Tech City Talent and Computer Science Graduate Employability

An independent learning review for the Tech Partnership and the JPMorgan Chase Foundation by Steve Matthews

May 2017

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Contents

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1. Foreword

One of the most urgent challenges facing communities around the world is the need for increased economic opportunity and more widely shared prosperity. At J.P. Morgan, we believe we are uniquely positioned to help invigorate the economy and help solve pressing economic, social and environmental challenges in the communities where we live and work. We try to deliver on this responsibility, using our strength, global reach, expertise and access to capital to support and invest in our communities.

This project was made possible with funding from the JPMorgan Chase Foundation. However, the views presented in this report are those of the authors alone and do not necessarily represent the views of J.P. Morgan or of the JPMorgan Chase Foundation.

2. Introduction

This report sets out the key learning from the Tech City Talent (TCT) project, which aimed to improve access by local computer science and IT degree students to internships with London tech SMEs. It also builds on the learning from TCT, and explores further the issues and challenges associated with computer science graduate employability, and where there might be gaps in the kind of response that is required to improve it.

2.1 The Tech City Talent Project

Project Rationale
Tech City Talent (TCT) ran from January 2015 to June 2016 and was an internship programme, funded by the JP Morgan Chase Foundation and managed by the Tech Partnership. It was designed to match computer science students, and later unemployed recent graduates, with small and medium-sized enterprises (SMEs) in the Tech City UK area of London. The project aimed to address the issue that graduates with a computer science-related degree are at greater risk of being unemployed six months after graduation than those from any other discipline, even though the tech sector suffers from well-documented skills shortages.

Context
The recent Government-sponsored Shadbolt Review1, which was published as TCT was ending, suggests that a complex picture lies behind the apparent misalignment of Computer Science graduate supply and demand. It identifies a number of factors that appear to be at play, including:

➢ **Work experience placements matter**: students completing sandwich courses enjoy the lowest levels of unemployment, the lowest levels of underemployment and better earnings;

➢ **Outcomes vary by the type of institution**: the very highest unemployment rates cluster in a small number of Higher Education Institutions (HEIs) with the lowest average tariff scores, which also tend to teach the highest proportion of Computer Science students from under-represented groups, including BAME students, women, mature students and students from low participation neighbourhoods (LPNs);

➢ **Employer concerns over work readiness**: while many employers find that Computer Science graduates are well prepared for work, others say that graduates' skills and work readiness needs to be improved;

➢ **Employer engagement**: engagement between Higher Education (HE) and industry is almost universally considered to be something which enhances student employability, but many

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[1] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/518575/ind-16-5-shadbolt-review-computer-science-graduate-employability.pdf (accessed 19 September 2016)

employers report that providers are not always interested in engaging and there can be practical communication issues.
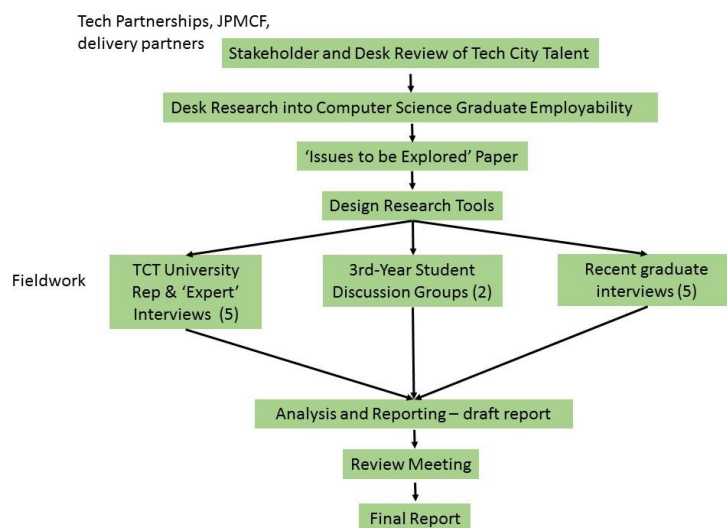
Approach

TCT worked with four East London universities and encouraged students, and later unemployed recent graduates, to register on a portal where they could present their skills and experience. The portal was promoted to employers, with that idea that employers would browse it in order to identify people to whom they could consider for internship opportunities.

2.2 Method

The report is based on a mixture of mainly qualitative research methods (see Figure 1.1 below), with the aim of securing the most useful information to inform future practice within the available resources.

Figure 1.1: Research Method Overview

The initial project review workshop (late November 2016) brought together people from the Tech Partnership, the JP Morgan Chase Foundation and those involved in delivery of the project in terms of engaging companies and supporting students. After consideration of the outcomes of the initial workshop and some desk research, an Issues to Explore paper was prepared and refined in consultation with the Tech Partnership. This provided the focus for the subsequent fieldwork (February and March 2017), which comprised interviews with three of the four TCT universities and two other senior and experienced people from the Higher Education sector with particular expertise in graduate employability[2]; focus groups with final-year students from TCT universities; and depth interviews with some recent computer science graduates of those universities.

The method adopted made the most of the data and individuals that could be accessed for the research, and made it possible to identify the key learning from TCT, but also explore broader themes that could be of relevance to future work. The approach was developed with the advice and support of Tech Partnership staff, and all research tools (interview topic guides and focus group discussion guide) and a first draft of this report were peer reviewed by Dr Jonathan Pratt, a highly experienced academic and education policy-focused researcher.

