ARTIFICIAL INTELLIGENCE --
DISPELLING THE MAGIC

Leader: ALLAN D. AFFLECK
Speaker: JAMES S. GREENE*

MR. ALLAN D. AFFLECK: Since this meeting is so close to Silicon Valley, it seemed appropriate to have a speaker who could talk about technology issues that would be of interest to actuaries. Our speaker is an expert in the area of artificial intelligence, an emerging field that has many applications in the future for actuaries, for the companies we work for and for our clients. Jim Greene is a partner in the strategic services practices of Andersen Consulting. He has worked in the San Francisco office of Andersen since joining the firm in 1978. Jim specializes in the financial services industry in areas involving strategic planning, market assessment, product development, pricing, and technology planning. He has worked with a number of insurance carriers and insurance brokers in strategic management projects, as well as assisting clients in the design and implementation of expert base systems.

MR. JAMES S. GREENE: Artificial intelligence -- somewhat of an oxymoron if you ask me. When Allan said that I am an expert in artificial intelligence, all those words together sound kind of like an oxymoron to me. I mean, is intelligence artificial? I'm not sure. Mine might be, but that's okay. What I would like to talk about is this whole notion of emerging technologies, specifically artificial intelligence in expert base systems, and about what those applications of emerging technologies can do for you, for your companies, for your clients. And I say this is dispelling the magic, because quite frankly, there is so much mystery surrounding this whole notion of artificial intelligence. I think that it gets in the way of the practical application and integration of this type of technology in our clients' businesses as well as the firms that each one of you work for.

So what I hope to accomplish is to give you information across four questions. First, why should you care? Yes, we're in the Silicon Valley and it's important to understand emerging technologies. But more important than that, I want you to come away from here with an understanding of the implications this type of technology has for you and your clients. Second, I want to give you a nontechnical explanation of artificial intelligence. And even if you had asked me to give you a technical explanation, I think I would have deferred and said I was not going to do that because there's so much as we speak, education and development and breakthroughs in this area, that anything I would tell you on a technical side would be obsolete by the completion of my presentation. Third, I want to talk very practically about what it can do for you and your clients and your companies. And fourth, as it relates to that third point, I want to give you an example of an expert base system that was actually developed for a real life company; in this case a property and casualty (P&C) company. And while the example is an underwriting example, I think it's important to understand the concepts behind it because

those concepts can be applied, whether it be in the P&C business, the life business and so on. So if I can get through those four items quickly and if you are reasonably happy when you get out of here, I think I will have met my objective.

Before I talk about these emerging technologies, I think it's very useful to take a look at the forces that have impacted the industry that all of us work in, particularly during the 1980s, because it's these forces of change across many dimensions that have had a significant impact on the ground rules of competition and the ground rules of success and ultimately the ground rules of trying to bring shareholder value to the respective shareholders of all of our client companies and the companies with whom we work. And I can go on about each one of these dimensions. But rather than do that and bore you, because you probably know all that, I just want to highlight a couple points.

Again, as it relates to competition, I look at competition and regulation as the two single most important factors that have forever changed the insurance industry. For a property and casualty example, when you look at the premium pie in 1980, it has shrunk over the last 10 years 30-35%, representing about $50-$60 billion. Why? Because nontraditional providers of insurance have entered the market and are doing this very well, both in North America as well as internationally. As it relates to regulation, I think that's something that has also contributed to nontraditional sources of competition. I do quite a bit of work in the financial services community, both with insurance firms as well as with retail and commercial banks. There are a number of national and international players on the banking side that are very much looking at the role of insurance products, tax-deferred annuities, single-pay life, investment advice and valued added for fee services as a way to affect their returns, their financial performance and their share-holder value. So we have a whole profusion of companies coming into this market, not just traditional players but nontraditional players as well.

All of this has resulted in change in economics, both on the expense ratio side and the loss ratio side. I think it goes without saying that those firms that are able to respond to these factors in a way that allows them to provide products that specifically meet well-defined customer needs and values in a cost efficient, high quality of service manner will be those that survive. That all sounds very much like motherhood and apple pie, but as I was telling Allan before the presentation, there are very few clients that have been able to successfully pull that off.

