The Next Decade at Rady

San Diego’s Unrelenting Philanthropist

Predictive Patterns in Financial Markets

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Ernest Rady, founding donor of the Rady School of Management
Dear Readers,

Over the past decade, the Rady School of Management has transformed not only the landscape on the north end of UC San Diego, but also the lives of its stakeholders — from the students to the faculty to the San Diego business community that demanded the school’s existence.

The Rady Business Journal has grown alongside the school, achieving a major milestone in the publication of this issue. This is the first academic year during which two issues have been published. We would like to thank the writers for their dedication. Faced with tighter deadlines, they responded with well-researched, insightful articles that are relevant to the San Diego business community. We would also like to thank the administration and Dean Sullivan for giving us the freedom to operate as well as the necessary resources to accomplish our goals.

Our mission at the Rady Business Journal is to leverage academic research to provide valuable insights to the local business community. This issue features articles that relate classroom theory to real-world examples involving companies that drive San Diego’s business community. Our writers have gone well below the surface to provide deep insight into issues that directly impact San Diego — including Qualcomm’s marketing campaign for its Snapdragon processor and Cymer’s recent merger with its largest customer, ASML. These articles are designed to serve as case studies within the community for the educational benefit of all.

While we are excited about our progress thus far, we look forward to continuing our growth in circulation, frequency, and influence. We are already hard at work developing our next issue, which will feature articles focused on the cybersecurity cluster in San Diego.

Thank you,
The Rady Business Journal Staff
July 1, 2003, was the Rady School of Management’s inaugural date — it is our reference point for when our community imagined a possible graduate business school at UC San Diego. “Imagined” is a true descriptor of the times, since our school launched with very few resources and even fewer commitments. Through the remainder of 2003, a clearer picture of our unique business school on the La Jolla “mesa” emerged — with considerable input from prospective supporters and the greater San Diego community. In short, our new business school at UC San Diego would be characterized by the following:

- Seamless integration across the UC San Diego campus
- Entrepreneurship as the underpinning
- Innovation and knowledge as our competitive advantage
- Reputation among the best in the world

Largely achieved, these attributes remain a guiding light. So we, as a community, should be proud of what has been achieved in a short 10 years. Which then begs the question — what’s next? What demand signals from our community and markets are on the horizon? How should we position our school so as to truly achieve excellence and impact? These are questions that our community now is considering — building on our successes to define a new tomorrow.

Early returns from our visioning processes paint an exciting future. Innovation and impact will still be at our core. Startup and emerging growth companies will remain a focus, and we will more fully embrace how innovation and impact translate into opportunities for established companies. For our students who target these companies we need to adapt and define curricula to develop different skills and knowledge sets. Our curricula must adapt to the needs and interests of our students.

Other needs in our school’s future concern the form of pedagogy — how teaching and learning are conducted. The use of technology in synchronous and asynchronous ways will be critical. Blended, face-to-face, and technology-enabled learning will become a necessity, and consideration of satellite classrooms — the first of which might be in North San Diego County and another near the Mexico border — will make learning opportunities more convenient to prospective students.

In addition to how and where we deliver learning opportunities, our school will focus on several new and exciting areas that students, faculty, and the community will embrace. For example, our school could be the nexus of a UC San Diego innovation ecosystem that would encompass incubators, accelerators, startup funds, mentoring, and much more. A one-stop shop for discovery to market to impact.

Additionally, social innovation, health and wellness, and business analytics are on the horizon — new and defining areas that engage the community and that are consistent with our brand. Innovation and impact are at our core in education and scholarship. And our goal is to have it be a signature for the Rady School. We aspire to be a defining, path-breaking school committed to excellence.

Robert Sullivan is the founding dean of the Rady School of Management. He is an expert on entrepreneurship, knowledge management, and operations management. He is the incoming chair of the Association to Advance Collegiate Schools of Business, the premier accrediting body for business education.
Love of the deal still has Ernest Rady up with the sun. Ten years after his gift gave birth to the Rady School of Management, Mr. Rady is as busy as ever — personally, professionally, and philanthropically

“Why many peoples’ lives have been affected positively — that’s where I get my jollies,” said Ernest Rady, founding donor of the Rady School of Management, from across a mammoth desk in the executive office at his firm, American Assets Trust (AAT), on a recent Tuesday. Mr. Rady had just returned that morning from a week in Europe.

The Rady School of Management’s founding donor hadn’t been on vacation. In fact, barring the occasional golf trip, Mr. Rady isn’t really the vacationing type. AAT, which in 2011 underwent a $564 million IPO, today controls more than 5.8 million square feet of retail and office space in the western U.S. As executive chairman, Mr. Rady had been across the Atlantic on an eight-day business development roadshow. The typical day packed eight meetings into 15 hours, starting at sunrise. Seated behind that intimidating desk, next to shelves stocked with a globe and encyclopedias, Mr. Rady showed no signs of jet lag. He’s not the jet lag type either.

Mr. Rady, 75, sets a grueling pace at AAT. “Ernest has found the fountain of youth, and that is staying active in business,” says John Chamberlain, AAT’s CEO and president.

Having forged a long and at times tumultuous career in San Diego entrepreneurship, Mr. Rady has since 2003 been applying an increasing portion of his substantial energy to the establishment of a legacy. That legacy, including the children’s hospital and business school that bear his name, is both marked and strengthened by the turns Mr. Rady’s life has taken over the past decade.

Since moving his family to San Diego in 1966, Mr. Rady has become an integral part of the local business community. He made his fortune as an entrepreneur, managing companies in real estate, banking, and insurance.

One of his first deals came in 1967: a $35,000 investment to finish an apartment building in El Cajon. The success of that project and other real estate deals led to the formation of American Assets. In 1972, Mr. Rady founded Western Thrift & Loan. Starting with an office in an Orange County trailer and $850,000, the company would later change its name to Westcorp and ultimately be sold to Wachovia for $3.9 billion in 2005.

Mr. Rady also got his feet wet in the automobile loan industry, starting an independent company in 1973. Later renamed WFS Financial, the company underwent an IPO in 1995 and is currently a subsidiary of Wells Fargo.

By the early 2000s, Mr. Rady’s success had put him in a position to begin building a legacy. At the time, San Diego was the largest
metropolitan area in the U.S. without a top-tier business school. It had MBA programs, but none that ranked in Bloomberg Businessweek’s top 50.

Amid the dot-com boom, UC San Diego was considering ways to invigorate business education in San Diego. A proposed UC San Diego school of management would develop a new wave of entrepreneurial managers to lead technology startups.

Founding dean Robert Sullivan had taken it as his mission “to convince the world that a 45-year-old, science-focused public university can assemble a business program that carries the same heft as old-guard schools like the University of Pennsylvania’s Wharton or Northwestern’s Kellogg.”

But dot-com optimism gave way to hardship as the bubble burst. By the time the University of California green-lighted the UC San Diego business school in 2001, funds had become scarce. By August of 2003, the school had received only $23 million in commitments toward its goal of $115 million.

Enter Ernest Rady.

Having arrived in San Diego when UC San Diego was in just its sixth year, Mr. Rady had watched the school grow in stature over the decades. The university would have been an attractive place for him to cement his legacy, but it was a memory from his childhood in Winnipeg that led him to open his checkbook. “My parents taught me that you can’t always take,” he told a group of students during a recent appearance at Rady. “You have to give back to the communities that support you.”

In January of 2004, Mr. Rady made a $30 million gift to support UC San Diego’s School of Management. The donation was the largest naming gift in school history and the second-largest philanthropic gift, second only to a $110 million pledge made by Joan and Irwin Jacobs in 2003.

At the time of his gift to the school, Mr. Rady was about to strike one of the most prominent deals of his career. In 2005, Wachovia announced a deal to acquire Westcorp. Serving as chairman and CEO, Mr. Rady saw Westcorp originate more than $6.5 billion in auto loans that year, and the acquisition was expected to make Wachovia the ninth-largest auto loan originator in the country. All told, Westcorp was expected to sell for $3.9 billion in Wachovia stock.

The next year, Forbes ranked Mr. Rady No. 140 on its catalog of “Richest Americans,” listing his net worth at $2.2 billion.

With his wealth at a new high, Mr. Rady once again turned to philanthropy, making a donation that ranks among the top 10 gifts in San Diego County history: $60 million to the Children’s Hospital and Health Center. Mr. Rady, whose father was a doctor, had been volunteering on the board of directors for 20 years.

With a school and a children’s hospital now bearing his name, Mr. Rady’s philanthropic renown was secure. Unfortunately, his home, wealth, and family life were not. The dizzying heights Mr. Rady enjoyed in 2006 would give way to a period, beginning in 2007, that he now refers to as the “worst four years of [his] life.”

In February of 2007, a home invader broke in to Mr. Rady’s house and Tasered him and his wife. The pair was then bound and gagged, along with the housekeeper, as the burglar searched for a floor safe.

Mr. Rady offered money to the robber — but to no avail. In that moment of crisis, Mr. Rady’s Canadian heritage provided an unexpected boon. The thief needed American currency and wanted nothing to do with the wads of Canadian dollars locked away in the bedroom. The robber left with $43 in cash.

Mr. Rady’s ill fortune continued the following year. Just two months after buying Westcorp, Wachovia had purchased Golden West, the second-largest savings and loan in the country, for $24 billion. In the crisis of 2008, it became clear that Wachovia had expanded its mortgage business at the peak of the housing bubble. Analysts suggested that Wachovia would end up losing as much as $11 billion on the Golden West deal.

The disaster for Wachovia became a disaster for Mr. Rady. When Wachovia acquired Westcorp for $3.9 billion in 2006, the deal left him with nearly 36 million shares in Wachovia. At the time, the shares were worth about $2 billion. Two years later, the shares were worth $125 million.

Mr. Rady’s financial troubles compounded in 2009 when family members sued him in what became very public court cases. Seven nieces and nephews filed a lawsuit worth $200 million, alleging that Mr. Rady had in 2007 offered to buy each of them out of the family business. Amid the Wachovia fallout, he could no longer afford to live up to his offer. In 2012, courts resolved the family dispute in his favor.

Recent years have provided something of a turnaround for Mr. Rady. In 2012, the San Diego Nice Guys, which annually honors a community-oriented San Diegan as its “Nice Guy of the Year,” was planning to recognize Mr. Rady at its black-tie awards gala. Mr. Rady agreed to accept the award on one condition — all of the money raised was to be split between the Rady Children’s Hospital and the Rady School of Management. “They ended up raising more money than ever before,” said Robert Sullivan, the school’s dean. The Rady School of Management allocated the funds toward fellowships for students with economic need.

