Digital Task Force
for Planning

A Digital Future for Planning

Spatial Planning Reimagined

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Digital Task Force for Planning

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FOREWORD

Before the pandemic broke in March 2020, we felt the need to establish a Task Force for planning to explore the impact of the digital transformation on its expertise, practice and culture. We set up an independent advisory panel at the start of 2021 with a group of influential thought leaders across a broad spectrum relating to planning and digital technology. It was formed to raise awareness about the expertise and skills needed to empower the planning profession in the digital era.

Our Task Force situates the digital transformation within the wider grand challenges that dominate society: climate change, biodiversity, aging, and the polarisation of wealth and poverty, all being rapidly informed by digital thinking. New data about town and country, and new ways of integrating the myriad of forces affecting the sustainability and quality of life in our communities using a whole systems approach are key to our report.

This is all set against the UK government's commitment to science and technology, cutting-edge research that will deliver strategic advantage to the UK, and to deliver government commitments to climate actions, natural capital net gain, levelling up, and reaching net zero. We believe spatial planning is a pivotal applied science enabling us to tackle these grand challenges systematically, with the digital revolution playing an essential part bringing new approaches to these large, interconnected issues.

During 2021, we spoke with a wide range of built and natural environment professionals and our report includes their responses as well as those of our advisory panel. Our main messages involve recognising spatial planning as a vital applied science discipline, developing systematic digital thinking, unlocking its full potential facilitating core digital capacities, investing in its research and training, and learning from other applied professions such as medicine where education and practice meet.

This is not a report that itemises the many digital tools used by planners although these are identified and noted. It is about the wider context of the digital revolution in spatial planning, and it presents 8 recommendations to be pursued by government and the profession. In this sense, it introduces a continuing dialogue, not an ending but a beginning, to reinvigorating the profession and its practice.

Finally, we express our gratitude to everyone who has supported our work. We were touched by the overwhelming support from planning professionals and other key stakeholders.

Michael Batty, Wei Yang
Co-Chairs of the Digital Task Force for Planning

14 January 2022

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Executive Summary

The Grand Challenges and a Whole Systems Approach

The survival of our civilisation through tackling the grand challenges that we currently face relies on transformative actions locally and globally. Thinking beyond boundaries and working collaboratively are fundamental requirements of such actions.

From the recent COP26 UN Climate Change Summit, the 'whole systems' approach is clearly essential to thinking and acting over the impact of climate change (and biodiversity decline) in the immediate and near-term future. The same applies to our missions for resolving public health, inequality, and poverty issues. As highlighted by the Pandemic, these interconnected challenges need a whole systems approach in dealing with our living environment. Social, economic and environmental policies need to be considered holistically. A whole systems approach also implies the need for digital tools and big data.

Unlocking the Full Potential of Spatial Planning in the Digital Era

The importance of planning has been widely recognised by built and natural environment professionals. As an important applied science discipline, spatial planning can offer a unique place-based systems approach to coordinate multisector efforts to deliver zero-carbon, environmental net gain, a circular economy and a green industrial revolution for a fairer society. At the same time, planning exercises powerful leverage to engage communities in creating beautiful and liveable places where low-carbon lifestyles predominate.

We have now entered an era of 'digital by default' where the dramatic spread of computational resources has pervaded every aspect of our society. Data, scientific thinking and digitalisation has been extensively developed in many natural and built environment disciplines. Digital Twins, Smart Cities, Big Data, Climate Models and a host of other simulations illustrate how far the revolution has come.

The digital transformation is now evolving into its fourth wave which is dominated by developing new organisational structures, or 'platforms'. Spatial planning involves a highly sophisticated sequence of interactions and decisions that require digital methods and data advancement which enable different systems to be inter-connected. These are transforming our previous linear thinking into a multidisciplinary intelligence based on a digitally enabled approach to spatial planning.

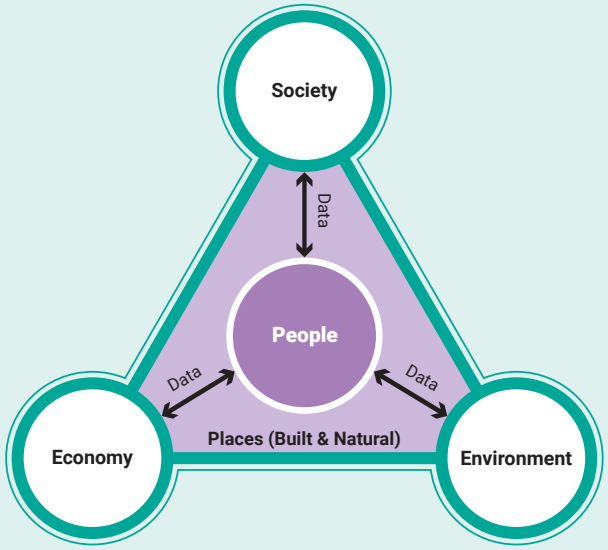
These transformations fundamentally require behavioural change with respect to our wider mindsets, but data and new technologies can help us achieve these goals in a way that was not possible before the digital age. Moreover it is essential to ensure that the approach does not become a digitised technocratic process.

In light of the transition to a circular economy and based on the fourth industrial revolution's focus on redesigning systems, the approach proposed here seeks a transformative digitalisation of spatial planning – a people-centric process which is enabled by digital technologies. It will generate better engagement in the plan-making process, enhance efficiency and optimise the value of data, and it will allow stakeholders, planners, designers, and policymakers to think intelligently through an evidence-based decision-making process. Participation using digital technologies for communication and design are central to its transformation.

Potentials and Principles for a Digitally Enabled Approach to Spatial Planning

Using a digitally enabled approach, the full potentials of spatial planning can be unlocked in many ways. Such principles are based on an intelligent and visionary joined-up approach and a cohesive multi-scale and multi-disciplinary approach which requires access to better data much of which is now collected in real time.

This will generate an invigorated community approach, more interesting, visual and accessible planning, a much speeded up planning processes, saving costs, and increasing efficiency and productivity, as well as a unified approach to information management.



The Concept of an Integrated Digitally Enabled Approach to Spatial Planning

The practicalities of plan-making require political decisions that are evidence-based and thus more transparent and democratic, balancing competing demands, and directing decisions pertaining to resource-allocation.

Thus a digitally enabled approach to spatial planning should embrace the following principles: strategizing with real purpose, innovating and exciting the young, defining spatial problems in context through new digital tools, communicating the differing importance and flexibility of individual policies, and embracing key questions of ethics, legitimacy, and ownership.

Collaboration through underpinning usability, accessibility, data operability and exchange is key to generating inclusivity, diversity, engagement & empowerment through citizen participation, and ensuring accountability, transparency, and consistency using a systematic approach.

Creating a New Cyclic Planning Methodology

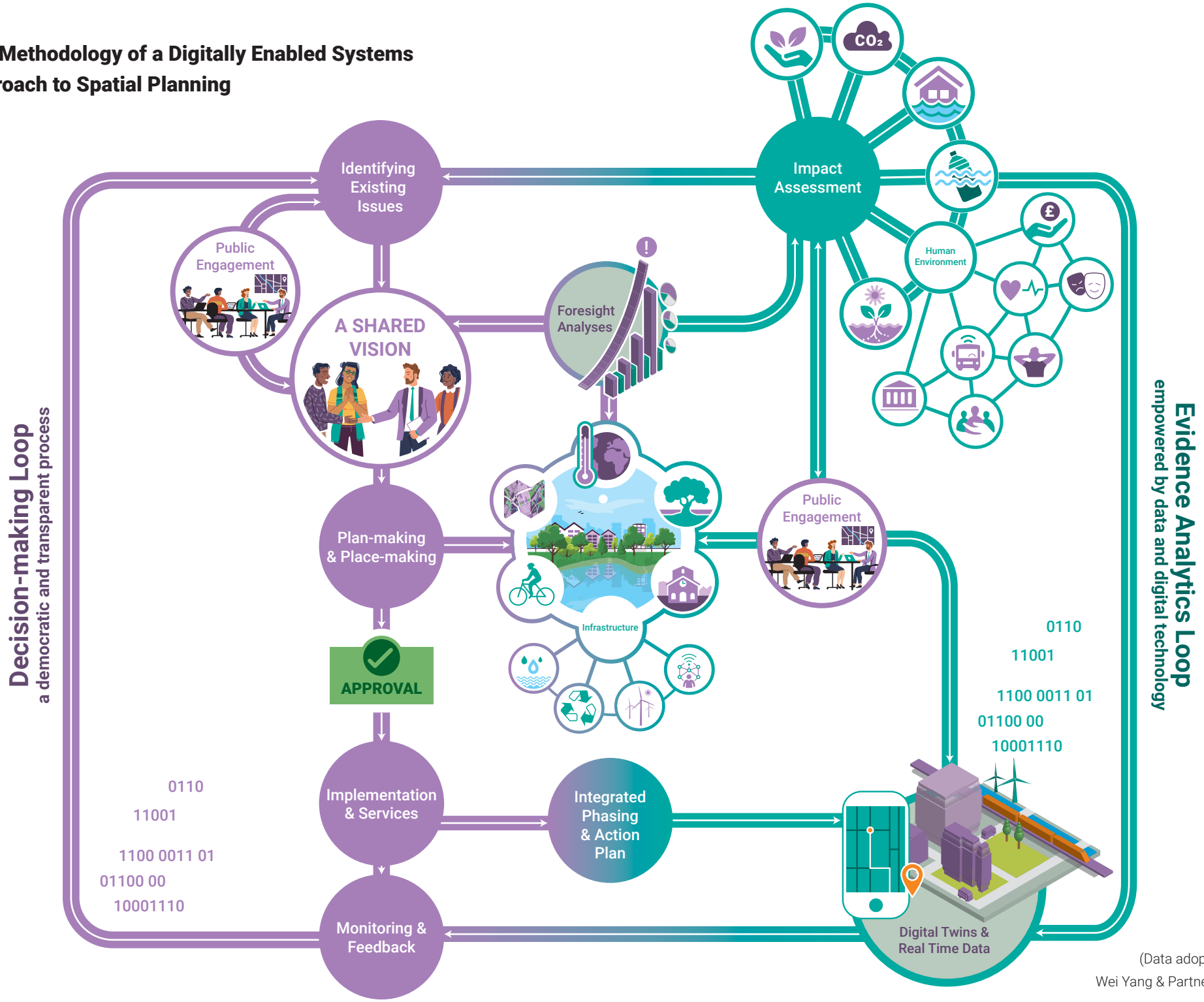
Using a place-based systems approach empowered by data and digital technology, we propose a new spatial planning methodology to achieve net zero and other mission-orientated goals.

In essence, we define a cyclic planning system based on two interrelated loops – an Evidence Analytics Loop which is about the science of systems and a Decision-Making Loop which is the legislative procedure. The former is informed by multi-disciplinary evidence empowered by data and digital technology; the latter is a democratic and transparent process of argument, discussion, speculation, invention, design, innovation and of course politics. The two loops are integrative and interactive with each other, and they can be interlocked in countless ways when adapted to the planning task in hand.

The methodology enables planners and key stakeholders to iterate and explore ideas while also engaging in plan-making in real time through a dynamic cyclic process – identifying existing issues, creating a shared vision of plan-making and place-making, approval of plans and their implementation, monitoring and feedback, all tied up in continual reiteration of this cyclic process.

The methodology aims to introduce a systematic digital technological advancement in day-to-day spatial planning practice. This of course cannot be accomplished overnight but many of the seeds which define the digital transformation provide a structure to develop this.

The Methodology of a Digitally Enabled Systems Approach to Spatial Planning



(Data adopted from: Wei Yang & Partners, 2021)

The Current Progress of Digital Integration in Planning

While there has been a range of responses to digital thinking and applications in planning practice across the UK, there is also a fundamental set of digital practices that are used to support the planning system in its operation. The work of the Task Force has identified that many relevant digital technologies and tools which can be utilised in the cyclic planning methodology are already available. We catalogue many of these tools simply to draw attention to the fact that the digital transformation in planning is already well under way.

However, through Local Planning Authority and Planning School surveys, the Task Force has identified a huge digital skill gap in planning authorities and universities. Digital integration in planning is uneven and highly fragmented and in and of itself should be treated as a key aspect of the need for 'levelling up'.

On the one hand, e-enabling customer-facing systems are being largely used in the UK for Planning Support. On the other hand, decades of ongoing processes of reform and especially the austerity measures introduced in the last decade since the Great Recession have meant that the planning profession itself has grown slowly to adjust to the new opportunities initiated by technological change.

Despite the fact that digital planning has been identified as a priority in the ***Planning for The Future*** White Paper (2020), there is a lack of national cross-departmental considerations on how to achieve the digital capacity required to deliver zero-carbon, environmental net gain, levelling-up, and other ambitious goals committed by the government.

What Needs to be Done

Through extensive engagement and consultation with key stakeholders, the Task Force has identified an urgent need to establish a complementary set of core digital capacities in data, platforms, tools and techniques, as well as develop adequate skill capacity within the planning profession through training and education.

The Need to Establish Core Digital Capacities:

- **A Common Spatial Data Environment based on National Mapping and Datasets:** the map and datasets (key environmental, socio-economic & public health data) that would enable every baseline study including forecasting, simulation, modelling, and monitoring for the country need to be specified and collated centrally.

- **A National Network of 'Regional Data Observatories' based on Regional Data Input:** regional bodies tasked with collecting and analysing demographic, economic, social and environmental data should be created.

- **An Integrated Planning Open Data Framework based on Planning Data Input:** digital planning support systems need to be designed to capture back office data in an integrated open data framework with decision support and public consultation functions.

- **Planning Metadata and Information Management Standards:** unifying planning metadata and information management standards to enable the twin pillars of development control and plan-making to be coordinated and synergised.

- **Digital Tools and Techniques:** a diverse range of digital tools and techniques which can be employed and integrated in spatial planning should be introduced to planners.

The Need to Establish a Digitally Enabled Spatial Planning Profession

There is also a deep urgency in cultivating an eco-system to allow advanced digital technologies based on new developments in artificial intelligence and simulation to be applied in mainstream planning practice and education. Planners should play a proactive role in driving the digitalisation of the profession by learning from other professions, such as engineering, environmental specialists, and the public health sector. The digital skillset for planners should be diversified to allow a wide scope of expertise to be developed, along with innovative ways of collaboration. Greater funding opportunities in teaching and training should be pursued to enable the urgent upskilling of planners in practice.

To conclude, the Task Force gives eight Recommendations to the government to implement a digital future for planning.

Recommendation Headlines

1 Recognising the Vital Role of Spatial Planning as an Important Applied Science Discipline where Its Digital Transformation has the Potential to Tackle the Grand Challenges

To maximise the potentials of digital transformation by establishing the key links between the grand challenges, the planning profession as an applied science discipline, and the continued development of new technologies and data.

2 Establishing a Chief Spatial Planning Officer Role in the Cabinet Office

To recognise the national significance of spatial planning for joined-up governance and to reinforce leadership in addressing the challenge of moving towards a more sustainable world.

3 Implementing an Integrated Digitally Enabled Spatial Planning Methodology

To create a digitally enabled cyclic system in planning through connecting the decision-making loop and the evidence analytics loop.

4 Establishing a Central Resource and Delivery Body to Empower Cross-Sector Innovation, and to Develop and Implement Digital Planning

To form a central resource and delivery body to lead the implementation of digital planning methodology as part of the levelling up agenda. The organisation will be responsible for coordinating the development of core digital capacities by setting up a national network of 'regional data observatories', promoting digital tools and technologies being mobilised in planning.

5 Creating a Comprehensive Mapping System, a Common Spatial Data Environment, and a Basic Set of Analytic Functions Tailored to Plan-Making

To establish an open data platform which integrates national data sources, development data, comprehensive mapping and associated analytic tools: focused on 1) Identifying Baseline Data; 2) Defining Consistent Spatial Data Standards; 3) Data Licensing, Security, and Confidentiality; 4) Establishing Common Datasets and Improved Monitoring; and 5) Developing Analytics for Better Local and Strategic Planning.

6 Establishing a Chief Spatial Planning Officer Role in Every Local Authority

To build and restore stronger leadership in spatial planning at the local level and to develop integration between local authority services using a whole systems approach.

7 Investing in Digital Planning and Forging an Ecosystem between Planning Research, Practice, Education, and Lifelong Learning

To integrate and invest in new forms of digital training and education in spatial planning through research, professional education, practice and lifelong learning, engendering a culture change in planning profession.

8 Developing a National Cross-Departmental Strategy for Digital Planning

To develop a national strategy to implement the digital transformation in planning enabled by a cross-departmental culture change. This should involve training in digital skills to support processes of levelling up and joining up across different planning agencies.

What Key Stakeholders Said - Potentials of a Digitally Enabled Spatial Planning

"Much of the planning system has remained unaltered since the 1940s. The full potential of geospatial data, computational models, scenario planning and the artistic leaps forward in digital design and rendering have not been fully embraced by the profession. It has become ensnared by the administrative burden of legislative interpretation, rather than being a creative and collaborative profession. Greater utility of data science by the profession would provide us with the opportunity to unlock the potential of – and reduce the complexity of – accessing and assessing the right data to inform policy needs, in a manner that can be more responsive to day-to-day needs, whilst establishing the longitudinal insights necessary to address the pressing challenge of rebalancing economic, ecological and ethical factors to address our single biggest challenge of the climate emergency."

- Ritchie Somerville, City Region Deal Group, University of Edinburgh

"A shared database to be created on a GIS base so constraints, brownfield land, contaminated sites, flood zones, travel to work patterns, housing market areas, areas of historic or ecological importance etc can be mapped and considered in the production of sound planning."

- Robert Purton, David Lock Associates

Digitalisation can "coordinate complex and competing policy needs" and "... seamlessly connect to other key national databases".

– Spatial Policy & Analysis Lab, Department of Planning & Environmental Management, the University of Manchester Roundtable

"Comprehensive mapping systems across the whole UK" is needed.

– Sue James, The Trees and Design Action Group

Digitalisation provides "a catalyst for change ..." enabling the "planning profession to be demystified, accessible and impactful – transparent and accountable".

- Dr Deb Upadhyaya

"The planning system more digitally focussed ... to improve the quality, transparency, and speed of decision-making on spatial planning matters"

– Spatial Policy & Analysis Lab, Department of Planning & Environmental Management, the University of Manchester Roundtable

"A digital planning system will require new and improved systems and tools that bring this together."

– Atkins

"Every opportunity should be taken to embrace the changes forced upon us in the last 14 months. The pandemic has taken local government, PINS and the planning system forward by about a decade. These changes are long overdue. Cost, political reticence and inertia held the system back and allowed development plans, planning applications and appeals to be prepared consulted upon and determined in a largely unaltered way for over 70 years."

- Robert Purton, David Lock Associates

"Digital planning can help to improve the democratisation of planning and make planning processes, and the subsequent outputs, more accessible to the population."

– The University of the West of England Digital Skills Workshop

"The value of digital planning lies in its value to community planning; production of legible maps; communication and debate of issues; visualisation of sites; 3D modelling for urban design etc."

- The Young Planners and Student Focus Group

"The digitisation of planning should lead to quicker access to data, better informed decision making and help better engage stakeholders in the planning process ... there is huge potential for greater transparency, efficiency and collaboration between developers, planning authorities, communities and across the wider sector."

– Atkins

"Digital planning right now is too narrow in its focus, it is primarily considered in new build and reducing cost of construction but the benefit often lies outside of the central project. More work needs to be done to educate organisations of the potential for digital planning and a digital planning strategy should be included in all projects."

- Colin Hewertson, OpenText PLC

"Plans that are working as data models as well as policy statements. This implies having parts of the plans that are 'self-refreshing' or simply frequently updated - and parts of plans that include targets and indicators which are related to policies".

- Martina Juvara, Urban Silence

Introduction

In 2015, the United Nations defined an agenda for sustainable development to be implemented by 2030. This " …. provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs), which … recognise that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth – all while tackling climate change and working to preserve our oceans and forests"[1].

Purpose of the study

We currently appear to be standing at a threshold, defined to an extent by the pandemic but also by the dramatic spread of computational resources into every aspect of our society. The survival of humanity and the possibility of civil society to tackle multifaceted crises depends on how quickly we can transform our ways of living, working, traveling, farming, trading, learning, caring, managing, and sharing to meet the grand challenges that now beset our planet. The digital transformation is central to all of these.

In our terms, this is a tipping point focussed on how to unlock the full potential of the planning profession to tackle the grand challenges of our times: climate and biodiversity crises, social inequalities, public health, economic polarisation, migration and aging, and a host of issues pertaining to environment and humanity, wrapped up in the UN Sustainable Development Goals[1] (SDGs).

However, in the last several decades, legal and politically defined functions of planning have come to dominate, whereas the legitimacy of planning as a public service for the provision of public goods has been significantly marginalised and the ability to plan through our visions for the future has been diminished.

Ever since computers emerged over 70 years ago, planning as a movement has embraced these new technologies in devising better physical plans for addressing the social and economic needs of contemporary society. Now, data science and digitalisation has become a priority across different fields and different sectors, such as engineering and transport; but there is a clear lag in spatial planning, which should directly benefit from this data and technological revolution to enable a better engaged plan-making process and much broader interdisciplinary collaboration. This revolution enables everyone to think intelligently about the future to support well-informed decision-making.

This study is an examination of how we can unlock the full potential for the planning profession to fully embrace data and technological advances. The scope of the study is about methods, practice, organisation of the planning system and the profession itself - not merely to 'digitise' the planning system, but fundamentally to 'digitalise' planning methodology – creating a reimagined digital enabled planning profession to tackle the grand challenges of our times.

The study uses the UK's spatial planning domain as its context. However, we consider that the digitally enabled spatial planning methodology we propose can be applied worldwide after suitable adaptation to different countries' own planning systems.

What planning is about?

Planning is both art and science. It is a key mechanism to deliver zero-carbon, environmental net gain, to spur on the development of a circular economy, and to achieve a green industrial revolution for a fairer society. At the same time, planning has powerful leverage to engage communities to create beautiful and liveable places. It achieves these aims by defining the use of land, protecting the environment, engaging in design, and stimulating social and economic activities.

The modern planning profession was born more than 100 years ago to proactively resolve the challenges of those times. One of its aims was to 're-integrate the sharply divided environmental professions'[2]. Planning is beyond the capacity of any individual built and natural environmental profession to subsume. It is the glue that binds their expertise together to create a better future in the public interest.

Planning should be people centric as it relates to everyday life. People's health and well-being was a key policy focus from the very first planning legislation which was enshrined in the ***1909 Housing and, Town Planning, Etc. Act***[3] and today health and well-being are still one of the planning profession's key foci.

Spatial planning is organised around applied social, environmental, and behavioural disciplines that synthesise different approaches to both the sciences and the arts. The full remit of its domain includes the wider landscape of cities and the countryside as well as marine areas. Utilising a place-based systems approach, spatial planning has the ability to develop a long-term vision and framework for citizens based on multiple scales, balancing competing demands, and directing resource-allocation decisions[4].

In this context, spatial planning is unique in many ways as it offers a place-based systems approach. There is no other profession that has the potential to systematically coordinate multi-sector efforts with underpinning principles of social justice. It is thus focused on re-creating a balanced system so that people, nature and society are able to coexist in harmony.

The Digital Task Force for Planning

In February 2021, an independent Digital Task Force for Planning was formed by Michael Batty and Wei Yang to initiate discussion within the planning profession and related disciplines on how the profession might embrace the digital revolution in a much more thorough way than hitherto. The team explored how planners might be provided with new skills, better data, new digital and non-digital tools and platforms for understanding, sharing and collaboration. This was in a context where new methods for spatial planning which can be both resilient and proactive would meet the needs of a post-pandemic future.

The Task Force is comprised of an interdisciplinary panel of experts drawn from a broad spectrum relating to planning from higher education, research, and practice **(see Appendix 1)**. The Task Force members met in 4 sessions throughout 2021 and communicated regularly to help shape the focus and scope of the study. Their specific views on digital planning are outlined in their visionary statements and reflections presented in **Appendix 2**.

The mission of the Task Force is thus to promote an integrated digitally enabled approach to Spatial Planning. It is a prelude to a wider ongoing debate about how planning needs to fit into the wider framework of development of our towns, cities and rural areas to meet targets defined around sustainability. The Task Force was agreed that digital thinking can sharpen and inform these goals.

Digital Task Force for Planning

Conduct of the Study and Purpose of This Report

Different from previous reviews of the planning system which were focused on the legislative and policy aspects of planning, this review took an entirely open approach that links many grand challenges together. The study is beyond professional, political, and departmental boundaries and is constituted as an independent group of concerned experts' intent on developing a reimagined spatial planning in the digital era.

A big question was asked: "What should be done now to make our world a better place for our future generations through achieving a universal common good". The Task Force regarded a new digitally enabled systems approach to spatial planning as one of the keys to unlocking the move to achieve net zero carbon, natural capital net gain, the circular economy, social inclusivity and related goals.

The Task Force carried out a comprehensive cross-sector consultation programme, involving local and national government departments, agencies dealing with the natural and built environment, digital technology, public health, and higher education. Evidence collected to develop the report including over **100** meetings with the Co-Chairs, **16** roundtable discussions, online surveys of Local Planning Authorities and Planning Schools, RTPI General Assembly discussions, a generic call for evidence questionnaire, and Case Studies **(see Appendix 3)**. Contributors to this report are acknowledged in **Appendix 1**.

The purpose of this report is to present a collective vision on how planning needs to respond to the digital future. The intended readers are national and local political leaders, professional and research bodies, think tanks, higher education providers and regulators, planners, as well as other built and natural environment professionals.

The report considers the actions needed to unlock full potentials of spatial planning and how the planning profession might tackle multifaceted grand challenges while at the same time creating sustainable communities.

Chapter 1 sketches the full extent of digital planning's potentials and principles; **Chapter 2** explains how a new methodology – an integrated digitally enabled systems approach – can work; **Chapter 3** sets out the core digital capacities required to deliver this methodology; **Chapter 4** examines the status of digital integration in planning; **Chapter 5** discusses obstacles and opportunities; **Chapter 6** explores the interventions needed to achieve digital integration and transformation within the planning profession; finally, **Chapter 7** illustrates what needs to be done next to achieve an integrated vision of future planning.

Each chapter concludes with **Recommendations** which urge government and relevant organisations to adopt a holistic approach using new technologies to grasp the enormous opportunities to develop an integrated systematic approach.

Chapter One

The Quest to Unlock the Full Potentials of Spatial Planning in the Digital Era

"Technology has changed the fabric of our world, but it has not changed the structure of it"[1].The fault lines which mark the divisions between developed and undeveloped nation states are being reinforced by the digital transformation and one of the biggest challenges we face now is what ***Global Trends 2020*** report refers to as the 'loss' of the future. This relates to the fact that in the west, polarisation in society due to new technology and automation is leaving an increasing number of the young disadvantaged compared to previous generations.

This decade, the 2020's, is thus a crucial time to tackle these issues which combined with the climate and biodiversity emergency, constitute a 'perfect storm'. How our living environment is planned has a direct influence on people's daily activities, their health and well-being. People's choices for healthier lifestyles are limited by the built environment[2]. How we plan, build, and retrofit our living environment is one of the biggest questions for which our society needs new answers.

How are housing delivery activities accountable to local communities? How will they contribute to the quests for net zero carbon, natural capital net gain, and levelling-up commitments? How are they fit-for-purpose for an aging population? How can existing and new communities adapt and mitigate to climate change? How will we move and interact using new forms of transport in the next decades? How will the new ways of e-working and e-learning change future development patterns? How will digital platforms change the ways we organise the location of place-based activities and facilities?

Given the limits on planning in the narrative of housing delivery, many strategic challenges remain with little oversight. There is a great urgency in clarifying the legitimacy of planning in terms of its full professional capacity and for rebuilding a broader civil and political consensus around its value, thus further investing in the skills and tools needed to unlock its full potential.

Visions and Reflections - 1

The World Deserves a Reimagined Planning Profession in the Digital Era

by Wei Yang

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The Legitimacy of an Integrated Spatial Planning

There is an overwhelming desire - globally and from other professions – for the planning profession to step up and take a leadership role to coordinate actions to address some of the pressing global challenges. Integrated spatial planning provides a systems approach[3] and the perspective for understanding and acting on the issues that enable us to join up these activities and ideologies. The digital transformation has the potential to provide the cement that establishes such joined-up thinking. This is reflected in the key grand challenges.

The Climate Emergency

Climate change is one of the biggest threats to the survival of humanity. It ranks highest as the most important of issues facing the world amongst the younger generation[4]. The ***Glasgow Climate Pact***[5] (2021) agreed at COP26 to keep the goals of the ***Paris Climate Agreement*** to limit global warming to 1.5°C over pre-industrial levels. However, current policies in place today will lead to a best estimate of around 2.6°C warming by 2100[6]. Even if countries meet their long-term net-zero promises, "global warming would be reduced to around 1.8°C (1.4°C-2.6°C) by 2100, though temperatures would likely peak around 1.9°C in the middle of this century before declining"[7]; clearly the track is not on target. More radical actions and transformative policies are needed urgently to keep the 1.5℃ limit feasible.

Also, despite the declaration of many national and local governments across the globe on the climate emergency, current policies are largely inconsistent[8]. For example, a recent Royal Town Planning Institute (RTPI) report has pointed out that the UK is 'highly unlikely' to reach its 2050 net zero target without much more powerful integrated transport and land use planning[9]. A study from UK National Infrastructure Commission (NIC) has also identified the unpredictable nature of behaviour change and infrastructure requirements beyond the current pandemic of Covid-19[10], which are likely to have a major impact on transport.

Scientists and some policy makers argue a catastrophe can be avoided if the world acts fast and boldly implements transformative actions. The UN's Intergovernmental Panel on Climate Change (IPCC) ***Sixth Assessment Report***[11] (2021) states that ***"Natural drivers and internal variability will modulate human-caused changes, especially at regional scales and in the near term, with little effect on centennial global warming. These modulations are important to consider in planning for the full range of possible changes".*** Planning can of course influence behaviour, but this will require a radical transformation in how we plan, design and use space, and how we live and move.

The UK Climate Change Committee's ***Sixth Carbon Budget***[12] has also recognised spatial planning as one of the biggest opportunities that local authorities have to deliver net zero[13], as well as the significance of societal and behavioural change, which can contribute to as much as 59% to the Balanced Net Zero Pathway.

The Town & County Planning Association (TCPA) and RTPI argue that planning is a key part of national survival system[14]. It should embed zero-carbon principles at all levels, mandating that nothing should be planned without having successfully demonstrated it is fit to take its place in a net-zero emissions future.

Case Study 1
Ordnance Survey Roof Aspect & Green Roofs Algorithms

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Case Study 2
Atkins Pangea

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The Biodiversity Emergency

Biodiversity loss and climate change are two sides of the same coin. Scientists from IPCC and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)[15] warn that climate change and biodiversity loss have largely been tackled separately, even though both are driven by human activities, and both have impacts on each other. Treating climate, biodiversity and human society as coupled systems is key to successful outcomes from policy interventions. They emphasise that climate change and biodiversity decline must be tackled urgently together, and with pollution and waste, they are immediate threats to humanity and the planet. Scientists are calling on countries to protect entire ecosystems rather than iconic locations or species, articulating this as ***"...measures narrowly focused on climate mitigation and adaptation can have direct and indirect negative impacts on nature and nature's contributions to people"***.

To prevent mass extinctions and bolster resilience to climate change, scientists urge countries around the world to commit to 30x30 targets[16], which request the protection of at least 30 percent of global lands, rivers, lakes, and wetlands by 2030; at the same time, as fully protecting at least 30 percent of oceans by 2030 to help safeguard marine ecosystems and fisheries. Through "area-based conservation measures", 30x30 targets aim to maintain global biodiversity and defend against the climate crisis and preserve the integrity of ecosystems. The targets will be a main negotiation focus at the UN Biodiversity Conference COP15 in 2022. The role of spatial planning is unique in delivering the 30x30 targets, both in terms of its place-based approach and its ability to coordinate at strategic national and regional levels based on ecological connections.

