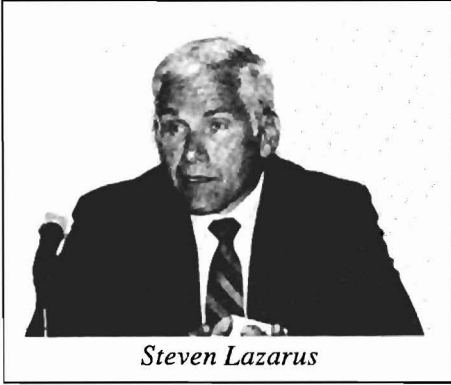


Steven Lazarus



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In order to adapt to the thematic challenge that we were given, I have decided to give this presentation in German, and it's title is, *Untergang des Abendlandes*. That is all the German I am going to use. I'm sure you will be relieved. Some of you may recognize that title. It is the name of a book by an Austrian author/academician of dubious academic reputation from the mid-1920s. His name was Oswald Spengler, and it translates as

Decline of the West. I was struck by that title when I recently read a book by Paul Kennedy called *The Rise and Fall of the Great Powers*. I was prompted to observe that in my lifetime, or at least starting shortly before my lifetime, in an absolutely rhythmic 20-year cycle, there have been books about the profound implications of the decline that Western civilization was going through. We can trace this cycle by starting with Spengler. Then, in the 1940s, there was Arnold Toynbee and *Civilization on Trial*, and then when I was in graduate school in the 1960s, there appeared a very interesting book by Professor and Mrs. Professor Meadows, called *The Limits to Growth*, which was a linear extrapolation of consumption of resources suggesting that we were going to run out shortly after the turn of the century. And now, almost 20 years later to the day, comes, not only the Kennedy book, but something much broader than that, the "School of Decline," as the *New York Times Magazine* put it recently. Moncur Olson, David Caleo, and others, are writing about the same theme: As in 16th-century Spain and 19th-century England, we in the United States have gotten ourselves into a posture of what Kennedy calls "imperial overstretch." Even the jacket design for Kennedy's book shows a John Bull character down the negative side of a mountain, while Uncle Sam is stepping off the mountain, heading for the negative side, and an easily identified oriental gentleman is about to assume pre-eminent position on top of the mountain.

This provides an academic backdrop for the subject of international competition. As Peter Peterson, the former Secretary of Commerce, former head of Lehmann Brothers, and current head of what is called an investment banking boutique in New York, has written in the *Atlantic Monthly*, competition is used to justify everything from the 65-mile-per-hour speed limit to certain aspects of the Strategic Defense Initiative program. Competition is one of those words that has been adulterated by overuse. Anyone who has served time in Washington, D.C., knows that occasionally one of these words will emerge and everybody will grasp it as a justification for their resource concerns. At the time I was in Washington, the leading concerns were the environment in the late 1960s and the energy crisis in the 1970s. But on this occasion, I think there is something to the idea of competition, and I'm a little sorry to see it going through such depreciation through overuse.

We are the world's greatest consuming economy. For a long time, our industrial enterprisers enjoyed a degree of success that finally led to what I think is an expanding degree of failure. Let me illustrate what I mean. In the automotive industry, it's been generally acknowledged that market studies were done by the folks who lived in Grosse Point talking to the folks who lived in Bloomfield Hills. They managed to confirm what each other thought: A very large car's enforced obsolescence was the wave of the future, just as it had been the wave of the past. By focusing narrowly and inwardly, we began to insulate ourselves from the flow of information, the kind of information that Joel was talking about before.

Meanwhile, in the last 10 years, we have seen the emergence of another economy, Japan, which is exploiting the myopia that we have exhibited for a period of time. Probably the most poignant example of that is the oft-cited VCR. The only reason I mention it again is because it's such a quintessential example of what happened. VCR's were beautiful technology developed by Ampex, an American company, available to RCA and other large American companies, but seen as applicable only to a narrow niche market in broadcasting. RCA chose to chase an alternative technology, the videodisc, which was ultimately written off as a \$500 million failure. A number of Japanese companies, upgrading VCR technology through something approaching 10,000 patented improvements, ultimately captured the entire market. Last year in the United States, we bought 12

million VCR's, most of which were manufactured in two plants in Japan. As a matter of fact, I stood at the Sanyo plant and watched one of these CIM processes produce VCR after VCR, some being labeled Fisher, some being labeled Sanyo, some being labeled Phillips. That example extends to any number of technology-based industries.

It's foolish and not useful to conceive of the Japanese as muscular economic giants before whom we are helpless. If one had another half hour, one could inventory and contrast the relative strengths and weaknesses of the two economies and the two societies and make a pretty good case for the pluralistic, innovative approach that we take, even though we have greater difficulty forming into consortia and doing things the way MIDI is approaching superconductivity ceramics.

But it's worthwhile examining how the Japanese do it. I know you've been exposed to these torturous examinations of how the Japanese do it more often than you care to remember, but I want to cite three examples of the Japanese approach and then base my further remarks on them. If any of you have ever visited Tsukuba City, the Japanese science city near Tokyo, you will recognize it as the location of one of the major new superconductive-ceramic laboratories. There a combination of MIDI and other Japanese government agencies and upwards of 20 of the major Japanese companies are pulling together a set of financial resources and a set of scientists from both the public and private sector to pursue this new, seminal technology. That is only one of several such laboratories being developed in Japan. A recent British survey team reported on what they saw in Japan in February and March. Their report suggests that the combination of public and private investment in superconductive ceramics in 1988 is going to be about \$100 million. Every time I see an estimate like that, I double it. I think that's a conservative view, because there is usually a hidden resource commitment going on as well. Furthermore, the Japanese investment in superconductive ceramics is being ramped at what I estimate to be about a 45- to 50-degree angle. That's an example of the Japanese ability to marshal resources and focus them on a particular technology.

Then there is the Japanese approach to patents. They now represent, by themselves, about 19% of the patents issued by the U.S. Patent Office. Canon, a single company, is up to about 1000 a year. Meanwhile, General Electric has declined from about 800-plus per year to the high 700s per year. That is an in-

dicative example of the Japanese movement into protecting technology in the U.S. market.

Finally, there is comparative education, which may not necessarily be the text for this particular meeting or this particular group, but it is the aspect of the competition that worries me the most. We have, at the University of Chicago, a program, which has been going on for about five years, to develop a brand new mathematics curriculum for kindergarten through twelfth grade. That product is new. It is a complete departure from the curriculum development that has been going on in the U.S. public schools for some time. In the course of doing that work, the Japanese and Soviet curricula were translated. When one compares the objectives of the Japanese and the Soviet curricula in kindergarten through second grade and the current standards in the United States, you find, for example, the introduction of negative numbers in the Japanese kindergarten where, in the United States, closure on the concept of adding two numbers is not aimed for until the fourth grade. I could relate example after example of this kind of disparity. You've probably all read the statistics on how we do in comparative contests among our advanced-placement physics, chemistry, and biology students and the advanced-placement students from 15 other Western countries. We come in seventh here, ninth there, dead last in biology.

Helmut Schmidt, the former German Prime Minister, once ended a speech by saying, "Technology is the answer," and then he paused and said, "What are the questions?" It was a provocative ending. I believe that technology is one strong response to this competitive situation. We have the natural constituents in our economy and in our society which can be marshaled to allow us to be a lean and muscular competitor again. But we are doing an indifferent job of marshaling those elements. We as a nation spend about \$120 billion on R&D. There's a strange symmetry, in that about half of it is channeled out through public institutions like Fermilab or Argonne or any of the other 700 or so national laboratories, and through research funded by the National Institutes of Health (NIH) and National Science Foundation (NSF) on campuses, and about another \$60 billion through the private sector. Even though there is a lot of debate about too much of it being channeled into defense programs, in total we certainly have a higher absolute commitment than any other nation in the world.

But what we've been seeing is pressure and decline in the private sector. From the perspectives of both my previous life as a research and development executive for a major health-care and biotechnology company and where I am today, I see a drawing in of the junction or docking points on the part of private industry - the closing of the central labs. Probably the most poignant example of this was GE acquiring RCA and giving away the Sarnoff Labs. I think nothing better demonstrates the phenomenon I'm talking about than that. That drawing in is happening throughout industry in many different places, and it creates a vacuum. What is occurring in a sputtering and groping and stumbling way is the beginning of a reaching out by public-sector technology toward industry to try to fill the gap that has been created by the industrial recession that we observed.

That reaching out has created several issues which I'm just going to touch on, because each one is worthy of a session like this. It has created the issue of what is starting to be termed "academic capitalism" or "laboratory capitalism." On the one hand are the institutions that have, over the years and decades, defined themselves as places that seek new knowledge, that freely disseminate new knowledge, that want to do good science, and have individuals looking for academic prizes or publications or seeking the high regard of their colleagues. Trying to reconcile that culture with the needs of an industrial enterprise that wants a certain amount of proprietariness and a certain amount of secrecy is a major issue. That issue is one that will grow in scope and tend to be exacerbated over time as we do more and more to organize and discipline our efforts toward technology transfer.

It is against that background and within that environment that the trustees of the University of Chicago, the contract manager for Argonne National Laboratory, created a mechanism called ARCH. I conceive of ARCH as being an experiment, because there is no protocol for it, and no blueprint. I've crisscrossed the United States looking for similar institutions whose work I could study in order to get an indication of how well they did or didn't do, but I found very few. I found quite a number of university-research and technology-transfer licensing organizations, but ARCH is only partially that. The mandate that ARCH has received from its Board of Directors is to be an enterprise creator. The main thrust of the work of ARCH is to create companies. ARCH also has a

certain amount of geocentricity in that, wherever possible, ARCH wants to help create companies within a region defined by a radius of 50 miles around the Sears Tower. That's a different kind of organism. That's much more like a venture capital partnership akin to the 120 entities living along Sandhill Road on the border of Stanford University. Those entities are constantly going out and finding technologies within the university and putting them together with very-early-stage capital, and then finding management and creating things like Apple Computer and Genentech.

ARCH is some odd combination of the two, and it's very strange to try to reconcile the demands of each. ARCH is independent. While it's a creature of the University of Chicago, it is not part of the University of Chicago organization. It is wisely not-for-profit. I say wisely, because there was a debate at the outset of ARCH's creation over whether or not to make it a for-profit organization. What I found in the year-plus of ARCH's existence was that if one wants to operate within the cultural context of a university and a laboratory, it is much wiser to be not-for-profit. Oak Ridge National Laboratory, as you may know, is managed by Martin Marietta, a for-profit organization that has approached the same set of issues with a for-profit mentality. They have gotten severely entangled with certain skeptical congressmen and the General Accounting Office.

In addition to the twin missions of enterprise creation and regional development, and the schizophrenia of being a licensing organization as well as a business-creating organization, ARCH was fortuitously placed within the Graduate School of Business at the University of Chicago, of which I am also the Associate Dean. This has permitted a flow of, at this point, about 45 business-school graduate students who work with us on an unpaid basis, investing 10 to 20 hours a week, pioneering and prospecting in the divisions of biological and physical sciences at the university, and all the various departments at Argonne. It has allowed ARCH to become aware of new discoveries well before one day before the publication date, which is when one used to hear about them. Furthermore, it gives us the opportunity to do some competitive market analysis and embryonic business planning. The enthusiasm, energy, and activity of the graduate students has been one of the joys of this work and probably is a phenomenon, part of a model that could be picked up and used at other places around the country.

Just a few final comments about the future, since we appear to be in the business this afternoon of predicting the future to some degree. There's an interesting debate going on right now in the pages of the *Harvard Business Review* between George Gilder and Charles Ferguson. Gilder contends that we are entering the time of the small. It's a philosophical position that is resonant with the point Joel Goldhar made about economic order quantities of one or the ability to tailor production to the individual unit. As I wander around the country, I see this new emphasis resulting in a resurgence of economic activity in areas where one might not have expected it, such as western Pennsylvania and eastern Tennessee. It takes the form of a lot of new enterprise, small companies with very flat organization forms where the executives in the company are wired together electronically and there's no four- and five-person tiering in order to get management communications up and down the organization. For a long time, additional manufacturing employment in this country has come from this type of company as opposed to the very large company. I find that encouraging. Gilder calls it the time of the microcosm. I think that dresses the idea up a little too much, and yet, I think there is something to the idea that the information revolution also creates a platform that allows this to take place and be powerful.

One of the continuing problems, however, is the absence of slack, the absence of docking sites between university and laboratory technology, and industry of any kind. The small entrepreneurial organization and the large corporation are extraordinarily busy. They may not be busy on the best things, but there are very few people who exist to prospect in the public sector for technology and find ways of bringing it in. So we are gropingly bringing technology out. The problem of interdigitation between technology driven out of the university and the laboratory and what is sought or demanded by the industrial enterprise is extremely different. It's like trying to build the transcontinental railroad blindfolded.

Finally, there is the problem that Peterson underscores over and over in his paper. That is the problem of moving a consumptionist society toward, or returning to, an investment society with a higher savings rate and a renewed national political commitment to invest rather than consume. If there is a political issue for our time, I think that is it. It underscores or affects anything we will try to do in this area of moving technology into effective use in the economy. If we fail at that, then all the work of all the technology transfers in the world is going to go for naught.