“Ernest turns down 95 to 98 percent of appearance requests,” said Robert Barton, AAT’s CFO. “But he’ll do it if it helps open channels for others.”

A career spent evaluating deals prompts Mr. Rady to examine his philanthropy in an investor’s terms. When he made his $30
A $45 million donation to the business school, he saw the gift as more of a long-term play. “I hope at some time my grandchildren will go down and see ‘Rady’ and say, ‘That’s what my grandfather did,’” he said.

The payoff is coming faster than that. In his wildest dreams, Mr. Rady said, he never could have expected to realize a return on the business school during his own lifetime.

But he saw an early dividend three years in. At a graduation dinner for the school’s first cohort, the FlexWeekend class of 2006, a group of students in their mid-30s approached his table and introduced themselves as “Radies.”

“He loved it,” remembered Sullivan.

Mr. Rady said he has always held a strong belief that the Rady School of Management is capable of great things. He expects that, over time, the school will graduate individuals who will have a huge positive impact on their communities. As Mr. Rady has experienced the swings of fortune that are extreme even among entrepreneurs, the school he helped launch has experienced its own fitful progress.

Today, the Rady School of Management is still setting ambitious growth targets — Sullivan expects the number of full-time faculty to more than double in the coming decade. The framework is in place to attract and retain the best of the best: The Financial Times ranked the school in the top 20 globally for faculty research and the top 10 for entrepreneurship.

Mr. Rady’s final assessment of his namesake school reflects the standard by which he measures his own activities at this stage in his career — how many lives he affects positively: “It’s been a plethora of benefit for everyone involved.”

Drew Beal (Rady MBA, 2013) is the co-founder and executive director of Social Ventures for Sustainability, a nonprofit that works with campuses and communities to encourage sustainable behavior changes. Drew’s background is in financial services, and his interests include entrepreneurship, consumer behavior, and sustainability. Drew’s hometown is Toms River, N.J.

Endnotes
Ever wondered why it is so difficult to forecast stock prices, movements in exchange rates, or the direction of the gold market? It is certainly not for lack of trying. Legions of professional fund managers, institutional investors, laymen, and market gurus are constantly scouring for any empirical evidence, news story, mathematical model, or computer algorithm that might give them an edge in profiting from higher returns by identifying predictable patterns in financial payoffs.

This quest for predicting future stock, oil, or gold prices will only get more intense in a world with big data. After the recent announcement that one study of Facebook Likes found that a preference for eating curly fries was linked to a higher IQ, undoubtedly we will soon be submerged in reports of novel predictability patterns.

It is exactly investors’ attempts at predicting future stock prices that make their objective of beating the market so difficult to achieve. Suppose that through data collection and extensive number crunching an investor comes up with a model that gives her a slight edge in forecasting daily stock returns. For example, instead of facing even odds that the market will move up or down, the model could improve the investor’s odds from 50-50 to, say, a 50.1 percent success rate versus a 49.9 percent failure rate.

Presumably, the investor would take advantage of this improvement in odds by buying slightly more stocks when there is a better than even chance that their price will go up the next day. As more money gets allocated to this strategy, the stock price will be pushed up on days with favorable return prospects and gets reduced otherwise. If only a single investor knows of the forecasting model, this investor might not buy sufficiently many stocks to push their price up to the point where the odds are again 50-50. However, as more and more investors learn of the model, it becomes increasingly likely that the stock price will quickly adjust ahead of the predicted event. At this point, the forecasting model ceases to work — it has become a victim of its own (past) success.

**Physics & Finance**

The Heisenberg uncertainty principle from quantum mechanics holds that there are limits on how precisely the position and momentum of a particle can be jointly measured. The analogy to forecasting financial market phenomena is that there are limits on how precisely stock prices can be forecasted and how much money a forecaster can make when acting on these forecasts. This is akin to the well-known observer effect from scientific studies — the act of observing a phenomenon may lead to a change in the phenomenon. The forecaster is part of the system whose law of motion she is attempting to predict.

A similar phenomenon arises in opinion polls. Suppose that an opinion poll accurately measures voters’ opinions and gets its predictions spot on. Unfortunately, when people see the opinion poll, they may decide to change their voting behavior and vote strategically (perhaps because their favorite stands to lose, and so they move their vote to another candidate). This means that the opinion poll will end up not being right — because of the effect it had on voting behavior after it got published. What is needed is a sophisticated opinion poll that takes into account the effect it has on voting behavior.

Recent research papers have found evidence that is consistent with these observations. One 2012 study examined 82 cross-sectional return predictability patterns. These involved ways to sort stocks by various criteria such as past returns or firm characteristics (such as price-earnings ratios), forming portfolios of the most desirable stocks, and earning outsized returns, even after adjusting for risk. The researchers looked at what happened to payoffs on such “anomalies” after knowledge of their existence became publicly available. On average the post-publication decay in predictability was found to be 35 percent, although it did not disappear entirely. Upon publication, most predictability that could be converted into abnormally high profits appeared to vanish, however.

Another study looked at the so-called accruals anomaly from financial accounting. The accruals anomaly holds that stocks of firms with larger accounting accruals (non-cash earnings) on average earn lower future returns. The study found that, once published, this anomaly largely disappeared as a result of inflows of capital by large investors such as hedge funds that aimed at exploiting this investment opportunity. Interestingly, the accruals anomaly did not vanish immediately after the initial study had documented its presence. It took about five years for this to happen, so outsized profit opportunities existed for a while.

These studies reveal a fundamental challenge facing researchers working on forecasting security prices. The more people become aware of your forecast — and act on it — the less likely it is that future forecasts will be accurate. Hence, there is no such thing as an accurate and
stable prediction model for security prices. To be successful, the forecasting rule must account for its own impact. This means having an adaptive strategy for how to evolve and change over time. The forecasting method becomes a mutating organism, constantly on the lookout for pockets in time with predictability patterns large and stable enough to be pounced on before they self-destruct because of the markets’ learning. It is equally important for the forecasting method to know when to quit as a result of the prior signals ceasing to be accurate. Poor decisions will be made if the forecast is dominated by noise. Strategies that might have worked in the past cannot be expected to continue to work indefinitely.

Adapting to Change

In my past work, I have developed adaptive forecast combination methods that combine a predictability monitoring algorithm with a method for forecasting stock returns conditional on having identified some “local” predictability. The figure to the right and above uses financial and macro variables to predict monthly U.S. stock returns. The figure shows periods where return predictability is identified by this adaptive forecast combination approach. Periods with some predictability are listed at the top under “combined,” while periods with no predictability detected are listed at the bottom (prevailing mean). While some of the episodes where predictability is detected are quite long-lived, it should be borne in mind that they typically are associated with predictive power (R²-values) on the order of on the order of 1 percent or so. Hence, the signal is very weak relative to the noise.

Predicting Risk

Despite these limitations, there are several ways that stock market prediction can be successful. Most notably, forecasting has proven successful in the area of risk management. While it is difficult to predict levels or directions of stock returns, it is easier to predict squared returns. This was pointed out in the work on volatility modeling conducted at UC San Diego in the early 1980s by Robert F. Engle and was cited as a reason for the 2003 Nobel prize in Economics awarded to Engle and his UC San Diego colleague, Clive Granger, the latter for work on cointegration.

Returns on many financial securities behave in a manner similar to air turbulence: It is difficult to predict the initial jolt in turbulence, but once it has occurred, it is likely that the turbulence will persist for a while. “Fasten your seatbelts” after an initial bout of high turbulence is sound advice that applies not simply to air travel but also to risk management.

While financial forecasts can be self-destructive, they can also be self-fulfilling, at least for a while. Suppose that investors act on forecasts of higher future prices by buying more of an asset,
thereby bidding up its price. If there is considerable uncertainty about the price in the first place, the increased stock price could itself induce higher future prices if there are many so-called momentum or feedback investors who project past price patterns into the future.

Which pattern will emerge — self-destructive or self-fulfilling — is a matter of the degree of uncertainty surrounding an asset’s “fair” price and the proportion of rational versus momentum or feedback traders. No prize for guessing which type of investor dominated in the recent Bitcoin bubble.

Contrast the difficulty in forecasting stock returns with another task such as forecasting the growth of the U.S. economy. Suppose that some experts are very good at this task and so produce more accurate forecasts. Will this lead to a similar demise in their forecasts? Probably not, although it might. For example, if the forecasts came from the International Monetary Fund, then predictions of low future growth rates might cause a country to change its fiscal or monetary policy, thereby leading to a less dismal outcome. However, in general, we would not expect such ‘observer effects’ to be as large as in the financial markets, where prices can move very rapidly.

Perhaps it is really true that economic forecasters were created to make weather forecasters look good. In fairness, weather forecasters do not face the difficulty that publishing their forecasts leads to a change in the weather. Bear this in mind the next time you check the weather forecasts or when you hear a self-professed stock market guru pronounce with great confidence the latest forecasts or stock pickings.

Allan Timmermann is the Atkinson/Epstein Endowed Chair Professor of Finance at the Rady School of Management and also holds an appointment as a professor in the Department of Economics at UC San Diego. He uses a mix of theory, data, and econometric techniques to understand the behavior of prices and expectations in financial markets. His objective is to understand what determines the movement of security prices and to use this in managing risk, forming portfolios, and forecasting future price movements.

Endnotes

Returns on many financial securities behave in a manner similar to air turbulence: It is difficult to predict the initial jolt in turbulence, but once it has occurred, it is likely that the turbulence will persist for a while.
On May 30, 2013, Dutch microelectronics firm ASML completed its $3.7 billion cash-and-stock acquisition of San Diego–based Cymer. The deal — financed in part by industry leaders Intel, Taiwan Semiconductor Manufacturing Co., and Samsung — could prove pivotal in the development of the next generation of microprocessor fabrication technology. At stake is industry leadership in the face of upstart technologies and the continued exponential growth in processing power dictated by Moore’s Law.

During the 21st century, historic advancements in telecommunications have spurred change on the macro level. According to a recent study by IDC,1 49.4 percent of the U.S. population has a smartphone, and about 67.8 percent of the population will use smartphones in 2017. There are more than 400 million devices connected to the Internet in U.S. homes, averaging more than one device per person, according to the NPD Group.2 One-third of the world’s population was online in 2011, and 87 percent of the global population has a mobile phone, according to a report from the International Telecommunication Union3. These giant booms in connectivity are made possible by advancements in semiconductor manufacturing processes that take place on the nano level.

