



Stanford eCorner

A True Model for Embracing Change [Entire Talk]

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Hemant Shah, co-founder and CEO of RMS, takes students on a ride through the highs and lows of growing and changing a company. From early days in an apartment with co-founders, to making the tough calls as a market leader in risk and catastrophe modeling, Shah discusses lessons around culture, business models, and pivoting a value proposition.



Transcript

Thank you, Heidi. I am definitely a Stanford brat. When I finally got married in 1998 and Danielle and I decided to move to San Francisco, my mother was in tears. She is like oh my God, you're leaving us. Like you're moving all the way to San Francisco. I'm like mom I'm finally leaving the zip code for the first time in my life. I would also like to just acknowledge right from the get go my father Professor Hareesh Shah, who got his graduate degree and his doctorate here at Stanford and then came back to teach as a young professor, which is why I grew up on the Stanford campus and my father's life work as a pioneering researcher in the field of earthquake risk assessment was not only the inspiration for this business, but was a catalyst. Without his support, RMS never would have been born, let alone thrived over the years. Now as a catastrophe modeler, I had to check out this building before agreeing to come and give a presentation. So we ran this building through our model and we looked it up in our database and it is something we call a Class 3 construction, which is quite good.

Recent construction, 125,000 square feet, four storeys in height, I hope we've got that right in our database. We then looked at its local hazard environment properties. It's on soft rock to stiff soil, that's pretty good. A low potential for liquefaction which is soil failure due to the water content in the soil and very low landslide potential. We are on pretty firm flat and we're unfortunately about 4.3 miles from the San Andreas Fault. Now when we crank this through our stochastic models, we are estimating that there is a 90% - there is 90% chance over the next 50 years that the damage to this building does not exceed 14%. Now I know that would be cold comfort if an earthquake strikes during this presentation but this is a pretty well built, well situated property and according to the RMS models, you're in good shape and we should be fine. So on this photo, it was taken back in 1989 of Weimin Dong, my co-founder, who was an Associate Professor at Stanford and myself. We look much younger and better 24, 25 years ago and that's a copy of what we called Iris version one which we shipped on a 5.25-inch floppy diskette. As part of I guess being a faculty brat we worked on the business plan here at Stanford.

The whole thing was a bit of an accident because I took a class, I was an engineering student doing my Masters work in the - what was then called the Engineering Management Program. And the Business School I think in a nod to multiculturalism set up a program that I think they called entrepreneurship in high-technology and the GSB welcomed a few of us, a few of us scruffy engineering grad students into their class to kind of foster some cross-functional collaboration and some innovation. In order to pass the damn class, we had to write a business plan for a high-technology start-up. So I and a few of my friends to pass the class developed the business plan for what became Risk Management Software at the time, now Risk Management Solutions and it was a very productive use of school time and various professors during that Master's year were very kind in giving me time to continue to sharpen the business plan during that final Master's year at Stanford. Now our story over time is we started with offering a single model for three cities in California to quantify earthquake risk. And over the years we followed a pretty straightforward strategic playbook, extending the geography of what we modeled from California to the United States, to Japan et cetera, expanding the number of perils we model from earthquake hazards to a range of climatic hazards to

terrorism hazards to disease pandemics, and being able to model more and more classes of physical and financial exposure and this has been our journey over the years. What I would like to do in this talk is not bore you too much with the background of RMS, give you a bit of context about the business. I'll tell you some stories about some of the shenanigans and challenges that we encountered along the way and then wrap up with a few comments about what I may have learned or be learning about this and then try to leave some time at the end for questions. Now one mark of progress in the business is that our models have got a lot more sophisticated over the years. When we started version 1, again three cities in California, earthquake risk only, we shipped on 17 5.25-inch floppy diskettes.

Our most recent release in 2013, global models, multiple perils, if we shipped on 5.25-inch floppies it would be about 500,000 of these 5.25-inch floppies, probably a cargo container load full of media to drop on premise at a client's site, which is one of the reasons we are now moving to the cloud. But I guess that's progress of sorts and we now have a pretty wide range of models for most geographies around the world. We model earthquake risk, we model hurricane risk, we model cyclone risk, typhoon risk, flood risk, fire risk, winter storms, tornado, hail, we model terrorism risk, 28 different attack modes from improvised explosive devices to chemical, nuclear, biological and radiological devices. We model a range of pandemic diseases that could cause significant human casualties and financial impacts around the world and we also even have a practice that is modeling what we call longevity risk, which is trying to assess the potential for a catastrophic increase in life expectancy due to things like the biology of ageing and regenerative medicine. There is a chance that life expectancy increases in very unexpected ways and while that's a good thing for all of us, it could be a significant financial catastrophe for some institutions and so that's a growing practice in the business or even doing some research and development around things like supply chain risk and for financial contagion as well. So a pretty broad range of peril models, catastrophe models, for a wide range of geographies, for a wide range of exposures. A couple just factoids about the business. We started there were five of us. We're now the world's leading catastrophe modeling firm. We have 1,300 employees around the world.

