

SMART PEOPLE, SMART IDEAS AND THE RIGHT ENVIRONMENT DRIVE INNOVATION

RTM interviews Craig Barrett on innovation, investment and international competitiveness.

Craig Barrett

OVERVIEW: *Recessions are difficult times. Companies respond differently to them, especially in the ways that they manage R&D. Intel's recently retired chairman, Craig Barrett, has been an outspoken advocate for continuing investment in R&D, telling Fortune magazine, for example, that "you can't save your way out of a recession; you can only invest your way out" (May 25, 2009). Anxious to explore how the semiconductor giant has managed to accomplish this, RTM editor in chief Jim Euchner spoke with Barrett about innovation, investment, Intel, and international competitiveness.*

KEY CONCEPTS: *R&D management, R&D policy, innovation, Moore's law, Intel.*

Craig Barrett retired as chairman of Intel Corporation in May 2009. He joined Intel in 1974 as a technology development manager and became the company's fourth president in May 1997, chief executive officer in 1998 and chairman in May 2005. Following graduation from Stanford University in 1964 with a Ph.D. in materials science, he joined Stanford's Department of Materials Science and Engineering, rising to associate professor. He has served on numerous boards, policy and government panels, including the National Academy of Engineering (past chair), the Board of Directors of the U.S. Semiconductor Industry Association, the President's Advisory Committee for Trade Policy and Negotiations, the National Governors' Association Task Force on Innovation America, and the United Nations Global Alliance for Information and Communication Technologies and Development, which he chaired until June 2009. He has authored over 40 technical papers dealing with the influence of microstructure on the properties of materials, and a textbook on materials science, Principles of Engineering Materials.

EUCHNER: *Many people use Intel as an example of a company that separates itself from its competitors by investing in innovation and R&D, in good times and in bad. What drove your decisions to invest, and how you did you deal with the reactions to those decisions?*

BARRETT: If you could look back in time, there's a guy by the name of Gordon Moore who was the founder of Intel. And Gordon has a law named after him: Moore's law.

Moore's law is really the roadmap for our industry. It's the roadmap for competitiveness in our industry. There's a new silicon process technology cycle every two years. There are new memory densities every two years. There are new microprocessors every few years. There's a new *everything* every couple of years.

Gordon coined a phrase many years ago, because our industry has probably been through more recessions than just about every industry around. I think in the 35 years I was at Intel, I went through 10 or 11 recessions in our industry. Very early on, Gordon said, very simply, "You can't save your way out of a recession. You can only invest your way out of a recession."

And what he meant by that is simply that it's new products and new technology that create the *demand* for your products. Unless you have new technology and new products, there's no new demand. So the only thing you can do in a recession is, in fact, to continue to invest and create exciting new products. And then that creates the follow-on consumer demand for those products.

We have followed Moore's law in the highest sense and then we have followed Gordon's advice at the detailed level, which is that you continue to invest in a recession. We've never slowed down the R&D investment. We've never slowed down our pursuit of Moore's law, even though some of our competitors have complained that

it's too expensive to continue to chase it and asked, "Why don't we slow down and get the benefits of our past capital investments?", and things of this sort. We always say, "No, no, no. Let's just continue to run at 200 miles an hour. Let's continue to chase Moore's law." That gives us a competitive advantage. If the competition doesn't like it, they get left behind.

The Corporate Executive Board surveyed 60 companies recently; 45 percent had cut R&D spending in this recession and 60 percent had cut full-time equivalents in R&D. So a lot of companies aren't following Moore's advice in that way. Why do you think that is?

In a sense, we are probably an extreme case in terms of the importance of technology and R&D, so we may be a poster child for this. But I have to admit that in all of the years that I was a decision maker at Intel—and I'm not anymore; I'm retired, so I can look back and talk freely about this—the financial community always felt that we were crazy to continue to invest heavily in capital and in R&D.

The dot-com bubble burst in the fall of 2000. We continued to invest heavily in '01, '02 and '03 in capital equipment and in process technology and new products. Ninety-nine percent of the financial analysts who followed our industry said we were crazy—we should cut back; didn't we know we were in a recession?

There was one day, I think in early 2004, when the market kind of turned, and they all said, for about a microsecond, "Oh, you know, in retrospect, those Intel guys did the right thing." But they forgot that the next day. They started criticizing us for something else.

I believe a lot of the press and the analyst community, who have never run a company, react when they see a recession—they think, "Save. Cut expenses. Have layoffs." That's all they know. That's kind of the classic textbook approach.

We are not classicists in that sense. We just said, "Hey, we know our industry. It's new products that make the clock go around. It's new products that make us competitive. It's new products that give us an advantage in the marketplace." And, therefore, we don't slow down.

Now, if you make cereal or something like that, then you might say that innovation and R&D are less critical for your products than in the semiconductor and computer industries. But I believe the 21st century is the century of innovation, that innovation will define corporate and country competitiveness. And there are only three things that drive innovation: It's smart people; it's smart ideas; and then it's the right environment that the government sets for innovation. The smart ideas come from the R&D budget, and the government sets the environment with tax rates, with regulations like Sarbanes-Oxley, with laws for intellectual prop-

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erty protection. The environment either promotes or discourages investment.

These are the only three levers you have to pull: smart people, smart ideas and the right investment environment.

When you were making these investment decisions at Intel during recessions, did you do anything differently in the way you managed R&D or investment projects?

The major thing we did was to modulate the total capital investment, because you have to invest wisely, obviously, and so you invest for what the demand is for your products. And if the demand for existing products modulates somewhat, then you modulate your total capital investment.

The thing we did *not* cut back on was the investment in new equipment for the next-generation technology. It takes us about two years to build a new factory or convert, say, a manufacturing line from an older technology to a new one. You are always making decisions two years in advance of when you need that capacity or capability. We always looked at the long-term trend of our industry. It was a growth trend. Still is.

We would always say, "Hey, it may be tough today, but in two years we will probably have recovered from this recession. We'll need this capability and capacity, so let's just tighten our belt and make the tough decision and invest." That's the thing that the press and the analyst community, I think, have a tough time swallowing, that in the midst of a real downturn they ask, "Why in the world are you building this new multibillion dollar factory. Don't you know it's a recession?" We say, "Yeah, we do."

You are simply willing to weather the storm of Wall Street, basically.

Yes, you have to have a little bit of a thick skin.

Did you do anything differently in terms of prioritizing the R&D portfolio or accelerating programs or managing talent acquisition during the recession?

Even during recessionary periods, we were still bringing new college graduates into Intel.

You always look for opportunities to pick up unique talent. Even during recessionary periods, we were still bringing new college graduates into the company. So, again, we place such a high premium on the “smart people” aspect of the innovation equation that we just look for the best talent everywhere in the world and try to hire them, almost regardless of the current economic environment.

Did you scrutinize the time frames of the R&D program? Many companies will shift the focus to shorter-term payoffs.

We have multi-generational product and technology programs. And at any time we have a couple of generations of new microprocessors under development and we have a few generations of the next transistor under development. Those programs are multi-generational and ongoing, so you don’t really do much to them.

Of course, you do all of the routine things, like you scrutinize all of the products you’re investing in, but that’s a program you should be doing all of the time, anyway. You check to make sure that the products have the right specifications for the market and that your development programs are on schedule. You make sure that you have the right resources in place and that you’re in tune with the market and how the market is changing and how that can influence your products. But that happens in good times and bad times.

It makes sense. During the recession, did you have to cut other parts of your business, even while you were maintaining the R&D investment?

Oh, yes. The manufacturing part of the business, for example. Again, if the demand gets moderated in a recessionary period then you can and should moderate the production capacity, especially for existing products. In fact, in this last cycle, we saw a decrease in demand for existing products. We closed a couple of older factories as a result. Our factories have a finite lifetime, and there are good times to close them and bad times to close them. A recession is typically a good time to close them, because you’re moderating your overall manufacturing capacity.

So you always look for those opportunities. But they’re driven primarily by the lifetime of your factories and by whether it makes sense to either close the factory or perhaps shut it down with the hope of reopening it or upgrading it at some later date. But we would typically moderate our manufacturing capacity during a downturn, and that would allow us to cut expenses there. And you look for cutting expenses in other areas, your support areas, whether it be finance or HR or sales or marketing or something of this sort. But the R&D budget is typically the one that’s sacrosanct.

How do you manage the tension within the organization if R&D is perceived as getting a pass on the tough times.

