Daniel_Berg Interview by Dick Larson, October 23, 2017, Houston, TX

Introduction: Early Life

DICK LARSON: Hello everybody, my name is Dick Larson. Delighted you joined us today. It's my pleasure to be here sitting, talking with Dr. Dan Berg. And he has been a pillar in the area of systems and operations research and services science and other things. And so we want you to get to know him. And he and I have known each other for many, many years. Dr. James Tien, who is now at University of Miami, where Dr. Berg is, both of them came from RPI before, so I've known them both for a long time. Dan, I'm delighted to be here with you today, and basically, this is your show. We want you to tell the story to the INFORMS community about your life and about how you got involved with service science and OR, and these sorts of things. But I guess what we're supposed to start with is the basic facts, like where you were born, what you remember about your childhood and how you eventually gravitated to science and these sorts of things.

DANIEL BERG: OK. I was born in New York City. And it was an interesting reason why. This is a joke coming on. I wanted to be near my mother. Old joke.

DICK LARSON: Oh, very nice.

DANIEL BERG: I was born in New York City. My family lived outside New York City, in Connecticut, for a good part of my life. But I went to school, grade school, and I went to high school-- I had to travel a long way to go to a high school called Stuyvesant.

DICK LARSON: That's a very famous high school.

DANIEL BERG: It IS very famous.

DICK LARSON: One of the most famous in the country.

DANIEL BERG: It IS very famous, deservedly so, because James Cagney was a graduate of Stuyvesant High School.!! You have to pass a pretty good test to get into it. When I went there, it was an all boys school, and it's a very small school, and they could not do all the sessions at once, so it was split session. For my first year, since I'd gone to junior high school, I had to literally get up around 5:30 in the morning, take a train. It was at 14th Street and 1st avenue. Since then, they've build a fantastic school on the other side of Manhattan, lower Manhattan, fairly close to the World Trade Center, which they had to shut down after the attack. In any event, the last two years of the-- excuse me, the first year was from 1:00 to 5:30 in the afternoon. The two junior and senior years were from 8:00 a.m. to 12:30.

So I was known in my neighborhood for going to bed at 8 p.m. In order to get my 8 and 1/2 hours of sleep.

DICK LARSON: I have some MIT faculty colleagues who routinely still behave that way.

DANIEL BERG: And now I'm known for taking a nap and showing up late for a taping.

DICK LARSON: So were your parents very supportive, or did you have siblings?

DANIEL BERG: I was youngest of four brothers.

DICK LARSON: Oh boy.

DANIEL BERG: And I was known as Baby Dan.

DICK LARSON: Baby Dan.

DANIEL BERG: OK, and my three elder brothers were very protective. It was at an age where they got involved in the war, and I was a young kid.

DICK LARSON: So you obviously got interested in science early on.

DANIEL BERG: Right, exactly.

DICK LARSON: And I looked at your background. I didn't know, actually, your advanced degrees. I guess you went to Yale?

DANIEL BERG: Went to Yale for my PhD in physical chemistry.

DICK LARSON: Physical chemistry, yeah. Tell us about that choice.

DANIEL BERG: OK. I was always interested in science. I'll tell you, if I may, a little bit about my parents. My father, who worked in Connecticut even when we lived in New York, he would leave early Monday morning and come back late Friday night. He worked in Shelton, Connecticut and in Danbury, Connecticut. He was both places, he was the plant manager for partners who owned the plant. So he worked for others until, I think it was the mid, late 1930s, when they sunk everything they had into a plant of his own.

DICK LARSON: Oh.

DANIEL BERG: I should tell you, the plant owners had-- there were three. Mr. Pepper, Mr. Salter, and Mr. Shaker.

DICK LARSON: You've got to be kidding me.

DANIEL BERG: I kid you not. No, it's a true story. But eventually, they sunk literally every penny they had and started a plant of their own, with my mother working full time as the-- taking care of the books, and my father working very hard assembling the factory, getting the plant going.

DICK LARSON: And what age were you at this time, approximately?

DANIEL BERG: I must have been eight years old, seven years old, something like that. And the stories attached to that. Stories that did me in very good state. To earn extra money, I was on a 25 cent allowance, enough to get to a movie. To get any extra money--

DICK LARSON: You had to earn yourself.

DANIEL BERG: I had to earn it from my--

DICK LARSON: So even though your parents were very busy, they spent a lot of time and energy with you, and they motivated you to be a hard worker.

DANIEL BERG: Yes. And they were-- my father would give me odd jobs just to pay me.

DICK LARSON: More than a quarter.

