

'An engineer requires imagination to visualize the needs of society, as well as broad technological and social age understanding to bring his vision to reality'. Sir Eric Ashby, 1958

This was the quote that encompasses the spirit of engineering and drew me to study engineering. I want to be that person. Looking into the future, I'm not sure how to proceed. As an engineering student, I have a few questions pertaining to my interests. Does my engineering degree prepare me for industry? Are students attracted to work in industry and consequently, are we aware of the routes into industry? Whose shoulders does this responsibility of recruiting young engineers lie on? (Everyone, I'm their future.) Finally and more importantly, why does it matter? Why does everyone make such a fuss about recruiting enough engineers-- 100,000 graduates a year to be exact?

The necessity of engineers is indisputable, it's as true as the necessity of oxygen! Engineers design and build every product in the world, and solve almost every problem. They shape our today's and tomorrow's; they keep us alive and comfortable. It is also increasingly true that modern economies depend on engineers, not just to function, but to *grow*. Engineers can accelerate production lines, reduce cost, create new products and services; all of which increase revenue and enable growth. Engineering contributes to about £500 billion (or a third) of Britain's economy across various sectors. There are whole research papers outlining the exact economic benefits of chemistry research to the UK in terms of labour productivity, GDP and other numbers. [1]

The world is ever-evolving and it is engineers who drive this evolution. Therefore, the role of engineers must adapt to this evolution. In the past, engineers were technical guys who operated businesses behind-the-scenes, leaving the business aspect to non-engineers. Today, engineers are expected to drive business growth. To facilitate the integration between business and engineering, new roles are created with fashionable names and fresh job descriptions. Engineering consultancy, cost engineer, continuous improvements manager; this is likely to continue in the foreseeable future. These roles enable the process of making and selling run in parallel, instead of one after each other. As it goes with specialisation, the more specialised, the better. Master of two trades and employ both? Even better!

Engineers can run the world if they are armed with non-technical skills and if they collaborate effectively with those of other professions. What kind of non-traditional, "soft" skills are we looking for? To name a few, they are business acumen, communication, marketing and project management. The systematic thinking used in manufacturing products is now applied to other business functions such as procurement, sales and distribution. In fact, it is not about learning defined technical skills such as coding - it's about learning how to work with technology, to leverage it and find new ways to use it. This line of thought is best expressed by the economist, Tyler Cowen: "Take Mark Zuckerberg who, of course, has been a great programmer. There is much more to Facebook than that. It's appealing, it gets people to come back, and he was a psychology major. It's that integration that's important." It should be noted that non-engineers are equally valuable and it is how we engage them and their fresh perspectives. What can economists tell us about the availability of resources and the sales guys about market demand?

Then, how do we translate this synergy concept into profit? Let us consider why Silicon Valley, home of technology, is such a successful engineering hub? It adapts to the modern world by marrying top engineering talent with venture-capital backed start-ups (aka money). Unlike other places with overflowing technical talent, Silicon Valley is also a place that encourages innovation and produces opportunity. It is an effective network in which its members cooperate and exchange information. At the heart of it, there is Stanford University that collaborates with companies and conducts research to support business aims. Silicon Valleys are not built in a day; they are formed as communities are - with organic factors like mutual interest and culture. The formula is as follows- convene diverse

stakeholders including companies and universities using incentives and pool some money. The latter is just as important, if not more. The providers of money should be as involved with the product as the engineers. No doubt, this is a conceptual idea, but this is the spirit that should be embodied. And in this culture, we will make new things that the world wants.

To achieve my idea of utopia where engineering reigns supreme, here are my proposals from the perspective of a student and soon-to-be graduating engineer.

In recent years, universities have begun to engage with industry and create value that is so apparent; it should have been this way all the while. However, from my humble university experience as an undergraduate, it appears that too little is done in this direction or it is not executed inspiringly. There is a short industrial placement programme in my course structure, in which second-year students tackle an industry-related problem faced by a real company. Engineers sat with us for about half a day and shared the insider view of engineering challenges. Although the concept is noble, the programme felt like a “play-pretend” exercise or an extended theoretical lecture on teamwork. The engineers’ guidance was nominal as they only outlined the problem and we proceeded to solve the problem blindfolded and meek. It is fair to account these problems to a lack of funds and time, but more has to be done. It is also becoming popular to secure job placements over summer or take a sandwich year in industry. Yet, these opportunities are still few and far between.

Also, there is opinion that lecturers should have industry experience, in contrast to research experience, to create an understanding of how new technologies are integrated into a business. Anne Watson, Chief Operating Officer of Sema suggests conducting periodic job-swaps and partnerships with companies. [2] This has been piloted by companies like Rolls-Royce, who have set up University Technology Centres across the world. Here, research is conducted by academic engineers according to the needs of the company and efficiently integrated into commercial processes. This is an excellent execution of collaboration, with measurable successes and intimate relationships that would never have been.

