

Engineers have long viewed design as a core activity. Managers would be wise to turn to them for **creative inspiration**.

Possibility Thinking

Lessons from
Breakthrough Engineering

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BUSINESS STRATEGISTS TEND to be well-versed in the identification and analysis of constraints. But what of possibilities? If the ability to see new possibilities is fundamental to creating innovative designs – whether of products, cities or business strategies – what do we know about state-of-the-art possibility thinking?

Not much, it seems. Business strategy has historically been seen as a largely analytic endeavor, with relatively little attention paid to the creative aspects of strategy formulation. In this article, we will describe eight ways to illuminate new possibilities taken

from Engineering success stories and discuss what each might look like if applied to business strategy.

1. Challenge Assumptions

Challenging assumptions and defying convention are often the first steps in creative Engineering. To produce something original, an engineer raises questions about the way things are done and entertains doubts about what is assumed to be necessary, natural, or customary.

For example, ‘seismic base isolation’ is a system of protecting buildings from earthquake damage by using bearings or supports, typically made of layered rubber and steel pads, to separate buildings from the ground on which they sit. The bearings allow a building to move freely on shaking ground. This approach challenges the customary view that we make a building stable by fixing it firmly to the earth. In describing the traditional method of limiting earthquake damage in *The Seismic Design Handbook*, **Ronald Mayes** wrote, “The basic approach has not changed [over the years]: construct a very strong building and attach it securely to the ground. This approach of arm wrestling with nature is neither clever nor subtle.” The new technology breaks from this radically by allowing a building to move, but to move without destruction. Putting ‘bearings’ underneath a building’s foundations separates the building itself from a potentially moving earth. One ambitious application has been the work of **Eric Elsesser** and his associates in retrofitting the San Francisco City Hall following the Loma Prieta earthquake of 1989. This building is now separated from the earth by hundreds of steel and rubber isolation bearings, making it the largest base-isolated structure in the world.

In the realm of business strategy, we see much the same process at work when managers challenge mental models and industry assumptions. New possibilities emerge when they refuse to accept existing paradigms and constraints. The potential opportunities revealed when managers look through a different lens can be enormous. Consider the incremental value created at **Raytheon** with the development of the new Vigilant Eagle anti-terrorism device, designed to protect commercial airliners from over-the-shoulder missiles. Conventional wisdom decreed that each plane be outfitted with its own protection device at a cost of approximately one million dollars per plane. With estimates for protecting all U.S. commercial aircraft of \$20 billion, creative managers at Raytheon hit upon a new possibility – that of protecting *airports*, rather than individual planes. They estimate that 70 per cent of U.S. air traffic can be protected for less than \$2 billion. Challenging existing approaches became the path to a cost-effective solution.

2. Make Connections

Making connections between seemingly unrelated ideas is also often at the heart of creative Engineering. Novelty can result from going outside of a single field or discipline and bringing together diverse concepts, tools, capabilities, and ways of thinking.

‘Tissue Engineering’ is a new specialty that creates usable human tissues for repairing or replacing damaged ones. Engineers have tackled this problem by relating medical and biological approaches to those of chemical engineers, materials scientists and engineers, and mechanical and electrical engineers. Some of the basic

approaches of tissue engineers borrow from Civil Engineering: ‘scaffolds,’ for example, provide biodegradable structures on which tissue cells can grow. Another key device used by some tissue engineers is the ‘bioreactor,’ a vessel especially designed for the cultivation of living tissue. Tissue Engineering is now emerging from the laboratory into medical applications and producing experimental products including skin, cartilage, and liver tissues.

Connecting can be equally powerful in the business environment. The use of analogies that connect different fields can provide a window of insight into new possibilities for value creation. While adhering to the mental models of one’s own industry is limiting, trying on the mental models of another can surface intriguing new opportunities. The story of **Ethel M. Candies** demonstrates the power of connecting across business boundaries. **John Haugh**, Ethel’s new president, faced the daunting challenge of growing the business in a confectionary market suffering from slow growth and consumers who preferred **Godiva** – despite Ethel’s superior quality in blind taste tests. Rather than continue to pursue the existing packaged-goods strategy, John combined his own career experiences in retail with close observation of the success of **Starbucks**. If Starbucks could do it with coffee, why couldn’t Ethel create a similar experience around chocolate? Thus was born **Ethel’s Chocolate Lounge**.

