adroit economics ltd

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Digital Tech Productivity Impacts - four potential big wins for the UK economy

Prepared by Adroit Economics

For and on behalf of

The Tech Partnership

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1. Introduction

1.1 This short paper sets out Adroit Economics' views of some of ways that digital tech could be used to boost the UK's productivity.

1.2 Our views are based on:

- Our recent work, on behalf of the Tech Partnership, reviewing all available global literature on the impacts of digital tech on productivity. The Tech Partnership undertook this work at the request of Government, to help inform the Chancellor's productivity plan[1].
- Our views are also based on Adroit's wide range of market research, appraisal and evaluation assignments in the fields of digital tech skills, connectivity and services, in the UK and internationally.

Digital technology productivity impacts: Four potential big wins for the UK Economy

1) **Boost tech skills in the economy**
   - Address tech professional workers' skills gaps
   - Increase tech professional pipeline of recruits
   - Increase tech users skills
   - Increase tech professional/user (hybrid) skills
2) **Fill digital connectivity gaps**
   - Better terrestrial broadband for small firms – rural rollout but particularly filling/upgrading urban gaps
   - Optimising satellite broadband – to fill both rural but urban gaps
3) **Better use of digital tech apps and services by SMEs**
   - Increase investment in and better use of the latest relevant digital tech apps and services by firms/ employees
   - Better exploitation of satellite services – GPS, EGNOS, Earth Observation
4) **Increase tech apps and services innovation**
   - Boost tech start-ups – focussing on students
   - Optimise the UK's network of innovation space to boost digital tech innovation
   - Increase applied R&D in digital tech apps and services

[1] https://www.gov.uk/government/news/productivity-plan-launched

Rational…….

- The UK economy is suboptimal in each of these themes
- There are significant gaps/ opportunities in each, which if addressed, the evidence suggests will boost firm-level and national productivity significantly
- Adroit has reviewed the global evidence base that allows us to estimate the potential benefits for some of these, and is undertaking and/or proposing new research, the results of which, will allow modelling of the potential benefits of the rest

Solutions……

- Some of these opportunities can be addressed by increasing awareness and co-ordination amongst firms
- Some of these will need action by firms
- And some will need co-ordination, support and in some cases, funding by government

The right solutions are critical…..

- The UK has engaged in substantial intervention in the digital tech area in the past
- There is a lot of experience to draw from
- Many people with that experience have moved on, their organisations disbanded
- Adroit Economics has a good handle on what works well and what doesn't – based on 20 years of appraisal and evaluation of tech sector projects
- Some types of intervention work very well, others are to be avoided

1.3 This report is produced by Adroit Economics, free of charge, in good faith, with the intention of helping inform the UK productivity debate.

1.4 If you would like further information on any point, please do not hesitate to contact us:

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2. Timetable - how soon could we boost UK productivity

How soon might we boost UK productivity if we pursue these themes?

- 8 initiatives could have relatively immediate effect

How quickly could each theme impact UK productivity			
	Near future boost to productivity	Medium term boost to productivity	Longer term boost to productivity
1) Boost tech skills in the economy			
▪ Address tech professional workers' skills gaps	■		
▪ Increase tech professional pipeline of new recruits		■	■
▪ Increase tech users skills	■		
▪ Increase tech professional/user (hybrid) skills	■	■	
2) Fill digital connectivity gaps			
▪ Better broadband for small firms – rural rollout but particularly filling/upgrading urban gaps	■		
▪ Optimise satellite broadband – to fill both rural and urban gaps	■		
3) Better use of digital tech apps and services – by SMEs			
▪ Iincreased investment in and better use of the latest relevant digital tech apps and services by firms/ employees		■	■
▪ Better exploitation of satellite services – GPS, EGNOS, Earth Observation	■	■	
4) Increase tech apps and services innovation			
▪ Boost tech start-ups – focus on students	■		
▪ Optimise the UK's network of innovation space to boost digital tech innovation	■		
▪ Increase applied R&D in digital tech apps and services		■	■

Return on Investment…..

2.1 Evaluations of previous appropriate interventions in the digital tech domain suggest that the right initiatives will generate a high return on any investment of public funds, in the vicinity of 10:1 or more.

