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**WILLIAM
BONVILLIAN:**

All right, let's jump ahead here. Let me talk a little bit about manufacturing in general, and the competitive challenge for US manufacturing. So the 1990s, manufacturing was 30% of US economic growth. And it had manufacturing at two times the productivity level of the services sector. So manufacturing almost invariably has a much higher productivity level than a services sector. US is 80% services.

So if you really want a high productivity growth, manufacturing is a way of scaling goods and affect product quickly. Service sector scale much more slowly because they're more face-to-face. So you probably want a significant component of your economy in something that scales and it introduces productivity effectively. And that tends to be manufacturing.

So manufacturing is also traditionally higher paying jobs. In 2001, they were 23% higher than the services sector. The ratio is not all that different today. Manufacturing is an important part of the US economy. It's about 12% of GDP, and it funds 2/3 of industrial R&D. It funds 3/4 of industrial research and development, and about 2/3 of overall US R&D.

And manufacturing firms account for a greater percentage of real GDP than all these other kinds of sectors. So it remains a very significant player, but it's also a big enabler for the other sectors. So manufacturing jobs-- and there's a lot of debate as to what the multiplier is-- differs from sector to sector, but it is the biggest job multiplier in our economy. In other words, a manufacturing job tends to create additional employment in the kind of value chains that it's connected with in the services sector, and supplier sector, and resource sectors.

So the US has been running frightening trade deficits in manufactured goods for a significant period of time. And it began under President Nixon, and has continued to grow since then. The most problematic number is the trade deficit the US has in advanced manufacturing goods-- in other words, complex high-value goods. The US is running \$100 billion trade deficit in those goods. So the theory that we'd seed low-end production but make it up by retaining high-end production, it's not working.

And manufacturing job loss has a pretty painful history. 2.7 million jobs were lost in that 2000 and 2003 recession-- 5.8 million jobs between 2000 and 2010, the majority of those focused on that 2008 recession. In that 2000 to 2010 timetable, we shut down about 62,000 factories net. The US has been moving its percentage of manufacturing employment ever downward. So we're at about 8% of US employment is in the manufacturing sector.

Other countries don't do that. So Germany employs about 20% of its workforce in manufacturing, Italy 19%, Japan 22%, South Korea 31%. In other words, manufacturing is a source of higher wages and it's a job multiplier. You can see some of the potential competitive advantages for retaining a substantial manufacturing sector. So those are kind of background points. Let me do a couple of pieces now.

I'll do Glenn Fong and Linsu Kim. So Glenn teaches at Thunderbird in Arizona, which is a very fine school for international business. And he wrote a piece in '98 about what was happening in Japan in that time period. So Japan is on a complete take-off as a leading world economy until the 1990 frame, and then it misses the IT innovation wave, as we discussed earlier. And it starts to have to reorganize and rethink its innovation system.

So Glenn argues that there are essentially three historical stages to Japan's competitive pattern. So first, it was the pursuer after the pioneer-- the US being the innovation pioneer-- then it's a follower right at the frontier with US, and then it becomes a world-class competitor. And he argues that, as Japan became a world-class competitor, it had to rethink its more centralized organization of its innovations.

So the old thesis about Japan, Glenn argues, is that it was focused on national industrial performance and a corresponding competitive balance between nations based on national industrial performance. And it was set by political economies really operating at the national scale, but at the governmental scale with a strong governmental role. But then a more pragmatic approach has to evolve.

So MITI, which I mentioned earlier, was the key organizing institution around getting collaboration between government and industry, and setting industry agendas in Japan. In its older period, it would set technology initiatives that were selected by high-level governmental leaders, including at MITI. And then in a more recent period, it's had to move towards technology initiatives that are really selected by industry.

In other words, at the frontier, the ability of government to pick the technology menu becomes

more problematic. You've got to get that down to industry decision makers that are much closer to markets and much closer to the innovation system itself. And that has evolved in Japan, that high officials just can't keep an eye on the rapidly evolving complex technologies.

So that's technology initiatives. Then there was technology targeting. In the old period, there was direct government targeting of one or two specific technologies that we're going to be pursued by the government. And the funding was at the late development stages. Government funding was focused really on advanced prototyping and engineering development. That's where the government support was going.

In the newer period, Japan shifted towards more fundamental research funding, along with it's applied, to put a broader range of technology alternatives onto the table. As Glenn characterized it, it moved to a kind of shotgun approach, not a more narrow rifle shot approach. And then finally, industry targeting.

In the older period, MITI would actually pick winning companies. It would decide who's going to win, designating specific companies for funding. And it would attempt to influence corporate mergers and consolidations to develop strong companies. So it's intervening at the company stage pretty systematically at critical areas.

In the newer period, MITI became much more collaborative. And it's funding a range of companies and a range of collaboration models, not attempting to target particular surviving firms that are winners. So in the computing area, for example, MITI goes from funding three firms over a 30-year period to 25 firms at the end of that period.

So it's moving towards a system that is less centralized and more reflective of the industry leadership, and away from an interventionist government role. So that's kind of interesting. Japan gets to the innovation frontier through a significant governmental role. But when it's at the frontier and it's truly a world-class competitor, it's got to develop a much more decentralized approach that allows ideas to rise up from that system.

So that may be an important organizational model for us to consider. That organizational model, of course, is more like what the US had on. Now, let me put Linsu Kim into this mix too. And his book *Imitation to Innovation* is a classic in looking at the amazing evolution of Korean economy. The thing to understand about the Korean economy is that the country was just totally destroyed and ruined by the Korean War. And every inch of that nation was fought over a multi-year period, and nothing was left standing.

It's a complete tragedy, and the population is completely disrupted. It's forced to move all about the country. Families are disrupted. Communities and villages are completely disrupted. It's all thrown together, and it's truly tragic. And yet out of that tragedy is one of the most remarkable stories of industry scale up and growth, and growth of the country that-- it's an amazing story. And essentially, in a 30-year period, to construct an economy out of literally nothing that's right at the frontier, it's pretty amazing.

So what's behind this? So in the 1960s period, Linsu Kim argues that Korean firms are on a-- what he calls a leadership trajectory. And the government is on a model of what he calls forced march industrialization. The government is supplying education through college. On the demand side, it's creating chebols, which are somewhat akin to the keiretsu model we were talking about in Japan. In other words, these are major industry leaders.

And the difficulty in this mix, in the government of the time, was its corruption. And this is-- Korea's is still in the hands of a dictatorship with corruption problems. And problem with corruption is it creates tremendous uncertainty in your business. That was kind of a difficult factor, but nonetheless, the government was playing a key role in pushing these major companies on a march to a strong international role.

AUDIENCE: Could you clarify what you mean by corruption creates tremendous business uncertainty?

