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IntelliSense: The Lifecycle of a High-Tech Startup

In early 2005, Sandeep Akkaraju, the CEO of IntelliSense, was assessing the first year's performance following IntelliSense's spinout from Corning. The pioneering MEMS design software company faced formidable challenges as the industry evolved and competition increased. IntelliSense already had been through the lifecycle of a high-tech start-up: growing into a profitable independent company, being acquired by a strategic partner only to be shut down by the parent company, prompting Akkaraju's team to step in and reacquire pieces of IntelliSense. For Akkaraju, the major hurdles before him were to guide the phoenix-like resurrection of a prior industry leader by executing an appropriate business plan, which would require securing and maintaining adequate capital and other resources.

IntelliSense had survived three distinct phases: startup, acquisition, and spinout. In 1991, Fariborz Maseeh, Sc.D., founded IntelliSense as a company that could produce total solutions for the nascent MEMS marketplace. During the first phase of the company's life, when Maseeh was the guiding force, investment capital was raised from Maseeh's own funds and grants from the U.S. government in the form of SBIR and DARPA contracts. The company became a significant supplier of MEMS design tools, engineering services and manufacturing. By 2000, IntelliSense had attracted the attention of Corning, the world's largest fiber-optic provider. Corning bought IntelliSense for $750 million in Corning stock. By 2003, the dot-com implosion coupled with declining telecommunications revenues led Corning to shut down the majority of its IntelliSense holdings.

Akkaraju, a design and process engineer who managed one of the Hardware Business Units in the original IntelliSense company, had left after the Corning acquisition to pursue a dream to travel. After his extensive travels, he worked on his MBA at INSEAD in France. He had returned to United States just as the opportunity to reacquire IntelliSense was presenting itself.

Since 1991, the market for MEMS and the way of operating a MEMS design business had evolved considerably. The old way of doing business—such as producing software and controlling the source code, as well as owning a fabrication facility (fab) so that customers could be offered an "end-to-end" MEMS solution—had its virtues, but more recent industry developments called into question the logic of a "total solution approach."

This teaching note was prepared by Teri Sprackland under the supervision of Professor Melissa M. Appleyard of Portland State University and Professor Mary Tripsas of the Harvard Business School. The case was written as a basis for class discussion rather than to illustrate effective or ineffective handling of an administrative situation.

Akkaraju had to formulate the business model for a contemporary design house that could retain its standing as a software designer while also competing with the other vendors who had entered and still remained in the market since 1991. To finance the new IntelliSense, the options included attracting venture capital—an option avoided throughout the company's history, forming strategic alliances with other vendors, seeking grants and corporate direct investments, or a combination of these choices. Akkaraju and his team also had to decide if IntelliSense should do business as it had in the past, by operating its own fab and providing end-to-end service, or outsource parts of the production. Could a company with a history of longevity find the capital to remain competitive? What business model would bring IntelliSense back from its hiatus?

The MEMS Industry since 1991

MEMS, Micro-Electro-Mechanical-Systems, are miniature machines that can perform many mechanical tasks on tiny scales with great efficiency. MEMS are constructed from silicon and glass wafers and are measured in millionths of a meter. MEMS have been applied to a range of fields, spanning medicine, computers and hardware, telecommunications, automobile mechanics, and oil exploration. An early MEMS device regulated ink outflow for inkjet printers, ensuring crisp and detailed image production. In 2001, it was estimated by the MEMS Industry Group that each American household averaged 1.6 MEMS devices per person. They also predicted the number would jump to 5 per person by 2004.[1] By 2005, medical MEMS monitored blood pressure and blood oxygen levels, with data read from hand-held devices used by doctors. Another category of MEMS, MOEMS (micro-optical MEMS), functioned as tiny cameras and were used in producing images for high-definition television. Table 1 below lists the myriad applications of MEMS devices.

Their small size made MEMS more energy efficient and faster than larger machines. Companies that designed better or new types of MEMS, or explored new applications, had an expanding market ahead of them. According to InStat.com, revenues for MEMS in consumer electronics were forecasted to grow at a 13.2 percent compound annual growth rate between 2003 and 2008, while the MEMS Industry Group predicted a 45 percent growth rate between 2002 and 2004.[2]

[1]Source: Report released 21 January 2002 at MEMS 2002, the 15th annual IEEE International Conference on Microelectromechanical Systems, in Las Vegas.
[2] *Ibid*.