The Economics of Biodiversity: The Dasgupta Review[17] (2021) – the first comprehensive economic framework of its kind for biodiversity – explicitly focussed on bringing natural capital into spatial planning: ***"Humans have influenced and changed many ecosystems around the world... One way in which we can manage this influence and activity, including policies and strategies for conservation and restoration, is through careful land-use and marine spatial planning to balance economic, social and environmental trade-offs"***.

The Pandemic – Public Health, Inequality, and Poverty

Health and well-being have always been central to good planning practice, both poor health due to social exclusion as well as the spread of diseases are twin foci that relate to how planners organise the physical structure of a place to mitigate these problems.

The pandemic has re-demonstrated the strong connections between our living environment and public health, in both physical and mental terms. It has also starkly revealed racial, economic and geographic inequalities in our society at many different levels from the local to the global, from developed to underdeveloped places. The most vulnerable communities have experienced the worst impacts from the pandemic globally[18]. ***"The spatial characteristics of our communities have shaped people's opportunities to catch or prevent the spread of the virus, these factors have also shaped people's mental health and well-being"***[19].

Spatial inequality is a direct reflection of social and economic inequality. *Build Back Fairer: The COVID-19 Marmot Review* (2020) concluded inequalities in social and economic conditions

before the pandemic have contributed to the high and unequal death toll from COVID-19 in England[20]. The review concluded, ***"reducing health inequalities, including those exacerbated by the pandemic requires long-term policies with equity at the heart"***[21].

Public Health England (2021)[22] recently published its recommendations supporting place-based action on inclusive and sustainable economies as mechanisms to reduce health inequalities through improving the health of the people and their communities. The Digital Task Force was initiated just prior to the pandemic occurring but this major event – perhaps one of the most significant events of the last 100 years as noted previously – has provided the entire community with a basis on which to begin to rethink the whole question of healthy cities[23]. It is time to realign spatial planning as a powerful leverage to address public health, inequality, and poverty issues.

Integrated Spatial Planning is the Solution to Tackle the Grand Challenges of Our Times and to Build Circular Economies and Sustainable Communities

The challenges we face now are much more severe than those at the time when the planning profession was first established, and to some degree, this is because best planning practice had not been consistently applied over the long term. Now emergencies, we have noted, are global in scope and only through global and cross-disciplinary collaborations, as well as through new skills, can we potentially address them.

The grand challenges need a joined-up global effort which should be our first priority. The UN Sustainable Development Goals (SDGs)[24], the New Urban Agenda[25] and literally hundreds of recommendations and reports from UN organisations and world leading organisations have coherently urged the need for transformative changes.

"Building considerations of nature and ecosystem services into the planning framework alongside other concerns such as public health, water management, housing, economic growth, and climate change can lead to tensions, but it can also help resolve those tensions by facing them explicitly"[26]. A major challenge in achieving greater sustainability will be tackling human health and environmental challenges in a comprehensive way that maximise synergies[27].

With foci considering multiple scales, balancing competing demands and directing resource-allocation decisions, spatial planning is also at the heart of the circular economy, This articulates an economic model based on ***"new ways to design, make, and use activities within our planetary boundaries, in which resource efficiency contributes to economic growth and human well-being as well as to greater sustainability"***[28].

It is evident that a vast amount of research and informed commentary are calling for utilising spatial planning with a long term, strategic, multi-disciplinary systems approach which can provide a transformative solution to coordinate the efforts from different professionals to tackle the grand challenges of our times, and, at the same time, evolve the circular economy and create healthy, ecologically rich, prosperous and beautiful places for us and for our future generations.

Case Study 3

Cutting CO2 Emissions from Buildings: The 3DStock Method

See Page 114

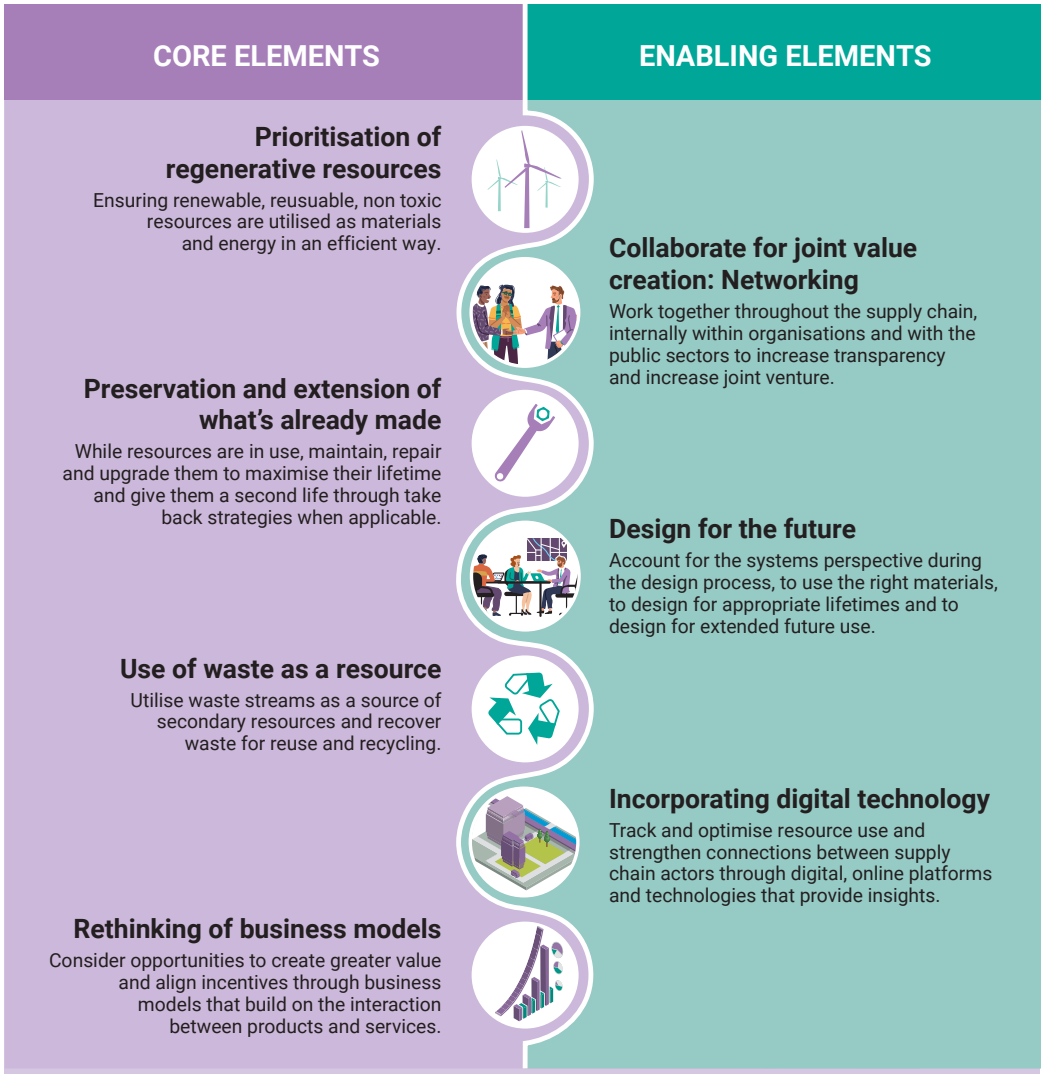
The Mandate for Digitally Enabled Spatial Planning

The circular economy requires us to redesign everything – products, business models, cities, and the linear systems that have lasted and dominated life for the past few centuries, certainly from the first industrial revolution[29] in such a way that they continuously sustain one another. *"With current advances, digital technology has the power to support the transition to a circular economy by radically increasing virtualisation, dematerialisation, transparency, and feedback-driven intelligence"*[30].

The same is true for spatial planning which is entirely coincident with the idea of circular feedbacks that provide an internal momentum for the whole system. Collaborative working, design for the future, and incorporating digital technology[31] are recognised as 3 key enabling elements of a circular economy. Again, they are entirely consistent with what integrated spatial planning should have – multidisciplinary collaboration and public participation, long-term vision, as well as empowerment through digital technologies.

Digital communication technologies which have become embedded within our daily lives, and governments – globally – have taken-up the challenge of 'digital by default' through the transformation of public services. It is largely taken for granted that digital methods are also an underpinning practice to achieve the UN SGDs[32], including the measurement of their achievement[33].

The first applications of digital planning started in British local government in the 1950s, and since then, a wide variety of



7 Key Elements of a Circular Economy

(Data source: GEO-6 for Youth)

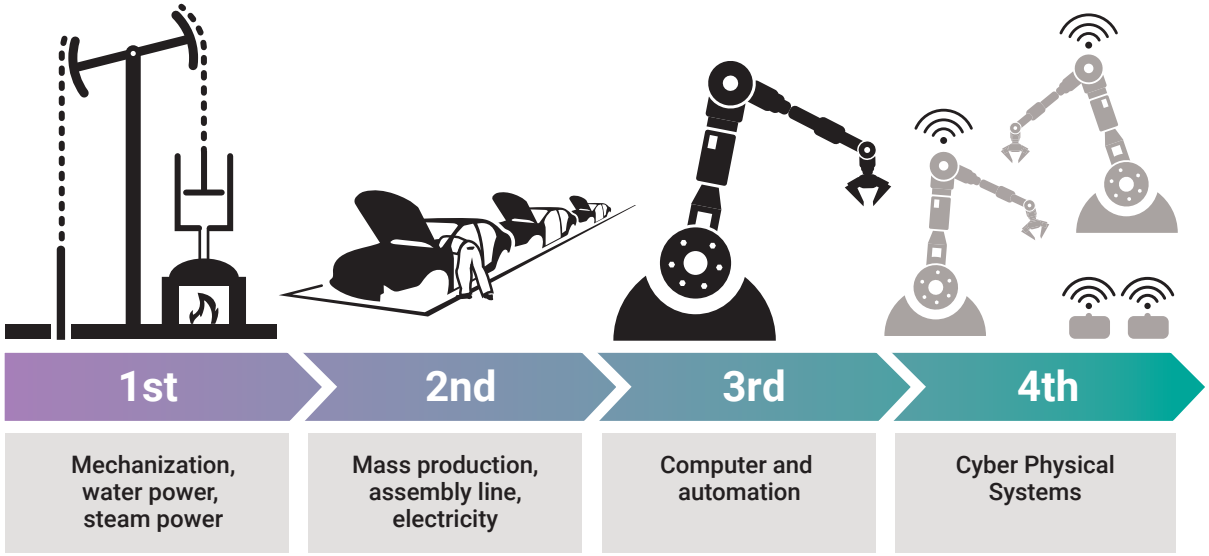
https://www.unep.org/resources/geo-6-youth

new tools and methods have emerged that have the potential to renew the way we make plans and make them relevant to our wider constituency. But during this process, cities have become ever more complex and new professions dealing with many traditional aspects of planning have emerged. Digital technologies have been extensively developed in many natural and built environment disciplines, and the current focus on Digital Twins, Smart Cities, Big Data, Climate Models and a host of other simulations illustrates how far the revolution has come.

At every stage of the digital transformation, we have never been able to predict the next. This is what makes it imperative that the planning profession deeply engages with the digital transformation through the adoption of new and powerful tools, new data, and new organisational structures.

While there has been a range of responses to digital thinking and applications in planning practice across the UK, there is also a fundamental set of digital practices that are used to support the planning system in its operation[34]. These include planning application systems, consultation and local plan methods for online participation, the use of GIS, markup languages such as GML, interactive maps, economic forecasts, population projections, retail catchment analysis, transport modelling, visualisations of new developments, and digital notification schemes within specific localities.

However, operating in a linear planning environment focuses primarily on processing development proposals[35], while a vast amount of valuable data is never captured and the information on how places function after new development and redevelopment take place rarely feeds into the future decision-making process. At the same time, different government departments work in silos in terms of capturing and making information available. Planning decisions are not usually informed by a full picture of the evidence, which is often only focussed on the short-term. The current operational framework of planning does not line up directly with the development of a circular economy and achieving the goals of net zero. They quite often operate in parallel worlds.



The Four Industrial Revolutions and Beyond
(Adapted from Marr in *Forbes Magazine*, April 5, 2016)

We currently span the Third (the digital revolution) and the Fourth Industrial Revolutions with the latter based on a fusion of digital, knowledge-based, and biological technologies. Schwab[36] says: "This represents a fundamental change in the way we live, work and relate to one another. We do not yet know just how it will unfold, but one thing is clear: ***the response to it must be integrated and comprehensive, involving all stakeholders of the global polity, from the public and private sectors to academia and civil society"… "The speed of current breakthroughs has no historical precedent. When compared with previous industrial revolutions, the Fourth is evolving at exponential rather than a linear pace. Moreover, it is disrupting almost every industry in every country. And the breadth and depth of these changes herald the transformation of entire systems of production, management, and governance."***

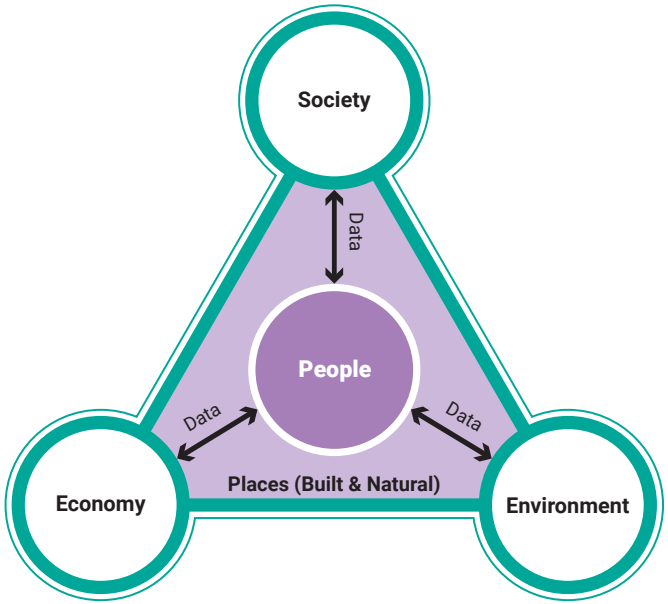
Visions and Reflections - 2
The All-Pervasive Impacts of the Digital Transformation

by Michael Batty

See Page 90

Spatial planning involves a highly sophisticated sequence of interactions and decision-making and current processes need to be dramatically transformed to meet many new goals. What we need is an integrated digitally enabled approach to spatial planning which fully embraces the advances in digital technologies and data.

This we show in a classic diagram of the sustainability pillars where society, economy and environment are brought together in a trio that goes back at least as far to the beginnings of institutionalised planning at turn of the last century as inspired in the work of Patrick Geddes[37], one of the founding fathers of spatial planning.



The Concept of an Integrated Digitally Enabled Approach to Spatial Planning

Through an integrated digitally enabled approach to spatial planning, different social, environmental, and economic dimensions of built and natural environment systems can be inter-connected. In this trio, each element interacts and overlaps with the others and thus represents an integrated picture of what planners must grapple with, relate, join-up, and handle simultaneously.

The people-centric nature of this way of thinking about spatial planning highlights the need to engage communities and consider their health and well-being throughout the process. The flow of data linking different aspects generates new sources of information and simulates further interactions. In a circular economy mindset, incorporating digital technology more broadly in the overall spatial plan-making process can help enhance efficiency and optimise the value of data and strengthen connections between key stakeholders.

Digitally enabled spatial planning will also generate better engagement in the plan-making process, a much broader interdisciplinary collaboration, and it will allow all stakeholders, designers, and policymakers to think intelligently about how to support well-informed decision-making. It will unlock the full potential of spatial planning – using a whole systems approach to develop a long-term vision and framework for citizens that considers multiple scales, building resilience, balancing competing demands, and directing decisions pertaining to resource-allocation.

Case Study 4
AI in Urban Planning in Singapore

See Page 115

Case Study 5
The Plymouth Plan and Its Use of Data

See Page 117

The Economic Case

A new way of managing and utilising information digitally will benefit significantly how we exploit and creatively use natural, social, human and manufactured capital, which can play a vital role in the UK Government's levelling-up agenda. A recent study assessing the value of Information Management (IM) in the construction and infrastructure sector proposes the economic case for investments that would raise IM in the UK threefold[38]. For example, the use of IM could potentially secure between 5 and 6 times the direct labour productivity for every £1 invested in IM, and between 7 and 7.5 times the gain in direct cost savings.

The Socio-Ecological Case

Human interactions between built and natural environment are highly sophisticated as these embody a socio-ecological system in its own right. Using public health as an example, in addition to the patient experience of care, 'improving the health of populations' and 'being a good steward of the per capita cost of care' have been recognised as important public health aims within the Institute for Healthcare Improvement's "Triple Aim" framework[39].

Using an integrated digitally enabled approach, spatial public health data, for example ***Public Health England's Fingertips resource***[40], can be fed into the plan-making process directly generating positive public health outcomes, as well as help cultivate low-carbon lifestyles.

The Environmental Case

An integrated digitally enabled approach to spatial planning can better manage natural resources, consider multiple land-use allocations, and enable multi-functionality, as urged in the 2021 IPCC & IPBES report[41] and the 2021 ***Dasgupta Review***[42].

A demand-supply analysis found that to meet the "… growing UK population's food, space, and energy needs, while increasing the area needed to protect and enhance the nation's natural capital," the UK would need to free up another additional 7 million hectares of land[43]. However, the amount of land at that scale is simply not available, as the UK as a whole is only slightly more than 24 million hectares in extent. It is crucial that spatial planning strategically considers different demands and maximises the utilisation of resources (land, sea, and other natural resources both above and below ground/water) to deliver multiple benefits; with a shared digital platform and database, an integrated digitally enabled spatial planning is a key piece in the jigsaw to achieve a just transition towards net zero carbon.

The Well-Being Case

Ultimately, what we want to achieve in our society is well-being for all and this translates into 'happiness', which derives from fulfilling the nonmaterial needs and aspirations of others. In Maslow's hierarchy of needs[44], the five main levels begin from the most basic to the most advanced needs. These are: Physiological Needs, Safety Needs, Love and Belonging Needs, Esteem Needs, Self-Actualisation Needs. Considering these various needs in an integrated and intelligent way, if empowered with other enabling policies and mechanisms, an integrated digitally enabled spatial planning could bring us a step closer to find that elusive quality of life: happiness.

Visions and Reflections - 3

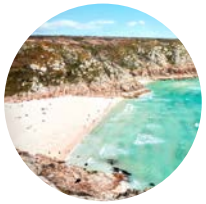
Economics and Digital Planning

by Bridget Rosewell

See Page 92

Case Study 6

Carbon-Neutral Development: Cornwall Development and Decision Wheel (CDDW)



See Page 118

Principles of a Digitally Enabled Spatial Planning

From the broad range of stakeholders contributing to the Task Force's work - planners and other stakeholders from the wider natural and built environment professions - there is a strong consensus on the importance and potentials of a digitally enabled spatial planning.

The following principles are established:

Strategise with Real Purpose

The digitalisation of planning needs to ensure that we focus on the reasons why we have a planning system and how this needs to function in a democratic society. Planning needs to be open, transparent and truly accessible if it is to best reflect the wide-ranging interests and perspectives that exist across our communities.

Innovate and Imagine: Excite the Young

Digital technologies that are evolving all the time are usually imbued with a sense optimism. Change is more likely to be embraced by the young and thus a spirit of collective cooperation is required from seasoned planners to those entering the profession for the first time. Planning has the chance to embrace new horizons and to meet its most difficult challenges using digital technologies to think laterally about what the future should be like.

Define the Spatial Problem in Context Through New Digital Tools

The need for spatiality in planning must be reemphasised in that one obvious way of reaching for the future is by recognising again the importance of how space, location and movement determine what is best. We need to reinvigorate the spatial and explore its complexity. This type of thinking is key to the systems approach and can be applied at different scales and over different time horizons.

Communicate the Differing Importance and Flexibility of Individual Policies

Planning consists of many problems of differing importance and the need to join these up and think flexibly about their relationships are left to being able to communicate the complexity of the planning activity to all involved, from planners to the wider public.

Embrace Key Questions of Ethics, Legitimacy and Ownership

We must assume that planners can grapple with ethical questions that are key to issues of social exclusion generated from policies that are inevitability and necessarily different in their impact on different social groups, age groups, those with different levels of wealth, and so on. Legitimacy and ownership are key to these issues while questions of bias and privacy are important to making the best use of data that reflects these differences.

Collaborate to Improve Usability, Accessibility, Data Operability and Exchange

For the whole of the planning process to be a truly democratic, it needs to be fully accessible. If the digitisation of the planning system is to be both effective and democratic, the planning profession and the general public's digital literacy need to be improved in tandem. Sharing data with the public and other end users of the planning system adds to the data's value but needs to be linked with improved access and ownership, better stewardship, higher quality and usage management.

Generate Inclusivity, Diversity, Engagement and Empowerment Through Citizen Participation

The way which digital technologies are deployed plays a key role to achieve inclusivity in planning. An inclusive planning process should celebrate diversity and engage with the wider public so that all groups feel empowered in the face of conflicts and opportunities that any plan might engender. There are many cultural and psychological needs that must be accounted for in delivering information to the wider public as well as to those who are working with data in the public service. The tools and models that are being developed need to take account of variations in the population across all dimensions relating to health, well-being, gender, income, social class, education, and a wide diversity of difference.

Ensure Accountable, Transparency and Consistency Through a Systematic Approach

All these principles interact with one another, but transparency and consistency are required in any plan-making process involving the control of development. In short, planners should strive for a systematic approach which takes account of how problems change with scale and location as values also change over time.

Visions and Reflections - 4

Digital Planning for Effective Public Participation

by Alexander Wilson & Mark Tewdwr-Jones

See Page 94

Visions and Reflections - 5

Digital Empowerment of Young Planners and Young People

by Kirsty Macari

See Page 98

Potentials of a Digitally Enabled Spatial Planning

The potentials of a digitally enabled spatial planning can be summarised as:

An Intelligent and Visionary Joined-up Approach to achieve a common sense of purpose – to meet the challenges of net zero carbon, natural capital net gain, inequality, the circular economy, public health and the delivery of sustainable development.

A Cohesive Multi-Disciplinary Approach to the analysis of huge amounts of multi-disciplinary data and to focus on key issues via working collaboratively with professionals and other key stakeholders is required. Comprehensive forecasting, urban analytic modelling, and strategic design simulation need to be integrated into the plan-making process.

Access to Better Data whereby more contemporaneous data, often from data streamed in real time as well as data collected by conventional survey would allow more dynamic plan-making and decision-making processes, and reduce the risks of using out-of-date data.

An Invigorated Community Approach to include those who might otherwise be excluded from engagement due to barriers to access and communication, and to use technology as a way of shifting local authority thinking from 'paternalistic' to community generated. This would allow digital platforms to be used by the community to propose plans and highlight requirements with the local authority providing the 'financial weight' and forum.

More Interesting, Visual and Accessible Planning by employing digital tools such as interactive maps and visualisations to engage wider communities.

Much Speeded Up Planning Processes, saving costs, generating human capital, encouraging wider research-development-application, and increasing efficiency and productivity.

A Unified Information Management Approach across central/national/local governments for better information flow and closer cross-departmental and disciplinary collaborations integrating the front and back office to improve regulatory processes including record keeping, notifications and historical records of decisions and change.

The Practicalities of Plan-Making where technology and data collection tools could be used to provide spatial data using social media, phone data etc. In this way, plan-making and place-making processes could be better based on actual human behaviour and real time data which could also develop into effective feedback systems.

Political Decisions that are Evidence-Based and thus more transparent.

A Common Ground for evidence used in the Examinations in Public (EIPs) to save time and public money.

Visions and Reflections - 6

Digitally-Driven Urban Planning: Challenges and Opportunities

by Alan Wilson

See Page 100

Recommendation 1:

Recognising the Vital Role of Spatial Planning as an Important Applied Science Discipline where Its Digital Transformation has the Potential to Tackle the Grand Challenges

There is an urgent need to formally re-establish the vital connection between the activity of spatial planning and the planning profession as an important applied science discipline in delivering systems approaches which tackle the grand challenges posed by climate change, biodiversity decline, public health, social inequality, aging, polarised economic growth and so on. This is deeply woven into the digital transformation and the role of planning in representing physical and social development needs to be acknowledged through key national and international statutory and advisory bodies: the UK Committee for Climate Change, the UK Council for Science and Technology, the National Infrastructure Commission and equivalent agencies empowered to bring a nation-wide systems approach to tackle the severe challenges we face.

Recommendation 2:

Establishing a Chief Spatial Planning Officer Role in the Cabinet Office

Many of the central government's key policies are connected to spatial planning issues. A stronger presence in spatial planning at the top levels of policy advice can be achieved by introducing this role. We recommend a Chief Spatial Planning Officer sits alongside the Chief Scientific Adviser & Chief Medical Officer in the Cabinet Office to advise government on the integrated spatial implications of climate mitigation and adaptation, local and regional economic growth, levelling-up, housing, infrastructure, land use, transport, and built and natural environment actions and policies.

Chapter Two

A New Methodology: A Digitally Enabled Systems Approach to Spatial Planning

A 'Whole Systems' Approach

From the recent COP26 UN Climate Change Summit, the 'whole systems' approach is clearly demonstrable as being essential to thinking and acting over the impact of climate change in the immediate and near-term future[1].

Good planning implies a collective sense of purpose, achieving a universal common good, as reflected in the quest to reach net zero, enable natural capital net gain, and the development of a circular economy that minimises waste and enables social inclusion. These are transformative changes that imply a thorough redesign of many systems, and they imply new methods of working with each other, sharing data and knowledge, and communicating and engaging effectively with the general public through both digital and non-digital media.

In 2020, the Council for Science and Technology (CST) wrote to the Prime Minister about achieving net zero for carbon emissions using a 'whole systems' approach. They said:

"We believe that a rigorous systems approach will reveal the effects that policy decisions in all areas of government will have on delivery of net zero, enabling decision-makers to understand how different policies interact and influence the transition of the whole economy towards net zero. It will also enable government to understand the interaction between mitigation, adaptation and resilience, including the need to protect biodiversity and wider sustainability initiatives.[2]"

They further elaborated this viewpoint saying:

"…to support this, it is essential that decisions in both government and business are informed by access to data and analysis to understand the system. Understanding the interaction between societal and economic behaviours will enable Government to shape policies and regulations to create a market environment that increases consumer and business demand for low-carbon solutions and encourages sustainable private sector investment decisions."

Three recommendations were given by CST to achieve such a whole systems approach:

1. Strengthen the institutions, governance frameworks and leadership structures needed across central government to galvanise action to achieve net zero;
2. Develop the analytical capability, flows of information, and reporting needed to inform decisions;
3. Maximise the contribution of technology, mobilise financial systems and galvanise international collaboration.

The Necessity of a Cyclic System in Planning

These transformations fundamentally require behavioural change with respect to our wider mindsets, but data and new technologies can help us achieve these goals in a way that was not possible before the digital age. In other words, our systems need to be redesigned with revolutionary technologies from the bottom up, exploiting their capacities in logical ways, rather than simply fitting in new technologies wherever they seem to plug the gap. We are suggesting something more fundamental that we assume grapples with the complexity of systems that can only be understood and changed if we employ the relevant data and technologies.

A useful reference is the Royal Society's ***Digital Technology and the Planet*** report[3]. To achieve net zero, the report explores the possibility of establishing 'control loops', sometimes called 'feedback loops' in systems theory connecting every asset through a digital infrastructure to enable the monitoring, reduction and optimisation of greenhouse gas emissions across different sectors.

The report also suggests that existing digital technologies could help cut 15% of UK emissions by 2030. Also, beyond supporting emissions reduction in energy demand and supply, changes in transportation, the building stock, the circular economy, and agricultural technologies, suggest there are many opportunities to use digital technologies to optimise systems to aim for multiple environmental and societal goals which reflect the UN's Sustainable Development Goals (SDGs).

A systems approach is needed for it is quite widely recognised that the optimisation for one goal can have adverse effects on others, with digital technologies allowing a systems approach to enable a better understanding of such interactions and thus better integrated interventions[4].

Visions and Reflections - 7

Digital Revolution and Big Data: Planning-Led or Planning-Lag?

by Cecilia Wong

See Page 102

The Current Systems Map for Housing and Infrastructure Delivery

A current systems map[5] for housing, planning and infrastructure was produced by the National Engineering Policy Centre (NEPC) led by Royal Academy of Engineering. The systems map was developed from a series of workshops with key stakeholders. It illustrates the lack of focus and confusion within the current system characterised by conflicting priorities and interests between different stakeholders and government departments.

The problems raised by this 'system of systems' perspective are immediate and obvious: different stakeholders with conflicts of interest only engage in their own circle (or cycle) and act within a narrow focus. The map defines these silos. The decisions made are rarely evidence-based and lack crucial long-term and strategic thinking. Bad decisions can create unintended consequences.

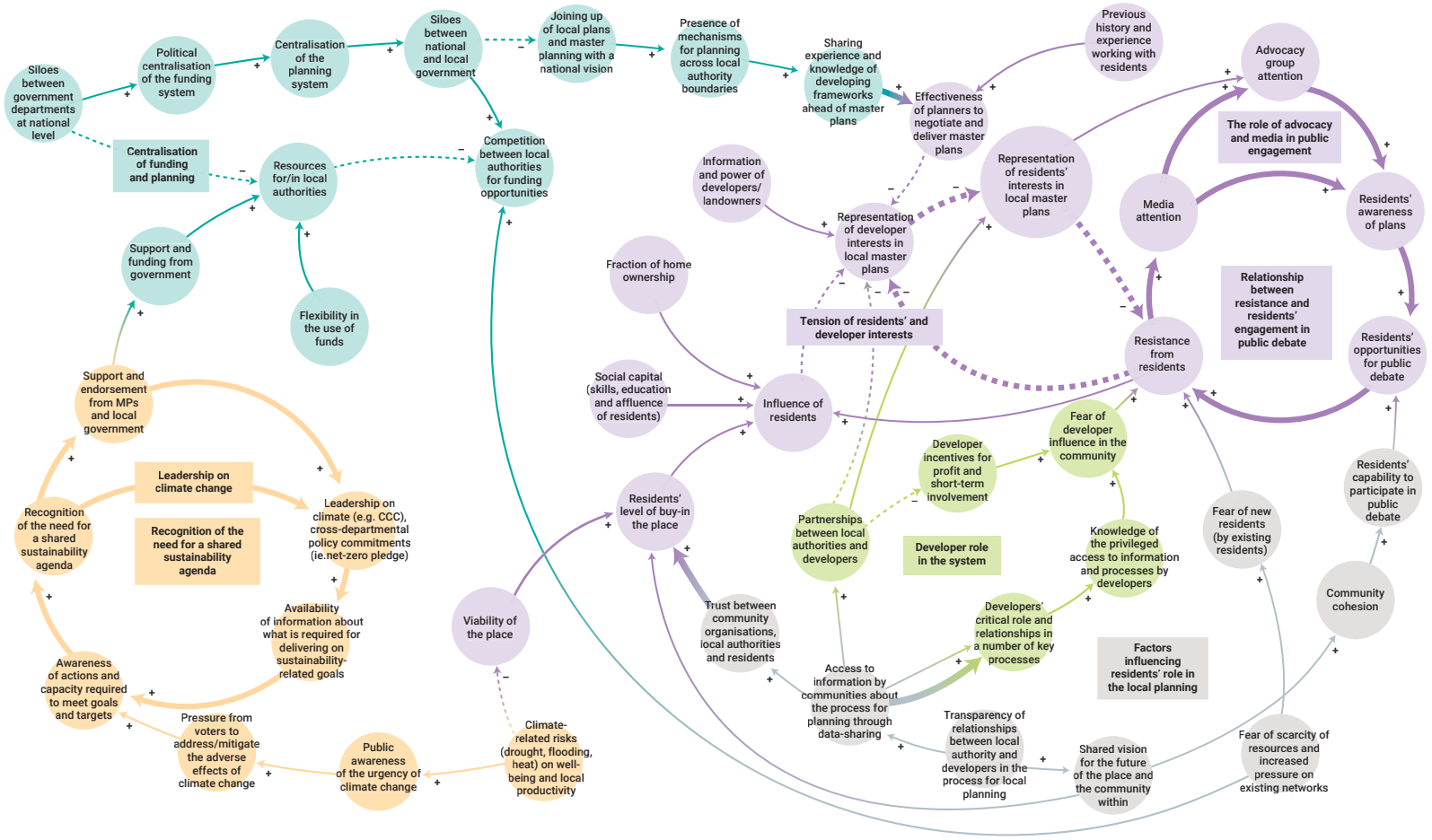
For example, poorly connected places generate car dependency, which leads to air pollution, high carbon emissions, obesity and other health issues, degradations of local amenity, anti-social behaviour, loss of natural habitat, and so on. If we continue to ignore these interactions that tie systems together posed by thinking in the silos implied in this figure, we will ignore the relatively unpredictable system-wide effects that take place. Recent incidents attributed to climate change from hurricanes to forest fires are part of the series of catastrophes that many eminent and respected scientists have warned would be unavoidable.