WILLIAM BONVILLIAN: You're not competing with other firms based upon your superior products and your superior ability to manufacture. Suddenly, a wild card is thrown into the mix and you've got to cope with the government, and buying off the government, and buying government support, if you want to stay ahead. So it creates a whole new variable that's much less-- that can't be managed by your business processes and systems.

So that's why when we read the *World Economic Report*, that's why corruption was actually one of the factors that was considered in the strength of your economy because it can be so disruptive of the ability to have a reasonable and fair competition system. So the chebols, to go back to our discussion-- that chebols were key to building and capturing these large-scale industries.

Now, Korea, when creates these major companies that dominate industrial sectors, they tend to block entry by small and medium-sized enterprises. So Korea, at the same time, is not creating a system of strong, small, and midsized firms. It's really focused on creating these big

chebols that can really function in international marketplaces. But that, in turn, can create inefficiencies, as well, Kim argues.

In education, Korea hit on a model of widespread education, and that has been-- it's a dramatic story. The college completion rate there is breathtaking. And the focus is to get a very highly educated population, which they have achieved. And then that highly educated population is able to staff ever more sophisticated industries. That's the model.

And it works. The one thing they don't do is move their colleges into research universities, which Kim argues is still a part of the model that needs to be achieved. There's a very strong export strategy in Korea. Martin, go ahead.

AUDIENCE: [INAUDIBLE] the research institutions, do they just send their people to study at research institutions then?

WILLIAM BONVILLIAN: Yeah, they have governmentally supported research institutions, and I'll get to a little more on that in a second. The wisdom of the US model is that you combine the education system with the research system. And therefore, you create a tremendous amount of learning by doing. It seems to work pretty well. If you're just supporting research institutions as separate research entities, you miss the dynamics of that education connection tie. Doesn't work as smoothly.

AUDIENCE: I ask because I think it might just be a way for them to cut costs, because research institutions might be more complex. So they focus on making a really good college education, then exporting people to do research in other countries, then they might-- it just might be something to make it more efficient for [INAUDIBLE].

WILLIAM BONVILLIAN: Yeah, I think there are certainly arguments there, Martin. One thing that the Korean government did do was it forced its big companies into international competition. So they've got a fairly mercantilist model of not allowing-- of protecting a domestic market their companies.

But it's not that big a domestic market. They've got to force their companies out into international competition, and they do it. And that builds tremendous competitive strength in these firms. We look around and see the strong Korean firms. It's a pretty remarkable story.

In terms of tech transfer policy, the policy was initially largely a reverse engineering of technologies brought in from abroad. But critical capabilities are being developed as part of

this reverse engineering effort. R&D policy-- it's focused, as I mentioned before, on these government research institutions. The GRIs provide more of a-- rather than influencing industry R&D as much, it's more of a talent base and support base-- as you were, indeed, suggesting, Martine-- for companies.

Kim also has this very interesting discussion of Korean culture here and what's going on that matches the evolution of this remarkable economic growth. So he argues that in Korea, this interesting blend of an Asian Confucian culture of family and collective support and a collective orientation gets merged with a pretty high level of-- quite high level of Christianity and its individualism for a very interesting combination. It affects strengths on both ends-- strengths on the collectivity side, but also the strengths on the individuals side.

Some of you may have thoughts about that. Also the Korean War itself, as we discussed, left the country destroyed, and ended village culture, but amalgamated the population in a way that created a certain kind of flexibility, as the old social and cultural barriers were swept away. So that it wasn't all bad, I guess would be Kim's conclusion.

And then because it's a country that has constant threat of war with North Korea, the universal military service provides a huge training opportunity for a management class, in effect. And since militaries, to be effective, has to be pretty meritocratic. It introduces a whole meritocracy system into Korean society and culture, replacing an older village, more class-oriented kind of culture.

There's a series of forces here that tend to create a certain amount of social mobility and elimination of historic social classes going on here, which is part of the story that enables, Kim argues, Korea to thrive. That military service is an interesting feature. Our military, back in the days-- which I can remember and you can't-- when there was a draft, the US military was actually a very important integrated force in this society.

That was a very critical step in the US to promote racial integration, when you had integrated military units at the height of threats of warfare and combat. It really changed a lot of thinking in society. So there's just an interesting side note there about what that kind of social organization can mean in a social context. But Kim argues that it's important in Korea.

So Korea develops, he argues, a learning technology culture. So the firms go from what he calls poaching and kind of reverse engineering, and then to reverse engineering, then to R&D, and then to true innovation. So Korea's certainly right at the technology frontier in a whole

series of areas. And they've moved through a series of steps to get there. And Kim argues that these are steps.

And you tend to frown on poaching and reverse engineering, but let me remind us that the first textile industry in the US was set up in Pawtucket, Rhode Island by an English immigrant named Samuel Slater. And Samuel Slater is working in the British textile factories. And the British textile factories realized they've got a monopoly on textile production efficiency worldwide, and they don't want anybody else to have it.

So you're subjected to a body search to make sure you're not walking out with plans, if you're an employee in these factories. And Slater's searched every time he leaves the factory. What his British employers didn't realize is that he had a photographic memory. So he worked with his textile equipment, goes to the United States, sets up the same stuff in Pawtucket, Rhode Island, and brings a textile industry.

So talk about poaching-- that's straight poaching. So the textile industry in the United States is organized essentially through the same model, and arguably, the same stages we went through. When Lawrence and Lowell are established here in Massachusetts, we're definitely into technological advances at the frontier of textile production at the time. So in a way, we went through similar stages.

R&D investment-- so there's very heavy R&D in the industry chebols, but the issue Kim raises is that there's not enough SMEs-- small and midsize enterprises-- to provide out-of-the-box ideas in thinking in the mix, and that that's a problem in the system. And he argues that needs to be changed.

But Korea, overall, has got a very high R&D to GDP ratio-- higher than the US. So the problems are limited university R&D, the need for a larger SME entrepreneurial base. He argues that a more liberalized economy away from the kind of elite chebol control is an important step. But there's a lot of lessons here from Korea-- the role of a strong governmental leadership in creating strong firms, but in effect, forcing them into international competition.

It's Darwinian. And the government education programs that facilitate very, very strong talent base country are clearly key. And the government use crisis to force its firms-- it would, in effect, force its firms into a crisis kind of circumstance, so that they would really learn how to compete and survive. So those are all interesting lessons from Korea. So who's got Linsu Kim,

and who's got Glenn Fong?

AUDIENCE: I have the Kim.

WILLIAM OK, and you've got Glenn Fong. So why don't we start with you, Matthew?