DANIEL BERG: Like painting exit signs in his factory. The other thing, which was really a good education for me, it was one of those cases where my father was a lot smarter than I thought, as it turns out. At that time, there was absolutely no air conditioning, and it was a hot factory during the summer. And he would send me out to carry back cold soda for the men and women on the production line. And he would go up and down the line, offering whatever they wanted.

DICK LARSON: Hand this out, yeah.

DANIEL BERG: And I, in my naiveté, stupidity, whatever you want to call it, asked him one day, "I don't get this. You own this plant, this is your plant, what are you doing giving out soda?" And he answered, and it stuck with me, dumb number four son, OK? "These people are on incentive payment. They get paid for their output, as well as the time put in to the production. They don't want to take a break."

DICK LARSON: And you don't want them to get sick, either, because of the heat, right?

DANIEL BERG: Yeah. "The more they earn, means the more we produce, and the more we earn."

DICK LARSON: Win, win.

DANIEL BERG: "And the more we earn, the more I can afford your allowance."

DICK LARSON: Even if it was only 25 cents.

DANIEL BERG: Even if it was 25 cents.

DICK LARSON: OK, so let's advance further. Now, did your father's plant play any role in your deciding to study physical chemistry?

DANIEL BERG: I don't think so. Although, he would have me, when I got a little older, help him with the accounting books. Mother was no longer doing that. This was to prepare the books to go to a professional accountant.

DICK LARSON: So you'd think you'd go to a management school then, instead.

DANIEL BERG: Well, it was-- I was precocious in math and they were very encouraging. I remember my mother asked me what I wanted for Christmas, and I said, a chemical laboratory.

DICK LARSON: Really? At what age were you then? More or less again. Eight or nine or 10?

DANIEL BERG: No, it must have been 12, something like that. And she had me design such a thing. Remember, this is in a fairly big apartment in the city. And she went to a lumber yard with me, and they built it. So I had a laboratory.

DICK LARSON: And you didn't do any experiments which causes explosions, or anything?

DANIEL BERG: Oh, yes, I did. When they weren't around. The story with that.

DICK LARSON: So that's how you got your interest in physical chemistry, started experimenting.

DANIEL BERG: Yeah, I think that's where it came from. I hung out with a group of teenagers that were somewhat like me. Actually, two groups. Some street smart teenagers,

DICK LARSON: And others who were--

DANIEL BERG: And others who were more bookish.

DICK LARSON: More science math, yeah.

DANIEL BERG: I remember it was-- must have been when I was 11 or 12, asking my father for $5.00 for chemicals.

DICK LARSON: That's a lot of money in those days.

DANIEL BERG: Yes it was. And he smiled-- and he was doing very well at that point, successful. And he asked me, "how can you spend $5.00 on chemicals?" And I answered, "I could do it because I had a rich father."

DICK LARSON: That's what you told him?

DANIEL BERG: That's what I told him. He was a jokester, too. And he said, "here's ten. Here's $10.00."

DICK LARSON: Oh, isn't that nice?

DANIEL BERG: And that routine then worked from then on. We had a little—

Graduate Study at Yale in Physical Chemistry

DICK LARSON: OK, so let's advance a little bit now. So you go to Yale, you get degrees, including a PhD in physical chemistry.

DANIEL BERG: Yes.

DICK LARSON: And why did you-- since this is an INFORMS interview, we want to get into that direction, but we want-- we need to know a little bit about your career trajectory, about how you spent-- if I remember correctly, you spent the first part of your career, basically in physical chemistry, and then you migrated off and eventually got into INFORMS types of things. So could you give us a little bit about--

DANIEL BERG: Yeah, I'll give you that. Let me tell you one interesting aspect. When I entered Yale, my first semester there, my brother took me to see my uncle, who was a millionaire. And this was deliberate. This was over, again, over Christmas vacation. My first semester at Yale. And the uncle, who had become a millionaire when he was in his young 20s by being the only importer of beaded--- in the 20s, in the 1920s, women wore dresses with wooden beads at the bottom, to hold the dress down.

DICK LARSON: I think I've seen pictures of these things.

DANIEL BERG: And a popular attachment with it was pocketbooks made of wooden beads made in Czechoslovakia.

DICK LARSON: And he imported those?

DANIEL BERG: And he imported those.

DICK LARSON: And made a fortune.

DANIEL BERG: He was the exclusive importer. And he made a fortune. Any event, he wanted to see me over Christmas. And this was-- I knew what was going to happen. He took me to a fancy lunch, and then asked me, how-- he didn't understand PhD. He was smart in the head, but not an academic guy. How could he accelerate my research program, was basically what he was asking. And I said, if I could work that summer, and get started with my research program, that would accelerate me. He asked me how much would it cost? I knew that was coming. And guess what that number was?

