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Public Policy and Skills for Smart Cities: The UK Outlook

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ABSTRACT

The idea that information is a key resource for the design and management of future cities matures currently through the thinking developed in the domain of ‘smart cities’. However along with the technology planning and operational aspects considered by the relevant communities of architects, planners, engineers, computer scientists and urban innovators, the time is right also to consider questions of skills and citizenship in a future city that is driven by enabling information. The impact of increasing digitisation of information coupled with the effects of innovation, e.g. of the Internet of Things, is profound on all aspects of city life, from transport planning and energy use reduction to care provision and assisted living. But they also include new ways of social innovation and organising communities, as well as access to political process. Hence familiarity, if not proficiency, in ‘digital era’ skills emerge in our view an essential part of future citizenship. We don’t only mean however efficient digital consumption skills, but also digital creation skills such as computational thinking and coding, entrepreneurship and systems thinking, information architecting as well as a risk-informed perception of data privacy and security. The challenges of delivering such a skillset are many, from designing a 21st century curriculum for schools and universities, to ensuring fair access to digital technology for people of all skills and abilities, race, gender, age and class. We believe firmly that taking time to consider these skills issues now is just as important as resolving the design and operational issues of the emerging technologies per se.

KEYWORDS

Smart cities; smart citizens; public policy; skills development

1 INTRODUCTION

Our cities and communities are places where aggressive urbanisation, steep population increase, and climate change pose existential challenges. Use of technology for adaptation, resilience and sustainable development is vital. Many aspects of urban life undergo a major transformation as cities exploit technologies to improve efficiency and control of operations and redefine the citizen’s experience. Ideas that were once deemed within the sphere of science fiction are being brought within reach by developments in mobile computing, civic technologies, wearables and other technological innovations: self-driven electric cars, parcel delivery drones and robotic assistants to name but a few.

However, it is essential to put these in context as technology should not develop in isolation of the needs and challenges of our

society. History shows how the potential of great innovations may be left untapped. For example, early versions of steam-powered engines, such as Heron’s engine [1], were invented as early as 100 A.D. but their potential was only fully realised much later during the Industrial Revolution. In turn, these emerging technologies could reshape many aspects of modern life at great pace that may require significant readjustment by society. We argue later that, besides contextualising technological innovation, a delicate balance between pace of innovation and adjustment to change can only be achieved when society possesses the right skills to cope with and capitalise on these.

In the UK there is a significant strategic focus on the investment, planning and development of physical infrastructure for achieving prosperous cities and regions coping with these challenges. In addition, the recent debate for more devolved powers for cities and regions has become a driver for novel models with many regions preparing to capitalise on any proposed reforms [2]. However critical digital infrastructure is frequently retrofitted and commoditised, and even overlooked. But to successfully enable the technological promises to become reality, we need to view the requirements of both the ‘hard’ physical and digital utilities infrastructure, and the ‘soft’ architecture and delivery processes as interrelated parts of the planning problem. It is such an integrated view that will enable these solutions to be fully contextualised.

Some models driving growth in this area are already in existence. For example, InnovateUK is a source of substantial support for future cities technology, with funding programmes orientated towards smart infrastructure, sustainable buildings, data-driven entrepreneurship, sensors, and the Internet of Things amongst others. In addition, the various thematic Catapult Centres form a platform that provides the essential networking, seeding and incubation of ideas to drive forward developments in Future Cities, Digital, Transport, etc. Many city authorities themselves have contributed by enabling and fostering innovation through incubation models, such as e.g. the Engine Shed in Bristol [3]. Many of these organisations, plus a number of growing incubator networks like FabLabs [4] facilitate events that aim at bringing the right people together under conditions that foster creativity (‘hackathons’). All of these means are examples of a network of opportunity for the development of future cities technology.

However, there exists an underlying presumption in that these forms of support and incubation are available and accessible to citizens, who in turn have the requisite skills and capabilities to make their ideas come to life. Entrepreneurship, design, technology awareness, computational thinking and programming skills amongst others, are all part of the potentially useful mix of abilities

to develop urban technologies supported by these platforms. If these means are to become key civic technology production platforms, any assumption about the skills and abilities of the citizen towards whom they are intended ought to take centre stage.

2 IS THERE A GROWING SKILLS GAP?

What would conceivably be the digital citizenship skillset in a smart city? Are our current educational and skills development processes orientated towards the challenges that future cities and their inhabitants are anticipated to face? Entrepreneurship and creativity, design and making, and computational and systems thinking are skills very much required. After all, engineering technologies are developed by people for people.

Alarming, several organisations and institutions have independently signalled issues in the pipeline of certain skillsets that would be deemed highly relevant in the future cities context and their labour markets [5][6]. Different cycles of economists [7] debate whether there is a shortage of such skills (particularly related to science, technology, engineering and maths – STEM). However, there is certainly an imperative for nations to deliver such skillsets through their educational systems more aggressively [8].