Since the first commercially available microprocessor, Intel 4004, was released in 1971,4 the fabrication processes for silicon chips have changed dramatically. Gordon Moore, Intel’s co-founder, famously said, “The number of transistors incorporated in a chip will approximately double every 24 months.” His prediction has become known as Moore’s Law, and it has been realized along the way via technical breakthroughs by the semiconductor industry. According to Intel, “The original transistor built by Bell Labs in 1947 was large enough that it was pieced together by hand. By contrast, more than 100 million 22-nanometer tri-gate transistors could fit onto the head of a pin.”5

Twenty-two nanometers is the current standard in the semiconductor manufacturing process. A nanometer is one millionth of a millimeter, and those tiny transistors are designed using light in a process called photolithography. There are several types of lithography technologies. Currently, 193-nanometer immersion lithography, called deep ultraviolet (DUV), is used to manufacture 22-nanometer chips. The distance of 193 nanometers is the wavelength of the light source, and because its wavelength is long when compared with the size of a transistor, expensive improvements such as double patterning or triple patterning are required. Semiconductor manufacturers are begging for a better lithography technology to make Moore’s prediction true. Extreme ultraviolet lithography, or EUV, at a wavelength of 13.5 nanometers, was supposed to be that technology — ready for commercialization by 2009. After four years, in 2013, it is still not ready for high-volume manufacturing. To accelerate the research and development process of EUV, ASML Holding from the Netherlands on May 30 acquired San Diego’s Cymer for $3.7 billion in cash and stock.

ASML

Founded in the Netherlands in 1984, ASML is one of the largest suppliers of photolithography systems in the world by revenue.6 At the end of 2012, ASML employed more than 8,000 employees and had customers in 16 countries. Wafer scanners are used to print chips onto silicon wafers. ASML’s scanners use light sources from both Cymer and Gigaphoton, and its major competitors include Canon and Nikon. It has a wide range of customers such as Intel, Taiwan Semiconductor Manufacturing Co. (TSMC), and Samsung.

ASML’s revenue reached its highest point at 5.65 million euros in 2011. It has been selling scanners with DUV technology and has been working on EUV technology since 2006. In 2010, ASML reached a key milestone by shipping six NXE:3100 first preproduction systems using EUV to manufacturers and labs for testing. Five NXE:3100 machines use Cymer’s light source for
EUV. The remaining machine uses a light source from Xtreme Technologies, which is owned by Ushio, a Japanese company.

Cymer
San Diego-based Cymer Inc. is the maker, supplier, and marketer of superior-quality UV light sources that are used in microfabrication to design performance-enabling patterns on semiconductor chips. The company supplies deep ultraviolet (DUV) light sources and is working to develop extreme ultraviolet (EUV) light sources for chip manufacturing. Its lithography tool manufacturing customers include Canon, Nikon, and ASML, which has been Cymer’s top customer.

The company was founded in 1986 by Dr. Robert Akins and Dr. Richard Sandstrom, both graduates of UC San Diego. Cymer has more than 1,200 employees worldwide and has field service offices around the world. It also offers an OnPulse service for installed base products so that light sources can maintain production goals for customers. Cymer also had silicon crystallization process tool products, which were used to manufacture LCD and OLED displays, but it discontinued new product development in this business in January.

Gigaphoton, based in Japan and owned by Komatsu, competes with Cymer in the DUV light source segment. Gigaphoton and Xtreme Technologies are also competing with Cymer in developing EUV technology.

Acquisition
With rapid changes in the semiconductor industry, ASML needs to keep up with technological innovation. Its systems are very expensive (with an average price of 22.4 million euros per unit sold in 2012), and it only sells a relatively small number of machines annually. Facing intense competition from alternative technologies in the race to continue Moore’s Law, ASML needs to advance development of EUV as soon as possible so it can maintain its position in the industry. It has been working intensely with Cymer for about two years; to speed up the integration of light sources with its EUV system, ASML acquired Cymer.

Between July 9, 2012, and Aug. 27, 2012, ASML entered into an agreement with Intel, TSMC, and Samsung for a “Customer Co-Investment Program” to accelerate development of EUV lithography.7 ASML sold 23 percent of its shares to those customers for 3.85 billion euros in cash. That transaction essentially provided the company the necessary cash to acquire Cymer. This acquisition could be pivotal for the advancement of technologies in semiconductor manufacturing; ASML made a very important strategic decision. However, there are a lot of challenges ahead of the firm, and if ASML fails to get EUV technology ready before competing technologies mature, it might have wasted $3.7 billion.

Technologies
Competition to release more efficient chips remains heated. Intel, an industry leader, has already released a 22-nanometer chip for its latest generation of processors. Intel plans to release a 14-nanometer chip in late 2013 or early 2014, and the industry expects to manufacture a 10-nanometer chip by 2015 or 2016. Research on 10-nanometer chips is going steady. Creating a 10-nanometer size could involve a number of experimental technologies, potentially based around photonics, graphene, and EUV lithography.8

Photolithography, as defined by Cymer,9 is the process by which semiconductor circuitry is patterned on silicon wafers. There is a light-sensitive material called photoresist on the wafer, and the deep ultraviolet (DUV) light emitted from the lithography light source exposes the photoresist material through the masks. The wavelength of the light limits the resolution of the lithography systems and hence the size of the transistors. Deep ultraviolet for lithography is invisible to human eyes and is generated by excimer lasers. There is a light-sensitive material called photoresist on the wafer, and the deep ultraviolet (DUV) light emitted from the lithography light source exposes the photoresist material through the masks. The wavelength of the light limits the resolution of the lithography systems and hence the size of the transistors. Deep ultraviolet for lithography is invisible to human eyes and is generated by excimer light sources. A class of molecules called “excited dimer” exists only in an excited state, which lasts for a very short period of time; it does not exist in a stable, non-excited state. That is the origin of the term “excimer,” which, in turn, is the origin of the name Cymer. Two types of excimer lasers are currently used for DUV: a krypton fluoride laser (KrF laser) at a wavelength of 248 nanometers and an argon fluoride laser (ArF laser) at a wavelength of 193 nanometers. Lasers with shorter wavelengths do not yet have enough power for production.
Immersion lithography enhances the resolution of photolithography. Current immersion lithography tools use highly purified water and achieve 45-nanometer nodes using DUV.

To achieve a smaller transistor size to fulfill Moore's Law, double patterning is used. As the name suggests, the wafers are patterned twice to achieve the necessary size of the pattern. Because the wafer needs to be patterned twice, double patterning has less productivity than single patterning. In order to create smaller transistors before EUV arrives, some firms are working on multiple patterning. Double patterning and all other types of multiple patterning are considered expensive work-arounds that push the limit of the resolution the light source can achieve.

Instead of emitting photons as in photolithography, electron-beam lithography (e-beam) emits a beam of electrons in a pattern on the resist. It can be used to manufacture chips or create nanotechnology architectures. However, e-beam takes too much time to expose the entire wafer and therefore throughput is low. As the next generation of photolithography, EUV lithography uses extreme ultraviolet light with a wavelength of 13.5 nanometers. Because of its extremely short wavelength, EUV is absorbed by traditional lenses; therefore reflective (opaque) multilayer mirrors are used to concentrate the light. The light is also absorbed by any gas in its path; therefore the light has to travel through a vacuum chamber. It also has stricter requirements on masks and photoresist, both of which are essential components of chip-making.

Challenges

The development of EUV lithography has missed a number of milestones and opportunities so far. It was supposed to be ready for 32-nanometer processes in 2009. Not only was that milestone missed, but EUV also was not ready for 22-nanometer processes and might also miss the chance for 14-nanometer processes, which are expected to be ready in 2014. EUV was supposed to reduce the cost of manufacturing, but because it has missed all those milestones, it may have lost its cost-effectiveness for production of smaller transistors. There is a consensus that EUV is necessary for the future and therefore it must be developed for smaller-than-10-nanometer-node production.

TSMC, Samsung, and Intel have invested in ASML for the development of EUV technology. TSMC has already installed an EUV scanner, but it is also supporting the development of e-beam as a backup. Both EUV and e-beam have faced delays and multiple challenges and may miss the 10-nanometer mark. Some industry experts say that EUV may not be used until 7-nanometer processes or later. Currently, chip makers have no choice but to use 193-nanometer immersion lithography with multiple patterning. The industry forecasts that if such delays continue, chip makers would have to use 193-nanometer immersion with multiple patterning at 7 nanometers.

While Intel has invested $4.1 billion in ASML for R&D funding and equity for development of technologies including EUV, it is already planning to move ahead with multiple patterning using DUV probably down to 11 nanometers. Even though multiple patterning is expensive, the smaller transistor results in a cheaper cost per transistor and, therefore, more transistors per chip for the same or cheaper price. From what it seems, the industry is preparing to continue with Moore's Law with or without EUV.

A first-generation EUV system was delivered by ASML and Cymer for research and development in 2009, and six second-generation EUV systems, called NXE:3100, were shipped in 2010 and 2011. However, none of the systems have reached the throughput required for high-volume manufacturing. ASML received 11 orders for third-generation systems, called NXE:3300B, and plans to ship them in 2013. These are still not expected to be ready for high-volume manufacturing. According to a 2009 presentation, ASML had planned to deliver an EUV system with a throughput of 150 wafers per hour by 2013, but it is still trying to demonstrate that it can reach 100 wafers per hour. These throughput issues are attributed to the light source that is developed by Cymer. With low throughput, EUV systems are more expensive than the DUV systems with multiple patterning, and that reality could prevent manufacturers from adopting EUV. The price of the NXE:3100 is already twice that of DUV scanners, and EUV systems that would be ready for high-volume manufacturing are expected to cost more than $100 million, compared with $20 million for DUV systems.

Cymer has been struggling with the development of EUV. By the end of 2012, the company had hoped to ship a 100-watt source, but so far it has only generated 50 watts of sustained EUV power.
in the lab. According to semimd.com, a 55-watt EUV source translates to a throughput of 43 wafers an hour. Cymer’s efforts in developing EUV lithography will now be bolstered by ASML’s acquisition. This is good for Cymer as it reduces the risk-difficulty burden. An EUV system needs to reach 250 watts for high-volume manufacturing. That is a lot of improvement to achieve. Aside from power and throughput, defect control is also very important.