Visions and Reflections - 8

Challenges and Opportunities for Local Authorities

by Janice Morphet

See Page 104



Legend

- - - opposite

——— leverage point: loop

The Current Systems Map for Housing, Planning and Infrastructure in the UK – Characterised by Conflicting Interests and Lacking a Shared Vision

(Data adopted from: Royal Academy of Engineering, *Sustainable Living Places– a Systems Perspective on Planning, Housing and Infrastructure*[6])

Building a New Methodology: A Digitally Enabled Systems Approach to Spatial Planning

The methodology aims to introduce a systematic digital technological advancement in day-to-day spatial planning practice.

Further developing the recommendations from the Council for Science and Technology and the Royal Society studies, a new methodology is articulated to achieve net zero and other mission-orientated goals using a place-based systems approach to spatial planning empowered by data and digital technology.

The methodology aims to introduce a systematic digital technological advancement in day-to-day spatial planning practice. It will allow decision makers and stakeholders to better understand and consider the interaction between people, economy, society, the built, and the natural environments; it will enable both central and local governments to shape evidence-based policies and regulations which are accountable to the public; and it will provide transparency and long-term debate and argument relating to the approval of development proposals. This of course cannot be accomplished overnight but many of the seeds which define the digital transformation provide a structure to develop this.

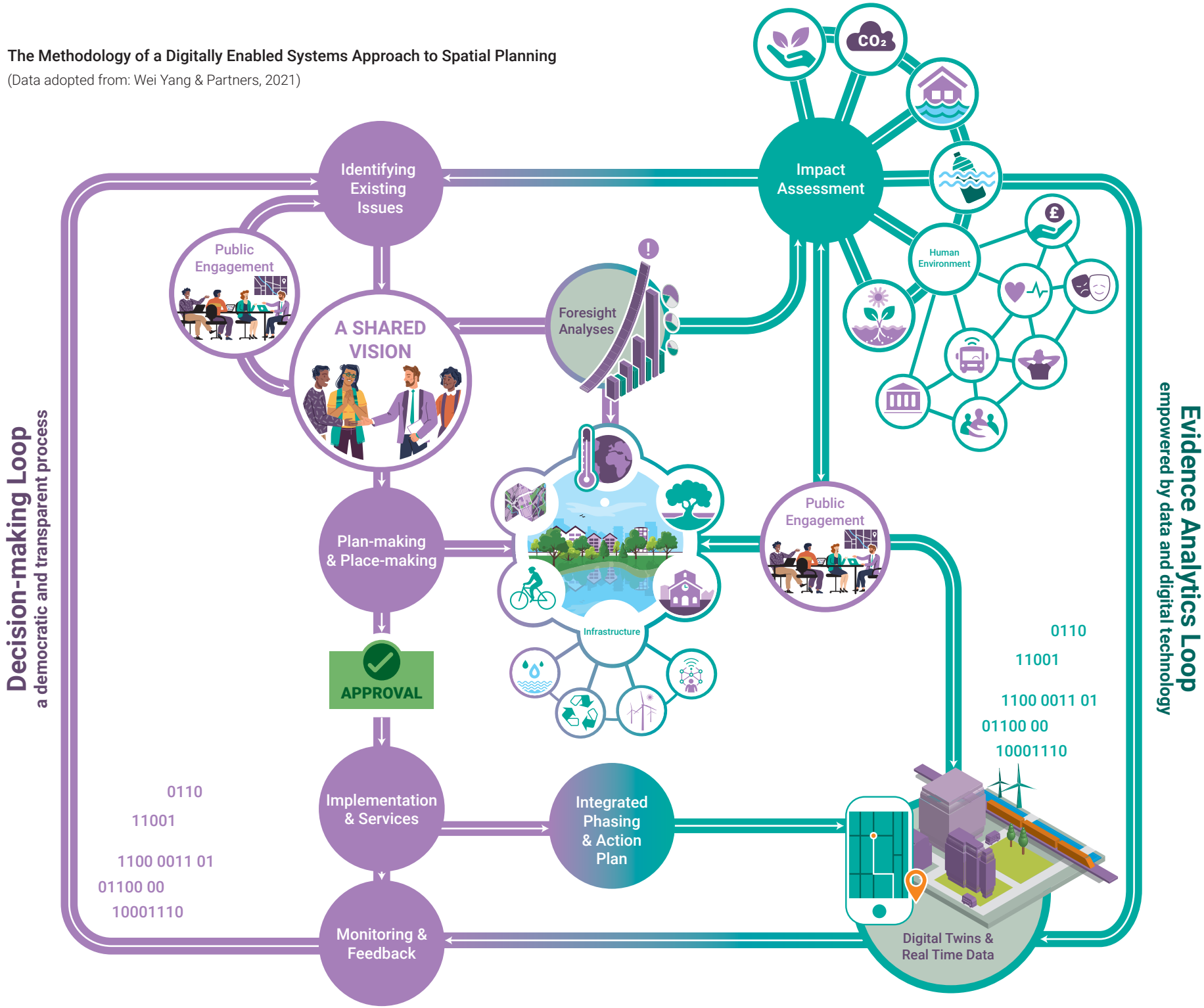
The methodology looks at the information flows and decision-making processes, rather than at particular types of decision. The loops define cycles that enable the planner to iterate and explore ideas while also engaging in plan-making in real time. In this sense, it echoes an old idea that planning is not just about product but is intrinsically involved with process. It can be applied to any planning tasks, either national or local, at any scale, sector or sets of these.

As the diagram shows, the methodology has two interrelated loops – an Evidence Analytics Loop which is about the science of systems and a Decision-Making Loop which is about legislative planning procedures. The former is informed by multi-disciplinary evidence empowered by data and digital technology; the latter is a democratic and transparent process of argument, discussion, speculation, invention, design, innovation and of course politics. The two loops are integrative and interactive with each other and they can be interlocked in countless ways when adapted to the planning task in hand.

Footnote 1:
From the middle of the last century, the notion that in a volatile and uncertain environment, the plan was regarded as something that continually needed to be refreshed gained wide credence[7]. In fact it was built into the 1947 *Town and Country Planning Act* in the form of a *Quinquennial Review* and it was key to the development of the systems approach.

The Methodology of a Digitally Enabled Systems Approach to Spatial Planning

(Data adopted from: Wei Yang & Partners, 2021)



Planners need to play an active role to engage key stakeholders in creating a shared vision based on universal common good through linking historic and predictive data analytics with people's understanding and requirements of real places. This shared vision will guide the activities of each stage through a circular process.

The key activities defining these stages which are embedded within each other as well as within the wider political context involve:

Identifying Existing Issues

From this foundation, communities need to be engaged in sharing their experiences and expressing their future needs. Existing impact assessments would need to consider interactive issues in relation to both built and natural environment. Their implications with respect to people, environment and society are diverse and wide; they involve natural capital, air and climate, and the human environment defined by socio-economic conditions, community and social infrastructure. These reflect tangible and intangible cultural assets, amenity, access & leisure, transport, public health and safety, nuisance & visual impact, water, soil, land & resources, waste and pollution. The list is long and is being continually redefined as new issues emerge.

In 2000, the Institute of Environmental Management & Assessment (IEMA) launched a new *Digital Impact Assessment Primer*[8] to outline how the industry might embrace digital practices through impact assessment processes.

The report discusses the fact that current digital innovations are occurring predominantly in Environmental Impact Assessments (EIA) but could have much wider application to other forms of IA, including Strategic Environmental Assessments (SEA), Sustainability Appraisals (SA), Health Impact Assessments (HIA), Habitat Regulation Assessments (HRA) as well as non-statutory assessment instruments.

For example, the diagram on the following page shows social determinants of health which include factors such as socioeconomic status, education, neighbourhood and physical environments, employment, and social support networks, as well as access to health care[9]. It is essential to grapple with these factors to establish a place-related baseline understanding for key issues in public health and wellbeing.

Case Study 7

Ordnance Survey and Riskaware: UrbanAware and Population Dynamics

See Page 119

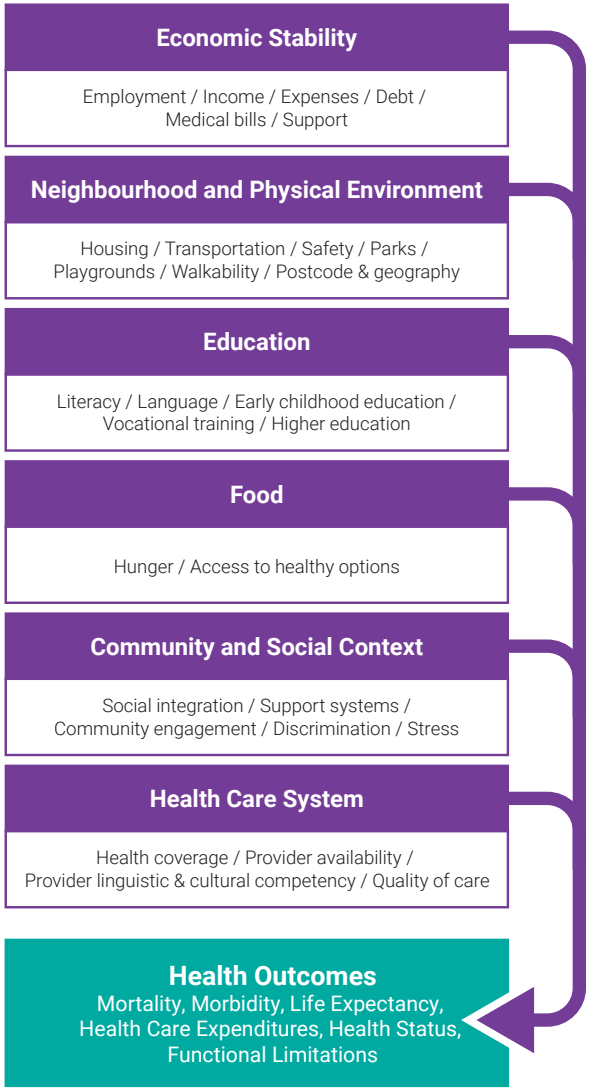
Case Study 8

Transforming Places Together– Scotland's Digital Strategy for Planning

See Page 120

Social Determinants of Health

(Data Adopted from: Artiga S. and Hinton E. (2018) https://www.kff.org)



Creating a Shared Vision

In this crucial stage, planners need to facilitate and engage with communities and other stakeholders to create a shared vision, which is based on the principles of universal common good - in terms of net zero, natural capital net gain (environmental net gain), the development of a circular economy, and social inclusivity.

Thinking about the future is fundamental to policymaking. In a fast-changing technological world increasingly dominated by a digital transformation that is changing traditional practices from both the bottom up and top down, in addition to resolving existing problems, this shared vision needs to be forward-thinking. Foresight exercises in relation to the national/regional/local context should be conducted to shape this vision. Issues such as climate change, the future of food and farming, energy and the built environment, the future of mobility, skills, the impact of an aging population, as well as all the new methods and tools that are beginning to define a science of cities[10] need to be considered holistically.

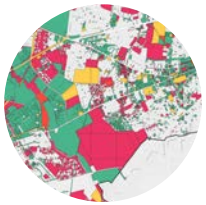
Plan-Making and Place-Making

Considering the whole environment as one ecological entity, connecting plan-making and place-making processes need to consider key interactions between human activities. These apply to both natural and built environment extending across all spatial scales and system types that focus on town and country, marine and coastal areas.

Using nature-based solutions, climate adaptation needs to be considered with land use, resources (e.g. minerals, soils), activities such as farming, fishing, leisure etc., as well as

Case Study 9

Digital Site Identification and Assessment in Hounslow



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Case Study 10

Digital Planning in Newcastle and Gateshead

See Page 123

distributions to ensure long-term resilience and enable the most efficient multi-functional use, as well as natural capital net gain.

Furthermore, local characteristics (both man-made and natural – heritage assets, architecture, public realm, land form, ecology and landscape), transport and connectivity issues in terms of networks (e.g. roads, streets and public spaces), and infrastructure provision (e.g. water resources, waste management, energy, ICT and smart infrastructure) all need to be considered in a spatial and integrated way, thus maximising carbon reduction and stimulating cultural and economic activities for low-carbon and healthy lifestyles.

Across the whole plan-making and place-making process, the public defined in terms of its wide array of stakeholders needs to be engaged in a variety of ways. The potential positive and negative impacts of proposals need to be simulated and assessed so that baseline conditions can be compared with future forecasts, thence informing evidence-based decision-making.

Approval

The grant of planning permission is a milestone that takes place continually within the decision-making loop in response to changes in the wider environment in which planning resides. To simplify the diagram, appeal procedures are not included in the loop, but every case outcome will be based on the reiteration of digitally enabled evidence-based process, whether it is being dealt with through a written submission, an informal hearing or by an inquiry.

Implementation and Services

Guided by the shared vision and consensus reached at planning approval, integrated phasing and action plans are developed to enable coordinated actions across and between different parties. The public would thus be informed and continuously engaged in the process.

Monitoring and Feedback

Different from the traditional linear planning process, closing the loop through monitoring and feedback is a vital stage in the systems approach. Utilising various digital tools, such as Digital Twins, Building Information Management systems (BIMs) and software tools, the evidence-analytics loop can be closed by analysing real-time user experiences and performance data.

Using embodied carbon in buildings as an example, from the initial design to the refurbishment or eventual demolition of the building, 83% of CO2 emissions arise at the operations stage in a building's life cycle[11]. User behaviour plays a significant role in this but in common practice, it is understood that neither energy performance, nor user behaviour are monitored, providing little feedback at the city/community scale. It is also understood that although BIMs are widely used at the building design stage in the UK, the potential of using Digital Twins to gather after-use data has not been fully utilised. Moreover, there are few if any links to other scales of modelling the built

Case Study 11

Virtual London: Visualising Digital Twins for Urban Planning and Design

See Page 125

Case Study 12

Greater Cambridgeshire Shared Planning Service and the Digital Local Plan

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Case Study 13

Waltham Forest's GovTech Catalyst Challenge: Housing Monitoring

See Page 127

environment, such as pedestrian and vehicle movement, public buildings and public spaces usage, biodiversity gains or losses, which are key to ensuring design is optimal at both global and local scales.

Reiterating the Cyclic Process

Evidence provided through the monitoring and feedback stages will directly feed into the next round of planning built on identifying new and re-identifying existing issues. Once platforms for such digitally enabled systems approach to spatial planning are established, the speed and efficiency of decision-making processes can be significantly improved. In addition, the system would allow more resilience and flexibility in terms of responding to unforeseeable incidents, such as the pandemic, and extreme weather conditions. To achieve this new methodology will require the establishment of core digital capacities – strategic digital platforms, common and routine applications of digital tools, availability of multi-sector data, information management standards, and the ability to use a wide range of digital techniques, which will be discussed in the next Chapter.

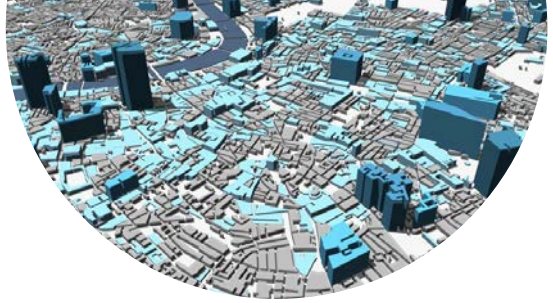
The work of the Task Force has identified that many relevant digital technologies and tools required in the new approach are already available. For example, Manchester University have developed planning support systems (PSS) to underpin policy making, as well as the RTPI's Map for England[12]. But there is an absence of systematic digital technological advancement in day-to-day spatial planning practice and a circular planning methodology to benefit from the digital technological advancement. This will be discussed in detail in **Chapter 4** when we examine the status of digital integration in planning and in **Chapter 5** when the Obstacles and Opportunities are explored.

There is an urgency in cultivating an eco-system to allow advanced digital technology to be applied into mainstream planning practice and education which will be discussed in **Chapter 6** where we present an outline for Establishing a Digital Enabled Planning Profession.

Recommendation 3:

Implementing an Integrated Digitally Enabled Spatial Planning Methodology

The new cyclic methodology for a digitally enabled approach to spatial planning is required which connects the decision-making loop with the evidence analytics loop. The methodology involves a revolution in plan-making enabled by digital technology, shared data, and multi-disciplinary collaboration. A holistic approach is required to drive, support and resource such a revolutionary change. This new methodology could bring transformative changes on how the country can deliver the net zero targets in carbon emission, nature restoration, levelling-up and the agenda for the circular economy. We see this as being developed by mobilising currently largely separate themes which need to be integrated across different agencies and academia for their successful implementation in planning practice.



Chapter Three

The Core Digital Capacities Required: Data, Platforms, Tools, and Techniques

Integrated spatial planning can function as powerful leverage to join up good forces that flow across different government departments, professional disciplines, stakeholders and the general public. This enables the collective to tackle the grand challenges and to achieve a universal common good.

The current array of technologies that can be employed in countless applications enable us to address social and environmental problems more effectively. Alongside this, there has been a transition from standalone computers down to tiny computable devices that can be embedded in material as well as organic systems, networked in countless ways, and this is changing the very domains that planning is attempting to address in reaching out to meet generic goals such as those of sustainable urban development.

From this has come the 'smart city' where digital devices are now being embedded into the fabric of the built environment, yielding new forms of data streamed from such devices which help inform us as to how cities are functioning in the very short term. This provides yet another perspective on the city from that which has traditionally been associated with institutionalised Town and Country Planning. Furthermore, the Internet of Things (IOT), Big Data, Urban Analytics, Building Information Management systems (BIMs), Digital Twins, Artificial Intelligence (AI), Machine Learning, Public Participation GIS, and countless applications and tools are being continuously developed and applied in activities relating to the core functions of spatial planning.

To a large extent, this report is motivated by the need to integrate these uncoordinated interventions to benefit the public served by the planning profession. Thus to achieve a digitally enabled systems approach to spatial planning articulated in **Chapter 2**, a complementary set of core digital capacities is required.

Case Study 14
DATA Place Plymouth and Open Data

See Page 128

A Common Spatial Data Environment – National Mapping and Datasets

In line with the request from Natural Capital Committee's advice (2019) to government on net environmental gain[1], but expanding this to a wider domain, the map and datasets (key environmental, socio-economic & public health data) that would enable the baseline study including forecasting, simulation, modelling, and monitoring for the country need to be specified and collated centrally.

These maps and datasets should then be made freely and widely available. Many such datasets exist and various agencies beginning with the Ordnance Survey and the Meteorological Office together with various Commissions, Agencies, and UKRI Research Centres act as their curators. But much more integration is needed if the climate and biodiversity crises are to be understood and addressed across many scales.

The same applies to the other grand challenges from social exclusion to public health and to the housing affordability crisis that requires consistent, comprehensive, and standardised data.

Cross sectoral joined-up action is needed to speed up the process. Although planning is a devolved government function, considering the vital importance of ecological connectivity[2] (see Footnote 2) and other environmental aspects, it would be logical to have a common spatial data environment based on system of mapping and datasets across the United Kingdom. This would form a crucial part of the national digital framework[3] and would support the National Spatial Infrastructure that has been put in place in a more ad hoc manner. There are several initiatives (see Footnote 3) that take datasets from these various organisations and add value to them, making them more relevant to different planning tasks[4].

Footnote 2:
The UN COP15 conference on Biodiversity in 2022 aims to agree the 30x30 targets. Experts say at least 30% of the Earth, if not 50%, should be under conservation to maintain habitats under a changing climate. Since 2010, countries have collectively managed to add almost 21 million square kilometres to the global network of protected lands, bringing the current total to almost 17% of the Earth's landmass. Yet less than 8% of these lands are connected – something considered crucial for ecological processes and the safe movement of wildlife. Meanwhile, total marine conservation areas lag at 7%, below the 2020 target of 10%.

Footnote 3:
For example, Manchester University Planning School is carrying out a Natural Environment Research Council (NERC) Digital Solutions programme which will provide tools and services to allow planners to leverage NERC's data holdings and integrate this with other UK wide data. A coordinated approach such as this is required to enable benefits from data sharing from the national level. The Data and Analytics Facility for National Infrastructure (DAFNI) has been set up to provide not only data but model systems to researchers and analysts working with data concerning infrastructure such as transport, water, electricity, telecoms and so on.

Visions and Reflections - 9
Planning with Data at Scale

by Volker Buscher

See Page 108

Case Study 15
Atkins Spatial Common Data Environment (sCDE)

See Page 129

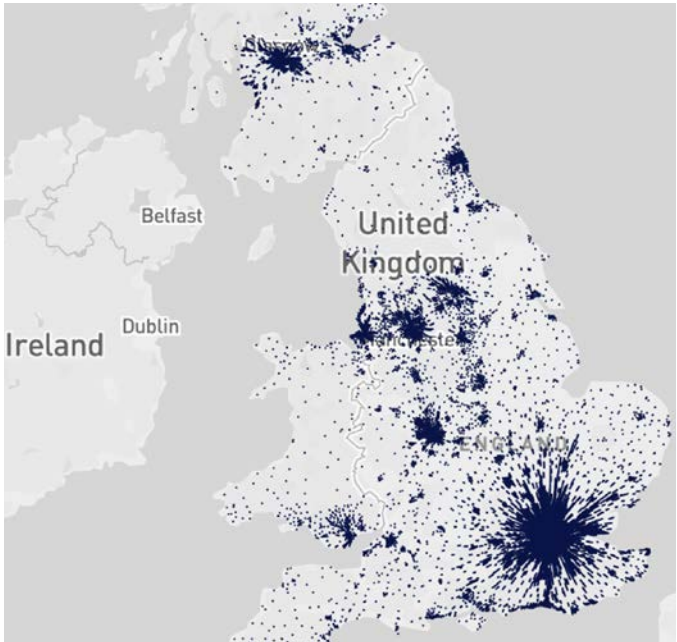
A National Network of 'Regional Data Observatories' – Regional Data Input

Notwithstanding several attempts in the past at establishing regional data centres (see Footnote 4), the RTPI[5] have recommended to government that regional bodies tasked with collecting and analysing demographic, economic, social and environmental data, providing local authorities and other stakeholders with consistent, trusted and timely evidence to inform strategic planning over wide areas, should be created. The list can be expanded to include user behaviour data. It should also include a citizen science participatory function as well as remote sensing and Local Environmental Record Centres data for local habitat maps. Similar recommendations for a national observatory in the form of a UK Knowledge Hub was made by UK2070 Commission[6]. The Office of National Statistics and the Ordnance Survey remain key to such establishments.

An Integrated Planning Open Data Framework – Input Data for Planning

There is a vast amount of information prepared and submitted for any planning application and building regulation approval. This needs to be compared with the voluminous information that potentially exists to drive the plan-making process. Digital planning support systems can be designed to capture back office data in an integrated open data framework with decision support and public consultation functions. Application information, approval, project completion, and performance data should be fed into the loop to monitor and evaluate the effects of spatial decisions and policies on different locations.

The front office public-facing function of integrated planning can incorporate many visualisation tools, e.g. simulated plans, 3D models, virtual and augmented realities etc. to help the public better understand the impact of any policy or proposal.



Case Study 16

The Planning London Datahub

See Page 130

Footnote 4:
In the late 1980s, the ESRC set up a network of Regional Research Laboratories to collate social and economic data that was organised using new forms of geographic information system, following recommendations in the Chorley Report, DoE (1987) *Handling Geographic Information*, HMSO, London. Between 1999 and 2012 a network of Regional Observatories, established by the English Regional Development Agencies, was responsible for collecting and disseminating economic and other data about their regions.

Planning Metadata and Information Management Standards

There is a clear need for uniformity in terms of data standards and information management in the control of development and the provision of effective plans that enable the twin pillars of control and plan-making to be completely coordinated and synergetic with one another.

Despite the fact that the four countries of the UK have different planning systems, there is no reason why there need not be a consistent planning metadata standard and planning information management standard developed, based on using the British Standards service. Once published these can also be used as international standards.

A system which enables plans associated with cross national or regional boundaries to be pieced together consistently is within our grasp due to many new data infrastructures that are increasingly built around new standards and web-based systems. This is only possible because of the coordination that digital technologies offer. Such a system would provide a technical 'levelling up' with respect to a consistent standard that would urge Local Planning Authorities (LPAs) to standardise their activities with one another.

This could then form a foundation on which different technologies might be developed, coordinated and standardised. It would not take away the local focus of plan-making and control for the system would embrace a degree of variety that characterises different places. It would however provide a platform for enabling LPAs to reflect on how other authorities were developing their plans and it would provide national and ad hoc agencies a platform for considering how their own proposals relate to the standard system of plan-making and control.

Key actions would include:

- Publish all spatial planning policies (current, proposed etc) as Web Map Services following a national metadata standard (e.g. via the EU INSPIRE directive which LPAs already use, and OGC standards).
- No plans should be in PDF form only any longer which is a barrier to sharing and data extraction. For example, Portugal has a national information territory information system, built upon the EU's INSPIRE standard, where plans at all scales (neighbourhood, municipal, national or sectorial) have to be submitted in electronic format[7].
- Written policies should be published following a national XML schema format.
- Land use policies should be presented consistently using standard visual icons and colour schemes, so everyone knows what each icon and colour represents. A good contemporary example is Germany where all local plans and zoning plans have to use the same visualisation schema[8].
- The Department for Levelling Up, Housing & Communities (DLUHC) and other national planning agencies could introduce increased unification of the way in which Local Plan mapping systems on LPAs' websites are set up and navigated to allow planning information to become more accessible and transparent.

Case Study 17

LandEnhance: Integrating Data Resources

See Page 131

Case Study 18

Ordnance Survey's Building Stock Database

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Digital Tools and Techniques

From impact assessment[9] to the monitoring & feedback stages, a diverse range of digital tools and techniques can be employed to enable the whole systems approach to spatial planning to be widely implemented.

Planners need to be fully aware of the applications of various digital tools and techniques to be able to lead the process and formulate cross-disciplinary questions to be analysed. One of the key requirements is the ability of the planning profession to generate insightful decisions about what kinds of digital approach are needed to produce informed and intelligent decisions about the types of digital tool needed at different stages of the planning process.

In **Table 1**, a list of digital tools and techniques are categorised to illustrate the core digital capabilities planners should have or should be aware of. It also indicates the comprehensive nature of spatial planning and its advanced potentials.

Table 1: Digital tools and techniques related to spatial planning

Data Bases, Information Systems and GIS Technologies:

Planners use a vast array of national and local official data ranging from national statistics such as the Population and Employment Censuses, environment, transport, waste, minerals, education, social services, flood, housing, land registry, employment, retail, habitat etc., taken from special surveys and often now complemented with other open-source data of various sizes from small to big. Automation and conversion tools help to abstract the complexity of data and digital technologies from the user. Data from multiple sources and of variable quality need to be combined through data integration tools, so that they might present actionable information through compelling user interfaces to relevant information systems. Much of this data is georeferenced to a coordinate mapping system which defines the cartography of some place or set of places using a GIS and increasingly such mapping extends to the third dimension.

Tools and Techniques:

Data Collection based on Big Data, Sensors/Automated Monitoring, Remote-sensing, Drone Imagery, Photogrammetry, Satellite Imagery, Open Data; Data Processes involving Artificial Intelligence (AI), Automation Tools, Data Conversion; Mapping Tools such as Desktop GIS, Web-GIS, Mobile Mapping Applications, Integrated Geospatial Web Platforms; and the whole array of Databased such as Spatial Common Data Environment (SCDE) and related systems from ONS, OS, and UKRI.

Analytic Tools and Models: Evaluation, Scenario Design, and Optimisation:

Analytic tools and models often based on theories about how cities grow and evolve are essential for planners to evaluate different policies, land use locations and infrastructure provision while assessing future trends against key sustainability criteria with different timescales. Widely used in environmental science and spatial analysis, technologies such as machine learning and weak AI for predictive modelling and forecasting is underpinning much of the data driven transformation across sectors – as exemplified particularly by applications to weather simulation and economic forecasting – enabling decision-making, digital twinning (together with sensors), and system integration[10]. Increasingly more than one tool or model are applicable to more than one application.

Tools and Techniques:

Digital Twins, Real-time (Live Data) Streaming, Climate and Environmental Risks Indicator Tools, Impact Assessment (can include Environmental Impact Assessments (EIA), Strategic Environmental Assessments (SEA), Sustainability Appraisals (SA), Health Impact Assessments (HIA), Habitats Regulations Assessments (HRA) as well as others based on the context), Land Use-Transportation Models, Economic and Demographic, Forecasting Models, Optimisation Models, Cost-Benefit Analysis, Design Methods, such as Geodesign.

Participation and Engagement:

Digital tools – smartphones, APPs, social media, gaming simulations and so on – have been widely explored for inclusive and participatory planning. Digital Participation should not be seen as online surveys or websites which simply mirror non-digital participation for they are now essential complements to traditional face-to-face methods. Thus digital tools enable discussions with diverse stakeholders to gather qualitative data on local priorities for place, enabling planners to analyse large volumes of data that reflect appropriate representations of the problem in hand[5]. The principle of selecting such tools (digital or physical) is the best way to garner meaningful engagement. The focus of participatory technology, in its broadest sense, is to understand how technologies and processes can be developed to better align how people experience what a plan implies and to develop a feel about future places. As yet we are at a beginning when it comes to consider what tools in the range of participatory methods can facilitate more communicative and expressive engagement[11].

Tools and Techniques:

Application Programming Interfacing Methods (API), APP-based Participation Methods, Creative and Expressive Activities, Interactive Mapping, Interactive Storytelling Applications, Public Participation GIS, Virtual Consultation Events, Planning Support Systems

Visualisation, CAD, VR and AR:

Visualisation in planning can be used for technical, scientific and non-technical purposes, ranging from hand-drawn sketches and illustrations, CAD plans & elevations, GIS mapping, 3D models and flythroughs, 2D graphic design, infographic reporting, virtual reality (VR) and augmented reality (AR). They provide powerful ways to communicate and present comprehensive information through visual platforms. They range from the desktop to the web and are increasingly available on any kind of computable device from the smart phone to the supercomputer.

Tools and techniques:

Web Mapping / Bespoke Web Systems (Local Plans/EIA), Computer-aided Design (CAD), Infographics, Virtual Reality, Augmented Reality, Mixed Reality, Animations/ 3D Flythroughs

Planning Applications Management:

Open and transparent data and regulations will support efficient communication and cooperation between local residents, planning authorities, local government departments, developers, infrastructure providers, businesses and other stakeholders. Through a backbone of machine-readable data and a common built environment language standardisation, the efficiency of the application process can be significantly increased. Open data can feed into the overall system using the various technologies introduced above.

Tools and techniques:

Public-Facing Front Office Software, Back Office Software for Planning Authorities, Development Management Dashboards, Varieties of PlanTech Databases and Software Tools

Recommendation 4:

Establishing a Central Resource and Delivery Body to Empower Cross-Sector Innovation, and to Develop and Implement Digital Planning

As part of the joined up environmental and levelling up agenda, a central resource and delivery body should be established to lead the implementation of digital planning methodology, coordinate the development of planning metadata and information management standards, share best-practice, facilitate exchange and collaboration, and identify training and research needs. It should be organised as a new form of academic/government/practice partnership that allows the business case for a rapid transition to a more digitally enabled system.