The responses by many clients in the companies in the industry have been a variety of prescriptions, if you will, for handling those forces that have forever changed the dynam-ics of the business in the 1990s. Many of you in the companies for which you consult probably have gone through the head count reduction, the efforts to try to get productiv-ity up relative to cost and to revenue, to introduce radically new products, particularly on the life side, as a way to mitigate the disintermediation that has occurred and continues to occur. Coming up with more customer-segmented products, and responding to customer-needs-type products can stop disintermediation on the life side. My hat is off to all of you to the extent that you can somehow project the impact that AIDS going to have on this industry. I think that is a tremendous challenge. On the P&C side, firms are trying to do less, trying to be everything to everybody, but they should focus more on

those products to those customers in a way that they truly can provide superior service and sustain some kind of competitive advantage.

Artificial intelligence and information technology represents one component of the prescription. So what I'll do for the balance of this presentation is now try to answer the other three-questions. Before I do that, I just want to read you a quote that came from a Delphi survey that we did with the Life Office Management Association (LOMA) probably a year and a half ago. We talked to 185 companies; 75 were life companies and the balance were P&C. We were trying to get an understanding of senior management views of the 1990s, the keys to success, the challenges and the issues. I just want to read one concluding remark that was made, because I think this very well summarizes the challenges that we and our clients face in the 1990s, and what the formula for success will be.

> Based on the results of this study, it seems clear that the key to success in the 1990s will be an organization's ability to plan and execute on a basis consistently superior to that of its competitors. In addition, successful companies will have flexible infrastructures that can support changes in products and distribution channels rapidly and efficiently. And part of that efficient distribution of product and service is tied in a very significant way to information systems and technologies, one of which is artificial intelligence.

I'm still looking in the past, but instead of looking in the past to the changes that went on in the 1980s relative to your industry, I'd like to talk about what's happened in terms of information systems. To put it in perspective, because I don't want to bore you with all the technical items, in 1980, the computing power that was resident in your handy-dandy IBM PC, Macintosh, Compact IBM look-alike, with the 20-mg hard disk 10 years ago would have been probably somewhere between 40 and 60 times the cost, as well as taken up space equal to this stage. And so that should give you some understanding of the increase in computing power, the decrease in cost per million instruction per second (MIP), if you want to get technical. The bottom line is it's a lot cheaper to have a lot more computing power at your fingertips. When you look at the history of how we use technology, in the 1960s what we were trying to do was automate those tasks that heretofore had been done manually, and most of the focus here, particularly in the insurance industry, was in general accounting systems, and to some extent underwriting; primarily general accounting systems, payroll, accounts payable, accounts receivable and so on. In the 1970s the challenge was trying to bring that information to the user community more quickly in a more meaningful fashion to allow nondata-processing-type individuals to be able to query data bases and get better information on facts, experience, claims, statistics and so on. And what we tried to do in the 1980s was pull together all these disparate types of applications and technologies and pieces of software and hardware, and bring them together in such a way that again, the nondata processing professional had at his or her fingertips information that was meaningful, timely, and responsive to the type of decision-making analyses that they had to do.

The 1990s, the New Age. I don't know why it's new; we're here. But it's the new age of emerging technologies. And the challenge that I face in my business, and I suspect many of you are in the same position, is trying to help clients understand how they can best

meet their specific business objectives, using all these technologies that exist today and the ones that are being developed as we speak.

I'm going to move the discussion into artificial intelligence. It was 10 or 11 years ago when I started to get into this area, and if you're like a lot of clients, when you talk about artificial intelligence, one of the items or visions that is conjured up is this whole notion of robots, as opposed to a commercial application in the business environment of this technology. And again, I think this magic has prevented so many of our companies in the insurance industry to take full advantage of the computing power and the decision support capabilities of this technology.

So if that is what artificial intelligence is not, let me take a minute and tell you what it is, or try to explain it in the context of three quotes. What is artificial intelligence (AI) technology? First, it is the capability of a machine to imitate intelligent human behavior. (I'm glad they don't want to have a machine that imitates unintelligent behavior. Although if you fly on some of the airlines that I do, you might think that they do.) Second, it is the study of how to make computers do things, which at the moment people are better at. And lastly, it is that attempt to create programs that solve problems such that if people were solving those problems, you'd call those people intelligent. That was my quote. When you cut through all the technical jargon and you cut through all the consulting and all the books that are written and all the newspapers and so on, what we're trying to do with artificial intelligence technology is to the best that we can, emulate human capabilities. And expert base systems, which is what the balance of my conversation with you will focus on, is one application, if you will, of this technology. A variety of other applications -- spanning, robotics, reasoning, vision, expert base systems and so on -- are applications of this AI technology. And AI technology is nothing more than combining hardware, software and human expertise in such a way that you can do the kinds of things just described.