BONVILLIAN:

AUDIENCE: OK. So I think besides [INAUDIBLE] covering a lot of his main points I think really interesting is Glenn Fong, he turns this argument on its head-- where most people think about political structures determining how competitive an economy is. But he looks at the competitiveness of the economy, internationally competitive-- competitiveness driving the imperative of the political structure, and how involved it becomes as the country moves from pursuer after the pioneer to a follower at the frontier.

And he gives the example of Japan. One theme that I saw throughout the question is how much of that process is a conscious decision, or how much of it kind of happens naturally? Is there a certain point when the government says, hey, we are approaching your frontier now, we should be hands-off? How does that end up happening in practice?

AUDIENCE: I think the approach is probably the most difficult part of the process, just because you have to set up and protect-- the chebols and systems have to be put in place that borrowed on these sort of cultural values. You mentioned the strong military service at this point. And a lot of other things have to come together.

And so I would peg the approach as sort of the hardest part. But I think once you have your system set up and you're looking to compete internationally, I think that's the point where you have to let go. But I think you need to reach some sort of maturity. And I think it's pretty easy to say, OK, we've copied everything that we've been able to copy. What's next? And if you don't have anything next, it might be tough to diversify and let things go.

WILLIAM So Rasheed just to used Glenn Fong's terms-- and correct me if I've got this, Matthew-- but
BONVILLIAN: when you move from pursuer of the pioneer to right at the technological frontier, that's the moment where you ought to think about your organizational model. Because to get to that world-class leadership on a continuing basis may require you to decentralize and change your government role, to build a more collaborative model and rely on a large number of players to be able to contribute ideas. Would you agree, Matt? Is that right?

AUDIENCE: Yeah. Well, the way that you said it almost implies that there's a conscious decision about how much the government's going to be involved.

WILLIAM BONVILLIAN: I think, for Japan, what happened was they realized they missed the IT revolution that was led by US companies. And we'll read about DARPA and the IT revolution in a later class, but you'll see where that comes from. And by having an R&D system that was pretty focused on applied work with industry, as opposed to university research, you get very good at the incremental advances, but you may miss fundamental breakthroughs.

And so I think Japan is waking up, in 1998, to these realities, and trying to think about its innovation organization to open up larger menu of innovation practices. That would be my guess. But I think that's right.

AUDIENCE: And the other thing I had was-- use this, Japan as an example-- looking at Korea, it does seem to fit the model. But to what extent does this model actually generalize? Off the top of my head, I think of the US space program or something like the Manhattan Project, where it's very much at the competitive frontier, but strong government involvement and basically targeting technologies did lead to major advances in research and development. Do we think that it-- that the model actually works all the time? Or is it necessarily even the best thing to be doing?

WILLIAM BONVILLIAN: Help out Matthew, team. Give him a hand here. He's got a lifeline out there.

AUDIENCE: Well, I'm curious as to why we, in the general discourse of innovation, only pay attention to East Asian countries, or largely pay attention to East Asian countries. Because you never hear about United States and innovations here being juxtaposed to, say, innovations in central or South America, or even Eastern Europe.

And perhaps technological advances are not as impressive there, or the breadth of their impact is not as extensive. And at the same time, I think there has to be innovation occurring in other parts of the world that are not South Korea, Germany, China, and Japan. So to what extent is that premised on that kind of American paranoia that was highlighted in the Hughes' piece against East Asia?

AUDIENCE: I think a good follow-up is we don't have a good-- enough counter examples for you, just because the breadth, and the highlight, and the attention hasn't been put there. And I would

hope in Central, South American and these Eastern European countries, they're seeing the pervasiveness of these different models. And there's no way that they're not thinking about these things or adapting their models to these sort of things.

AUDIENCE:

I was at the AAAS meeting last week, and some of the people who were coming in from Russia were saying that they had found that some of the advances that were just being noticed in North America had been made in Russia like a decade ago. And they had just never transferred to the international scholastic community because they were Russian-centric.

And I thought that that was a really fascinating component about knowledge transfer, as well as knowledge sharing. Because if our focus is only on competing with East Asian countries and Germany, to what extent are we missing opportunities in the United States by paying attention to other countries that might have interesting innovation cycles or products that we could learn from?

AUDIENCE:

Just to add onto that-- so I think the reason we look into Asia a lot is because they were economies that weren't doing great, and then they pretty much did a 180 in less 30 years. And there are a lot of factors to it. A lot of it was having very strong leaders coming from periods of not doing too well-- so they were more unified-- and then having a strong young population.

So most of the countries that did really well during this period or had a age pyramid like this. So it's a lot of young people, very few old people. And they were able to move very quickly, and especially because they have these strong leaders. These other countries, I think a lot in Latin America, they don't have these strong leaders or these periods that come up beforehand, so there hasn't been rapid growth, innovations-- even though there has been a lot of innovation, especially in manufacturing in Brazil, parts of Mexico.

So I think it's just we haven't paid too much attention to it because it doesn't seem like a threat. But these other countries have moved so quickly that it does seem-- you can see it more than a threat. Because if you look at Singapore, it was a country that was pretty much not there. They had a very strong leader, was able to make quick decisions that are very strong, and be very strong in saying, this is what I believe, this is what I think we should do, and then going after it. And they were able to completely 180 their economy.

And I think we're also talking about the role of government in the US has committees making decisions for innovation. But actually, Charlie Munger, who-- everyone knows Warren Buffett, right? More or less? Charlie Munger's his right-hand person. And he says, in the past, in

general, countries do better when its one very smart, talented leader, because they can make these hard decisions.

And in the US, we do have an executive, but I think everybody at this table can agree that people don't really say, he said that-- we should do it. So the benefit is these are very credible leaders that most of the time, when they make it that position from a downturn period, are very talented and skilled.

And they do make bets. They can make these [INAUDIBLE] say, you know what, this is an industry that's going to grow very quickly. Let's put three people. There's like 3, 30, 40 companies that could do well, but I think these three are really going to win, and we're going to put all our eggs in this basket, and we're going to do well.

And that's something that's very, I guess, I would call un-American, because we're very much-- everybody can go about it. We want to leave opportunity. But these countries do have this capability, and they have already shown that they can grow so quickly, versus as other countries, I think-- I think another thing too is Latin America, Russia, we still see a lot of corruption.

These other countries were able to get rid of it. Like Singapore, what Lee Kuan Yew did was say, I'm going to pay everyone about twice as much, but if I find out that you're being corrupt, you guys are pretty much done. So I don't know if it was a death penalty or it was very severe sanctions, but it was also severe sanctions upon them and their families.