The body will provide leadership in integrating innovative visualisation, public participation, data analytics, artificial intelligence, and digital twinning in planning, and the challenges and opportunities they afford government, planning authorities, and planning professionals operating on all levels.

The body will be responsible for setting up a national network of regional data observatories linked to relevant organisations and local authorities. It will engage the public through the national network which will facilitate better understanding of planning in resolving comprehensive challenges. Some of this organisational infrastructure already exists and provides a sound basis on which to build.

Recommendation 5:

Creating a Comprehensive Mapping System, a Common Spatial Data Environment, and a Basic Set of Analytic Functions Tailored to Plan-Making

To enable the new methodology, the priority is to develop a comprehensive dataset across environmental, social and economic spectra for the whole UK. This requires a common mapping system and a national planning data environment with agreed standards applicable to all four countries in the UK so that it is able address the challenges of climate change and biodiversity. The organisations are in place to do this and much of the data is there but joined-up thinking is required as well as the standards and infrastructure to deliver this to planning authorities and developers.

The common spatial data environment functions as a planning data library, in which the information needs to be in a form that is accessible and understandable to planners, decision makers and the public. As a national agency, Ordnance Survey (OS) has the benefits of scale. It can be done across the country to ensure consistency and reduce cost. OS could potentially provide services that ensure all data is accessible, deal with licensing problems, and back office work support to help integrate data based on spatial planning needs. So planners do not need to worry about data problems, and can focus on generating new insights.

A directory of data available is required to list what data is discoverable, as well as mechanisms for enabling future data to be added in the future. Within this recommendation, several tasks need to be pursued:

Task 1: Identifying Baseline Data

There is a need to scope and agree core and "good" data for plan making and the analysis of digital sources, identifying the baseline data required for decision making across the board, and setting out a programme to deliver it. Emerging requirements such as biodiversity net gain, environmental net gain etc, are vital so that we have the baseline data against which they can be measured. This needs to be input and verified from the local level, while being managed and monitored at the national level in an open and transparent way.

Task 2: Defining Consistent Spatial Data Standards for Planning

Spatial information is complex and the need to establish consistent spatial data standards forms an urgent task. Data standards need to be established across the whole UK along with quality assurance standards. A common standard and approach to data collection, management and exchange for planning needs to be defined and used across all levels of planning. INSPIRE (in the EU) and the OS are working on such spatial data standards and the UK Data Standards Authority is already establishing standards to make it easier and more effective to share and use data across government[12]. This exercise needs to be focused on spatial planning requirements.

Task 3: Reviewing Data Licensing, Security, and Confidentiality Requirements

Government leadership is required to resolve licensing and information sharing requirements. Using the 'public data for the public good' principle and the General Data Protection Regulation (GDPR) would need to be reviewed and updated to enable essential data to be incorporated into evidence-based spatial planning, and at the same time, removing many different tools for surveillance of the public.

Task 4: Establishing Common Datasets and Improved Monitoring

To define the 'Planners Information Requirements'[13] through the lifecycle of development, real-time digital data feedback loops that support continuous review of spatial and strategic plans is essential. This should take account of all transport modes and mobilities, environmental management, infrastructure and utility information, and more qualitative outcomes such as quality of life and health.

Consideration needs to be given to how tracking of data related to built assets could be surfaced from existing sources of development in the construction industry, using Digital Twins, BIM and associated digital construction software products. Tracking and reporting of this data through the creation of 'Planners Information Requirements' that could be fed into the capital delivery stages would be analogous to requirements fed in from operations and facility management experts. Much of the new data that is being acquired through real time streaming opens the door to Local Planning Authorities having a much more central role in the development of smart city technologies[13].

The concept of Planners Information Requirements would be the first step towards a real understanding of what data needs to be unlocked as well as what data, further down the life cycle of development is relevant and should be harnessed for better plan making and planning decisions[13].

The growing interest in creating Digital Twins of assets, infrastructure, and ultimately for whole authorities and towns/cities could create a more progressive framework to support the digitalisation of plan-making at all scales. This would include moving from periodic review, based on detailed time-specific technical studies to more real-time activities organised in continuous form. While an exciting prospect, this step-change in process and data management will create new challenges for those responsible for maintaining the integrity of data[13].

Task 5: Developing Analytical Tools and Models for Enabling Better Local and Strategic Planning

New methods of integrated forecasting based on new datasets derived from much more frequent monitoring of land use change would enable planners to have much greater understanding of patterns of urban development, thus avoiding increasing segregation and congestion, and enabling more sustainable development to take place.

Planning needs digital tools to effectively monitor what is being implemented and these tools should be compatible with different back-office systems and scalable/transferable to other local authorities, based on nationally applicable data standards. This task can be built on existing advances and data initiatives–such as Greater Manchester Data Hub, and the London Development Database[13].

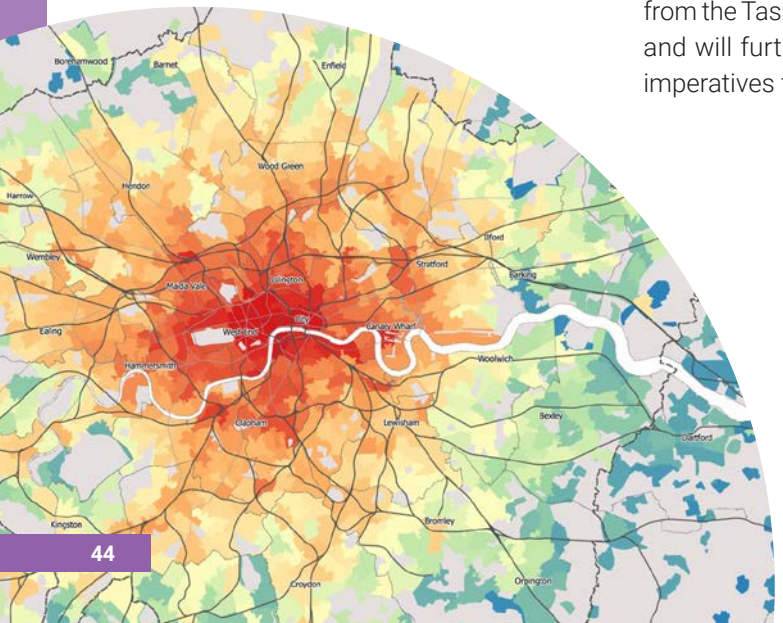
Chapter Four

The Status of Digital Integration in Planning

The digital computer was invented in the middle years of the last century, and it ushered in a revolution in the way we represent and think about the world that continues to play itself out. Very early in this revolution and certainly by the late-1950s, local authorities in Britain were beginning to introduce rudimentary forms of management information systems based on mainframe computers[1] and by the 1960s, many new digital tools and models were being proposed which had some applicability to planning[2].

While there has been a range of responses to digital thinking and applications in planning practice across the UK, there is also a fundamental set of digital practices that are used to support the planning system in its operation. These include planning application systems, consultation and local plan methods for online participation, the use of GIS, markup languages such as GML, interactive maps, economic forecasts, population projections, retail catchment analysis, transport modelling, visualisations of new developments, and digital notification schemes within specific localities.

In this chapter, we will reveal the key findings from the Task Force's surveys and consultations and will further discuss current technological imperatives for planning.



Progress So Far

The progress of digital integration in planning in the UK is sharply uneven and fragmented in practice. On the one hand, E-enabling customer-facing systems are being largely used in the UK for Planning Support Systems[3]. On the other hand, decades of ongoing processes of reform and especially the austerity measures in the last decade have meant that the planning profession itself has grown slowly in adjusting to the new opportunities initiated by technological change.

In 2002, the Planning Portal was established by the UK government to provide an entry point to online planning information and allow planning applications in England and Wales to be submitted online. In 2009, the ePlanning.scot Portal was setup by the Scottish Government. In 2021, a Planning Portal NI was launched for Northern Ireland including more advanced features. The England Wales Planning Portal is planning to launch their 4th platform soon, which will be more interoperable with other systems, is designed to be spatially aware, and will focus on the whole range of activities and procedures associated with an application[4]. Now, planning committees can be carried out through online and hybrid meetings, as well as digital services for hearings for Nationally Significant Infrastructure Project (NSIP) applications and other planning appeals and inquiries.

With this common basis for the development of proprietary systems, each nation has sought to develop their own digital approaches further to meet wider national priorities. These also include smart cities initiatives in infrastructure, transport and mobility, or through consultancies procured as part of local government 'all-access' contracts with large tech firms.

In England, the ***Planning for the Future*** White Paper[5] (2020) sees technology as an essential pillar in planning's future. There is a suggestion there that AI might be used in some way to automate planning procedures. Funding of £65 million for English local authorities has been announced in the 2021 government budget to create a "new digital system". In December 2021, Made Tech was appointed by the Department for Levelling Up, Housing and Communities (DLUHC) to support the delivery of digital planning reform[6]. This includes "creating data standards and tools that enable planning rules to be set as data, co-creating modern data-driven planning software with Councils, and the market and digital engagement with citizens to bolster the PropTech engagement sector".

In Scotland, a £35 million five-year programme ***Transforming Places Together – Scotland's Digital Strategy for Planning***[7] was launched in 2020. RTPI Scotland produced ***The Benefits of Digital Planning*** (2020) and ***Measuring What Matters*** (2020)[8] to provide evidence bases for the strategy.

Adjustments to the planning system have been underway for some time but this continues to happen incrementally in different parts of the UK. Resources are provided differentially to trial new technology where there are several pilots funded by government bodies (e.g. MHCLG Local Plan Pathfinders scheme, PropTech Engagement Fund, Local Digital Fund), work by university research teams (e.g. Newcastle University's digital civics programme, Edinburgh University's City Region Deal: Data Driven Innovation Initiative), tech start-ups (facilitated by the Connected Places Catapult), and in some cases by local authorities on their own volition.

The RTPI and Connected Places Catapult published a shared vision on digital planning technologies in 2019[9]. Educationally research funding provision from the UK's Research Councils (UK Research and Innovation – UKRI)[10] has focussed on piloting new techniques which support digital innovation and the public services. The Alan Turing Institute (ATI) was set up in 2015 by the UK government through UKRI to develop academic orientated research into AI and data science, but currently with a limited focus on spatial planning.

Alongside these drivers of change, there has been an increased role and reliance on technologies for automation[11], efficiency and engagement in places, especially in local government where cost savings are usually to the forefront[12] and in the NHS[13].

However, from the Task Force surveys and meetings involving both academia and practice, there is clear evidence that despite the digital agenda being supported by the government through various funding and initiatives, most of the activities involve making the planning system digital – primarily to speed up the development control function. The significant task of digitalising the planning profession – endowing it with new skills and introducing it to new technologies based on digital analysis and design – lies far behind.

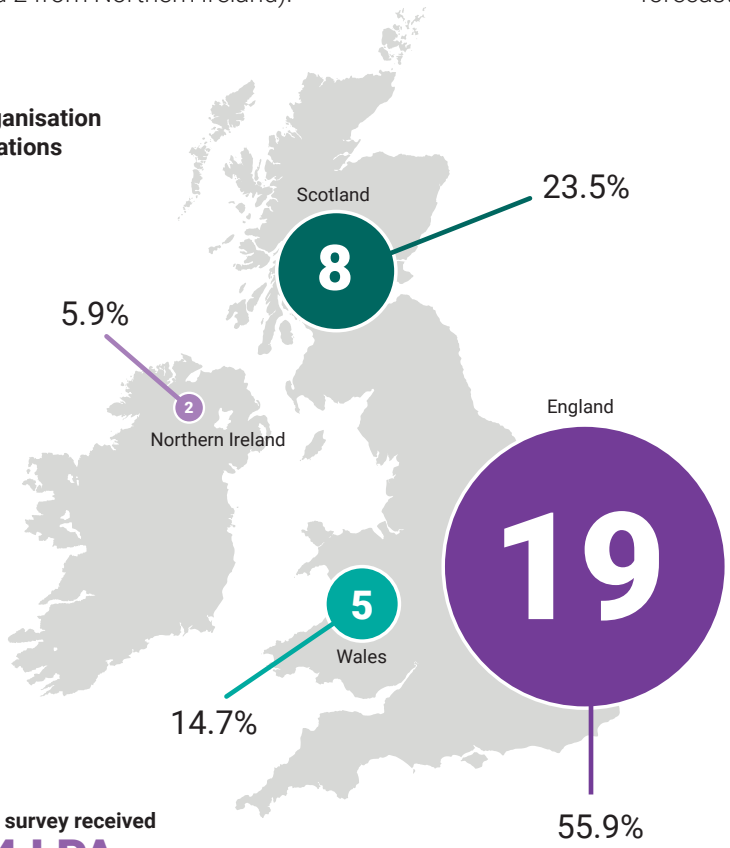
In the following sections, the status of digital integration in different planning sectors will be examined in detail.

Digital Integration in Local Planning Authorities

To understand the current digital capacity in Local Planning Authorities (LPAs), a modest online survey was conducted for a 6-week period from July to September 2021. The survey received 34 responses across all 4 UK nations (19 from England; 8 from Scotland; 5 from Wales; and 2 from Northern Ireland).

In terms of digital tools that were most widely used, most LPAs used desktop GIS, and simple decision support systems involved in planning applications, web mapping, and project management. Forecasting methods involving transport, scenario modelling, housing and population forecasting were consistently used by between 20% and 40% of the respondents, whereas they were only used occasionally by between 30% and 60% of the respondents. Newer tools involving 3D modelling, VR and AR, and new automated technologies for capturing data (e.g. 'drones', machine learning, artificial intelligence) were commonly used by less than 10-15% of respondents.

Organisation locations

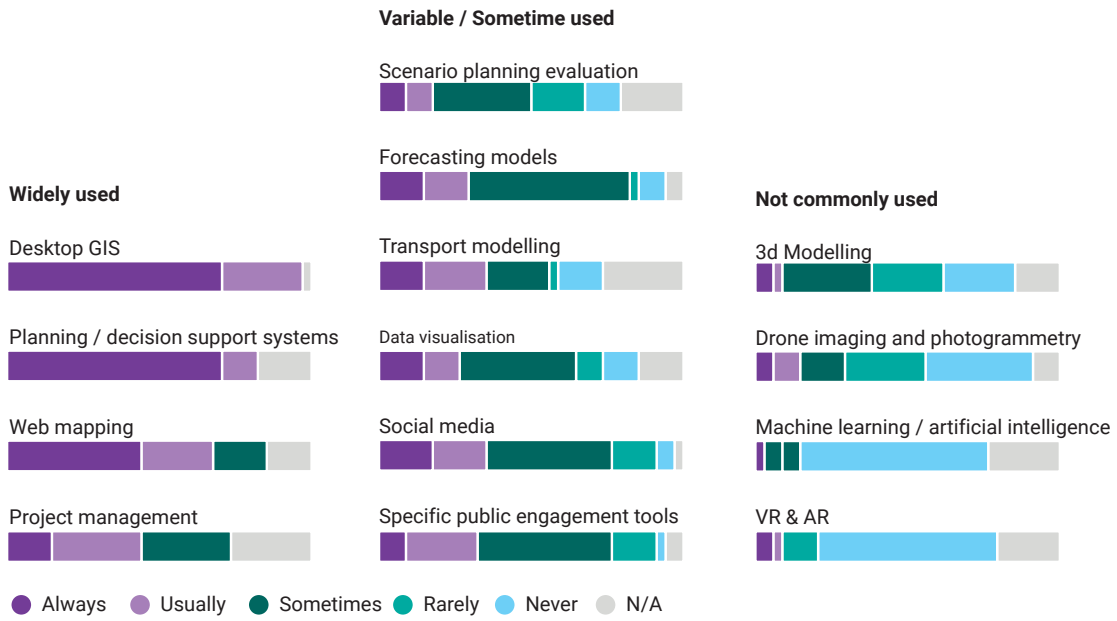


The survey received

34 LPA responses

across all 4 nations

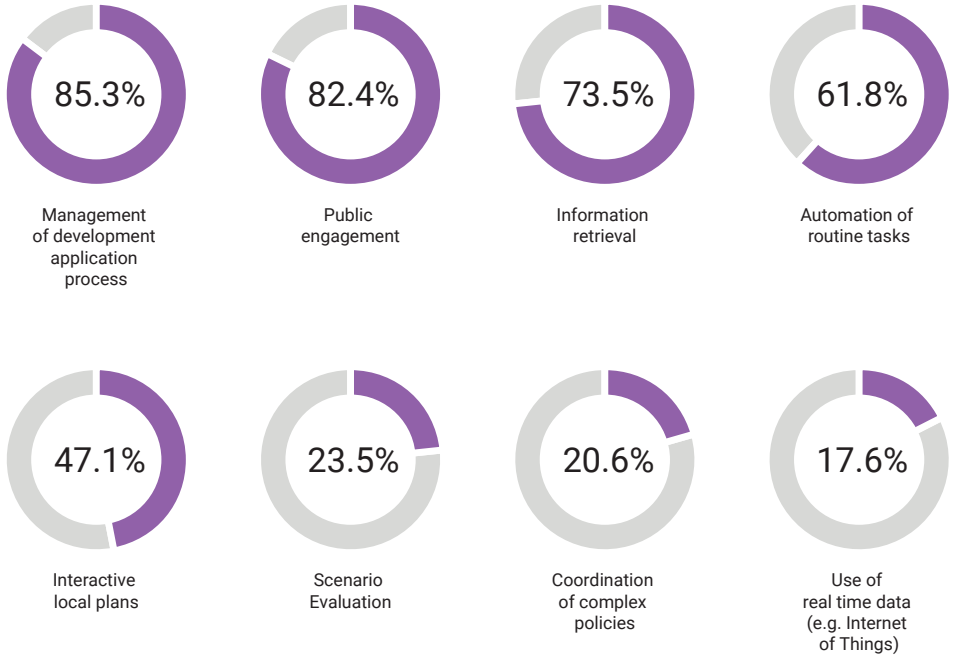
How often are the following tools used in your organisation?



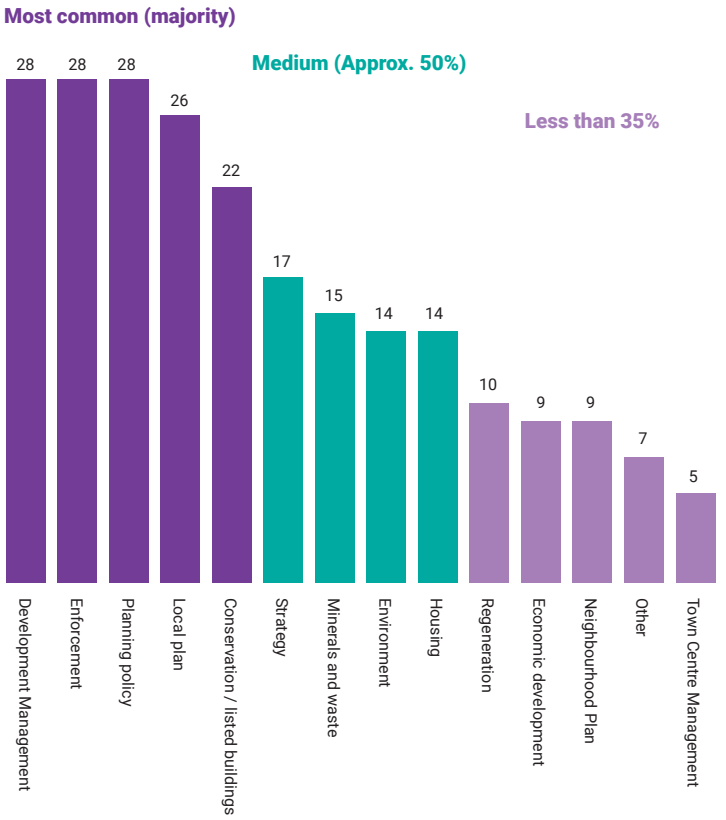
For example, 85.3% of the respondents used digital planning tools for development application process management; 82.4% for public engagement; 73.5% for information retrieval, and 61.8% for automation of routine tasks. 47.1% had interactive local plans; only 23.5% of them used scenario evaluation tools, 20.6% had used them in coordination of complex policies, and 17.6% had used real time data. The focus on big data and on smart city technologies was largely absent as this was regarded as being beyond the mandate of most LPAs and their planning sections apart from the largest.

To an extent this pattern of usage essentially relates to the fact that most parts of the planning system are focussed on development control and local planning and some of these tools that we have defined are not used much because they pertain to more supra-local scales, to regions and the nation by agencies and consultancies that are outside the LPA structure.

How are digital planning tools used within your organisation?



Which areas of planning are those using digital techniques working in?



>50% of the councils responded that they **do not** link planning application data with Local Development Plan preparation

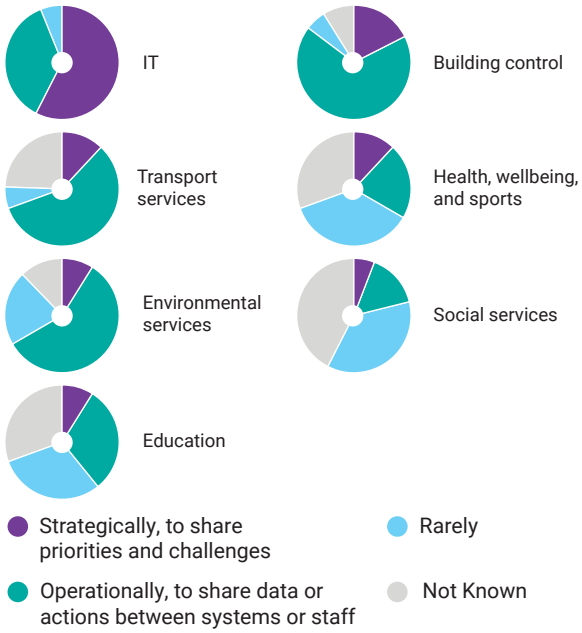
The survey also highlighted the inefficiency of data capture in the current linear planning system. More than 50% of the councils responded that they do not link planning application data with Local Development Plan preparation. Of those who had linked the data, some of them simply used data such as basic housing and car parking space information.

When answering this question concerning linking planning applications to development planning, a respondent to the LPA survey said,

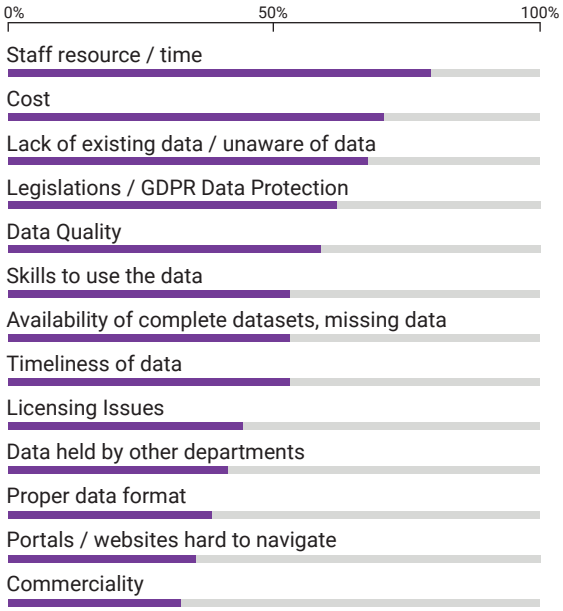
"No - because nobody thought to link the systems properly or collected all the right information in UNIFORM. It was just viewed as a fancy database that could print you a map. We should be linking planning application spatial data with Building warrant, completion certificate, and council tax to show spatial change over time in an holistic and iterative basis".

Furthermore, data sharing between different departments within the same council was another issue highlighted. Operationally, planning departments share data or actions with Building Control, Transport Services, and Environmental Services; they strategically share priorities and challenges with the IT Department, whereas data sharing between planning departments and Health, Wellbeing and Sports, Social Services, and Education departments were significantly less. More than 60% of the respondents were rarely aware or simply unaware of sharing data with those departments.

To what extent do you interact with other divisions of the local authority specifically on digital issues or shared data?



What challenges do you face when acquiring data?



What barriers does your organisation face preventing adoption of digital planning tools?

1. Cost of tools / datasets
   85.3% (29)
2. Insufficient digital skills among planners
   76.5% (26)
3. Technical challenge of integrating solutions with existing systems
   70.6% (24)
4. Awareness of digital planning solutions
   64.7% (22)
5. Lack of training resources / providers
   61.8% (21)
6. Procurement challenges
   61.8% (21)
7. Software licensing
   58.8% (20)
8. Procedural challenge of integrating solutions within existing workflows
   58.8% (20)
9. Lack of consistent data standards
   44.1% (15)
10. Lack of fit-for-purpose technology
    41.2% (14)
11. Value of solutions not demonstrated sufficiently
    38.2% (13)
12. Barriers to understanding due to IT jargon
    35.3% (12)

The barriers facing acquisition and use of digital tools in terms of software relate very largely to costs, skills and training where greater than 70% of all LPAs responding considered these as barriers to applications. The cost of tools, insufficient digital skills, the technical challenges of integrating solutions with existing systems, a general lack of awareness of what digital planning solutions were available for the tasks in hand and a lack of training resources tended to dominate current practice. Over half the authorities considered that procurement challenges, software licensing, procedural challenges involving integrating solutions within existing workflows, lack of consistent data standards, and not fit-for-purpose technology were key to inhibiting applications.

One of the LPA survey respondents wrote:

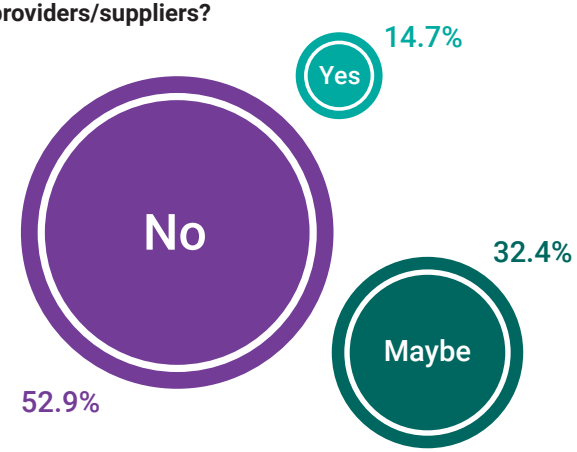
*"**the Council was unwilling to buy all the licenses for the products we need.** We were told as we never asked for the tool assumed that we didn't need it. But if you are never asked how your work is evolving and never shown the tools available – how would you know to ask. We have highlighted solutions and been told the Council doesn't use that tool - only to discover years later that the tool was offered by ESRI, but our corporate GIS said it wasn't needed. Corporately Planning is seen as a Development Management processing department and therefore why would we need digital mapping or to collect data visually. Also, there is no realisation that spatial data is a valuable asset and that the Development Plan is a key asset management tool for Council. If we don't understand or manage the data properly then we are constantly costing money. If we can be more efficient with spatial data, then we can free up resources and also generate better more innovation resilient solutions for our communities."*

The list of obstacles is long and detailed. The value of solutions generated by formalised digital thinking has never been sufficiently convincing in planning, and there have been and continue to be enormous barriers to understanding due to IT jargon. Also, the value of spatial planning and spatial data are not fully appreciated in many councils. In the majority of UK local authorities, their executive teams don't have a Chief Planning Officer's position[14]. The RTPI research found that only 23% of the 212 local authorities surveyed in the UK and Ireland had a head of planning service that reported directly to the local authority Chief Executive, and therefore heads of the planning service have little say on the budget and staff resources. Also, within a local authority, corporate GIS and planning are normally two separate departments. This further limits the scope of digital integration in LPAs.

Over half (52.9%) of authorities consider they do not have sufficient staffing resource/capacity within their department to process current levels of applications and engage with existing service providers and suppliers. There is uncertainty about how prepared LPAs are with respect to whether or not their organisation is able to adapt to further digitisation in planning. About 40% consider they are not prepared largely because they have not invested enough in the skills required and only have a few digital specialists and these roles are highly stretched across several areas. Only 20% of authorities state that majority of their planners are comfortable with digital planning tools.

>50% of authorities consider they **do not have sufficient staffing resource/capacity** within their department

Do you feel your organisation has sufficient staffing resource/capacity within the planning department to process current levels of applications and engage with existing service providers/suppliers?



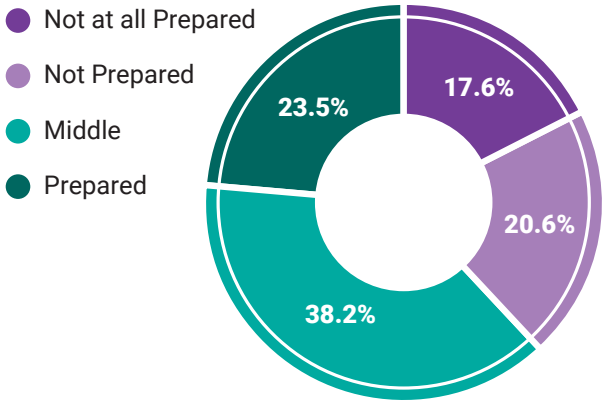
Where should the cost of training be covered?

In fact, our survey suggests that a large proportion of planning staff are not experienced with digital tools other than standard office automation software such as spreadsheets and word processing. GIS, for example, although widely canvassed as a core planning technology, is still the province of a very few experts and sometimes these skills are relegated to low-level technical tasks. The problem is quite clear that where key expertise is required in database technologies, GIS and urban analytics, this is almost non-existent, and an enormous vacuum thus exists in LPAs.

It is hard not to draw the conclusion that the training of planners in scientific and computer skills in planning schools and their continuous professional development require significant improvement. There needs to be a strong and sustained push to reinvigorating the whole planning mission and its professional and political stakeholders to embrace these challenges.

How do you learn about new digital planning tools?

How prepared is your organisation to adapt to further digitisation of planning? e.g. new digital initiatives or adoption of existing digital tech (1 - Not at all prepared, 5 - Highly prepared)



Digital Education in Planning Schools

To understand the current digital capacity in the UK planning schools, an online survey was conducted through the Planning Schools Forum for a 4-week period during August 2021. The Forum is formed by 32 RTPI Accredited Planning Schools, from whom 10 responded to the survey.

The survey revealed that half of the respondents had a handful of digital specialists, 2 schools had adequate digital planning skills amongst half of the staff, no school claimed they had majority of teaching staff with good digital planning knowledge.

In terms of teaching, GIS, web mapping, project management, scenario planning & evaluation, spatial data analysis, and data visualisation are commonly taught to a basic level, but mainly within modules, rather than being in separate courses. These are not widely taught in Degree Apprenticeships. Half of the schools expose their students to CAD and 3D modelling in both undergraduate and postgraduate courses, whereas forecasting models (e.g. population, housing, employment), and transport modelling are not widely taught. Machine learning /Artificial Intelligence, VR/AR, and programming languages are not taught with one exception.

What is being taught in planning schools seems to have a clear correlation with the digital skill capacity revealed from the LPA survey. A couple of universities have world class expertise in modelling, simulation, GIS and spatial analysis as well as big data with their links to national centres such as the Alan Turing Institute, but such teaching and related research is not in units which teach mainstream planning.