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[2] Elaine Boyes, Chief Executive of the Association of Graduate Careers Advisory Services (AGCAS) and ex-British Computer Society, and Prof Sally Fincher, School of Computing, University of Kent and Vice Chair of the Council for Professors and Heads of Computing. Both have been involved in the Shadbolt Review and Kent is highly regarded for its practice in terms of enabling computer science graduate employability.

2.3 This Report

Given that the project failed to meet the objectives that were originally specified for it, it was decided to review the experience of TCT, but also to build on that experience to explore in greater detail, through small-scale qualitative research, some of the issues that computer science students, employers and universities face in 'bridging the gap' between university and work. While research of this type cannot provide an exhaustive analysis of all the issues, it is hoped that the report makes a useful contribution to the broader debate on computer science student employability.
The report is structured as follows:

> **Section 3** sets out what was learned about computer science graduate employability from the TCT experience.

> **Section 4** analyses information obtained through the desk research and fieldwork to set out some of the key issues and challenges around graduate employability that affect students, employers and universities.

> **Section 5** presents some key conclusions, along with recommendations for next steps that could be considered in the light of what was learned and wider developments.

3. Learning from Tech City Talent

This section reviews the TCT project, considering firstly what happened while it was live, and then what was learned from the experience. Finally, based on the learning from the project and some issues identified through desk research, some aspects of computer science graduate employability that merit further attention are identified. These were explored in the fieldwork for this report, with the key findings and conclusions set out in sections 4 and 5.

3.1 What Happened

TCT worked with four East London universities (University of East London, London Southbank University, Queen Mary University and London Metropolitan University) and encouraged students to register on a portal where they could present their skills and experience (in text and video form, with content checked for suitability and people given feedback on how to improve it). The portal was promoted to employers, with that idea that employers would browse it in order to identify people to whom they could consider for internship opportunities.

As many as 214 individuals were registered on the portal at one point, but the anticipated 'dating' did not happen. The project was reviewed and more one-to-one support was provided to individuals using the portal, and extra work was undertaken to engage employers – either directly or through business intermediary organisations. The marketing messages used to promote the scheme to companies were also changed: initially the scheme had been presented as a way of finding people with skills that might be relevant to companies' recruitment problems, but the skills available seemed not to match the requirements employers had (when job descriptions for intern roles were received from employers they tended to expect more than the candidates could offer in respect of knowledge, skills and experience). So, greater emphasis was placed on the role the project could play in terms of corporate social responsibility (CSR) by enabling more recruitment of local people, including unemployed computer science and IT graduates.

Despite the adjustments to the programme, and the extra work put into engaging employers and supporting individuals, the project only succeeded in placing one graduate intern, who left the post after two weeks.

3.2 What Was Learned

Mismatch of Expectations Between Tech SMEs and Students
The internal project review and discussions with HE staff, students and recent graduates suggest that the single most significant reason for the failure of TCT was that the expectations of SMEs and students were mismatched: students were looking for an opportunity to develop their skills in a working environment, while the companies tended to have specific, more highly skilled recruitment needs they wanted to fill. A key issue was that SMEs were targeted. Whereas large companies with established internship and graduate recruitment schemes are more likely to accept that recruits will not be 'the finished article', and understand the need to enable people to develop, SMEs may operate less strategically, and be much more focused on more immediate requirements:

> *'Employers were told, "Here are some people with great skills, who could be the solution to your recruitment problems", but, in the event, they didn't really have the right skills in terms of employability or technical skills, especially those who had degrees like IT and Business, and maybe lacked proven skills in areas like programming.'*
>
> *Review Workshop Participant*

Another factor that was likely to make this kind of work especially challenging is that, in addition to being focused on SMEs, the project would be working with companies in a tech cluster that was local to the universities concerned, but also highly sophisticated, characterised by rapid growth, and

nationally and internationally renowned, acting as a 'talent magnet' for some of the most highly skilled tech people in the world. Analysis from the Office for National Statistics' Business Register and Employment Survey (BRES) conducted for this report shows that the tech sector in Tech City (Hackney and Islington London Boroughs) is a fast-growing population of businesses, with a very well developed and distinct subsector profile: employment grew by 23% over the period 2009-2016, compared to zero growth in the economy as a whole in the Tech City area.

The mismatch between what companies wanted and the students seeking internships were able to offer seems to be significant. Figure 2.1 below provides an example job description for an internship role that one of the interested companies put forward to the project team. The role described requires someone who is ready to take on a high level of personal responsibility, is highly flexible, motivated and committed, and has a wide range of technical and 'soft' skills, and experience of a wide range of work situations where theoretical and practical knowledge can be applied.

