

MITOCW | 14. Innovation and Energy Business Models

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PROFESSOR: OK. We've been chatting up here and taking up valuable time. We have the privilege today to have Donald Lessard-- Professor Donald Lessard speaking. Don and I and Professor [INAUDIBLE] taught this course the previous prior two years. So he's been in here before. He's an expert on international business, international finance, regular finance and, of course, the Cuban revolution, which he witnessed as a small boy. Don?

DONALD LESSARD: Perfect start. OK. I wish I'd been with you all term, but I'm glad I'm not. I'm on sabbatical this year. And I'm enjoying that. So I'm probably a bit rusty in the classroom today. But I hope we'll have a good time. I'm going to talk about innovation and energy business models. So that's a big mouthful. We're trying to get a lot of things done in one session. But it's-- where I really want to go is to make you comfortable with, focus on-- these are the big questions.

The first question always is what problem are we solving? What's the value proposition? What problem are we solving for whom? How? How will we monetize it? How will we turn it into a business? What's the best business model to do that-- second question. And we're not going to answer all of that. But I want to give you a little sense of which kinds of energy innovations lend themselves to startups, which kinds of energy innovations have to be undertaken by large incumbent firms, which ones might be undertaken by new, big pioneering firms, which ones require consortia-- right? So how big, what kind of structure has to carry a particular type of innovation forward because energy is a very complicated space.

Then this is something we will not completely deal with in this session, but I'll start on-- and you've been talking about a lot already-- under what circumstances will the innovation you're focusing on be viable? And who and what has to change for it to work because that's the primary question. You've got a better light bulb. Who is going to have to change for it to work? What are the various barriers to change going to be? You looked at Hexion and you look at biofuels.

You've got questions within the firm. You have questions with the customer. You have questions within the industry. You have questions with regulation. You have questions with societal attitudes. So which of those things have to change. And that takes you back to the business model because the business model very often will be not only about producing the thing, but also bringing about the change that's required so that the thing will be viable in the marketplace. So that may really complicate the notion of a business model.

And finally, the standard strategy questions-- what capabilities-- what do you have to be good at? What scale? What scope? What various activities do you have to be involved in? And where do you have to be? And that's for another session later. Where do you have to be to make this work? And of course, the answer is it all depends. I'd say it depends on many things, but I'm going to focus on really the first two. And they're related. They're slightly different concepts, but they're related.

It depends upon the maturity of the technology. And it depends upon whether the innovation is disruptive or not. So we need to start doing some classification of the nature of the technology, the nature of the innovation to understand what kind of business models might work. OK? So far.

And then I'm going to talk a bit about innovation games, which is a nice way to think about different types of innovation processes. It's some new work being done by a friend of mine. And then we'll end with some innovation business models. OK.

So technology maturity-- you read the paper. Here you can do this with a rising S curve or you can do this with this falling curve in terms of rate of innovation. But there is a sense that most technologies go through these three phases. What's the statement in Genesis, "without form and void?"

So it's without form and void. And there may be some sense of an unmet need. And there are lots of different solutions being brought about. Nobody's quite sure how to do it. There are entrants in all kinds of places. It's a zoo.

It's highly fluid. There is no clear sense about which the best products or technologies, or even what categories sometimes the products or services fit into.

PROFESSOR: Warren Buffett talked about 2,000 automobile manufacturers circa 1910.

DONALD Yeah.

LESSARD:

PROFESSOR: Everybody with a different way to get rich.

DONALD So automobiles took off. Yeah. 2,000 automobile manufacturers in the US. By-- what-- 1933, you'd probably
LESSARD: slimmed down to 16. Now we're back to-- what-- eight maybe, but with three based in the US.

Big consolidation over time. Fluid phase-- everybody is at it. Transitional phase-- it's starting to take shape. And then the mature phase-- it's consolidated. And it's really blocking, and tackling, and tough competition on an operational basis. And it's largely scale-based.

It's Comcast, right? [LAUGHS] So you think about communications and internet and all those things. We've got some mature monopolists over here with regulatory capture. And that's mature phase.

But we've got all kinds of new stuff going on in the same time and a number of transitional things going on at the same time. And energy is particularly lively this way. Again, from the paper-- fluid phase. Right? A lot of uncertainty. This is important. A high rate of product innovation and high degree of process flexibility means people do things lots of different ways. It's almost craft industry. One company does it one way. Another company does it another way. You really haven't scaled it.

You produce the product or service however you can. Demand is taking off, but still a slow total volume. This is important. Not always the case, but what does that tell you about who's buying the product in this phase? Functionality is more important than brand names. Who's buying the product? Who would care more about functionality than brand name?

Think about it in terms of computers or internet. Somebody who really knows the stuff. Right? Somebody who knows the functionality, is a lead user, is really into what it does. Don't tell me who makes it. Tell me exactly what it does. Right? So you get the techies of that particular product into it. So the early emergence of an electrical car or the early emergence of some other new product may be much more about the intricacies of that particular product because you've got a set of people who are fascinated with the functionality. Right? Later it becomes is it accepted? Is it a brand name? Is it standard?

So this is saying that the markets are different. The nature of what's going on in the firm is as we go across. But also, the customer behavior is different. And what are you trying to do? You try to develop your technology and you're trying to hang on to it because you're inventing new ways to satisfy some unmet need. You're going to try to cash in on that. You know that there's going to be a shakeout. You know there's going to be a consolidation. You're trying to hang on either to a market position or some IP or ideally both. Right?

Now we get into a transitional phase, dominant design. So think about bicycles in what? 1880s? And they had one big front wheel and they had a little small wheel. And they had two equal wheels. And some had chains and some didn't. If you look in the old books-- all kinds of designs. I don't know what year, but probably mid 90s or maybe 1905 or so the standard two wheel bicycle with a seat position. The chain emerged as the dominant design. Of course, there were other companies making other designs. But most bicycle companies were focused on that.

What happens? It's a much better understanding about what customers need. Much more process innovation. So in my global strategy class one of my favorite cases to teach is Shimano.

And we look at Shimano from 1921 through the present. And Shimano starts off in a small village outside of Osaka. It actually is the village where the samurai swords were made. So it has experience with metal working. The bicycle is not invented there. It's invented in France.