Table 1. MEMS Applications[3]

Defense	Medical	Electronics	Communications	Automotive
Munitions Guidance	Blood Pressure Sensor	Disk drive heads	Optical or Photonic Switches and cross-connects in Broadband networks	Internal Navigation sensors
Surveillance	Muscle stimulators & drug delivery systems	Inkjet Printer heads	RF Relays, Switches, and Filters	Air conditioning compressor sensor
Arming Systems	Implanted Pressure sensors	Projection Screen Televisions	Projection displays in portable communications devices and instrumentation	Brake force sensors & Suspension control accelerometers
Embedded Sensors	Prosthetics	Earthquake Sensors	Voltage controlled oscillators (VCOs)	Fuel level and vapor pressure sensors
Data Storage	Miniature analytical instruments	Avionics Pressure sensors	Splitters and couplers	Airbag sensors
Aircraft Control	Pacemakers	Mass Data Storage Systems	Tunable lasers	"Intelligent" Tires

IntelliSense Enters the MEMS Marketplace

In 1991, when Dr. Maseeh founded IntelliSense, he wanted to create a company that could provide software with the design capability for making custom MEMS devices. After earning a B.S. in Structural Engineering and an M.S. in Mathematics from Portland State University, Maseeh pursued a doctorate of science at MIT. The concept for IntelliSense derived from Maseeh's doctoral work at MIT. The emphasis was on providing software that combined computer aided design (CAD) with MEMS applications to meet the needs of the expanding electronics industries. He began by consulting on MEMS projects, and then applied for and won a Phase I Small Business Innovation Research (SBIR) grant from the Office of Naval Research in September 1993. The funds allowed IntelliSense to hire software engineers and acquire a modest infrastructure for the company near MIT.

[3] Source: MEMSCAP Website at www.memscap.com.

The first software package was completed in 1993 named MEMaterial, which was the first material analysis software for MEMS. By 1994, Maseeh secured a Phase II SBIR grant that allowed IntelliSense to develop its core software. Called IntelliCAD, it featured a CAD environment with a database of thin-film materials that had been compiled by Maseeh himself. In 1995, IntelliCAD was released. It was the world's first CAD for MEMS aimed at reducing product development iteration. This product was later renamed IntelliSuite due to a conflict with another company over the name, which resulted in IntelliSense winning a much needed cash settlement.

IntelliSuite was the first commercial software available to MEMS designers. The tool collected information on micro-technology thin film material generated by research institutions around the world. These data were processed by IntelliSense's novel multi-variant estimation routines and transported to a general-purpose program that built and graphically displayed the device geometry. Combining material and geometry information with IntelliSense's process simulation tools and multi-physics analysis code, designers of every discipline were able to create new MEMS structures and enable new products. These capabilities became standard and necessary components of the micro-technology design processes, enabling hundreds of products across 17 countries.

The new software allowed MEMS designers to simulate the design, manufacture, and operations of a MEMS device by combining the software CAD design tool and the performance characteristics database. By allowing customers to engage in virtual testing, millions of dollars could be saved in conventional development costs. As the first such commercially available software, IntelliSense quickly established itself as the leader in the market.

"In the early 1990s, MEMS was like MTV for scientists; hip, cool, micro, gears the size of ants," recalled Akkaraju.

MEMS designers responded favorably to IntelliSuite, because devices that had taken as much as a decade to develop could now be produced in a fraction of that time. IntelliSense posted triple-digit growth over the following several years.

Capital Considerations

But living largely on government and contract funding limited the company and what it could develop. Maseeh had decided that IntelliSense would not apply for further SBIR grants. Why turn down money from the government unencumbered by the oversight of venture capitalists? "Because you become consultants at that point [with] no scalability," Maseeh said. "I told my team from now on, it's another big risk. We no longer would write another SBIR, but live or die through commercial contracts. That is when the company started waking up."

In 1996, software competition arose in the form of Microcosm Technologies, Inc., another MIT spin-off and a company with $20 million in venture-backed assets, far more than IntelliSense had. In 2001, the company changed its name from Microcosm to Coventor, Inc. As Coventor, the company was collaborating with customers on design of MEMS in the biotechnology, optical, and radio frequency fields.[4] The European-based MEMSCAP entered the market in 1997, and became the other major player in MEMS design and manufacture. How could IntelliSense compete? Maseeh had already decided on making sales the driving force for IntelliSense. He then needed to ensure that the products his staff sold could still attract significant market share.

Build, Not Outsource

A major decision point for the young company was to extend from a software and engineering services business into hardware production. At this point Maseeh saw an opportunity to further strengthen the company's position: he had an on-site fabrication facility constructed.