Although the acquisition was largely funded by Intel and other major players in the industry, they are looking at options such as multipatterning, a combination of multipatterning, directed self-assembly, limited EUV, and e-beam lithography. If it becomes difficult to shrink features, improve performance, and lower power per transistor, the industry would then look at other options such as energy scavenging, die stacking, better customization, and differentiation.

**Competition**

There are two different types of light source for EUV, according to ASML’s website: a laser-produced plasma source (LPP) and a laser-assisted discharge plasma (LDP). With the former, “a high-energy laser fires on a microscopic droplet of molten tin and turns it into plasma, emitting EUV light, which then is focused into a beam.” The latter consists of using “a strong electrical current through a tin vapor to generate EUV photons.”

Cymer has been working on an LPP source, and Gigaphoton (under the Komatsu Group) is also working on an LPP source. Xtreme Technologies is working on LDP sources. ASML has used an LPP source from Cymer in five of the six NXE:3100 systems and used an LDP source from Xtreme in the remaining one. Nikon is working on EUV1 system, and aside from an EUV system named SFET, Canon is also eyeing nanoimprint lithography and maskless lithography.

Aside from the competition for EUV light sources and systems, ASML also faces challenges from e-beam lithography from startups IMS Nanofabrication, Mapper Lithography, and Multibeam. E-beam throughput is not yet high enough to be a serious threat to EUV. Another form of competition is nanoimprint lithography. These all still need development time to replace EUV, but if EUV’s development does not mature soon enough, the situation can be quite dangerous for EUV and ASML. EUV has been very expensive to develop. ASML has spent the same amount on the development of EUV as it has on the creation of the previous two generations of lithography technologies. It has been spending close to 600 million euros per year on research and development, and its main priority has been EUV. ASML is also expecting to spend 50 percent more on research and development for the next five years. If it cannot produce an EUV scanner earlier than competitors or before competing technologies get a stronghold, ASML’s acquisition of Cymer could be considered a failure.

**Best-Case Scenario**

One piece of good news is that EUV has more industry support than other next-generation lithography candidates. E-beam and maskless technologies have seen more delays and challenges than EUV. EUV also faces another dilemma — the potential end of Moore’s Law or “Moorepocalypse,” especially for complementary metal oxide semiconductor (CMOS) devices. Many believe the beginning of the end is here. It is common to see headlines such as “Moore’s law savior EUV faces uncertain future.” In another sign, chip maker AMD is taking longer than expected to get from a 28-nanometer chip to a 20-nanometer one. This could lead to the end of Moore’s Law and ASML could have additional time to deliver EUV. If no alternative can be found, the industry could wait for ASML and its EUV scanners.

On a larger scale, advancements in semiconductor manufacturing have brought astounding improvements to everyday life such as cars that park themselves, prosthetic hands that function like real ones, laptops that last more than a day with a single charge to the batteries, embedded computing devices in glasses and watches, and flying robots that are only the size of a penny. If Moore’s Law holds, there could be a slew of daring new creations that challenge the imagination. With EUV as the frontrunner to keep Moore’s Law alive, ASML has a burden on its shoulders to meet key milestones. The success of EUV could mean not only continued historical progress for the semiconductor industry but also a sustained innovation trajectory for the global economy.

Aung Kyaw Myo (Rady MBA, 2013) has worked in product development in software and consumer electronics. His post-MBA focus is technology, operations, and entrepreneurship, and his goal is to build businesses with a positive social impact.

Prarthana Srikant (Rady MBA, 2013) is a life sciences and health care professional. She developed an interest in the high-technology industry after coming to the Rady School of Management. She is an avid follower of tech trends that will shape the life sciences industry.
San Diego is at the forefront of development of new medical technologies in a time of vast change to the health care regulatory infrastructure. Demographic shifts in the U.S. population are adding more than 30 million people to a health care system already experiencing a shortage of health care providers. The Affordable Health Care for America Act has fundamentally altered the way health care works in America. With the purpose of making health care more affordable for everyone, some of the changes will significantly impact business locally. Currently some of the business problems that are most relevant to San Diego and the health care industry are reduction of readmissions to hospitals, increased fraud protection, detailed billing, solutions for the increase of patients with chronic illnesses, and solutions for quality of care.

The Rady School of Management students involved in the Venture Capital Management (that oversees the Rady Venture Fund), technology commercialization, and Lab to Market classes are in a great position to take advantage of the myriad of business opportunities that are springing up in our own backyard. There are more than 600 local life sciences companies and nearly 2,000 wireless technology companies here. San Diego venture capital firms continue to invest hundreds of millions of dollars into startups annually, and some are saying that San Diego is poised to be a mini Silicon Valley. The Rady School of Management has complemented this trend through its entrepreneurial curriculum. I am one example of a student who successfully used the Rady programs to aid in the success of a local startup wireless health care company.

LEVERAGING ACADEMIC OPPORTUNITIES

The Rady School of Management provides a wide range of programs, classes, and networks to support entrepreneurship within its students. One very effective class that lets entrepreneurs get their feet wet is the Venture Capital Management series. This program oversees the Rady Venture Fund’s deal sourcing and investment due diligence. Participating students evaluate the pitches of promising companies looking for venture funding.

The technology commercialization program, meanwhile, pairs promising students with incubated startup companies in a
Finally, the Lab to Market series is a three-course program that supports students’ startup ambitions from idea to investor pitch. Here the students work collaboratively to brainstorm products and services that will transform the future of genomics, biotechnology, health care, and consumer products, to name a just a few. Once the program is complete, students pitch business plans to local venture capitalists and angel investors. The insights gleaned from the series allow for a community of Rady alumni to create innovative organizations and viable local startups.

This curriculum “will offer our MBA students real-world experience and promote business growth in the region,” said Lada Rasochova, a Rady School alumna who manages the Rady Venture Fund, in a press release. “We would like to build long-term relationships with these companies, and help them as they grow,” she said. “In addition to receiving help from our students as part of the incubator program, companies can apply to the Rady Venture Fund, and we provide mentoring, education, facilities, utilities, introductions to domain experts and other services for startup companies before they have achieved sustainability through revenues or private funding.”

I used the Rady Venture Fund, technology commercialization and Lab to Market programs to consult with startup companies and eventually found a good match with telmedx, an mHealth startup whose telemedicine platform allows doctors to remotely examine patients over mobile phone cameras at any time. Leveraging the skills I learned at Rady, the telmedx team and I were selected to join Janssen Labs, a Johnson & Johnson incubator based in the Torrey Pines area of San Diego. Fewer than 10 percent of all applicants are accepted to Janssen Labs. In a recent press release, Diego Miralles, the head of Janssen Labs, highlighted San Diego’s mHealth competitive advantage. “We have an entrepreneurial community within us,” Miralles said. “That is a great source of inspiration.”

**DEVELOPING TELMEDX**

One of the major themes from the Lab to Market series at Rady was talking to and engaging with customers during the early stages. Customers’ insights, needs, and demands will help shape the direction of marketing, product development, and advertising. This key lesson from Rady was directly applicable to the task of honing ideal markets and customer segments for telmedx. This insight helped the company gain traction with hospitals and concierge medicine practices. Similarly, the due diligence processes that were a hallmark of the Venture Capital Management program helped telmedx craft investor-friendly business plans and pitch slide decks.

Through talking with customers, we determined that the telmedx system should be used to remotely monitor follow-up care and help reduce hospital readmissions. Accountable care organizations can maximize reimbursement revenue as well as realize rewards for meeting patient quality measures. Deploying the telmedx system allows earlier and better medical decisions to be made from more immediate live patient interactions and high-resolution still images that provide critical medical information from a mobile phone camera.

Excess health care costs in the U.S. reflect needless emergency room visits and preventable hospital readmissions, adding up to about $39 billion annually; telmedx’s solution can easily be integrated into existing medical routines and workflows. In San Diego alone, one health care provider estimates that the addition of visual information about individual patient triage calls prevents unnecessary emergency room visits, saving approximately $14 million per month.

Although there is reason to believe that telemedicine enables better care and reduces health care costs, the technology has had only limited market penetration. The lack of integration with medical practice business processes and the lack of inexpensive FDA-certified, HIPAA-compliant telemedicine systems are all contributors. The telmedx platform addresses these problems.

Our core platform architecture is complete and has been deployed in usability trials in a variety of medical settings ranging from long-term care, concierge or direct medicine, clinical trials, and sports medicine. Contracted sales and other trials are currently being developed in multiple countries in several medical scenarios.

I am just one of the many entrepreneurial-minded Rady students who have leveraged the school’s spirit of innovation to create promising startup ventures. San Diego is at the bleeding edge of the intersection of business and science, particularly evident in the mHealth industry. Rady’s entrepreneurial culture is instrumental in leading change locally, resulting in intangible economic growth.

Andrew E. Ajello (Rady MBA, 2013) is a serial entrepreneur and business consultant with experience in the mHealth and clean tech sectors. He focuses on corporate strategy, business development, due diligence, and venture fundraising for his clients.

Endnotes
Unleashes the Dragon

The marketing campaign for the Snapdragon processor tests whether smartphone users will embrace San Diego’s technology giant

By Saurabh Bajaj and Amit Rai

Toward the end of 2012, marketing managers at Qualcomm, the world’s leading mobile chipset provider by revenue, were reevaluating the progress they had made in a new business-to-consumer marketing initiative. Qualcomm had gone to great lengths to market its Snapdragon system on a chip (SoC) technology. The company was hoping to create a signature product in the eyes of mobile users, who for the most part did not know the role Qualcomm technology played in their devices. In December of 2011, the San Diego–based company had gone so far as to re-christen its namesake downtown football stadium Snapdragon Stadium for 10 days.

In many ways, Qualcomm was exploring uncharted territory. For years, the company had been content to quietly dominate the mobile chipset market without everyday consumers knowing it. By instead marketing its technically sophisticated products to knowledgeable mobile device manufacturers, Qualcomm had grown from a seven-person startup in 1985 to a telecommunications giant with more than 20,000 employees in 2012.1

Historically, Qualcomm processors had led in market share among OEM (original equipment manufacturers) mobile device makers such as Samsung, Google, HTC, Nokia, and Blackberry in the high-end mobile devices market, especially smartphones. It had done so by creating an institutional emphasis on new product development and a stellar reputation among its manufacturing customers, often at the expense of consumer marketing.

As the consumer landscape changed during the first decade of the new millennium, management began to rethink this approach. It was not clear that Qualcomm’s traditional focus on business-to-business (B2B) marketing could help it address two trends that were likely to impact the company’s future.

