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## Hoping a wide use of OR for society



Ms. Takeda is an active specialist in optimization, a field of Operations Research (OR) based on applied mathematics. However, on the contrary, she said that as a little girl she did rather poorly at school and studying was her weak point. But she used this inferiority complex to persevere in her great efforts to study and to maintain her spirit of inquiry, which paved the way for her to becoming a research scientist. However, no excitement can be seen behind her soft smiles. Instead of confining herself within the academic world, she appears always open-minded and outgoing, as she is willing to make her research results widely available to society.

even though I did not particularly love it. (laughter)

Maybe I just wanted to maintain a wide range of choice for my future. I don't mean to praise myself, but I'm rather a hard-worker.

**You mean you chose a career as a mathematician in the course of events as you continued striving? You didn't have any special dream for the future or any special desire to do something?**

As I recall, I didn't have any particular coveted dream to become something.

Upon graduation from high school, I joined Keio University's Faculty of Science and Technology where as a sophomore I chose the Department of Administration Engineering. In short, this department is where you study methodologies for creating and/or managing systems of society using mathematical tools. As such, targets of this learning have broad fields. Customer flow planning for supermarkets, production line planning for factories, and city planning . . . all these tasks are covered by the Department of Administration Engineering.

Speaking of myself, I had specialized in mathematical economics through the master's course. But soon I found myself increasingly intrigued by solving numerical formulas themselves. In fact, I became inclined for more mathematical studies, such as scheming out problem-solving methods and creating algorithms for packaging on computers and solving them. Under such circumstances, for the doctor's course I moved to Tokyo Institute of Technology's (TIT) Graduate School of Information Science and Engineering. I specialized in optimization, a field of operations research, and obtained the degree of Doctor of Science.

Throughout the three years of the

doctor's course, I found myself absorbed in solving difficult problems. By that time I was inclined to see how my research results could be used to benefit the actual world. I was also interested in experiencing a life in the business world at least once. So, upon receiving my doctor's degree I found employment with a major electric machinery manufacturer, where I was assigned to its laboratory to engage in optimization of generators for an electric power company.

**Why did you return to TIT's laboratory two years later?**

My job at the electric machinery manufacturer was exciting and fulfilling because my clients were pleased with my work and I could see my research results leading to new products or patents. There was nothing to complain about.

Just two years after I joined the company, I was told, "Would you like to apply for a post of assistant at the Tokyo Institute of Technology? This will be the last chance for you to come back to TIT as a research scientist." So I made up my mind to do so.

Until then, I had not been confident enough to be able to establish myself as a researcher. I knew I was not the genius type. I also felt that I was not suited to pursue an academic career . . . I finally made up my mind to dedicate myself to study when I left the electric machinery manufacturer to return to the university. It was rather recently, only six to seven years ago. (laughter)

**Then you moved again from the TIT's laboratory to Keio University, right?**

I returned to Keio two years ago. I got married around the time that I returned to the TIT's laboratory that had a fixed term of service. Since my husband works

**Our stereotype image of a mathematician is an extremely sharp and wise person. May I ask if you have been good at mathematics since your school days?**

To tell you the truth, I was a dropout as an elementary school girl. I made the poorest grades in school – so bad that my mother was even called to the school and was asked why. (laughter) On top of that, I was like a tomboy, running around in the school, climbing trees in the schoolyard and so forth. I was always being scolded. Therefore, any one of my old friends in the elementary school days is surprised to hear that I'm now a research scientist.

I'm truly thankful to my mother who told my teacher, "The problem about this girl is merely being slower than the other students in making progress." This remark encouraged me and made me think that I would be OK only if I work harder than the others.

I might have been the type who did not want to lose at anything. I was so strong in a desire to overcome tough subjects that during my junior and senior high school days I strove to study all the subjects thoroughly, even subjects that required learning by memorization. Frankly speaking, I had no other choice than to continue studying mathematics,



as a research scientist for a university in Tokyo, my choice of workplace was limited to universities in the Tokyo Metropolitan area if I were to live with him under one roof. It was just about that time that Keio announced to publicly invite a researcher, for which I applied. I was more than happy when I was able to return to my alma mater, Keio.

### Is your husband also engaged in studies similar to yours?

Yes, he is an OR research scientist like myself.

Right now we are working together on a joint thesis, which is in the finishing stage. We are positively stimulating each other even at home, often discussing about studies, asking for advice and so on.

### It's wonderful that the husband and wife can talk about studies while understanding each other's work. By the way, what subjects are you now teaching at the university?

For sophomores and third-graders, I'm teaching OR, my specialty, in addition to mathematics. Also six seniors belong to my laboratory.

For those students eager to study for a period of three years including the master's course, I give them the latest research themes while trying to have discussions on an ongoing basis. On the other hand, for students who will end their campus life as undergraduates, I'm trying to support them in matters of their interest so that they can enjoy studies.

A student who likes playing darts, for example, is engaged in study on optimization of darts as the extension of his hobby. When it comes to a student whose hobby is playing the flute, I encourage him to use the optimization technique to restore part of a musical

score that was lost in war fire.

### It's possible to apply the optimization method of OR to such a diversity of areas, isn't it? Very impressive!

Yes, indeed. That makes it interesting. I always want to maintain a wide range of choice just as I did as a student when going on to the university. In other words, I don't want to limit my theories to only one application field. This is why I make it a rule to team up with people from many different fields according to research theme.

It is true that mathematics contains areas of purely theoretical pursuit regardless of whether they can serve practical purposes of our society. In my case, however, I'm not happy unless I can see how theories are put into practical use, and how they can contribute to society. Theories without concrete applications have little appeal to me.

I'd like to promote and let OR and

optimization studies be better and widely known among more and more people so that they would say "Wow, I didn't know optimization was used in such-and-such a thing!"

### ◎ Just a word from . . . ◎

● **A student:** Ms. Takeda has a great power of concentration and often suddenly comes up with new ideas. On the other hand, she becomes almost blind to things other than the target that she is concentrating on. (laughter) She never fails to give advice whenever we ask her a question. She also always gives us new ideas one after another.

(Report and text: Madoka Tainaka)

For the full text of this interview, please refer to:

<http://www.st.keio.ac.jp/kyurizukai>

## I challenge highly complex decision-making using a scientific approach.

### Ms. AkikoTakeda

Ms. Takeda engages in the development of optimization techniques that take uncertainty factors into account. She addresses the development of algorithms for efficiently solving optimization problems in fields such as financial engineering and statistical machine learning. After obtaining the degree of Doctor of Science in 2001, she joined Toshiba Corporation's R&D Center as a staff researcher. She then became Assistant Professor at Tokyo Institute of Technology's Graduate School of Information Science and Engineering. From 2008 to present, she serves as Assistant Professor at Keio University's Faculty of Science and Technology.

