

ext time when you hear "Sweden"—instead of IKEA, ABBA and Swedish meatballs—think of Apollo 11. Here is why: A firm owned by Hasselblad family in Gothenburg, Sweden, built the cameras used by Apollo 11 in its history-making mission. The pictures of the first human being to walk on the moon surface was captured by a 70 mm Hasselblad camera [1].

Here's another example of Swedish innnovation. I used to wonder "what was being made in that SKF manufacturing plant beside Highway 401 in Milton, Ontario?" The building with all the flags of Sweden and Canada in its parking lot. Well, that is a branch among many branches that Svenska Kullagerfabriken (SKF) — meaning Swedish ball bearing factory — has around

the world. The reduction of friction using a layer of metallic spheres was invented by a Swedish engineer, Sven Wingquist in 1907. Thereafter he founded SKF here in Gothenburg [2], and now you cannot name any machinery of any form around the world which does not use ball bearings.

Swedes are very creative and resourceful people, and this dates back to their long tradition of getting the most from what their harsh Nordic climate can offer.

If you are not yet as enthused as I, let me add the invention of powdered milk, the safety seat belt, dynamite and discovery of many elements of the periodic table to the list. Do not forget also Volvo, Scania, Saab, Ericsson, Husqvarna, Skype, and COMSOL.

I came to Sweden as a postdoctoral researcher so it was quite natural to explore this country first by observing my new work environment: Chalmers University of Technology. The interview here in 2015 at Physics Department, which was called Teknisk Fysik (Engineering Physics), was a very unique and memorable experience. I realized this is a place where engineers and physicists understand each other. You can speak the language of each party and you will be understood by both, e.g., whether it's, say, the "tight-binding Hamiltonian," or the "graph incidence matrix of a circuit." Luckily I was given an offer and didn't hesitate to accept it right away, despite the fears and worries about crossing the Atlantic ocean and those many "what ifs" a researcher couple may ask.

The first positive impression was learning that all graduate students, staff and faculty members are entitled to offices of the same quality. There is no evidence of inequality in distribution of work spaces depending on the rank, seniority, or budget of a research group, and things like that. All offices have windows as it is understood that winters are murky and the rest of the seasons are often cloudy.

Even those laboratories that have no access to windows due to unavoidable architectural features, are generously decorated by pictures of trees and flowers. This reduces the sense of being incarcerated in a box during the few hours that students and teachers must spend there.

There is a strict set of rules in Sweden called (Arbetsmilijölagen = Working Environment Law) [3] that requires employers to provide healthy and safe working environments for employees of any rank. This is a very important factor in keeping the research workforce mentally and physically happy. Each employer has access to an Arbetsmilijölagen booklet outlining whom should be called to make the necessary amends, should something go wrong.

The Swedish government recommends that a part of every public building budget must be spent on the arts. Therefore all department buildings, new or old, are decorated with artworks created by artists from both classical and contemporary art. The same is true when you step in public libraries, hotels, and health centers. An extensive research by Jadwiga Krupinska, a professor of architecture at Royal Technical University (KTH) at Stockholm shows that the architecture of a school influences the ability of students to learn [4]. A pleasing architecture encourages students and teachers to stay longer and enjoy working and learning more.

ACADEMIC CULTURE: In addition to personal meetings with your immediate manager or research supervisor, there are weekly meetings (or seminars) where a few groups of very similar research interests sit together. One or two members of a group present a 30-45 minute seminar followed by questions posed by senior professors. This can help students polish a paper before submitting it, or increase the quality of a talk before presenting it at an upcoming conference. This forces graduate students and postdocs to expand beyond their comfort zones, to speak about and expose their research results to instructive criticism and revitalization.