First, Qualcomm faced increasing global competition from other mobile processor vendors such as Broadcom, Samsung, MediaTek, and Spreadtrum. In fact, if Qualcomm wanted to sustain sales growth, it had to increase penetration of low-end smartphone markets in emerging economies such as China.2 Qualcomm management now recognized that branding, differentiation, and recognition among global smartphone users would be a key factor in implementing that strategy.

Second, because of declining PC sales growth and increasing adoption of tablets, Intel’s entry in the high-end mobile chipset market was now imminent.3 Meanwhile, the emergence of social media platforms such as Facebook, Twitter, LinkedIn, and YouTube had given rise to the need for Qualcomm to communicate with its end consumers. Failure to exploit this new channel could exacerbate Intel’s threat.

Despite all the company’s technological achievements within the $150 billion smartphone market,4 Qualcomm lacked recognition, and the average smartphone user was not aware of Qualcomm. In his own words, Qualcomm’s chief marketing officer, Anand Chandrasekher, considered his company a “$100-billion-plus company in terms of market cap that nobody knows.”5
Management thus faced several questions: Was brand recognition by end consumers critical to Qualcomm’s future? If so, how would Qualcomm achieve this recognition? How would Qualcomm educate end consumers about the contributions its product made to their mobile devices? The company had begun a preliminary exploration of these questions through the marketing of its proprietary mobile device application processor, Snapdragon. Perhaps those initial efforts would yield some insight as to how to proceed.

Background

Headquartered in San Diego, Calif., Qualcomm was in 2012 the global leader in digital wireless telecommunication products and services. That year, the company had more than 20,000 employees across 157 locations worldwide and net revenue of $19.12 billion.

The company began in July of 1985, when MIT alumnus and UC San Diego professor Irwin Jacobs and USC and MIT alumnus Andrew Viterbi, together with five others — Franklin Antonio, Adelia Coffman, Andrew Cohen, Klein Gilhousen, and Harvey White — founded Qualcomm, short for “Quality communications.”

Qualcomm had an early success with its commercial product OmniTRACS, a satellite-based commercial mobile system for the transportation industry. Qualcomm would later gain a major industry foothold by creating a new industry standard. Three months after the Telecommunications Industry Association (TIA) endorsed a digital technology called time division multiple access (TDMA) in 1989, Qualcomm introduced a new digital technology, code division multiple access (CDMA). CDMA divided digital signals into different “languages” so that multiple devices could communicate with one another simultaneously. CDMA offered better call quality and more capacity potential than GSM (global system for mobiles), the existing technology. At the time of its introduction, industry experts were effusive, saying things like, “CDMA violated the laws of physics.” CDMA would later play a large role in meeting increasing demand for cellular mobile bandwidth and would lay the platform for a global adoption of mobile devices.

In the following decades, Qualcomm developed new technologies that were readily adopted as industry standards: CDMA 2000, WCDMA (wideband code division multiple access), and LTE (long-term evolution, marketed as 4G LTE, is a standard for wireless communication of high-speed data for mobile phones and data terminals) all evolved from CDMA architecture.

The Snapdragon Processor

A mobile application processor is a system on a chip that supports applications running on a mobile operating system. Qualcomm built the entire SoC architecture into its Snapdragon S4 processor, which integrated all essential electronics components — including memory management, graphics processing, and multimedia decoding — onto a single chip.

By the end of 2012, the Qualcomm Snapdragon mobile processor powered one-third of smartphones worldwide. The Snapdragon processor integrated the modem, a 3-D graphics processor, a CPU, GPS capability, 3G and 4G LTE connectivity, and HD video capabilities. Snapdragon-enabled smartphones were lighter and thinner than their contemporaries. Even Qualcomm’s most powerful competitors could not replicate the company’s granular control over each part of the chip.

This tight integration on a very small chip resulted in lesser use of space and energy consumption and thus led to higher power efficiency. Tighter integration also meant that components could communicate with each other more efficiently and quickly. With this competitive advantage, Qualcomm topped the mobile market share in 2011 and led in Android and Windows Phone hardware support in 2012.

The Snapdragon processor had emerged as one of the best mobile processors in several performance attributes measured by industry experts. Some of the well-known attributes of OEMs were the battery life, speed performance, and graphics performance.

The first Snapdragon mobile processor was launched in 2008. By 2012, Qualcomm enjoyed a leading global position in smartphone market share, thanks in part to Snapdragon. The company led the cellular baseband market with 51 percent revenue share in the first half of 2012 on the strength of its leading position in CDMA, WCDMA and LTE basebands.
B2B marketing consisted of partnering with, educating, and engaging wireless carriers. As they were the primary buyers of the smartphones from the OEMs, it became important to work with carriers to educate them about Qualcomm's Snapdragon processor. One of the reasons for its success in B2B marketing was that business-side customers (partners like network carriers and smartphone OEMs) were sophisticated enough to understand and value the technical superiority of Qualcomm's products.

However, Qualcomm processors’ superior attributes were not always the deciding factor for business-side customers. In those cases, customers would often switch to non-Qualcomm processors. For example, in April of 2013 Samsung launched its Galaxy S4 smartphone. In India, S4 was powered by Exynos 5 Octa, Samsung’s own 8-core processor. Because emerging countries were still transitioning to the third-generation (3G) network, Samsung decided to use its own processor without 4G LTE capability, focusing on the ‘number of cores’ as a selling point to the end consumer. In contrast, the S4 series in the developed world with 4G LTE capability was powered by Qualcomm's Snapdragon S600 chip. Samsung recognized the technical superiority of Qualcomm’s products, but only used Snapdragon to power its devices when the technology was required to please end consumers.

Branding Snapdragon

In 2012, Qualcomm hired Intel executive Anand Chandrasekher as its new chief marketing officer. With this leadership change, Qualcomm aimed to enhance consumer awareness of the Snapdragon brand. One of Qualcomm’s first initiatives under Chandrasekher was a keynote appearance at the industry’s marquee event, the 2013 Consumer Electronics Show in Las Vegas. Qualcomm CEO Paul Jacobs kicked off the show by presenting Qualcomm’s new “Born Mobile” theme.

Qualcomm structured its B2C marketing and branding strategy into three groups: owned, earned, and paid. With its “owned” strategy, Qualcomm focused on creating and distributing content to its consumers through various social media outlets. The purpose of this strategy was to create simple messages and videos to explain difficult concepts such as the Snapdragon chipset’s value proposition and technical superiority. Qualcomm’s “earned” strategy paid attention to the strong analyst and PR relations that it had created over time.

The company also created TV ads, promotions, and YouTube videos, and it also ramped up branding efforts by engaging with four branding, PR, and advertising firms. But Qualcomm management approached its “paid” strategy with caution. The company unveiled its “A dragon is coming” commercial in January of 2013 to create a new icon for the Snapdragon brand.

The new dragon mascot was central in this branding, and it personified the processor’s upgrades. Chandrasekher had pledged to boost the marketing and advertising to build Snapdragon as a consumer brand. Promotional videos for Snapdragon received 2 million views on YouTube and Facebook in 2012.
Changing Global Demand

Following decades of success built on Qualcomm’s standard-setting CDMA technologies, the industry had begun to address the question of how to bring mobile access to rapidly growing emerging markets. From 1990 to 2011, worldwide mobile phone subscriptions had grown from 12.4 million to more than 6 billion.

Globally, end users bought almost 426 million smartphones in the first quarter of 2013, and the Asia/Pacific region accounted for roughly 53 percent of total global sales. While global smartphone sales growth was 0.7 percent year over year, Asia/Pacific regional smartphone sales growth had been 6.5 percent. China led this trend with a 7.5 percent growth rate. These trends suggested that as smartphone sales reached a saturation point in the Western world, emerging markets remained an important source of growth.

In the third quarter of 2012, China had surpassed the U.S. as the world’s largest smartphone market. However, most of China’s smartphone sales were driven by low-cost phones that often lacked the capability to work with the fastest 3G (third generation) network. This regional threat of low technology adoption meant opportunities for local players like MediaTek. Demand for low-cost smartphones rose for two reasons. First, Chinese providers did not subsidize end-user adoption of high-end smart phones, as U.S. providers did. Second, lower per-capita income in emerging countries made affordability a concern. Qualcomm stood to benefit if it could find a way to engage the price-sensitive consumers in rapidly growing markets such as China.

After having dominated the high-end smartphone market, Qualcomm was now targeting the emerging markets by building cheaper entry-level chipsets for smartphones. Now, it faced head-on competition with the local low-end specialist, MediaTek. MediaTek had shipped 500 million chips in 2012, an indication of the company’s rising prominence. MediaTek enabled a market for low-end smartphones by providing small manufacturers “turnkey” software solutions and reference designs for easy mobile phone manufacturing. Companies with workforces as small as 10 people could now manufacture low-end smartphones using this package. The low-end smartphone market posed the challenge of price-sensitive customers demanding high-quality smartphones at a lower price.

In many emerging markets, carriers did not sell smartphones directly to their consumers. Instead, the consumers chose the smartphone and carrier separately. Thus, consumers were sensitive to marketing and messaging strategy, and they did care about device components. By 2013, emerging-market customers were professing knowledge of specific chipset attributes such as number of cores, and Qualcomm was looking for a way to reach these message-sensitive consumers.

Social Media

The early and mid-2000s had witnessed widespread adoption of social media networks such as Facebook, LinkedIn, and Twitter. In addition to connecting billions of end users to one another, social media provided a platform for companies to directly communicate their brand messages and to reach out to a wider base of potential customers. Social media was increasingly seen as a way to make brands “real” and personal to consumers. By 2011, U.S. consumers and gadget enthusiasts had begun to compare smartphone specifications on public forums. People had started paying attention to what was in their mobile devices — they checked reviews on CNET and read articles from TechCrunch, Engadget, and various tech bloggers who had a great influence on tech consumers. There was reason to believe that these sources played a significant role in customers’ decisions when buying smartphones.

Communication from brands to the consumers was no longer a one-way street. Consumers and technology experts had begun voicing their opinions about companies and their products on social media channels. It had become important for brands to effectively communicate via social media outlets and interact with consumers. Although this trend was clear, it was unclear how a traditionally B2B brand like Qualcomm would negotiate a transition to B2C marketing.