Complementing the advances in micro-technology software infrastructure, IntelliSense's state-of-the-art MEMS fabrication facility provided rapid introduction of application-specific micro-components. The company built new MEMS components, leveraging its technology expertise and software advances. These products ultimately included DNA analysis chips, sensors to increase the safety of air transportation, components to speed the transmission of fiber optic communication, and new systems for drug delivery.

Maseeh pursued an organic growth strategy where capital came from his personal assets, revenues from IntelliSuite sales, and customer financed contracts. By 1998, the company outgrew its 20,000 square-foot facility. In 1999, with the addition of a 55,000 square-foot facility filled with a state-of-the-art clean room and equipment, IntelliSense was able to offer prototype devices and production volumes to its clients. Manufacturing engineers were added to the payroll, and they helped guide the company based on clients' feedback. IntelliSense became ISO certified soon after.

Maseeh "ramped up sales people," as he put it, and sales and profitability soared.

James Marchetti, former director of software business development for Corning IntelliSense, recalled that Dr. Maseeh frequently told his management team: "Sales put food on the table." IntelliSense had become the only end-to-end MEMS service provider in the industry, designing and manufacturing both four and six inch wafers, and developed strong market position.

[4] Source: Coventor, Inc. website at www.coventor.com.

Choosing the Ideal Customers

However, was IntelliSense empowering its future competition by selling its software to customers that could become competitors? Again, Marchetti recalled that hardheaded revenue considerations were a big part of the decision, “In the end, revenue was the key consideration for the software group; in reality, other companies would not become competitive with our fab operations just by using our software—a successfully manufactured device required much more than a good design. Plus customers could just as easily buy a competing software tool, so if they were going to buy software, [we wanted them to] buy our products.”

Research and development interests fueled a lot of the customer demand, according to Andrew Swiecki, also an MIT graduate and former VP of sales and marketing at the original IntelliSense. “IntelliSense targeted companies that needed additional MEMS development and manufacturing capabilities,” Swiecki noted. “IntelliSense provided a MEMS product development option for companies interested in quickly bringing new products to market.”

The potential customers were quickly evaluated in terms of the size of the company, what their research and development budget was—since that was where IntelliSense made its money early on—and their possibility of getting to the manufacturing stage where IntelliSense could again earn a revenue stream if their fab was used. Size of the potential customer target was not the only issue, Swiecki noted: “There is value in a small customer that does not exist in a big prospect.”

IntelliSense was also willing to develop a new capability if a customer needed it, seeing it as an opportunity to expand its offering on a guaranteed sale.

“IntelliSense understood the MEMS technology space and tried to help customers apply MEMS technology to their products,” said Swiecki.

By positioning IntelliSense as the “total MEMS solution,” Swiecki said the company had an advantage. “IntelliSense had the infrastructure to develop the concepts, evaluate those concepts through prototypes, and take the prototypes into manufacturing—a rare combination at the time.”

Swiecki emphasized that the right customer was important: “IntelliSense was looking at markets where the volumes were smaller but the value of MEMS was higher. This pushed us toward telecom, medical and life sciences, and away from automotive and consumer products. ”

When IntelliSense was young, pricing of the product was a concern, not because it was too expensive, but because Coventor charged so much more. “Their software cost was

substantial," explained Marchetti. "They had to license some very expensive tools and resell them. Our tool was $20,000 for a one-year license; theirs was $80,000-$90,000 for a one-year license. As a customer you could think 'the competitor is very overpriced' or 'what the competitor is providing is so much better.' The latter is the marketing message Coventor focused on during head-to-head competition. To counter this impression, IntelliSense used side-by-side comparisons of products, and raised the price of a new release by 25 percent."

Corning Acquires IntelliSense

In 2000, IntelliSense's customer and strategic partner, Corning, decided that the MEMS company would make a good addition to its business portfolio. A number of IntelliSense's hardware competitors, such as Xros, MCNC and others, had been sold for substantial valuations to firms like Nortel and JDS Uniphase. Further, Coventor and MEMSCAP, IntelliSense's primary software competitors, had both received funding. Corning saw the market as viable and potentially lucrative. IntelliSense was a leader and a pioneer in the field. Unlike the competition, IntelliSense was independent, owned all its assets free and clear—including its manufacturing infrastructure and almost all of its own software code—making its profit margin higher than that of the competitors, according to Marchetti.

The growth of venture capital funding for MEMS-based companies indicated that MEMS technology could be applied to a variety of products, Swiecki noted.

Additionally, Maseeh preferred to sell the company rather than go public because he felt the initial capital infusion from an IPO would be high but would die down later. He sold IntelliSense for $750 million in Corning stock and became a VP at Corning, running other Corning business units as well as IntelliSense.