So that's a completely different way of going about it. So I think just don't see other countries as a threat, even though they have good capabilities. But these countries did do amazing things in 30, 20 years that can't be taken lightly. But you could also debate that it was because there was very young populations, because also Japan and South Korea had stagnation right after. Final point--

WILLIAM

BONVILLIAN:

So, Martin, that's a very political economy perspective. Going back to some of the points that Matt was making earlier, I think the central Glenn Fong argument is that that may get you a fair distance for a period of time, as you're getting to the frontier. But then when you get to the frontier, you better figure out a more bottom-up, more collaborative kind of model if you want to keep the ideas-- if you need that big mix of ideas that's going to enable you to go to a series of the next things.

That's Fong's argument. And his point is that Japan really had to reorganize its innovations away from the political economy kind of approach you were describing before to really a very different organization, when it reached that moment of [INAUDIBLE] innovation and competition.

[INAUDIBLE], in response to your question, in a way, I want to go back to what we talked about in the first class. For a long time, we thought that this innovation system stuff was the way in which the rich countries got rich. It was just a way to build further wealth in a relatively modest number of countries that figured out how to dominate and lead these innovation systems.

But then other things started happening. Korea comes up from being totally destroyed. Taiwan's somewhat similar. Economies like India, which is obviously one of the poorest in the world, is able to start building a very significant middle class. And China's the latest element in this story.

In other words, an innovation-based growth model can be pervasive and work in the developing world. Now, we've managed to translate that at pretty interesting scale in parts of Asia. You're exactly right-- we haven't translated, with the possible exception of Brazil, into a pervasive model in Latin America, for example.

One of the options for doing a paper in this course is to look at other national innovation systems and dive into them. And I really hope of you will pursue this. We don't particularly focus on this in this class, although we could. But the Brazil story's absolutely fascinating, and a remarkable story. Obviously, they're in a fair amount of economic trouble from macro factors at the moment. But nonetheless, it's a very promising and encouraging story overall. But there are others, and there are other parts of the world too.

AUDIENCE: So funny that you mention Brazil, because while we were talking about this, I remembered that there's major airplane companies or airplane manufacturers-- so you think Boeing--

WILLIAM I flew up in one this morning, Embraer.

BONVILLIAN:

AUDIENCE: Yeah, exactly. And they're from Brazil.

WILLIAM [INAUDIBLE]

BONVILLIAN:

AUDIENCE: Based in Brazil. And they are really important now, and will be important in the coming years, because Boeing and Airbus dominate these very large, big airplanes-- like 787s, these very large aircraft that only tend to get bigger in scale.

But Embraer is important because they focus on shorter flight distances with smaller aircraft, and developing out of that market. But I just looked, and they were actually, in the '90s, this public private partnership-- so came while Brazil was looking at shorter distance flights and doing that a lot better. But it does come-- sort of this pursuer after pioneer.

And I think they're now probably shifting to build more aircraft-- instead of copying smaller aircraft designs, they're having to now become the pioneers and really start building new smaller-scale aircraft, and take that market. And Brazil's interesting, just because they were allowed to do that.

And I don't know what sort of factors played into them being allowed to initially start that public private partnership in around the '90s, when Embraer started. But I think now, they're probably going to have to shift pretty drastically and radically in looking to do that. But that's a place I don't think we've touched yet is Brazil.

AUDIENCE: I think there was a lot of pushback from their competitors for-- that Embraer was getting unfair treatment from their government, in terms of other trade agreements-- I don't remember specifically. But it does conflict rifts with international relations.

WILLIAM So Chris, I'm going to shift over to you, and we're going to Linsu Kim.

BONVILLIAN:

AUDIENCE: So I think Bill really gave a good background on the article, but--

WILLIAM You don't have to say that, that's OK.

BONVILLIAN:

AUDIENCE: You did though. But to go into a bit more about the process of how Korea came up to speed on the forefront of the innovation frontier at that time, they really went through this process of imitating what was out there, and then from that basis, going on to innovate, and do their own R&D, and create more advancements for those products.

And this trend really supported by those close intertwined partnerships and almost

interdependence between the government and the chebols. And the chebols still exists. Even to this day, they're really family-centric, dynastic corporations. Like the Lee family has controlled Samsung for however long they've been in business.

And that centralist government support and structure has really allowed them to enter really high capital industries and really get to the front really quickly, as we've been discussing, has been a factor also in Japan. So just focusing on this right now, we discussed how the focus on the partnerships between the chebol and the government has kind of stymied the ability of SMEs and the smaller funds to enter the space.

So one question that someone had was, how can the country catch up the economy and foster both aspects of the larger corporations, as well as the smaller businesses? Do they have to partition funds, have different initiatives or approaches for both sectors? How do you guys think they should approach that kind of growth? Go ahead.

AUDIENCE: It seems like the chebols are focused on specific industries right now, like construction and electronics. So it's probably going to be harder to get smaller firms to get a footing in those industries. So in my opinion, it'd make more sense to pick something new and focus attention on developing those industries, because I don't think there's going to be a startup that can compete with Hyundai. But maybe there's something in energy or IT that they have room to grow more.

AUDIENCE: Or maybe even focus SMEs on more domestic affairs-- I don't know if agriculture or some industries in Korea might-- you could target them potentially.

AUDIENCE: And I think you just need to offer governmental support and financial protection probably a little bit different than the chebols need or don't need. But you just have to decide what's the scale that you're trying to look and build at. If you're trying to build and serve smaller sectors that might be underdeveloped, like agriculture, for example, you might just have to look a little bit smaller than trying to cater to one, or two, or three chebol companies off the bat.

WILLIAM BONVILLIAN: Chris, you think that-- from your reading of Kim, do you agree with him that Korea needs to foster an SME startup kind of community?

AUDIENCE: You mean in the context of present day?

WILLIAM BONVILLIAN: Yeah, present day.

BONVILLIAN:

AUDIENCE: In present day.

WILLIAM BONVILLIAN: Is that going to be an enhancement to Korea's innovation capability? Do they really need to do this? What do you think?

AUDIENCE: Personally, I think their structure that really focuses on the bigger corporations and their impact and their ability to really compete globally has been working. So I do think that the corporation push has been successful. Whether SMEs should be supported from the government, I think it's worth exploring. I do think that finding them a niche is really important because there's no point or kind of redundant for them to try to enter industries that the corporations have a hold on.

AUDIENCE: I'd say it's probably important, just because [INAUDIBLE] innovator's dilemma. Usually when you're big, you focus on a specific technology. Like for Kodak, they invented the first digital camera, but because of the way their supply chain and their current business was, they couldn't-- they didn't want to manufacture because it would ruin their existing business.

So the danger of having too big a giant, is, in order to innovate, it takes so much effort on them that they won't do it. And if your economy is based off of that and based on those four giants, especially with rapid technological innovation, you really don't want to be in that position. So having that SME structure would be beneficial.