DICK LARSON: $1,000.

DANIEL BERG: It was $300.

DICK LARSON: $300?

DANIEL BERG: Yeah, this was-- remember, I'm an old guy. This was 1950. And it was $300 at Yale for room and board.

DICK LARSON: Amazing. And he paid for it?

DANIEL BERG: He slips $300 into my pocket. I take it out and give it back to him. And we played that game til I--

DICK LARSON: So that accelerated your Yale career.

DANIEL BERG: So I started my research program. That fall, my thesis advisor got an ONR grant for-- when we were doing a very interesting, relates to MIT, using wartime radar equipment to get high voltage pulses to measure the conductivity of solutions, electrolytic solutions. Confirming Onsager's theory and then applying it to a place where he was never done before, and that's carbon dioxide and water, to determine the true disassociation constant of carbonic acid. It turns out, when you put CO2 in water, most of it is CO2, just dissolved. And at room temperature, only 0.7% forms actually reacts with the water to form H2O, plus CO2, to H2 CO3.

And all the handbooks at that time, probably even today, gave the acidity of carbonic acid as a very weak acid. If you look at the structure, it shouldn't be. It should be stronger than vinegar, acetic acid. And any chemist looking at the molecule would say that, because in acetic acid, a methyl group, CH3, actually, is replaced by hydrogen to form carbonic acid. And that would mean more hydrogen. You would think it would be more acidic.

DICK LARSON: OK, so I think the audience know, will say, that you're an expert in chemistry.

DANIEL BERG: Well, physical chemistry. And in theory.

DICK LARSON: So what we want to move-- we want to move toward the INFORMS kind of thing. So I'm interested in what your career was after you graduated.

DANIEL BERG: Right. Well, doing this, with my getting the grant, I got off being a TA of the physical chemistry lab, where, I have to tell you, one of my students was Roberto Goizueta, who became president of Coca-Cola, was a student in my laboratory. But, OK. So I got through my PhD in three years.

DICK LARSON: Amazing.

DANIEL BERG: Publishing six papers.

DICK LARSON: Even more amazing.

DANIEL BERG: And with a proof of the theory, and doing it to determine something that is vitally important. The true dissociation constant.

Westinghouse and Introduction to Carnegie Mellon

So now, my thesis-- one of my thesis professors suggested I go to Westinghouse, where they were looking for electrical--

DICK LARSON: That's Pittsburgh, right?

DANIEL BERG: In Pittsburgh. That's where I went. And that's where I met my wife. I became-- this relates to my-- I was very inventive, full of publishing. I rose in the hierarchy. I became Director of Research for Westinghouse.

DICK LARSON: Is this how you got involved with Carnegie Mellon University?

DANIEL BERG: Exactly.

DICK LARSON: Bingo.

DANIEL BERG: You've done your homework.

DICK LARSON: Bingo.

DANIEL BERG: I knew that. They sent me on, I say it with a smile, an executive program at Carnegie Mellon. And in the executive program, Dick Cyert, who was becoming-- who was dean of GSIA, if you remember--

DICK LARSON: Graduate School for Industrial Administration.

DANIEL BERG: Exactly. OK. And it's really the engineering school for IE. Founded by Mellons in 1948, something like that. Dick asked me to critique his course. And he was very good at taking criticism. I critique his course, saying, you taught a very good course in strategy. I was using it, it was useful. He said, but? I said, right, but.

DICK LARSON: Was this like corporate strategy?

DANIEL BERG: Yeah, it was basically corporate strategy.

DICK LARSON: So now, he's taken you out of physical chemistry pure, and now into systems--

DANIEL BERG: Oh yeah. I was, by that point, a manager.

DICK LARSON: You're a manager, OK.

DANIEL BERG: But taking courses, still publishing, still productive researcher, but I was--

DICK LARSON: But you're developing that tie to Carnegie Mellon.

DANIEL BERG: Yes. And he then says, when I said, you did not mention the role of technology in strategic management. And here, this used to be Carnegie Institute of Technology, and just recently became Carnegie Mellon University. That was Guy Stever, that's another story.

DICK LARSON: So at one time, did you then totally leave Westinghouse to go to Carnegie Mellon?