The classic choice of an IPO versus an acquisition was never easy, but for Maseeh, the risks of an IPO were too great. He was shortly proven right when by 2002 the telecom industry suffered a serious collapse. Corning revenue dropped from roughly $6 billion in 2001 to $3 billion in 2002. In addition, the advent of competing companies reduced market share for IntelliSense. By September 2003, Corning decided it could no longer accommodate IntelliSense as an independent business, and plans were made to close the division and lay off its remaining employees. In the software business, Coventor stepped in and tried to offer IntelliSuite customers a transition package that would bring them to Coventor products, which provided customers with an exit strategy.

Reviving the Phoenix: Questions for Survival in the New MEMS Marketplace

In December 2003, Sandeep Akkaraju had decided to acquire a portion of the IntelliSense assets from Corning. In terms of his educational background, he had earned an M.S. from

Louisiana State University and had been an engineer for the original company before it was acquired by Corning. After the Corning acquisition, he fulfilled a long-held dream by spending a year traveling the route of 14th century Moroccan traveler Ibn Battuta. Following his travels, he pursued an MBA at INSEAD.

Akkaraju returned to the United States with an eye to becoming an angel investor, but the decision by Corning to close down his former company gave him the opportunity to step in and make a significant investment beyond the angel role he had earlier considered. When he learned of Corning's plans to close IntelliSense, he felt he could bring the company back to a strong market position.

The company's name certainly had market recognition as a pioneer from the previous decade, when it had forged ahead of the pack in providing MEMS software design and manufacturing. Akkaraju decided to stop his MBA studies and instead move directly into the fray as the CEO of the spinout. IntelliSense had a legacy of success, but times and markets had changed in the intervening years, and Akkaraju had several important decisions to consider. Could Akkaraju's phoenix rise again and maintain market position? There were several major decisions that had to be made.

First, should the new IntelliSense maintain its manufacturing facility? Having its own fab had been a big advantage in the early days of MEMS development, but the costs associated with maintaining and upgrading a fab were very high. The earliest business plan as laid out by Maseeh involved an aggressive organic growth model: build the company and revenues by selling a good product. In order to make the product as profitable as possible—and that meant it had to be useful and attractive to potential customers—Maseeh's IntelliSense built and owned its own manufacturing facility and thereby offered customers a product that was almost completely built in-house—the "end-to-end" solution.

By reducing the number of outside vendors, IntelliSense could keep costs to the customer down. In 2002, IntelliSense had outsourced only one major segment of software, produced by ABAQUS.

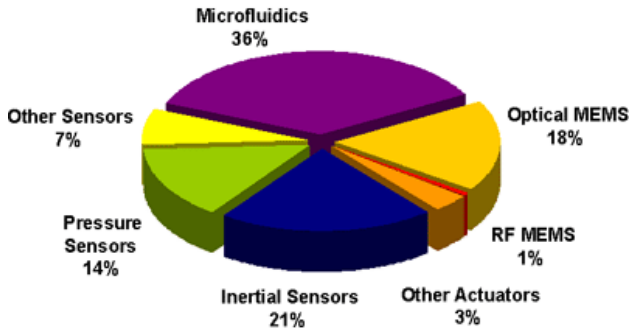
By 2004, however, there were other manufacturing facilities. They more than met demand for various products and had the capacity to take on additional production for design companies.[5] Similar to trends noticed by Akkaraju in the semiconductor industry, the availability and low cost of outsourcing to this excess foundry capacity meant that IntelliSense might not want to reacquire its own fabrication capabilities. So if IntelliSense were going to outsource manufacture and packaging, how would the new company gain access to fab space and other important support? Competitor Coventor had formed alliances with its customers to handle its fabrication needs, while MEMSCAP had its own manufacturing facilities. What model could IntelliSense reasonably access and afford?

[5] World MEMS Fab Report, by Yole Développement at www.yole-dev.com.

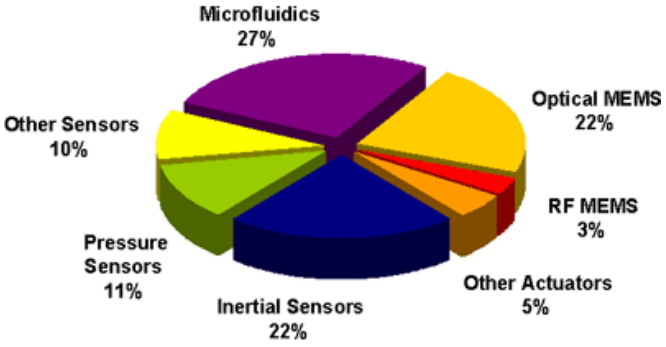
Second, when Maseeh started IntelliSense in 1991, there was very little competition in the MEMS design marketplace. The concept was new, the technology to build MEMS embryonic, and industry perception of the value of the devices minimal. By 1995, when IntelliSuite debuted, those conditions had changed. MEMS went from being devices for a small variety of specialized uses to being incorporated in a vast array of objects, including cell phones, televisions, computers, automobiles, air quality sensors, hospital equipment, and others. The following diagram reflects the anticipated evolution of the market.