AUDIENCE: Yeah, I kind of want to hit on both of those. So with the chebol versus SME structure in Korea, I'm wondering, are the major, major legacy corporations-- are they profitable enough and large enough to be self-sufficient-- they don't really need the input from the government, as they did decades ago? Could the government focus more on SMEs, and would that be a more strategic way to go about things? Or do they have a situation in Korea-- I don't know, I haven't-- I've only been there once, and it was only for about a week, so I don't really know.

Do they had a situation similar to what I think we face in the United States, where yes, we have legacy technologies and sectors that are probably self-sufficient at this point and highly profitable, but we're so ingrained-- the government still gives subsidies to fossil fuel industries, subsidizes their R&D indeed, and that-- although they shouldn't necessarily need that.

It's like that, and they have powers that they can continue to get those funds. So what is the situation in Korea? Are they ingrained and can't really separate at this point?

AUDIENCE: From what I know, definitely it's still very ingrained. A lot of the corporations have-- I don't think it's corruption necessarily, but close political ties to the government in power. So it might be difficult, I think, to separate the two.

And going back to the point of whether SMEs could be on the rise in the future, I think it's also a cultural difference. Because in Korean and Asian culture, it's often more traditional, in that it's very prestige obviously to go into these very developed and longstanding companies.

And there's not so much an innovation drive, like there is here. That startup culture is really attractive to a lot of the young millennials. I don't think that exists so much, let's say, in Korea. So whether it be a job to go to an SME or go to a big corporation, I feel like that wouldn't even be a decision. It'd be obvious to go to a big corporation.

So I don't know if the cultural stigmas and the standards have guided--

WILLIAM Right.

BONVILLIAN:

AUDIENCE: [INAUDIBLE]

WILLIAM Another cultural point here that we're dealing with about risk-taking, which is a pretty key
BONVILLIAN: element in the US failure-- pretty high tolerance for failure. All right. Look, good summaries. To get through this, I'm going to push one to our next-- let me just do one chart.

Just so what recessions look like in the US and what's been going on and repeated sequences of recession, here's the 1981 recession-- dip, rise. And jobs come back relatively quickly. Then 1990, it starts stretching it out further. Then in 2001, the jobs recovery is really remarkably slow. And then the 2008, 2009 recession, even further out on the level of job reductions.

And a painful reality is that you still never recovered from the 2001 recession by the time the 2007, 2008, 2009 recession is on us. So there may be an argument that something fundamental is going on structurally in the economy, when you see a chart like that.

In each successive recession, it's less of a business cycle. It's more structural. And it looks like there are deep structural causes in these manufacturing employment declines, when you start seeing a chart like this. We'll talk more about it next week, but here's declining median income for the US, which we'll talk more about next week too.

So particularly pay attention to men, who were-- tend to historically have played a larger role in manufacturing industries in the US. So this is change in median real earnings for men and women from 1990 to 2013-- so an extended period from '90 to '13.

No high school diploma, men-- median income declined in that time period 20 points. High school diploma or some college, 13-point decline. And then advanced degrees, 21-point rise. Bachelor's degrees, 16-point rise. This is a society that's going like this, and that's what we're dealing with. And arguably, it's related to this.

Let me move to Suzanne Berger. You should get to know her, because she's around here, and she's really a remarkable talent and has been a great teacher for me. This is her 2005 book called *How We compete*. And her essential point is that there are different varieties of capitalism. We've been talking a lot about that today.

And the different approaches emerged between the US and Asian economies in advanced technology goods in this later part of the 1990s, early 2000s time period. So what's going on here? IT is a driver, and codeable specs tied to computer-driven equipment is enabling a divorce between production and design.

So in the old time period, in a prior time period, Suzanne argues that manufacturing companies, production firms were a lot like model airplanes. And you all probably don't remember the era of plastic model airplanes. I do. But you'd get this batch of plastic parts, and they never quite fit. You'd have to work them, and you'd get glue all over, and the glue would spill over, and it would just be a mess.

And you try and clean up the glue with a Kleenex, and the Kleenex would stick to the model. And you'd put rubber bands around it to try and get it to lock in place, and you'd break the damn thing trying to get it fixed. That's what manufacturing used to be like, she argues. And to manage, that you needed a very integrated vertical system with all parts of that system tied and connected together to get around the difficulty of the production process.

But with codeable IT-based specs and computer-driven equipment, he moved to an era of LEGOs. It's all computer-driven. You're going to be producing LEGOs, and they are always going to snap perfectly in place. That's how the production system changed, she argued, in these two-- from these two different eras.

And the classic example is the iPod. Apple was able to pick a mix of MP3 best technologies,

and they tied it to a new software access system for music in database form, as you all know. Now it's video, as well. A classic Apple move, right? The problem with MP3 players before Apple was that you had to commit a crime in order to use the MP3 player. You were stealing someone's music.

And it was a criminal act. What kind of product forced you to commit a criminal act? It's not a great product line. So Apple invents an entirely different way of organizing the music industry, but it ties it to existing MP3 player technology, which it receives to perfect. How is it able to do this? It was able to do this in a remarkably short period of time. It was a matter of months.

So he figures out what the optimal MP3 player technologies are, who is producing them, and go to them and enter into contracts with all over the world-- particularly in China, but elsewhere, as well. And it knows that they're going to snap together like LEGOs in the end, because they are using codeable specs on computer-driven equipment. So you can now distribute your production model.

So Apple doesn't-- can do this in a matter of months. It doesn't have to go buy green space outside Wilmington, North Carolina, or something, and build a new factory, and get all the permitting, and spend years doing this, and raise a billion dollars to do it. Instead, it quickly enters into a deal-- a series of deals with existing producers, but it knows that it can bring the product back, because it's going to be LEGOs, and they're going to snap into place. Amazing, absolutely amazing.

And I was in Japan in 2006, and-- in January. I spent a wonderful day as it was snowing in Kyoto, which was complete magical. But it was mostly back in Tokyo. And the headline in the leading English language newspaper in Tokyo was "Apple sells 14 million iPods in two weeks; where is Sony!!"

It was just a reality that Apple had been able to spring to this whole new product line in a remarkably short period of time by using a digital dispersed distributed production model. And it's pretty irresistible, because you-- that level of time and investments you have to assemble ahead of time makes this really quite convenient. So lots of US firms moved to this model, and they're technologically enabled by these technological advances to do so.

Now, Suzanne also goes on to argue, hey, other people-- and she's looking a group of Asian countries and firms-- are not necessarily doing this. So in Korea, Samsung continues to control the key components. It allows a certain amount of assembly offshore. In Japan, there's a

conscious effort to keep integrated innovation model, and control all the critical stages.