2,000 bicycle shops spring up in a year. Everybody's making bicycles in their own shops. But as the dominant design emerges and as you get 2,000 bicycle shops, Shimano figures out that there are economies of scale in making rear hubs and crank sets. Not in welding frames, not in putting on handlebars, not in making bicycle seats, but in making hubs and crank sets. And then they get really good at that. They become codependent. Right? They become a supplier of components to the whole industry. You still have a couple of thousand bicycle makers, but you have one company that's making the high scale economy, more high technology product.

And they really start focusing on process innovation. They find ways to make things cheaper with the same quality. So they go from casting to drop forging. Huge jump in quality. So process technology starts becoming the differentiator because it allows me to deliver the same product either at a lower cost or with greater functionality. So back to the frontier you were talking about last period. And so the competition becomes much more about process and scale and experience and becoming good at things. Right? And quality and availability becomes the competition.

The technological capabilities of the firm are much less about development, much more about manufacturability. Again, we've got a large customer base. We probably have a fairly strong brand. Mature phase.

The product starts commoditizing. There are more than enough manufacturers for it. There's a more than enough capacity for it. It's very hard to differentiate your product from someone else's. More similarities than differences. And filed products convergence of product and process innovation. Really focused on cost control, lean and efficient organization. Lean, tight, not waste a penny, do everything right.

Now just think about the company that is in the mature phase how ready it is now to engage in a new round of innovation. It's just squeezed all of that out. If it's a single product company, it's in a phase of its life where it's really worried about efficiency and production process. And it's pretty well forgotten. It's forgotten about the innovation process. A classic example was Volkswagen, which was a single product company for many years. And the Bug became-- the Beetle became the dominant design. And it was out there and it held up and it held up and it held up and they kept producing and producing and producing it. Staying in that market. They forgot how to design a car. They forgot how to bring in a new model. It took them a lot of time to relearn that. Right?

So you see this kind of cycle. This is common sense stuff. But if you look at a technology, it's important to think about where are you in the evolutionary period. Is this pre-fluid? You don't even know what's going on.

Is this fluid but it's starting to take shape? Is this transitional where you're beginning to see the emergence of dominant designs and you're starting to see the shake out and you're starting to see a few firms take on strong positions. Or is this really mature, cost based, quality based, brand based competition where the big players win typically or the very focused players win? OK. So you've got it?

Spend two or three minutes-- five minutes-- three minutes with the three or four people around you. What I want is an example of an energy technology at each stage of evolution. So again, something that is just emerging, turmoil, something that is kind of in a transitional stage where you can start seeing that it's going to look this way but it's not quite settled, and something where it's highly mature. It's head to head competition.

So think about clean tech products of a wide variety. And again, very importantly, I'd say anywhere in the energy supply chain. So I tend to think of primary energy, conversion, transmission, distribution, end use. But now we have end use in industry, residential, transport. And then, I guess, we have Dick's area, which is how do we balance that stuff? Or how do we balance the whole thing if we include demand management?

So that would be the space we're looking at. So anything in that space-- new technologies, innovative technologies for-- new is the wrong word. But technologies that are coming into the marketplace or are in the marketplace for primary energy, energy conversion, energy transmission, storage, et cetera or for all kinds of end use. What stage would you put them at? And within your group give me one for each area.

Give me fluid, transitional, mature.

AUDIENCE: So for the [INAUDIBLE] different energy storage [INAUDIBLE] in the grid, so for power [INAUDIBLE]. So, like, using compressed air [INAUDIBLE]

GUEST
SPEAKER: So we have-- not only do we have batteries and very different kinds of battery technologies, and we have compressed air, and we have flywheels, and we actually have quite a few substitutes, because we have fast start generators, and demand management is actually a substitute if you think of the balance, but it's a zoo. I've been trying to follow A123 with its grid level storage. And no one knows what the dominant design is there.

And is this to be used for grid stabilization? Do you want to stick it out on the end next to a wind farm? It's not known. It's all going on over in the Department of Material Science. There are what, about six different-- six or seven different competing companies, or more, out of DMSE.

AUDIENCE: [INAUDIBLE]

GUEST Right, like Sadoway's swimming pools. OK a transitional?

SPEAKER:

AUDIENCE: [INAUDIBLE] as opposed to wind. Because--

GUEST Which kind of wind? OK, let's put wind. Good. Why is it transitional?

SPEAKER:

AUDIENCE: [INAUDIBLE]

GUEST Pardon?

SPEAKER:

AUDIENCE: It wouldn't be drive-by?

GUEST Yeah. No, so grid level wind-- and again, if we were drilling down a little bit, we'd find, I think, that on-shore wind looks like it's starting to standardize. Off-shore wind is still very much in the air in terms of the standard design. So you're somewhere in between.

SPEAKER:

Although I guess there's still some big transitions in the size of the blades. I look out my window in Vermont, and I have 180 footers now. And they're going to build 480 footers, with strobe lights.

AUDIENCE: So on-shore is beginning to standardize.

GUEST Right, but that's the point. So the water is starting to freeze. It's starting to congeal. It's starting to standardize.

SPEAKER: There's a real shift. Partly, the demand has shrunk a little bit with European financial difficulties, with uncertainties about the US credits. And the Chinese have run through a very quick ramp up, partly. But it's also starting to consolidate. So it's OK-- mature-- or mature?

AUDIENCE: [INAUDIBLE]

GUEST Big--

SPEAKER:

AUDIENCE: That's a very interesting question.

GUEST You think today's boiling water reactors will be the design used in 20 years? Right, so that's-- right. That's your question mark. So it's mature and almost dead now. But if it comes back to life, it's probably going to become fluid for a little while. I hope not too fluid, but anyway, OK. OK, team in the middle, whoever you are?

SPEAKER:

AUDIENCE: So for fluid, you had-- we'll say fuel cells.

GUEST Which?

SPEAKER:

AUDIENCE: Fuel cells.

GUEST SPEAKER: Fuel cells. Yeah, that may-- yeah, that's pretty fluid. Maybe pre, but that's good. It's still largely in the labs.

AUDIENCE: You gotta find some way that doesn't need [INAUDIBLE].