Figure 2.1: Example Employer Job Description (Identifying Information Removed)

Junior Product Analyst **Job Description** **Summary** We are young and quickly growing consultancy that helps our clients define and deliver great consumer digital products. Our clients are typically, but not exclusively, in the media and publishing industry. XXX's core offering spans the breadth of the product lifecycle from validating initial ideas to defining strategy through to managing delivery and launch, as well as defining the ongoing product road map. We're based in Shoreditch, London, but spend the majority of the time on site with clients. We're looking for an energetic, self-starter with a passion for digital products to join our team as a *Junior Product Analyst.* The successful candidate will get exposure to a number of clients, projects and challenges. You will bring a range of skills and experience to your role working with our clients. You'll produce research and insights that contribute to client business cases and the discovery of a digital product that is valuable, usable and feasible. Your personal values will strongly align with our own: integrity, transparency, honesty and work-life balance. The ideal candidate will be someone looking to grow with the company and eventually take on the role of Product Analyst or Product Consultant. Some occasional UK and EU based travel may be required. **Responsibilities** You have the following responsibilities: ● Perform competitor, industry and market analysis ● Review and gather insights from client's existing primary and secondary research data	● Create questionnaires and surveys for primary research ● Conduct user testing interviews & surveys ● Perform research to define the assumptions that underpin business cases ● Write research reports and presentations ● Present findings to clients and XXX team ● Assist with defining product features and functionality ● Assist with requirements gathering workshops & review sessions ● Writing user stories and acceptance criteria ● Assist the writing of client proposals ● Input into project deliverables and presentations ● Input into client business cases ● Support other consultant's activities ● Manage XXX's twitter account and weekly email newsletter ● Write occasional blog posts for the company website ● Ensure XXX's high quality standards are met at all times **Key Skills** ● Experience conducting primary & secondary research ● Experience documenting research outcomes ● Experience interviewing research subjects ● Excellent communication skills, including the ability to target your message to various audiences ● Ability to derive insights from a large amount of information ● Ability to summarise a large amount of information into a concise and clear format ● Ability to think broadly but also dive into the details ● A can do attitude. You need minimal support to get things done. ● Knowledge of industry trends ● Excellent time management skills

What was required was what one of the staff from one of the universities involved in TCT called 'mission critical skills':

> *'In Tech City Talent, the vacancies could not be found, and those that were found had selection criteria that were not reasonable. SMEs want contractors with specific skilled roles, like android developer, or iPhone developer, someone who lives and breathes code – mission critical skills. Bigger companies, though, want generalists, especially from Russell Group universities, who they will then develop into a range of roles. Company expectations have to be more realistic, and students need more exposure to working environments'*
>
> *Higher Education Interviewee*

> *'The key issue was that graduates were not yet job ready, so simply presenting people through the website would not be enough.'*

Section 5 considers the kind of practice that can help to address this challenge, but the experience from TCT underlines that working with SMEs to set up internship opportunities needs more time than was available, and companies may need to be persuaded of the benefits of such a long-term, more strategic approach to their talent acquisition and retention methods.

The TCT experience suggests that other, more detailed aspects of the mismatch from the employer's perspective included:

1. The timing of the offer did not always align to the company's preferred times to recruit interns.

2. The process for selection and profiling of interns was not immediate enough or matched enough to the precise needs of companies.

3. Smaller firms relative lack of Human Resources capacity.

4. The offer overall was not strong enough to incentivise engagement, although the JP Morgan connection 'was a real 'opener'.

5. A lack of support with wages. The training grant that was available was welcomed, but also raised the issue that people would need to be trained and training would need to be found.

Other Factors

A number of other factors, more related to the students themselves, were identified in the review workshop as being contributing factors to the mismatch between employer and student needs. They tended to come from low average tariff universities, which can be associated with poorer student employment outcomes. Many also had been awarded lower-class degrees (2:2 or below). They included people doing a degree which combined IT with subjects like business or marketing, which might be considered 'lighter' on some of the more technical skills that employers require.

> *'Many were not computer science graduates* per se*, but had degrees like IT and Business, maybe therefore lacked proven programming skills.'*
>
> *Review Workshop Participant*

It seems likely that the group of students who took part differed significantly from the tech sector workforce as a whole in terms of ethnicity and may have had an above-average proportion of people from low-participation neighbourhoods (LPNs)3. In addition, many students faced circumstances which would make their involvement in internships more challenging, especially in terms of care and family responsibilities, and the need to earn while studying, which could create clashes in terms of time commitments.

The students involved in TCT also tended to come from lower income backgrounds, may have lacked social connections in tech and often had personal characteristics not typical of workers in the sector. Finally, there was some evidence of people initially involved in TCT who, it later transpired, were not eligible to work in the UK.

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3 The project tracker spreadsheet had 44 people on it, 6 of whom (14%) were female. Ethnicity was not recorded, but anecdotal evidence is that a high proportion of students were from a BAME background. 20 entries in the tracker have postcodes which are sufficiently detailed to allow comparison with HEFCE POLAR3 analysis of participation in HE by neighbourhood (http://www.hefce.ac.uk/analysis/yp/POLAR/). The 20 records suggest that nearly two thirds of the graduates came from neighbourhoods with low youth participation in HE (POLAR3 quintiles 1-3).

3.3 Issues for Further Exploration

The project review workshop and subsequent desk research identified seven potential key issues and challenges affecting students, employers and universities that merited further exploration in relation to the problem of computer science graduate employability. These are:

> **Type of institution**: the Shadbolt Review shows that unemployment and underemployment is more likely for graduates at universities with low average tariff scores.

> **Type of course**: Shadbolt highlights year-long industry placement sandwich courses as the most effective in terms of graduate employment outcomes. Courses which combine IT with other subjects (such as business or marketing) may appear less technically specialised, and the extent of external industry certification of degree courses can also vary.

> **Demographics**: Shadbolt showed that employment outcomes can be worse for women, people from BAME groups, mature students, those from Low-participation (in Higher Education) Neighbourhoods (LPNs), and people with disabilities.

> **Personal circumstances**: Shadbolt suggested that poorer employment outcomes can be associated with students who study local to their home as a way of keeping costs down and / or being able to attend to family and care responsibilities as they study.