Before I talk about expert base systems, let me talk about voice recognition. I have a client in investment banking who, in its New York trading office for municipal bonds, has a voice recognition system to affect trade execution. It's really become a shout recognition system. If you've ever been in any of these trading rooms, you know how hectic it can become. This terminal can be programmed to respond to my voice and the intonations of my speech. So I can be screaming, yelling and so on, and it's a shout recognition system that dispenses with all the manual record keeping that heretofore had accompanied trade execution. So there are practical applications of this technology. It's not a bunch of guys in white coats in labs throughout the country. And what we'll finish up the conversation with is talking about one of those applications, expert base systems.

Expert systems can be thought of as decision-making systems which are designed to assist humans in performing complex processes. And whether that be underwriting, claims, actuarial work, statistical analysis, diagnostic kind of work, decision support, taking a variety of disparate facts and trying to make some sense out of them, expert base systems are trying to marry the expert with software and hardware, mathematical computations, statistical analyses and so on.

ARTIFICIAL INTELLIGENCE -- DISPELLING THE MAGIC

What we're trying to do with expert base systems is make this corporate asset available that so many of our clients talk about, which is the information resident in the minds of our experts. And when you look at what companies are doing in the life cycle of many individuals in a company, you'll find that as firms try to downsize -- or they try to soften that and call it "restructuring" -- and have these early retirement programs, the good news is they might be reducing near term cost; the bad news is walking out the door are individuals who have in their heads a great deal of expertise specific to whatever particular functional area or areas they happened to be in. And one of the objectives of expert base systems is to try to collect all that expertise and integrate it along with software and hardware in such a way that we can leverage that individual's expertise. Questions that expert base systems are trying to answer include: What is wrong with the diagnostic approach? What are the risks associated whether that be a particular type of risk profile that we want to begin writing to, a particular way that we'll begin to underwrite an approach to claims, and so on? And the need for the human expert is a very important point. And that's another misconception about this technology -- that once we have these expert base systems in place, we simply can go about our business absent of individuals. And the contrary is true, that once we have expert base systems in place, the need for ongoing human involvement is critical. I have an example that will demonstrate that. I have a number of clients who have at their disposal the type of information needed to do the business to conduct their work. But their desks are populated with too many terminals, too many phones, too many fax machines, all of which drive up the cost of doing business and drive down productivity and the timeliness to conduct the kind of business that they're supposed to be doing.

What we're trying to do with expert base systems instead is in an integrated fashion, marry experience, marry fax, and marry strategies to equal answers. And whether those answers have to do with technical kinds of issues or more strategic kinds of issues relative to new product development, pricing, entering new markets with existing products or new markets with new products, the type of analyses that you're responsible for and the type of analyses that your clients expect you to perform can better be handled if you have this view of the world that's more integrated which will pull information from all those data bases that we talked about, as well as leverage the respect of expertise that's resident in and outside your particular firm.

What we're trying to do with expert base systems, and frankly what we're trying to do with any emerging technologies, all this big-time major computing power at our finger-tips, when you cut through all of it, what we're trying to do is provide the right information to the right people in the right format at the right time so that we can make the right decision. (What a scoop, I could have had a V8). That's another motherhood and apple pie kind of statement, but it should be taken quite seriously because few companies, very few clients can integrate all four of those. They might have the right information, but it takes too much time to get it. Or they get it to the wrong individual. Or it doesn't reflect all the expertise resident inside that particular business; and in support of the right decision. How many times do you get information that seems to be timely, but it's all directed not at a pricing decision, but at a new product decision? So trying to get all these four components of the right strategic and tactical thinking and decision-making processes in place is one of the objectives that we have of expert base systems.

These are underwriting examples, and while they may not have applicability to all of you, I think what is applicable is the development approach and some of the objectives that are behind these two alternatives. In this particular case of using expert systems, it's in underwriting, and it doesn't matter whether it's private, passenger, auto or commercial lines of specialty risk. What's important is that the underwriting function lends itself very, very well to the application of this type of technology, and let me try to explain why. There are two typical ways that companies are using expert base systems. And before I go through that, let me say, "Companies are using this." Well, there's a segmentation of companies. There are the dabblers; the companies that say, "I don't want to be first in with this fancy stuff. So I think instead what I'll do is sort of dabble. It's low risk. It's low cost. It's well contained. I can measure the results. And then I'll see whether or not I should try to integrate it into my production systems and integrate it into the flow of people information and activities." So they are the dabblers. But there are also the leading edge types, some of whom might say they're the bleeding edge. But the leading edge types are saying, "I am going to bid on my investment in expert base systems and some other emerging technologies. It is indeed how I'll meet some of the challenges in the 1990s specific to customer service, being flexible with bringing new products into market, agent support and so on."