Digital planning skills across department's teaching staff

0 schools had a **majority of teaching staff** with a good knowledge of digital technologies

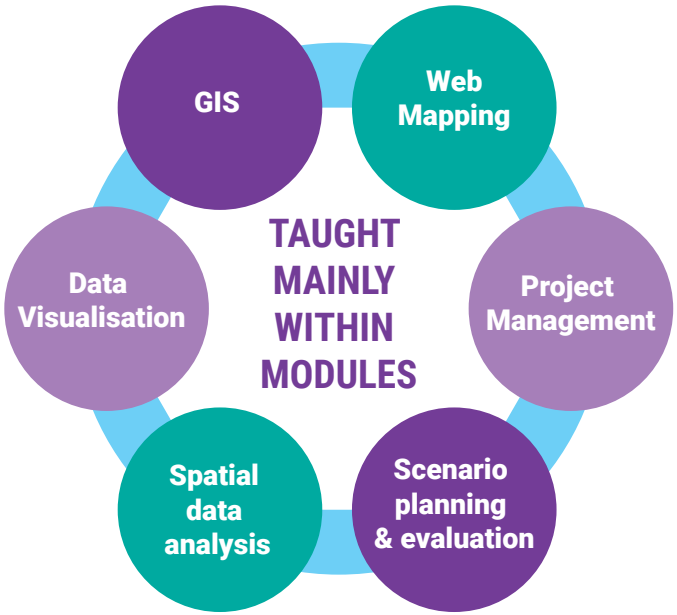
2 have **half of staff** with a good knowledge of digital technologies

5 have **a handful of digital specialists**

2 rely on **one member of staff**

1 has **no staff** with good knowledge of digital technologies

Digital Tools Taught



Preparedness of adapting to further digitisation of planning through teaching, e.g. new digital initiatives or adoption of existing digital tech.

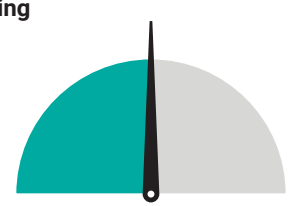
Challenges faced when updating programmes or modules to include digital planning

7 out of 10

selected revealed that present programme content and assessment is already at full capacity

7 out of 10

selected have difficulties in selecting the most relevant tools / skills to teach



5 out of 10

selected have challenges in identifying which current modules to lose if they were to accommodate new digital content

Digital Tools Taught

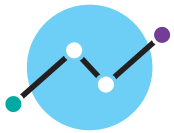
Half of the schools teach **CAD & 3D modelling** in both UG & PG courses

Forecasting models (e.g. population, housing), **Transport modelling**, are not widely taught

Machines Learning / AI, VR/AR, Programming languages (Python, R, Javascript) only taught in Planning and Environmental Management of Manchester Uni within modules.

Relevant Subjects Taught

Quantitative methods, statistics, visualisation, survey design are more widely taught in UG & PG courses. But they are not widely taught in Degree Apprenticeships.

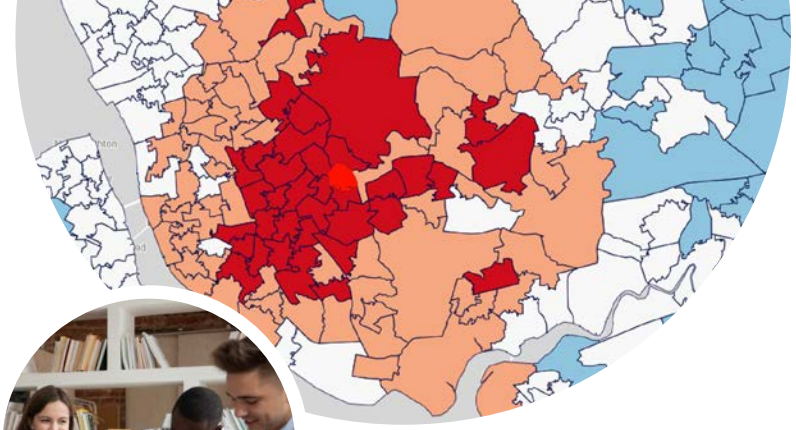


Data analytics is not widely taught.

Behavioural science is not taught in any of the 10 schools replied.

In academia, teaching tools for plan-making other than in urban design are largely absent and most of the urban design tools involve becoming acquainted with visual media. There are few links to planning theories and city science and the notion of dealing with metropolitan planning and transportation are largely absent too. It is somewhat strange that tools for transportation planning do not figure in physical planning education, but this is part and parcel of the fragmentation of the subject as more and more has been crammed into the curricula from cognate fields with those and existing fields increasingly squeezed for content.

In the survey, when planning schools were asked about the challenges they faced when updating programmes or modules to include digital planning, 7 out of 10 revealed that present programme content and assessment is already at full capacity, 7 out of 10 have difficulties in selecting the most relevant tools / skills to teach, and 5 out of 10 have challenges in identifying which current modules to lose if they were to accommodate new digital content. There is extreme pressure on the planning curricula for space to teach essential skills and this is as much a consequence of tuition fee increases to make the master's degree courses more affordable. The fact that the previous long-standing 2-year Master's degree course is now squeezed into one year has compromised planning education significantly.



Challenges faced when conducting research in relation to digital planning

7/10
Lack of appropriate funding for research projects

6/10
Awareness of digital planning solutions

5/10
Insufficient digital skills across staff

Plans to expand digital planning skills across staff, e.g. hire new lecturers and researchers, offer training sessions.

ONLY 3
of the schools who replied have plans to expand.

One very important issue that is very different from earlier eras when information technologies were developed in planning is that the forces driving course development in planning schools within a university are no longer primarily academic. They are now based on issues concerning the modularisation of courses, and the quest for ever more fee-paying students, usually overseas who can pay four times as much for their education than UK-EU students. These amongst other issues are hindering the development of good digital skills in areas where such skills need to be built from the bottom up. This takes time and a crowded curricula makes it difficult.

For example, some of the biggest universities with well-established planning schools are now dominated by other initiatives in cities and planning in engineering, computer science, urban studies, and transport amongst other subject areas. Mainstream planning curricula has been unable to avail itself of all these new approaches which are all based on digital thinking which are now in the ascendency.

In fact, various surveys of how information technologies are being taught in planning schools have been conducted occasionally over many years[15]. A recent survey by Potts and Webb from the University of Cardiff established the broad outlines of the impact of digital technologies on the training of planners in universities[16]. Their survey bears out similar conclusions to ours. Although there is increased interest in digital technologies and their teaching, an integrated perspective on these technologies is lacking when it comes to the way they are taught and used. A more detailed survey of what digital tools planners use in Australia comes to similar conclusions[17].

The unevenness of adoption of new knowledge and skills in planning schools is partly the consequence of the rapid pace of technological change that has occurred over a relatively short timescale, and the time it takes to modify the content of planning degree programmes, but it is more than this.

A scientific mindset has been almost squeezed out of planning education in the last half century and the systems approach which in the first half of the 20th century implicitly dominated master planning and then became explicit in the post war years, gave way very quickly to an education that is largely reflective and critical of the planning system and no longer aspires to design and analytics.

But it is also the case that this has resulted in the content of the planning curriculum lagging behind emerging practice and barely responding to many other digitally focussed initiatives within universities that deal with cities and urban policy. This has consequences for the ability of the planning profession to develop the appropriate knowledge and skills to respond to contemporary needs, and to help shape the future of the planning system to deliver development and growth.

Digital Capacity in the Private Sector

In terms of groups who are engaged in developing practical digital tools, it is difficult to separate out the industries that are involved in developing consulting using state-of-the-art digital software for planning. Much of this is developed in-house, from firms and agencies that are developing software which is much closer to office automation than to strategic problem solving and master planning.

Longstanding UK-based firms such as Arup, Atkins, WSP, Mott Macdonald and so on have grown substantially as consultants in national and international markets in contrast to a more local industry in the UK that has been fostered by various government initiatives such as the Connected Places Catapult's PlanTech Challenge and SME Network[18].

Now, a small but significant group of PlanTech[19] companies are devoted to automation and data analytics in planning. After the development of financial information systems which are sometimes called FinTech, applications in planning are called PlanTech which exist in contrast to other 'Tech', particularly 'PropTech', which can be defined as a technology which "is the application of information technology and platform economics to real estate markets"[20]. GovTech of course is an obvious set of applications to local and national government systems.

We have not conducted a comprehensive survey of PlanTech firms but have had in depth one to one meetings with several active firms and invited their contributions as case studies. The PlanTech sector is hugely diverse in terms of its applications and developments in new software and software services are not usually the prerogative of subject area disciplines or professions such as architecture, planning, surveying and so on but are being developed by a very large range of companies specialising in different kinds of software, many of them focussed on IT in general and geospatial data in particular.

The focus however in PlanTech tends to be on providing direct services and tools that are close to questions of representation such as various kinds of mapping which link the area to GIS, rather than exploring digital technological breakthroughs to resolve multifaceted challenges. Various forms of office automation linking to databases that sort and visualise data on the development process, public engagement, planning applications and planning decisions, are also part of this new domain but progress in mainstream planning practice has been slow.

Within the PlanTech sector, there is awareness of duplication efforts by different firms offering similar services. The desire for a more coordinated process in terms of collecting, retrieving, storing, visualising and sharing data, as well as industry standard is also evident.

Current Technological Imperatives

Over the last 75 years, the digital transformation can be articulated as a four-fold transition from Hardware to Software to Dataware to Orgware, and this is one part of the increasing pervasiveness of digital tools and media during the period.

Orgware, meaning ways in which organisations adopt and embed such technologies into their structure, was recognised as significant very early on back in the mainframe era. Ways of interacting with such physically big machines and the pecking order for digital operations forced many organisations to consider different ways of embedding computers into their functioning. And this involved developing organisational structures – 'platforms' in another words – that were very specific to the ways in which one needed to interact with such machines.

As the transformation continues and deepens, more and more radical changes are likely with respect to the way we organise our activities. In fact, the recent development of the term 'platform' has become synonymous with networked structures that hold the various activities defining an organisation together. In this sense, platform economies are now becoming the norm.

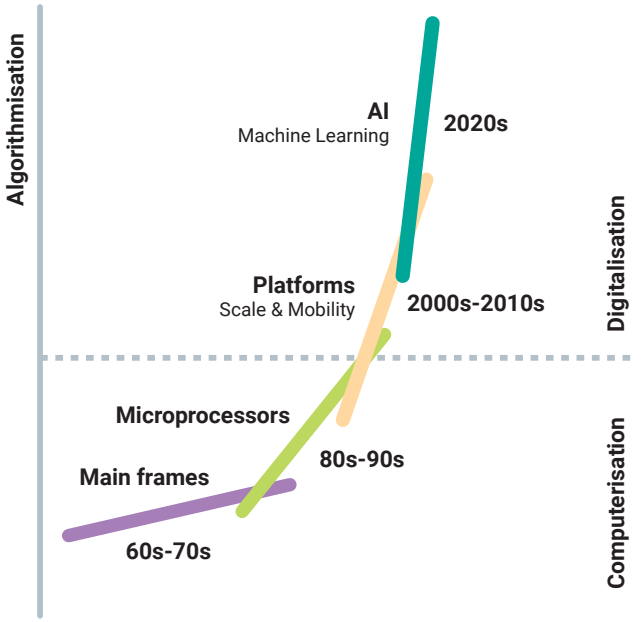
At present, the most topical theme dominating the digital transformation is the hype that surrounds Artificial Intelligence (AI) and Machine Learning. AI is a collection of simulation tools that enable finding patterns in data, usually in big data that is streamed in real time and is continually being added to. Some of these tools are part of more extensive platforms. These techniques can be useful at finding associations in data that are hard, if not impossible, to find using less automated techniques but these associations do not necessarily accord to our own perceptions and logics.

It is now entirely possible that parts of the planning system might be automated in obvious ways such as in the checking of various regulations with respect to applications for planning permission. This is no more or less than continually improving the efficiency of office automation and it is contained in some of the recommendations of the *Planning for the Future* White Paper. There is a suggestion there that AI might be used in some way to automate planning procedures, but it is unlikely that AI will ever be employed to make decisions that involve a wide array of different data, which are both qualitative and quantitative.

Instead, the planning system needs to embrace the 'platform' concept - the idea of organising networks of related functions into platforms – which are becoming central to the way large organisations are structuring their operations so that they might add value through such a synthesis. The logic of how different organisational goals can be achieved through integrated systems of digitally enabled spatial planning – 'work flows' – involve effective cross-department and cross-disciplinary data sharing and urban analytics to support an evidence-based decision-making process.

All of this is part of the emerging structure of the post-industrial global economy which is a kind of platform capitalism[22] which largely depends on a free and accessible internet.

The digital transformation has now become so convoluted that it is especially difficult to disentangle the various strands that now compose the environment in which urban planning has to operate. It is particularly important to ensure that professionals engaged in plan-making have tools that are both necessary and sufficient to be able to cut through the morass of software that is now available. Planners need to make informed choices with respect to the most appropriate ways to support making effective plans for sustainable places which tackle the multifaceted grand challenges that we outlined in previous chapters.



The Emergence of Platforms and AI[21]

(Data adopted from Larsson, 2021)

Recommendation 6:

Establishing a Chief Spatial Planning Officer Role in Every Local Authority

Local Government requires stronger leadership in planning, and we believe the role of a Chief Spatial Planning Officer should be restored as part of each local authority's Executive Team. This position would integrate the spatial development and implementation of corporate strategy (including net zero carbon targets, climate adaptation and mitigation strategies, local nature recovery strategies etc.), land use and transport planning, while overseeing the Council's data infrastructure and technologies insofar as they pertain to property, land, transport and amenities. The RTPI has also campaigned for a Chief Planning Officer in every local authority[23].

Recommendation 7:

Investing in Digital Planning and Forging an Ecosystem between Planning Research, Practice, Education, and Lifelong Learning

Additional and more flexible long-term funding opportunities for research, training and education programmes need to be mandated by government to broaden the digital skills and capacity of the planning profession, thus creating an ecosystem between academia and practice, as is standard in the medical profession.

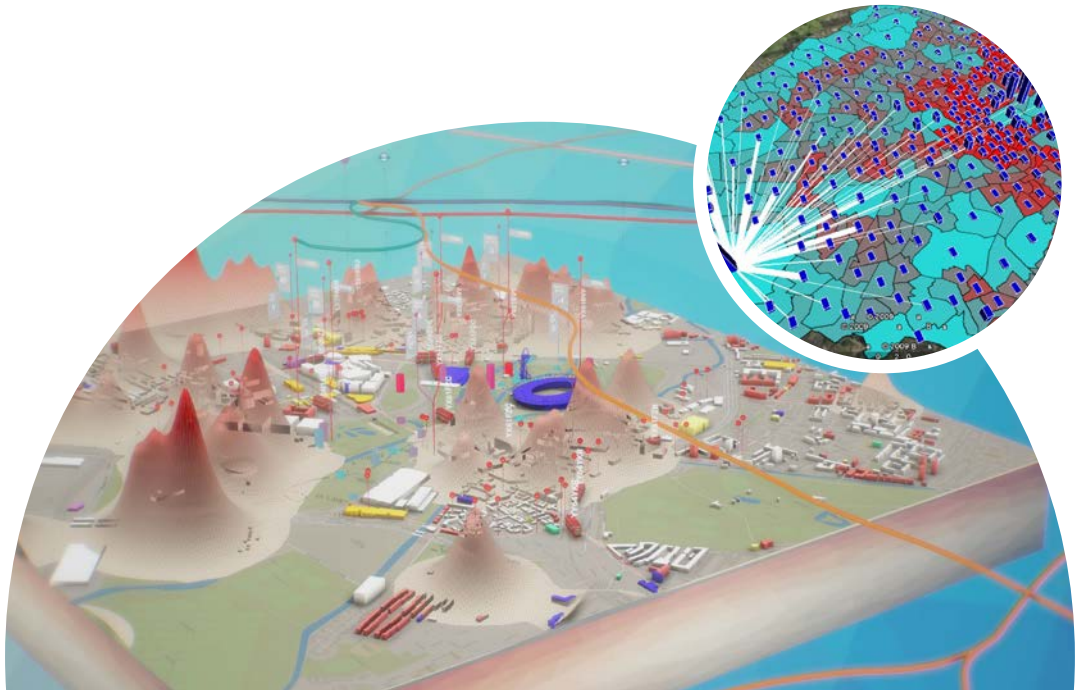
There is an urgent need to provide essential digital training for all planners. More bursaries to fund planning education, especially one extra year of Master's degree study on digital or other specialised skills should be provided.

Chapter Five

Discussion: Obstacles & Opportunities

The digital transformation which Schwarz[1] defined as his 3rd and 4th industrial revolutions has had a massive impact on science and society in terms of destroying jobs but also creating new ones which, more often than not, appear to eventually exceed in numbers those they have replaced. New technologies are in many respects a mixed blessing for at any point in time, their costs to present practice and their benefits to new ones are hard to weigh up.

Spatial planning offers a unique place-based systems approach to tackle the grand challenges of our time, but the task is clearly beyond the ability of one profession and one country. It is only potentially possible when enabled by latest digital technologies and comprehensive data analytics. The key issue is thus developing a digitally enabled system whose focus involves planning traditional non-digital as well as new digital activities which pertain to land use.



Obstacles for Digital Integration in Planning

The obstacles slowing down the digital transformation in planning are discussed here. In addition to the severe issues on budget, costs, skills and training in Local Planning Authorities discussed in **Chapter 4**, additional obstacles can be summarised as: the skills gap, the limits of technology and data, organisational constraints, and professional boundaries.

The Skills Gap

Planning as it is practised in the UK is historically a strongly technical activity, where planners generate visions of the future that they largely present in visual terms. As the digital transformation has deepened, more and more simulation and optimisation tools are being developed by IT literate consultants and by IT companies 'for practice' but not 'in practice'. The skills gap is thus getting ever greater. Most planners do not have the time in their professional practice to learn new software in their employment. Even if they had time, they would require some specialist help as the more advanced tools are almost exclusively confined now to methods used by consultants who have the opportunities to invest much more heavily in such expertise.

The Local Planning Authorities and University Planning Schools surveys conducted by the Task Force and summarised in the last Chapter revealed many barriers with respect to skills that planners needed. Many of the barriers identified relate to obstacles other than the lack of skills per se but it is worth quoting some of these to give a flavour to the evident frustration in planning practice that now appears to be widespread.

Manchester University Roundtable remarked:
"The aptitude and literacy of data science, digital technology and policy interpretation of planners and other key actors … (is)… critical to whether the quality of planning outcomes can be enhanced with the prospect of digital planning".

While the Local Planning Authorities Roundtable said:
"There is a lack of skills needed in many planning departments. Underfunded planning departments can mean that planning staff have to undertake tasks that could be better done digitally or by others, leaving them to focus on key planning work. Let planners be planners! We talk about lacking the talent in the profession, but we talk less about how badly we use, promote and encourage the talent we have."

This is an important point. Planners are generally well trained and able to pick up tools and software fairly quickly, but they need the space and time to do this. But from various workshops that we have held, there are quite telling observations such as that articulated from the Environmental Roundtable: ***"… planners don't understand GIS, the GIS teams don't understand planning…so how to ensure that digital data is accompanied by user friendly insights?"***.

And the hoary perennial, which is growing ever more serious in modern society, not just in planning but more generally in all facets of life, was voiced in the Planning Practice Roundtable as:
"The technology knowledge gap between younger generations and decision-making people needs to be addressed."

In terms of a lack of skills in planning schools, the fundamental reason is because of the lack of understanding from higher education decision makers on the importance of planning. Of the 10 planning schools responding to the survey, only 4 have 'planning' in their department titles. The number of lecturers now trained in planning is an increasingly small proportion of the academics teaching planning related courses and although some have been employed to develop digital skills, these are little more than one or two in most schools.

The majority of responses identified that lack of appropriate funding for research projects, lack of awareness of digital planning solutions, and insufficient digital skills across staff were the main challenges facing those developing research in relation to digital planning. One planning school responded:
"We are aware of the growing importance of digital planning and will modify the programmes to incorporate more of this subject area over the next few years. Utilising existing School staff with appropriate digital skills on the MSc Planning programmes will require rebalancing their existing workloads. Any support on lobbying and making a case for these changes to line managers would be appreciated."

The Limits of Technology and Data

The first applications of digital technologies focused on data and forecasting models. Information systems containing planning related data were developed in a straightforward way and have gone hand in hand with database technologies and information management. To an extent, these technologies have only now become problematic with the rise of 'big' data streamed from sensors and mobile devices. Forecasting models however produced hard-to-assimilate digital tools from the start. Simulation and predictive modelling to support planning introduced a range of techniques which were both alien to the past training of planners and introduced new specialists to the process with very different mindsets.

It is no exaggeration to say that many of these analysts treated planning as akin to managing defence policy and many of the techniques developed came from this domain. Several tools were very badly adapted to the context of planning and there quickly developed an aversion to their use[2]. Some of these problems are as listed follows:

Many Tools are not Fit for Purpose: planners were immediately confronted with tools that did not seem to fit the problems of most concern and it is therefore not surprising that the slow adoption of digital tools has been dominated by those that are the easiest and most straightforward to understand and use. Hence it was not until the 1980s when desktop computing arrived, that many of these simpler and more accessible tools were picked up, particularly in rudimentary databases based on spreadsheets. It really took until the Millennium for planners to become comfortable with the use of graphics software and with GIS but a lot of the added functionality based on spatial analysis remains largely unused in planning to date.

Tools that deal with plan-making as described in **Chapter 3** have always proved to be more difficult to articulate in software. Design methods of various sorts and concepts of the planning process incorporating goal formulation, urban analytics, the generation of scenarios and their evaluation and then implementation have defined the planning process for many years and the technologies involved are now embedded under the general label of planning support systems.

AI and Automation: Only recently has there been a resurrection of tools that might pertain to making plans and policies, to decision-making and policy analysis, and to an extent, these depend on developments in AI. In fact, most planners are only exposed to these technologies through debate about their relevance and although there is a strong momentum to attempt to automate the planning applications process through weak forms of AI, this is still a pipedream. There are few tools to do this and what does exist is experimental.

Even though there is an implication in the recent White Paper on planning that the planning decision process can be automated, it might be possible for a small number of routine tasks, but this is unlikely to be feasible for the whole process for many reasons[3]. There remain very mixed reactions amongst planners and policy makers that such tools can be developed at all to produce relevant and appropriate solutions, and insofar as AI might be helpful, this can only be a metaphor for structuring the planning process.

Lack of a Joined-up Approach: The quest for technologies that are 'joined-up' in the digital realm has barely reached the planning profession as yet and there are many examples of the frustrations caused by the piecemeal applications of software and datasets from different sources which make it impossible to develop integrated planning.

Planning applications software and data rarely relate to the sort of data and techniques required for Local Development Plans. With respect to larger scales at the regional and national level, there are a variety of tools and software that mirrors more local scales but do not in fact scale down in that they have never been adapted to different plans at the local, district and urban design scales. Infrastructure planning is classically of this nature in that it is mainly the province of national agencies and has little connection in any integrated way with local planning.

The Local Planning Authorities survey revealed that the inability to connect up even extends to the purchase of software by one department and its use by another but with no coordination as to what the user department actually needs. One response was: ***"You need to also talk to IT teams and planning IT experts within Planning teams as they install and keep these digital tools working. A new system may be great for a planning officer but not perform the other 80% of automated tasks the current system does for all other staff within the Council because the (software) developers and designers have not asked the correct people 'what do you need?'"***

Lack of Adaptation in Practice: Another major limit on developing appropriate applications and methodologies informed by digital technologies involves the rate of change in the construction of new tools and the application of new methods.

In the case of more advanced digital tools, even consultants are unable to afford the time to learn and adapt new software and thus a good deal of this remains in think-tanks and academic research groups which are continually developing new variants which are rarely tried and tested on real problems. The fact that many tools remain languished is of particular concern at the present time as so many new tools are being invented which spin off from the old and enable those who are able to learn about them to develop new and quite different approaches.

This problem is getting ever more serious as the cycles of innovation in technology continue to speed up and more and more individuals are acquiring digital skills outside the traditional remit of planning. The quest of course is to integrate these new skills with the core foundation of spatial planning, but this requires a lot of time spent in professional development and substantial costs in making such acquisitions.

Organisational Constraints and Professional Boundaries

Organisational Constraints: Generally speaking, local government has not adequately adapted to the information age and many new technologies, particularly digital tools and procedures, have been grafted onto a very old model that is more suited to the last century than this one. This is also relevant to different layers of government and new institutions are being created all the time to deal with problems that pertain to planning in different ways and which do not fit easily into existing structures.

For example, the notion of strategic planning has been shunted backwards and forwards by different political parties despite the continuing and increasing need to look beyond a local authority's boundaries at how their problems and solutions spill over into adjacent areas.

The two-tier system on transport and minerals authorities adds more complications, although such agencies do still exist alongside and sometimes within the local authority structure and there is some potential for joining up with physical planning.

In addition, there are countless agencies at national level such as the National Infrastructure Commission, the Geospatial Commission, the Ordnance Survey, the Office of National Statistics, Natural England, the Met Office, the British Geological Survey and many ad hoc agencies, think-tanks and centres that provide important information as well as digital tools, maps and datasets that can be used in planning. We have interviewed many of these organisations and they tend to be technically rather than practice focused. Therefore, limits on their role in practice has restricted more widespread application of more advanced technologies that they are able to develop or would like to promote.

However, in Local Planning Authorities, the separation of divisions or departments within the authority itself all using IT often leads to the inadequate allocation of tasks. Those in control of hardware, software and management information through operations and procurement often do not interface well with those who might use this software. Also, inflexible procurement procedures prevented new technologies and services, which often emerge from start-ups and SMEs, to be used in the public sector.

The unrelenting pressures on local government to show value for money inhibits planners from continuing their professional development in digital skills and this reinforces the difficulties of communicating with IT experts within their own organisations, driving wedges between different groups using IT in different ways.

Professional Boundaries: As we have emphasised several times, planning consists of linking development to plans that control such change. Planning requires creative and analytical skills on the one hand with respect to plan preparation and good organisational skills involving office automation to handle planning applications on the other. Data stitches development and its control together but most of this linkage has been developed in somewhat haphazard ways in the past. Only now is there a focus on the need for powerful systems that enrich the databases planners need to work with using data from the development process.

As a profession, the role of planners has moved from technical-scientific-designer-based perspectives which dominated the profession when it was founded by Thomas Adams in 1913, to being narrowly perceived as largely an administrative and legislative set of tasks and functions today. This largely consists of operating the planning system which involves regulative and legally binding local plan preparation to processing and adjudicating applications for planning permissions in various ways.

More specialist functions for example, those pertaining to large scale urban development, transport planning, and urban design which do involve digital tools, are mainly in the domain of the largest consultants while a lot of basic work for housing developers also forms much of the consulting work related to planning applications. This reflects a synthesis of knowledge about the planning system and its legislative basis as well as the local politics and organisation of the authority involved. It seldom involves new forms of data or new tools and models.

It is not hard to see why this deskilling has taken place. Inevitably and necessarily, planners need to understand how their systems of interest work and to this end, there has always been a gap between our knowledge pertaining to understanding and that pertaining to creating effective solutions and designs.

Planning began over 100 years ago with a focus on design for a social purpose but as planners grappled with these problems, there was a need for a better understanding that began to squeeze out the focus on design from the profession.

In parallel, new perspectives on understanding cities and regions emerged, the domain of specialists with the planner focusing more on a synthetic role linking these approaches together. In planning education, there was a strong move against design and systems thinking as the focus moved to the social sciences dealing more with planning problems than solutions.

Due to the exigencies of local politics and the successive attempts by national government to roll back the power of the welfare state, planning became denuded of its core in local government as the more skill-based activities such as building construction, environmental specialists, and transport began to make inroads into the role of planners.

All these trends have conspired to lower the esteem with which planners are viewed in local and central government. In the wider climate of deregulation and de-professionalism, planning has lost its role as a way of addressing problems that can only be resolved in an integrative manner. Key stakeholders who joined our roundtables starkly revealed these problems.

The Local Planning Authority Roundtable identified repeatedly the continued cuts in support that have affected this activity.

This was articulated as: ***"Planning has a significant impact on everyone's lives but the process in local government is massively underfunded – development plans in areas are worth billions of pounds but the investment in planning activity is a fraction of this".***

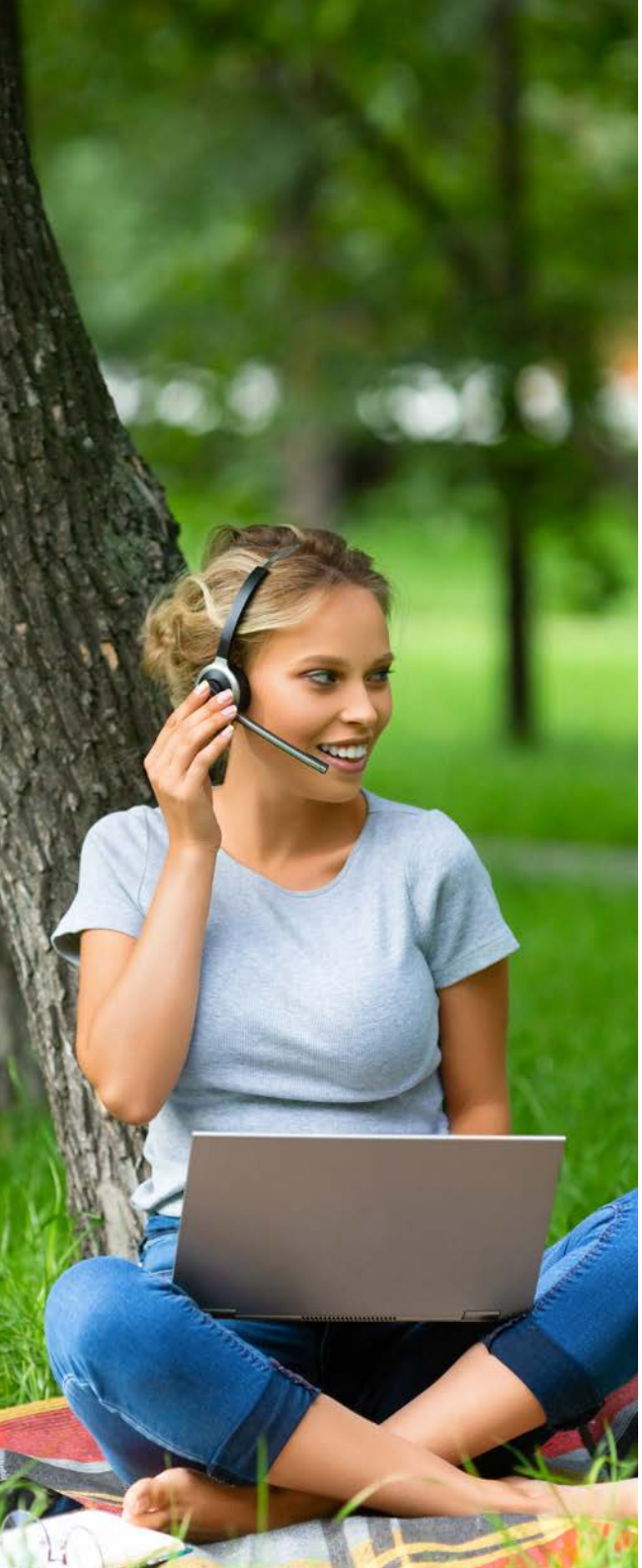
The conclusion that ***"…the planning profession is undervalued…"*** dominated the discussion. The sentiment that the planning profession is stuck in a mode where it is struggling to 'reimagine' itself was voiced as: ***"In very few spheres of industry is there such an intricate knitting together of legislative direction, but with so little flexibility in the delivery mechanisms, it has to be achieved through links to professional boundaries that have shrunk rather than broadened over the past 40-60 years."***

Lack of leadership: The leadership role in mobilising professions that contribute to the built environment was once the focus of planning. But with the deskilling of the profession, with the emergence of more powerful skills to deal with development in the engineering, construction and the legal sectors, and new forces involving digital data that are driving change in modern society, planning requires a new momentum that is able to embrace the myriad of changes that are now affecting urban development. Most Local Planning Authorities are struggling to expand the skills needed to embrace this new future, and there is little consensus about how the appropriate skills can be mobilised.

At the same time, in the universities, those with the skills for understanding the new digital world do not have the same mindsets that planners were once endowed with. In data science, GIS and spatial analysis, there is little focus on forecasting, urban design, urban analytics, and design methods, both quantitative and qualitative. To an extent, reinvigorating planning to embrace these new skills needs to be accompanied by a new way of organising how these skills might be deployed as well as acquired.