2.2 Cost-benefit analysis is required to test policy options. Adroit Economics has/ and is undertaking some of the required cost benefit analysis. We have also assembled most of the metrics required to do high level cost benefit analysis of policy options in the remaining areas.

3. Boost tech skills in the economy

1(a): Address tech professional workers' skills gaps

- A significant proportion of tech professional employers report skills gaps amongst their workforce. Approximately half of all tech professionals work for specialist tech firms and the other half for tech departments in firms in the rest of the economy
- Research shows there is a clear relationship between increased proficiency of tech professional staff and increased productivity of tech professional firms, but more important than this, this feeds through to better service provision to their clients i.e. the rest of the UK economy…and it also feeds through to increased sales of UK tech professional services overseas (thus boosting exports)
- The latest Tech Partnership employers' survey found that tech employers don't train their staff as much as they would like to. The two biggest barriers to training are (a) funding issues and (b) difficulty of freeing up staff time for training

Suggestion

If a solution can be found to this log-jam and applied on a wide scale this will enable tech professional staff skills gaps to be addressed through a combination of increased take up of apprenticeships, particularly higher-level apprenticeships and CPD. This will result in increased proficiency and hence productivity of the tech sector but also of the tech sector's clients (the rest of the UK economy) and increased exports of UK tech sector services overseas.

One approach to this might be

- The Tech Partnership has been piloting a number of new approaches designed by industry. A number of these have already been evaluated. Picking the ones that worked base and rolling these out on a wide scale

1(b): Increase tech professional pipeline of new recruits

- In addition to needing to boost the skills of existing employees, the digital technology sector also needs to recruit to fill circa.1 million vacancies over the next 10 years (approximately 100,000 a year). Most of these will be new entrants to the sector. The majority of these will need to come from the education system (school, college and university) and some will be those changing careers from other industry sectors.
- The numbers of students following computer science and other relevant digital tech courses at GCSE, A Level and degree level are not enough, in part due to poor curriculums and unqualified or poorly qualified teachers. Take-up by women is particularly low. Does IT have an image problem?
  - The latest Tech Partnership employers' survey shows that most recruits into to tech professional roles/ apprenticeships are from foundation and first degree level
  - Recent analysis undertaken by Adroit Economics of OECD statics suggests that the proportion of computer science graduates to all stem graduates in the UK is relatively low compared with other counties in the index. Moreover, we found a statistical correlation between this proportion and country productivity. Many other factors could also account for this, but it does seem reasonable to assume that there is some form of link, direct or indirect between the relative numbers of computer science graduates and country productivity, given how key digital technology is to productivity

- The lack of qualified teachers and poor curriculums is beginning to change
  - = More exciting and industry-relevant computing curriculums are being developed – not least by the Tech Partnership. And these are starting to be put in place across schools and colleges at all levels - key stage 5, GCCE and A Level…coupled with new foundation and full degree courses in computer science
  - = More teachers are being trained to teach computer science and related topics – for example, London's Mayor, Boris Johnson, has established a fund to better-train 1,250 computing and IT teachers in London's schools and colleges
  - = This may be impacting already – only 375 students were doing computer science A Levels in London in 2014. The number has risen to 557 for 2015. The number is small, and it may be early days yet, but this could be the beginnings of increasing the pipeline

Suggestion

The vital area on which policy makers and industry need to focus is on the numbers taking up foundation and first degree industry-relevant computer science courses – this is the level that digital tech employers tend to recruit most from.

How can more students be encouraged to pursue computer science related foundations and first degrees? Are we doing enough? What more can be done? What do other countries do?

One approach to this might be

- Increasing take up of computer since at A Level is a key point in the pipe line
- To make computer science A Levels even more attractive to students, one approach might be to establish links between doing a computer science A Level and an employer, for example building in a sequence of work-experience in the sponsors office, into the course, providing a mentor, organising for the sponsor to set the class a real-life project
- To work this would need to be done on a wide scale

1(c): Increase tech users (literacy) skills

- = A number of studies in the global literature show a clear link between firm productivity and the level of IT user skills amongst general employees. A significant proportion of firms report that they employees do not have sufficient IT user (literacy) skills. This applies at all levels of the workforce. One major study shows that firms can lose up to 10% productivity as a result of poor use of IT. Even a small increase in user knowledge can have quite major impacts on productivity.