 Qualcomm’s strength traditionally lay in its ability to innovate on the smartphone platform with cutting-edge chipsets. The company normally spent 20 percent of revenue on research and development; Qualcomm approached paid marketing with much more care and skepticism. It had highlighted markets that it wanted to focus on and then created awareness among users in those markets.
Snapdragon Inside: Moving Forward

Qualcomm recognized the importance of differentiating its products in the eyes of end consumers. The company had become convinced that everyday smartphone users could understand terms like processor, GPU, and 1080p HD as well as recognize the importance of these components.

Qualcomm perceived that consumers vaguely understood that complicated technologies made smartphones cooler and better. Now Qualcomm faced a decision: How could a technically minded company with a longstanding B2B marketing strategy appeal to the mass market in the U.S. and in emerging countries? How could Qualcomm be successful in communicating the value proposition of a technically complicated product that an end consumer could not see and feel?

Qualcomm had begun investing in consumer marketing strategies both in Western and emerging countries to create awareness among high-end and low-end smartphone users.

Also, in the mobile device industry, there were multiple operating system leaders — companies like Apple, Google, and Microsoft. OEMs such as Samsung, Motorola, HTC, Blackberry, and Nokia manufactured and assembled the complete smartphone. Chip manufacturers such as Qualcomm, Broadcom, and MediaTek made the chips. Considering the intricate supply chain, would another branding effort confuse consumers? These were the important questions that needed to be answered if “the dragon” was to continue its flight.

Saurabh Bajaj (Rady MBA, 2013) focuses on innovation, product management, and strategy for the high-tech industry. His goal is to build high-impact products and businesses that create great value and utility for consumers and industries alike.

Amit Rai (Rady MBA, 2013) has a background in IT and financial services. He concentrates on entrepreneurship and technology.

Endnotes
19. Ibid.
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I do not remember why I decided to jump out of a plane. But I had reserved a date, put down a sizeable — and nonrefundable — deposit, and, most significantly, bragged to everyone I knew that I was going to do it. There was no backing out, despite the fact that as the day neared I was growing increasingly doubtful.

Maybe this was not a good idea. Perhaps, rather than being daring, it was just being dumb.

To reassure myself, I took to the Internet. My Google search for “skydiving safe” returned a long list of sites. I clicked on the first, a blog hosted by a site selling skydiving gear, and scanned the article. The first lines held my answer: “You stand a better chance of dying in a car accident on the way to the dropzone than you do of dying from your jump. Skydiving is safer than driving a car.” I did not need to read any further.

Whew! Not dumb. Daring. The data backed me up, and you can’t argue with the data.

“You can’t argue with the data” is a familiar persuasion device, one most often deployed when we are trying to defend beliefs that we consciously or unconsciously want to be true. Beliefs like, “I’m a smart, competent person. My politics are sound, my religious beliefs valid, my decisions informed. I’m healthy and wise. My views about the world are correct.”

And skydiving is safer than driving a car.

It was only later that night at a gathering of friends (most of whom, like me, study decision biases) that my sound reasoning was called into question. “Safer comparing what?” asked one. “Miles driven to miles fallen? Number of car trips to number of jumps? Time in the sky versus time on the road?” “And how do you mean ‘safer?’” asked another. “You can walk away from most car accidents. No one walks away from a parachute that didn’t open.”

In the end, the group decided that the proper comparison was the survival rate of people who board an operational airplane and...
land in it versus the survival rate of those who board and then jump out of it. And also, that I was dumb.

In trying to convince myself of something I really wanted to be true — that everything was going to be okay — I illustrated the very processes of motivated reasoning that I had spent my graduate career researching. Motivated reasoning describes the differential way we evaluate data about propositions we wish to believe and propositions we wish to reject. Our own orientation toward the implied hypothesis is the “motivation” part. What we do with the data is the “reasoning” part.

A large amount of research including my own demonstrates that when we are thinking about a favorable proposition — that is, one that is flattering, or accords with our worldview, or supports some line of action we have already decided to take — we tend to ask the implicit question, “Can I believe this?” We look for data that support what we want to believe and stop as soon as we find some. We do not think all that carefully about it but tend to take it at face value.

We interpret ambiguous information as supporting our hypothesis. By applying a relatively low standard for acceptance, looking for supportive evidence, and thinking superficially about it, a person so motivated can almost always find some basis for believing. “Can I believe this?” Yes!

On the other hand, we turn into excellent critical thinkers when faced with a proposition we do not like — one that impugns some aspect of our identity or challenges a cherished worldview, for example. In this case, we implicitly ask not “Can I?” but “Must I believe this?” We want to see all the data, not just a subset or convenience sample. We think very carefully about it, always looking for the fatal flaws. By thoroughly considering all the information and thinking critically about it, people motivated to reject a proposition often do spot the inconsistencies, ambiguities, and statistical flaws inherent in any real-world body of evidence.

“Must I believe this?” No! It’s a neat trick. We look for evidence in both cases, so no one can accuse us (and we cannot suspect ourselves) of bias. Both “Can I?” and “Must I?” are perfectly reasonable decision criteria. They are, in fact, embedded in the American legal system, which requires us to prove criminal cases “beyond a reasonable doubt” (“Must I?”) but to show only a “preponderance of evidence,” usually defined as greater than 50 percent, in civil cases (“Can I?”). (This is how O.J. Simpson was innocent of murder in one trial but guilty in another, based on the same evidence.)

The bias isn’t in simply believing whatever we like at will. Rather, it’s the subtler process of unconsciously applying a lower standard of acceptance to things we want to believe and a higher standard to things we want to reject. The result is that we believe ourselves to be both unbiased and right. This extends to social and political views on topics as wide-ranging as climate change, fracking, economic policy, reproductive freedom, and whether there really is such a thing as the hot hand in basketball. Anywhere there is disagreement, people on both sides are citing data to support their views.

And because “you can’t argue with the data,” we all tend to believe that if people who disagree with us had access to the same information we have, surely they would come to the same conclusion that we have. Except, of course, they don’t — and they are thinking the same thing about us.

That’s certainly what was going on at our dinner party. I was trying to inform my colleagues of the data so that they could come to the same reasonable conclusion as I had. They thought I was crazy. They helpfully pointed out that I had loaded the dice from the beginning by searching for “skydiving safe” (as opposed to, for example, “skydiving fatal”); by failing to question the source of the information I cited, its validity, and the possible bias of its author; and by closing my computer as soon as I got the answer I wanted. I had to concede the point.

My story illustrates the motivated reasoning of an individual making a “go/no go” decision, the outcome of which affects nobody more so than the decider. But more complex and consequential judgments are equally susceptible to the forces of desire. Business and government leaders make decisions every day that potentially affect the lives and livelihoods of millions, and they frequently do so in the context of a preferred outcome.

Because it is an error to judge the quality of a decision process solely by the outcome of the decision, it can be difficult for an outsider to conclusively point to motivation as a factor in any particular situation. For example, imagine a person seeks a diagnostic medical test for a serious but rare condition. When the test comes back negative (that is, indicating an absence of disease), the patient accepts the result at face value and concludes she does not have the condition. Is this motivated reasoning? She decided to believe what she wanted to believe — that she is healthy — even though diagnostic tests are rarely if ever 100 percent accurate. In this case, though, even though the patient reached a favorable conclusion, there is no evidence that she ignored or manipulated data to get there. Rationality simply happened to align with desire.

In contrast, consider the Bush administration’s decision to invade Iraq in 2003, justified to the public on
the grounds that Saddam Hussein possessed weapons of mass destruction. When it was discovered that he did not, vocal critics of the war claimed that President George W. Bush had manufactured a reason to invade simply because he wanted to. (Theories about why he was thus motivated include avenging his father, benefiting politically, and giving free rein to hawkish tendencies.) The charge was that the administration concocted bold lies to sell to Americans.

Subsequent analysis reveals a perhaps less intentional, but no less pernicious, process of motivated reasoning. By their own report, key decision makers started with the question, “Can we make the case that WMDs exist?” and organized their decision strategies with the goal of answering yes. Among other things, those involved tended to accept at face value intelligence consistent with their theory and passed that on to the president’s inner circle. In contrast, they scrutinized intelligence that contradicted their beliefs, asking the CIA to justify its methods, questioning the reliability of the sources, and at times questioning the competence and political fealty of those delivering news they did not like. Data contradicting the presence of WMDs was less likely to be passed up the line.

This group was also prone to interpreting ambiguous information in a way that would support their beliefs. When independent inspectors repeatedly failed to find evidence of an Iraqi program to produce biological, chemical, and nuclear weapons, the administration concluded not that such programs probably didn’t exist, but rather that Hussein had become exceptionally clever at hiding them. They elevated unsubstantiated intelligence that Iraq was seeking Nigerian “yellowcake” to the level of undisputed fact, with Colin Powell reporting in 2002 to the House International Relations Committee that “With respect to the nuclear program, there is no doubt that the Iraqis are pursuing it.” When aerial photographs of Taji revealed a configuration of buildings consistent with an active chemical munitions site, the administration concluded that that was the only thing the site possibly could be, again presenting a suggestion as fact. (No weapons were subsequently found.)

In short, Bush’s political opponents accused him of manufacturing an excuse to invade — of willfully ignoring the facts. But a closer look turns up many clues that those in the Bush administration were looking very closely at the facts. They did so, however, with the goal of confirming their hunch that WMDs, their justification for war, existed. In this way, some in the group became convinced that not only were they right, but that they had also arrived at their conclusion after a thorough and unbiased accounting of evidence.

One misstep in this example, as in my own skydiving story, was the failure to engage a team of rivals early in the decision process. A potentially powerful way to counter the bias of motivated reasoning is to really listen to people who genuinely disagree with you, or at least who have no stake in your pet theory being true. They, just like my earth-bound colleagues, are most likely to expose real flaws in your reasoning that your “Can I?” approach may have led you to miss.

What you do with their insights is up to you. This summer, I’ll make my 100th skydiving jump. Assuming I don’t crash on the way to the dropzone.

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For a discussion of the Bush administration’s decision process regarding Iraq and WMDs, see Hersh, S.M. “The Stovepipe.” The New Yorker, October, 27 2003. (Online at http://www.newyorker.com/archive/2003/10/27/031027fa_fact)

For further reading on motivated reasoning:
For one weekend in November of 2012, Sony Electronics USA welcomed more than 40 MBA students to its San Diego headquarters for its annual Case Competition. Grouped in teams of four with strangers from other top MBA programs across the country, participants were given 24 hours to develop 15-minute business pitches in response to a real-world problem. Contestants signed non-disclosure agreements to assure the company that details of its strategic position would not be leaked.