In every department, group or division, people gather on a weekly basis for an hour of drinking coffee and enjoying Swedish cookies and cakes that are brought by a volunteer colleague (or according to a periodic list of names). During this Fika Pause (coffee pause), the department head, graduate students, senior professors, young faculty members and staff all sit together informally and chat socially. This helps you to know your colleagues better, and to learn about your departmental new rules and decisions.

of the department. He writes an interesting and fun-to-read short article that he skillfully relates to a recent issue of interest in the department. It is interesting how a busy physicist with a huge administrative load manages to write a literary article. By reading it you learn something new about the department, or even something related to history, language or literature that you previously knew nothing about. He even shares with you which novel he has just finished reading. During my employment here at Chalmers, I witnessed two

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Every three or four months the head of the department/division enters your office for a friendly chat about your research, your progress, etc. You can show him what you are doing, what you have just calculated and he asks if you have any personal issues, if your housing is ok, if you feel good, etc. Importantly he asks about your next plan after postdoc years, gives advice on how to apply for jobs and even expresses his willingness to help with recommending you to companies or other research groups. For an international postdoc this is a very decent and generous act practiced by the head.

In addition to that informal visit, there is an annual evaluation session. You personally meet the head and he evaluates your progress based on your research achievements. Note that you are not only evaluated by the number of your publications. Later you are told how much your next year salary is raised based upon your performance.

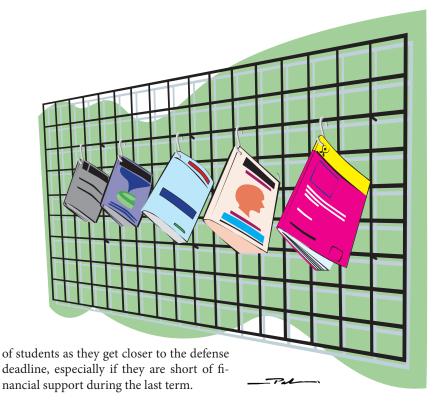
Every year the president of the university invites all employees to complete a question-naire. The questions range from issues like racism and sexism at work, your concerns about your office space, your colleagues, to your ideas about your immediate manager, and work-life balance, among others. The statistics will be published a few months afterwards and there is a review session organized by the head of your division/department to discuss how issues can be avoided or resolved. This helps decision makers in the university to involve everyone in problem solving, as a lack of feedback makes a system very much prone to instability and malfunctioning.

There seems to be a culture here at the Physics Department, that everyone receives a newsletter with nice forewords written by the chair(s) consecutive department chairs in office who religiously practice this culture of reaching out, writing and talking to employees. Every Christmas all employees receive physics toys, puzzles and postcards from the chair as Christmas gifts. For graduate students and international postdocs, these gestures fill them with a sense of belonging, respect and appreciation.

The progressive atmosphere I'm describing has time-honoured roots. The culture, attitude and experience of governing an organization called "University" by Swedes dates back to 1470. At least, the practice of mentoring, housing and paying a PhD student dates back to 1728. This is when a young and poor student called Carl von Linné enters Uppsala University. Professor Olof Celsius hires him, gives him a room at his house and let him do his research on his vast botanical garden, after realizing his struggle with poverty and his genuine passion for learning.

Another culture worth mentioning here is that people keep the door of their offices open all day long. Just enter and ask your question, instead of shooting emails around.

When graduate students finish writing their thesis, they submits the pdf file to the university press (after the supervisor's approval). Then the university prints and delivers 100 copies of the thesis to the student's office before his/her defense date. Attendees can receive a free copy during the defense as a gift, or keepsake. The expense of envelopes and postage stamps are covered by the university so that the student can send his/her thesis to anyone around the world, e.g., future employers or famous people in his/her thesis research area. This removes a huge burden and stress from the shoulders



A copy of the thesis is hung on a stand or a special wall designed for such purposes at each department or division. Feel free to take a thesis off the hook, take it home, read it and return it. PhD students should graduate within four years unless they choose to teach. In that case they have five years to finish. After publishing a few papers they have this option of graduating as licentiate (PhD sans dissertation) and go to industry. Let me mention how formal, ceremonial and majestic are the PhD defense sessions. When I remember my own defense session—which looked no more than a long weekly meeting—I feel jealous of the students here.