We have hundreds of clients. This is not a business that has tens or hundreds of thousands or millions of consumers pinging our website. This is a business that serves hundreds of institutional clients around the world to help them manage their financial risk to catastrophic events. We have a subscription business model in which we license our analytics and our intellectual property with an annual recurring revenue model while we do some consulting work. And just to give you a sense of individual client revenues range from about \$100,000 a year to license our models and data and analytics to over \$10 million a year is our largest single client. And our models are embedded into the fabric of the insurance, reinsurance and special investors that we serve, helping them to price structure and underwrite risk, assess and manage capital and exposure to these risks and develop and implement mitigation strategies to reduce the consequences of these disasters. I thought I would say a couple of words about what the hell a catastrophe model is, for those of you who might be wondering. This is not a closed-form mathematical model. This is not a single analytic expressed with end parameters. It is a composite model, which is an attempt to characterize using stochastic techniques the underlying characteristics of earthquake occurrence in this case, the frequency of events where they occur, what the local consequences are of those events seeing ground shaking at this site, what the exposure is to this individual building to that ground shaking, how that translates into things like physical damage to the property and potential for human harm for occupants in the building, through to the financial consequences of those damages so that our financial services clients can access the risk.

That's what we mean by a catastrophe model. This is just an illustration of an earthquake model, but the architecture is similar for the climatic hazard models, for the terrorism models, the disease pandemic models, and so on. There is lots of ways that these models can be expressed. Here is a couple of expressions of our terrorism model. You can express these, the model output as a scenario. So you can go into the stochastic model and pluck out an event such as a five-ton truck bomb attack in Times Square, New York City. We modeled the bomb blast, the effects of channeling pressure waves through the urban environment. It could assess the footprint of damage from an individual scenario, in this case a truck bomb attack. You can also express this as a risk map which is the integration of all the possible events that we think might occur. So get a kind of contour of risks throughout say Manhattan, but our sort of defining and signature expression of risk is something that we call an exceeding probability curve, which is a way of expressing risk, which is what is the probability over a given time period that there is X dollars, euros, yen, pounds, what have you of loss or greater to an asset or portfolio of assets.

So this particular curve you would read as saying there is a 1% chance per year that this asset has \$200 million of loss or more from the underlying events that we're simulating. This asset could be millions of insurance policies, it could be one large industrial facility, it could be a large urban environment, but this is the kind of output that we generate. And it's pretty significant, big compute, big data and analytic output. Often the input data to these models runs in the gigabytes and the output from individual analysis can run into the terabytes and in some cases into the petabytes of information just for one set of simulated output. So there is a pretty significant computational resources get brought to bear and I will talk a bit about that later as part of the - some of the stories about RMS. Now just to bring to life briefly before reverting back to the beginning and walking through some of the things we've experienced as a business, just to illustrate a typical use case for these catastrophic models. Now it wasn't that long ago when Hurricane Sandy, Superstorm Sandy barreled into the U.S. Northeast. One of many really bad outcomes was that the New York City subway system MTA was completely submerged and flooded with water. The economic

losses were extraordinary to the New York subway system and we were enlisted after Hurricane Sandy to help them construct a parametric hedge against future flooding losses to the New York MTA so that they can construct a bond against that parametric trigger and lay off financial risk from storm surge flooding into investors and to the capital markets.

And RMS got retained to perform the analysis of the New York City subway system to help construct the parameters that would drive the trigger to the bond and help them construct the deal and then support the placement into the capital markets. This is the kind of financially minded use case around an RMS catastrophe model that happens quite often with our customers. And in this particular case this is - this particular catastrophe bond was awarded non-traditional deal of the year by Bond Buyer last year and it helped the New York MTA close its financial risk gap to future storm surge events and this is the kind of thing that we do and there was a lot of publicity about this deal in the Wall Street Journal. So that's just one of many use cases that I could share about how catastrophe modeling gets used to inform financial risk management decisions in the real world and how we add value to our customers. Okay, so that's a bit of the background and some context to RMS as a business. I would like to share with you, with some of the time we have here, some of the stories along the way that informed my own journey as a co-founder and CEO and shaped the development of this business over the last 25 years. Actually it's a very wonderful time to be giving this talk. This year 2014 is the 25-year anniversary since we formally incorporated and started our business. So I'll start with the experimentation phase when we first formed the business, otherwise known as the start-up chaos. We were equipped with a bit of money from my father and a couple of his friends, I'd guess now the term of art is angel investing, but the early days of RMS were pretty seat of the pants.