GUEST SPEAKER: Transitional?

AUDIENCE: [INAUDIBLE] solar [INAUDIBLE]?

GUEST SPEAKER: Grid solar. Again, we start drilling down, right? So the crystalline stuff looks fairly mature. The thin film stuff is probably fluid. The concentrated solar is still probably fluid. So that's a good catch all. So let's just say grid.

AUDIENCE: What's nice about it is while you have a pretty mature crystalline silicon technology in solar, you've got all these other designs being worked on-- Solyndra, et cetera, and people are looking to increase efficiency. And if somebody hits it, crystalline silicon gets displaced.

GUEST SPEAKER: Well, and you have everybody looking at the efficiency of the chip. And all that matters is the installation cost.

AUDIENCE: If you get the chip more efficient, you don't have to have as much installation, because you don't take as much space.

GUEST SPEAKER: It's still. Still. OK, I'll take a group over here. I don't know exactly where the boundaries of the groups are, but I'll just take one. In the back on this side?

AUDIENCE: You want a mature one, or--

GUEST SPEAKER: Well, if you say the same, you just say the same.

AUDIENCE: So for fluid, we talked about, like, wave energy within the ocean-- ocean wave energy.

GUEST SPEAKER: And that may be pre also, but it's starting to merge, so ocean or wave. It's very early.

AUDIENCE: We actually talked about wind and solar, so--

GUEST SPEAKER: Yep, OK.

AUDIENCE: And mature, we talked about, like, turbines, like a gas turbine, or like a coal-fired plant, stuff like that.

GUEST SPEAKER: Why is it, with-- why is it that you're all focused here? If we're going to solve-- if we're going to solve the energy problem, we've got to knock a third off the carbon footprint here, we've got to cut a third of the inefficiency here, and we've got to cut use here by a third. Why is it you're only focusing on one of the three? OK, let's have something over here.

AUDIENCE: For fluid technology, most of ours have been-- we talked about WiTricity. And transitional--

GUEST Again, fluid was?

SPEAKER:

AUDIENCE: WiTricity.

It's a company--

GUEST OK, what do they do?

SPEAKER:

AUDIENCE: It's kind of a start up. They developed the technology-- [INAUDIBLE] develop the technology [INAUDIBLE] that wirelessly transmits electricity--

GUEST Ah!

SPEAKER:

AUDIENCE: [INAUDIBLE]

GUEST OK, so wireless-- yeah. Yeah, Tesla comes back to life, right? OK, good.

SPEAKER:

AUDIENCE: Transitional, we talked about LEDs and solid state batteries. And we wanted to separate batteries into several categories, and argue that lead acid, lithium ion and [INAUDIBLE] were more mature [INAUDIBLE].

GUEST Right, so again, which kind of batteries do I have here?

SPEAKER:

AUDIENCE: Solid state batteries.

GUEST Solid state batteries, and here I have lead acid batteries, right? So this is interest, and now you're moving into the middle and at least towards the end with those two. But it's interesting, because the categories-- you say, within an existing broad category of technology you probably have some of all of those-- within wind, within solar, within storage, within lighting. So you've got these life cycles going on within classes of technology as well as across.

Anybody-- OK, let's go over here. Anything radically different? No? OK, anybody who's got some downstream examples-- something here, like what we use? Yeah?

AUDIENCE: Converters?

GUEST Pardon?

SPEAKER:

AUDIENCE: Switching [INAUDIBLE] converters as transitional?

GUEST OK, tell me a little bit more. For what kind of use?

SPEAKER:

AUDIENCE: OK, so take a look at your [INAUDIBLE] and whatever is in there. Often times, like, old ones generally had transformers inside, and then they're [INAUDIBLE]. But newer ones, which are more efficient, tend to have that type of electrical converter.

GUEST
SPEAKER: So power supplies and power converters for all kinds of stuff? OK. Some of them-- I mean, there clearly is-- there's a mature category of those, right? And then-- so power converters, but there's also emerging better ways of doing this. I spent about a day running around Delta Electronics in Taiwan, and they're all over this. They are the power converter guys. Yeah?

AUDIENCE: Mature could be a fluorescent light.

GUEST
SPEAKER: A what? Oh, fluorescent light, yeah. So now we have fluorescent, right? It's not dead yet. It still has several waves of innovation in it. It's still competitive for some uses. But it's a mature technology. Although, I guess the drivers-- the drivers for the fluorescent light, there's some big changes putting the drivers on a chip. Lowers the cost, raises the efficiency. So if you get inside the fluorescent light, there's some MIT professors who have the new chips to drive them. Yeah?

AUDIENCE: There's a different way of approaching this. You wanted to discuss the final third as well, so put habits in mature, because I don't see much innovation in thinking about how you can [INAUDIBLE].

GUEST
SPEAKER: That is a very interesting different way. So you'd say, what is it? And when we talk about disruption, we'll talk about the customer. It was a nice thing, saying here, we're talking about hard stuff-- technology. But in fact, human behavior-- human behavior could be categorized, and institutional behavior could be categorized in the same way.

And our habits for commuting and driving, and where we choose to live, those things are pretty hard wired. Our habits regarding the use of electricity, mental attitudes, probably pretty mature. We've been doing that now for 100, 130 years-- pretty mature habit. We've got some things that are transitional. There may be some things that are quite fluid, right?

So this is-- so you could apply a similar thinking structure to behaviors. This is focused on technology, but I think you've all got the point on any time you're looking at a technology, you want to know where it's at. Because that's going to tell you a lot about what's going to be required to have a successful business model in that phase.

OK, now we'll go on to the next piece of this, which is discontinuities or disruptive. And they're similar. And Hiram, maybe you can straighten me out in terms of the difference between these literatures. I view them as almost the same. But the point of kind of discontinuities or disruptive change-- so we've got some incumbent technology, right? And it's gone through an S curve of unit sales, and it's matured, and it's leveling off. And a challenger comes in.

Out of the fluid phase, it starts really emerging-- let's say, in the transitional phase in here-- it starts garnering some sales. It's probably not direct competition at first. It may even be dismissed as irrelevant, right? And over time, if it's appropriate, it will supplant the existing technology. So I gave you a reading about Kodak, and a reading about some of the difficulties that Kodak had in dealing with-- this is film-based based photography.