DANIEL BERG: At that point, no. But the plot thickens. He then says, you know, you're right, Dan. Come teach a class. Come teach a class in the strategic management of technological innovation. So I started teaching at GSIA, a course in what I thought they were lacking. And being down there one day, now teaching in the program that I was in, as well as a credit course, someone saw me when they were looking for a dean, and Dick got wind of this and said, why didn't I think of it? Dan, come be dean of the Mellon College of Science.

DICK LARSON: This is an incredible story, because you weren't recruited as an official faculty member, you were had this liaison with industry, and then they realized all your talents. They said come be dean. And you were also provost there, too, weren't you?

DANIEL BERG: Yeah, I became provost after becoming dean. But at that time, Dick-- so many little tidbits. Westinghouse had done something fantastically stupid just before this. I was teaching, teaching there several years. They had committed 80 million pounds of uranium fuel. I was not a nuclear guy, OK? And in the end of '75, '76, they had control of 15 million pounds. And they had committed 80 million pounds for nuclear reactors. They were short 65 million pounds. The price of uranium oxide went from $8.50 a pound to $43.50. a pound like that.

DICK LARSON: Because of their commitment?

DANIEL BERG: No, because it turns out there was a cartel. We didn't know that at the time. There was a cartel fixing the price. Rio Tinto. Canadian cartel. They asked me, literally just before Christmas, to chair a committee for the corporation to think of all the ways of getting below market price uranium.

DICK LARSON: Legally.

DANIEL BERG: Of course, of course. Came January, they formed a new company. And they asked me to leave my research director's job to be technical director of this new company.

DICK LARSON: What was it called?

DANIEL BERG: Uranium Resources. Very novel!!!

DICK LARSON: Uranium Resources, yeah right?

DANIEL BERG: First job, it relates--

DICK LARSON: Fantastic.

DANIEL BERG: First job was to follow up one of our crazy ideas. So I'm on the corporate plane with our chairman of the board to go to the State Department. When you enrich uranium, the uranium, when you find it in the ground, it's 0.7% percent U235. For running in a nuclear reactor, you have to get it up to 3%, 4%. To get it for weapons, you have to get it up much higher, it's a classified number. For submarine reactors, you get it up to 90%. So you're taking a lot of U235, 0.7%, and going through, at that time, a diffusion plant. Today, it's centrifuge.

DICK LARSON: So this is an example of where, both your newly emerging management system skills, and your chemical skills got together.

DANIEL BERG: Yeah. And it was R&D development, getting plants in operation. And the reason I couldn't take the dean's job, I thought, is this is a year later, they are after me for dean. I'm still doing that course, I'm now teaching at night in a graduate program. The nuclear fuel cycle.

DICK LARSON: So they ask you to be dean when you are still a full time employee-- you're head of this uranium company.

DANIEL BERG: Exactly. Right. After the first year, my boss says-- he's giving me the biggest raise I've ever gotten, percentage wise, 25%. Saying, Dan, you did exactly what I needed to do. I'm working on the legal cases, I'm off to Africa. You're taking care of the plants. I've had no worry because you were doing what had to be done, and you've done it. And I had spoken to my wife at that time, saying this job is a one more year job. Because the plants are coming in, I have nothing to do after the first three acts, three different kinds of plants that we're putting into production.

DICK LARSON: So you did that, and then you left this company?

DANIEL BERG: No, then my boss says, Dan, you get an A+, and here's a raise to match it. A year from now, you're going to be out of a job. But I'm not going to let you go for that other year. I don't care who wants you at Westinghouse. I don't care what, you're in this job another year. And I said, you got it, I'm committed. Along comes Dick Cyert, and here's my stupidity again, saying, Dan, want you to come as dean. Can't. I don't want to talk to you, Dick, not interested. Come see me, have lunch with me. OK, come see him. Why don't you want to talk to me? I made this commitment. We'll wait, he says.

DICK LARSON: Wait a year.

DANIEL BERG: I wasn't used to that in industry. You turned down a job, bye bye. Who's next on the list?

Dean at Carnegie Mellon

DICK LARSON: So that's what happened? So you waited a year and then became dean?

DANIEL BERG: They waited, and at the end of the year, I made the switch.

DICK LARSON: Now is that when-- because I look at your resume, and there's a distinct difference. There's a bunch of physical chemistry, chemistry types of science things, then all of a sudden, you kind of switch to systems. Is this about the time that that happened? Or maybe a little bit later after that?

DANIEL BERG: No. Both through the course I teach, which is management of technological innovation, that's a systems issue. You just don't have a good idea, and there's an innovation. It takes finance, chemical plants, planning, new technology, all of the above. So to get something from the idea to the economy is a systems idea, so I was always comfortable with that.

DICK LARSON: So your systems emerged naturally from these other backgrounds?