> **Knowledge and skills**: good employment outcomes tend to be associated with people who have the best technical skills, work experience and softer skills often referred to as 'employability skills' (which includes things lie communication, team working, 'drive', being a 'self-starter', etc).

> **Economic, social and cultural capital**: access to economic resources (money, assets and property), personal connections and relationships that provide access to career opportunities and help inform decision making, and personal characteristics (including class, background, 'character' and attitudes) that are valued by those making recruitment decisions.

> **Visa requirements**: the TCT experience suggested that the ability to work (in terms of visa requirements) may have been an issue in some cases.

In section 4 these issues are considered in turn, and areas which might merit further exploration highlighted.

4. Computer Science Graduate Employability: Key Issues and Challenges

This section considers the key learning that came out of the fieldwork with HE staff, final-year students and recent graduates in terms of the key issues and challenges associated with computer science graduate employability, with reference to the seven themes identified in section 3.

4.1 Type of Institution

The idea that the graduates of institutions with higher entry requirements are more attractive to employers of computer science graduates was largely confirmed in the interviews and focus groups. Most of the institutions involved in TCT were not Russell Group4 universities, and there was widespread agreement that the type of institution attended did make a difference in terms of graduate employment outcomes, and can put graduates from outside the elite group at a disadvantage:

> *'There's a lot of competition for jobs when you start applying. The big companies have high standards in terms of knowledge and experience which people like us tend not to have compared with someone who's been to Cambridge, for example.'*
>
> *Final-year Student Focus Group Participant*

> *'The big companies want more generalist graduates from Russell Group universities, but in reality, great IT staff often have poor A'Levels, but can be good programmers. Zuckerberg and Gates, for example, don't have degrees.'*
>
> *Higher Education Interviewee*

If this perception that graduates from the less prestigious universities are at a relative disadvantage when it comes to applying to large company graduate schemes is accurate – and the data in Shadbolt on student employment destinations seems to bear it out – it validates some of the original thinking behind TCT, namely that the potential of SMEs as graduate employment destinations should be explored further. This is not to say, of course, that graduates from lower tariff institutions cannot access large company graduate schemes – many clearly do – it simply raises the possibility that there could be an 'untapped market' for computer science graduate employment:

> *'There's a lot of focus on big banking and consulting companies like Capgemini, KPMG, etc in careers fairs and the like, but people know little about SMEs and start-ups, where there are lots of interesting opportunities. They may not even be in tech. It's about going beyond the obvious ones. It may be a lot easier to get a job with one of these companies. '*
>
> *Recent Graduate (employed in tech)*

Helping SMEs to adopt longer term, more strategic approaches to recruitment and retention – with time to take on undergraduates and recent graduates without a great deal of experience – could also be a response to skills shortages; companies could 'grow their own' people into roles, rather than struggling to fill more specialised job vacancies.

4.2 Type of Course

The experience of TCT was that graduates with broader degree programmes, and so fewer specialist technical skills (such as coding), might be less attractive to the type of tech SMEs that the company targeted. We have already seen that more 'generalist' graduates from the more prestigious universities can also be especially attractive to large companies with graduate recruitment programmes. A further issue could be that degrees such as computer science are also considered to

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be quite generalist by smaller companies with specific skills requirements in mind when they are recruiting:

> *'Computer science is a very general degree – you learn a bit of everything. You then need to specialise in some specific areas.'*
>
> *Final-year Student Focus Group Participant*

The evidence from the Shadbolt Review is that sandwich courses which include a one-year industry placement tend to generate the best graduate employment outcomes. This is borne out by the strong messages that came out of the fieldwork about the importance of graduates having work-relevant experience (see section 4.5 below).

Obtaining a good degree – 2:1 or 1st class honours – plays an important role in students' employment prospects. In addition to being a marker of the individual's ability and commitment, the level of degree can also be seen to some extent as a marker of technical skills:

> *'Most employers know what technical skills they want and will actively seek them. They know what to expect from the university, and will be less confident of those with a lower-class degree.'*
>
> *Higher Education Interviewee*

What now seems certain is that universities will now pay much more attention to supporting their students in securing relevant employment after graduation. The Shadbolt Review has shone a spotlight on the issue, but, perhaps more significantly, the Government's new Teaching Excellence Framework5 (TEF) is expected soon to become law (although some of its provisions may be amended in Parliament). The TEF's assessment of teaching quality includes a number of measures (such as student satisfaction), but also places heavy emphasis on graduate-level employment destinations. Universities that are less successful at helping their students find suitable work are liable to be graded more poorly and may face sanctions in terms of fee levels that can be charged too. This could lead to a significant reorientation of some computer science and IT degree teaching, or even the closure of some degrees and departments, given that the TEF is awarded on a subject-by-subject basis.

It is likely, therefore, that all universities, especially those that perform more poorly, will have to reinforce the work they do to improve graduate employment outcomes. And work is already happening at national level to improve universities' performance on graduate employment – both generally and for computing / IT degrees specifically:

➢ The Council for Professors and Heads of Computing has produced a good practice guide, *Computing Graduate Employability: Sharing Practice*6 and has established a 'Disciplinary Commons' group7 called GECCO, which meets regularly to share and showcase good practice.

➢ The Association for Graduate Careers Advisory Services (AGCAS) has also been doing a lot of collaborative work to share good practice around the notion of 'Graduate Attributes'8, or specific personal characteristics, attitudes and skills that successful individuals from a given institution can be expected to have.