Students had received the case a week in advance but spent most of the initial hours of the competition getting to know their teammates’ diverse working styles.

Sony was getting to know them, too. While the students worked, HR representatives dropped in to evaluate each participant’s creativity and efficiency. This was new. As recently as 2010, talent recruitment at the contest was more of an afterthought for Sony. But over the years, Sony recruiters began to recognize that the competition offered the chance to observe numerous qualities that couldn’t be gleaned from traditional interviews. Today, winners of the Sony contest not only get $5,000 but are also guaranteed final-round interviews for the company’s prestigious Rotation and Educational Development program, and Sony now views the MBA case competition as one of the most important recruiting tools in its arsenal.

The shift at Sony — away from a reliance on traditional interview techniques and toward an emphasis on creativity in the face of real business problems — is a response to an evolution in the way U.S. companies derive value from their employees. In 2010, IBM conducted a survey of 1,500 CEOs. The survey revealed that the most valuable management skill has shifted away from operational acumen to creativity. “Events, threats, and opportunities aren’t just coming at us faster with less predictability,” wrote IBM CEO Samuel Palmisano, “they are converging and influencing each other to create entirely unique situations that require unprecedented degrees of creativity.” In the May 2013 issue of the Harvard Business Review, Stanford professor and entrepreneur Steve Blank concurred, saying that nearly all large companies need to continually innovate to effectively combat increasing external threats. Historically, companies have focused on cost-cutting to increase profit, but that approach has a limit. The U.S. Congressional Research Office has reported that over time, U.S. companies have outsourced more and more service jobs to save on labor costs. Today, the importance of innovation as a revenue driver has deepened, prompting adaptations in hiring practices, incentives, and organizational structures.

Hiring Practices

As the need for creativity in business increases, traditional job interviews become more and more unsuitable. Professional career coach Robin McNatt said that while traditional interviews can provide a good starting point for screening purposes, the correlation between an impressive interviewee and successful employee is low (30 percent to 50 percent). Once the field is narrowed down to a few finalists, the interviewer must focus on a different process, one that determines motivation, culture fit, and potential for increased responsibility down the road. Interviews that center on split-second judgment and knowledge recall succeed in finding employees who make good first impressions with technical competence, but who can fail to realize a long-lasting fit. “There’s an opportunity to do it better,” said McNatt. The high-pressure situations of job interviews only highlight the exceedingly coveted prize for a single “winner.” Traditional economics — as well as our intuition — tells us that additional
Internal problems require people who can think beyond the restrictions of the conventional.

Incentives

Many companies choose to incentivize employees with a financial reward to increase their production. Ideally, management matches the incentive directly with the desired action or output, lest they risk rewarding unwanted behavior. Incentive strategies that correlate rewards to increased performance have been found to only be effective when the processes involve routine mechanized tasks. Such is the case of multinational manufacturer Lincoln Electric, which famously offers employees no base salary, but rather piecework compensation and bonuses depending on output. Because churning out arc welding equipment requires no strategic thinking, only brute effort, that type of incentive works well as a motivational technique at Lincoln Electric. But when the outcome requires even basic problem solving, a larger reward results in poorer performance. Extrinsic incentives tend to result in tunnel vision, thereby promoting efficiency at the expense of creativity, essentially creating a glass ceiling of improvements confined to the status quo. In today’s corporate landscape, where routine, step-by-step operations are outsourced to people and software that can do those things faster and cheaper, the remaining internal problems require people who can think beyond the restrictions of the conventional. Knowledge that a large reward looms may be enough to distract employees. Cognitive skills, like attention, contract under the pressure to secure a reward, undermining the very reason for using it.

Organizational Structure

Technological advances and shifts in the global economy have revolutionized organizational settings. Increased ease of business development through technology and outsourcing has mature industries slashing entire departments to help foster an environment of rapid growth. New challenges require new organizational structures and abilities. Enterprising companies create a culture that promotes collaboration and encourages employees to continuously learn from each other. Younger, more nimble companies place even greater emphasis on openness. Seventeen-year-old video game software company Valve feels so strongly that hierarchy stifles innovation that it has no management. Not even the president of the company has anyone who reports to him. “We want innovators, and that means maintaining an environment where they’ll flourish,” states the 2012 employee handbook.

Behavioral economics and organizational strategy demonstrate how creative thinking improves with a diverse group rather than with a group consisting only of top performers. San Diego software company Mitchell International's senior vice president of human resources, Jack Farnan, said he believes that diversity of thought stems from diversity of hire. According to Farnan, drawing on a large collection of cultures as well as equality in gender representation allows the company to have access to a wide array of problem solving techniques. Heterogeneity in thinking often produces different — and offsetting — estimations. Similar to diversifying a stock portfolio to vary exposure to different investment sectors, adding disparate points of view not only broadens the range of possible solutions, but also mitigates the risk of overcommitment to any one opinion. For collaborative jobs like product design, divergent experiences and opinions bring to light a fuller range of potential problems and solutions. Qualcomm’s Forward Looking User Experience Outreach program (FLUX) allows employees from various technological backgrounds to meet biweekly in an effort to discover novel solutions to new or existing problems. Already generating more than 60 actionable solutions since inception, the FLUX program bends the rules of the traditional work week by allowing employees to independently assemble and develop ideas that go beyond their daily job descriptions. The depth of detail inherent in viable solutions drives creativity and connects people with different areas of expertise.

Small changes in structure impact the breadth of creativity within an organization. The nominal group technique (NGT) is a problem solving process that helps better identify and prioritize decision alternatives. Contrasted with brainstorming, which encourages an unstructured flurry of ideas and is subject to informational influence, NGT demands that individuals create a list of alternatives on their own before discussing with the group. A more thorough voting system ensures that the top ideas are ranked according to quality and feasibility. The idea was first developed in 1971 by behavioral scientists Andre L. Delbecq and Andrew Van de Ven to create innovative solutions to strategic problems. Fully discussing each of the independently conceived ideas not only allows creativity to blossom in the solution set, but it also ensures the minority opinion is heard. Simply voting by majority rule silences the minority in favor of an influential few. “The evidence is absolutely overwhelming that using a nominal group technique produces more and better ideas than does brainstorming,” said Yuval Rottenstreich, professor of organizational strategy at UC San Diego’s Rady School of
Management. He compares the emerging importance of NGT with that of data analytics. “In both cases, there’s a modern tool that’s available that surely helps your firm, and the only thing keeping them from using it is themselves.”

Traditional notions of management work solely to produce compliance. To get engagement, companies are better off focusing on self-direction. A burgeoning approach provides employees with the tools they need not only to motivate themselves, but also to produce innovative thoughts. The first device is autonomy, which urges employees to direct their own effort. Research shows that people who have some control over their work feel more positively about it. Second, allowing employees to master a task or complete a project reinforces in them the desire for self-improvement and individual growth. The third technique is purpose: the yearning to participate in something that has meaningful real-world implications. Companies that customize this three-pronged approach to human resource management are positioning themselves for a future where creativity and innovation is the primary source of competitive advantage.

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Endnotes
8. Ibid.
9. Pink 2009. See also “Can the Promise of Reward Increase Creativity” (http://eisenberger.psych.udel.edu/files/12_Can_the_Promise_of_Reward_Increase_Creativity.pdf)
11. Ibid.
Amazing technological advances have reduced the constraints that our physical bodies and minds place on our performance. Medications can increase people’s ability to concentrate, to stay awake or get a good night’s sleep, or even make full use of the oxygen in their blood. Implants can make the blind see or the deaf hear again. Advanced prosthetic limbs mean that amputees can dance, climb mountains, or run marathons. These products can take forms beyond medication and treatment, as well. Software and hardware advances like Photoshop or even cell phones can help people be and do better, as can services and procedures like SAT prep courses or résumé polishing services.

Yet when Lance Armstrong admitted to using performance enhancing drugs to win the Tour de France, it was clear that he knew how harshly he would be judged for having done so, and he revealed that he had worked hard to justify his behavior to himself. He went so far as to look up the definition of cheating and decide it couldn’t apply to him, as he was just creating a “level playing field” instead of gaining an advantage over others. And while athletes are well-known users of enhancing products, sports are not the only domain in which people commonly seek a potentially unethical boost.

Some surveys have shown that over a third of college students at some schools have used Ritalin or Adderall off-label to concentrate for an exam or assignment. The narcolepsy medication Provigil is sometimes used by pilots and surgeons to increase wakefulness. Six million doses of Botox were administered in 2012. Although Armstrong’s excuses (and those of others in similar situations) may seem ludicrous to outsiders, they emphasize how important it is to examine and understand the tension between the good these products can do and the unfair advantages they can bestow, and the differences between how such products are perceived by their users and how they are perceived by observers of that use. Products that can enhance traits and abilities are becoming more common, more effective, and more readily available. Potential users of these products and those firms that develop, market, and sell them need to understand what the playing field now looks like.

One notable feature of this trend is that many, if not most, of these products were originally intended to help those at a disadvantage perform at normal levels, but now get used by healthy people seeking to build on their existing abilities. This adds an extra wrinkle to these products’ development and marketing, and has a strong influence on how their use is perceived. Both firms and consumers can play a part in making sure products that can increase performance help as many people as possible, with as few negative “side effects,” like moral discomfort, guilt or even accusations of cheating, as possible. Research has revealed three rules for firms to follow, to keep potential consumers open to their products, and one basic rule for the users themselves.

**Firm Rule #1: Be Natural.** One basic feature that predicts public perception is enhancing products’ artificial nature. People are often uncomfortable with ingesting things they perceive to be unnatural or synthetic. Modern preferences for organic and natural foods, and discomfort with genetically modified crops, typify this trend. Medications and other chemicals fall into this category as well, and the more unnatural an enhancing product seems, the less acceptable it seems. A pharmaceutical intervention administered via injection seems less ethical than one administered via a pill, for example. Even young children believe that amplifying traits via medication, rather than authentic effort, is cheating, and that people who do so are less talented than those who are naturally abled. The more closely firms can tie the positive effects of their products to traits the user already has or to effort the user needs to put forth, the more positively those products will likely be viewed. For example, observers may be more accepting of a person who loses weight via a drug that works in concert with diet and exercise than one that “magically” melts pounds away.

