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# Using rivalry to spur innovation

**Companies looking for new sources of creative energy might want to look backward—to the productive rivalry that catalyzed much of the artistic innovation during the Italian Renaissance.**

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**Business leaders tend** to raise their eyebrows when they read about parallels between history and modern management—and for good reason. There are undoubtedly many people who offer better leadership lessons than Attila the Hun, and it is unclear whether Alexander the Great can tell us much about business strategy. So it's with some trepidation that we set forth the premise of this article: that the Italian Renaissance was such an extraordinary period of creativity it can shed light on how to stimulate business innovation.

We're quite conscious of other great eras of innovation—the 18th-century industrial revolution in Great Britain, the late-19th-century emergence of managerial capitalism in the United States, and even the present period of digital innovation. One thing that's striking about the Renaissance, though, is that it took place on a scale not very different from that of many large, modern enterprises. Northern Italy is no larger than the state of Michigan, and at the beginning of the 15th century, the three great centers of Renaissance creativity—Rome, Florence, and Venice—had a combined population of roughly 200,000.<sup>1</sup>

The ability of a population and region of this size to generate creative output—ranging from the world's largest masonry dome to linear perspective, modern-day portrait painting, technical breakthroughs in glassblowing and bronze casting, the italic type of the Aldine Press, sfumato and chiaroscuro, and the designs in Leonardo's sketchbooks—makes it, in our opinion, intriguing for innovation-minded leaders. What's more, there are some uncanny parallels between what went on during the Renaissance and principles that have proven their worth in R&D organizations—such as collision between diverse experts, providing loose guidelines, and establishing stretch goals.

Less in line with mainstream R&D practices: the degree to which Renaissance creativity was built on professional rivalries—like the ones between Leonardo, Michelangelo, Raphael, and Titian—that are commonly viewed as some of the most productive in history. It may be that by overlooking the potential of rivalry, modern R&D organizations are missing an opportunity to promote ground-breaking innovation.

### **What we've already learned from the Renaissance**

Some of the practices that made the Renaissance such a creative period have already been largely integrated into today's R&D labs.

#### Promoting “collision”

Consider, for example, the popular notion that constant collision between engineers, scientists, and managers will lead to better collaboration and ultimately yield the best ideas. The classic

<sup>1</sup>See Elizabeth S. Cohen and Thomas V. Cohen, *Daily Life in Renaissance Italy*, Westport, CT: Greenwood Publishing Group, 2001, p. 7; Peter Partner, *Renaissance Rome 1500-1559: A Portrait of a Society*, Berkeley, CA: University of California Press, 1980, p. 82; and Richard A. Goldthwaite, *The Building of Renaissance Florence: An Economic and Social History*, Baltimore, Maryland: Johns Hopkins University Press, 1982, p. 33.

manifestation of collision is the multidisciplinary corporate R&D lab, where innovators of different stripes are gathered together in a single research facility. Among the most famous of these facilities are IBM's Watson Research Center, HP Labs, Bell Labs, and GE's Global Research Center. Virtual spaces, if built correctly, can also be effective for encouraging collision. Take the example of Tata's Innoverse hub. This portal serves as a virtual innovation forum where employees from across Tata's business units can post ideas, comment on them, and then vote on the ones they like the best. In one year it gathered 12,000 ideas, on topics ranging from R&D to management and strategy, several hundred of which have been turned into projects or implemented through operational reforms.<sup>2</sup>

The concept of collision resonates with the creative energy of the Renaissance. Italy at the time was one of the most urban regions of Europe, and, although small by modern standards, the cities were densely packed centers teeming with painters, craftsmen, and sculptors.<sup>3</sup> Rome, for example, attracted flocks of artists from throughout Italy seeking the patronage of the Vatican. The relatively small urban space forced them into frequent and often intense interactions with each other. Artists benefited from the diversity of the colleagues around them, and the high rates of collision with these peers allowed them to learn from each other, exchange ideas and techniques, and build off each others' diverse accomplishments.