Kodak wrote it from the initial chemistry to pretty much dominating the market. Although they did have a little challenge from the Japanese and the Germans. But they rode that market very nicely. Now, we're in a totally different world. Nobody uses film-- totally different product. And so you see these cycles over and over again.

I may be getting out of line a little bit, but one of the things you want to think about in these discontinuities is who is having to change? This becomes a critical thing. So the question I'll pose in two slides after I do this next one is, discontinuous at what level, disruptive at what level? Because you really have to sort that out.

But in order for your opportunity to materialize, what changes do you need? Do you need changes in end user behavior/habits? Do you need changes in prices? Do I now need peak load pricing, or do I need carbon pricing? Do I need a change in policies, building codes, right? So a whole series of things that may need to change, not just my technology. My technology may be maturing, but I may need behavior, I may need prices, I may need regulation. And of course, we'll come back to these. But you'll think about which point you can lever.

Let's look at this point now, though. Disruptive to what? So we're trying to classify a technology-- an innovation-- as to whether it will be disruptive or not, just because it's fun, but because it gives us some notion of how we need to address it, and what it will take to get it implemented. Is it disruptive to the customer, to the firm, to the incumbent firm, to the platform or system, to the industry, to the regulatory context, to the social acceptance and mindset? We're kind of going down in levels of difficulty.

So-- oh, that slide turned out beautifully. But customer-- and we could-- you've talked a bit about customers taking on new products?

AUDIENCE: [INAUDIBLE]

GUEST We tend we tend to focus on the price and the economics of a new energy use. And then, of course, we get in an argument about whether people really look at the current cost or whether they look at the life cycle cost. But there are two other issues, at least, that go along with that price and that price calculation-- new behaviors or competencies. Do I have to start acting in a different way? Does this require that I undo some habits to use this new product? If it does, I've got a much harder sell, right? And I have to think, this is not marketing my product. This is getting you to change your behavior. That's one issue.

SPEAKER: Or the other, of course, is does it require new system complements? Do I have to have other goodies to go along with it? So you give me some device for-- I don't know-- controlling the heat-- the air conditioning in my unit. I also need, obviously, the controls on the pieces. And I probably need that to be hooked in with my cell phone so I can do it from a distance. I need an infrastructure that intercommunicates.

So think about the customer. You've got a product for them. You say, this is a new and improved product. It's going to save you energy, and/or it's going to reduce the carbon footprint. Hopefully, it's going to do both of those. And so you should buy this product.

And if you do a careful lifecycle calculation, which you probably won't do, you may find that this product is attractive. You still have to think about, am I going to use it? What do I have to do differently? And am I going to have to change out a bunch of other stuff? Because the critical point about energy-- and you've seen this over and over again-- is this is the installed-base industry to kill for, right? It's got huge installed base of complementary stuff. So you're wiring, your appliances, everything in your house are all built in a particular way. To change that is a big job-- kind of scary job.

OK, so I'm not going to go too deeply on the customer today, because I didn't give you any readings on that. But I think that's the primary one. Yeah?

AUDIENCE: [INAUDIBLE] when you think of disruptive innovation, actually, in some ways, [INAUDIBLE]. innovation, it comes from the bottom. So the transistor radio is a classic example. So when [INAUDIBLE] patent transistor radios. But the point was transistor radios were something that teenagers could take in their rooms, listen to radio stations, so they don't have to sit around the living room with their parents and put on the big tube radio.

The point is is that it was [INAUDIBLE] disruptive to the teenagers. As a matter of fact, they got privacy. [INAUDIBLE] the quality of the reception was pretty poor, and the quality of the sound was pretty poor. But this was a very expensive technology. You know, the same way that all of you adopted social media, it's a very simple method. To a lot of people that are used to not doing that, much more disruptive.

So in many ways, when you think of a project that you're working on for your papers, for example, you can think of disruptive innovation in ways that you can find a customer that is actually, in many ways is a very simple way-- almost too simple a way to get there, and then it disrupts from the bottom. So it disrupts the marketplace, but it's not necessarily disruptive for the individual who's going to take it up.

GUEST SPEAKER: Well, in fact, the-- if you like, the disruption may be desired by your customer. So "disruptive" sounds like this is negative. So all of the family had to sit around the single TV set or the single radio set, and the parents may have liked that or may not have liked that, depending upon their style. But certainly, there were customers who wanted to get away from that, who wanted privacy, wanted to go their own rooms. So you say, this is disruptive for the existing family habits.

But the question is, is there a segment that finds this disruption attractive? I'm just trying to open up this concept of disruption at all of these different levels, because we tend to think of it, is it disruptive to the incumbent firm? But that's only one of the many considerations, and should not be a negatively or positively loaded term. It's a descriptive term.

Is it disruptive? Does it require certain types of changes? And very often, does it require changes in a complementary set of activities? And then, what are those changes required? So not how do we make it, but what changes will be required so that it is adopted? And that will often be a more central part of the business model than how do we make it. That's--

AUDIENCE: Wind and solar are interesting from that point of view. And we'll come back to them week after next. But putting a lot of wind in an electric power system requires a lot of changes in other parts of the system. I mean, it's not disruptive to people who get electricity. It's not disruptive to people who are buying. It's disruptive to, how you run the grid?

GUEST SPEAKER: Right, So if we push past, what, 6%, 8% in a deep grid, in wind or solar, then it's disruptive to the grid. And it may be disruptive-- it's probably going to be disruptive the economic model of the grid. Because how do you recover the additional costs associated with having the depth to deal with the intermittency? Or you could say, wind has to have storage at source so that its interaction with the grid is smooth, right? That's happening in some places.

AUDIENCE: Then you're not going to have much wind.

GUEST No, no, A123 is actually in Chile, they've got this. So you've got wind farms way the hell away, right? If you've got a wind farm a long way away from a population center, then your problem is you're going to have to build a very high capacity line to deal with the intermittency. It becomes economic to put grid level storage at the wind farm tuned to the wind farm so that it can then feed through the line on a steady basis.