**Firm Rule #2: Be Selective.** The traits that get enhanced also matter — some traits are more appropriately enhanced than others. In particular, research has shown that the more fundamental to a person’s identity a trait is, the less okay people are with enhancing it. For instance, people are much more comfortable with the idea...
of taking a medication that might enhance their ability to memorize things than one that might improve their ability to empathize with or be kind to others. One thing that moderated these beliefs is how improvement due to these medications is described. People were more accepting of medications that improve fundamental traits when they were advertised with a tagline like “Become Who You Are.” Such taglines described the medications as revealing the user’s hidden ability levels or enabling a person’s true traits to show. In contrast, taglines like “Become More Than Who You Are,” suggest that medications allow users to show ability levels they wouldn’t otherwise have.

Firm Rule #3: Be Accessible. Finally, the playing field does matter. People are sensitive to the effects the use of such products might have on others, and they are less approving of enhancements when they help some people get ahead, especially at the expense of other people. Feelings of both competitive fairness and distributive fairness have an influence. Most of the objection to college students using nonprescribed ADHD medications (beyond health and legal concerns) is that those users might receive better grades than other students who had worked just as hard (or harder) to succeed. The idea of someone else having their path smoothed while one’s own is not is frustrating. This is especially true when that other person’s path is smoothed because they have more money or privilege. Unequal access is likely to make someone’s use of an enhancing product seem especially unfair.

Consumer Rule #1: Be Careful. But if all of this is true, and people are uncomfortable with products that enhance traits and abilities, how do people convince or allow themselves to use these products? The taglines above give some clue. Research I have been conducting with a colleague, Mary Steffel of the University of Cincinnati, suggests that people believe that enhancing products have different effects on themselves than they do on others. People have access to their own beliefs and intentions about how well they could potentially perform, and end up treating that potential as if it already reflects reality: they don’t give other people the same credit for potential. Thus, when they consider using products that can help improve performance, they believe that those products will help them reveal a performance level they know they could reach but haven’t yet. But without the same confidence that other people have yet-to-be-revealed potential, those exact same products seem to add traits and abilities that don’t belong to others. This view that enhancing products enable one’s own true traits to show, but embellish others’ abilities, means that people believe that their own use is more acceptable than others’.

Further, this double standard leads people to think that they should be less obligated to disclose their use of enhancing products than others are — in business, education, or even dating contexts. Issues of disclosure become more important as enhancing products become more common and their ethical and legal ramifications become clear. For example, does a sports team have the right to require that its athlete admit any use of PEDs before signing a contract? Should hospitals (or patients) request that their doctors disclose whether they use self-prescribed focus-enhancing medications during procedures, or at any point in the hiring process? This research suggests that the answer to questions like these is likely to differ depending on whether one is asking for or making the disclosure. The double standard also changes how strictly people believe these kinds of products should be regulated depending on whether they are thinking of themselves or others. When people focus on themselves using a medication, they believe that medications should be more widely available than when they focus on a group (even one that they are a part of) using the same products to the same ends. Future research will continue to determine what else causes and alleviates these double standards, and what other features can make these products more or less acceptable to users and observers.

What does this mean so far for the biotech and other firms that produce enhancing products and services, and for people who wish to take advantage of them? It is important to note that people aren’t uniformly against the use of enhancements. Advice to producers and marketers to increase their appeal might include: to consider ways to make them seem more natural in form and function or to tie their effects to inherent features of their users (like effort and existing traits); to think carefully about which traits products enhance; to find ways to make sure their products are available to as many people as possible; and to minimize any negative effects the use of their products might have on others. In addition, our research and that of others shows that people do recognize the difference between products and users trying to gain an advantage and those who may need encouragement to overcome a deficit. Advice to potential users is simpler: remember that you may not have the same view of your behavior as others do, and what you consider to be a disadvantage may not appear to be one to others. After all, the playing field now looks very different to Lance Armstrong than it does to his disappointed fans. Thoughtful development, marketing, and use of enhancing products can help these new wonders of technology be as useful, helpful, and remarkable as they truly can be.

Elanor Williams is a postdoctoral scholar at the Rady School of Management. She studies consumer decision making, including topics like how people use others to help them make choices and why people repeat mistakes.

Endnotes
5. Ibid.
Emergency Preparedness
With Micro-gaming

Small businesses can prevent a disaster-induced failure through simple, cost-effective simulations

by Sara Jones

Any newcomer to San Diego soon learns that it is a small-business and startup town. About 94 percent of the 97,000 businesses in San Diego are small businesses. On average, these small businesses have between three and 10 employees. They span industries as diverse as retail, finance, and manufacturing. As different as they are, all of them face a common threat that manifests swiftly and unexpectedly: a natural or manmade disaster. According to the Insurance Information Institute, 15 to 40 percent of businesses fail following a natural or manmade disaster. And the cost to the surrounding community is dear.

On Sept. 8, 2011, a power blackout affected an estimated 2 million people in Arizona and Southern California and cost the impacted area (Southern California, Arizona, and Mexico) about $20 million in government overtime. At least one business had a disaster-preparedness plan in place, though. When the power failed, Giuseppe Gutierrez and his team at Albertsons Del Mar implemented standard company-wide protocol for power outages. Their backup generator kicked on in seconds, doors stayed open, pallets of ice and water were moved to the front of the store for easy access, and staff members were posted at the doors to direct people where they needed to go to get what they needed. While the gas stations, convenience stores, drug stores and other grocery stores in the immediate area had quiet cash registers, Albertsons Del Mar was open for business during its normal hours for the duration of the blackout. The supermarket had what Gutierrez considered “a 366th day of sales” and saw a 30 percent spike in customer count that day — clearly the result of effective preparation by a large business.

But small businesses are not without their own creative solutions. Just as they are forced to be nimble and imaginative in the areas of finance and marketing, small businesses can also exercise those qualities in the area of disaster planning. In particular, they can model their disaster-planning process after a broader planning technique called micro-gaming. Micro-games are mini hypothetical crisis-management sessions intended to boost team dynamics and communications. Phillip Van Saun, the director of UC San Diego’s Continuity and Emergency Services, is an evangelist for this technique and believes decision-making in a crisis must be fast and frugal. “You can’t always predict or prevent disasters, but you own the space of preparedness,” he said.

Van Saun, a former member of the Marine Corps Presidential Helicopter Squadron, also believes that the choice not to prepare is a choice of willful blindness. Indeed, he titled his primer on crisis management “Failure Is an Option.” In this book and in his presentations, Van Saun outlines six steps for a micro-game: 1) Present the basic details of the risk to be addressed; 2) brainstorm possible solutions; 3) discuss challenges to a resolution; 4) determine possible moves given the realities of your culture; 5) select moves to respond to the problem; and 6) implement steps to mitigate the identified risks. In order to carry out the micro-game, Van Saun recommends that managers gather their staff on a regular basis for small increments of time to work through the six steps. At first, a facilitator guides the group to identify and adjust for bias in the decision cycle, demonstrates how to ask good questions, engages the team in fast and frugal decision-making, and closes with an analysis of what went well and what needs to improve. Once the group gets regular practice and builds these habits of mind, the role of the facilitator diminishes, empowering employees and team members to take the initiative themselves.

For startups and small businesses whose coffers are already tight, micro-gaming can be cost-effective when compared with the cost of formal training workshops. For example, if a startup with seven employees, each with an hourly rate of $30, met for 30 minutes over a company-hosted lunch (est. $30) twice a month to micro-
game any number of possible topics, the cost of micro-gaming would be only $3,240 per year. Of course, these meetings could induce follow-on policy development or action items that might incur incremental improvement costs, but the intention is to save time, effort and money when what Van Saun calls “predictable surprises” such as fires and earthquakes actually do occur.

Partnering with two professors, Van Saun is bringing micro-gaming into the curriculum in two academic departments at UC San Diego, where it is seen as a way to develop the psychological capacity to respond to chaos and uncertainty. In her urban studies and planning course, Mirle Bussell, Ph.D. uses the technique to encourage students to anticipate where things might go wrong and respond to those challenges in a group setting. In the planning industry, there is a rational, linear planning model; micro-gaming introduces a non-linear, more realistic decision-making model. Bussel believes these skills are critical not just for urban planners, but for all planners. She also sees these skills as valuable for everyday decision-making, not just crisis or event-based decision-making.

Michael Kalichman, the director of UC San Diego’s Research Ethics Program, also uses micro-gaming as the backbone of his class called Ethics and Survival Skills in Academia. He aims to teach students to work with each other to anticipate trouble spots in research and lab testing before they happen and gain an advantage against the unexpected. Kalichman believes that proactive conversation about what can go wrong helps the individuals and the group to see the complexity of risk. It allows them to be better prepared to minimize the occurrence of academic misconduct and therefore failure. Through these micro-games, his students come to learn that there are many right answers.

According to Van Saun, this heightened state of preparedness and risk management can be incrementally developed when micro-games are implemented over time and as the challenges presented become more complex. Kalichman said, “So many benefits come from talking with each other about these things. [Students] see that micro-gaming is a small investment for a great return.” The planning technique can be coupled with existing tools that prepare small businesses for disasters, such as the American Red Cross Readiness Rating and the PSPrepTM program, sponsored by FEMA. Additionally, the Small Business Administration and the American Institute of Certified Public Accountants offer general guidelines for small business emergency preparedness.

As the victims of San Diego’s recent disasters know, wildfires, earthquakes, water main breaks, and even power outages have a way of revealing the value of preparedness. Many victims fall into the trap of denial, convincing themselves that disasters will never happen to them or that it won’t be that bad. Those who champion micro-gaming know that change cannot be forced; individuals and teams have to want it for themselves. Peter Danielson, an assistant professor in UC San Diego’s Global Public Health department, and Daniel Jacobsen, a Ph.D. candidate in UC San Diego’s Bioengineering department, are both students in Kalichman’s course. They say that the use of past experience as topics for micro-gaming is valuable to develop that respect for the power of disasters to change lives. Van Saun cautions, however, that the skills developed in micro-gaming are perishable. Jacobsen concurs that “they must be worked frequently and on a continual basis; otherwise they atrophy.”

Van Saun believes that through the regular practice of micro-gaming, small businesses can find better ways to manage risk and be prepared for natural and even man-made disasters. As more San Diego small businesses engage in this practice, the whole community builds resilience across the entire spectrum of risk.

Sara Jones (Rady MBA, 2013) is an active volunteer with the U.S.C.G. Auxiliary. Her interest in business continuity and preparedness comes from her volunteer and paid experiences with the American Red Cross, including the 2003 and 2007 San Diego wildfires and the 2004 and 2005 hurricane seasons, as well as her role as an analyst in support of the Department of Homeland Security.

Endnotes

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