But with that as background, let me get back to this example. There are two alternatives in underwriting. First is where it's more automatic. And this is where whether it be the application or the claim or whatever the particular piece of information that needs to be acted on, it is entered directly into the expert system. The expert system, again, there's no magic. It's a bunch of rules and conditions, mathematical computations, statistics and factors in there, a scorecard if you will, and criteria against which all that information on that property application is evaluated against. And based on the type of profile, the risk profile that is embedded in that particular expert base system, the knowledge base if you will, a decision is made either to decline it, accept it or refer it to another expert so that he or she can then make the decision.

On the flip side, the second alternative is what I think is more typical of what companies are doing because they're nervous about handing over, if you will, the risk selection process or decision-making process, particularly if it's your first time into this machine. Instead, this is where the application again is entered -- hopefully it's scanned in, not keypunched in -- and on line the expert is viewing how the expert base system is interpreting all that information against the knowledge base of rules and conditions. And this is more typical. I have a client whose underwriters are looking at the machine, the terminal, understanding that decisions are being made and they can stop the process at any time. They can override it. Ultimately though, it's the individual, the human who is making the decision to accept it, refer it, defer it, reject it. There are two different ways to go, and really firms get comfortable with the second way. A knowledge base filled with a lot of experience will then migrate to an alternative one. Why? Quite simply because it's a lower cost.

I think most of you can relate to this. Chart 1 is an example in underwriting where, whether it be P&C or life business, the clear accepts and the clear declines are very straightforward. Most of the time, probably 80% of the time, human intervention is required. Along with human intervention comes cost. Along with human intervention
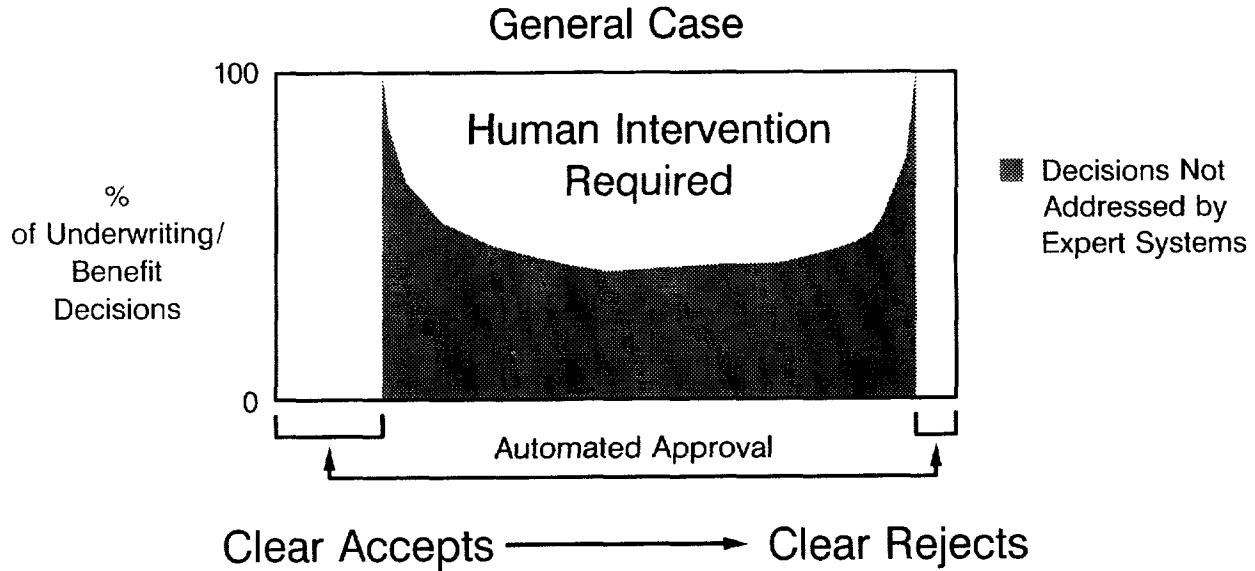
Application Approval Profile

General Case

Clear Accepts ⟶ Clear Rejects

CHART 1

comes a longer production pipeline -- getting an answer back to that particular client or that particular agent or policyholder or whomever the constituent happens to be. So one of the objectives of this application approval process with expert base systems is to compress that section in the middle so that we will have a higher hit rate of rejects or a high hit rate of accepts. Now to insure that the rejects indeed are rejects and that the accepts indeed ought to be accepts, obviously you want to have some kind of quality assurance process where for every 50, or 100 applications, whatever your tolerance for risk happens to be, you take a look indeed at that machine, that knowledge base, and arrive at the kind of conclusion relative to your target risk profile that you would if you were underwriting that piece of business.