- Issues behind poor IT user skills include:
  - = New entrants to the workforce from school and college do not have all the IT literacy/user skills that employers require
  - = Whilst there is a range of vendor specific training on offer, cost and freeing up staff time are barriers to take up
  - = Apps and services are evolving so fast that addiotnal knowledge and skills are continually required

= One major study also found that employers and employees alike, often believe that they have sufficient IT user skills, when in fact, with only small improvements to knowledge, their proficiency could increase significantly.

3.1 Counter to this is that 'today, you can learn almost anything you want to free on line using Google and Your Tube. How then do we reconcile continued IT user/literacy skills with this? Further research is required.

Suggestion

Notwithstanding the findings from any future research, there are some obvious things that could be done now

One approach to this might be

- Firms tend to listen to what other firms say to them, rather than what the IT industry or government says to them
- If we can find a way of firms, that are on top of the game, that have trained their staff in optimal IT use, to tell other firms what the benefits are, this is a start
- How can we do this at very low cost? The best route is to work through business intermediary/ representative organisations such as the Chambers of Commerce and the Federation of Small Businesses – both of which are already doing a lot in this space
- What would probably help these organisations most is more ammunition to disseminate i.e. case studies of local firms telling other firms of the benefits

1(d): Increase tech professional/user (hybrid) skills

- One of the most chronic areas of skill shortage occurs in relation to the specialist 'hybrid' skills required by new, fast growing areas of the digital economy – for example, optimising big data, cloud and mobile competing, dealing better with cybercrime.
- Employers operating in these areas report significant difficulty in recruiting people with the right level and mix of skills. Studies in the global literature show clear links between optimising big data and firm productivity and between better cybercrime protection and business survival.
- A combination of skills are typically required in these fields – advanced tech professional skills, combined with other stem skills, coupled with business systems, business process, marketing and other business related skills. The ideal courses might include a mix of computer science, wider maths/ engineering skills with elements of an MBA

Suggestion

The Tech Partnership is currently working with industry to develop much needed course content/ curriculums and to pilot alternative training routes.

One approach to this might be

- Rolling out the most successful of these pilots on a sufficiently large scale is one obvious solution to this issue

4. Fill digital connectivity gaps

2(a): Better broadband for small firms – rural rollout but particularly filling/ upgrading urban gaps

- Major studies in the global literature show a link between both the extent of broadband usage and increases in available broadband speeds and country productivity
- More recent case studies, including from the UK, are beginning to provide a better understanding of how firms, particularly small firms, can use and benefit from faster higher quality business broadband. These studies (including those undertaken by Adroit Economics for BDUK in 2014, of early-stage voucher adopters), are also beginning to quantify the sorts of cost saving, time saving, sales and turnover increases ordinary firms can realise from faster better broadband
- BDUK's recent high level survey of a sample of UK voucher adopters found that circa 90% or more of firms reported efficiency, productivity, turnover and sales benefits of faster better broadband
- A major pan-European regional SME survey programme being launched by a consortium led by Adroit Economics (and including Point Topic, the University of Manchester and the EU broadband policy team BRESAT), will provide yet further evidence of the true nature and extent of the impact of faster better broadband on SME productivity. The pilot phase of the survey is just going live and will include Manchester, London, Andalucía, Cyprus and Bulgaria. Very initial findings suggest quite large immediate benefits of faster broadband to some SMEs
- In parallel, the latest data on rollout and availability of terrestrial broadband services, in the UK and across and much of wider Europe, is thought to suggest that the anticipated 5% rural coverage gap by 2020 is more likely to be 10-15%; moreover, evidence is emerging of significant urban gaps, particularly affecting SMEs. For example, a recent analysis of Ofcom and VOA[2] data earlier this year by Adroit Economics and Point Topic, found that 80% of GVA produced by London's SMEs was produced by SMEs in areas with poor (sub 30 Mbps download speed) terrestrial consumer broadband. This raises a challenge to, and an opportunity for policy makers. How can connectivity be so poor in London, one of the world's top cities?

Suggestion

The UK voucher scheme, paying for SME connection charges to faster broadband across 22 UK cities, appears to have stimulated notable take up and rollout in the cities in which it was operating. The voucher scheme has just ended. Is this too soon? Huge terrestrial broadband coverage gaps remain in urban areas as well as in rural areas. Finding ways of addressing this quickly would surely serve to boost UK productivity?