Developments like these indicate that universities are and will continue to be actively seeking solutions to the issue of computing graduate employability, so any additional activities that are considered by bodies like the Tech Partnership or the JP Morgan Chase Foundation need to framed with these developments in mind.

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5 http://www.hefce.ac.uk/lt/tef/
6 https://cphcuk.files.wordpress.com/2016/01/computinggraduateemployabilitysharingpractice.pdf
7 https://employability.disciplinarycommons.org/
8 http://viewer.zmags.com/publication/1a21a329#/1a21a329/1

4.3 Demographics

Demographics do seem to play an important role in employability, because they can be markers of disadvantage when it comes to doing well at university and being successful at finding suitable employment. Taking ethnicity, for example, one TCT university reported that about 60% of its students were from BAME groups, while around only around 6-7% of the engineering and technology sector workforce is from a minority ethnic background.

The universities involved in TCT, which included one Russell Group member, all tend to recruit a very diverse group of students and are successful at widening participation in Higher Education:

> *In some national work on computer science employability, some universities developed 'personas' that would shed light on some of the challenges that students faced. While one university's had very few challenges, ours had many 'weights' to bear, many of which related to their demographic characteristics, such as family, kids, low income and having to take more responsibility in terms of family.*
>
> *Higher Education Interviewee*

> *'Our students are often the first person in their family to go to university.'*
>
> *Higher Education Interviewee*

The more diverse group of students that TCT universities recruit might be expected to encounter particular challenges in terms of demographics. One higher education interviewee, for example, recognised the issue of companies with a particular type of 'founder culture' recruiting 'in the founder's image'. Another underlined the well-documented challenges faced by women in the tech sector:

> *'The gender and IT issue is actually more of a Western European issue – it's less of an issue in Spain, for example – but women in computing careers, and STEM more generally, has been stuck at around 15% for a long time now. Attitudes seem to be set very early in school. Tech Mums, Computing for Girls, etc are often part of the response to this, but the sector is not very welcoming to women.'*
>
> *Higher Education Interviewee*

4.4 Personal Circumstances

Students' personal circumstances can play an important role in shaping employment outcomes. Sometimes these are related to the demographic factors already discussed: women, for example, may be more likely to combine studying with family and caring responsibilities, and there simply may not be time for placement or job applications, networking or extra travel:

> *'You have to get out to tech meet-ups to network, but this is really hard when you're studying full time and have two small children. There's no time for evening meet-ups.'*
>
> *Recent Graduate*

For others, personal circumstances can limit what jobs can be taken up:

> *'Personal circumstances do create extra pressures for some of the students that we work with. Some have turned down jobs with IBM or Microsoft outside of London because their parents wanted them closer to home. The issues also applies to men: there was one young man who needed to be around to help his mum, who was a lone parent looking after his younger brother.'*
>
> *Higher Education Interviewee*

Another higher education representative felt that care responsibilities, which can be especially associated with mature students, are one of the key factors that affect people's employability, and explained that placement models are beginning to evolve in some universities to accommodate this.

From the interviews and discussion groups, it appears to be quite common for students like those involved in TCT, who were quite likely to be living at home, to face challenges relating to personal circumstances such as these. Indeed, a number of the final-year students and recent graduates mentioned that one of their reasons for studying IT was that the possibility of remote working might be possible in some jobs, which would dovetail better with other responsibilities.

The other main limiting factor from the perspective of people's personal circumstances is work: many students in the TCT universities need to have part-time jobs to make ends meet for themselves or their families. While this clearly eats into the time that people might have for job search and applications, it does also provide potentially valuable work experience that can help people get a job – especially if the work is in the tech sector. Universities are also adapting their teaching practice and student support to accommodate working students:

> *'Issues that students face that impact on employability include that students are busy with part-time jobs and family… so when industrial speakers are brought in, we tend to do it in normal teaching hours when people are likely to be free. Extra classes may be run remotely at the weekend, when people can fit it in.'*
>
> *Higher Education Interviewee*

4.5 Knowledge and Skills

As we have already seen, there can be a significant mismatch between the expectations that employers may have and what students and recent graduates have to offer. There are three dimensions to this mismatch: people's experience of work, their technical skills and their broader set of what tend to be called 'employability' skills.

Work Experience

A major source of frustration for final-year students and recent graduates who have not yet found a job is that roles can be specified in a way which excludes them because they lack the requisite experience. The central paradox at the heart of this problem is exemplified by TCT, namely that many companies, especially SMEs, start-ups and rapidly growing companies want people who are 'ready to go' with highly developed skills and lots of experience to deliver 'mission critical' tasks, but in order to develop those skills you need a job in tech. This frustration was voiced frequently by final-year students and some recent graduates involved in the research. And one university staff member felt that the problem could be getting worse:

> *'Our biggest challenge has been to find internships for our students, despite a lot of contact with companies. In the past we used to place 150 students a year, but can't now. This is strange given the levels of skills shortages that are supposed to be there. This may be due to some parts of the industry shrinking: with AI and Cloud some parts of the workforce are shrinking, and some jobs may be going overseas.'*
>
> *Higher Education Interviewee*

A key challenge, therefore, appears to be how to grow the range and number of employer placements, including with SMEs, or how other opportunities for students to gain work-related experience can be grown. This might include offering different placement formats (a variety have been trialled around the country) or engaging with companies in other ways, such as through student projects or consultancy services staffed by students.