Another academic practice also fascinates me: When an assistant (associate) professor is promoted to associate (full professorship) level, the person has to present a public lecture. He/she will be introduced by the chair of the department and the public will learn why he/she was promoted, what are his/her research interests and achievements. After attending a student-friendly talk by the promoted faculty member, everyone enjoys coffee, cake, and champagne in his/her honor.

Newly hired faculty members are sent to Swedish language courses as they must attain mastery over three years in order to teach undergraduate courses. Prospective instructors are also offered courses on ethics, methods of supervision and advising graduate students and pedagogy (teaching skills) — regardless of their academic merits and backgrounds. It is well understood here that being a top-notch researcher with many

high impact papers in your CV does not necessarily make you a top-notch mentor and a teacher. When a supervisor is not happy with his/her students' performance, there are procedures and rules to handle this respectfully and professionally. This involves seeking assistance from senior professors (if applicable) to help the student to get out of the research pothole, or referring the student to relevant help centers in campus. Faculty members are advised not to handle these cases with adhoc methods, and they should not allow the criticism to become personal, or to undermine a student's confidence.

The faculty members consider and respect their students and postdoctoral researchers as their colleagues. Every day you witness research groups of small and large size, walking toward department restaurants for lunch. The lunch time from 12:00-13:00 is meant to enjoy a meal and a friendly chat between senior professors (or even members of the Royal Swedish Academy) and their students. The atmosphere is very helpful in releasing the stress from the brain of a student who has been in a clean room since early morning, or a frustrated postdoc who was trying to get a plot out of simulations.

Almost every department has its own restaurant and everyday at least three kinds of meals are offered for every taste: meat, fish and vegetarian. In addition, there are lunch rooms at each department with access to free coffee, tea and baskets of fruits. Faculty, staff and graduate students can warm up their

lunch in dozens of clean microwave ovens. During some Fridays a live music concert is performed while everyone is having lunch. Undergraduate students are also provided the abovementioned facilities with the same quality and quantity, except that they have to pay for their coffee.

In Chalmers you never feel under-appreciated or isolated. Your boss tells you "great job" if you did so, and vice versa. International graduate students are entitled to enroll in Swedish language courses. The expense is covered by the supervisors. This helps students to find a job here or in Scandinavia in general. Knowing one of the Nordic languages is an advantage when you apply for a job within Scandinavia.

Since an international PhD student (as an employee) pays taxes and contributes to the society, he/she is entitled to the social benefits, e.g., employment insurance, which helps him/her to get paid by some amount after graduation. This will give the graduated PhD student some time to look and find a new job. This is immensely helpful and stress-relieving as the student might be worried about his/her visa status, financial status, etc.[5]

PhD students at Chalmers are allowed to take extra courses outside of their research spectrum in order to widen their skill set. Courses in pedagogy, rhetoric, management or even linguistics are what a PhD student can take to avoid being a one-dimensional person skilled only in his/her own research area.

Graduate students can also choose to take a one-year intensive course on pedagogy and education in parallel to their studies. Then they can apply for high school teacher positions. Due to the shortage of science teachers in Sweden, the government allowed the ministry of education to fill the gap by hiring PhD graduates in physics and engineering. Those like me who do not have a pedagogy certificate (and Swedish language certificate) can still find teaching positions at international (English Speaking) high schools, although with lesser social benefits compared to the former group.

WORK-LIFE BALANCE: The Swedes' strong work ethic should not be translated as spending weekends in the office. You have to rest and spend your time with your family during the weekend, in order to start a working week with renewed vigor and passion. When your kid catches cold and you have to stay at home, simply tell your boss that you

are working from home. The working hours for research staff are flexible and based on trust and respect. You have to deliver what you have promised and meet the deadlines and keep the quality high.