DANIEL BERG: Yes. I would say, I was working where you had to work in a system, you had to understand the system, you had to know the weak points of the system. You had to know how to go from A to Z in that system to be successful.

DICK LARSON: So then, let's go to where you go to move to Carnegie Mellon.

DANIEL BERG: So now I'm at Carnegie Mellon.

DICK LARSON: And you're dean.

DANIEL BERG: And I'm dean. And I'm dean of-- for my first six months not knowing how the system works. The head of biology resigned before I got there. So I said I'll be head of bio-- I didn't know. It was just to see how the system worked in Carnegie Mellon. Financial system, the educational system, as being a department chair. The dean of engineering was very helpful to me. I was the new guy, but I didn't know the culture. OK. any event--

DICK LARSON: So now, were you still, were you doing research now, at this time, more in the systems area, were you publishing in that area?

DANIEL BERG: I was doing research, turns out, with a guy who became dean of engineering, who was in the electrical engineering department. He had his own motive, in that he was trying to bet on a new horse. I was the new guy in town, and he was a department chair, and he was both currying favor, and I had something to offer in a program he already had. So I was continuing to do research on his grant. OK. But the key thing that I did, which was doable because of the talents that were there, was in computer science. They were doing work in artificial intelligence and robotics.

DICK LARSON: Well, from an MIT point of view, it's horrible for me to say this, but I think that's where AI was born, Carnegie Mellon University.

DANIEL BERG: Herb Simon.

DICK LARSON: Herb Simon, that's right.

DANIEL BERG: They had an idea. Raj Reddy, I don't know if you know that name.

DICK LARSON: I do.

DANIEL BERG: He's connected with the medal you're going to receive soon, Dick. We'll get to that. Raj Reddy, who was and is a fantastic guy, and a fantastic researcher, and knows how to get the system handled and done, had this idea to form a robotics institute. This is in 19-- I want to get the exact date '78, '79, just been there, Carnegie Mellon. Oh, if I can backtrack, this is pertinent to us. I go on this trip to the State Department. The chairman of Westinghouse, who's with me, remember, this is my first trip, first time at Gateway corporate headquarters. We fly on a corporate jet, and this is all new to me. This is before Reagan Airport, but we were met by our limousine to take us to the State Department. But before we go, he says, how about some lunch? I was glad he asked, because I couldn't bring it up. Chairman of the board. I see he eats a hamburger. Hey, this guy is human. We go to the State Department and he says, let's take a walk around the block, we have a little time. Fine, let's take a walk around the block. We pass the National Academy. He says, what's this building?

DICK LARSON: The NAS, National Academy of Science.

DANIEL BERG: National Academy. At that time, National Academy of Science and Engineering, Institute of Medicine. What's that about? I tell him, Abraham Lincoln, 1862, 3, whatever, formed it to give advice to the government. It's not a government agency, you know the routine. We give the presentation, I give the presentation, at the State Department to get Russian tails, because Russians, when they run their system, they come out with end product that's 0.25% uranium.

DICK LARSON: Still useful.

DANIEL BERG: It's like squeezing a damp sponge.

DICK LARSON: Yeah, still useful.

DANIEL BERG: We come out with 0.2%, so they are throwing away some stuff at an outsystem that's still usable. So this is the height of the Cold War that we're going to import the tailings to get uranium, which could be used for weapons or for nuclear plants. That was the crazy idea. Since the war, we buy their enriched uranium, dilute it, dilute it. So it was a good idea, wrong time. But, OK, we go back to the office, fly back after this. There's a letter. I just got elected to the NAE.

DICK LARSON: You.

DANIEL BERG: Yeah.

DICK LARSON: That's when you were elected to the NAE?

DANIEL BERG: That's when I was elected to the NAE. And I'm, of course, elated.

DICK LARSON: It's a great accomplishment.

DANIEL BERG: Yeah. I call him up, and I was still a young guy. Call him up. Mr. Wilcox, did you know? You were questioning me. You must have known this. You know they know everything. He didn't.

DICK LARSON: He didn't know. It was a surprise to him. So what a coincidence. He asked what that building was, and later that day, you found out you were a member of the NAE.

DANIEL BERG: Exactly. And of course, I'm thrilled.

DICK LARSON: You've had many, many awards during your life. Is that the one you're proudest of? Which award are you proudest of?

DANIEL BERG: Well it's certainly one, and it certainly brings a smile, the memory. And the incident of going with him, on all the rest.

Systems Approach to Services

DICK LARSON: So we want to kind of advance now, given our--

DANIEL BERG: Yeah. Moving along.