A notion was proposed at one of the roundtables - ***"We need to have a better aligned collaboration model within the profession – to avoid everybody duplicating each other's effort. Perhaps a good model would be to look at sectors like utilities where there is a requirement to invest x% in innovation and projects are done across multiple utility network operators amidst good sharing of best practice."***

Too often, the development of new technologies in practice depends on a champion picking up the challenge and working across departments to infuse innovation. This is important but we cannot afford to assume that this is the way of things. We need new organisational structures to cultivate these new skills and embed them deeply into the work practices of day-to-day planning.



Opportunities in Identifying and Realising Digital Planning

Opportunities are not simply countering the obstacles we have identified so far although in realising new opportunities that would lead to informed digital planning, new approaches will resolve many of these.

In this section, we will focus on four key themes which are: the pandemic and the rapidly adapting world, the rate of technological change, the emergence of networking platforms, and the involvement of citizens, stakeholders, and planners.

The Pandemic and the Rapidly Adapting World

The pandemic has demonstrated to everyone in society that planning is not just about building houses, for the way we plan and build will have direct impact on people's health and wellbeing – the very reason the planning profession began over 100 years ago.

The digital transformation now involves cybersecurity, health applications, sensor technologies, and platforms of many kinds that are being developed to fuse traditional markets with those that are formed using digital networks. This is particularly evident now in FinTech, online marketing, internet shopping, and in citizen participation.

All of this was in play before the pandemic began in the first months of 2020, but the massive impact of the disease stopped traditional activities in cities in their path. Just as the digital transformation and its various revolutions have never been anticipated at any stage, the emergence of the pandemic was no exception. It was entirely unanticipated or at the very least, our reaction to it was unanticipated. We may have speculated that a pandemic was coming as many such events have come before but we were completely unaware of its impact until it did emerge.

For example, although digital conference facilities have been available for a number of years, the pandemic has seen a massive growth in online conferencing to the point where a very large proportion of GDP in industrialised nations is now created and affected through such online meetings. Zoom, Google-Meet, Teams, GoToMeeting, Skype and more specialist tailored platforms are available everywhere, working with rather low bandwidth but offering remarkable facilities for remote communication[4].

This is changing the way we work in many activities and in fact, this report could not have been produced during the pandemic without these systems. It has been done entirely remotely in that all the meetings held have been virtual. What we have not done is explore ways in which particular planning activities can be accomplished remotely but many of the digital tools in planning have been adapted anyway to the web and can thus be used and applied remotely. The notion of 'doing planning' under Zoom is not as far-fetched as it might seem.

Digital design studios in architecture and now in urban design as well as the use of 3D visualisations and augmented realities have been around for over 20 years and thus many of the tools discussed in this report, are already in networked form and can thus be used remotely.

We cannot speculate with any authority about how technologies and our use of them has been changed and will change because many social contacts through work have disappeared during the pandemic while new forms of online engagement have taken their place. There is little doubt that we do not have any sense of the way our work behaviours have changed due to working from home and not meeting on a day-to-day basis with our colleagues to discuss issues pertaining to the many facets of planning that the range of professionals involved in the activity deal with.

It would appear that the development of new technologies during the pandemic period has somewhat stalled and although surveys do reveal that the adoption of new technologies has been speeded up in the last two years (as evidenced in the use of online conferencing)[5], it is entirely unclear as to whether or not this period has been one of significant innovation in these new technologies.

Certainly, many businesses have begun to rethink their structure and processes of work and marketing but this does not seem to have been extended as yet to practices of planning such as those we are exploring here. What is clear however is that the pandemic has changed the way we behave with respect to core issues in urban planning, particularly location and mobility.

The move to working from home and living in non-metropolitan locations, and the massive drop in the use of public transport which has been under threat for many years anyway before the pandemic began, is now key to where we might best locate jobs and housing. The move to active travel and new modes of transport, a combination of local and online shopping, better live-work balance and more time with families, new regulations and new local practices such as wearing of masks and social distancing, and the provision of routine services such as health care as well as education using network communications will have fundamental implications on how future communities should be planned. The integration of latest digital technologies can help planners understand the many subtle changes associated with the pandemic much quicker and address them in a proactive and holistic way.

Better and Faster: The Rate of Technological Change

That the development of new information technologies is continuing to speed up is clear from the increasing number of choices that planners have with respect to the array of digital tools at their disposal. It is no longer a problem to access various hardware from handheld computers to much bigger systems although software always remains a crucial issue in terms of cost as does data.

Two important features in practice at present are contained in the focus on 'interaction and integration' for what is missing from many planning activities is the need for joined-up thinking that can be strongly supported through integrating different systems. A good example is GIS. It is now possible to develop powerful GIS applications on the web using what is effectively free (sometimes open-source) software. Systems for processing planning applications are rarely linked to such GIS but it is now entirely possible for the databases based on GIS that inform the plan-making process to be linked to those that deal with planning applications.

All that is required is the will and of course the expertise to do this. Moreover this is not costless. Much of the quest for integration of different systems which does raise questions of skills not only of a generic kind based on the need to link different ideas but also developing software and related systems that are interoperable, also involve interaction between planning professionals and the wider public.

Leeds City Council for example ***" … are developing a Location Intelligence Hub to present and publish … planning data in an accessible (form) using interactive maps. The intended impact is to provide a one stop location to access data for both internal and external data to allow greater self-serve"***.

In another local authority Bradford, planners are building a ***"Digital Twin linked to Clean Air Zone and strategic growth framework to feed a clean growth city 'live' spatial plan."***

In Plymouth, for example, a new platform for open data shared amongst several units is being developed. ***"Open Data – Data Place Plymouth – is a central repository of open data, currently used by 9 entities including other council departments, the Police, i-DAT (Plymouth University) and CCG (Clinical Commissioning Group). The intended impact is to provide Plymouth communities access to open data and allow them to experiment and develop solutions to local problems. Led by junior and senior officers, Data Play comprises events which allow digital communities the freedom to 'play' with open data to address specific challenges or problems. The intended impact is to promote a space for innovation and networking to help tackle a problem or a challenge by providing a solution or a service."***

It is clear that this type of service not only integrates important functions and generates much better practice but links planners and related professions in a way that enables them to do a range of jobs better.

These are excellent examples of how new digital initiatives are being developed in local authorities. However, it is crucial to share and apply best practice, as well as joined up actions across physical administrative boundaries.

Moreover, interactive maps are an important means of linking the wider public, a variety of planning tasks and the ongoing development of a place in ways that provide a synoptic view. Such maps, sometimes badged as dashboards, can be an important focus and forum for agencies effort. Our discussions revealed many such maps are being developed 'to bring alive' the planning process.

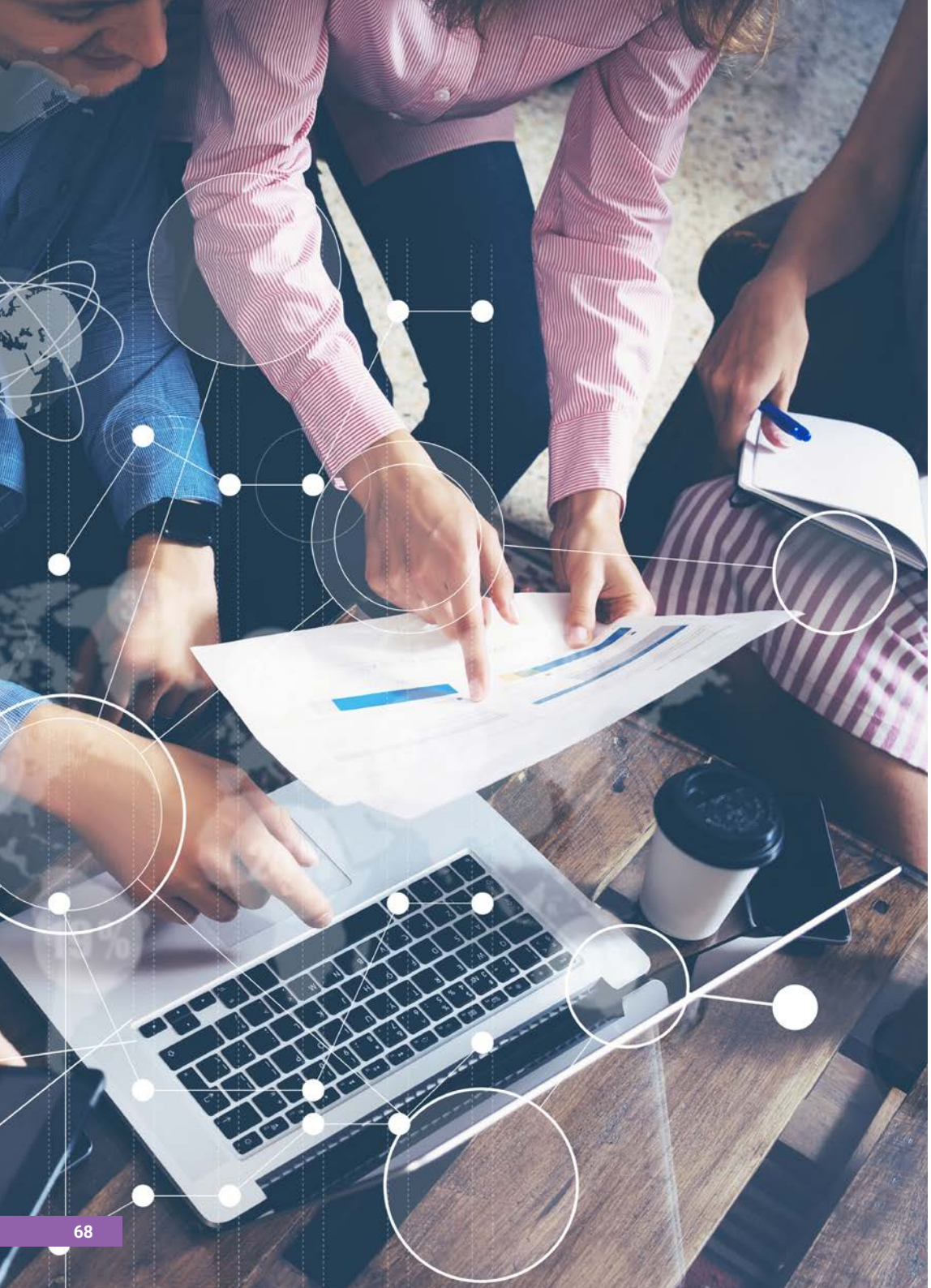
Typical of these initiatives ***"… interactive policy maps (are being developed) to present the Council's development plan and consult on emerging development plans (with the) next steps … to create an online data repository where the public, developers and agents can access Local Plan Written Ministerial Statements, GIS features and data. This will reduce data requests from developers and agents."***

There are many other examples that the Task Force explored and there is much more innovation than appears at first sight, a lot which is not publicised but represents the foundation on which a strong basis for using digital tools can be built and be extended across all aspects of planning.

Particularly important are links between different agencies dealing with development, housing, health, transport and environmental concerns. In particular, the latter areas with respect to environmental impact assessment throw up some important developments which should be emulated in mainstream physical planning.

Atkins, for example, in responding to this issue of joined-up activities and providing appropriate data say: ***"The reforms proposed in the Planning White Paper would create a new dynamic between plan-making and preparing planning applications and, within this, the role of environmental assessments to support sustainable outcomes–social value, environmental benefits and appropriately located economic growth."***

They also say ***"There is currently much digitally available data to aid assessment. The EIA/SEA/SA processes are becoming increasingly efficient by applying digital solutions using digital data and mapping. This combination of bespoke digital tools and technologies, lean assessment principles, and a focused data-driven approach to environmental assessment, is or should be at the heart of …. Next Generation Environmental Assessments."***



Opening Up Cities: Networking Platforms and Citizen Participation

The internet has opened up the world in a way that was inconceivable 50 years ago when the first inter-network was put in place by the US Defense Advanced Research Projects Agency.

By the time the pandemic struck, there were the beginnings of exchange and market systems that put consumers and producers in contact with one another across the internet. Companies such as Uber and Airbnb provided platforms for virtual interactions linking consumers and producers who largely drive the system through a virtual marketplace where demand and supply can be reconciled. During the pandemic there has been a rapid growth in online delivery services mirrored around similar network connections.

In fact the companies that made this possible simply organised the software for such transactions with consumers and producers doing all the work, paying for their own networks, and providing their own demand and products. These platforms, to some extent, provide their owners with a 'free lunch' because the only things that they provide is the software that powers the system.

Similar platforms are being developed for many interagency operations. Already office automation has permeated many organisations, and this now depends almost entirely on the internet where data and software are stored and where increasingly 'free' services are being provided.

It is possible, but we are not aware of this yet, that local government generally could be linked up in these ways. Planning authorities could share software and data with the 'cloud' representing the backcloth and if this began to happen, the whole notion of planning at different scales could come back onto the agenda. There are enormous opportunities for linking up planning across the whole country – levelling up – by providing standardised information management systems for representing data at the national scale and linking them to plans everywhere.

There is even the prospect that part of the continuing emergence of the smart city would thence contain this kind of platform urbanism that would reinforce the notion that planners and planning is as much a part of the problem and the solution as it is something that is independent of the system being planned[6].

Regulation however is a massive problem just as are the social media platforms, where increasingly these different technologies piggyback on one another, each creaming off another layer from profit. This whole area of new information technology is in its infancy, and it is also bound up with the development of the internet itself which has its own problems in terms of ownership, access, and regulation.

There are no end of possibilities for mixing new technologies with various kinds or real and augmented reality. Some of these technologies are used to monitor the city in real time. This is particularly the case for traffic where a mix of weak AI techniques and human operators are located in the control centres of the largest cities. Control rooms dealing with lots of other real time issues in cities such as climate change, flooding, power generation, and even socio-economic aspects of the city such as rents, house prices, migration and labour market flows as well as Fintech information, have been developed in several large city locations. The simplest versions of these are constructed as dashboards updates in real time.

If these technologies and data can be proactively used in a new approach to a digitally enabled spatial planning, as we have illustrated in **Chapter 2**, planners with other professionals and stakeholders can join forces to tackle the grand challenges we face, and at the same time create more sustainable and resilient places for us and for our future generations.

Our Recommendations for this chapter are continued in the next chapter.

Chapter Six

The Mission: Establishing a Digitally Enabled Planning Profession

There are many sectors which impact on the built and natural environment, all grappling with the way digital technologies might be best integrated in practice. Infrastructure engineering and transport planning have been based on computational methods ever since computers were invented and the training of those who are involved in their practice has always been based on scientific principles. In economic forecasting too, computational techniques have been employed in determining economic policy since their infancy in the 1950s, notwithstanding trenchant critiques of the appropriateness of such economic forecasting over many years.

In these contexts, applications do not imply that analogue practices are simply translated into digital form. The digital transformation goes well beyond this in that the use of digital tools not only changes the way we do things, but also generates entirely new practices that have no prior presence in the way we understand systems and intervene in their futures.

As we have emphasised throughout the report, the wider purpose of integrating new tools into planning and providing an entirely consistent digital information management system and resource is to develop a holistic approach to tackle multifaceted challenges, as well as create resilient, beautiful, inclusive and sustainable communities.

The Role of Planners and the Professional Institute in Driving the Digitalisation of the Profession

To an extent in the UK, the development of a common spatial data environment and standards across the country would support the Government's levelling up agenda by reducing the significant planning capacity gap between rural districts and metropolitan areas. Although the Task Force does not have responses from all Local Planning Authorities with respect to the adoption of digital technologies, from our Local Planning Authority Roundtable discussion, we understand that there is considerable unevenness and that levelling up would do much to address this by providing the basis for a much more consistent national planning information management system built around the digital transformation.

In developing this wider context, planners need to become much more powerful advocates for systemic change, not for its own sake, but for its ability to deliver on several of the critical issues that are facing the profession, the country, and the world; and this needs to be built around digital foundations, indeed around all contemporary technologies. Planners also need to manage decisions made in previous political vision statements, written every 5 or 10 years, which will always be out-of-date and perhaps no longer relevant for current political agendas. But all planning decisions, and the trade-offs that may be necessary, should be presented in a way that is easily understood and properly communicated and digital technologies are key to facilitate this.

Learning from other professions

It is worth noting that a parallel concern for embracing the digital transformation involves health in general and in particular, the UK National Health Service (NHS). The same type of distinction between substantive tools used to enable medical practitioners to make people better as well as understand how our human systems work, and the wider context of how the health system delivers this practice through the hierarchy from hospitals to general practice, mirrors similar issues in planning: between the analytics we develop for understanding cities and producing better plans, and the changes in development that are processed and determined by the planning system.

Commissioned by the Secretary of State for Health and Social Care, the impact of ***The Topol Review: Preparing the Healthcare Workforce to Deliver the Digital Future***[1] (2019) has been profound. The review unfolded the scale of the potential impact on the workforce of digital technologies. The cultural change and service transformations required are immense and these parallel to some extent those required in planning. The review argues for a whole new cadre of clinical and analytics staff to analyse and interpret the growing body of clinical and other data and build the intelligent systems to drive service improvement. In this context, this is a report that defines what is needed in terms of new skills in health care.

A similar report like ***The Topol Review*** (see note above) is required for urban planning and there has been nothing like this since the publication of the ***Schuster Report*** of the Committee on Qualifications of Planners[2] in 1950. What is required now for the planning profession is a new 'Schuster Report'. The Task Force's Local Planning Authority and Planning School surveys demonstrated a huge digital skill shortage in planning practice and education.

The survey also revealed that more than half of all practitioners learn about these tools through CPD/Training events, professional planning magazines, by word of mouth, through the web and through conferences.

It is remarkable that academia hardly features at all in this mix. But in examining these sources, there is an enormous mismatch between what is being communicated from planning schools to practice. Only about 10% of professionals report that universities provide a key resource for these new tools while unofficial sources such as social media play more of a part than academia.

In order to address these challenges and make a culture shift on digital applications, there is a need to generate collaborative effort across academia, students, practitioners, professional bodies and professionals from the many other sectors that impact on planning. As the professional planning body, the RTPI can play a key role in facilitating the collaboration and engagement of key stakeholders to develop more digital capacity in planning practice, research, and education.

Case Study 19

A Digital Planning Agenda for Australia

See Page 133

The Urban Analytics programme in the Alan Turing Institute could also act as a vehicle for this knowledge exchange, but local government and planning schools need much better integration with the programme. The ESRC Regional Research Laboratories established over 30 years ago led the way at that time and arguably there is need for a similar initiative but focussed more on establishing foundations that reinforce a decentralised system binding national agencies and national governments together. It is important to link planning schools and their colleagues trained in data science and computer modelling to collaborate with local authorities to develop data infrastructure and digital capacity.

Finance and resources are critical in this as many local authorities have suffered from severe funding cuts during the last decade and have lost their research and intelligence capabilities. Investment in future technology requires planning to develop a culture that embraces other sectors and partners, and planners are much more than simply a client group to be supported by new software and data.

RTPI membership promotion needs to reach digital and environmental specialists working or interested in planning to provide them essential planning knowledge. This amounts to widening the remit of the profession but at the same time strengthening its core competences. It puts the onus on the profession and on academia to reinvigorate the technical and creative skills of planners from the earliest stages of their professional education, or even starting from primary and secondary school education stage. During COP26, Education Secretary Nadhim Zahawi spoke at an interview about his 'Sustainability and Climate Change Strategy', where spatial planning and geo-spatial mapping were included in his plan to put climate change at the heart of education[3]. Similar initiatives have been developed in GIS particularly in high school education in the US over the last 20 years or more[4].

The planning profession should be at the forefront of identifying what digital technologies are needed and how they can be integrated in practice. For this, planners need to reinforce and extend their leadership roles.

A Diverse Digital Skillset for Planners

In a world that seems to be changing ever faster, it is not expected that every planner be a digital expert in planning, but the overall planning profession should have a diverse digital skillset.

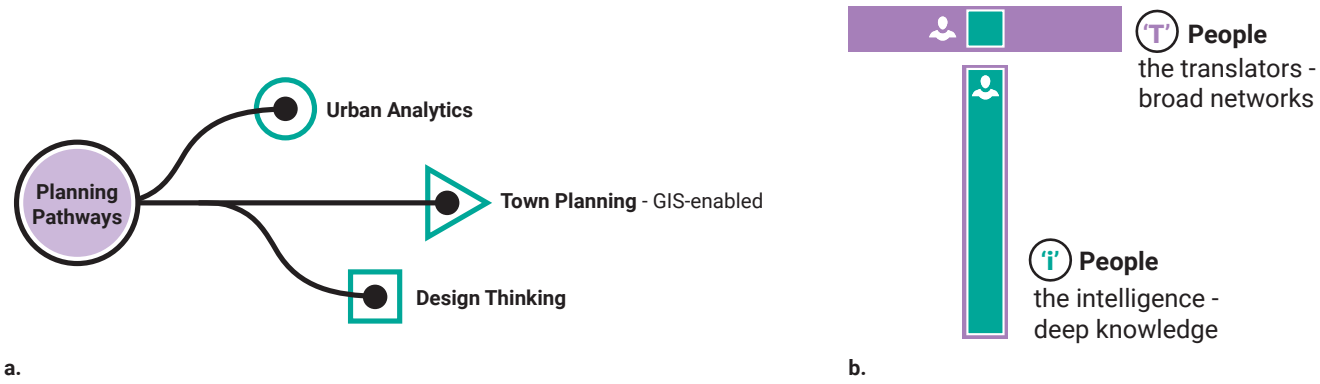
Ritchie Somerville from the University of Edinburgh says that he does not believe there is such a thing as "basic level of digital literacy" for digital literacy is changing all the time. He defines three pathways to digital literacy that the profession should be seeking to encourage.

He illustrates the core skills as reflecting spatial representation through, for example, GIS or any spatial mapping system of which there are now many. He argues that this should be a core undergraduate level skill so that it can be built upon at graduate level. If undergraduates are without these skills, they should acquire them in the first stages of their graduate degrees that reflect the two other pathways, namely ***Urban Analytics***, which covers the spectrum of how to work with those who have "deep" data science and modelling skills, as well as the development of those skills themselves; and ***Design Thinking*** which covers the development of critical thinking and the ability to assess, hold and manage the complexity of inputs that inform modern planning, while working with people and communities to visualise and understand the way factors interact and what choices might mean.

In diagram (a), he reflects this juxtaposition of ideas in terms of translators and analysts, reflecting both broad and deep thinking respectively. In one sense, the ideal to aim towards is to combine these skills in a single person and this has been the goal of planning education throughout most of the last century. Since then it has been under scrutiny and there is no real consensus any longer. That is one reason why a new 'Schuster Report' is required.

This echoes our earlier point about integrating planning education with computer science, data analytics, GIS and a host of new disciplinary tools that would link different perspectives together but mobilise them to collaborate with local authorities to develop robust data infrastructure and digital capacity. This is no mean challenge for it not only suggests that different analytical and design thinking should be integrated through digital technologies but also that this integration should be brought to bear on planning authorities.

It suggests an obvious but much neglected idea that academia and practice should cooperate and work together everywhere; and that different elements within academia and practice would benefit from this wider sense of how different areas might be integrated.



Digital Pathways for Planners (a) The Three Pathways; (b) Deep and Broad Knowledge

(Data Source: Ritchie Somerville, 2021)

The following proposals were identified through surveys and roundtable discussions involving both practitioners and academia. They are important mechanisms to extending and deepening how planners might develop new tools for aiding their practice:

- Better measurement of planning outcomes with new data, technologies such as sensors, 3D spatial analysis and visualisations, new methods based on big data analytics, all set against a background of a good grasp of spatial geographies.

- Use of open-source software and coding languages in order to open up the 'black boxes' that exist everywhere, thus minimising the use of proprietary software.

- Further integration of digital planning tools in modules such as neighbourhood planning, Local Plans, decision support systems, and geodesign along with the development of new conceptions of agent-based modelling, set against a qualitative background based on Story Maps as well as interactive maps.

- Defining an inclusive agenda so that no social groups (e.g. older people, disabled people, etc.) are left behind in the digital planning arena.

- Working closely with PlanTech and PropTech companies to harness new digital infrastructure and emerging technologies such as weak AI and machine learning, virtual and augmented realities and new social media.

- Solving the licensing problem for much software by training a large cadre of planners to engage in opening up software and data. Providing basic digital tools for all to use without cost and alerting the profession to the power of open data and the creative commons.

What is already clear is that the basic level of digital literacy is mixed within organisations, especially when considering the wide range of individuals affected by planning interventions. Even with education, this will continue to be the case.

In the rush to progress a more digital planning system, it is important that a clear focus be maintained on the practical experience of those seeking to work within or engage at all stages of the planning process. At the risk of going over old ground which is always the case at whatever stage of the industrial revolution we care to focus on, as a profession, planning needs to ensure that it does not become a technocratic process, nor reinforce a technocratic elite.

Digitisation may risk planning becoming exclusionary by creating barriers to broader engagement and democratic discussion. Digitalisation – a transformative process enabled by digital technology is needed to support better collection of data across a wider range of issues (with a greater focus on real time) with the use of that data in a structured and less siloed way to inform planning decisions that are focused on clearly defined outcomes.

These broader problems which are important to sensitise planners to issues other than digital technologies, are also accompanied by some very key notions about more basic tools. It is no good developing a large cohort of planners who have 'plug and play' skills that enable them to produce maps in countless ways if the content is lacking.

In the move to mass education, it is even more important than it ever was to ensure that planners come equipped with good basic skills in literacy and numeracy for this enables them to have a fundamental appreciation of what makes big data, urban analytics and design methods work in practice.

The challenge of course is to develop the right blend of skills while the right context for their further development enables planners to develop the all-important role of leadership. These are so important to synthesising a wide array of technical and scientific perspectives that they need to be developed in such a way that they can be continually adapted to changing situations.

Reforming the Planning Curricula

As the Planning School survey has identified, variations in the teaching of digital skills within planning schools are quite narrow with the focus being mainly on basic desktop software particularly spreadsheets and rudimentary GIS along with other forms of visualisation technology. Building a curriculum around these software is possible but it is hardly sufficient to generate the kinds of digital skill that are needed in practice.

The range of software needs to be much wider, and it needs to be linked to basic theories about how the city system and the planning system function. You cannot build good models unless you have good theory in the first place. Unless the curricula is linked in this way to theory, then it will never be more than a collection of disparate techniques. For undergraduate education, there is a need to plan and map out different skills and levels of learning conducive to digital competence and by introducing more integrative applied projects.

Given that Planning's Master's degrees are one year programmes, in theory, the curriculum can be updated very rapidly. However, the scope to introduce more advanced skills in the 12-month generic postgraduate Masters is very limited. This is partially because there are many core content and skills to be covered for RTPI accreditation. This is also exacerbated by the fact that many students come from diverse backgrounds with usually low skills in GIS and statistics. In fact, there are many university geography departments that no longer teach anything quantitative although increasingly there are pathways through such degrees that enable a student to specialise to a limited extent.

To strengthen the foundation training for those who have a keen interest, Manchester University is proposing to introduce a second postgraduate year involving more advanced applied training through real life projects and internships. This would differ from the Data Science Masters by having a strong focus on spatial planning, with data science and digital technology as tools for planning analysis and decision-making. This type of advanced Master's degree should also provide a pathway for students to apply for (1+3) ESRC studentships for the doctoral degree.

In order to attract planning students to specialise further, there have to be incentives such as good career prospects with higher earning propensity in the longer term and, more importantly, to have attractive bursaries to fund this extra year of study e.g. possibly from the government through DLUHC although mobilising the private sector is also key to such actions.

In the University of the West of England, there is ongoing discussion about what digital skills should be developed. Resourcing is a continuing issue as there are gaps within the current staff team and potential future staff may not have the skills to engage in such teaching. As with other universities, key resources might be available 'in-house' but these links need to be cultivated and it is likely that new connections and partnerships need to be made. Alongside resourcing, there is also a matter of time, particularly in postgraduate programmes where time is at a premium.

Everything has its own opportunity cost, so developing certain skills in one area adds pressure on whether something else can be delivered. Universities can provide opportunities for students to access and self-learn a variety of applications (such as through Linkedin Learning).

Many students however have to combine study with work or personal commitments and time is precious, particularly so for degree apprenticeships. There also needs to be much more discussion about how digital skills are evaluated and assessed. While students are encouraged to reflect on the various ways in which a task can be completed, and the tools available for doing so, assessment briefs typically focus on the output rather than how such outputs are produced.

There is a wider need of course to recommend the development of universal geo-coding skills in undergraduate curricula of many kinds but since the notion of pre-requisites fell off the university agenda in planning schools many years ago, most planning schools simply assume that students at the graduate level do not necessarily have any core skills of this kind. The answer of course is to introduce pre-requisites but for a variety of reasons this would be very difficult to implement, and it reduces student demand in an era where cost of education is critical to the university.

Rapidly developing and varied computer software and packages means that it is not possible to provide anything like a full coverage in any planning school's teaching curricula. It is therefore important to provide hybrid teaching of basic skills and knowledge, with live sessions on foundation literacy of digital skills and a wider range of online self-learning modules on more advanced skills and different software for those who are keen to learn.

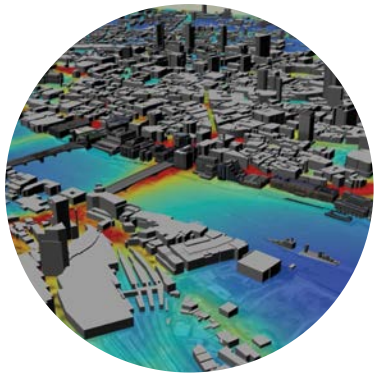
Online packages could be developed via collaborative effort between different planning schools, the RTPI and DLUHC, but this in itself is a major quest with considerable cost implications. The current teaching of GIS and other digital skills is very much dependent on whether there are lecturing staff members who possess such skills and expertise.

Many academics themselves are not competent with digital technology and lack confidence to embed it in their curriculum. However, the most effective way of learning is to embed the technology into the syllabus rather than just into one or two specific modules. Digital skills are best acquired through learning by doing but there still needs to be considerable formal study. Some learning must of course be seen as longer term rather than focusing the emphasis on degree timing.

From the perspective of the consultant, Atkins argue that a planning curriculum does not necessarily need to equip planners entering the workplace with a detailed knowledge of how to apply specific digital tools for specific situations. But they say, it will be increasingly important for students and those active in the profession to understand and be at the forefront of the development of technology and digital tools to support the wider planning system. Moreover, large consultants often have the luxury of training their own in different tools and techniques, and even funding their employees to follow part time specialist degrees in urban analytics as at UCL and Manchester. But the picture is very different for the majority of SME consultancies.

Planning academia and practice need to promote the need for strong and up-to-date digital skills, digital platforms, GIS, and the use of accredited software for planning. Upskilling needs to ensure that planners know how to use the digital tools and educate themselves about newer emerging tools.

There is a need to identify the challenges that planners are currently not able to address adequately because they do not have sufficiently developed skills or understanding of the potential of information management. And it is important to identify how much digital planning is needed to support the new digital planning agenda in the curricula of planning courses at all levels; this could include introducing specific digital planning courses and promoting PhDs and research in digital planning and systems approaches.



Capacity Building and Upskilling Planners

Planning is a highly creative profession, and it is distinguished by its primary commitment to the benefit of the public and the longer-term interests of society[5]. To fulfil this commitment, planners should be self-motivated to upgrade their own skills.

Ritchie Somerville argues that:
"… the profession needs to reframe the skills it has and how it uses them. Historically, planners were critical thinkers, and this capability has been downplayed in the work many planners are asked to perform. It should be celebrated. The balance of art and science has also been lost. We need a profession of creatives as well as technicians."

In fact, we need to go beyond this and within the creative groups, we need to include thinkers in environmental science, social science, behavioural science and in the various theories that underpin our knowledge of urban society. Digital skills are only relevant if planners are able to use them appropriately, a far cry from blind technocratic application.

The Manchester University Roundtable reinforces Somerville's sentiments when they say:
"There is a need to upskill all professional planners with the basic literacy to adapt to the new environment of digital planning. It is important to avoid the schism of having one or two specialists in the workplace while others are illiterate of the digital environment. The RTPI needs to revise its expectation of a basic level of professional competence in the light of digital planning. There is a need to redesign RTPI's own learning modules for CPD with online tests along the lines of the European Computer Driving Licence as a part of CPD etc."