#### Giving researchers their space

Many of the world's greatest inventions have been stumbled on by mistake. Smart R&D managers recognize this and allow their researchers to turn mistaken or unexpected findings into new lines of research, products, or technologies. Recently, there has been much discussion of Google's policy that allows researchers to spend time on their own ideas, projects, or personal development. It's not a new idea. 3M has long allowed its employees to spend 15 percent of their time on projects of their own choosing.<sup>4</sup> Similarly, at Tata Consultancy Services, each employee receives 5 hours of a 45-hour work week for personal projects.<sup>5</sup>

The Renaissance equivalent of setting R&D guidelines was the commission—say, for a painting or piece of architecture. These contracts would stipulate a subject to be painted, who would paint which parts of the work, the dimensions and medium of the painting, the timeline, and the amount of money to be paid. Although at times these contracts could be quite specific, during the Renaissance, artists' prominence in society increased, so that they increasingly could negotiate contracts that allowed for creative interpretation and stylistic flexibility.

Michelangelo's painting of the Sistine Chapel's ceiling is a fine example of how an artists' higher social position translated into greater negotiating leverage with patrons. In 1506, Pope Julius II

<sup>2</sup>Jessie Scanlon, "How to build a culture of innovation," *BusinessWeek*, August 19, 2009.

<sup>3</sup>See Elizabeth S. Cohen and Thomas V. Cohen, *Daily Life in Renaissance Italy*, Westport, CT: Greenwood Publishing Group, 2001, pp. 7–8.

<sup>4</sup>Jessie Scanlon, "How 3M encourages collaboration," *BusinessWeek*, September 2, 2009.

<sup>5</sup>Jessie Scanlon, "How to build a culture of innovation," *BusinessWeek*, August 19, 2009.

decided to complete the painting of the interior of the chapel (the walls had been painted 20 years earlier) with a grandiose fresco across the entire ceiling. He went to Michelangelo, who was well known as a sculptor (though not much as a painter), and asked him to take on the job. Only after some cajoling did Michelangelo agree. In the initial contract, the Pope proposed a scheme of 12 enormous figures of the Apostles. Michelangelo convinced the Pope to agree to a much grander subject that documented humanity's need for salvation. Michelangelo later bragged that he had gotten the Pope to allow him "to do as I liked."<sup>6</sup> The artist's ability to negotiate for flexibility contributed to the remarkable creation that is the Sistine Chapel ceiling.

### Setting stretch goals

Smart companies establish practices and programs that encourage innovators to "shoot for the stars." Consider, for example, Royal Dutch/Shell's GameChanger program, which is designed to seek out and fund good ideas that have a low chance of coming to fruition but could have a profoundly positive effect on Shell's business. GameChanger teams in each of Shell's business units vet, select, and then support ideas as they are developed. Ideas can come from within the company or from outside innovators, although Shell retains the intellectual-property rights to any designs or products that might be generated. The company devotes 10 percent of its innovation budget to the program, which generates fully 30 percent of Shell's R&D projects. By recognizing the power of good but far-fetched ideas, Shell has reaped the benefits of a number of new technologies that few thought were possible to achieve.

Similarly, the masters of the Renaissance were constantly setting themselves artistic and engineering goals that were beyond reasonable reach. When Brunelleschi arrived in Rome, he set to work studying the remarkable architectural masterpiece that is the Roman Pantheon. The structure's dome, in particular, fascinated him: he was awestruck by the sheer amount of space that it covered and puzzled over how such a feat of engineering had been achieved. Then the city of Florence began construction of its now-famous Basilica di Santa Maria del Fiore (more commonly known as the Duomo) and in 1419 sought an architect to build a dome to cover the massive, 42-meter-wide space above the church's chancel. Such a vast space had not been capped with a dome since the Pantheon's construction, in ancient times.

Brunelleschi won the commission. To overcome this extraordinary architectural challenge, he developed a number of engineering techniques and construction practices. His final design entailed a double-shelled brick dome, with no external buttressing, that rested directly on the church's drum. To complete the design, he invented a unique system of hoists, basing the technology on what he had read the Romans used to construct the Pantheon. His masterpiece defied precedent on innumerable levels: it was the first octagonal dome in history, the first dome to be built without a wooden supporting frame, the largest dome in existence at the time,

<sup>6</sup>Loren Partridge, *The Art of Renaissance Rome 1400–1600*, New York: Prentice Hall, 1996, p. 17.

and is still the largest masonry dome in the world. By drawing on the past and innovating beyond it, Brunelleschi was able to achieve what many had deemed impossible.

