innovation, it cannot limit itself to using only those teams that are geographically close. If the best software minds are in Karachi and the best systems resources are in Palo Alto, then any tool available, electronic or otherwise, must be employed to remove the distance that separates these pockets of greatness.

Boeing is an excellent example of a company that has removed the distance that traditionally separates teams. The airline giant put together a computerized engineering system that wired suppliers, manufacturers, engineers, and even some customers into the development process. The result was the Boeing 777, whose CATIA and EPIC design systems have revolutionized product development. Likewise, during design and construction of the Hong Kong airport, more than 100,000 2-D and 3-D computerized models were exchanged among 20 design contractors and 40 construction companies. Now that the airport is open, the stored information is being used for airport operation, maintenance, and facilities management.

These examples demonstrate how wiring the teams together allows distant pockets of greatness to work as a virtual team. Wired innovation also allows robust, around-the-clock testing and improvement of prototypes.

## Closing

You can tell if your radical innovation initiatives are healthy by measuring the:

- Rate and quality of experimentation and prototyping
- Bandwidth of the deal manager and the team
- Quality and quantity of the deal flow
- Deal options that are exercised (e.g., invest, merge the deal, sell)
- Absence of organizational antibodies
- Disappearance of distance in the style and intensity of teamwork
- Flexibility of the organization to adapt to the changing deals

Traditional incremental innovation approaches will not generate radical innovation. You can't hit par if the only club you have is a putter. The „long game“ of radical innovation requires its own discipline, tools, and approaches.

*Robert Shelton (shelton.r@adlittle.com) is a Director in Arthur D. Little's Technology and Innovation Management Practice. He is based in our Palo Alto, California, office. His major focus is on integrating technology into companies' strategy, organization, and operations.*