And now, it's not-- but now, it's disruptive in that wind farm has to combine storage, right? So it's a more complex business model to avoid the disruption to the grid. So general point-- any technology you think about, you need to think of the various points at which it may be disruptive. And not saying disruptive is bad, but rather to focus on who is going to have to change how, and will they have the incentives to do so, and how could you work on those incentives for them to do so? It's just a way of thinking about the process.

OK, incumbent firm's capacity to change. This is the Christiansen article. Would one of you like to tell me-- tell us all the Kodak story in terms of those four quadrants? I just happened to pick up the FT yesterday and had this beautiful story ready for today's class, right?

So we all know that Kodak lost it, right? It dominated the film business. It was an early participant in digital technology. It certainly had the money to do it. It certainly had the technology to do it. And it's nowhere, right? So it totally lost the score. And it had a fantastic brand name. It had everything going for it-- lost it.

So what was it in that story that-- I guess the question would be, does this framework even help, and how would we kind of shoehorn that case into this framework? So did it fit with their processes, capabilities-- the one thing I'd add-- processes, capabilities, and relationships? Did digital fit with Kodak's-- why not? How not?

AUDIENCE: I mean, I guess, for the longest time, they invested in film technologies. And so--

GUEST We're chemists. You start off kind of at the habit or people level, right? The high prestige people in this firm are optics people and chemists. There are some really pretty hairy stuff going on there. And those are-- so first of all, the prestigious people, this is not prestigious. So that's a little bit of an issue. And so it doesn't draw in the chemical capabilities at all, or the filmmaking capabilities.

Kodak was also a very advanced manufacturing company. If you go on the Kodak plant, it was what, a mile long-- a continuous-- one single, continuous machine to make all this film-- just a technical marvel. Again, digital cameras have nothing like that. So there's not a deep manufacturing capability.

Selling capabilities-- putting them in stores ought to be about the same. Anything different about the model between putting cameras and film in stores versus digital cameras in stores? What?

AUDIENCE: Well, film is a complement for a film camera.

GUEST Film is a complement. You probably basically subsidize or sell the camera at a very low cost, especially the cheap cameras, right? There were disposable cameras that basically cost nothing, because you're selling film. What's the complement that you sell with digital photography?

AUDIENCE: [INAUDIBLE]

GUEST You may sell some complements in the internet in terms of storage and in terms of social media, but it's not within your same category. It's not even people you know. So I would very quickly start saying, yeah, this would require Kodak to be a very different place. On the other hand, they do have a brand name that is associated with images, right? They do have the optics that are still very important in digital photography.

So they have some relevant capabilities. They're not out of the game. But they don't have them all. How about the values and time horizon? Did you pick up anything from the story about values and time horizon? Yeah?

AUDIENCE: I didn't fit with their values, because the way that Kodak had been, like, started by the founder was just with film, right? They never talked about digital. I think that was the problem when they were deciding whether or not to go into [INAUDIBLE].

GUEST It's almost-- that's identity, right? So is our identity images, or is our identity photography?

SPEAKER:

AUDIENCE: Yeah, and they probably felt that if they want to digital, they would lose, like, a lot of their customers. Because they had always been film, and then that's it.

GUEST Or that they would cannibalize their customers thinking that they alone owned the transition. It's a little bit of hubris, right? Just because they were a leading firm didn't mean that they alone owned the transition. But let's get down to the nitty gritty-- value and time horizons.

SPEAKER:

How did Kodak measure investments and the desirability of investments? What did they-- it was in the story. What did they judge investments on, or businesses on-- good business versus bad business? Who's there. If you if you read the story carefully from kind of a financial or accounting perspective, it would have jumped out at you.

Profit margin-- the difference between sales price and cost. They were in a near monopolist position with a mature product. They had very high profit margins. Anything that they're looking at, they're judging in terms of profit margins. This new product, even if eventually it's going to have a high profit margin, will not have a high profit margin. You've got to be forward-looking, right?

The company is looking at, let's say, quarter-by-quarter at the current profitability of the existing business. If you use that optic on businesses which now fits the existing business, no way in hell you're going to choose this new business that's going to take five seven, eight years to launch. And it's actually going to take quite a long time to figure out what the complements are that you reach into to get the extra profit, right?

So if you look at digital photography, I'm sure that a lot of money is being made by people other than camera makers. There's a lot of value out-- there's a lot more photography being done. There's a lot more being swapped. Granted, it's swapped at lower costs. But I suspect it would be interesting to go out and add up who all makes money on Facebook, right?

Facebook makes money. YouTube makes money. You have a whole series of places that make money out of storing and swapping images. Some of that space might have been Kodak's, right? They were in the image business.

AUDIENCE: Well, they tried. They had an online--

GUEST Well, they tried.

SPEAKER:

AUDIENCE: --processing service.

GUEST Point is, companies evolve. Companies change with the conditions they are in, with the pressures they're in. This
SPEAKER: was a company with a very mature technology that it was driving. It had a couple of tough competitors, so it worked quite a bit about cost. But it still had nice margins.

It had this fantastic scale and quality-oriented manufacturing. It had brand name-based distribution. It made most of its money off the film, not off the cameras, well-tuned business model, and you could judge each different sector by profit margin. And along comes this new business that is going to take 10 years to build.

Come on, guys, right? We're not in the VC business. We're in the current profitability business. So I think that puts a little life into this figure.

It's hard. It's very hard for incumbent companies to change, especially-- and we often talk about the disadvantages of a company being diversified, because it gets very confusing, it's not focused, et cetera. One of the advantages may be that it may, in fact, house technologies at all three stages of maturity. Because if the company is predominantly at a mature stage, it's going to have a very hard time dealing with things at the transitional stage.

Because everything it's going to do is going to be tuned to cranking it out, low cost, lean, manufacturing, operations focus. The best parking lots will belong to the sales managers and the manufacturing managers, not the scientists and the innovation folks, not even the engineers. So it's going to shift who gets the parking lot-- who has the power.

AUDIENCE: OK. Or you could do it the other way. [INAUDIBLE] was very finely-tuned tuned in a very-- in a different direction, in that cost-oriented, technology-oriented, focused on a segment, all built to do-- to deliver top quality to a set of customers. Tough to turn that ship. Tough to turn that ship.