One approach to this might be

- A reinvigorated voucher scheme may be one of the best solutions

[2] Valuation Office Agency

2(b): Optimising satellite broadband to fill both rural but also urban terrestrial broadband coverage gaps

- Part of the solution to rural and urban terrestrial broadband coverage gaps may be satellite broadband.
- A satellite broadband workshop recently hosted recently by Tech UK in London explained that satellite broadband is a well-kept secret.
- Satellite services can currently support speeds of 20 Mbps download; trials are underway, including by BDUK of faster services.
- In the US, satellite broadband is a major player in consumer broadband markets, not just in remote areas but in New York City, addressing key gaps in urban coverage. Some of the leading US satellite broadband providers are starting to look at Europe.
- Technology and innovation is moving fast and availability of service and coverage across Europe is expected to accelerate.

Suggestion

Satellite broadband remains a well-kept secret though. Take-up is low. What can be done to change this? The EU broadband policy team – BRESAT – led by Avanti and of which Adroit Economics is member, is proposing an EU-wide approach to satellite broadband policy, for individual member states to consider. The final BRESAT workshop will be held in early February 2016 in Sofia, Bulgaria, hosted by the Bulgarian Government. Following adoption of BRESAT recommendations, the first major pilot area is likely to be the Alpine INTERREG region.

One approach to this might be

- For the UK also to take a lead role in piloting satellite broadband, as both a rural and urban gap solution?

5. Better use of digital tech apps and services by SMEs

3(a): Increased investment in and better use of the latest relevant digital tech apps and services by firms/ employees

- The global digital tech industry is developing an ever increasing range of apps and services. Innovation is rapid. Speed to market is rapid. Current key themes around which rapid development of apps, services, business models and business offerings is prolific include: cloud services, mobile computing, data analytics and cyber security. These are today's themes. What will be tomorrow's themes?
- For SMEs, the choice can be confusing. Keeping abreast of the options can be difficult. Effective use of some apps and services depends on a SME's broadband speed and quality of service. Many SMEs will not be aware of this or understand this.
- Many SMEs will probably think they currently have the best IT suitable for them. It is very likely that many will be wrong.
- Lack of awareness, confusion, cost barriers, lack of a digital tech professional on the payroll, are all reasons why SMEs may not be optimising digital tech
- If we can find cost-effective ways of helping break this log jam, such that a higher proportion of SMEs invest a little in better apps and services, especially linked to accessing faster better broadband, then the boost to productivity could be significant
- The UK has 10 years' worth or more of policy and programmes seeking to address these issues. Policy and programmes come and go with political, organisation and funding changes.
- Today, the UK doesn't really have any main stream programmes in place to encourage increased investment by SMEs. The last programmes went with cuts in business support.

Suggestion

Is there a cost effect way of addressing this issue? Yes, at least in part. Awareness raising is the first step. Some clear incisive messages are required…'if you use this, you could save costs and boost sales'…etc.….and these messages need to come from SMEs who have done this, to SMEs who haven't (yet). How do we do this?

One approach to this might be

- Adroit Economics is leading a consortium (including Point Topic, the University of Manchester and the European Commission's broadband policy advisory group, BRESAT) to undertake surveys of SMEs in regions across Europe to explore how SMEs use and benefit from faster broadband.
- The survey for the first time will provide definitive evidence of the economic impacts of faster broadband – but – the survey will also provide many real life examples of how SMEs are using and benefiting from faster broadband and associated us of better apps and services.
- If these examples can be effectively disseminated, say by regional intermediary business organisations (such as the Chamber of Commerce in the UK and similar intermediaries in other countries), this will put tech investment in apps and services more firmly on the radar screen of SME CEOs/FDs. It's a start.