### **What the Renaissance can still teach us**

Despite these parallels, there is one important Renaissance innovation practice that rarely figures in today's R&D labs—the use of rivalry. It is difficult to overstate the extent to which the Renaissance was built on the professional rivalries of its major figures. While these men generally held each other in deep respect and esteem, they also competed passionately against each other for commissions, recognition, and prestige. Competition can sometimes yield petulance and destructive energy. But rivalry during the Renaissance seems to have contributed to a competitive culture that bred creativity and innovation. Artists were rivals—but they were also colleagues and frequently friends. To compete, they borrowed from one another, drawing on the techniques and innovations that they most admired from their peers.

#### [A more productive kind of rivalry](#)

Rivalry can mean outright competition—a zero-sum contest in which two individuals or teams go head-to-head and one is declared the winner at the expense of the other. But in the Renaissance, rivalry was linked to a second notion, called *paragone*.<sup>7</sup> In direct translation, *paragone* means “comparison.” During the Renaissance, it implied the placing of two artists, or their individual works, side by side in order to judge them, weigh them, distinguish them, and critique them. With *paragone*, two equal rivals were compared and celebrated for their relative achievements. Comparing two or more works in this way did not diminish one at the expense of the other. In fact, artists were sometimes commissioned to work on similar projects simultaneously, with each one presenting a subject in his own unique and brilliant way.

An integral part of the philosophy of *paragone* was the belief that such direct comparison could motivate artists to greater feats. For example, in 1515 the young Raphael was commissioned by Pope Leo X to design ten tapestries for the lower walls of the Sistine Chapel. Knowing they would hang directly below the ceiling painted by Michelangelo, Raphael pushed himself to new heights of creative brilliance.<sup>8</sup>

#### [Harnessing rivalry today](#)

There are few examples of companies that embrace anything approaching *paragone* in their R&D labs. To be sure, some companies hold innovation competitions, such as Tata Group's recent Innovista challenge, which generated 1,700 innovative ideas from across the company. But these one-time contests do not really replicate the kind of productive artistic rivalry that made the Renaissance so creative. Moreover, competition is generally discouraged in the business literature on innovation. Management experts prefer to talk about cooperation and collaboration within R&D centers rather than competition and rivalry.

<sup>7</sup>Rona Goffen, *Renaissance Rivals: Michelangelo, Leonardo, Raphael, Titian*, New Haven, CT: Yale University Press, 2004.

<sup>8</sup>Marcia B. Hall, ed., *Rome: Artistic Centers of the Italian Renaissance*, Cambridge: Cambridge University Press, 2005.

But rivalry does not necessarily preclude collaboration; we believe R&D managers should be seeking to integrate the two more deeply—in short, to implement a modern form of *paragone*. The best way to do so is to set two or more teams working on the same project at the same time. Again, this isn't a new idea: recall the famous competition between the System 360 mainframe computer and the 8000 series at IBM during the early 1960s.<sup>9</sup> And as Mark Little, director of General Electric's Global Research Group, explains in the article that follows (see "Competition and collaboration in General Electric's Global Research Group"), his company makes extensive, though understated, use of competition. What we are suggesting is that the idea of competition—specifically, *paragone*—should be a part of more companies' regular R&D processes. This may sound costly, but assigning several teams to tackle the same problem is not necessarily unproductive or inefficient if it leads to *better* solutions. Here are three principles for executives interested in harnessing the power of *paragone*:

- **Forming teams.** Competing teams could come from different divisions, include a diverse array of experts, and take explicitly different approaches to the same problem. After all, there are often many ways (sometimes coming out of different disciplines) to resolve an R&D challenge, and there is often no way of knowing which one is best without trying them out. Moreover, teams can have biases and narrow specializations, making it all the more important to have an explicit diversity of approaches.
- **Appreciating differences.** During the Renaissance, paintings were placed side by side so that viewers could compare and appreciate them and other artists could borrow from them. In the same way, the various solutions that teams develop can be held up next to one another in order to judge them on their relative merits. On many occasions, ideas from one can be integrated into the other. Or a solution that is ultimately passed over can be sent back to the labs for development in new directions.
- **Conducting "market tests."** Another way to replicate the practice of *paragone* is to bring designs to an internal jury or group of customers and let them weigh and contrast the different solutions. In some cases, more than one of the products may find customers who appreciate them, just as Renaissance artists each had their own following.

Whatever the judgment mechanism, there is good reason to believe that having two or more teams working on a given project can have a strong motivational impact. A friendly and healthy degree of rivalry will spur teams to think deeper and harder about a given problem, leading to new levels of creativity. As long as this spirit of rivalry is managed effectively, R&D teams will push themselves further just knowing that their proposals will ultimately be held up in comparison to others.

<sup>9</sup>For more on this competition, see Rowena Olegario, "IBM and the two Thomas J. Watsons," (especially p. 388) in Thomas K. McCraw, ed., *Creating Modern Capitalism*, Cambridge, MA: Harvard University Press, 1997.



All that said, we are realistic about the challenges associated with rivalry. Even during the Renaissance, some rivalries grew out of control and at times led to duels, imprisonments, and murders. We have no doubt that poorly managed rivalry could devolve into the kind of destructive competitiveness that R&D managers try to avoid, stifling the exchange of ideas and undermining collaboration. Strong management, though, should be able to ensure that competition does not create bitterness, promote discord, or cause individuals to feel threatened or defensive.

Most important, a company must supplement the implementation of *paragone* with a deep and pervasive culture of cooperation and collective achievement. The Renaissance masters knew that their greatest achievements were probably those that they would accomplish collectively. They wanted nothing less than to define a new age of art, culture, and civilization—and they were never going to do this alone. Likewise, a great company will make sure its innovators understand that its most lasting breakthroughs and achievements are the product of a collective effort—and will celebrate and reward all who participate.



Without knowing it, the world's most creative companies have fruitfully embraced many practices that made the Renaissance uniquely creative. Executives who want to push their R&D teams to greater heights might consider drawing from the Renaissance philosophy of *paragone*. Harnessing the creative energy of productive rivalry should yield more, and more valuable, business innovation. ○

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## Putting it into practice:

# Competition and collaboration in GE's Global Research Group

Mark Little, the head of General Electric's Global Research Group, describes how his company uses rivalry to stimulate innovation without disrupting a culture of collaboration.

**To get a reality check** on the notion that the Italian Renaissance holds valuable insights for executives hoping to stimulate innovation, Bernie Ferrari sat down with GE senior vice president Mark Little, the director of the company's Global Research Group. GE Global Research employs 2,800 people in four research centers (Bangalore, India; Munich, Germany; Niskayuna, New York; and Shanghai, China), who provide basic research and core technology support for the company as a whole. While GE has thousands more technologists spread across its individual businesses, Global Research pursues fundamental innovations in ten technology areas—ranging from biosciences and imaging to ceramic and metallurgy technologies—that cut across GE's business units.

Little's verdict: "It's an interesting thing that you're onto here," he said of the idea that rivalry is an important but often-overlooked lever for catalyzing innovation. A variety of GE research efforts employ rivalry, but Little noted that it is infrequently discussed and often plays second fiddle to collaboration as a cultural norm. Little also described the way in which GE embraces several other Renaissance practices—giving people space, setting stretch goals, encouraging collision between diverse specialists—that are more representative of mainstream R&D approaches.

### Productive rivalries

This article was stimulating for me. I hadn't thought much about, or verbalized, rivalry as an element of what we do. But some of my colleagues laughed when I said, "We are sisterhood and brotherhood; we are collaboration; we are teamwork." My colleagues said, "These are scientists. They know how to compete. They know a lot about rivalry."