From an employability point of view, the Shadbolt analysis is clear that the most effective way of developing the kind of work experience that employers want is through year-long industry placements, which companies tend to use as 'extended interviews' to identify people who will later be offered full-time jobs. A key characteristic of such companies is that they are not looking for an immediate appointment of someone who is 'ready to go' on 'mission critical' tasks. Instead, they are building a talent pipeline of people that they can develop into roles. This suggests that there are two key tasks that need to be addressed to increase placement opportunities for students:

- Engage more companies, including SMEs and start-ups, perhaps offering a 'menu' of ways in which they can work with the university, rather than going for a 'product sale' of one particular format of placement. There is much good practice already in HE in this area, with leading universities like Kent, Napier and York sending around 70-80% of their students out on a year-long placement. This is achieved by devoting significant resources to employer engagement with two full-time staff in the computing department (at Kent) to handle employer liaison and manage the placement process. With the TEF (and the possibility that students themselves will demand better employment outcomes with rising fees and debt, which did come up in the focus groups), universities are likely to devote more resources to this kind of activity.

- Encourage more companies to take a strategic approach to building a talent pipeline, rather than seeking staff with very specific skills as and when they are required. This will increase the scope for new graduates with skills that can be developed over time to find their first job. Higher levels of engagement with companies could help with this, but the key requirement is to sell the notion of building a talent pipeline.

There could also be lessons for HE to learn from newer developments in the market. One recent graduate got their first career opportunity through an internship secured through a private company (Inspiring Interns[9]). There has also been an expansion of newer types of training providers and recruitment agencies which offer highly focused specific tech skills training for specific job roles:

> *'Makers Academy, Just IT, Firebrand, etc are now working to address this need. They have employer links and can place the students.'*
>
> *Higher Education Interviewee*

HE itself is, of course, part of this pattern of innovation. London Southbank University's Clarence Centre for Enterprise and Innovation[10] requires its tenants to engage in curriculum development, course delivery and other aspects of the university's academic work:

> *'This encourages them to feel part of the community, not just a "tenant"…Businesses need to become co-deliverers of programmes with universities.'*
>
> *Higher Education Interviewee*

More immediately, as is already happening in some universities, students are being encouraged to build online portfolios of their work (eg: code for WordPress, Google, etc) that prospective employers can look at to assess their knowledge and skills:

> *'Having an online portfolio gets you out there. People should start building one from the first year – it gets you focused.'*
>
> *Final-year Student Focus Group Participant*

Technical Skills

The fieldwork also surfaced an interesting tension between the more general focus of computing degrees and other offers with a more specific focus on particular skills that can immediately be deployed within companies. We have already referred to the growth of newer training and recruitment companies focused on specific technologies and skills that are demand in the tech sector, often with 'guaranteed' jobs or money-back offers if employment is not secured. A further aspect of this issue is the extent to which degree programmes can or should be more focused on the acquisition of specific skills for which there is known demand.

On the one hand, there is the idea of the 'rounded' degree education, that gives a broad appreciation of the issues, and ability to adapt and learn as new technologies are used, rather than just acquiring a particlar set of specific technical skills that may quickly become outdated. On the other hand, there is a growing interest in including industry certifications and a strong focus on tools like PRINCE2 for

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[9] http://www.inspiringinterns.com/
[10] http://www.lsbu.ac.uk/business/office-space/clarence-centre

project management. Many students see the benefits of external certification of skills when it comes to finding suitable employment:

> *'In order to stand out from other candidates, it would be good to have more external certification of modules – things like Red hat for cybersecurity or CCNA for networking. This would give you a real boost when you apply for a job. Maybe you could pay a top up, perhaps with a discount, to get the certification.'*
>
> *Final-year Student Focus Group Participant*

> *'Some modules in the teaching are not really real life and related to work – they're too abstract and seem to be just about getting assessed for academic purposes, with a lot of irrelevant "reflection". There's a lot of talk of PRINCE2, for example, but they don't teach it. You have to pay extra to do this. We've suggested it is included in the curriculum.'*
>
> *Final-year Student Focus Group Participant*

While it is impossible to specify from the research for this report the kind of curriculum developments that are needed to enhance graduate employability, ongoing development of curricula to enable better employability seems likely.

Employability Skills

The fieldwork suggests an individual's 'employability skills' are a key determinant of graduate employment outcomes and have multiple aspects. The following does not attempt to set out a definitive taxonomy of 'employability skills', but aims to provide a basic categorisation of the different themes that emerged from the fieldwork:

➤ **Understanding career opportunities**: being able to develop an understanding of career opportunities in their sector, what is of interest to them and how to access those career opportunities.

➤ **Job application skills**: such as developing a good CV, handling the different stages of selection procedures well, including the technical skills to pass tests in subjects like maths, English and psychometrics.

➤ **Confidence and resilience**: personal qualities and attributes sometimes described as 'drive', 'application, 'get up and go', being focused, taking personal ownership of the need to find a job, and 'commitment' to a successful outcome.

➤ **Soft skills**: generic capabilities that employers are believed to value, such as team working, communication, presentation skills, good time keeping, appropriate appearance and behaviour.