There is a clear need to have more on the job training for planners, especially as the training budget of local authorities tends to be very limited for planning staff. After the shift from the former 2-year Masters programme to one-year graduate programmes, the problem is that it is unclear what continuous training these graduates receive after their degree, especially in relation to digital skills when they enter practice.

Manchester University further argues that:
"If the government is serious about pushing the digital agenda for planning, then MHCLG (now DLUHC) should fund training – online and/or in person. The development of digital training centres for local planning officers and other professionals through CPD would be a way forward. Our own experience of doing distance learning at the University of Manchester is that it requires a lot of preparation time and universities can only help to do this if there is full economic costing to allow us to employ dedicated staff to develop online training modules in a professional manner and to provide quality online support".

In terms of the capacity building of the spatial data infrastructure for planning, planning schools (together with their colleagues whose specialisms in mathematics have now made both physical, engineering and social sciences much more relevant to planning) should explore collaboration with local authorities and with consultants. The idea would be to help local authorities develop a digital strategy for spatial planning by identifying priorities to update their information systems and to look for good practice and more cost-efficient ways of doing things. Universities despite the constraints of time and cost are in a unique position to develop such initiatives. Alan Wilson, from Alan Turing Institute suggests a planning equivalent of 'teaching hospital' model, which play multiple roles in education, research and practice.

Kirsty Macari, from Dundee University has suggested that digital education in academia and practice should be supported through continuing workshops and planning data Hackathons.

There is a clear consensus on the need for upskilling planners from the key groups that the Task Force consulted. Some of their remarks are quoted here:

- From the University of the West of England Roundtable: *"There is a need to engage with business/ service providers to understand what is happening and to recognise whether certain upskilling is needed. Planners might need to know how certain things work, but it might be the case that they just need to be reassured about the quality of the outputs rather than understanding how it was generated."*

- From OpenText plc: *"… we will need to define some new roles for data specialists in all sectors, most new workers today are technically savvy, and applications are changing so rapidly that specific application courses would be quickly outdated. They need to be trained in the why and less of the how. New systems are coming online every day, so it is essential planners find a better, more efficient way of getting the answers."*

- From the RTPI General Assembly: *"Future skills for planners need to be thought about now. This will have to be differentiated by role though all planners will need to have a basic understanding of what digital may be able to help them with. We need to shift from thinking of GIS teams as the modern-day typing pool and embed these approaches across all planners' work. We need to make sure that a business need first approach is taken so as to allow planners to know how tech can help them do what they do, not planners needing to fit their work around tech … and planners (need) to lead the way, and not be lead (by digital). It is for planners to use as a resource and decide."*

- From the Local Planning Authority (LPA) Roundtable: *"New skills need to be developed, e.g. economics, user experience design, engagement, service design, data science, psychology, financial modelling, sustainability etc. to bring the profession up-to-speed."*

- From Atkins: *"Upskilling planners in both public and private sectors is important. Planning Authorities need to ensure they have the digital literacy, skills and capacity to procure and deliver the right digital tools, and the skills to use them and interrogate their outputs. It is important to ensure they are well-equipped to harness changing technologies to make informed data-driven decisions whilst being aware of their strengths and limitations. This to a great extent is dependent on funding; however there are other sources (education and CPD) that can help improve digital literacy and skills amongst planners at graduate, post graduate and when in practice at all levels."*

- From the LPA Survey: *"Introductory level training on what can be achieved would be useful. This should focus on specific processes. e.g. digital processes that could support how to undertake a Housing Land Audit/Business Land Audit, how to assess viability of development sites, etc."*

- From the LPA Survey: *"How to scenario plan by layering data and setting parameters? How to organise metadata so that the spatial data is useable and visible? What tools are available and how to access them? How to visualise data in dashboards and story maps? The list is endless."*

- From the LPA Survey: *"Everything really so that we can adapt and learn what will be best for us to work more effectively and efficiently."*

The Covid-19 pandemic has highlighted the importance of urban resilience, as well as the potentials of digitalisation. The establishment of a digitally enabled spatial planning is key to ensure the profession has state-of-the-art and robust skills to be able to plan the future which we must assume will forever remain an uncertain one.

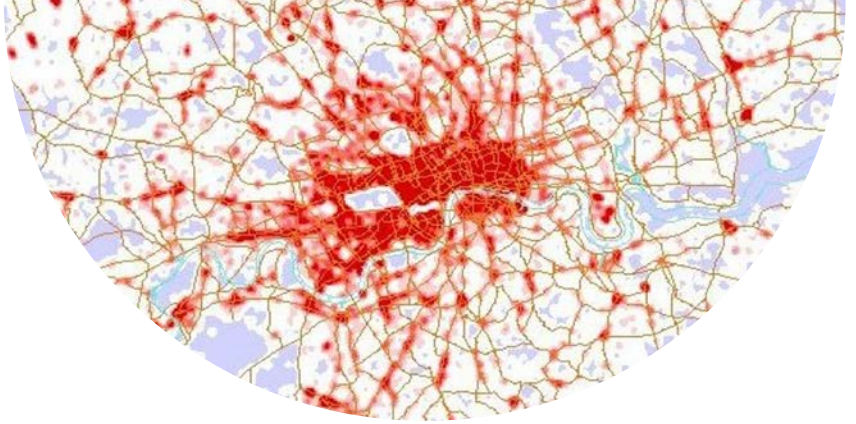
Recommendation 8:

Developing a National Cross-Departmental Strategy for Digital Planning

To achieve a joined up environmental and levelling up agenda, the Government should develop a national cross-departmental strategy to deliver the digital future for planning – its cultural change and service transformations required, as well as new skills and training needed for planners.

The scope of the strategy can learn from other professions, for example the NHS' *The Topol Review - Preparing the Healthcare Workforce to Deliver the Digital Future* (2019). Recommendations need to be costed to estimate the amount of funding required to upskill the profession and to provide adequate capacity against the social, economic and environmental benefit.

A useful reference is to compare our call for such a strategy to the *Schuster Report* presented to Parliament in 1950. Schuster noted the synthetic and integrative skills that planners brought to bear on plan making and the control of development but also acknowledged that there were many aspects of planning that require deeper domain knowledge. This has continued to tax the profession, but the digital transformation has heightened our awareness of the problem of building a technically competent but political astute profession that requires a synoptic view for the wider public interest.



Chapter Seven

Conclusion: Implementing a Shared Vision for Future Planning

This report presents a collective vision for a digital future for planning – not only from planners, but also from a spectrum of like-minded built and natural environment professionals – as they believe at this crucial moment in human history, we have to work beyond professional and political boundaries to tackle multifaceted grand challenges collaboratively.

In fact, the report is not about the planning profession itself. It is about reinvigorating the profession, about recreating a reimagined planning profession – a profession that can coordinate the best knowledge and advance the most appropriate digital tools and technologies from related disciplines so that we can achieve a shared vision and to create a better future for everyone.

Although the report is about 'Digital Integration' or 'Digitalisation' in planning, there is no intention to impose a techno-centric approach; rather we want to empower planners and communities to have the capacity, motivation and opportunity[1] to be proactively engaged in shaping the future of the planning in developing our living environment in the best possible and most sustainable ways.

Digitalisation through its efforts to modernise and transform will not be successful unless behavioural changes occur in parallel at the same time. From our report, further work exploring how tackling the grand challenges suggests that behavioural change should focus on diagnosing who and what behaviours we need to influence. Then interventions can be used to change behaviours by means of education, persuasion, incentivisation, training, enablement, modelling, and environmental restructuring. This list of changes is long. Strategic levers can then also be identified to make sure interventions have the best chance of spreading and sticking.

For the long-term benefit of the future planning profession, the RTPI needs to play a key role in forging an ecosystem between planning research, practice, education, and lifelong learning to harness the state-of-the-art knowledge generated within and beyond the profession[2].

This report calls for a consensus between all who have an interest in developing more sustainable places which embrace the grand challenges that we currently face. We must act urgently to grasp this opportunity presented by the digital future for spatial planning. The Task Force urges the Government and the profession in its widest sense to take the necessary steps to develop a cross-department national strategy to implement the digital future for planning.

Case Study 20

Using Behavioural Science to Transform Energy Policy in Wales

See Page 134

Summary of Recommendations

Recommendation 1: Recognising the Vital Role of Spatial Planning as an Important Applied Science Discipline and the Potentials of Its Digital Transformation to Tackle the Grand Challenges

There is an urgent need to formally re-establish the vital connection between the activity of spatial planning and the planning profession as an important applied science discipline in delivering systems approaches which tackle the grand challenges posed by climate change, biodiversity decline, public health, social inequality, aging, polarised economic growth and so on. This is deeply woven into the digital transformation and the role of planning in representing physical and social development needs to be acknowledged through key national and international statutory and advisory bodies: the UK Committee for Climate Change, the UK Council for Science and Technology, the National Infrastructure Commission and equivalent agencies empowered to bring a nation-wide systems approach to tackle the severe challenges we face.

Recommendation 2: Establishing a Chief Spatial Planning Officer Role in the Cabinet Office

Many of the central government's key policies are connected to spatial planning issues. A stronger presence in spatial planning at the top levels of policy advice can be achieved by introducing this role. We recommend a Chief Spatial Planning Officer sits alongside the Chief Scientific Adviser & Chief Medical Officer in the Cabinet Office to advise government on the integrated spatial implications of climate mitigation and adaptation, local and regional economic growth, levelling-up, housing, infrastructure, land use, transport, and built and natural environment actions and policies.

Recommendation 3: Implementing an Integrated Digitally Enabled Spatial Planning Methodology

The new cyclic methodology for a digitally enabled approach to spatial planning is required which connects the decision-making loop with the evidence analytics loop. The methodology involves a revolution in plan-making enabled by digital technology, shared data, and multi-disciplinary collaboration. A holistic approach is required to drive, support and resource such a revolutionary change. This new methodology could bring transformative changes on how the country can deliver the net zero targets in carbon emission, nature restoration, levelling-up and the agenda for the circular economy. We see this as being developed by mobilising currently largely separate themes which need to be integrated across different agencies and academia for their successful implementation in planning practice.

Recommendation 4: Establishing a Central Resource and Delivery Body to Empower Cross-Sector Innovation, and to Develop and Implement Digital Planning

As part of the joined up environmental and levelling up agenda, a central resource and delivery body should be established to lead the implementation of digital planning methodology, coordinate the development of planning metadata and information management standards, share best-practice, facilitate exchange and collaboration, and identify training and research needs. It should be organised as a new form of academic/government/practice partnership that allows the business case for a rapid transition to a more digitally enabled system.

The body will provide leadership in integrating innovative visualisation, public participation, data analytics, artificial intelligence, and digital twinning in planning, and the challenges and opportunities they afford government, planning authorities, and planning professionals operating on all levels.

The body will be responsible for setting up a national network of regional data observatories linked to relevant organisations and local authorities. It will engage the public through the national network which will facilitate better understanding of planning in resolving comprehensive challenges. Some of this organisational infrastructure already exists and provides a sound basis on which to build.

Recommendation 5: Creating a Comprehensive Mapping System, a Common Spatial Data Environment, and a Basic Set of Analytic Functions Tailored to Plan-Making

To enable the new methodology, the priority is to develop a comprehensive dataset across environmental, social and economic spectra for the whole UK. This requires a common mapping system and a national planning data environment with agreed standards applicable to all four countries in the UK so that it is able address the challenges of climate change and biodiversity. The organisations are in place to do this and much of the data is there but joined-up thinking is required as well as the standards and infrastructure to deliver this to planning authorities and developers.

The common spatial data environment functions as a planning data library, in which the information needs to be in a form that is accessible and understandable to planners, decision makers and the public. As a national agency, Ordnance Survey (OS) has the benefits of scale. It can be done across the country to ensure consistency and reduce cost. OS could potentially provide services that ensure all data is accessible, deal with licensing problems, and back office work support to help integrate data based on spatial planning needs. So planners do not need to worry about data problems, and can focus on generating new insights.

A directory of data available is required to list what data is discoverable, as well as mechanisms for enabling future data to be added in the future. Within this recommendation, several tasks need to be pursued:

Task 1: Identifying Baseline Data

There is a need to scope and agree core and "good" data for plan making and the analysis of digital sources, identifying the baseline data required for decision making across the board, and setting out a programme to deliver it. Emerging requirements such as biodiversity net gain, environmental net gain etc, are vital so that we have the baseline data against which they can be measured. This needs to be input and verified from the local level, while being managed and monitored at the national level in an open and transparent way.

Task 2: Defining Consistent Spatial Data Standards for Planning

Spatial information is complex and the need to establish consistent spatial data standards forms an urgent task. Data standards need to be established across the whole UK along with quality assurance standards. A common standard and approach to data collection, management and exchange for planning needs to be defined and used across all levels of planning. INSPIRE (in the EU) and the OS are working on such spatial data standards and the UK Data Standards Authority is already establishing standards to make it easier and more effective to share and use data across government. This exercise needs to be focused on spatial planning requirements.

Task 3: Reviewing Data Licensing, Security, and Confidentiality Requirements

Government leadership is required to resolve licensing and information sharing requirements. Using the 'public data for the public good' principle and the General Data Protection Regulation (GDPR) would need to be reviewed and updated to enable essential data to be incorporated into evidence-based spatial planning, and at the same time, removing many different tools for surveillance of the public.

Task 4: Establishing Common Datasets and Improved Monitoring

To define the 'Planners Information Requirements' through the lifecycle of development, real-time digital data feedback loops that support continuous review of spatial and strategic plans is essential. This should take account of all transport modes and mobilities, environmental management, infrastructure and utility information, and more qualitative outcomes such as quality of life and health.

Consideration needs to be given to how tracking of data related to built assets could be surfaced from existing sources of development in the construction industry, using Digital Twins, BIM and associated digital construction software products. Tracking and reporting of this data through the creation of 'Planners Information Requirements' that could be fed into the capital delivery stages would be analogous to requirements fed in from operations and facility management experts. Much of the new data that is being acquired through real time streaming opens the door to Local Planning Authorities having a much more central role in the development of smart city technologies.

The concept of Planners Information Requirements would be the first step towards a real understanding of what data needs to be unlocked as well as what data, further down the life cycle of development is relevant and should be harnessed for better plan making and planning decisions.

The growing interest in creating Digital Twins of assets, infrastructure, and ultimately for whole authorities and towns/cities could create a more progressive framework to support the digitalisation of plan-making at all scales. This would include moving from periodic review, based on detailed time-specific technical studies to more real-time activities organised in continuous form. While an exciting prospect, this step-change in process and data management will create new challenges for those responsible for maintaining the integrity of data.

Task 5: Developing Analytical Tools and Models for Enabling Better Local and Strategic Planning

New methods of integrated forecasting based on new datasets derived from much more frequent monitoring of land use change would enable planners to have much greater understanding of patterns of urban development, thus avoiding increasing segregation and congestion, and enabling more sustainable development to take place.

Planning needs digital tools to effectively monitor what is being implemented and these tools should be compatible with different back-office systems and scalable/transferable to other local authorities, based on nationally applicable data standards. This task can be built on existing advances and data initiatives–such as Greater Manchester Data Hub, and the London Development Database.

Recommendation 6: Establishing a Chief Spatial Planning Officer Role in Every Local Authority

Local Government requires stronger leadership in planning, and we believe the role of a Chief Spatial Planning Officer should be restored as part of each local authority's Executive Team. This position would integrate the spatial development and implementation of corporate strategy (including net zero carbon targets, climate adaptation and mitigation strategies, local nature recovery strategies etc.), land use and transport planning, while overseeing the Council's data infrastructure and technologies insofar as they pertain to property, land, transport and amenities. The RTPI has also campaigned for a Chief Planning Officer in every local authority.

Recommendation 7: Investing in Digital Planning and Forging an Ecosystem between Planning Research, Practice, Education, and Lifelong Learning

Additional and more flexible long-term funding opportunities for research, training and education programmes need to be mandated by government to broaden the digital skills and capacity of the planning profession, thus creating an ecosystem between academia and practice, as is standard in the medical profession.

There is an urgent need to provide essential digital training for all planners. More bursaries to fund planning education, especially one extra year of Master's degree study on digital or other specialised skills should be provided.

Recommendation 8: Developing a National Cross-Departmental Strategy for Digital Planning

To achieve a joined up environmental and levelling up agenda, the Government should develop a national cross-departmental strategy to deliver the digital future for planning – its cultural change and service transformations required, as well as new skills and training needed for planners.

The scope of the strategy can learn from other professions, for example the NHS' *The Topol Review - Preparing the Healthcare Workforce to Deliver the Digital Future* (2019). Recommendations need to be costed to estimate the amount of funding required to upskill the profession and to provide adequate capacity against the social, economic and environmental benefit.

A useful reference is to compare our call for such a strategy to the 'Schuster Report' presented to Parliament in 1950. Schuster noted the synthetic and integrative skills that planners brought to bear on plan making and the control of development but also acknowledged that there were many aspects of planning that require deeper domain knowledge. This has continued to tax the profession, but the digital transformation has heightened our awareness of the problem of building a technically competent but political astute profession that requires a synoptic view for the wider public interest.


Harmsworth Quays

APPENDICES

APPX1: Contributors to the Report

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Panel Members

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The Royal Town Planning Institute (RTPI), RTPI General Assembly Members, RTPI Policy Practice and Research Committee, RTPI Education and Lifelong Learning Committee, RTPI Young Planner Chairs Panel, RTPI South West Region, RTPI London Region, Planning Schools Forum, Planning Officers Society (POS), Planning Officers Society Minerals Planning Forum, BAME Planners Network, Neurodiversity in Planning Group, Women in Planning, Centre for Digital Built Britain, Ordnance Survey Rapid Prototyping Team, Centre for Advanced Spatial Analysis (CASA), The Bartlett Faculty of the Built Environment UCL, Wei Yang & Partners.

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One to one meetings with the Co-Chairs (based on the meeting order):

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Women in Planning; Claire Daniel, UNSW Sydney, Australia; Sarah Chilcott, Planning Portal; Richard Greaves, Essex County Council / POS Minerals Planning Forum; Stefan Webb, FutureGov; Jennifer Schooling, Li Wan, Timea Nochta, Centre for Smart Infrastructure and Construction, Cambridge University; Mark Enzer, Centre for Digital Built Britain; Catherine Young, Holger Kessler, Callum Irving, Geo-spatial Commission; Sue James, Edge, Trees and Design Action Group; Donna Lyndsay, Ordnance Survey; Philip Steadman, Energy Institute, UCL; Liz Pringle, David Hall, Tania Watson, Alastair Mitchell, Scottish Government; Rachel Fisher, Rachael Antwis, DEFRA; Grace Manning-Marsh, LandTech; Neale Blair, Planning Schools Forum / Ulster University; Nick Smith, UWE Bristol; Tony Crook, University of Sheffield; Susan Michie, Paul Chadwick, Centre for Behaviour Change, UCL; Lucy Kennedy, Spottitt; Sue Pritchard, Food, Farming and Countryside Commission; Rebecca Miller, Tim Binding, Plymouth City Council; Ying Jin, The Martin Centre, Cambridge University; Michael Chang, Public Health England; Adele Maher, Nick Parlantzas, OxCam Arc Project, MHCLG (now DLUHC); Helen Dias, Michael Glasgow, Joanne Farrar, Stefanie Hedgman, Tim Pearce, Viral Desai, Teresa Gonzalez Rico, Geoff Waite, Fiona Wilson, Sarah Doughty, Will Squires, Atkins; Alex Rainbow, Cornwall Council; Cliff Hague, Heriot-Watt University.

Participants of Local Planning Authority Survey

Merthyr Tydfil County Borough Council; Wrexham County Borough Council; City of Bradford Metropolitan District Council; Ceredigion County Council; Ards & North Down Borough Council; Inverclyde Council; Fife Council; Glasgow City Council; Belfast City Council; West Lothian Council; Broads Authority; Watford Borough Council; London Borough of Ealing; Leeds City Council; Denbighshire County Council; Cherwell District Council; Buckinghamshire Council; Gateshead Council; London Borough of Havering; East Sussex County Council; Wiltshire Council; South Oxfordshire and Vale of White Horse District Councils; East Ayrshire Council; Leeds City Council; Plymouth City Council; St Albans City and District Council; Dundee City Council; North Lanarkshire Council; Loch Lomond & The Trossachs National Park Authority; Rhondda Cynon Taf County Borough Council; Colchester Borough Council; East Riding of Yorkshire Council; Ipswich Borough Council.

Participants of Planning School Survey

University of Manchester; Birmingham City University; University of Plymouth; University College London; Ulster University; University of Cape Town; UWE Bristol; University of Westminster; Oxford Brookes University; University of Liverpool.

Participants of Roundtable Discussions

Natural Environment Roundtable

Michael Batty and Wei Yang (Co-Chairs); Sue James, Trees and Design Action Group (TDAG) & Edge; Donna Lyndsay / Charles Draper / Rebecca Taylor, Ordnance Survey; Patrick Gray, British Geological Survey; Richard Benwell, Wildlife and Countryside Link; Jennifer Manuel, MHCLG (now DLUHC); Andy Ruck, DEFRA; Ellen Fay, Sustainable Soils Alliance; Alison Smith, Environmental Change Institute University of Oxford; Allan Simpson, Anglian Water; Sara Carvalho, Birmingham & Black Country Wildlife Trust; Martin Baxter, Institute of Environmental Management & Assessment (IEMA); Chris Talbot, Warwickshire Wildlife Trust; Andrew Canning-Trigg, Forestry Commission; Rob Humphries, Environment Agency.

Planning Authorities Roundtable

Michael Batty and Wei Yang (Co-Chairs); Donna Lyndsay, Charles Draper, Ordnance Survey; Paul Chadwick, UCL Centre for Behaviour Change; Dave Hall, Scottish Government; Jennifer Manuel, MHCLG (now DLUHC); Peter Kemp, Greater London Authority; Paul Frainer, Greater Cambridge Shared Planning; Kristen Williamson, South Downs National Park Authority; Rebecca Miller, Plymouth City Council; Angharad Williams, Mid Devon District Council; Richard Limbrick, London Borough of Camden; Sue James, Trees and Design Action Group (TDAG) and the Edge; Melda Saihab, UCL.

Planning Practice and PlanTech Roundtable

Michael Batty and Wei Yang (Co-Chairs); Donna Lyndsay / Charles Draper / Rebecca Taylor, Ordnance Survey; Lucy Kennedy, Spottitt; Helen Dias, Atkins; Atefeh Motamedi, Atkins / Neurodiversity in Planning Group; Jennifer Manuel, MHCLG (now DLUHC); Ying Jin, University of Cambridge; Grace Manning-Marsh, Land Tech; Harry Quartermain, Barton Willmore; Martina Juvara, Urban Silence; Daniel Mohamed, Urban Intelligence; Joe Welch, Urban Intelligence; Sue James, Trees and Design Action Group (TDAG) and the Edge; Melda Saihab, UCL.

Healthier Place Making & Digital Planning Roundtable

Michael Batty and Wei Yang (Co-Chairs); Erin Walsh / Natalie Record, Connected Places Catapult; Jennifer Manuel, MHCLG (now DLUHC); Michael Chang, Public Health England; Julia Thrift, TCPA; Niiashie Adjaye, Walulel; Christina Victor, Brunel University; Rebecca Miller / Tim Binding, Plymouth City Council; Sue James, Trees and Design Action Group (TDAG) & Edge; Tony Mulhall, RICS; Shari McDavid, Mental Health Foundation; Melda Salhab, UCL.

UWE Bristol Digital Planning Roundtable

UWE Bristol (staff): Nick Smith (Chair), Chris Newton, Justin Robbins, Emma Matthews, Rebecca Windemer; UWE Bristol (student): Valery Steinberg, Catherine Huberson-Abie, April Valle, Raphaella Da Silva; Practitioners: Matthew Montagu-Pollock, Braden Stonehouse, Charlotte Bowen (VU.City), Peter Thompson (Origin3), Sara Dilmamode (Citiesmode Planning).

Management University Spatial Policy & Analysis Lab Roundtable

Cecilia Wong (Chair), Ransford Antwi Acheampong, Richard Kingston, Caglar Koksal, Nuno Pinto, Andreas Schulze Bäing, Wei Zheng.

Education, International and Planning Practitioner Early Career Roundtables

Cecilia Wong and Kirsty Macari (Co-Chairs), Joshua Speedie, Callum O'Connor, Rebecca Weston, Ryan Walker, Adam Trafford, Martin Fleishman, Sam Berry, Tim Sanders, Liam Curran, Justin McHenry, Chun Ho Chow, Annamaria Squeglia, James Dodds, Georgia Peters, Ruth Potts, Brian Webb, Nuno Pinto;

Jennifer Offord, Keeley Mitchell, Atefeh Motamedi, Charlotte Morphet **Neurodiversity in Planning & Women in Planning**; Owain Evans, Rory Garside, Katharine Forbes, Robert Blake, **Cardiff University**; Fola Olaleye, **UCL**; Kate Spalding, Alison Flood, Martin Walker, Ivan Brown, Sarah Crowe, Sarah Christie, Freya Macleod, Niamh Brownlie, **University of Dundee**; Tim Walters, Ted Blackmore, Megan Beattie, Carlos Gonzalez-Martos, **University of Manchester**; Leonia Ratajczak, **University of Ulster**.

Participants of the **North Devon Roundtable, GLA Local Planning Authority Roundtable** (Chaired by Peter Kemp); **GLA Private Sector Digital Planning Roundtable** (Chaired by Charlotte Orrell).

The World Deserves a Reimagined Planning Profession in the Digital Era

Wei Yang[a]

"It is vital that we recognise spatial planning as an important applied science discipline, which interconnects social, environmental, and behavioural science."

A Shared Sense of Purpose

In a recent 'Generation Z' survey[1] carried out by Amnesty International, climate change ranks the highest as the most important issue facing the world amongst 18-25 year olds. Together with the pandemic, the climate and biodiversity crises are the most direct threats to the survival of humanity. Our future prosperity, our health and well-being aspirations are dependent on whether those urgent crises can be tackled.

During the Digital Task Force consultation, several colleagues reminded us that planning system is an intensely political activity. But I first want to argue that in order to tackle the grand challenges of our times, we need a joint vision to work towards a Universal Common Good – net zero carbon emissions, natural capital net gain, a circular economy, and social inclusion. I hope nobody would disagree with these principles and the goals set out in the UN SDGs. I believe it is time for the planning profession to take a leadership role in forging a common and collaborative sense of purpose with other good forces in the wider society.

Reimagining Spatial Planning as an Applied Science Discipline

It is vital that we recognise spatial planning as an important applied science discipline, which interconnects social, environmental, and behavioural science. Spatial planning synthesises a variety of perspectives and approaches and is the glue that binds built and natural environment expertise together to make the world a better place in public interest. Every one of these disciplines has something to contribute to planning but it is beyond the capacity of any one of them to subsume. Spatial planning is a pivotal discipline to deliver a place-based systems approach to achieve zero carbon, to formulate a harmony with nature, to create healthy and beautiful places, and to bring the best out of people in contributing to a circular economy and an inclusive society.

In summer 2021, the Prime Minister set out plans to realise and maximise the opportunities of scientific and technological breakthroughs[2] to ensure the UK's world-leading science and ideas transform into solutions for public good. The National Science and Technology Council, formed and chaired by the Prime Minister, has a remit is "to provide strategic direction on the use of science and technology as the tools to tackle great societal challenges, level up across the country and boost prosperity around the world" – a set of targets identical to what spatial planning needs to achieve. The government is currently investing £14.9 billion in R&D in 2021-22. In the 2021 Chancellor's Autumn Budget, science and innovation have been given a central role with a commitment to significantly increasing funding to £20 billion by 2024/25[3]. I believe enormous potentials can be unlocked if spatial planning can be invested as an applied science discipline of national significance.

a **Wei Yang** is Chair of Wei Yang & Partners and an Honorary Professor at University College London. She was President of the Royal Town Planning Institute for 2021.

Spatial Planning Empowered by Digital Revolution

The greatest innovation needed in spatial planning is a whole approach change enabled by digital technologies and big data. In the last two decades, advances in data and digital technology have become deeply embedded within our daily lives. E-commerce giants have transformed the commercial regime. Their success comes from creating revolutionary data-driven supply-chain systems with the ability to provide customer-adaptive products. However, the digital revolution seems to have by-passed spatial planning. Digital integration has been slow and has happened in a piece-meal manner. In mainstream planning practice, there is little cross-disciplinary breakthrough and big data has not benefitted the understanding of community needs and how our cities, towns and villages need to function as much as it could.

Digital revolution in planning needs to start from how we work with each other, how we share our data and knowledge, and how we communicate with citizens. Some stakeholders attended Task Force roundtable discussions have expressed their similar views.

- ***"There needs to be a concerted effort to link departments through cross-cutting themes and planners are one of most pivotal professions in achieving this. This should be a major aim of the profession."***

- ***"Planning needs to be dynamic in that it focuses on future visions within a wider public-political discussion. Digital planning could be a key route to prepare for this future – real time data analytics would be important to keep the profession relevant for future."***

- ***"Planners are one of the main conduits for research to come into practice and to support it, we need to understand the data they need and how it gets used."***

- ***"Planners need to take a leadership role and know where they are going…driving the car and holding the map with support from data scientists who can contribute to designing the car and data technicians who can mend it."***

Developing Digital Skills and Capacities

The digital revolution in planning needs to be led by planners, as digital technology can enable planners to do things which they do not have capacity to do before, but the planner's role can never be replaced with automated procedures for resolving problems of the kind that planners face. In January 2021, I asked RTPI General Assembly members to identify the profession's key transferable skills – a set of comprehensive skills including visioning, analytical skills, problem solving skills, engagement, negotiation & presentation skills, spatial skills, and management skills were identified. The soft skills and empathy (unique to human beings) are fundamental qualities of the profession's skillsets. Planners do not need to be expert at everything but being digitally enabled would allow them to link their unique place-based skillset with other professions' expertise to facilitate democratic and evidence-based decision-making process.

This decade, the 2020's, is a crucial time for the future survival of humanity. The UN Environment Programme has recognised planning as a popular profession for young people seeking 'green jobs'[4]. The Planning profession, together with Architecture, has been regarded as the second of the top 10 occupations for sustainability[5]. The Planning profession must take its professional responsibility seriously and be proactive to modernise itself.

"Digitally enabled spatial planning should have the power to break departmental and professional silos. It can be a transformative solution to coordinate the efforts from all good forces to achieve a Universal Common Good."

The RTPI General Assembly (2021) identified leadership skills, digital and data analytic skills, multidisciplinary skills, public/private cooperation and social media skills as key future skills which planners should have. It is consistent with a broad analysis in the industry – ***The State of the Profession Report 2020*** has identified that Data Analysis is the fastest rising core skills shared amongst sustainability professionals, with statistically significant year-on-year growth of 18%. There is an urgent need for the planning profession to develop adequate digital skills and capacities, to ensure it is future proofed to cultivate interdisciplinary leaders and enablers, and to continually attract talent from future generations.

All in all, the world deserves a reimagined planning profession in the digital era. Digitally enabled spatial planning should have the power to break departmental and professional silos. It can be a transformative solution to coordinate the efforts from all good forces to achieve a Universal Common Good.

APPX2: Visions and Reflections – 2

The All-Pervasive Impacts of the Digital Transformation

Michael Batty[b]

"This is especially germane to the crisis facing how we develop a much stronger and robust physical planning system based on the best data, methods and practices."

Computers were primarily invented to speed up the processing of numerical data, initially for scientific calculations and then for transactions processing in business. But right at the beginning, in the middle of the last century, their progenitors, people like Alan Turing and John von Neumann, saw they could be adapted to processing anything that could be represented with a binary logic. Since then, pictures, words, sounds, and of course every kind of number are the subject of computers and the claim that they are 'universal machines' is now widely accepted.