3. Visualize

For an engineer, making something new often means first thinking about how it might look – picturing it in the mind’s eye. Engaging the senses beyond what words describe sometimes opens new paths to creativity.

Visual thinking is a key element in many kinds of Engineering, particularly those dealing with large structures. In some projects, however, the visual element is particularly striking and the creative act appears to be tightly bound to thinking about problems pictorially. One recent example is the Gateshead Millennium Bridge, carrying foot traffic across the River Tyne between the cities of Newcastle and Gateshead in northern England. This remarkable structure was envisioned as a ‘blinking eye’: it opens to allow river traffic not by lifting up, but by pivoting. The movement of its supporting arch and its curved foot surface creates a remarkable sight, enhancing the visual aspect of the engineering both while stationary and while in motion.

Visualizing is perhaps the most challenging concept to transfer from the world of Engineering to the world of business strategy. After all, strategies represent ideas, not concrete objects: they are comprised of numbers and words – how can they be made visual? Yet there is significant value in pushing our thinking along this dimension. Designers, we are told, ‘think with their pencils’ – allowing the emerging visual images they sketch to deepen their understanding

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of what they are designing as it unfolds. If strategists think only with their spreadsheets, how much use of imagination can we expect?

Trader Publications, a producer of free classified product guides, has taken the dictum to use visuals to heart. As part of its strategic planning process, managers not only describe competitive publications, they obtain copies of them. These copies are aggregated at corporate, where managers array them in conference rooms for examination. This experience – the visual and visceral experience of handling these publications, according to Trader executives, produces far richer possibility discussions than reading reports about them. In a similar vein, organizations have begun to experiment with creating strategy maps – pictorial guides that use analogies to portray both their and competitors' strategies. The act of creating these maps often triggers profoundly new insights.

4. Collaborate

Many Engineering innovations are the product of cooperative effort and could not be developed any other way. Groups bring together a range of talents and capabilities, applying them to generate results that reflect both individual skills and a collaborative creativity that is more than the sum of the separate endeavors.

A jet airliner is one of the most complicated products designed by modern engineers. It contains literally millions of individually-designed parts, which must work together to meet the highest standards of performance and safety. **The Boeing Company's 777** jet is a model of collaborative creativity on an extraordinary scale. The collaboration behind it, however, is interesting not simply for its scope but also for the pioneering communication methods it relied on. This was the first major aircraft designed using extensive computer networking – more than 2,200 work stations linked by eight mainframes – to bring together thousands of engineers working on every phase of the project at the same time. Although many never met in person, the computer system promoted a collaborative process so central to the project that the 777's slogan was 'Working Together.' At the heart of the system was software developed by **IBM** and **Dassault Systèmes**, called CATIA (Computer-Aided Three-dimensional Interactive Application). Boeing extended this with EPIC (Electronic Pre-assembly In the Computer), allowing

engineers in disparate locations to design and test 'virtual' prototypes of crucial components of the airplane.

Interestingly, in Boeing's design of its newest product, the 787, the firm has pushed collaboration beyond groups of engineers to collaboration with customers as well, creating special Web portals that solicit their input on likes and dislikes to incorporate into the design process. These examples of collaboration with suppliers and customers represent just two of many 'white space' possibilities.

At **United Technologies Corporation**, collaboration between in-house technical talent at two separate divisions – jet engine designer **Pratt & Whitney** and cooling specialist **Carrier** – created the breakthrough Purecycle product with virtually no new components needed. Purecycle converts waste heat to electricity – an opportunity that went unrecognized until engineers who thought in terms of power met up with engineers skilled at using heat exchange to produce cold air. Crossing such functional and business unit boundaries can provide rich sources for enhanced value creation.