According to Swedish Law you are entitled to have five weeks of paid vacation per year [6]. You are strongly encouraged by your boss to enjoy this vacation to remain healthy and productive. You can transfer a limited number of your vacation days to the next year but it is not recommended. During your vacation you are fully insured, provided that you inform the head of your division before departure by filling the vacation form.

Parents can enjoy a long maternity and paternity leave. They can even distribute that throughout the year as they wish to ease the life-work balance.

During flu seasons you are advised to stay at home and get well if you are sick. You should not come to work and spread the virus. There is a one-week vacation during mid-February that is called sportslov (sport holiday). During this week families venture out and let their kids enjoy winter sports, e.g., skiing, ice skating, ice fishing etc.

If you have winter-induced tiredness (trötthet) and seasonal depression as an artifact of that, you are entitled to many professional services and help. The most important thing is that everyone understands you. Alternatively you can travel to somewhere with more sunshine. Sweden's proximity to the most important destinations within Europe makes the travel easy and affordable. For an international student or a postdoctoral fellow with a Schengen Visa, going to conferences and meetings within the Europe is easy, and strengthens your CV. If you happen to be an international student in Canada waiting for clearance checking of your US visa application, you'll know what I mean.

SOCIAL SYSTEM AND SERVICES:

As a postdoctoral researcher I am paying more or less the same amount of tax I used to pay in Canada. However it is the Swedish Tax Agency (Skatteverket) who fills your tax return— not you. The Skatteverket sends you the filled form a

few weeks before the tax declaration deadline. If there is any difference or change, there are sections to be amended, otherwise sign the already filled form and drop it in the mailboxes in front of every social service building. This is one of the moments you feel you have been taxed fairly, as the huge and unnecessary stress of filling the tax return form and the waste of time due to that "do not exist". Since it is the university (or in general, your employer) who informs the tax agency about your salary, benefits and deductions etc., there is no need to supply the tax agency with loads of paper.

Governmental public services in Sweden provide assistance in many different languages. This is extremely helpful for recently landed immigrants and those like me who work in Sweden temporarily. When I received my SIN card (called Swedish ID here), it was accompanied by "Welcome to Sweden" letters in three languages—Swedish, English and my mother tongue (Persian)—explaining to me the next steps. Even stuff like drivers' test books, etc., are published by the Swedish government in many languages, and they

are available to be borrowed from the public libraries.

I have also the option to receive an English version of my tax return assessment in case I want to submit it to Canada Revenue Agency. All these services and prints posted to you are free of charge.

Regarding health care, I am impressed by the fast and patient-friendly technology used. A nurse plugs your blood or urine samples into the table-top analyzer before your eyes. You observe the results being printed and the doctor looks at them and reports to you right on the spot. In special cases, there may be a delay of a week or so to receive a report back from a hospital lab.

If you intend to move to a new place, all you need to do is fill a moving report form in the website of the Tax Agency (Skatteverket). After 24 hours, your new address is known to every public service agency in Sweden, including health centers, your bank, your credit card provider, TV, internet and phone service providers, among others. Most movers in Sweden, both international and



intra-national (intercity, intra-city) are very professional, fast, efficient and fair in terms of pricing.

Education in Sweden is free. Swedish citizens can send their kids to very good universities without paying any tuition fee.

Regarding public transportation, I must say it is transportation technology at its best, although they don't have Japanese Shinkansen (bullet trains) yet. But each and every corner of the Gothenburg area—even rural portions - has access to public buses that run frequently, regularly and precisely. They are mostly fueled by methane gas extracted from human waste and compost. Express trains made by Sweden (e.g. X2000) take you from Gothenburg to Stockholm in three hours, which usually takes six hours by car. Electric buses made by Chalmers University of Technology and Volvo° take you every 10-15 minutes back and forth between Johanneberg and Lindholmen campuses separated by the Göta River. Recently, a driverless bus has started to operate within the main campus.