After all, there is much argument about whether the university prepares a student for industry. It is fundamental to build technical competence as well as soft skills, the latter of which are harder to define and impart. As universities experiment with structured modules (with names like ‘Management for Engineers’) that merely aim to introduce and make aware, they have yet to measure its effectiveness. Then, there is increased emphasis on extra-curricular activities as recruiters seek proof of such involvements on CVs. As discussed earlier in this essay, the roles of new-age engineers are intricate and nuanced. These roles have yet to be defined and so, we must be adaptable and quick to learn new things.

Perhaps, the image of engineering plays a part here. Should we recruit students that are more inclined to study other courses with similar technical requirements, but whom are more people-centric or design-minded? Are we putting them off with perceptions that engineers are only mechanics? The media shouldn’t portray engineers in hardhats and large blueprints. As much as it is true, it’s not the entire picture. It is as much a design and humanities field, only from a different angle. We juggle economics, design, marketing, communications, sociology and everything else. To begin with, it would be useful to create opportunities to work with these sorts of people, pick their brains and develop meaningful relationships.

After the education phase, it would follow that these graduates begin engineering careers. However, over 30% of Engineering and Technology (E&T) graduates leave the E&T industry, with even higher proportions of female graduates doing so, further exacerbating the gender disparity. [3] Why do

these bright graduates with a flair for Maths and Science and an evident passion, having chosen to spend four years studying engineering, leave the industry that they were trained for? Traitors! There are substantial efforts in attracting school children into STEM subjects, but only few that focus on attracting graduates into STEM careers.

There are great messages disseminated in an increasingly interesting and coherent manner—engineers are the backbone of every industry, they are paid well and so on. However, the available promotional material does not engage with my demographic. In my humble opinion, messages targeted at university graduates should focus on the job market. I would love to know about the variety of roles available upon graduation (in contrast to the variety of industries that we could get involved in) and that there is a place for people of different personalities. “Don’t leave engineering to find a better career! There’s one right here!” Personally, I have possibly childish priorities including fancy corporate attire and a more prestigious scene like finance. Also, the recruitment efforts for finance are as effective as disruptive advertising. They are well-structured, attractive and plentiful. Branded with the life of the fast and successful, they attract thousands of graduates each year.

In essence, there are four arms of engineering: fixing things, making things, having ideas, helping others (extracted from a quiz called “Whose Crew Are You”, targeted at younger audiences.) At times during my degree, engineering seemed to dwindle down to theory. Someone should renew this spirit of engineering. Tell us about the new, different roles that do this, so it’s not just a fairy tale we were told of in our lives “Before Engineering”. What exactly will I do? As the primary forger of future engineers, it would be appropriate and convenient that the responsibility of signposting students towards engineering careers be borne by universities.

Finally, we should adopt the maker culture. The maker culture is a technology-based extension of DIY and is often engineering-oriented with projects like electronics, robotics, 3D-printing, app-writing and so on. Popularized in the United States and slowly introduced to the UK, this culture makes a party out of hacker events, crowd-funded projects and start-up competitions. It’s grown-up Lego that’s accessible to all. It brings together creativity and competitive spirit. Change begins at home and it is apt to introduce the maker culture while we are at university. This leverages on our youth-wild ideas, immense hopefulness and noble dreams of changing the world, while utilizing our growing command of technical knowledge. It is a hands-on approach beyond the traditional curriculum that drives the engineering spirit home. It sparks entrepreneurial ambitions and creates a community of innovators. It is the type of engineering that the modern world demands and the type that creates new products to sell.

I am a second year Electrical Engineering student and female. I was brought up in an average Malaysian family of middle class income and I moved abroad to study at The University of Sheffield. I represent three different demographics, each with distinct characteristics and perceptions of engineering. My conservative Asian upbringing regards engineering as an “approved profession” (alongside medicine, law and accountancy). These careers guarantee job security and a comfortable salary, and imply that you are well-placed on the social ladder. For this reason, there is no shortage of engineers in Asia, compared to the United Kingdom [4]. Although these values are not perfect, it creates an acceptance and pride for engineering that the UK lacks. There were no structured campaigns that attracted me to engineering, as I just knew it was an option alongside everything else. I had numerous relatives who talked about their jobs and had good lives. As I assimilate myself into this new country, I discover that there’s a higher accessibility to great engineering and great teachers. Given the crisis, its countrymen are not yet exploiting these strengths. Besides that, females are wildly underrepresented and efforts should be carefully shaped and continued to attract women into Engineering. Finally the number of applicants for electronic and electrical engineering is

declining compared to other disciplines. Its presence in industry is not as popular as aerospace's jets, and awareness of these should be created as well. It's always about awareness!

This is my story. I chose engineering for its flexibility and the promises of making things. It felt like the job that can do anything, and it still is. We should be excited about it and share its magic with non-engineers alike. The new it-word is synergy. Together, we can change the world.

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