GUEST It's very hard to be good without being finely-tuned. And if you're finely-tuned, it's very hard to change. That's the
SPEAKER: whole story. There's nothing more to it than that. Then, you can think about the different elements of that change-- and I think this is a useful categorization-- to make an assessment of whether it's even worth trying.

You can make an assessment, is it worth trying. And then, what things would you have to work on in order to make the change? Or do you totally give up? Christiansen's claim to fame, he basically says nothing innovative can come out of a big company. It always has to be a start up. That creates a major conundrum for us in the energy sector, because almost anything you need to do in the energy sector is large-scale and highly interdependent, and therefore requires scale. But it needs a start up-- catch-22.

Any other questions about this? Yeah?

AUDIENCE: So I would assume that we're talking about organic growth, right? But a lot of times, you'll see companies, especially in tech business, where you might not have that much capital intensive investment. So a lot of things are really just based on software. For example, Google, I think they're very finely-tuned.

But at the same time, they're innovating very quickly. They're changing things. They require a lot of different types of companies. And I think it's because if they see a technology that's promising, they're able to sort of grow inorganically by that company, and see-- let the company almost operate independently for a while, and see how earnest that technology is.

GUEST Very, very interesting point. So if we were to complicate it, we'd say that you could say that this is a story about
SPEAKER: organic growth-- kind of just investing yourself. And you might say that we could avoid some of these issues by acquiring. And we can let things operate by themselves for a while, and then we can bring them in.

Now, we get a new set of challenges. The set of challenges is, is the company going to be successful at integrating the acquired firm? Or is it going to leave it alone and basically become a portfolio owner? Therefore, it really didn't bring it in. Or is it going to bring it in and crush it?

It's very hard for large companies to do this well. One of my major case studies over the years has been CEMEX, the Mexican cement company. And they have grown entirely by acquisition. And they are very-- until 2007, when they bought the wrong company and almost bankrupted themselves, they were very successful acquirers. But there were a lot of tricks associated with it.

They have a post-merger integration process. One of the key tricks they developed-- not a trick, it's very important. They developed the 80-20 principle in the post-merger integration. So after 18 months, the company we acquire-- it's a cement company-- is going to be operating exactly like the rest CEMEX. Hey guys, this is an acquisition. This is not a merger. You will operate exactly like CEMEX.

But if the post merger integration team, which consists of people from CEMEX and the newly-bought company, don't come back with roughly 20% of the practices that they could change in CEMEX, they failed. So we're willing to learn from the company we acquire. That's a way of creating dynamism in a large parent company, right? Very few companies have that kind of dynamism.

I've done a lot of work with BP. BP bought Standard of Ohio. BP bought Amoco. BP bought Arco. They changed the label, they didn't change the systems. And you see what we got. So acquisition doesn't solve the problem.

It may give you-- it may give you a way to have multiple cultures. It may give you a way to have two pieces of the company that operate on a different clock speed. But if you're going to gain the advantage, ultimately, you're going to have to integrate it. And that's very, very, very hard. So good point, but--

AUDIENCE: One of the things that also happens, from time to time, is you typically made-- the start up-- you've made the founders of that company rich.

GUEST Yeah.

SPEAKER:

AUDIENCE: And you know I can stay and work in a larger organization, although I preferred a small company. Or I can go buy a yacht, start another company, or--

GUEST And it's my baby. So if you bring in the acquisition side-- and especially, then you have to also deal with kind of
SPEAKER: family and founder life cycles, which is much more Hiram's area. So you're going to have to lay that in as well, right? So you've got to be at the right life cycle.

But, so the acquired firm has to be willing to be acquired, and has to actually want to transfer what it's good at. And the key middle employees of that acquired firm have to want to stay there. And the top management either wants to integrate itself into the company's bought, or just vanish. So now we have this dynamic within the incumbent firm. We also have the dynamic within the firm we're going to acquire. So it may solve our problem. But it's difficult.

So bottom line, change is hard. Change is particularly hard for large, bureaucratic organizations. If a company has really dominated a product market segment in something like energy, by definition, it's huge. It's very bureaucratic. It's probably very cost-oriented. If it's a public utility, it's even worse, because it's regulated, and again, it's very large. And it's focused on cost and a very particular definition of service. And it has a set of people and capabilities for delivering the current products and service, not for developing new ones. So it's going to be the extreme of this case.

OK, let's go to the next level. So the system context changed. This is the Michelin article, right? So Michelin brings you this new, no-flat tire. Why did it fail in the marketplace? Was it a lousy design? Great design, right? Then why did it fail? Yeah?

AUDIENCE: The repair [INAUDIBLE] didn't want to take the time to put in a new, expensive [INAUDIBLE] help change the tires properly.

GUEST
SPEAKER: OK, so this is-- a tire-- an automobile tire, unless it's absolutely perfect-- and of course, why would you have a run flat tire if it was perfect? The fact that it's a run flat tire already admits to the fact that it's going to have damage and need repair. So that the inherent nature of the product says, this is a product that you buy and then a product that you service. And the whole appeal is you want to be able to drive to the service shop, right? You want to go 45 miles on your flat tire at night. You don't have to stop on the freeway, et cetera.

So it's embedded in a system. Is it just the tire repair shop that we need, or do we need any-- do we have any other complements that we need to make this work? Yeah?

AUDIENCE: You need new rims, because--

GUEST
SPEAKER: You need to have a rim. It needs a clincher rim. If you ride really old motorcycles, you have clincher rims. Now we have rims that are just with tire pressure. This needs a clincher rim again. So you've got to go and talk to Hayes, or whoever it is that makes the wheels. And you've got to get the auto manufacturer to specify those more expensive rims that have the clinchers on them.

AUDIENCE: And also pressure management system that was integrated into the vehicle itself.

GUEST
SPEAKER: So now, I have to buy the valve stems, but it also has to be part of the car's computer system, in terms of the pressure management system. So who do I-- let's just think about how many parties we have to coordinate. And how many parties have to pre-invest before they know that this technology is going to work so they can work.