The first office that we had was my apartment and we used to play some games with our early customers, who hopefully aren't watching right now, where when we get phone calls to my apartment that involved any sort of technical challenge we'd have this system set up where I would have a phone or I could have two lines, page my co-founder Weimin Dong, who was the brains of the operation, conference call him in and patch him into the client to create the impression that we had a proper firm that could answer their questions and there was this kind of craziness. Another kind of example of the early chaos in improvisation was we had an early prospect who wanted to take a look at our software. They were domiciled in the U.S. East Coast and we didn't have enough money to make the trip over to the East Coast to set up shop and give them a proper extended workshop and demo. So being very naive we said we'll tell you what, if you want to take a look at our software why don't you advance us some money so we can fly out to visit you, run the workshop and if you decide to buy the software we will credit it back against the purchase price. So it was a lot of crazy stuff like that. At one point we basically ran out of money and one of our early colleagues, another Stanford grad, turned up for work and I had to inform him that we really couldn't pay him very much anymore because we were running out of money, but he could move into my apartment free of charge in order to provide him the ability to still work at the company. The early days were wonderful for a lot of reasons, not the least being the great team. I would say of the first 25 people, I'm going to call out a couple of my early colleagues who are here in the audience today, I think about 80% of us of the first 25 people were all Stanford grads. They were either friends of mine from the class of '88 or '89; they were friends of friends who also were Stanford grads; they were part of my father's network of grad students, post docs, research associates.

So there was a real kind of Stanford ethos, camaraderie and sense of shared mission that got us through a lot of those crazy days. We used to pull lots of all-nighters like every start-up does and we used to have staff meetings, the big choice of whether we have the staff meeting at the Stanford pub or 42nd Street. I don't know if any of you remember 42nd Street which was a great bar in downtown Palo Alto where we used to have some of our staff meetings. Now when we first got started, we did have a version 1 of our product. This is what it looked like. It shipped on the 17 5.25-inch floppy diskettes, coded in Fortran 77, but we understood even back then we had the intuition to recognize that this was really a proof of concept. And what we needed to do in these early days was experiment and engage in actual work with real customers to really understand what was the product that we could deliver that would really solve concrete use cases and add concrete business value. So in the early days what we set out to do was a lot of experimentation. Rather than saying we had our V1 product, now we're going to take it to market, we spent a lot of time essentially even though we knew very clearly that we were a software company, a lot of the early engagements were essentially consulting projects. Signing up customer - my customer on the concept that an earthquake risk model could add value, but really engaging with them the consultative work to figure out how this really could be made useful to a specific business problem.

We spent countless hours and days holed up with our customers, understanding how they did business, understanding their vernacular, what kind of data did they capture, how did they make an underwriting decision, how did an insurance loss control engineer go into the field to collect data about a piece of property to make a recommendation to the insurance underwriter, how could we deliver a piece of software that might facilitate that decision and so on and so forth. So it was a period of great experimentation to really learn the use cases of our customers, get paid for doing so, in order to get to a place where we could say that we understood what the product strategy needed to be. Now some of this experimentation got a bit crazy. One of the more wild experiments that we did, because you get distracted when you're 23, 24 years old, is that we thought how, what if we constructed, offered a product which was an earthquake report that we could sell to homeowners in Palo Alto in order to help them as consumers assess their risk to earthquake damage and we got off on this crazy tangent

where we were constructing consumer brochures, buying mailing lists, mailing out brochures, collecting information by fax about homeowners' homes, running of reports just like the old days of e-commerce when you order the sneakers somebody goes and runs out, buys a pair of tennis shoes and ships it to you. We would get the fax in, we would type it into our computer, we'd compile the report and send it and charge 100 bucks, a complete disaster and certainly something that we learned the hard way not to build a business, the consumer business around our earthquake risk analytics. But a lot of experimentation is learning not only what does work, what doesn't work. And as we approached the end of this experimentation phase we learned a lot of things, but one thing that really got us into a bit of a jam was that by the early '90s towards the end of this phase, we probably had about 22, 23 clients who had paid us real money to experiment with them on how an earthquake risk model for California could add value to an insurance or financial services used case. But with 22 clients, I think we had probably 23 or 24 versions of our software, and we were a little bit out of control. And it was a real challenge to balance that kind of need for experimentation in the context of actual customer use cases, and actually then reconcile that with the need to build a scalable business around a singular vision of what the product strategy was and an actual product development plan to deliver that kind of capability. So a great deal of experimentation, some misfires and a bit of a jam.