5. Harmonize

In every area of human effort, creativity is intimately associated with the quest for beauty. This is most obvious in the Fine Arts, but it is no less true in the practical arts like Architecture and Engineering. Here, especially, there is an aesthetic quality that often lies in harmony, in fitting the products of human ingenuity agreeably into their environment.

In Colorado's Glenwood Canyon, a key link in the interstate highway system required the construction of a viaduct to carry the road over a narrow, curving stretch of the Colorado River. The Hanging Lake Viaduct fits aesthetically into this precious natural setting, while providing an efficient and reliable transportation link. Meeting this challenge involved not only designing a structure that would harmonize with its environment, but also minimize harm to the river and its surroundings. The builders used a giant gantry and crane to set the pre-cast concrete box girders into place from above. The number of piers supporting the road was reduced by producing spans as long as 300 feet. Bridge members were designed with straight lines to blend with the striations of the canyon walls.

In business strategy, we have a long history of paying attention

to the ‘fit’ of an organization’s strategy, both in terms of its internal consistency and in its appropriateness for its larger environment. Good strategies, we know, are aligned along many dimensions. We have an equally long history, however, of largely ignoring aesthetics – of treating them as trivial adornments to high-end products and services. In fact, it is somewhat difficult to even describe what the ‘aesthetic’ dimensions of a strategy might be.

What makes a strategy more than merely functional – a thing of beauty? The origin of the word ‘aesthetic’ lies with the Greek term *aisthetikos*, meaning ‘of sense perception.’ Thus, we might conjecture that it relates to strategies that appeal to the senses, rather than merely to cognition – new possibilities that have an *emotional* appeal, a ‘presence’ that commands attention and invites engagement. Yet consider how banal and clichéd so many corporate missions are; no wonder they fail to command attention, much less emotion. Then consider instead the emotional engagement **The Body Shop** evoked when it committed to natural products and lack of animal testing coupled with a recycling ethic. These simple aesthetics created a unique and compelling value proposition for targeted customers who shared their values. Change, psychologists tell us, is primarily driven by *desire* – it is in that sense of the term ‘aesthetic’ that we can learn from designers how to make business strategies more compelling and new possibilities more evident.

6. Improvise

Outer space exploration is one of the last places we would expect engineers to improvise. Few activities appear to be so thoroughly planned from start to finish: whether executing repairs on a device millions of miles away or devising ways to extend the work of multimillion dollar instruments, the spacecraft engineer may work with the most extreme constraints of all. The Voyager 2 space probe was launched in August 1977, primarily as a back-up for the Voyager 1 flight to Jupiter and Saturn. Designed to operate for five years, it ended up carrying out important missions for more than 12 and is still sending data back to earth. Voyager 2 has been constantly re-engineered, repaired, reprogrammed, and reconfigured by earth-bound engineers working with the constraints of a device which receives its communications in a dead language minutes after the commands are sent.

In the business context, limitations to action are often seen as ‘stop signs’ – signals to give up the quest for an innovative solution. For designers, the response is the opposite: constraints act as triggers to seeing new possibilities. Some of the most successful business strategies were not the result of careful forethought; instead, they were the products of improvisation, created out of necessity when familiar options were unavailable. **IKEA** offers a case in point. Nearly every element of its now famously-harmonized strategy –

furniture packed flat in pieces, customer home assembly, and self-service in their warehouses – was a clever response to an unanticipated problem. Customer self-service, for instance, originated with the opening of the Stockholm store, which was so unexpectedly popular (and hence understaffed) that frustrated customers grew tired of waiting for scarce warehouse personnel to bring their purchases to them, and went in search of them themselves. What distinguishes IKEA is not that such problems developed, but that it was able to observe new possibilities inherent in them, and to build these serendipitous discoveries into its strategy.

7. Reformulate

New possibilities can emerge from new formulations of problems rather than new solutions. When people change goals or revise notions of what is important and what isn’t, different priorities and approaches may be more appropriate.