So Michelin invests years in this technology. And they test lots of different kinds, and they find out this one works. And they're a very good engineering company. They obviously, in that testing, had to work with some wheel manufacturers. But they've got to get some wheel manufacturers to pre-invest in that capacity.

They've got to convince Honda, or Toyota, or General Motors, or somebody to specify that tire and wheel, probably on a premium model, probably at much too low a scale to make money on, to get it out in the marketplace and get it tried. And now, I'm going to tell you that 5,000 vehicles this year are going to have that wheel, and it has to be able to be serviced at, what, 50,000 points in the United States? Because I've got 45-mile range, so I've got to be able to get to a authorized Michelin repair shop within that range, otherwise that product doesn't do me any good.

And now, I'm really pissed off. I paid extra money for a product that's going to solve this problem for me. And suddenly, I find out it's worse than the standard product which I could have gotten fixed at any old service station. You got it?

So we have a product. And this is fairly simple. So I only have three, four, maybe five different complementers to deal with?

AUDIENCE: This is not an uncommon kind of problem. If you think about video games, who develops the game for a console that doesn't sell? Who wants to buy a console for which there are no games? You've got to get the consoles out and the games developed.

When they invented credit cards, you had to get the merchants to put it in the terminals to accept the cards. And you had to get the consumers to carry them. But if no consumers carry the card, what good is the terminal? And if no merchants accept the card, what good is carrying it? This chicken/egg problem of finding complementers is not uncommon.

GUEST
SPEAKER: It's the chicken/egg. And if you're going to drive the development of this platform-- which is what it is. It's now the Michelin Run Flat platform that includes the Michelin tire, the inner ring that is manufactured by someone else, the rim that is manufactured by someone else, the tire monitoring system that is manufactured by someone else, *and* the distributed repair stations, then you're probably going to have to have a brand and reputation that make people think that you will succeed. You have to have a deep enough pocket that convinces people that you will succeed. And you have to have a deep enough pocket to prefund some of these other activities.

So this is not an activity for a start up. Start up might well come in on the platform. In fact, it may be the best time to come in, because the platform sponsor has to prefund the complements anyway. Start up may be available for cheap to come into one of those places. But they can't push it. So this is just a perfect example of the complements.

What--

AUDIENCE: --design and then sell it [INAUDIBLE].

GUEST
SPEAKER: Right, so if you came up with this design, you'd say, who could make best use of this design? And the first question you're going to ask is not what technology is involved, and who knows how to use this technology, but what changes will be required for this product to make it in the marketplace? And who has the standing, and the power, and the prestige to bring about those changes? You're looking at your technology, but you say, what needs to happen?

If you're making an app for an iPhone, that problem's been solved for you, right? Apple has created the platform. They even have the cash collection system for you. They even have their standards. All you have to do is make your app and stick it on the platform, because the platform exists. And in fact, a good platform is a good entry point for smaller firms. But if you've got an idea that is going to change a system, you're going to have to find a system driver.

OK, any ideas about what Michelin might have done with all of those tire people? Yeah?

AUDIENCE:

I was just thinking, as you were talking about it. Wouldn't it maybe have been better, since they have this-- they need the network of places that can repair the tire to maybe approach the market from, like, maybe a really luxury sports car type manufacturers? Because they kind of-- like, if you're going to buy a really expensive car, usually you only trust a couple of people to service that car. Then you only need that tire system and that special service shop. And people who own those expensive cars are willing to pay more, and take their car to the special service shop.

GUEST

Key lesson-- you pick segment. You pick a segment that will place a very high willingness to pay for your

SPEAKER:

innovation. Remember last session. You pick a segment that is manageable. And in fact, initially, you're probably going to pick a segment that is not profitable, because your goal is to get out and show that it works. And if you go for the big segment, then you've taken on a big change problem. If you go for the small segment, you've taken on a manageable problem.

Now, I've got this set of specialized tire repair places. And I probably already have agreements with them that they will favor Michelin, right? What do I do? I rent them the machines, and I charge them on a per use basis. Because I say, I don't know if you're going to have many customers for this machine or not? That's my risk. Your risk is learning how to use it, right? And if we succeed in selling this thing, then you're going to get some business. And then you can pay me back piecemeal.

So you could think about business models that took the complementers into account. My sense is Michelin did not do that. Because they had a better product. They had a clearly superior technology. There was no question this was better. But to get people to adopt it-- change, change, change. And I have to think about it differently as the customer a little bit. But it's mainly my complementers that I have to bring along. And I have to get it specified on the car, and then I have to service it afterwards. OK.

Difficulty of change-- and this, I guess you've had Dick channeling Susan as opposed to Susan teaching you, on kind of the cultural-- the cultural, sociological side. But this is a little bit like culture. If you think of how hard it is the change on the customer's part or on the firm's part, I would argue that it goes in this order. So I've got to learn how to do new things in a different way. That's pretty hard. But it's harder if I have to use new complements, or change the form in which I use things.

So use form-- shared cars versus owned cars, that's a totally different use form. It's a very different style, right? Or clustered housing versus distributed housing-- whole series are like that. And then finally, a different way of thinking about it, we-- we, collectively in this country-- a car is immediately available. So we can go someplace on a whim. And that's one of the advantages of having a car. It's that freedom of being untied from schedules, or being untied from this, and that, and the other thing.

If we go to shared cars, or public transportation, or something else, we would have to change the rhythms. Suddenly, you'd have to become synchronized with everyone else again. You'd have to become Swiss. Swiss society is built on railroads. American society is built on cars. That's deep. That's really deep for a society that has not developed that way, and where people really value that autonomy. So just think of kind of levels of change.

OK, discontinuity will happen on the level of industry as well as technology, and there'll be an area of substitution, area of design competition, area of incremental change. This is, again, in the Munir and Philips article. Industry dynamics-- this is kind of a repetition-- dominant design, similar competencies. The interesting point, in this article they talk about the activity network versus the industry. Because you think of, there is a field of firms that are both competitors and complementers. And in a well-established industry, there will be four or five other firms that look like you. And that will be the industry. And that's pretty much who you look at.

In a transitional phase, there are all kinds of players that might be involved. And you've got to think outside your normal boundaries. That's their key point.