We then got into a phase where it was really about establishing the business model. By 1993, we were able to raise about \$3 million in venture capital on the basis of some of the early evidence that we had that customers would pay us money for an earthquake risk model and we had been able to upgrade our digs up from a smaller office in Palo Alto over to one on Castro Street, in Mountain View. But at this point in the journey I encountered one of the early crucibles that many young entrepreneurs encounter. And that's the recognition of one's own limitations, and to have the humility and the self-awareness to not stand in the way of what's needed to build a real business and grow. We went through the process of raising venture capital. I came to be introduced to my colleague Tom Hutton, who is sitting here in the front row. And Tom is also a Stanford grad, engineering MS and then went on to do his MBA at Harvard. Was introduced to us as a potential CEO to build the next phase of the business as part of raising capital and really starting to get more systematic about what it takes to really build a software business out of the experimentation phase. And I think one of the things that was a real learning experience for me was knowing when it's okay to ask for help, and to stand aside and let someone come in to help teach you. And over the years, Tom became a mentor and taught me pretty much everything I now know about business and helped really systematize, from those early experimental days, the company into a much more scalable business model.

During this phase we not only focused of course on adding more customers and adding more employees and building the business, there were two key challenges that we really focused on. One was articulating the product strategy and understanding what is the coherent value proposition, and the use cases that we needed to deliver against to fulfill that value proposition and develop a proper product roadmap and product development plan, to pivot from lots of experimentation, with lots of customers and lots of individual wins to something coherent and scalable. In our case we stepped back, and with Tom and Rich brought another colleague who was our first head of engineering, colleague classic '88 at Stanford as well. We built a proper product roadmap that recognized, the category isn't earthquake risk model, it's natural hazard model. It's not California, it's global. And it's not just insurance or reinsurance, but it's multiple classes of exposure. Articulated that roadmap and with the investment capital we raised, we were able to then invest in building against that roadmap. Another key challenge that we overcame at this point is what's the business model of the business? At time we had envisioned that we, being a software business, would sell our software. I think the price points at the time were \$15,000, \$25,000 and we'd charge an annual maintenance fee, 15%, 20%, 25% against that initial sale. And that's how we were going to build the business.

During this phase, we came to understand that to build a scalable business, it's not just about the technology or the product, it's the business model itself. What's the business model that is right for this kind of technology that can create a sustainable and durable source of revenue to fund the growth of the business? And we re-envisioned the business not as a software - perpetual software sale, but as an annual subscription model, which was a key innovation at the time which has led to the recurring revenue business model that has enabled us to sustain the growth year after year, to about \$300 million in revenue is what we have today. So there was a lot of work in this phase. Raising venture capital, articulating a coherent product strategy, executing it and also being clear about what kind of business model we needed to put in place in order to sustain this business over time. So by the late 1990s, we were feeling pretty good. We had grown from \$2 million, \$3 million in revenue over the decade to about \$30 million in revenue, factor of 10x increase in revenues. We were making a bit of money, which is always helpful. We had some pretty good customers. We had a range of models for different parallels and different geographies around the world. And we even had, we were very thrilled - it's a sort of sign of coming of age, we even had an industry analyst called the Tower Group write an industry report about this nascent market called catastrophe modeling.

And we felt like okay, we have established the business, we have real customers, we have a good business model, we are making a bit of money, analysts are talking about cap modeling as a product category. \$30 million niche analytics business, that's not so bad. Lots of niche analytics businesses get to \$20 million, \$30 million, \$40 million and that's their potential, we've grown by a factor of 10. And we began to enter a phase I refer to in hindsight as the mature market fallacy. And this was a very interesting learning experience. So there were a couple of things going on at this phase in the business. One is that we began to think of the business as starting to mature. When you look backwards, 10x growth, that's not bad. \$30 million in software,

recurring revenue is pretty good. We looked around and said, we've built models for most of the developed countries.

We had an earthquake model not only for the U.S, but for Japan. We had a wind - we had wind models for Europe, we had the typhoon models for Japan, we had earthquake models for Latin America. We had penetrated a lot of our major target customers, and we started to think about the business as a maturing specialty analytics business, that certainly we thought could continue to grow. But that perhaps the significant growth story was behind us. At that point, we made the decision to sell the business, to the Daily Mail and General Trust. Which I won't get into the details, but it was part of the mindset, which was that we had invested in this little start-up, we had overcome the years of start-up chaos, we had validated our value proposition, we had raised venture capital, we had invested in building a coherent product line, we had good close customers, we had a good revenue. It was growing but beginning to - growth was beginning to slow and sort of the thought was it is the logical time to exit. Unfortunately around the same time which was fueling this view of the mature market fallacy, sometimes business challenges are exogenous to your business. For those of you who recall this time, this was the .com boom was approaching its crescendo in the end of the 1990s. And it got to the point where around 1999-2000 we started to experience this kind of combination of this is a maturing business and this tremendous exogenous forces of the .com boom.