3(b): Better exploitation of satellite services – GPS, EGNOS, Earth Observation

- If satellite broadband (referred to earlier) is an unintentionally well-kept secret, then other satellite services are an exceptionally unintentionally well-kept secret. If you ask people what satellites do for us, in the UK most people will think of Sky TV and won't go beyond that. The vast majority of us, by default, use GPS, mainly via our sat navs, and more recently via our smart phones and tablets. We won't necessarily think of these as valuable satellite services. Use of GPS, as much by default rather than intentionally, is widespread and has had a major impact on many aspects of our lives, including on the economy and on productivity. The extent of economic impact has not been assessed.
- GPS is the most basic positioning service available. It's free. A newer, better, more accurate and reliable satellite positioning service is also available – free – across Europe.
- The generic name of this service is SBAS. The brand name in Europe for this service is EGNOS. Unless you are in the satellite positioning industry it's very unlikely you will have heard of either, yet its potential benefits and impacts are large.
- Europe is only at the start of the process of exploiting EGNOS. The US equivalent system is called WASS. It is much more advanced and better exploited.
- SBAS (EGNOS) has uses in aviation, maritime navigation, road vehicle and freight management, rail network management and precision farming to name but a few. The benefits could be in the billions.
- When EGNOS positioning services are also combined with new earth observation services (which are also free), the potential increases further

Suggestion

Finding opportunities to use and optimise these twin free services is an easy win. The implications could be significant. But first we have to find ways of stopping this being an unintentionally very well-kept secret. The UK Space Agency, in association with the European Space Agency is doing a lot, but capacity is inevitably limited.

One approach to this might be

- Working with the UK satellite industry, Tech UK and tech clusters such as Tech City, to find ways of engaging the wider digital tech innovation communities in exploring the types of apps and services that could be developed to better exploit these enhanced positioning and earth observation satellite services.

6. Increase tech apps and services innovation

4(a): Boost tech start-ups – focus on students

- We could just sit back in the UK and let the global digital tech market create and sell us new apps and services which we could then use in our businesses to boost productivity.
- This would work, but for all sorts of reasons it's also good to do some of our own research and product development
- Ensuring some of the R&D activities of the big global tech firms' takes place in the UK is a start, but another important source of R&D and wider innovation derives from tech start-ups.
- Cambridge was probably the first UK city back in the 1980s synonymous with tech innovation and tech start-ups. Since then we've seen proliferation of science parks, technology parks, technology incubators, technology clusters, technology quarters, across the UK, with every city laying claim to a slice of the action.
- The most recent example is Tech City in London.
- The issue is the size of the pipeline. The more people engaged in the process the greater the rate of innovation

Suggestion

So the question is how can we do more, how can we ensure more people are engaged in the tech innovation pipeline?

One approach to this might be

- One idea might be that we find ways of giving the anticipated increased pipeline of A Level, foundation and degree computer science students increased opportunity to explore innovation and potentially starting up as part of and/or during their course. Some colleges and universities include student hot houses or incubators onsite, or in a nearby science park. It's a numbers game. Can we find ways of doing more of this, cost effectively?

4(b): Optimise the UK's network of innovation space to boost digital tech innovation

- It's more difficult for schools to include student hothouses or incubators on site:
  - = Space is often limited
  - = Converting and staffing space is expensive
  - = Incubation space within schools or colleges often doesn't provide quite the right change in image.
  - = Moreover this needs to be done on a large scale if it's going to work
- Why not then explore scope to leverage the UK's existing network of incubators, innovation and enterprise centres.

Suggestion

So we need to find ways of linking schools and colleges to external incubation. One approach to this is to find a way of enabling students doing A Levels and foundation degrees in tech, to spend some time in a nearby business incubator, linked to a tech mentor. There are some really exciting incubators operating in our cities, very low cost to take part in and providing a wide range of innovative support to members

One approach to this might be

- To pick a flagship incubator in each city and set up high profile pilots linking local schools and colleges to these – via a combination of work experience, hot desking, mentoring, shared projects and so on

4(c): Increase applied R&D in digital tech apps and services

- Start up (seed corn) funding remains an issue. 2nd stage funding is even more critical. Unless these critical funding gaps are addressed, new innovation can die before it takes root
- Public funding is still available, via various routes to support SME innovation, but it's not necessarily geared towards young single person start-ups or micro firms. Can we find ways of increasing the pipeline of funding for these during early stage development?

Suggestion

How do other countries do it? Adroit presented to senior politicians and civil servants from Finland's tech city – Espoo – in the House of Lords, in a workshop to explore alternative funding mechanisms, that didn't rely on public funding but instead leveraged main stream city finance. There as some projects doing this in the UK, in relation to financial services innovation

One approach to this might be

- Could we use this approach for wider digital tech?