Engineers’ goals and priorities may shift for a variety of reasons. Changes in fashions, markets, or politics may make approaches that were once considered desirable or necessary seem inappropriate. Or, engineers and society at large may learn new things that lead to a re-evaluation of results and a reorientation of efforts. Few better examples can be found than the re-engineering of South Florida’s rivers and wetlands. The Kissimmee River begins near Orlando and flows southward for about 100 miles. Historically, it meandered through a one-to two-mile wide flood plain, covering all but a small portion of the land for most of the growing season. In periods of large storms or hurricanes, waters from the Kissimmee and other rivers would destroy homes and crops over a wide area. To reduce flooding, the **U.S. Army Corps of Engineers** straightened the river in the 1960s, and drained much of the nearby wetlands.

However, even before the project was completed in 1971, it was clear that this effort had resulted in devastation of wildlife habitats and the displacement of many animal and plant species. State and federal agencies decided that engineers’ efforts needed to be reoriented toward undoing the damage: recovery of the River became one of the most ambitious restoration projects ever undertaken. Slowly the Corps of Engineers and the **South Florida Water Management District** are returning major portions of the Kissimmee from a canal back into a meandering river, to make the environment once again hospitable to its historic inhabitants.

Re-examining the definition of a problem holds great potential for generating new possibilities in the business realm. One of our favourite stories is that of **P&G**’s creation of the Swiffer mop. After decades of focusing on the problem of ‘producing more effective detergents,’ P&G re-oriented its thinking to focus on ‘creating a cleaner floor,’ as well. This led to the realization that detergent was only part of the solution, and that significant opportunities existed

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in producing a better mop. A similar shift occurs, at a generic level, whenever business strategists move from focusing on the problem of 'How do we sell more of product X?' to 'What need is the customer trying to satisfy?'

8. Play

To an extent that is often unrecognized, play is a key element of the creative act. Perhaps the best example is the design firm **IDEO**, which stocks each of the firm's offices with an identical 'tech box.' As the firm's Web site describes it, "Each tech box has several drawers holding hundreds of objects, from smart fabrics to elegant mechanisms to clever toys, each of which are tagged and numbered. Designers and engineers can rummage through the compartments, play with the items, and apply materials to their current project." Computer and database linkages allow sharing of tech box play among the firm's offices, and each box has a 'curator' who constantly updates the contents.

The idea of play may appear ill-suited to the business environment, but the single-minded pursuit of efficiency and optimization can lead to 'analysis paralysis' and leave little room for the emergence of new possibilities. To play is to try to do something, not merely to think about it. Play does us the great service of calling attention to the value of the experiment, the willingness to forfeit certainty in the name of learning. Organizations good at finding new possibilities are quick to conduct low-cost experiments rather than detailed market feasibility studies. For example, consumer products companies are increasingly likely to talk their key retailers into just a small amount of shelf space in a few stores to test new ideas, preferring to fail early and on small volume rather than do major roll-outs based on predictions of consumer behaviour that may prove incorrect. This kind of 'serious play' is likely to pay big dividends in opening up new possibilities.

In closing

We suggest that business strategists begin by asking themselves a simple set of questions that draw on the approaches described here and provide a warm-up for the possibility-thinking muscles of our strategic brains:

1. Take an absolute industry 'truth' and turn it on its head. Ask "what if *anything* were possible?" and look at the new opportunities that appear.
2. Look outside the boundaries of your usual world. Ask, "what if we were operating in an industry quite different than ours – what would we be doing instead?"
3. Put the numbers aside and get some images down on paper. Try using a napkin. What emerges?
4. Find a partner and go forth and co-create. Ask, "what can we do together that neither of us can do alone?"
5. Push yourself beyond the 'workable.' Try to get to 'intriguing.' Ask, "What is really worth doing – what can I get excited about?"
6. Act as if necessity truly was the mother of invention and make surprises work for you instead of against you. How can you turn an unexpected development into an asset?
7. Try on a different definition of the problem. Step away from your product and ask, "what is the problem my customers are really anxious to solve?"
8. Go out and conduct low-cost experiments instead of forming a committee. What can you do *today* to move a new possibility forward?

As we look across the approaches for surfacing new possibilities outlined here, their applicability to business strategy is clear. Engineers have long viewed design as a core activity. As managers – particularly strategists – come to share this view, we would be wise to turn to them for creative inspiration. **R**



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