DICK LARSON: Moving our agenda.

DANIEL BERG: So I'm now at Carnegie Mellon, still teaching at GSIA, know all the people, I know the members. I didn't know at that time, it was before INFORMS. I know all people who are members today of INFORMS. And I knew the economists. I worked in the program that I was at earlier with a guy who won the Nobel, Bob Lucas, if you remember that name. Won the Nobel Prize in economics. So I was involved in GSIA while I was still at Westinghouse.

DICK LARSON: Well, GSIA, and what it's evolved into, has been a major in operations research, management science. You look at Al Blumstein--

DANIEL BERG: Yeah, who I knew then.

DICK LARSON: And so that really brings--

DANIEL BERG: These are all friends before--

DICK LARSON: This is part of the bridge we're looking for.

DANIEL BERG: That's a connection,

[CROSSTALK]

DANIEL BERG: And of course, to say it straight, now the transition, now the intellectual transition, I would say that technological innovation and the systems approach is part of INFORMS. There are meetings on this, sessions on this. So I'm comfortable in forums without what I then did, but then I did something that more directly connects. This is, while I'm at transition as provost, to RPI, where, provost to provost job.

DICK LARSON: Yeah. You were provost at Carnegie Mellon first, right?

DANIEL BERG: I was provost at Carnegie Mellon, having formed the Robotics Institute.

DICK LARSON: Then you go to RPI then, Rensselaer Polytechnic Institute.

DANIEL BERG: Later, I became provost at RPI. The guy who was president is George Low, who headed up the Apollo program. Who, unfortunately, dies, gets ill with recurrent melanoma and dies prematurely. And I become president. Having served as president, I then become, post-president, a faculty member.

DICK LARSON: At RPI.

DANIEL BERG: At RPI. I'm still a relatively young guy.

DICK LARSON: And all the time, you're writing papers, too.

DANIEL BERG: All the time, I'm writing papers.

DICK LARSON: And getting more awards, yeah. I've seen the file.

DANIEL BERG: OK. The question then is, what do I want to do as an academic? And I applied the lessons that I teach and learned on strategic planning. I drew the Venn diagram-- I kept it, took a picture of it when they moved my office-- of what it had to be for me to work as an academic, as a full time, not administrator, as a full time, PhD producing, teaching professor. I was an institute professor. My title, even when I was president, was Institute Professor of Science and Technology.

DICK LARSON: That's a pretty big umbrella. Very important.

DANIEL BERG: Right. This is around 1988, '87, '88. And I do a little bit of literature search, I talk to people, and I conclude-- I went on sabbatical a little bit later at University of Penn, and I conclude that the academic community, with the exception of the marketing academic community, had neglected the service sector.

DICK LARSON: That's when you got involved with the service sector.

DANIEL BERG: Exactly. It was a choice.

DICK LARSON: This was the late '80s.

DANIEL BERG: Late '80s.

DICK LARSON: You were one of the first people to recognize that.

DANIEL BERG: Exactly.

DICK LARSON: Because I think the NAE didn't recognize it until about 10 years later.

DANIEL BERG: Well, I was involved in that. And I was involved with several other things. I was involved in the NAE, I was head of the Education Advisory Committee for the NAE, and I was pushing the service sector. I found that-- the Venn diagram, incidentally, had to be something that was academic, publishable in top journals, something that connected to my technology background, something that would contribute to the service sector--

DICK LARSON: Which is about 80% of the US economy.

DANIEL BERG: Now 82%, but it was high 70s, then. Still growing a little bit. And I had it-- the other advantage was this really, from my search, it was, was this really neglected by what I call the engineering community? I saw that there were a lot of papers, not a lot, a few papers, where the community was using some of the attributes in engineering and planning to do what I call marketing. It was, it was dominated by the marketing community.

DICK LARSON: But services, as a topic of study, both science and engineering, was ignored, relatively so.

DANIEL BERG: Right. The place I went to for a sabbatical, a little bit later, was Penn, had a little group. With this guy who's now the head of the Philadelphia-- oh boy, the--

DICK LARSON: Management science?

DANIEL BERG: No, no, no. This is the finance for the country. You know him. A guy who's, I think, a fellow in INFORMS. Patrick--

[AUDIENCE SHOUTS]

DICK LARSON: Pat Harker?

DANIEL BERG: Harker. Pat Harker took over the group. And he was their head of the service center. And I think that was the only place in the country, and Pat-- so there was a little bit of it going on. But that's when I made the switch, and low and behold, I got the group I was in at RPI to get interested, and Jim Tien--

DICK LARSON: Also a member of the NAE.