Let me finish up with an example from a real live client. And I think in this way you'll have a better understanding, or hopefully a better appreciation for how clients in the real world of the insurance industry use this technology, what the business case behind it was, what the objectives were, the benefits, and how they developed it. In this particular case, this is a client who today is at about $4 billion in premiums, and like many of our clients and companies in the industry, was and is going through a tremendous amount of restructuring relative to organization, people, and products. At one time it tried to be everything to everybody; now it is trying to be very good with very few products targeted to a very specific segment of the P&C market. And distribution channels have been changed significantly. It has gone from 7,200 agents to about 3,200, and it is trying to have a more exclusive relationship with those agents, working only with the high priority-type agents, and reducing their distribution channel costs and approving the productivity of the remaining agents. This calls for a great deal of change. I think that's consistent with this firm as well as so many of the companies represented here in your clients.

With that as the structural background and the business background, the client in this particular case is the Executive Vice President of one of their personal insurance groups, and not a technical information systems person. He is a business marketing product kind of individual as opposed to technical. At the time, I guess Executive Life had about six processing centers throughout the country with about 450 underwriters in personal insurance, all of whom had in total responsibility about an $800 million book of business. And the average months of experience of the underwriters was 18 months. So you can imagine, if you were in the senior management group of this outfit, the concern you would have over, "How is Jim Greene as a 27-year-old, who has been here a year and a half, making risk selection versus another individual who's been here 20 months?" And they weren't sure there was the consistency. In fact, they were right. There wasn't the consistency because the project that proceeded this was trying to decompose on the expense side and the loss ratio side why they were having the kind of results that they were in automobile. One of the primary reasons was there was no consistency in the selection and evaluation of risk. We always have a very clear definition of the type of risk that we want, but a very inconsistent execution of trying to evaluate and select that risk.

Lastly, and this was a point I think I talked about earlier; experiment with this emerging technology in a low-risk and a low-cost environment. "Spend a couple hundred thousand dollars," was the attitude of this executive vice president, "to try to evaluate whether or not we really can get a significant return in a broader way once it's been implemented on

this emerging technology because too many of my peers in industry are trying it. And while I don't want to be first in, I don't want to be last in."

We spent a lot of time with this client up front, working with this individual and his management team to understand from their perspective the benefits they wanted to get out of the expert base system. And part of the reason why we hammered on them to do that is we thought it was very important to clearly establish the expectations of this technology that heretofore had never been used in this organization. So the benefits included the following: First, it was somewhat of crisis mentality. We need a quick fix to risk selection. We're not going to turn off the spigot, a new business, but we do need to have a better understanding of how we're assessing risk, with a new business as well as with endorsements. The second point is about changing philosophy from eligibility to desirability, and since we're in northern California, I can call this sort of a holistic approach to underwriting. But it is a very important point. I am not eligible if 21-year-old Jim Greene comes across two violations; that would be an automatic reject to this particular client. But I may be desirable simply because the firm has a relationship with my parents who have property insurance. My father might also be an independent manufacturer, so they might want to get some commercial or specialty risk. So there is a disconnect between desirability and eligibility. One of the benefits they wanted to accomplish from the expert base system was to get the knowledge of the experts who understood the difference in this expert base work station and have that be part of the selection process of new business and assessment of risk on endorsements. Lastly, reduce the expense and loss ratio.

Any time you take on a new technology, whether it be an application of artificial intelligence, whether it be image processing, whether it be DB2, regardless of the application, it's always very important to take somewhat of a phased approach. For those of you in the consulting business, you'll probably say, "Yeah, right, Jim. That's how you can get more work; you just phase them to death." It's not true. But in this particular case, you take the same approach to introducing a new product to the insurance community where you would first want to, in a low-cost, low-risk environment, prototype it, test it, feel what it's doing, how it's reacting, have very specific indicators of performance, measure it, monitor it. Then go to phase two after the prototype development, which is try it in a larger scale environment, and I'll talk about that in a minute. And then ultimately, if and only if it works and meets those benefits and objectives, implement it in what I'll call the production systems.