Lots of those- lots of us who had joined the business as kids were getting ready to move on. We had to... one example is we had to relocate our office, and at the time landlords were getting warrants and equity, and Technology Company in Silicon Valley to return for office space. We couldn't afford that. We went like refugees across the Dumbarton Bridge in a wagon train to Newark, California. We felt like we weren't at the center of this transformative thing called the Internet, and it was a very scary time. We had one year, I can't recall if it was '99 or 2000, I think it was '99, where our turnover rate approached 40% in the company. And this is not 4 to 10 people, we had close to, we had probably around 100 plus people in the business. To lose almost half your company, for all the right reasons, tremendous opportunities, we had grown the business, there were... there was a liquidity event.

But it was a very scary time trying to manage through this process. And we began to think of the business as mature-maturing and we made the decision to sell the business. And many of the start-up team exited, lots of hugs and handshakes. The people started to move on. And there was a tremendous amount of turnover at this time. And at that point was another key milestone. I have here kind of very grayed out this quote from a strategist, the now deceased C. K. Prahalad who taught strategy at University of Michigan and had extensively written in the Harvard Business Review, had a chance to workshop the RMS strategy before he passed away. And he wrote about what he called the mature market fallacy where often it's not a business that's mature, but in the executive's own conceptualization of the stream of future opportunities that becomes mature.

And so you challenge yourself to rethink and reinvent oneself and the notion of how you can grow and add value in order to create a future stream of opportunities for the business. So shortly after the acquisition I sat down with the team and with the new owners and said you know what, I know we think we can grow this business from \$30 odd million to \$40 million, \$50 million, maybe \$60 million. We know you've put in place a very generous earn out for us to earn out our shares and options. And we can see how this story is going to end, like it does in so many of the situations, the start-up team earns out, it moves on and starts up the next business. And the business stays as an interesting niche analytics firm in our case. \$30 million, \$40 million, \$50 million of revenue is no slouch as a software company. And that's the end of the story. And in this particular case, I am not entirely sure why, maybe future years of therapy will help. But we sat down and we went to the new owners and we said you know we don't think this story is over. We don't think the next chapter is the earn out and success is a \$50 million version of RMS with some real profits.

How about a version of this story, which is we can grow to \$100 million in business. And we had several ideas on how we might re-envision our opportunities for growth, and how we can monetize that growth and how about we essentially kind of restart things up again? So instead of these very nice earn outs, how about we re-up with more equity in the business? How about a significant new set of grants devolved down to recruit the team, re-up the veterans who were inclined to stick around for the next phase of growth and let's see we can actually make another run at this. And not just sort of call it a day at a \$30 million-\$50 million specialty analytics business. And to our great surprise, the new parent shareholders said yes. So we re-upped, a lot of equity was dispersed to the team, we implemented some new ideas that were about penetrating more deeply into our customers, not just having them have a license for our models, but really working the models into the heart of their business processes. We started to innovate, in expanding beyond natural hazard risk into things like terrorism risk and disease pandemic risk and in many ways the decade that followed was the most productive and significant growth stage of the company's history. We went from at the beginning of the decade about \$30 million in revenue to the end of the decade about \$250 million of revenue. We crossed the \$100 million threshold much sooner than we thought. And by the latter part of the decade, the models had been elevated to a whole another class of value in our customer's enterprise and we had really reinvigorated RMS and overcome the mature market fallacy and reinvented who we are, how we add value in the scale and size of the opportunities before us. Which then brings us to the present, you've all heard of this notion of the innovator's dilemma, by the end of last decade, 2008, 2009, 2010, things were looking pretty good at RMS.

We were closing, I think, on \$250 million of revenue, again, up from \$30 million a decade before. We were quite profitable, margins 30-plus-percent operating margins. We were growing steadily, not like a rocket ship, but growing steadily. And we were really woven into the fabric of the insurance, re-insurance markets that we serve. And it's started to get a little uncomfortable, and there was a sense of the language were starting to change, the language of meetings in the company started going from growth to how do we protect our market share. The language started shifting from, how we going to double the company, again, as the key metrics to, how do we ensure we can keep a 50% market share in the business that we're serving. A lot of language that was self-congratulatory, it was language that was, we are the leaders as oppose to we're leading. We are the most innovative company in this space as oppose to innovating, and while what we did everyday was quite innovative after all building stochastic models for typhoons and floods and terrorism is inherently incredibly stimulating and intellectually demanding work, we were running in the same play book that we had been running for over a decade and there was a sense of defending the status quo, celebrating what we had accomplished, as oppose to re-envisioning how we could add value, what we needed to do to invest in new ways of adding value, and how to think of ourselves not as the market leader in the field but rather than the 50% market leader in the niche field what's the market that we could serve that we're the 5% to 10% market share player in. And it's the classic sort of innovator's dilemma which is how do you make the shift from being so invested in one's own status quo to take the necessary risks to try to drive a new round of growth in the business. And this was a very interesting and challenging time.