DANIEL BERG: Also a member in the NAE, member of INFORMS, a fellow. We wrote a paper which applied the systems approach to service. Such an obvious paper. Conceptually, of course! The most popular thing I've ever written.

DICK LARSON: Wow. Amazing.

DANIEL BERG: So it just shows you, you know? I don't take credit for robotics, other than I was the guy who got the money, 5 million bucks. Dick Cyert, the president, wouldn't let us do anything until we had the money. I take credit, but it was not my idea. The best thing I did with robotics was choosing Raj Reddy, who did a fantastic job, and being the conduit to get the money. But in the service sector, that was done with thought. That was planned.

DICK LARSON: But I think one lesson, that people who are listening to you, might take out here, is that most people think of folks who have a career in operations, research, management of science, whatever INFORMS is, because it's so many different things these days, as starting and studying your PhD in that area, and kind of working in that silo for their lives, you came from a totally different approach. You studied chemistry first, physical chemistry, and you went and worked for Westinghouse, and you became an academic almost by accident. Not by accident, but they observed your talents and skills and said, we want to take you away from industry, and you become leaders in major research universities. And then you migrate into OR, in a general sense, rather than some narrow technocratic theorem proof point of view.

DANIEL BERG: As I say-- well, first of all, Dick, your statement was Dick Cyert's selling statement to me. Dan, you're really an academic. You belong in the univers--, etc. And I was comfortable. I was teaching two courses. I was two adjunct professors, in engineering and in GSIA. And I would also say I was always quantitatively oriented.

DICK LARSON: But I will look at the papers that you've written that got authored and coauthored, and the titles are so diverse and so amazing. It's almost incredible to think that one individual could be expert and contribute in so many things. Could I ask you, before we go on to service science here at INFORMS, one thing that struck me, I did see you talked about power women in one of your papers. Do you remember that?

DANIEL BERG: Oh, yeah.

DICK LARSON: I'm just curious as to what that was about.

DANIEL BERG: Well, we had a thought. The thought was, and we called the technique, with tongue in cheek, but it makes a point, we used other people's databases, and extracted from their data, when they were doing something else, the connections to the service sector. So they were doing-- they were looking for the top power women in industry, or whatever.

DICK LARSON: Oh, and somehow from this, you could ferret out the power women in services?

DANIEL BERG: Exactly.

DICK LARSON: Oh.

DANIEL BERG: OK, so we called this surface mining. Because it wasn't deep, it was getting at the concept with a database that was reliable, that somebody had spent a lot of money and a lot of effort for getting, and we were saying, is there any insight into the service sector?

DICK LARSON: So it's kind of like early data mining.

DANIEL BERG: It was. That's why we called it surface mining. In the coal industry, there's surface coal, where you don't go into a mine. And so we were being tongue in cheek. But gathering knowledge about the service area that people were neglecting. So we were able to, until we got tired of doing this, we kept looking for good databases.

Contributor to INFORMS

DICK LARSON: OK, so let's get to the OR, management science point. The folks watching our interview today, how would you like them to think about you as a contributor to INFORMS, and what INFORMS has done?

DANIEL BERG: Well I clearly was a backer of the service science section.

DICK LARSON: You were in at the beginning of the formation of that journal, too.

DANIEL BERG: When it was begun. I've worked with a number of the prominent people in this area. I think now my record is two papers submitted, both rejected, to the service science--

DICK LARSON: That's OK, I've been rejected by service science, too.

DANIEL BERG: I've been rejected by better places. So I'm a participant. But if you also want the other intriguing answer?

DICK LARSON: Yeah.

DANIEL BERG: How did I get in to be a-- they took my badge-- a fellow?

DICK LARSON: INFORMS Fellow.

DANIEL BERG: INFORMS Fellow. The truth. When the fellows were formed, they automatically gave anyone who was a NAE member a pass. That's how I got in. Now, I was involved, OK. I was coming to meetings. But I became--

DICK LARSON: But your interdisciplinary, transdisciplinary model, I think, for younger folks, who are emerging in the INFORMS community, can serve as an exemplar for somebody who doesn't want to live their life in an academic silo, and have a lot of different contributions.

DANIEL BERG: And just discuss it in a different view, in the National Academy of Engineering, I've elected to be in section 8, so I consider that my professional home.

DICK LARSON: Which includes operations research, section 8.

DANIEL BERG: It is.

DICK LARSON: Primarily is operation research.

DANIEL BERG: Well, the name of it is manufacturing, operations research, and there's one other name. And it covers--

DICK LARSON: Maybe systems.