So the risk in the Apple model is that you're offshoring your production capability, and a certain amount of the innovation capability's going to follow. That's the risk. And to avoid that, companies in Japan and Korea are moving in a very different organizational model. Both models, she argues, may well work. So these are varieties of capitalism at play here.

But the important thing I want you to understand is that you can now, for the first time historically, sever production and design. And it's pretty irresistible to do so, because you significantly reduce your risk, and exposure, and your investment levels upfront. So that's why, she would argue, US firms tend to pursue this model.

And we'll go to her next book next week and discover why the model may not necessarily be optimal. We'll hold that in advance until next week. So who's got Suzanne? Let's go ahead then, Matthew.

AUDIENCE:

So in *How We Compete*, basically they look at a whole bunch of different companies in many different industries and try to find what it is that makes companies competitive. So they find that there's no single paradigm. And one of the key lines there is that there's no sunset industries, just sunset strategies.

So really, to be competitive, what they found is that companies always need to be questioning their processes, looking for ways to innovate. And then what I got out of it were primarily two different balances. One is this idea of intelligent offshoring, where maybe outsourcing all of your manufacturing is not the best idea because there are other costs involved with that, and can create innovation gaps within your own country.

And then the other balance being with IP, and how do you create a collaborative environment where that's conducive to growth and development, but also protecting your IP, so that you don't create your own competitor? And so I have some questions here. I think one of the first things is how do companies in fiercely competitive sectors actually set themselves up to constantly be innovating? It's a tough thing to do.

WILLIAM

BONVILLIAN:

Let me underscore the importance of your question. The number of companies that are a hundred years old you can probably measure on one hand. They go through disruption, and they change, and they die. Long-lasting, long-enduring companies are rare. And it's retaining this innovation capability that's so critical, so you're driving at a really key question.

AUDIENCE: When you mentioned innovative firms, firms that keep staying at the head, my first thought is Apple. and I think Apple's, what, like 30 years old now? It hasn't even proven that it can withstand the trend. So I'm trying to think of something that is actually more than 50 years old that has been consistently on top of things.

AUDIENCE: I think Coke is probably my favorite example.

WILLIAM Coke's one, and IBM's another.

BONVILLIAN:

AUDIENCE: Yeah, and then IBM. I think IBM I know more about, just because they developed as sort of in f wave-- in the context of the US was looking for answers in the semiconductor realm. But more importantly, they had to deal with the whole advent of personal computing, and then they shifted now into more IT-based services. And so they just contract out and solve your problems.

And I think it's like you have to be sensitive to these big technological disruptions, and then ride the wave or get out completely, and being able to shut down kind of large sections of-- it was previously advantageous maybe for Kodak to use disposable cameras, but now we have digital cameras.

And so you have to be able to be like, OK, we're going to really radically change the course of our company in order to sustain and stay alive. And that's a hard decision to be able to make. And so I think the resistance to change piece is probably differentiates your Cokes from maybe your less long-lasting companies.

WILLIAM And next week you're going to start to read your textbook, which is about the difficulty of
BONVILLIAN: innovation in complex established legacy economic sectors. And that's a large part of this [INAUDIBLE] answering your question.

AUDIENCE: The question too is, if there's these new capabilities and you don't use them, somebody will. So it's kind of like a Pandora's box, because I may not want to change my whole supply chain and get rid of a ton of jobs for my employees because of all the things that happened after, but my competitor is probably going to do it. And if I don't do it, then he's going to have a lower-- he's going to lower his costs, and he'll most likely beat me to market.

And there's a quote from Andrew Carnegie, where he goes like, you should always use the

best tools, even if it's very hard to cheat your old tools. Because as a titan of industry, if you don't, somebody else will.

AUDIENCE: And the other thing I liked from Hayes I think about-- I know it goes a little bit into next week's readings here, but to what extent do you think that design and manufacturing can actually be separated? I know here at MIT, in the mechanical engineering department, there's still a big emphasis on taking the manufacturing classes, in terms of just understanding when you're designing, what is feasible, what is possible to manufacture.

Maybe 3D printing, it's a little bit more separate. You're basically saying can be made. But there's a lot of know-how embodied in having the manufacturing there too. I don't fully think that they can be-- or it's wise to fully separate them. I want to see if people also have some more thoughts there.

AUDIENCE: I was going to say that maybe the separation is just a figment of our imaginations, because I know that when Suzanne Berger was on the panel in bootcamp course-- I think it was Suzanne who said that the people who-- the designers for Apple spend most of their time not here. They spend their time in the offshore manufacturing.

WILLIAM Shenzhen, in particular.

BONVILLIAN:

AUDIENCE: Makes sense.

AUDIENCE: So they're not really separate, although they're quote, unquote "separate."

AUDIENCE: I think also objective is important. And if you're trying to separate, what are you trying to separate in order to do-- if you're trying to separate in order to cut costs, you'll find a way, because it'll be more advantageous for you to send your manufacturing section over, if you're Apple. But even if you do that, you're going to have to send your designers in order to do the next thing and really consider how am I going to manufacture this thing that I've designed.

And in order to do that, you can't separate them. So the mechanical engineering department, I think, is probably pretty smart by training-- when training all mechanical engineers who are then going to go up design and manufacture, even though you might specialize in one or the other, you need to have a strong basis and a foundation of both, and understandable are critical in order to do anything that's probably long-lasting or meaningful, and I guess quote, unquote "innovative."

AUDIENCE: When we talk about design, what do we mean? Do we mean the designer of an industrial system? Do we mean the designer of an industrial appliance? Do we mean the designer of hardware? Do we mean the designer of software? What components of design are we concerned about, and in what ways is this relevant in the conversation we're having right now about integrative innovation processes?

AUDIENCE: [INAUDIBLE] I'm viewing it, when we see-- we're comparing the design and manufacturing, so I wouldn't think of it so much as software. Primarily hardware, where the design may be having a 3D model or a layout of my circuit board that I'm going to send to a manufacturer on the other side of the world, who will actually make those components, put them together, and send them back to me. That's at least what I [INAUDIBLE].

AUDIENCE: Yeah. I guess I raise that concern because, as a designer myself-- I think of myself as a design researcher, because I think about the ways in which you can take systems engineering approaches to social issues. And there's a big debate right now in the design community about what design even is. There's this big debate about design thinking and versus the design cycle, and who gets to create it.

And there's even more of a debate about the nuances and exerting the power in creating something. All of these hardware choices are political choices, and they have impacts on both the user and the society in which they're implemented. So that's why I think it's important to really consider, when both the author and we talk about design, what kind of design we're talking about, and we view it not necessarily as a neutral and apolitical action, but very much as a reflection of what that corporation values and what kind of values they want to promote in a society.