The company was not a goliath but by our historic standards we sort of 5, 25, 50, 1,000, 800, 900 people in the business, lots of clients, real profits, significant revenue streams, market share position, we re-envisioned in a very top-down way a new strategy for the business. Which was, one in which would require us to take some very significant risks in order to pivot our fundamental value proposition and how we add value in a way when we still had the tools at our disposal, the financial resources, the market position, the momentum, when we could still be in control as oppose to settling on an increasing defensive posture about defending market share, defending position, and then waiting for the time for somebody to change the rules of the game out from underneath us. After all, a lot of these kinds of businesses where you have very significant market positions, don't often succumb because your number two or number two competitor picks up 10 points of market share, is because you become so invested in defending the status quo, you don't see something coming that fundamentally change the terms of value that the customer experiences and the ways in which they can consume that value and there's some disruptive change that causes you to fundamentally loose the plotline and then no matter how much you try to defend your market share, it's like sand running through your hands. So, we went through this process which was very challenging because we went into our own organization and, said, we need to undergo a substantial pivot in our strategy, we need to go from being a - primarily being seen as the world's leading provider of scientifically informed catastrophe models to delivering the exposure on risk management environment for this industry to, yes, analyze risk using models to manage risk. And, to do so by opening an ecosystem of capability to our competitors and to others to build models in analytics and applications on our platform and deliver all of that software and platform-as-a-service in the cloud. And these conversations were extremely difficult internally. Some of the most challenging - and the story is not over yet, by the way, so I'm not quite sure how this is all going to turn out - we had a number of - this transformation has been going on for over two years now but it start with the lot of very angst-filled internal dialogue about why is there the need for change. And the institutional, internal and cultural barriers to change when you have been able to develop a reasonably successful business that has a well-defined brand and market position that is understood by employees and customers alike to be doing something very specific, very well and getting compensated for that. To make the pivot and do something different only happens in one of two situations, one is when you're under existential threat of death and that's quite a motivator to try something different or the opportunities are so significant, it challenges you to think differently and take some risks. And we went through a whole internal process and I've made so many mistakes and learned so many things the hard way about how a top-down strategy to take an organization that was intensely proud as it should be of everything that you had accomplished over a 20 years of innovation in a very specific dimension to take that organization through change and build the case for change was extremely difficult.

And we got there, we got there, we got full alignment but it took a lot longer than I thought, it was much harder than I imagined and it was very scary at times. When you are starting to pivot the company and try to bring the culture with you and realize that you might fracture the very organization that brought you to this place and you haven't yet made the definitive, not only intellectual case but emotional case for why a company should go through significant change, it's a very scary place as a leader to go through that realization that you might not make it to the other side and often it's not the customers of the market who votes, it's your own employees and colleagues who vote whether they buy-in to the rationale for change and stick with you through the process. We've been going through this journey now for almost three years. We have been building what we called RMS(one) which is certainly going to deliver world-class catastrophe models but it's essentially now we're positioning as an environment for resilient and real-time exposure on risk management and we are framing this as a core system in our clients' interim enterprise delivered as a cloud-based service and we feel it can more than double our addressable market. We are going to market in about six weeks with the initial release of RMS(one), so the story is not yet over but we have made the pivot internally and gotten significant buy-in alignment and held the company together through a very significant internal change, management effort, new priorities and investments in the business and technology, and colleagues. If you look at the senior 20 people in the RMS leadership team right now, senior 21 people in the RMS leadership team, 17 people of the 21 people are

either new or had a very different job just two years ago, so tremendous amount of change in the leadership team that we brought to core culture through, the modeling team stayed intact or as enthusiastic as ever about delivering great models to this platform. But there's just a whole lifetime of lessons I feel I've learned about the soft part about leading transformation change in one's own culture and many mistakes were made but I think we learned fast enough that we're coming through okay on the other side. And now we're delivering a very significant new platform, several hundred million dollars of investment have gone into the software engineering and cloud computing infrastructure. We stood up data centers in Iceland, in the U.K., in Canada, here in California and soon in Asia and we are going to market with the significant offerings of private cloud not only just offer up our models but the models of our competitors and others in what we hope to be as the specialize risk management ecosystem of third-party providers via our platform to this very large trillion-dollar global financial services industry that's looking to manage risk. Now being modelers, we haven't - we are still fiercely aware of our core DNA among other things we did is generate exceeding probability curves for the number of cores we would need to have on demand to meet the use cases of simultaneous clients firing off large scale hurricane, flood and earthquake analyses all at the same time and we're modeling here the probability that in any one day during peak business season we will need more than 30,000, 35,000, 40,000, 50,000, so this is significant big compute infrastructure that we're building to be able to scale up to deliver this much compute capacity in the cloud to the needs of an entire vertical market and we haven't forgotten that we are modelers.