I want to get you to the next slide. This is where I want to end. So this is a way of bringing together technology maturity versus the product architecture. Roger Miller is a friend of mine. I did a book with him about 10 years ago. This is his latest book. It's about to come out.

And he says, think of innovation as a game. Every innovation is a game. It has many, many different players. And product architecture-- is the product standalone, is the product platform-based, is the product a closed system? Market maturity-- is it emerging, is it in a transitional phase, or is it mature? Eureka! What does that say? Single inventor, start up, neat idea, Eureka, it's standalone, it's transitional, you do it, right?

Mature markets, stand alone-- new and improved tide. It's the new version, or five star energy rating as opposed to-- Energy Star rating as opposed to 4 star Energy Star rating, or the next version of LEDs, a little more warmth in the light compared to the last warmth. The lighting part is already satisfied, we're now in incremental improvement.

Is it platform-based? So Apple-- iPhone versus the other guys, Microsoft and whatever they sell-- Android-- so Apple versus-- iPhone versus Android, those are platform wars. And you've got heavy, heavy investment by sponsors of those platforms fighting with each other. And you have a lot of app producers who are actually playing across both of them, right? They're in both ecosystems.

Or if it's mature, it's mass customization. It's just apps. It's no longer the platform wars, because there is the established platform. System breakthrough, pushing the envelope, I'm not quite so sure about his terms there, but interesting classification.

So let me change this question. Let me change the question to think about the technology that you were working on in your team, and decide where it fits there. Take a couple of minutes to think about-- kind of position it, and tell us why. Because it'll tell you a lot about the business model that's going to go along with your technology.

Let me be countercultural in Cambridge. So let me start on my right, and just go around this way. I don't have to get everybody. But you know, each team kind of tell me what your technology is and where you think it fits.

AUDIENCE: So our [INAUDIBLE]

GUEST OK, so why is it platform-based?

SPEAKER:

AUDIENCE: There's hydrogenation. There's also solar thermal, solar cells. There's a lot of ways to get [INAUDIBLE]

GUEST OK, so there's-- we're in, certainly, a transitional technology area. I would think the platform base becomes,

SPEAKER: again, who bears the cost of storage and where does the storage fit into the system, right? So it's going to become part of a grid.

AUDIENCE: But it's also who are the complementers that make the pieces? You may have battery makers on one hand, and semiconductor people, or the folks doing the thermal-- who makes the big block of graphite or wherever you use as the thermal storage medium. So you do have different sets of complementers depending on what road you go down, I think. Is that what you have in mind?

Yeah.

GUEST And so there's going to be some pathway of grid development with particular types of storage embedded in order

SPEAKER: to make this storage feasible. That, in that sense, would be a platform. And that's good. OK, next group?

AUDIENCE: We were talking about solar also. But [INAUDIBLE] getting better, and the need for solar is always going to be increasing as well. What's more important in our eyes is pressing it on [INAUDIBLE] part that's already mature for something that doesn't [INAUDIBLE].

GUEST So where does that put you?

SPEAKER:

AUDIENCE: [INAUDIBLE] where-- like, it's not that-- not necessarily that you're even improved one solar to another, but you're improving a-- just acquiring.

GUEST Grid level or household?

SPEAKER:

AUDIENCE: More household.

GUEST That would be very different, right? So it may be radical for the household. But it's kind of one more feature to

SPEAKER: change your energy cost mix, and change your greenness. So in that sense, it might be new and improved. It probably has a brand name beside it. It probably has a financing complementer. It may have-- be series Home Improvement, where you put it on charge and you do 17 other things at the same time.

So it could be-- it might be here or it might be here. It could be between those two, depending upon the economies of scope. But that's good. OK, next team?

AUDIENCE: We talked about [INAUDIBLE] solar, [INAUDIBLE].

GUEST OK, and again, the question is whether you need to link those or whether the grid will link those, right? And Dick

SPEAKER: and I were just talking about what's the difference between a closed system and a platform-based system. If the grid manages the complementarities, then it's an open system. If you manage the complementarities, you've chosen to mix them.

AUDIENCE: [INAUDIBLE].

GUEST OK, I'm going to run out of time quickly. So let me do a couple more teams-- that team and this team here, and
SPEAKER: then we'll come down to one team over here to more or less cover. So what do you have?

AUDIENCE: [INAUDIBLE]

GUEST Nuclear again? Anybody who's different? Anybody who's down at the user end of the chain? Yes?

SPEAKER:

AUDIENCE: Well, I want to say-- yeah, I guess user in terms of transportation. So yeah, so ours is about publicly-shared electric vehicle systems.

GUEST OK.

SPEAKER:

AUDIENCE: So our guess would be that that would kind of tend towards a platform more, because in the middle of the actual market before the transportation market is kind of mature. But the economy technology is very much in a transitional phase. Like, you have to improve a lot of-- you'd have to improve the technology. To make it feasible, you'd need to kind of change existing infrastructure in the system, like charging and other things.

GUEST And you also have to change some fundamental habits in many ways. So you're talking about a large system
SPEAKER: change. You're going to need an important systemic change agent. OK, you could go on on this. I think it's very important to kind of classify where you are.

If you think of what are the different business models-- just quickly in the last minute-- start up or skunkworks, right? So either it's a freestanding company or it's a freestanding piece of a company. Because it really is autonomous. And you want to optimize the innovation process.

That's probably an established brand-- new and improved, but it already has some reputation. It already has market position. It already has distribution. The product is not different enough to get you out of that channel.

If it's up here, you know you need a networked shaper-- somebody who's got money, and name, and whatever else. Down here, this is already somebody who has a dominant platform. So the utility has a dominant platform if it will bring you in. If not, how do you go around it?

This is probably a public/private consortium. You're nuclear/solar, you're going to get this developed by a public/private consortium the first time around. It's too big. It's too complex. No one is going to take it on other than that.

On the other hand, if we're talking about a new generation of-- a new kind of grid generation, probably-- maybe a large incumbent, so Duke Power, or South East-- one of the big utilities in the south, or a private consortium. This is not final, but this gives you an indication of who do you have to be when you grow up, not because of the complexity of the technology, but because of who needs to change in what ways in order for your technology to be implemented. So that's the story on innovation in business models. All set, thanks.