When I look at this laptop, I don't think, this is beautiful, this is elegant, this is functional. I think, this is how this company wants the world to look like, and this is their long-lasting and material vision for what the world could look like for the long run.

AUDIENCE: Alternatively, I think a lot of design thinking actually is for companies that, while we're looking at what they-- what we think their vision is [INAUDIBLE] when we look at, say, a Macbook, I think a lot of them are looking to, and most designers at Apple would say, in their design process, they're looking at the users and seeing what the users actually want. [INAUDIBLE] there's a lot of looking both ways.

AUDIENCE: From a capitalist perspective, the way I would look at it is, OK, what are the manufacturing abilities? How much does it cost me? How long is it going to take? What are going to be the issues? Don't make it complicated. Simplify it, simplify it, simplify it, because in execution, it's going to be way more complex, and I'm not trying to deal with that.

And then, OK, I'll make it. Make sure it's slightly different than my competitors. Make sure it follows the values of my company in a certain amount of way. And then when I market it, you think it's something more than it actually is because then you'll buy it, because it's worth the value.

AUDIENCE: I think maybe American Apparel and-- they hinted at American Apparel, Lucky Brand Jeans, and some other companies that are very heavy-- or their models are particularly because they're based in the US. And even though it might be less expensive to like build and manufacture your jeans or your t-shirts, for example, outside of Los Angeles, you lose other factors, which is being able to say made in the USA, blah, blah, blah.

But also you gain production speak and all of these things that Martin was talking about from coupling these design and the manufacturing processes and leaving them here. But at the end of the day, I think you do a cost benefit analysis, kind of like Martin said, and then just make sure that your company values is in line with the product and how you want people to interface with the world through your product.

AUDIENCE: But then going off that, I'm curious how much of an advantages that you get from producing in the US can-- or whatever their gimmick is-- how long those will last. Like American Apparel just closed all their stores. So does that mean that that approach isn't sustainable and that they should have taken another look at outsourcing?

There are other factors contributing to it, but is that-- do these companies have to pick what society will want as their special sauce, and hope that it lasts long enough, or are they eventually going to need to think about these alternatives?

AUDIENCE: They definitely should consider the alternatives, but when-- at least with American Apparel, like you were saying, there's probably a ton of factors. And I think just to answer that question, we just need more data. So we need to somehow control for the type of industry, the time period, the location, et cetera, et cetera. And then you could compare. Based on the information that we have, the question-- we just don't have the numbers to back up either side.

AUDIENCE: Or another example-- I think that this was written before Zara came under fire for a bunch of basically human rights issues-- outsourcing--

AUDIENCE: But I'd look into-- did that affect sales?

WILLIAM Or do you want to lay out the Zara model for us, Lily?

BONVILLIAN:

AUDIENCE: Oh, gosh.

AUDIENCE: Do you know it?

AUDIENCE: No, I'm afraid I can't--

WILLIAM I can summarize it for you.

BONVILLIAN:

AUDIENCE: --articulate it well.

WILLIAM Or Martin if you know it.

BONVILLIAN:

AUDIENCE: If you know it better [INAUDIBLE].

WILLIAM I don't know. We'll find out.

BONVILLIAN:

[LAUGHTER]

AUDIENCE: You do it, and then I'll appendix anything--

WILLIAM Please do. It's an example that Suzanne Berger uses. And the point about Zara is that, by

BONVILLIAN: locating its production facilities it's very close to its markets, it's able to move production to its sale system in a very, very short period of time. So by tracking fashion markets and what appears to be moving and selling, it's able to shift its production system quickly onto new styles that seem to be emerging.

Whereas if you shipping that style across, say, 8,000 miles of ocean in a container ship that's moving at 8 and 1/2 knots, you're not in the game. So Zara has figured out how to keep that relationship between production facility, market, and sales facility very tight, and therefore, be

able to serve emerging markets. Fashion is somewhat different than other areas, but the point, I think, is still there. But serve emerging markets very quickly-- so rising to your market opportunities in very short periods of time. How's that, Martin?

AUDIENCE: Pretty much what they do is they go into the Fashion Week, and they're like, oh, this is a really expensive thing. What we're going to do is we're going to find a very cheap way of doing it. They have it on the market by two weeks pretty much.

They like rapidly design and they go for a low price point, and then they'll put it into the market, and then people will buy it. You're not buying for value. You're buying because this is trendy, and I don't want to spend much. And that's kind of their value prop right now. because they're usually slightly more than H&M, but it's just that right model for I want to buy a good amount, and I don't want to look like I'm from 10 years ago.

WILLIAM Does that sound right, Lily? OK.

BONVILLIAN:

AUDIENCE: But yeah, I would have to look at the data of how their sales reflected. Because I think some people do care, or they might act like they care, but probably when they vote with their dollar-- because there's Zara and there's H&M, but there's not too much of a difference. And I'm pretty sure they different products.

So somebody might be like, I really like this sweater from Zara, so I'll definitely go that way. I would debate that there's a very small percentage that'll be like, I'm totally never going to buy from the store again-- or I'm totally not going to buy from this store again, and then not go back to buying from like two weeks later.

WILLIAM So I'm going to bring us back to Mac, since we've now gone off to into the fashion world-- back
BONVILLIAN: to some more fundamental. Do you have some closing points you want to make on Suzanne's book? What do you think is really key in it?

AUDIENCE: I think one real key point that maybe we didn't get as much to talk on is that maybe we have, as Americans, this idea of a birthright to being at the forefront of innovation, and really pointing out that no one who's completed and sitting on their laurels will stay in that position. I think there's a good contrast between her ideas on outsourcing versus Berger's. Something to think about.

WILLIAM Good. Good point, Matthew. All right, that brings us to our closing reading. This is one of MIT's

BONVILLIAN: great provosts, Joel Moses, who was deeply involved in the early and, indeed, later stages of the computing revolution. So this is a young Joel at project MAC at MIT, which is MIT's implementation engine for a lot of the early computing advances.

So Joel steps back and writes this fun piece, which I wanted to throw in here at the end, to pick up our determinism theme one more time. We've been talking about different kinds of innovation systems and how different countries have varieties of capitalism and varieties of innovation systems. And Joel takes us back a step and gives us more of a 10,000-foot kind of look, which I was-- I've always been intrigued with.

He argues that there are three fundamentally different design methodologies. So this is a design methodology in a societal sense, rather than engineering design, that Matthew was leading us through earlier. And he argues that, historically, the US has used what he calls a tree and branch organizational attempt, which creates very hierarchical firms.