As I close in on a couple of wrap-up comments, I do want to leave a little time for Q&A What do I know? I have only worked at one job my whole career. Lots of different experiences in that 25 years but couple of things that I wanted to share may be as a sort of summary thoughts. I guess, first off, is there is more to life than social media technology companies? You don't have to ride in a big gleaming white bus to come to work and if you're interested in big data analytics you can do something more socially meaningful than build algorithms to help people buy more stuff on the web. There are a lot of companies, like RMS, that harnessing big compute scientific computing and very sophisticated analytic capabilities to solve really serious mission scale problems and encourage you, as students, to recognize that there are lots of cool companies doing very serious stuff with this kind of technology. Strategic intent matters, it's okay and I think at times necessary to have heroic aspirations as C.K. Prahalad said, all out of proportion with one's capabilities and the challenge isn't not to envision the gap but how to systematically challenge your organization to close the gap. And that sets up my third point which is mission matters. RMS, since day one, has been a purpose-driven company. Our big ideal from when we started the company was to make the world the safer and more resilient place.

And that I don't mean just as a slogan, there's a whole theory of the firm which connects what we do to the markets that we serve, to the problems we are trying to help them solve to making the world a safer and more resilient place, both expose disasters by having more coverage to finance the recovery of communities after disasters and ex-ante by building in the financial incentives to create mitigation to reduce loss when the events occur. Mission matters, and mission matters is not because it's just cool and it makes you feel good when you look at it at the slogan on the wall but when you need to go to get organization through years of change and sometimes very painful change when whether it's almost 40% turnover due to the exogenous factors in your business or the pivot to a major strategic change which is very risky and how to hold your organization's culture intact. If you have strong mission, it's not do you have cool slides, and did you get great Sushi at lunch, it's do you really have a purpose that your team buys into that transcends the day to day what you work that really matters that makes you believe in your core that what you do makes an impact. If you believe that, if you have that mission-based ethos in an organization, you can be extremely resilient, at times a great change in challenge and risk and take the organization through that journey. Now the observation is, sometimes things that matter take time. It seems like - and I'm not some, I guess, I'm kind of an old guy coming back to Stanford and talk to bunch of students, but it seems like so much focus now is around building and flipping and transacting businesses, where - yeah, there might be a nod to a mission statement to a Big Hairy Audacious Goal. At the end of the day, the organization has started, geared, wired, and run to effect the take-out, the sale, the acquisition or the liquidity event, and things that matter - and there's a lot of things in the world that need to be sorted out, the really big things that matter sometimes take time. Now, maybe you don't just stick around in the same business like I have for 25 years and to make a go of it, but I think we need to extend our half-life to solve the kind of problems requires a commensurate cognitive scale of thought, purpose, and action that can't be solved in a three-year cycle and then on to the next thing. Sometimes these things take time and I know it's hard to think in terms but I fully expect to be here in 25 years still in pursuit of this heroic mission. And finally, take the time to invest in your own learning and development and grow as a person.

I know that can sound kind of soft and woolly coming from an engineer speaking to many engineers, but I think a lot of people now confused developing oneself with networking. All right. All right, you guys all do that yourself. Networking, yes, of course, there is opportunities to learn, that's not what I'm talking about. It's about having the humility to recognize how little you know and how important it is to continually and passionately invest in your own self-discovery to make yourself a more effective leader. One of the best opportunities I had, tremendous opportunity that I took full advantage of, is that I got invited to participate in a leadership development program put on by the Aspen Institute and unfortunately it wasn't two years of full-time in Aspen, Colorado but it was a three-year elapsed time where I got the chance to spend many weeks in a program - intense program with some wonderful people in the spirit of community-based leadership, ethical leadership, and leadership with purpose. And it's these kinds of things that often get overlooked in the frenzy of the next big thing and the next flip and the next

valuation round and the next startup, and find time to pursue one's own growth. And finally, I'd like to just say that my own management team is very excited I am here. Out of this 20-odd-person leadership team we have today, almost half of the team, about 40%, or Stanford alums either in the business school or the engineering schools, so we feel very proud to be part of this community and thrilled to have this opportunity and this honor to come and share out our experiences with you what we've gone through over the last 25 years. So with that, I just want to thank you for this opportunity.

I think we've got exactly seven minutes for questions. And, Rich, you can ask me any hard questions. So what are the biggest lessons you've learned in your latest business strategy changing the DNA of the company in the new direction? Well, I think the - there is a lot, there is a lot. I think getting people - the first mistake I made was overly intellectualizing the strategy. Of course, it makes sense. It's so evident. Here is the logical argument and didn't engage people enough emotionally and why there was a need for change and engage people as human beings emotionally around why should they, as people, buy-in to a new strategy and why that strategy doesn't alienate them from the business that they love, and they made the choice to come work here. And that was something that I feel like if I do this again, I will spend far more time on that aspect getting emotional buy-in from the team as opposed to just trying to cram it down top-down because it makes intellectual sense. Another thing that was maybe some unfortunate statement on human nature, but in the early days of the change management process which I guess is the proper way to refer to these things, it didn't seem like much like a process at the time but initially the change management process, I spent a lot - I am a very optimistic person. I am a glass half-full person and I saw the need for change in very aspirational, these are huge opportunity.