There has also been significant attention at the European level, particularly with the development of digital competences through the Digital Agenda for Europe and evidence brought forward of its impact on many vital sectors such as future care services [9]. Across the UK a high-profile debate on reform of the traditional ICT curriculum has culminated in changes (in England from September 2014 [10], with significant reform expected in Wales) that emphasises more the scientific and conceptual aspects of computing, rather than transient skills and applications of information technology [11]. Despite this emphasis, the UK and Europe are still perceived to be behind global competitors such as the US, Canada and China. For example, a conscious initiative to address future citizenship challenges has been developed in the US, where currently 19 states contribute to the ‘Partnership for 21st Century Learning’ [12]. Their framework addresses leadership, innovation, technology and key skills (e.g. finding information, presenting, critical thinking etc.) that are deemed essential.

But education is not just about skills development – and skills should not only be viewed in the context of a job market. The Speaker’s Commission on Digital Democracy [13] report highlighted a number of key areas where future citizens should be concerned. These include increased participation in political processes (e.g. engagement with elected representatives, e-petitions, social media debates) and the ability to understand and use electronic means of voting. Furthermore, the ability of social media to foster community relationships and nurture grass roots movements has already become a key medium for enabling political process and engagement with the public, with high profile examples coming from US politics [14]. One of the implications here is that, not only may citizens be disadvantaged with respect to future job skills, but also in terms of participation to community life and political process, where they may have limited or no access to emerging technologies.

3 GRAND CHALLENGES

Can we actually plan for and deliver these digital citizenship skills? Many would argue that universities cover aspects of entrepreneurship, design, innovation, teamwork etc. through their current curricula. A recent industrial report highlighted several educational Smart City initiatives across the UK [15]. However, the typical university offering is still rooted deeply in 19th century disciplinary silos, delivering skills in sub-divisions of ‘science’, ‘engineering’, ‘arts’, etc. [16].

The traditional curriculum model served well the science and technology sectors of the 20th century and contributed to the almost unimaginable boom of technology development. However, even then pioneers like Alan Turing, John von Neumann and Lilian Gilbreth were multi-disciplinarians who worked across the interfaces of science, engineering and art. We are now also seeing the powerful interdisciplinarity in science and engineering research, where computational techniques are shaping not just how science is done, but what science is done [17].

However, access to university education is not universal. Traditional academic study is not suited to everyone and socio-economic barriers to university still exist in many developed nations. Therefore, university curriculum alone should not be the focal instrument of delivering these skills. On the other hand, the university as a whole, with its public engagement and widening access initiatives, can be part of the solution, along with new hybrid models of delivery and participation such as massive on-line open courses (MOOCs). But yet again the success of this model presupposes resolution of the digital divide: digital competencies and access.

These matters are essential to be dealt with through effective policy interventions, because for citizens to engage fully with future forms of political process, trust is an essential aspect. This can only be built upon a sound understanding of the nature of the technology, involvement with broad actions of public engagement and, where possible, more specific engagement with open innovation platforms. An example of the latter is Bristol Is Open’s Programmable City capability [18]. There is a need for technology to be viewed as an enabler, as opposed to be demonised and fundamentally mistrusted – which is one of the side-effects of the ever-challenging surveillance versus privacy debate, especially in the light of recent whistleblowing about government surveillance programmes. Greater transparency of these programmes and sufficient oversight structures would assure the public of the role of technology, without harming the potential for capitalising on innovation and change that is based on intimate and potentially intrusive technology, mobile phones, wearable devices, wireless sensors and similar.

Unfortunately, there are many other socio-cultural barriers that could prohibit proliferation of these skills. Ethnic minority and female access to STEM careers is still a concern [19], as it limits the pool of talent in the sector. Many initiatives are underway to address these issues, but certainly more could be done. In addition, a potential move towards a freer market approach in Higher Education may lead to a greater squeeze of funding for the humanities in the UK, but also globally [20]. This could deprive the

field of fundamental thinking and it is hard to imagine a debate on future cities that is not shaped around the imagery of Fritz Lang's iconic Metropolis, or Blade Runner's dystopian urban landscapes.

4 CONCLUSIONS

We have seen important steps in resolving some of these issues. Reform of the school curriculum, from developing baseline digital competencies to deeper computing, computational thinking and programming skills, is crucial in changing wider public perceptions of technology and its impact on our lives, as well as equipping young people to live and work in a more computational world. Shifting society towards digital creation rather than just consumption could catalyse a profound change in civic engagement. Developing a digitally confident and capable citizenry through long-term technology innovation strategy and industrial policy could be achieved all the way from using open data as an effective policy instrument through to digital infrastructure being viewed as the critical fifth utility.

Where successes have been achieved is because the technology, society and policy interfaces have worked in harmony prioritising needs, enabling integration by breaking barriers of existing silos and delivering purposeful technology. In the light of challenges faced by our cities this is even more critical to happen now. This is a triple-axis issue. First, ICTs are essential platforms that can no longer be viewed as an add-on. For example, it is inconceivable that a city planner would not consider how a building will be linked to power and water supplies in the present day. In the near future, it should be just as inconceivable that a city planner would not consider how a building will be physically and logically connected to 'cyberspace'. Equally for technology developers not to consider the nature of needs of the citizen, and where process and policy is required to enable (or regulate) their artefacts, would be detrimental. Finally, for the citizen to pass on the opportunity to engage with enabling and life-changing technology is an opportunity that, given the challenges our cities and communities face, we cannot afford to miss as a society.

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