All four categories present challenges for students and recent graduates. Understanding **career opportunities,** for example, seems to be particularly challenging in the tech sector. In part, this is due to the nature of the work:

> *'In IT, unlike, say, nursing or medicine, there is a relative lack of "role differentiation": there are no clear roles like surgeon or nurse, just roles that keep changing. As a result, we aim to produce people with knowledge and skills which are more generic, rather than more specific ones which might date more quickly. For employers with very specific needs in mind, it may be less clear "what it says on the tin", but industrial experience will usually address this.'*
>
> *Higher Education Interviewee*

Perhaps because of this, students understanding of what opportunities might be open to them appear to be quite limited, and their university may not always be a good source of intelligence on what is going on in their target labour market. One recent graduate, who now himself recruits interns, explained:

'I found that starting my internship was something of a step into the unknown. I'd never really had a job before. You wouldn't look for interns to have in-depth experience of high-performance systems, for example, but you would be looking for signs of commitment to learn and develop, have drive to take on new things. There's a lot to take on. I quickly had to move into a whole new programming language and then into activities like testing. None of this was really taught on the degree course. Things will always keep changing.'

<p align="right">Recent Graduate</p>

This suggests that initiatives to improve graduate employability should include plenty of activities which improve students' understanding of the sector they are planning to work in, and help them to understand where they might want to fit in. However, often the best way of making sense of the complexity is to get a job:

'A big challenge was to understand the job options that were out there, such as business analyst, designer, developer, or UX designer or Visual designer. I only became aware of these when I got my first job as a project manager.'

<p align="right">Recent Graduate</p>

Some would argue that understanding career opportunities needs to start before people even apply for university, so that people choose a degree course that is right for them.

Job application skills are a major concern to students, especially those who fear that they may not 'fit the profile' of what the employer is looking for. The major graduate schemes are highly complex multi-stage operations, with perhaps as many as seven parts to pass before someone is offered a job. There was a lot of discussion in the focus groups about how frustrating and 'unfair' such processes can feel, and people wished they could have more access to meet employers personally earlier on, rather than going through lots of anonymous tests, and also be given opportunities to prove their technical skills sooner, rather than more generic questioning and testing. Their main concern was that a lot of effort could be wasted, and they wanted to know more about their suitability for particular roles and how the processes worked in practice.

Recruitment-focused networking opportunities would be really valuable. You want to meet the HR people to understand their recruitment processes, and interview-based approaches would be much better.

<p align="right">Final-year Student Focus Group Participant</p>

One particular skill that came up a number of times for less confident students is being able to illustrate what skills and qualities people do have, for example those gained from other types of work or life experience, even though they may have no experience of working in tech.

Confidence and resilience appear to be growing in prominence and may be especially relevant to the types of students targeted in TCT, given the multiple challenges they can face:

The main employability challenges relate to students who don't go on placement, and fall into three broad groups. Firstly, there are those with care responsibilities – often mature students. Then there are also people who are less career motivated at university and want to focus on their studies. Thirdly, there is then a group of students who generally are making less progress overall, and this includes being able to find a placement…A monthly meeting to discuss employability could be a good first step to working with the last two groups, and will surface some of the underlying issues that may be at work. Confidence may be an issue.'

<p align="right">Higher Education Interviewee</p>

What seems to be required will vary by individual, but can improve being supportive, but also 'pushing' people more to take ownership of their need to find a suitable job:

More of a personal touch, rather than AI and online processes, could make it easier to understand recruitment processes and what is required. People also need to be pushed or given moral support in a more personal process. It's easy to get a bit nervous and put yourself down'

Recent graduate

'A key challenge relates to students' confidence, and their ability to engage with the career planning process early on, especially if they are the first in their family to go to university. It's a big challenge just to get settled into HE. Students are of different types: some are very proactive and clear about what they want – they go to career talks, seek help and advice. Others, though, kind of hold back from the whole employability thing. They're afraid they're not qualified enough. They can question their ability before even applying. Some can also be quite introvert. You have to build their confidence to take the leap.'

Higher Education Interviewee

It was evident when recent graduates were interviewed during the fieldwork for this report that some individuals would be classified as confident 'self-starters', but also that others clearly need a lot more support.

A major challenge is to build confidence and resilience in order to help people get the jobs they want: knowing yourself, taking scary steps, rather than retreating from it. The issue is to take ownership of it, rather than just seeing the negatives and challenges. It's all about motivation, and also basic behavioural things like reading emails and taking action.'

Higher Education Interviewee

In one of the interviews with HE staff members, the interviewee came up with the idea of getting successful alumni to mentor students for employability, maybe calling them 'employability ambassadors'.

Soft skills are clearly a mainstream part of the work that universities already do on employability. The fieldwork revealed a wide range of special workshops on 'employability skills', as well as the embedding of skills like communication, team working and presentation in the way that the curriculum is delivered.

4.6 Economic, Social and Cultural Capital

There was evidence from the fieldwork that economic factors can play a role in students' employability: one HE staff member, for example, suggested that, for some students, finding the extra £15 to attend a networking event can be a major barrier.

Social capital can also make a big difference. Everyone interviewed recognised the importance of building a network: with peers, with people in industry, through tutors, using tools like LinkedIn, and attending events and meet-ups. Three things stand out on the issue of networking and building social capital. Firstly, family background can limit people's ability to network: some people's parents can (and do) introduce them to useful contacts, especially those from a middle class or professional background; others cannot. Secondly, people have to build their own network and have the time or commitment to do so: networking by definition is a very personal thing. So universities and others can provide networking opportunities, but people themselves have to put the effort in. Thirdly, networking is especially relevant in the tech sector because of the common practice of seeking employee recommendations when companies recruit. Many of those interviewed had secured a tech job after being recommended.