PEOPLE: In sharp contrast to the stereotypical remarks that I used to hear before coming to this country, Swedes are not reluctant to talk to foreigners. Darkness or coldness of winters has nothing to do with their social attitudes. From the Lucia festival in December until Midsummer Day in June there are many events that symbolize the happiness, love and care of Swedes for family, friends, humanity and nature.

I may only say Swedes are more formal, shyer and less talkactive than I. So I initiate the conversation and find myself in a friendly and instructive chat. There is a considerable chance the super nice senior gentleman or lady I am talking to has once been an engineer working in Ontario! Or visited Persepolis in my original country, Iran, a few times.

Swedes are language-aware if not linguists. Everyone speaks English and most know a few other languages as well, even Japanese! This is very helpful if you visit Sweden as a tourist or for a short visit. On the negative side, this reduces your incentive to become well-versed in speaking Swedish.

In general I find Swedes very knowledgeable and studious about different cultures and languages in the world. There are simple reasons for that—they read a lot, they travel a lot and they host multitudes of cultures

in their land as immigrants. Even schools educate children about the different cultures, languages and traditions that exist in Sweden, especially those of immigrants.

The people of Sweden are fans of science. Isn't that because they live in Alfred Nobel's land? Every year the National Swedish TV (SVT) educates viewers by broadcasting the Nobel Prize ceremony from beginning to end. On a mid-December Sunday, sit before the TV and watch the Nobel Prize ceremony and its sparkling gala dinner all day long. Let SVT reporters educate and amaze you about gravitational waves, topological materials, conjugate polymers, etc. Another proof of what I say is this: In every newsstand in Sweden you see newspapers like NyTeknik (new Engineering), Dagens Industri (Industry Today) and magazines like Teknik Historia (History of Engineering), Språk (Language), AXESS, Företagshistoia (Business History), etc. In this era of having access to virtually everything online, being bombarded by so much bad news, and being distracted by social media etc., still there are people who buy and read publications with in-depth reporting. Let me mention I am very fascinated by the quality of television programs being broadcast, e.g., material on National Swedish TV (SVT) channels, AXESS TV and Kunskapskanalen (Science Channel) — all without commercial advertisements.

REGARDING JOB MARKET: As

I have no direct experience with any Swedish industry yet, let me relate what others have found. In our department I witnessed three PhD students graduate during the past two years. One of them did her PhD in molecular dynamics study of nano-materials and

ended up being an antenna designer for a telecommunications company. Two of them did theoretical studies of heat and electron transport and quantum nano-mechanical effects in condensed matter. Upon leaving Chalmers, one of them was hired as a simulation engineer for electric cars; the other as a designer in Saab's Aircraft division. It seems that industries here appreciate the importance of fundamental science and try to absorb people with broad visions for their future developments. For them, a problem-solver trained in quantum mechanics seems more appealing than a master of this and that microcontroller or programming language.

CRITICISM: I am not successful at all in hiding my enthusiasm about this beautiful, advanced, independent and strong country. So balancing up my accounts by noting a few areas for improvement seems in order. The public health system is one concern. Notwithstanding my earlier praise for its use of technology, doctors seem very reluctant to take your symptoms seriously and refer you to a specialist for a more thorough test. During August all doctors are away for vacation, so try not to be sick in August!

Finding an apartment or town house to rent is hugely difficult here in Gothenburg. Before moving to Sweden, your employer helps you by hiring agents to find a place for rent. To find a new place, however, you need to do a lot of searching, calling, emailing and promoting yourself as a good tenant, highlighting your Swedish references. In some cases you are interviewed by the landlord. Usually your manager and nice staff at university do their best to help you, inform you of any available housing options, and even help you with regard to references and recommendations. Prices—as you have guessed—are higher than Canada. Rent is almost twice of what I used to pay in Ontario. Everything else is 1.5 times more expensive than their Canadian counterparts, even for something of the same brand or quality. This can be generalized to other major cities of Europe, though.