And he argues that this very hierarchical system-- and you can picture with the organization chart looks-- it's like a tree, top management all the way down through many different hierarchies of levels-- that that fits a mass production company. This is the kind of economy that was compelled coming out of the Industrial Revolution.

And it's organized for manufacturing at a national scale for national markets, where a lot of vertical integration is required. So think about the big three US car companies. Now, then he makes an interesting additional point, which is this, by the way, fits an Aristotelian hierarchy of ordered knowledge. This is the way in which Western thought organizes science. That's what Aristotle is doing, he's creating these tree and branch systems.

Surprise, it shows up in industrial organization in the West. But he argues that the tree and branch hierarchy means tremendous inflexibility and great difficulty in managing change, because you've got to bring all those different systems, all those different levels in the line in order to pursue change.

So the second design methodology is around what he calls a layered system. And he argues that Japan's incredible success of the '70s and '80s is not just the different industrial model, a quality production model. It's deeper than that. There's a whole social organization set of issues that's coming with it. And [INAUDIBLE], you were driving towards some of these points, I think.

So in Japan's system, there are separate layered levels, and you tend to move through your career with your age cohort. And as a group, you move from level to level. And there's obviously several levels here. It's much less tree and branch hierarchical. It is pretty flat within that age cohort. And you tend to know that you're going to move with your level into successive position.

So it forces a significant amount of consensus. So Joel's interesting comparison is this is Plato's *Republic*-- the philosopher king, the guardians, the citizens-- those are kind of layers. So not an Aristotelian, but a Platonic model. And then he says there's a third.

And this is the network model that the US nurtured coming out of the IT revolution, which is much flatter, much less hierarchical. Not even layered-- it's pretty flat. And it's driven by the collaborative group innovation systems that are required for the development of the IT sector-- that a rigid tree and branch hierarchy is just not going to work in that IT world, which requires a tremendous amount of almost democratization of workforce.

So back, Martin, to your Andy Grove analogy, when the leaders of Intel-- when Bob Noyce, and Grove, and Gordon Moore were setting up Intel, there are no offices. Everybody's got a cubicle, including Noyce, and Moore, and Grove.

The network model, Joel argues, is actually much faster, and much more flexible, and much more subject to change than even the layered model that Japan brings about. And so you start thinking here, gee, it's no wonder the US auto industry got rolled when it came up against Japan's layered model. And then you start thinking, oh, no wonder Japan missed the IT revolution, if the organizational model required this network.

Now, look, these are highly speculative. We'll never prove these. They're really only for discussion purposes. All of us know that are more complex stories behind it. But I think there is an idea about the relationship between social organization and the kind of industrial developments that your society is going through, and the kind of organizational models that those compel.

Joel's great complaint is that engineering lacks the models to be able to grasp these different organizational structures, that you can't really fit that within a traditional kind of engineering analysis, and that engineering, therefore, needs to rethink this. That's part of the reason why he's a major leader of MIT's Engineering Systems Division, which, of course, has now been closed. But that's part of what Joel and some of his colleagues are trying to do, when they set

up BSD at MIT.

I just want to close out by saying that there's another thing that we'll need to consider, as we move into next week's class-- that the whole nature of competition is changing in manufacturing, that it's no longer a world of manufacturing goods, it's a world of manufactured goods that are fused with IT technologies that, in turn, are service delivery models.

So there's a whole fusion of services and manufacturing going on that makes some of the stories we've been talking about today more complicated. In past decades, the story was quality. Now, there's a whole level of customization, and speed, and customer responsiveness that we have to think about, as well. And your ability to get on top of those, as well as on quality, becomes key.

It's not simply the best technology, but it's the best technology plus the best business models and delivery models that have to be thought about. There used to be traded goods, traded product. Now, there's traded all kinds of knowledge management and services that are tied to these products that becomes critical factors in your ability to compete.

In the past, it was the workforce skills side. Now, it's much more continuous learning in your workforce. Then it was low cost of capital. Now, it's efficiency in all the financial services stages that you've got to get through the hurdles of, not just the initial capital cost. And there's a whole evolution of intangible capital, as well.

So there's a whole new set of factors that's coming into the manufacturing world, that we've only started to glimpse from today's discussion. But let's go back to Joel and his three models.

Chris, it's all yours.

AUDIENCE:

So to summarize, Joel is presenting these three models-- the hierarchical decomposition model, where it's the branch tree structure, the network design model, and then the layered design model. And then he basically goes on to outline a bunch of examples where you could present-- or sorry, apply different methodologies into analyzing various systems.

So he goes through a philosophy example, he goes through manufacturing, even more science-based-- so like the models of the human mind and body. And one of them I found particularly interesting was where he brought up culture, and how preconceptions of how engineering and manufacturing is viewed here versus, let's say, Germany or Japan has really

impacted the way these countries have responded towards shifts in manufacturing, and how that industry develops-- and also how cooperation in Japanese culture has really allowed the precipitous rise of their industry and manufacturing capabilities, and how that shaped and kind of forced American firms to adopt a similar structure or methodology in order to compete.

Interestingly enough, a lot of the examples were not really engineering-based, even though he started from the hierarchical model, which is seen very often in engineering. And I thought that was really interesting. And we can definitely go into some of the examples more, if anyone has a particular one to go into.

But to start off the discussion. I thought this question was really interesting. How does a country shift from a tree structure-- so the hierarchy one-- to a more layered or network structure, once it's already been established? So if there's any thoughts, feel free to throw them out.

AUDIENCE:

So I took a class called structural organizations, and it talks about-- so it's not like there's a right or wrong answer. It just really depends what you're trying to do. So in general, it's more networked, it means you want to make better decisions. But the drawback is it'll take a much longer time.

Hierarchical, you might not make great decisions, but you'll make them very quickly. And as long as people respect the person who's making the decision, it turns out to be pretty much OK. In terms of a company, I think it really does depend, because I think the network structure works great for like a Facebook or something with internet base, where you're really competing for ideas, you're trying to come up with the best ideas. Things move quickly, so you want to iterate quickly. Versus, I think, if it was manufacturing, I wouldn't want that as much.

WILLIAM

Chris, did you agree with Joel's presentation here? Do these models make sense to you?

BONVILLIAN:

[INAUDIBLE] got an interesting story out here or-- what do you think?

AUDIENCE:

I thought it was interesting how he presented three frameworks for looking at different firms, and then went about applying that model to different situations, companies, industries. I thought that was interesting. Again, just like some of you, I had a little bit of trouble distinguishing between some of them as I was reading it.

So perhaps going into more about defining the differences between the different models, and also maybe even trying to generalize which model would be applicable to-- what

characteristics would be most amenable to these models, that could be an interesting additional step.

WILLIAM

All right, I think on that good note, we'll end a few minutes early.

BONVILLIAN: