



Stanford eCorner

Copy Exactly: Establishing Competitive Manufacturing Capabilities

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Intel was a marvel at technology and invention from its 1980's-era inception, recalls former Chairman of the Board and veteran company insider Craig Barrett. But the company's strong suit was not manufacturing; in fact, they were often undersold on their own products by Japanese competitors. To improve their skills in this arena, Intel executives performed significant benchmarking of their overseas product producers, and a decade later they'd learned to standardize production across multiple factories.



Transcript

I mentioned before that when I joined Intel it was populated by a lot of physicists and chemists and engineers in general. And they were great technologists and they invented all sort of new circuits, new devices. But frankly, we in the initial stages of the company, were not very good at manufacturing devices. We were great technologists and we would bring new circuits into the marketplace. And we'd make a few of them and we make some money on the first few that we sold. Then, other people would come along and manufacture them and give us stiff competition. And the only way we were able to survive is continue to go to the next generation of devices, the next generation of technology. And the Japanese-based companies were especially competitive in this respect. They had really learned how to manufacture in volume and were very cost effective and high quality in their manufacturing capability. In fact, 20-25 years ago in the mid-1980s, we were at a timeframe when the Japanese-based companies - NEC, Toshiba, Fujitsu and others - were really, if I can use an indelicate phrase, "kicking butt".

They were really taking it to the American manufacturers. And companies like Intel were in serious trouble at that time. In fact, I can remember very specifically a time frame when many noted academics; I don't think any here at Stanford but certainly a lot of Harvard and on the East Coast, were telling us at Intel, "You guys are crazy to be in the manufacturing business. You ought to just design circuits and leave the manufacturing to someone else because you will never compete with the Japanese-based companies." And that was in about 1984 or '85 that this pronouncement was made. It also is when companies like Intel were starting to lose money because we could not adequately manufacture devices. So, our company was, as they said, in serious decision at that point in time. What do we do with our future? Do we follow this academic advice and get out of the manufacturing business and just become a designer of circuits? Or do we in fact try to become a manufacturer? We actually chose the latter approach. And I can remember leading airplane load after airplane load of our executives and our people to Japan, touring Japanese factories, talking to them about manufacturing technology, seeing what they did on their manufacturing floor. And after about two years of that, we went into a huddle and concluded that they weren't doing anything very sophisticated or anything very secret. They were just applying good engineering principles and engineering discipline, statistical principles and statistical control discipline.

And they had set a series of high expectations on what manufacturing lines could produce. So, we came back to the US and committed ourselves to that, trained the entire company on statistical process control, design of complex experiments, all those sort of things that are good engineering discipline but were lacking on the manufacturing floor. And by 1988, '89, 1990, we had improved the situation quite dramatically. And probably one of the most proudest moments in my professional career

was when, after having visited Japan about 20 times to learn how to manufacture in the mid 1980s, we had a constant flux of Japanese executives to Intel headquarters to see how we were manufacturing in 1990. We had completely turned the tables. So, that's when really the company became, I think, noted as a manufacturing powerhouse of sorts. But it was really the application of engineering discipline and engineering principles to the manufacturing floor, and it was not the sort of thing that the scientists and engineers automatically bring with them out of school to our manufacturing floor. But we'll get a little bit to that later on. One of the topics that we became known for was something called "Copy Exactly". The fact that we had half a dozen big manufacturing facilities and each one of them had a plant manager and each one of them was really king of their domain or queen of their domain, looking at the audience.

They had absolute rule over what went on in their manufacturing plant. It was a little bit like a department head here in the School of Engineering; I presume that you have absolute rule over what goes on in your department. Audience 1: Of course. Craig Barrett: Of course. At least you think you do. But the problem we had was we'd have these six manufacturing plants nominally running the same technology with different sets of equipment, different processes, different recipes. And if you ever try to move a product from one plant to another, it was next to impossible. None of the plant managers were willing to give up their autonomy or their control. I actually remember a meeting that we had one day. There were 21 senior manufacturing executives of Intel.

I was running manufacturing at the time when I called the meeting. And I projected that we would change the way we would do business in the future. Rather than having independent factories, we would have very closely linked factories. Every factory would look the same. We would run the same recipe, have the same equipment. And I was basically telling the managers who were there that I was taking a lot of their authority away from them. One of them raised his hand and basically said, "You know, this is a different style of management you are suggesting, Craig. Do we get to vote on it?" And having counted the number of participants in the meeting, 21 as they walked in the room, I said, "Yes, we're going to vote but I have 22 votes." And that's how this concept which has given some notoriety, called "Copy Exactly", which is every one of our factories today looks the same, has the same paint, the same tiles, the same air conditioning, the same equipment, the same recipe and they all operate absolutely identical. It drives a lot of our people nuts because they think that you should be allowed to twist knobs to optimize at the local level as opposed to running a common recipe across the board. But we do it the McDonald's way.

If you go to any McDonald's around the world, the French fries all taste the same. If you come to any Intel facility, our products behave the same and manufacture the same. We can easily transmit them from one area to the other.