What's interesting, though, is that we don't talk about rivalry. I don't get in front of our people and say, "I love that we've separated you into different teams and that we're playing you off against one another." We don't talk about ourselves as an internally fighting team, although we have a number of processes that do just that. And we don't talk about individual or team success, although we foster it.

What we talk about is working together, collaboration, and the success of our businesses; we want everybody focused on that. Rivalry takes place in an atmosphere of trying to



produce results together. Often we'll say, "Please champion this because we need to have this idea sorted out"—not, "You champion this thing, and you're personally bound up in it." It's less personal if I say, "You guys look at *A*; you guys look at *B*. You tell us all about *A*; you tell us all about *B*. And then we'll sort it out." Whether *A* or *B* wins, these teams will come together to make it a success. Here are some real examples of how that works:

- **Aircraft engines.** My colleagues in GE's aviation business reminded me that the GE90—the big, very-high-thrust engine developed back in the 1990s for the Boeing 777—was developed by two independent teams. Now, we would never build two engines and then run them off, because that's just too expensive; you don't spend a billion dollars each on two engines and then test them. But we did have two independent teams do very detailed conceptual designs, and then we ran them off against each other. One of my colleagues was deeply involved; his team won the competition, and then the other team was charged with challenging and pushing everything my colleague's team was doing. He didn't like it, but he said it made them a lot better and helped the whole thing go forward.
- **Composite materials.** Ceramic matrix composites are an emerging technology for very lightweight aircraft engine components that, unlike any metal, can sustain very high temperatures. You want to go to high temperatures in aircraft engines because the higher the air intake temperature, the better efficiency you get out of the system. Our aviation business had one approach; the GE Research Center had a different one. They developed them in parallel, took them down the road, all the way through testing, and then picked one; now we're going forward on that one.
- **Power generation.** Combustion systems for gas turbines are hugely important. There are big differences between peak and off-peak demand, especially in today's world where you have renewables coming off- and on-line, and it's really important to be able to turn gas turbines down. You want to be able to hold the efficiency up while you turn the power down, but machines don't naturally work that way. So we are, as we speak, running off three different technologies, created by three different teams, which are looking at different ways of solving that problem, with interesting, novel technologies. The best team will win, and we will blend the best features of each.
- **Solar energy.** We have had three parallel tracks for solar energy. One is silicon based, which we have really pulled back on because there's a great deal of capacity in that segment, and it's suffering. Then there's thin-film solar, where we've got a little company called PrimeStar Solar that we're injecting research technology into as aggressively as we can. And while working on that, we're working on the next generation of solar energy with another material called CIGS.<sup>1</sup> So we've in effect been competing with three different approaches, run by three different teams, to see which wins in the marketplace.

<sup>1</sup>Copper indium gallium (di)selenide solar cells.

We have many more examples of this kind of competition going on all over the company: limiting particulate emissions in our transportation business, creating a new battery business, and new imaging approaches in health care. These problems that we're trying to solve are so difficult that, typically, we can't have one person do it. So there's no da Vinci, no Michelangelo making a sculpture on his own. It's a different sort of team game. It's not as if we don't have people who are preeminent leaders in some of these areas, who get to champion those causes. Not at all—we have many of those. We have chief scientists and chief engineers who, in some sense, are like master artists. But they are singular in their discipline. We don't have two in one place. So you don't have rivalry that's directly comparable to that of the master artists.

### **Making rivalry work**

I don't focus on people winning and losing. I focus on people sorting out the pluses and minuses of different options. That's a big, vitally important contribution. I think our scientists and technologists see it that way too. And I have never heard anybody complain about us doing these things.

Of course, that organizational dynamic depends in a significant way on having competent people judge these competitions. If you have somebody in a decision-making position who is viewed, particularly by the losing team, as not really capable of making good technical assessments—say, a manager who is more of a generalist than the deep specialists on the team—that's organizationally bad. So we have mechanisms to guard against that, not the least of which is getting outside people who are experts in on the judgment.