I found that also when we realized as a leadership team that we needed to balance the need for change with, it's going to be great if we pull this off and the opportunities are much more, but also that the status quo is not risk-free. So human beings, we always think the status quo ex-ante is the risk-free option and change is risky. It's very hard for us. I think a lot of social science suggested to cognitively realize that the status quo carries a lot of risk. So we started talking about the downside and the risks that if things that can go terribly wrong if we just keep sticking to our knitting and - we didn't overdo that because again I'm a very optimistic person but we started dialing in maybe a 22% weight on the downside, supposed downside, and that really tipped people's minds that there is a need where the status quo isn't tenable. We have to change and the risk of change is balanced against the risk of not changing as oppose to just a great stuff that's going to happen if we successfully pulled it off, balance against the fear that if we fail, we're going to screw up what we already built. So that was the - yes. I'm curious when you say your addressable market has doubled. So what is that addressable market now and does that also include things like financial market risk or other kinds of risk? Yeah, the short answer is that the addressable market, the way we are defining it is in the near-term, we think we can double the business. The longer-term, it's the three vectors of volume space.

It's about extending into new classes of risk. So we've got R&D teams working on that kind of thing. The second is the pivot from the value is primarily built around the - it's not just the model, it's the environment and the platform in which these institutions manage risk including consuming the tools, analytics, and applications of others. And the third is the customer's customer and the customer's customers' customer a key part about the cloud proposition isn't just about doing things more efficiently as we can now - we have a few hundred customers or institutional, what about a few thousand customers or 10,000 customers, the broader community of interest that is exposed to catastrophic risk not just large insurance companies and hedge funds but corporations and entities around the world that we can extend the tail of the business significantly. Yes? So I know you started up 25 years ago, so how do you keep that innovative - I mean perspective, how do you keep that innovative culture throughout those 25 years and what type of value incentives did you use to motivate your employees? I think a lot of it is - what the psychological damage I got as a kid I suppose. But I mean there is a kind of - there is - I mean we all know this. I mean everybody in this room is super ambitious and high achieving. There is some unquantifiable thing that gets you motivated to do that and that with your whole life. I think the thing - a more practical response is this notion of mission really matters. I mean if you really internalize why you exist and what your really big aspiration, not just, I want to change the world but what's the fear, that creates a very, very big context and a very distant horizon that stays evergreen and constantly creates this tension or when you look at where you are, you're forced to not just look backwards and just think about how far you've come, how little progress you've made against your goal.

And it's that kind of creative tension that gets created like, oh, shit, we have so much still to do that stimulates this kind of innovation and risk-taking that then gets worked into the culture of the company because you are always - you're stretching yourself so far in terms of this notion of what you want to accomplish as a business. Yes? So when is the right time to start your own company? Well, I think all I can speak about is my own experience, 22-years-old, business plan was written in school. I got to work with great people like Rich and learned from people like Tom on the job, other people might have the opportunity to go work someplace first to learn the skills that I learned from Tom on the job. There is no right answer. All I - my experiences was 22-years-old. And June of 1989, we incorporated and were pulling all-nighters answering clients' questions. Yes? I trust you're familiar with, like, Nassim Taleb's antifragile concept; just curious, how you kind of apply that to your clients; not only telling them where the risks are but how they can? Yeah. We have this concept - it's on a new concept that we look to quantify and articulate the resiliency of our clients' risk management strategies and it's an inversion of the proposition so much of our society and business culture is focused around optimization. You make a set of assumptions and then you drive to optimize the

hell out of that system to maximize the economic returns. And that leads to hyper-efficient supply chains that blow up when anything goes wrong because there is no inventory in the system anymore, to give you but one example.

The same thing happens with financial services risk. You can have a view of the world that is taken and you optimize the hell out of the risk management strategy to maximize the return on allocated shareholders' capital but what if your assumptions are wrong. We all saw what happened in 2007, 2008, and we've had a couple of versions of that ourselves. We learned the hard way where clients overly-optimize around our models and then we're surprised when we learned the hard way that all models are wrong and some are useful. So we have a whole construct now that we uses resiliency where we explore the fragility of the clients' risk management strategies to the underlying assumption to see how brittle the strategies are and we invert the proposition to provide a measure of resiliency that they can use to trade-off against the efficiency, optimality imperative to create a balance between those two competing criteria for building a portfolio.