In Praise of Resource Constraints
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“You get what you pay for” best summarizes the traditional management orthodoxy that team performance is strongly linked to material resources. After all, it makes intuitive sense that a team’s access to money and equipment is a key determinant of good results. So when a project is lagging behind, a commonly observed reaction among managers is to drive it along by making more (rather than fewer) resources available. Resource constraints, on the other hand, are seen as having a fundamentally inhibiting effect.

But the problem with the resource-driven mindset is that managers can easily fall into the trap of giving free rein to team members — “throwing money at the problem” — in hopes of procuring innovative outcomes. When projects fail, rationalizations often start with excuses such as “We ran out of money” or “If only we had more time.” In such cases, the resource-driven mindset may well have backfired. Resource adequacy is in the eye of the beholder, and if a team has the perception of inadequate resources, it may easily be stifled.

Actually, we believe that resource-driven thinking has so dominated the research agenda that it has clouded our consideration of many situations in which scarce resources (precisely because they are scarce) are desirable, potentially leading to breakthrough performance. One way to think about innovation productivity is to consider a large company that invests, say, $100 million to generate a new product that a startup might only be able to create with sweat equity. Consider, for example, the relationship between the Swiss pharmaceutical giant Roche Holding Ltd. and the Silicon Valley–based biotechnology firm Genentech Inc. According to a Roche executive, the rationale behind Roche’s major investments in Genentech was that the latter was able to earn significantly better returns on research and development than Roche did. Similarly, IBM Corp. discovered decades ago that adding programmers to a software project that was late did not help. Indeed, progress slowed even more.

In Innovation Despite, Or Because of, Limited Resources

Resource constraints fuel innovation in two ways. In a 1990 article in Strategic Management Journal, J.A. Starr and I.C. MacMillan suggested that resource constraints can lead to “entrepreneurial” approaches to securing the missing funds or the required personnel. For example, the Game Changer innovation program of Royal Dutch Shell Plc long operated on the shoulders of its social network, which allowed innovators to find technically qualified peers willing to contribute to their efforts on a complimentary basis. In other words, individuals innovate despite the lack of funding by using social rather than purely economic strategies. Thus tin-cupping, horse trading, bootstrapping and currying personal favors partly or wholly substitute for economic transactions in which nonentrepreneurial innovators (or those less socially connected) would pay the full price.

Such efforts speak for “resource parsimony” — deploying the least resources necessary to achieve the desired results. For instance, new product development teams might use testing equipment on weekends, when it is readily available and free. Likewise, team members might know engineers or other professionals — say, from supplier firms involved in past projects — who would be glad to give informal design reviews in anticipation of future remunerative work.

Resource constraints can also fuel innovative team performance directly. In the spirit of the proverb “necessity is the mother of invention,”
teams may produce better results because of resource constraints. Cognitive psychology provides experimental support for the “less is more” hypothesis. For example, scholars in creative cognition find in laboratory tests that subjects are most innovative when given fewer rather than more resources for solving a problem.

The reason seems to be that the human mind is most productive when restricted. Limited — or better focused — by specific rules and constraints, we are more likely to recognize an unexpected idea. Suppose, for example, that we need to put dinner on the table for unexpected guests arriving later that day. The main constraints here are the ingredients available and how much time is left. One way to solve this problem is to think of a familiar recipe and then head off to the supermarket for the extra ingredients. Alternatively, we may start by looking in the refrigerator and cupboard to see what is already there, then allowing ourselves to devise innovative ways of combining subsets of these ingredients. Many cooks attest that the latter option, while riskier, often leads to more creative and better appreciated dinners. In fact, it is the option invariably preferred by professional chefs.

The heightened innovativeness of such “constraints-driven” solutions comes from team members’ tendencies, under the circumstances, to look for alternatives beyond “how things are normally done,” write C. Page Moreau and Darren W. Dahl in a 2005 *Journal of Consumer Research* article. Would-be innovators facing constraints are more likely to find creative analogies and combinations that would otherwise be hidden under a glut of resources.

A product innovation example offered in 1991 by Ikujiro Nonaka and Martin Kenney in the *Journal of Engineering and Technology Management* involved a key part of a photocopier — its drum. A team of engineers at Canon Inc. was considering how to redesign the drum in order to ease photocopiers’ maintenance requirements. The challenge was cost: A number of key parts needed to be redesigned at a low enough cost so that they could be replaced at certain operating intervals. The team members claimed that the task was impossible; but the team leader, Hiroshi Tanaka, engaged his colleagues in a comparison between the photocopier drum and the prosaic beer can. How was it possible to manufacture beer cans at a low enough cost to make them throwaways? This analogy created the conceptual breakthrough the team needed: to make the photocopier drums disposable.

Just how instrumental resource constraints can be in bringing about more innovative outcomes can best be observed when different teams are struggling with the same innovation problem but have different resource endowments. The development of jet propulsion, in which the classic challenge has been the enormous quantities of heat generated by the combustion, provides a vivid illustration, as described by Phil Scranton and Michael Gibbert in their 2006 working paper “Constraints As Enablers of Radical Innovation? The Case of Jet Engine Development.”

Generally speaking, the more performance one wants out of a jet engine, the more fuel and air one needs to feed into it, the hotter it gets and the more likely are engine failures because of material fatigue. Certain metal alloys used for the engine have better heat-withstanding properties than others, but they are almost always much more expensive.

In the post–World War II era, several American teams under General Electric Co. and several German teams under Bayerische Motoren Werke AG were competing against each other in a race to resolve the jet engine performance dilemma. The stakes were high, given that the Cold War had started and the West was eager to come up with reliable jet technology before the Soviet Union did. The German team eventually won by proposing a radical departure from the status quo, which in fact is still used today. It developed a “bypass” technology in which the rotor blades and other engine parts most exposed to high temperatures were hollowed out so that air could flow through them, thereby cooling them off.

Whence this idea? The American team had a virtual blank check to buy whatever costly raw ma-
materials it needed to create the most heat resistant alloys (the Cold War jet propulsion development program cost the U.S. government nearly twice as much as the Manhattan Project). The German team, by contrast, was forced to rely on cheaper alloys, as it had significantly less funding at its disposal and simply couldn’t afford the more expensive metals.

**Sometimes Three Is More Than Four**

Of course, while necessity is the mother of invention, it is not invention itself. And parsimony has its own limits. Otherwise, fewer and fewer resources would invariably lead to ever more innovative outcomes. But our view does force managers to be realistic about team members’ attitudes. Whether a team will end up seeing a glass as half full or half empty may be gauged, for example, by comparing prior innovation performance against budget. While some team members will have a track record of “resourcefully” innovating when resource-constrained, others may thrive only when what they perceive as generous levels of funding are made available. Confounding the two types of team members (or putting them on the same team) will most likely lead to inferior performance.

Nevertheless, wherever possible we do advocate resource scarcity: Abundance is not only costlier, but it also does not provide the stimuli for finding the innovative solutions that constraints inevitably invite. It may pay to remember the old Finnish army adage (derived from Finland’s battles against much bigger adversaries throughout the course of its history): “If the heavy armor does not move with four people pushing it, take one man away and let us see if three can do it!”

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