Also, it's not like we say, "We've got a chapel that needs to be painted." We say, "We'd like to do something in oil and gas, and it's this kind of a problem." Then we work with the people who know enough about it to figure out where we should be going. Let's say a team working on battery life is making good progress on the chemistry. We might say, "You know, the chemistry isn't going to be enough; we need to work on the configuration too. And we know a person who is brilliant at configuration; let's challenge that person to put together a team." That really happened in this battery case, and it's not uncommon.

### **Giving researchers space**

By and large, our model is to keep people focused on things that they and we together have chosen to work on. We don't say, "Go do whatever you dream about; we will try to find a way to fit it into GE." We say, "These are the spaces that GE is in. These are things that we're interested in learning about. We'd like your ideas on how to solve these kinds of problems or on getting into adjacent kinds of things." For example, because we're not a semiconductor business, we're not asking people to come up with ideas for new semiconductors—even though we have people who are well capable of doing that.

Having said that, some of our cooler ideas have come from people dreaming up things on their own and then saying, “Let’s look at this idea.” And we do have pools of money for seeding ideas. We fund the idea a little bit, we find out we like it, and we fund it more. What we’re hoping to do is get these ideas to blossom to the point where the businesses become interested, pick them up, fund them, and turn them into products. It’s not people individually sitting around having a lot of free time to do whatever they want to do. But there’s a process to get them access to money, which gives them flexibility to do more. That’s very much part of how we get new ideas.

### **Stretch goals**

Our people don’t come to us to think about the next little incremental thing. So the very nature of the research center is that we’re working on things that are hard to do, where the likelihood of failure is not zero. And we also have some overarching goals, a few big themes where we said, “Let’s have these be areas where we try to achieve some great things.” They are long-term, difficult problems.

One example is solar power. We say we want to get the cost of generating solar electricity to be competitive with the cost of electricity from fossil fuels. Just to give you some context about how hard that is to do, with today’s low gas prices, you could probably generate natural gas-fired electricity at 5 or 6 cents a kilowatt hour. Solar costs 25 to 30 cents. Closing that gap is really tough. You don’t have to close it all the way, because you can put solar panels on your home and avoid the transmission and distribution costs, which might be another 7 or 8 cents. But it’s a big challenge. So we are trying, on multiple fronts, to drive the cost of solar way down.

Another goal is cutting the cost of desalination in half. Another is going to subsea oil and gas and liberating all kinds of new fuel sources that we can’t get at today. We also are focused on a couple of kinds of cancer. These are big thematic things. They don’t catch everything we do, but they are out there as emblematic goals for us; everybody knows about them, and lots of different people are working on them.

### **Collision of people and ideas**

This place is designed to foster the deep technical excellence that you get by having people come together across disciplines; that’s the magic we have. A specific example of this is in health care. We bought Amersham Biosciences some years back, not very long after starting our own biosciences activity. The Amersham acquisition put us into medical diagnostics in a whole different way. And although Amersham had a research center in New Jersey, it moved its people from New Jersey to Niskayuna.<sup>2</sup> They didn’t do that because they thought we had better biologists than they did. They did it because they wanted access to other disciplines: the engineers, the physicists, the device people. The “collision,” they knew, would bring them benefits. And it has paid off beautifully.

<sup>2</sup>Niskayuna, New York, is the largest and oldest GE Global Research center of activity.

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Another very live and real thing for us is that our business leaders come to the research center routinely. For example, John Dineen, the head of GE Healthcare, spends a full day with us every quarter. To some extent, those sessions are about reviewing the projects we have under way. But in a more important way, they’re about shaping the future of the business. These are deep, meaningful discussions, involving serious give and take, that really help shape where we’re going. I’ve heard business leaders say these are their best days at GE, because they are out of the flow of the urgent stuff they typically have to deal with—closing a quarter, winning an order—and are free to really think about the future of their business.

Finally, there is something we call a Session T. Session T is by design a very deep session with customers, most often but not always held at a GE research center. Customers come in and join with people from the GE business that serves them—typically, marketing, product management, and technologists—as well as our people. The purpose of that session is to gather information from the customers about what they see for themselves in the future—what needs they have—and then to think together about how to create what they’d like to have but don’t. That’s very powerful for us. [O](#)