Share of MEMS Revenues by Device, 2002 vs. 2007[6]

2002



2007



[6] Source: In-Stat/MDR, 7/03.

After Corning acquired the company, IntelliSense's executives had to decide whether to focus exclusively on projects for the optical markets, or diversify into the wider realm of MEMS applications.

"At that time, we were in discussion about whether we should pursue other opportunities—would they be a distraction or important for diversification," Marchetti recalled. By that time, Maseeh had left IntelliSense but attended that meeting via a conference call. "[Maseeh] did not make the decision but provided the guidance to the team 'you guys want to make sure you will still be around in the future,'" Marchetti said. There was keen discussion with strong proponents on the all-optical side, but in the end the decision was made to keep all revenue streams open.

A question for Akkaraju's IntelliSense was whether to hold with the diversified market or restrict the company to a narrower and more specialized market. Was it feasible to try to produce something for everyone?

Third, because Maseeh in the past had rejected the idea of running a company that depended on government grants and restrictive consulting contracts, IntelliSense had to focus on its customers. The sales force often talked with clients and learned about their needs and wants in design products. "The biggest thing at IntelliSense, not taught in business school, is the need to sell, to follow the customer," said Swiecki. He continued, "The purpose of a good business isn't to get money from investors, the purpose is to get money from customers." This customer and sales-based model helped make the company strong in its founding years.

How, then, would the proposed solution to its fab needs allow growth and needed modification as markets continued to evolve? Cash would be needed to grow the company. Was it finally time to line up a corporate investor or venture capitalist, or would it be wiser to stick with the growth-through-sales model of organic growth that had brought success to the company in its first iteration?

Finally, could IntelliSense with its flagship IntelliSuite product survive and retain brand recognition and market share in this third corporate iteration? Now that MEMS design firms could outsource manufacturing, how would IntelliSense's prices stay competitive with the competition?

Lessons existed from other electronics giants with name recognition. In the semiconductor industry for example, Fairchild and Zilog survived and prospered in new forms. Fairchild Semiconductor had been one of the pioneering companies in the chip business, until its brilliant team of founders had all left to start other companies such as Intel, Advanced Micro Devices (AMD) and National Semiconductor. The latter, under founder Charlie Sporck, had brought Fairchild into its own fold when the ailing progenitor was about to be sold to a Japanese competitor. Later, however, Fairchild's executives performed a leveraged buyout and taken the company back into the world on

its own. Zilog, another pioneering semiconductor company, had followed a similar path during its years as a subsidiary of energy giant Exxon before its executives had managed a similar feat. How could IntelliSense capitalize on its reputation as a pioneer and stay viable? Were either of these paths in store for IntelliSense?

The Third Chapter

IntelliSense had assets from which to stage a third reinvention, but were they enough? CEO Akkaraju and other leaders in the new IntelliSense came from the original company and were instrumental in designing both the core product and the business model that led to prior success. The company's design product was good enough to capture the majority of the market through the 1990s, so customer recognition of the name and quality of IntelliSuite set the bar for the industry.

As of early 2005, the IntelliSuite tools produced by IntelliSense were the industry standard used by corporations and universities in over 20 countries, representing about 50 percent of the MEMS design market worldwide.[7] According to Akkaraju, IntelliSense held "more than 60-75% of Asian markets, and about 40-50% of the US market by our own estimates." Could the new IntelliSense expand via its historic organic growth model, relying on growth capital from sales, or would it have to adopt new approaches to fund growth?

IntelliSense also continued to recruit the best possible candidates as employees, with a majority of staff holding Ph.D.s, MBAs, or both. The company owned virtually all of its intellectual property, so had negligible, if any, licensing fees to pay to third party vendors.

Looking to future growth, one issue was still the small size of the target market. According to Akkaraju, MEMS-related software remained in a niche market. "The market size is not very broad today. MEMS are still in an early phase. Each design/prototyping iteration is in the million-dollar range. It typically takes a few design cycles to get an end product. If we've shaved off even a single cycle, the software has paid for itself. The software is priced accordingly," he said

[7] Source: IntelliSense website at www.intellisense.com.