Remotely technical -- I'm trying to take away this magic, what this expert base system looks like in the flow of the underwriting decision. An application will come in, and in this case I'll call the expert system a workbench because indeed it is a set of tools that the underwriter will use to do his or her job. That information is scanned into the workbench, which is then drawing on a knowledge base. And the knowledge base is simply a collection, although it's a deal to try to get it in there, capturing the information. But it's simply a collection of rules and conditions, computations, mathematics, statistics that represent the best thinking of the particular expert or experts relative to risk selection, or whatever the decision is you're trying to make or the assessment and analysis that you're trying to conduct. Based on the application data that came off that application, based on the information resident in that knowledge base, all the rules and

conditions will do their "magic" if you will. The computer will go through the scorecard and say, "Age, given this age to that age -- what are the rules and conditions?" And the computer will go through several iterations to come up with a decision or recommendation, whether or not we should accept this risk, decline it or refer it. At that point then, the expert, in this case the underwriter, would make a decision to accept it, or to reject it. And that's what was happening in the prototype. We had no automatic rejects or accepts. And by the way, in the prototype, it was all with in-force business. We're not doing this with new business. It was all in-force business, so this was a very safe environment. And the reason we wanted the expert to continue to stay involved in this iterative process was that the expert would say, "No, the knowledge base that we have in there, the rules and conditions don't make sense. Let's fix it." So we would. We would update and refine that knowledge base. And a knowledge engineer is a fancy name for what historically we would call a systems analyst. But now these kids coming out of school say, "Well you know, I'm a knowledge engineer and I have my Econ degree from Stanford. That's worth another 10 grand, isn't it?" I don't think it is, but it sounds good.

Architecturally, that's what it looks like, and that workbench might be on a micro-computer, it might be on a terminal being driven by mainframe horse power, it might be a terminal driven by an AS400 mini-computer. We can get real technical. That doesn't matter. The point is, it is a work station supporting you as actuaries or you as underwriters or whatever your particular function happen to be.

A couple of implications for you. What I've tried to do is give you this 40,000-foot description and fly over an emerging technology, specifically expert base systems. Now what I'd like to do is leave you with the dos and don'ts if you will -- the message, if you decide to take it back to your clients or companies, as it relates to expert base systems and artificial intelligence. Never ever say "artificial intelligence." That got me in trouble with a particular client, in the sense that it took me two months to dispel the magic. I would instead say that this is a tool, with some technologies, some techniques no different than spreadsheets, no different than word processing software. It just is a different application. Don't get hung up on the words.

The expert is the key to success. Again, there is no magic. That knowledge base is populated by the expertise resident in the expert. And in our particular case, what we always ask for on these assignments before we help a client develop these prototypes is the best underwriter, the best actuary, the best whatever the function happens to be. We want the individual that if you took him off the line for two months, it would really hurt you from the standpoint of taking your best individual. And the reason we want the best individual should be obvious because that expert base system needs to be populated with the best thinking represented in the company.

Get data processing involved early for two reasons. You don't want to hurt their feelings. More importantly, you want the data processing professional to be thinking ahead six months from now about how he might integrate this actuary work station into the existing production actuary work stations and how all this information can be brought together. Early on address the integration notion. Manage expectations. Spend a lot of time up front making sure that your client and/or senior management of your respective

companies understand what they will and won't get during each phase of the whole effort.

And lastly, don't ignore the potential that this technology has. I just can't tell you enough. Granted, I'm prejudiced because I am in the Silicon Valley; I'm inundated with this stuff all the time, but I also help clients introduce and implement this technology. Many companies in the insurance industry in the 1980s went from saying, "I don't want to look at this technology" to being dabblers where many have successfully integrated it into their production systems as they develop new products, conduct decision-making types of activities, and try to successfully compete in the 1990s. So don't ignore it. And the reason I don't want you to ignore it, is with all those factors that I talked about earlier in this presentation, all of those represent a significant amount of change that all of us and all of our clients and your companies need to deal with. Information systems and emerging technologies like expert base systems represent one area, one component that can help you try to take advantage of the opportunities that are certainly represented by change, but at the same time, try to mitigate some of the threats that certainly exist and will continue to.

MR. AFFLECK: Jim, on behalf of us all, I'd just like to thank you and say I think it's obvious that you're a leader of the pack in your field, and we appreciate you coming across the street to be with us.