DANIEL BERG: So I was elected into power systems. I left that to be a member of the interdisciplinary group, section 12. And then I switched to 8, where I'm a participant.

DICK LARSON: In terms of your own professional identity, how much of your professional identity is associated, let's say, with INFORMS versus AI versus chemistry these days?

DANIEL BERG: Oh, chemistry, I subscribe to the journals and, just as I'm an IEEE member, I was a fellow in IEEE before I was a fellow in INFORMS. When I was director of research, I joined ASME, I'm not a mechanical engineer. So I was always involved with other activities that I was connected with. But as a participant, I'm trying to think. I go to, I think it's three, technical meetings a year. PICMET, which is engineering-- stands for Management of Engineering Technology. I go to INFORMS. And I'm a member of the meeting-- oh, this gives me a segue. The meeting -- tell the world, because I'm proud of what you're receiving, I'm proud of being a participant in what you're receiving, Dick. I was a founder of an organization conference called Information Technology and Quantitative Management ITQM.

DICK LARSON: That's a very international group, too, isn't it?

DANIEL BERG: And this year, the meeting is in New Delhi, India, in December. And there's going to be a new award presented to Professor Richard Larson of MIT. And the medal is the Daniel Berg medal. I get a chill when I say it, Dick. It was developed two years ago and Raj Reddy was the keynote speaker that I arranged. And unknown to me, he took the fee that he was getting, the keynote speaker fee, and said there ought to be a medal in Dan Berg's name. And through him and friends of mine, including my financial advisor, including Jim Tien, including a corporation in China, including several others, raised enough money to make an endowed medal. And you are the first, but not the last, in this line. You are the initiator of this medal in December. All done by colleagues and friends of mine who did it on their own. They didn't have to do it. And they did it. And I'm so pleased at that, and I'm so pleased that you got selected for this.

DICK LARSON: Well, I'm deeply honored, I'm deeply honored.

DANIEL BERG: Well, we are honored.

DICK LARSON: Looking forward to going to New Delhi with you on that. Why don't we close, if we could-- because I'm a little bit embarrassed that you mentioned that. I don't want to be the person who's interviewed, but I'm very deeply honored by that. So thank you, thank you so much.

Perception of OR and INFORMS

So maybe we should close by your perception of OR in the general sense, and by OR, I mean the umbrella of things that INFORMS does. What do you think it's doing best right now? And if you could change it in any direction, what suggestions might you have about that?

DANIEL BERG: When I went again to GSIA and the management course, but also at RPI, my closest connection to OR is the textbook that they use at RPI. Ecker and, I'm trying to think of his name. Guy who's now emeritus. Name like Hammerschmidt. And both those guys are still teaching OR. And I have gone through a text, I know a little bit, I'm a layman about OR.

DICK LARSON: But INFORMS does a lot more than just OR, now. INFORMS has about 15 journals or so, service science being perhaps the most recent one.

DANIEL BERG: Right. So there are a lot-- you know, when I go to an INFORMS meeting, the issue is which session do I want to go to? Even for me--

DICK LARSON: It's like a section of a city with all these different ethnic restaurants.

DANIEL BERG: Exactly. So there's a lot of choices. And I always end up, always, and there's choices there, too, at the keynote talks. Because you get somebody--

DICK LARSON: Those are really good.

DANIEL BERG: Spending half an hour or so with a topic. And I have a-- some of my best friends are ORs.

DICK LARSON: Oh that's good. That's good to hear. So is there something, I guess my last question, if INFORMS could improve in a particular direction, do you have one recommendation in that area?

DANIEL BERG: Oh boy.

DICK LARSON: Or it's doing fine, as far as you're concerned?

DANIEL BERG: Well, you know, I've come almost every year since I've become a member. I don't know how many years.

DICK LARSON: If you look at the size of these national meetings now, it's unbelievable.

DANIEL BERG: Exactly! I walked through yesterday-- yesterday I walked through the recruiting place, and it's unbelievable.

DICK LARSON: Jam packed.

DANIEL BERG: Jam packed with people looking from all over the world. And people looking for jobs from all over the world.

DICK LARSON: Today, at this meeting here in Houston, we have almost 6,000 INFORMS members.

DANIEL BERG: Whatever they're doing--

DICK LARSON: So they're are doing a lot of things right.

DANIEL BERG: I'd like to know the recipe. And they're obviously successful.

DICK LARSON: Dan, thank you very much for joining us today.

DANIEL BERG: My pleasure. Good questions, Dick.

DICK LARSON: Thank you very much. Take care.