The evidence on the importance of **cultural capital** – essentially whether people match the dominant culture of a company – is much more anecdotal, but many recognise the issue. Demographics could be part of the picture if a student comes from a different background to most people in a given company, or if the company culture might be considered 'male'. But some aspects of cultural capital seem to overlap with the employability skills discussed earlier in this report:

'The issue of "founder culture" is common: companies often seek to employ in the founder's image, which might include "fierce and geeky" or "middle-class boys with good table manners", for example.'
Higher Education Interviewee

4.7 Visa Requirements

Although the issue of people being legally able to work in the UK was identified as a possible challenge for a number of students involved in TCT, the fieldwork does not suggest that this is a significant challenge for undergraduates, given that there appear to be higher numbers of international students on postgraduate programmes. Concern about visa requirements to work in the UK may be increasing though, given the uncertainty around immigration policy created after Brexit, even among people from overseas who have lived in the UK for a long time.

5. Conclusions: Bridging the Gap Between University and Tech Careers

This report has explored, through small-scale, mainly qualitative research with staff in Higher Education, final-year students and recent graduates, the experience of TCT and the broader issues and challenges around computer science graduate employability. It is clear further development of practice is needed across the seven broad areas considered. However, it is also likely that many of the issues identified will already be priorities for action in universities: the new Teaching Excellence Framework (TEF), policy pressure post-Shadbolt and possibly a greater demand by students for a better return on their investment in education will drive changes that should improve employment outcomes for computing and IT graduates.

5.1 Issues and Challenges that May Require Action

Against this background, and considering the different issues that the research considered, it might be expected that:

➢ Universities will work to improve students access to work placements and experience of various formats, and seek to grow the involvement of students in tech projects with companies through consultancy, research, innovation and knowledge exchange activities. The interface with companies, especially SMEs, will become increasingly important in improving graduate employability, and remain particularly challenging for newer universities.

➢ Universities will continue to develop curriculum so as to support graduate employability. This will vary a great deal by institution and course, but may include a greater emphasis, to some extent, on more of the skills that employers are known to require immediately.

➢ The issue of graduate employability seems likely to remain especially challenging for people like those who were targeted for TCT, who tend to come from more disadvantaged backgrounds and often have to balance study with other responsibilities, such as care and family.

➢ There will be a need to encourage more tech companies, especially SMEs, to consider talent pipeline development strategies, 'growing their own' skilled staff more frequently, rather than relying on always being able to appoint highly skilled and experienced people.

➢ Students, especially those targeted by TCT, will need all the help they can get to understand better the career opportunities that are available in tech, and to develop their job application skills, confidence and resilience in finding work, and in networking.

5.2 Recommendations

While many of these issues will be addressed by universities and students themselves, it is recommended that the Tech Partnership and JP Morgan Chase Foundation explore the scope to develop and test innovations in the following areas:

1. Activities which improve the interface between companies and universities in novel ways by, for example, offering multiple forms in which a company can engage with a university or making recruitment and selection processes more accessible.

2. Initiatives which aim to support people from disadvantaged backgrounds to access good quality career opportunities in tech by helping them build social capital or learn more about the culture and practice of the tech sector.

3. Work which promotes a culture of talent pipeline development in companies, and openness and commitment to helping people develop skills and experience.

4. Projects which offer the potential to build students' understanding of tech employment opportunities.

5. New approaches to building students' confidence, resilience and commitment when seeking career opportunities.

In the course of the research a number of potential project ideas were identified (see Figure 4.1 below) which could address some of these proposed priorities for further action.

Figure 4.1: Specific Project Ideas for Further Action Identified in the Research

Project	Description	Originator
1. Host / sponsor more technical events at universities	On leading-edge subjects like robotics, core programming languages or software testing, but pitching events at a beginner / entry-level audience to 'ease people' into the subject matter and make them better for students and companies looking to recruit interns.	Recent graduate
2. Sponsor extra employability support staff	At universities which are especially active in widening participation, so as to provide extra, personal support, coaching, advice and encouragement to students looking for internships and their first job.	Recent graduate
3. Employability Ambassadors	Get recent alumni to come back to university to brief students on job opportunities and provide advice, encouragement and support, keeping students engaged and enthused.	QMU and a recent graduate
4. Flexible Employer Interface	Providing extra support for universities to be more flexible in working with companies, addressing a wider range of requirements and a more bespoke service, so as to increase engagement.	University of Kent
5. Recruitment-focused Networking Events	Visits to companies or visits by companies to universities to increase understanding of recruitment and selection procedures by meeting HR staff (rather than operational staff).	LSBU final-year students
6. Usability Lab	Providing a high-spec home for a student-staffed IT consultancy service	LSBU
7. Tech Entrepreneur in Residence	Getting tech leaders seconded in part time for a number of months on a part-time basis to coach, advise and mentor students on employment and start-up options. Also as co-developers of curriculum and teaching.	LSBU and UEL final-year students
8. Mini Tech Projects for SMEs	Create tech projects with SMEs for students to gain industry experience. Companies would bid for a small budget (say £1K) for the university's students to deliver a project in an area like social media, web technologies, big data, etc and have to articulate the skills required in their proposal (so they could see the value of the graduate skills required).	UEL