Dark Swedish winters make it hard to keep up one's spirits. But having social gatherings with colleagues and friends, openness of restaurants and bars until late night, charming coffee shops with nice furniture, real candles and vases of daily delivered flowers on every table, bountiful quantities of fish, shrimp and beer, Semla (a cream puff pastry with almond paste) and Saffron Bulle (saffron bun) during winter, and importantly, lack of wind-chill and freezing rain, make the winters still survivable. Spending a vacation in sunny south



East Asia is another option, especially if you are asked by your boss to use your vacation days before the year ends.

CODA: Friendliness of faculty, staff and colleagues here at Chalmers have made my stay an unforgettable memory—a precious lesson and experience that I look forward to sharing wherever I go. I strongly suggest graduate students in Canada should also visit this endless source of learning and exploring, Sweden, as a part of their education. Come here for an internship, PhD study or post-doctoral research.

I encourage engineering faculty members in Canada to send their graduate students here for an internship. Luckily, there are good examples of such student exchange programs between University of Waterloo, Chalmers University of Technology and Lunds University. Even teaching experiences (course contents, choice of textbooks, teaching techniques) are something that could be exchanged between Swedish and Canadian professors. Translating teaching resources from Swedish to English or vice versa is something which teachers and students of both countries can benefit from.

Faculty members can spend their sabbatical leave here. Be ambassadors of Canadian culture, literature, science and technology. This

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is what Japanese do for Japanese science and literature, right next door to the Royal Swedish Academy at Stockholm [7]. Let's not lag behind them.

Be ambassadors of Canadian culture, literature, science and technology.

There are many similarities between Canada and Sweden as two strong, independent and industrious countries that work hard to invest in fundamental sciences and engineering research for the well-being of their own people. Both countries strive to isolate and protect their people from the ups and downs of the global economy and the political chaos around the world. Both countries share a long history of being promoters of peace and multiculturalism, and they share the same concerns regarding the well-being of the arctic.

I am very happy that I refused to listen to the common advice of "Everyone goes to Silicon Valley" after my PhD years. Entering the Nobel museum, seeing the hanging portrait of Svante Arrhenius and remembering the very first chemistry book my father bought for me, brings a smile to my face, warms my

heart and tells me "Coming to Sweden" was the best choice I've ever made.

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About the Author



Daryoush Shiri received his PhD in electrical and computer engineering in 2013 from University of Waterloo, Canada. Prior to this, he worked in a few start-up companies as a RF/analog CMOS design engineer and team leader. His thesis was devoted to computational study of electron transport

in silicon nanowires. As a postdoctoral fellow at the Institute for Quantum Computing (IQC), Waterloo (2013-2015), he collaborated in developing scalable package for quantum computing circuits.

He came to Sweden in 2016 as a postdoctoral fellow at Department of Physics, Chalmers University of Technology, to work on heat transport in 2D materials. Currently he is a researcher at Quantum Technology Laboratory (QTL) in the same university working on simulation of superconducting microwave circuits for quantum computing. He co-supervised a few PhD and master's students during these years. He loves teaching and always quotes John Archibald Wheeler: "If you would learn, teach." In his free time, he enjoys cycling, cooking, translating, and reading historical/comparative linguistics. He is a member of IEEE, APS and German physical society (DPG).

N.Ed. Dr. Daryoush Shiri is also the translator of "Letters from Canada," published in our Winter 2017 issue. Written by two German scientists posted to our country in the early '90s, that piece explores Canada's technological achievements from an outsider's perspective, and identifies challenges in Canada's R&D landscape at that time. The IEEE Canadian Review welcomes proposals from our readers reflecting on their experiences working abroad, either past or present; contact icr@ieee.ca

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