Do you have that problem, or is it just a different cultural environment at Intel?

I think our employees all recognize that our competitiveness in the marketplace is directly proportional to the quality of product development, the quality of the ideas that we develop, and therefore the R&D organization. We *are* Moore’s law. There’s no easier way to describe it.

And we either follow Moore’s law—that is, we double capacity every 18-24 months in computer memory, microprocessors, transistor performance, whatever it is—or we’re dog food. Everybody in the company understands that. And they understand how important R&D is to our future.

We’re a big manufacturing company, and we recognize the importance of manufacturing. We’re a big marketing company, and we recognize the importance of marketing. But manufacturing and marketing don’t work unless you’ve got great products and great technology. Everybody in the company understands that.

I’ve never seen any animosity or sibling rivalry because we continue to drive the R&D budget.

Let’s switch now to the role governments play in creating an environment for innovation through investments in R&D and in education. This is something you feel fairly passionately about.

Yes, I do spend a lot of time talking about innovation and competitiveness and what countries can do to foster it. I only wish the United States was higher on my list.

Do you feel that the U.S. is on the right track with some of the recent changes included in the stimulus package?

A bit. The great bulk of the stimulus package is in the general category of asphalt-ready projects or preserving existing jobs. All you have to do is look at the auto industry and look at where most of the stimulus dollars are

going, and they're not going for anything new. They're going for the creation of today's jobs. Some countries, I think, are pretty aggressive with their stimulus packages and are really looking forward, into the windshield of the 21st century. I believe the U.S., by and large, is still looking in the rearview mirror and trying to preserve what was, not trying to create what could be.

What recommendations do you have? The tradeoff is the same one that companies often face: how much do you deal with the here-and-now and how much do you invest in the longer-term future?

Several years ago when the National Academies of Science, Engineering and Medicine put out the report *Rising Above the Gathering Storm*, it had a prescription for what the U.S. should do to be competitive in terms of investing in R&D, investing in 21st century infrastructure, investing in really improving education. There's something like \$100 billion being touted as available in the stimulus package for education, but most of it is just going to supplement local tax revenues for the existing education process.

The U.S. hasn't really done anything dramatic to improve K-12 education, to raise the standards. There's some talk of that today, but we are still pretty mediocre by OECD standards or by the standards of any industrialized nation in the quality of our K-12 education.

What about the increases in investment in the research arms of the federal government, for example, the budgets for the National Institutes of Health?

One of the primary calls for action in *Rising Above the Gathering Storm* was doubling the U.S. basic research budget over a period of five or seven years. By the way, that call has been out there for well over a decade, and it's not a Republican or Democrat issue. But Washington D.C. operates on a two-year election cycle. Basic research budgets do not give a return on investment in a two-year cycle; consequently, the basic R&D budget has been shortchanged consistently, whereas billions of dollars have gone into other pork-barrel projects and earmarks, because they are instantaneous, here-and-now. "Here's the bridge; here's the building; here's a section of highway. Here's something I can point to and get re-elected." It's very difficult to point to a basic research project that may not bear fruit for ten years and say, "Re-elect me because I supported this."

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The 21st century is about looking forward; it's not about looking backward. It will be about those who are investing in the future. Look at some of the stimulus packages around the world. The Australians, for example, are investing about \$20 billion to put a fourth-generation broadband wireless infrastructure throughout Australia. The U.S. has allocated, I think, about \$2 billion to bring broadband wireless to areas that don't have it to date.

What we're doing as a country, the magnitude of the investment, just pales in comparison to what Australia, a country one-tenth our size in terms of population, is doing. Or look at what the Chinese are doing in terms of putting next-generation infrastructure in place, whether it's a high-speed rail infrastructure or promoting the spread of the Internet and the spread of computers to their general population to get themselves ready for the 21st century.

I just don't see a parallel to those programs in the U.S., even though we are allocating untold hundreds of billions or trillions of dollars to stimulus. I don't think we'll come out of that with the infrastructure that gives us a competitive advantage. We're still stuck in this kind of two-year cycle. "What have you done for me yesterday?" not, "What are you doing for me the next five to ten years?"

That's a serious issue. And I do appreciate how much you and people like Norm Augustine are doing to make that issue visible. Thank you very much.

My pleasure. ☺

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