This insight took a long time to become established and it depended primarily on two forces that emerged in parallel. First miniaturisation of the binary logic in the hardware of the transistor based on new materials of silicon meant that computers have become smaller and smaller and faster and faster with no end in sight[6]; and second linking computers together in network after network so they might share data and software with the Internet and the web have mushroomed, so that at the present time essentially anyone or anything can link to anyone or anything else. Although this network of networks was first devised in the late 1960s, it also took more than 30 years for it to become all pervasive with much traditional media and data ported to and becoming accessible through web sites.

Digital computation has gone through several revolutions, focusing on the miniaturisation of hardware and thence on its software becoming ever more significant and expensive relative to hardware, and now with entire organisational structures being developed around computation. Platforms underpinned by the web are being quickly developed in which the 'cloud' represents the environment associated with remote memory storage and computation with hand-held devices being used to access these digital resources.

At this time, the digital revolution can be seen as evolving from relatively independent computers although networked, to organisational and institutional structures built around the internet which deliver a massive array of resources over countless activities traditionally accessed manually. The invention of the smart phone, with the launch of the iPhone in 2007, marks a clear divide but the revolution is continuing apace and the pandemic has really forced the pace with respect to the use of automated services. Moreover, the emergence of 'Big Tech' is distorting our national economies in ways that are generating new digital divides[7] with respect to applications and usage. This is especially germane to the crisis facing how we develop a much stronger and robust physical planning system based on the best data, methods and practices.

As soon as computers moved out of the scientific lab into the wider world of government and business, forecasting tools and data systems were developed for a variety of strategic planning purposes. These formed part of the

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systems approach which influenced planning for a brief interlude in the 1960s. Once the personal computer (PC) emerged as computers scaled down to the desktop, more routine applications using data-base systems such as spreadsheets were developed. During the 1980s and 1990s, significant advances in geographic information systems (GIS) and the analysis of spatial data were made and this was extended into 3-dimensional models of cities that supported local planning and urban design. Area-wide urban information systems were also developed and the notion of building information infrastructure for developing methods, analysis and forecasting came onto the agenda.

To an extent, by the end of the century the focus of computers in planning was still organised around methods, tools, and techniques which individual planners could mobilise for some of their activities in development planning and control. The take-up in planning, in fact, had always been slow and where such tools were developed, these tended to be in consulting, in NGOs, think-tanks and increasingly in business. Most of this expertise now resides in professions other than planning which is a deep-seated problem.

In the last decade and certainly during the pandemic, the widespread use of computers in all kinds of problem solving and policy analysis has accelerated. Moreover, the rise of social media, big data based on real time streaming from sensors embedded in the built environment as well as from mobile sensing with respect to our smart phones has changed the nature of the data that we have at our disposal. This has heralded a much stronger focus on how the city is reacting to shorter and shorter temporal change. The 24 hour city, the 15 minute city, the focus on short term disruption, and the impacts of rapid cascades in housing as well as in other markets have crept onto the agenda of the so-called 'smart city'. New models and techniques building on these perspectives have emerged but there is little synergy with the traditional physical planning system. Transportation, for example, which is strongly reflective of such short term change is almost entirely absent from local plans and related policies. Much of planning within local authorities now focuses on housing in the most reactive way, relating to where it might be located while its status as a capital asset is now so deeply ingrained in the prevailing wisdom of planning that many other goals pertaining to the grand challenges are often forgotten or at least downplayed.

There is however a much more significant trend emerging through the digital transformation. Increasingly hardware is no longer a problem but software is fragmenting into smaller and more diverse components that can be assembled in modular fashion to look at a multitude of problems that previously could not be easily handled. However to mobilise such technologies requires expertise and there is a massive gap in the education for planners that simply does not recognise that anything other than a bare awareness of these skills are the keys to the future.

These tools are increasingly part and parcel of the skills of data science which are now the focus of the many platform-like economies that are exercising such profound effects on the structure of the global economy. In 1950, when planning was in its infancy, the Schuster Report[8] of the Committee on *Quaifications of Planners* argued that a diversity of skills should be reflected in planning education. It is clear that a new Schuster Report is well overdue.

The biggest platform companies essentially develop services through software that brings together consumers and producers who interact through online market places that these platforms make possible. In terms of planning, new forms of service delivery and passenger transport through companies such as ***Uber*** and residential accommodation through ***Airbnb*** are changing the nature of land use and transport in cities. In fact increasingly these companies are having an enormous impact on location and land use, and increasingly planning should grasp the meaning of these changes while responding to them appropriately.

In short, knowledge of individual digital tools is not the issue although these should be grasped much more thoroughly by planners – but it is the wider implications of digital infrastructure that is changing the nature of our cities and potentially the way we should respond to them. Because so much of the digital transformation is hidden from us, we consider there is an urgent task in hand to reskill and upskill planners not only in the basic tools of the earlier digital revolution but in the impact of new organisational forms for urban functions in cities associated with the development of platform economies[9].

In the next decade as the networked world builds deeper foundations, information platforms are likely to emerge at all scales, and as part of this, national systems for planning might well emerge despite the need for local action and reactions. We should be prepared for a debate where government and science policy push the quest for national consistency especially in standardised procedures to activities such as planning.

APPX2: Visions and Reflections – 3

Economics and Digital Planning

Bridget Rosewell[c]

There is one obvious aspect to this, and several which are more wide-ranging. The obvious is the effect of digitalisation on efficiency.

Digitalisation of materials reduces cost, saves resources, and facilitates distribution. This aids efficiency, although it must also be admitted that digitalisation equally facilitates more editing and more drafting and so it does not always feel that way.

On balance, however, there must be a benefit in cost terms.

The more important question, however, is how economic thinking can be better applied, or indeed applied at all, where digitalisation has occurred. There are three themes here: one is considering alternatives, one is flexibility over time in evaluating need, and the third is dynamics.

"We face a world in which the past is not going to be good guide. Climate change, the imperative of net zero, and the pace at which change must happen all require us to think differently about our plans. More than ever, a plan is unlikely to survive contact with reality."

Considering Alternative Appraisals

Economic viability is often a secondary consideration in any plan, mediated through housing need and employment land studies which offer only one potential future. Only in large planning applications is it considered worthwhile to commission an economic viability report, which can struggle with pre-determined features. For example, a proposal for a racecourse in the Green Belt near London faltered in the face of an innovative and impressive design for a stand which could never have created any payback.

Digitalisation offers the prospect, both in creating a local plan and in developing specific applications, of being able to look at alternatives. A more digitalised system can be more flexible, and produce visualisations of alternatives quickly. These can then be compared across many dimensions including the financial.

Twenty years ago, such comparisons required manual entries into spreadsheets and quickly got bogged down in the detail of areas, physical constraints and so on. I vividly remember a project which had been worked on for over a year before the likely rent got put into the equations – it was just too difficult.

c **Bridget Rosewell** is Commissioner for the National Infrastructure Commission and Chair of the Independent Review into Planning Appeal Inquiries.

Flexing the Plan

A second element is flexibility. As well as looking at alternatives, planning could begin to address optionality over time. Instead of one masterplan which requires permission every time circumstances change, it should be possible to allow for mixes of types to be permitted within a range. Economic analysis, alongside other disciplines can help value the potential for ranges of uses to be defined. This has been done at least once but in pre-digital times, and it took a lot of work and a lot of spreadsheet manipulation. In delivering the first planning permission for the station and associated development at Ebbsfleet, we looked at flexing between business, leisure and residential development within an overall envelope and with minima and maxima for each type of use.

Flexibility over time also requires a different approach to the appraisal of need. The cottage industry of housing and employment need assessments can become, in a digital age, more flexible to evolution over time and less ruled by linear forecasts from past data. That means of course more room for judgement and consideration of how the future might be different from the past.

"Digitalisation allows us to think more dynamically than previously."

Getting Dynamic

Finally, we should talk about cost-benefit analysis. This concept is at the heart of how planning and economics come together, but digitalisation allows us to think more dynamically than previously. Classically, cost-benefit ratios take an estimate of costs and set it against a monetised estimates of benefits over a given time period, then discounting the future at an agreed rate. How to do this is set out in the government's Green Book. It is a point in time estimate, which separates benefits into categories and values them in monetary terms as far as possible, including such elements as the price of noise impacts, of time saved or lost and so on.

It is a pity that this exercise has come to dominate the appraisal of large projects – indeed its first outing was the appraisal of the site for a third London airport in the late 1960s. It is a pity because if there is a realistic application of such analysis, it is for smaller projects where it is possible to hold enough variables/factors constant that such a fixed appraisal might make sense. In larger projects, there are feedbacks and behavioural impacts which cannot effectively be captured and set against costs which are themselves uncertain at the outset.

Digitalisation allows for these dynamics to be considered and included. It can capture how costs are changing and how this relates to the deliverables of the project. It also allows for visualisation which in turn permits better consideration of behavioural impacts and user reactions. The kind of plans that are often presented are birds' eye views. What will this look like from a user's point of view? How will it feel to push a buggy or ride a bicycle? What about green space, seating, cafes? Visualisation allows improved thinking about how benefits might arise, and what their value might be. For example, in looking at the relocation of a bus station the standard rules, say, is that walking further to the bus is a huge disbenefit. However, it is possible that a slightly longer walk in more pleasant surroundings, with a café and a dry cleaners on the way would provide ways of managing life which would change behaviours over time and create a more successful place. This is ruled out by standard analysis and the bus station still spoils the entrance to Victoria station. Without effective visualisation it was impossible to test the proposition that a small time disbenefit could be compensated for in other ways, including better footfall and income for retailers, let alone air quality and dwell times.

Conclusion

We face a world in which the past is not going to be good guide. Climate change, the imperative of net zero, and the pace at which change must happen all require us to think differently about our plans. More than ever, a plan is unlikely to survive contact with reality.

Economics does not have a good record in thinking beyond the use of past data, but economic thinking can help in considering broadly costs, benefits, how time can impact choice and alter impacts. The availability of more real time data from digital sources, and the ability to model options, stress test outcomes and include judgements on matters not so susceptible to monetisation (good design, for example) should all be incorporated into our planning processes.

APPX2: Visions and Reflections – 4

Digital Planning for Effective Public Participation

Alexander Wilson[d] and Mark Tewdwr-Jones[e]

d **Alexander Wilson** is Lecturer of School of Architecture, Planning & Landscape, Newcastle University

e **Mark Tewdwr-Jones** is Bartlett Professor of Cities and Regions, Centre for Advanced Spatial Analysis, University College London

Public Engagement in Planning

Public involvement in local decision-making has been a feature of governmental processes in Western democracies for more than 50 years. It is, in fact, a diverse set of enabling mechanisms that cover both representative styles of government and participatory styles of government. Public involvement takes the form of direct elections and ballot box votes, held at periodic times to elect politicians and officials to established and policy opportunities where the public, broadly defined, are part of a set consultation process, where government is seeking the views or reactions of citizens to a new proposal, plan, strategy, or even development. These forms of involvement, elections and consultations, are a feature of representative democracies.

Since the 1990s, public involvement in the affairs of local government has also seen the rise of more direct forms of democracy, with enhancement of participatory opportunities. The extent of participatory democracy is dependent on a range of circumstances, including styles of government, opportunities for open democratic debate, the specific issues under consideration, and the involvement of third parties. The reasons for the rise of participatory democracy may correspond to the view that it allows for direct voices in discussion with government, or that it may reach sections of the electorate who might otherwise not become involved in consultation processes. A further feature is that the participatory exercise may include broader and more open-ended issues rather than government seeking responses to a pre-determined issue with a restrictive number of possible options.

From Consultation to Participation

Participatory democracy is not necessarily an alternative to or replacement of representative democracy. We still exercise the right to vote for local politicians every few years, and those politicians are elected on a manifesto that sets out commitments to policy change and service delivery over the following period. We hand responsibility and trust to our elected politicians to represent our interests and take action on our behalf. We still have the right to be consulted on matters from time to time, whether that is in relation to economic development, housing, transport or other activities. Sometimes, and only in certain countries, this also involves the opportunity to cast your vote in referendums on set propositions. All of these options are part of representative democracy. And a hallmark of urban planning is that it has built-in consultation mechanisms into set governmental processes that allow for citizen involvement in both plan-making activities and in the determination of development proposals.

Harnessing the Digital for Better Engagement

As the use of technology has grown, planners – both in research and practice – have started to understand the opportunities presented by digital technologies in making planning more democratic, accessible, and accountable. Done well, opportunities for democratic participation in matters to do with urban and rural change can open up new ways of discussing places, capture people's lived experiences, and set in train options and debate about future visions. Digital opportunities allow those that choose to participate at times convenient to them, in interesting and novel ways, with the possibility to better understand proposed development changes and how they might be influenced and reshaped. While there are examples of where digital participation has been proved successful for meaningful engagement, the majority of digital engagement happens through poorly designed systems, usually through websites and online surveys that merely mirror non-digital options. They require participants to have a grasp of the complicated planning system and language, and do very little to open up the planning system beyond those already involved.

Planning has a lot of catching up to do. The science and technological communities have marched on, developing innovative tools. Gradually, places are being shaped perhaps more by these digital and data interventions than traditional long-term planning strategies. For example, live data streams, at a city scale, can capture levels of transportation use, air quality, pedestrian footfall in urban areas, the extent of waste that requires collecting, and the busyness of car parks. All of this data may, in theory, enable planners to take immediate decisions to manage change.

A Question of Balance between Digital and Non-Digital

The digital is not a force that can be stopped, so much is obvious from the genesis of this Task Force. So it is a matter of finding the right balance, distinctive to individual places, between accepting the onset of new technology and its impact, and a belief in maintaining a form of regulated planning. But to do that, professional planners must be responsive to at least considering the possibilities of digital technology for their work, and acknowledge the role technology is already playing in shaping planning, whether or not it is in the hands of professional planners.

Citizens can possess vital knowledge about places through their lived experiences, and are well placed to share ideas about how the complex problems of places might be overcome, providing that citizens are given appropriate ways to express their ideas and emotions. Creating participatory platforms is one issue; capturing and acting upon these presents other challenges. The premise of participation is often on a very technical and procedural system that bears little resemblance to how places are organised, how people experience places, or how they prefer to discuss them. These difficulties

"Digital opportunities allow those that choose to participate at times convenient to them, in interesting and novel ways, with the possibility to better understand proposed development changes and how they might be influenced and reshaped."

often lead to forms of consultation and technologies that are designed around these processes, rather than taking a people-first approach to engagement. As previous research has indicated, we have always known that there is broad interest in citizens being more involved in planning decision-making. Climate change is but one significant issue that continues to generate a desire to people to express their views or even do something. But there is also a need to develop opportunities that encourage and accelerate this interest, leading to meaningful insights from people that can make planning and places more democratic, more liveable, and better planned.

Features of Digital Participatory Tools

The onset of new innovative and interactive digital tools – smartphones, tablets, apps, social media, gaming and so on – are already being used extensively by the public, to vent their opinions. These alternative platforms, everything from Facebook and Twitter to Mumsnet, are often outside traditional planning consultation processes that are becoming increasingly archaic. These digital participatory planning approaches are, in reality, an amalgam of an array of tools and platforms that can be grouped under the heading "digital planning", and are quite disparate in design and form. Some are designed specifically for formal planning processes, commissioned and deployed by Local Planning Authorities. Others are innovative devices that stand aside from formal planning but are meant to enable citizen interaction and communication on wider urban change matters.

Some Critical Questions:

Can Alternative Planning Participation Technologies Encourage and Support the Sharing of Fresh Perspectives from a Wider Group of People?

Downloadable digital technologies, such as the app-based participation methods, can provide the means for more people to participate more easily, if they have access to the technology, but this appears to be more successful for here-and-now issues rather than to engage people on possible long-term place changes.

More creative and expressive activities, such as gaming devices, gives people the space and time to communicate complex ideas, of a more strategic nature, that can relate to longer time periods. These are also more visual and therefore are likely to be more accessible to a greater number of people.

For some of these, people need to have access to smartphones or computers. But some digital technologies do not rest solely on smartphone access. There are benefits of technologies that are not apps and websites that are often overlooked, namely that they can engage people who either have no access to smartphones and computers or have no interest in, or knowledge to participate through, digital means. These may be though interactive sessions, or workshops, or part offline/part digital facilitated forums.

Can Alternative Planning Participation Technologies Be Designed to Allow People to Better Share their Experiences of Place?

Traditional consultation methods restrict the means and the vocabulary (usually relying on text) to communicate complicated feelings on place. To counteract this, the role of alternative media has been explored in the hope it might allow people to better express these views on their terms. Instead of focusing on numbers of participants, there should be an increased emphasis on unearthing and exploring the barriers to meaningful engagement through planning. The focus of planning participation technology, in its broadest sense, can then seek to understand how technologies and processes can be developed to better align with how people experience and feel about future places, and whether a range of participatory methods can facilitate more communicative and expressive engagement.

What Are the Attributes of Technologies that Better Align with How People Want to Participate?

Broadening the engagement into matters of place rather than concerned with strict and narrow definitions of planning as viewed by planners and legislation, has been shown to be a particularly effective way of starting conversations about where people live. Discussing the built environment can be aided by allowing people to add additional context to their comments. One of the drivers of facilitating this communication is engaging with non-text participation, which better facilitates people describing their views about their own places.

Engaging with alternative and novel media, not usually used within planning consultation, can also drive participants' interest in engaging with the activity; however, this is unlikely to provide a long-term solution to the need to encourage enhanced participation. To achieve this, planning should engage with people by asking questions that more closely align with the concerns they have with places. This means using language and topics that reflect place experience rather than defined through policy syntax.

Communicating these questions through novel mechanisms provides an opportunity for enhanced ways for people to communicate issues, but also raises questions on how place-experiences can be translated into the narrower parameters of the planning system.

Finally, digital planning for public engagement is not singular. Having a suite of participatory methods or tools that align with how interested people are in places can also be effective. Rather than seeing technology as a single option, more engagement using different technologies with different communities in the same place, can lead to a more effective and positive response.

We have three suggestions to implement and deploy digital planning for public engagement:

- **Put Reflection First, not Technology**

  Before methods for engaging people are chosen, there is a critical step in considering what the engagement is trying to achieve. The first consideration should be about what is being engaged on – which is the best way to garner meaningful engagement – rather than about the technology that is going to be used.

- **Use Task-Appropriate Technologies**

  It is important to reflect on the task-appropriateness of different methods and digital technologies that are available, and which would best suit the task being undertaken. Different technologies lead to different outcomes (in terms of the responses they encourage). There is a crucial step here in reflecting on the design of the opportunities for engagement, and whether the format of these tools genuinely allows people to give adequate responses on their terms.

- **Employ a Range of Participatory Tools**

  Although using the internet to engage people in matters relating to physical change and planning might allow more to get involved, there should be reflection on both the type of comments that are likely to come back, and how the methods support this. It is important to recognise that engaging more people does not necessarily mean that the opportunities for engagement have been more effective: the quality of this participation should always be understood.

APPX2: Visions and Reflections – 5

Digital Empowerment of Young Planners and Young People

Kirsty Macari[f]

Changes in the use of digital technology in planning and engagement have accelerated over the last 2 years through increased remote working in response to the Covid-19 pandemic. We have experienced both digital excitement and fatigue with meetings, events, community consultations for major planning applications and local development plans and of course education, all taking place online and remote from physical connection. Is there perhaps an assumption that digital technology makes it easier for young planners to work and get ahead or in responding to attempts at engaging young people with planning? Is it expectation or reality? Recent discussions with young planners at varying stages of their career from student to early career planners and of course, educators within higher education, considered the impact of digital as we transition in response to experience and technology.

Digital forms a transaction in which we can create efficiencies in practice across the public and private sector, whilst enhancing public interest. Young planners however are indicating a greater need for standards in relation to digital literacy, data quality and investment in practical skills. They seek to take an action-forward role in their natural use of digital tools but not at the expense of in person, softer skills which are often key to progressing change for the wider public benefit. Digital empowerment for all is necessary, but how do we shift from responding to a global crisis to creating systems for the future? Our experience of digital can allow for participation but should not be the only default position. There is a long way to go in ensuring equality of access in relation to both quality and consistency of such adopted approaches.

With each local council area comes their own website, with each website comes their own approach to digital governance in planning, and from our various roundtable discussions, young planners felt that there was a need for a more national approach to how we integrate digital, creating a coherent narrative around expectation and value. There was no doubt that digitisation of policy and use of mapping layers can support a better understanding of what is needed in a local context but efforts to "digitise" can at times feel, at best, tokenistic. We need to question beyond whether it is money, time and/or skills that are needed to support the creation of a digital planning system that is at risk of being outdated before it can demonstrate successful change and embed the UK as a front runner in planning the future.

Upskilling and embedding digital education can support longer term benefit in relation to the reduction of data-driven workloads as we build a baseline of data that is robust, measurable, useful and most of all accessible. Meaningful and proportionate data collection needs to be embedded in the planning process but requires an understanding of its purpose and quality. Decisions to support social outcomes cannot be built around data but it must sit alongside citizen experience. We need to build in time and capacity for ensuring rigorous data capture and sorting. Flawed data will only create the best

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intended but wrong solutions. Data requires monitoring as does its interpretation. But with data comes a fear. A fear of privacy being lost, a fear of knowing differences between public and private data, and a need for honesty and transparency between data users and providers and perhaps most of all fear of automation. Perhaps digital can further enhance our interdisciplinary skills alongside other built environment professionals?

The use of digital technologies can support efficiencies in the public and private sector; however we must maintain a position of social and public good as the driver and not the monetisation of a system and process. By preventing monetisation, we can ensure that local communities can be a holistic part of digital planning, supporting community growth, capacity, and resilience.

A purpose of digital planning is that it can support increased diversity in the profession. There is a need to reduce the disconnect between understanding planning and how it shapes lives beyond the physical management of urban and rural environments. By embedding these needs as drivers for change rather than in response to technological advancements, the purpose of planning can be at the forefront of designing future places.

These collective views were gathered by young planners across UK and internationally. Their shared conversations, regardless of location or experience will continue to shape understanding of the needs and ambitions of digital planning. It is possible to capture steps for future discussion in three distinct early positions shared by young planners:

- The use of digital technologies is part of the transactional process and not the solution.
- Accessibility, quality, and equality are necessary at early stage of the design of digital systems and tools to support empowerment in communities and to facilitate the social responsibility that comes with planning beyond the usual drivers of change.
- Design for digital planning must be done with and by planners to ensure that Digital Twins can meet the needs of hybrid engagement whilst shaping the digital skills of planners.

Regardless of our own views of digital it is clear that digital planning is rapidly being introduced with announcements such as the £1.1 million fund to test the use of digital tools and data standards in England[10], the ongoing development and investment in Scotland's Digital Strategy for Planning as part of transforming planning[11], and the work showcased by young planners such as those attending the roundtable discussions we have initiated as part of this Task Force in the focus on the move from education to employment.

Each person's experiences and interactions with digital planning will be unique. There are no exact answers, no defined solutions but young planners were clear; full digitisation of planning is not the solution, but part of the process and system to engage people with decision-making and knowledge-building opportunities in a meaningful, accessible and future thinking way. Our move towards digital actions must always start with understanding the purpose and intended impact and what it will to contribute to change.

"Full digitisation of planning is not the solution, but part of the process and system to engage people with decision-making and knowledge-building opportunities in a meaningful, accessible and future thinking way."

APPX2: Visions and Reflections – 6

Digitally-Driven Urban Planning: Challenges and Opportunities

Alan Wilson[g]

Planners face two kinds of challenges: those of present and future cities; and those of developing the profession itself to meet these challenges. The 'real' challenges are substantial and extensive. Consider these headings to help structure the issues: people, living in cities; urban form; organisations, the economy of cities; infrastructure; climate change and sustainability, not to mention pandemics; governance.

People, living in cities, need housing and access to employment (and therefore incomes) and a wide range of services and recreational opportunities; the complex system of organisations that make up the economy supply all of these. These issues, in the context of demographic and technological change, provide a challenging agenda. The way this is delivered will be a function of the form of the city, its infrastructure and how it is governed – all of these in the context of planning sustainable cities that can meet environmental challenges. A common denominator across this agenda is 'land': the variety of activities and the supporting infrastructure. All functions need land and it is not surprising that this has become perhaps the principal focus of planning. There is a key point to be taken on board at the outset: all the elements of this agenda, and the associated challenges, are interdependent. Any plan or intervention in one area has consequences in others. Hence to meet the real challenges, planners need the 'equipment' to handle the complexities of interdependence.

"To meet the real challenges, planners need the 'equipment' to handle the complexities of interdependence."

A first challenge for planners, therefore, is to be able to handle these complexities. There is a second and related one: planners, by definition, are planning for the future on behalf of their communities. It is intuitively obvious that there are huge uncertainties: technological, social and economic change in the context of climate change, continually peppered by 'black swan' like events such as a pandemic. There are two significant developments which provide both opportunities and challenges for planners. The first is the 'big data' revolution: we have better and richer sources of data available than ever before – by orders of magnitude; the second is the potential availability of analytic capabilities which reach beyond anything in the current planners' toolkit. These are related, of course: data availability, and continuing increasing computer power, facilitate the analytics.

The engine of the potential analytic capability is provided by mathematical and computer models of cities. Planners can use these in the way that pilots train on flight simulators. The models have a history of around

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six decades, essentially driven to their present level of development by a combination of research and computer power. However, they have not been fully utilised by planners, in fact, hardly at all. Some of the models are highly developed, used and tested – particularly in retailing – by companies predicting market share, and in transport by the engineers who are more familiar with data and computer-driven analytics. In each case, the benefits are clear: optimising the network of outlets improves the bottom line for retailers; and transport engineers could predict improvements in congestion and accessibilities and indeed undertake a full cost-benefit analysis of alternative investments. Appropriate indicators could be developed (and indeed have been) for planners but these have not, typically, been deployed. It is perhaps significant that the successes with models have been in very specific areas with very clear benefits. To handle the complexities and uncertainties of the major planning challenges, comprehensive models, such as Quant, developed in UCL[12], and Spenser, developed in Leeds[13], are needed along with the capabilities to build their data bases and to deploy them in scenario exploration.

The models represent in detail how cities work at a point in time and they can be used to predict the consequences of interventions at least in the short run. This is precisely how they are used by retailers and transport engineers. The long run is more difficult because of these uncertainties (not to mention budget constraints). The solution, as we have noted, is to explore a range of future scenarios. These uses could range from tracing the specifics of something like new housing developments or more broadly in producing master plans. In the latter case, if the scenario exploration produces a preferred plan, the system can be used to investigate how to get there, how to avoid 'bad' consequences en route.

This could be done now – so why is it not happening? Quant and Spenser function as national scale models and could be made available to any planning authority in the country. The models developed as part of the ITRC-Mistral project for national infrastructure also have the same potential[14]. Serious government investment would be needed to achieve this. More broadly, there has been insufficient investment in the technology of urban analytics – the D part of R and D, combined with the shortage of capability in understanding and using the analytics – something very much beyond GIS (useful though that technology is).

What does it mean for the profession? Is there a coming utopia of digitally-analytic-driven planning for the future?

The planning profession itself would have to absorb the necessary skills rapidly and with enthusiasm – in part by functioning in a multidisciplinary way, bringing in complementary expertise – rather as the medical profession connects to medical scientists. Planning Schools could play major leadership roles, both in education and research. Think of teaching hospitals and their multiple roles in education, research and practice: what are, or could be, the planning equivalents? The government could invest to ensure that the technology is available, possibly working with some lead local authorities who could become beacons for these developments. The models are not perfect of course and the government should also ensure that there is a sustained research programme for their development and practice. It is the increased use of these models and analytical tools in planning that would drive future research: there is a symbiotic relationship here. It is also worth noting that these analytic capabilities are under-used in other public sectors – notably health and education, sectors that are components of the planners' comprehensive models. It would be possible for the planning profession to lead the way and to transfer its new and developing expertise into these areas.

If the profession could absorb and develop the digitally-driven analytic capabilities that are now available, planners could be leaders in government - central, regional and local – in working to meet both the challenges of future cities, but also in promoting these analytics in other public sectors.

"There has been insufficient investment in the technology of urban analytics – the D part of R and D."

Digital Revolution and Big Data: Planning-Led or Planning-Lag?

Cecilia Wong[h]

Alasdair Rae and I have recently (2021) edited a volume on '*Applied Data Analysis for Urban Planning and Management*'[15]. The contributions made in the book highlight how big data and digital technology are opening-up possibilities to examine planning questions that were previously found impenetrable. Despite beginning the analysis from different perspectives and different spatial contexts, the opportunities and challenges identified by the authors writing in that text often resonate each other. This statement tries to pull out the key messages emerging from these essays to set an agenda for future reference.

"We have also to work out how best to train a new generation of planners and managers who have a strong grip of policy issues and being technically astute to deploy these technologies."

The Mismatch between Planning Issues and Analytical Tools

Planning is embedded in a dynamic social context interacting with a wide variety of actors and practices. To Rittel and Webber[16] writing in 1973 only by laying out alternative understandings of problems, competing interests, priorities, and constraints, is it then possible to apply more formal analytical tools to understand a specific problem scenario. Given that planning issues and big data are both complex and socially situated, there are important challenges when applying data analytics to address planning concerns. The communicative turn of planning requires quantitative techniques that are both analytical and communicative instruments. This means that different methods and techniques should be flexibly combined to tackle specific policy analytical needs under specific spatial contexts.

The tension between the administrative geography of a planning system as a government institution and the functional spatial scale of real-life phenomena has been a long-standing conundrum. The criss-crossing of multi-scalar policy layers over different temporal dimensions have created both complexity in and challenges to measurement. Also, many techniques and methods are based on the traditional policy sector silos, which no longer serve the purpose of integrating different policies within coherent spatial frameworks and initiatives. The advance of new analytical techniques over different sources of big data has however offered some promising prospects.

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The Intersection of Technology and Governance

The potential use of GIS and digital visualisation platforms to share knowledge across departments and to disseminate ideas in public does not often sit well with traditional centralised management and closed expert policy networks. There are also digital divides among different groups of users as well as institutional divides over the control of data access. Complexities in planning issues require policy makers to question normative assumptions and stakeholders to rethink the principles of spatial organisation and activities. The challenge however lies in balancing the presentation of complex concepts in a form which is understandable by a range of actors besides a small group of advanced users. This brings up the pertinent issue of how to design digital planning platforms and support systems that provide multi-dimensional analysis for the more technical astute professional and narrative-driven functionalities for the wider public. Given that users can be the key drivers of data analytics through crowdsourcing information and community-based participation, digital information can be used as the negotiation medium to achieve planning and development consensus.

Transaction Costs and Marginal Gains of Big Data

While new technology and sheer amount of new data are on stream, many are not open sourced but held by the private sector or public organisations under strict privacy laws and data protection regulations. The many advantages brought by the data rich environment have come with the challenge over how to collect, manage and integrate large and diverse datasets with unstructured formats, as well as dealing with the constraints of technical know-how, ethical considerations, the regulatory environment, and available resources. Despite its 'big' size, the scope of big data is indeed very narrow as such data tends to be passively generated by users and is market-driven and does not include the attributes of individuals to allow more nuanced analysis. All these constraints mean that the use of big data comes with major transaction costs of data mining, data integration and data access compliance.

Complementary Rather than Displacement

While GPS tracking via mobile phones can show individual movements even though the quality of such data is only mediocre, such data cannot replace traditional surveys to provide in-depth analysis of social relationships and socio-economic attributes. The varied and incomplete coverage of big data also create bias and errors in measurement and analysis. There is thus an emerging consensus that a mix use of big data, traditional data and other independent data sources together is the best way forward. Despite the lack of consistency and variability of big data, its experimental use can encourage communities to use the information as a collective way of 'seeing' to address medium- and long-term planning issues such as public participation, social segregation, regional connections, and functional divisions.

Back to the Future: Planning-Led or Planning-Lag?

The digital revolution is both a blessing and a curse to planning, as the processing and analysis of a large amount of data from different formats requires a lot of technical know-how and imagination to handle. So, will it be planning-led or planning-lag in the face of the digital and big data era? Lessons from the 1960s quantitative revolution and the use of GIS in the 1990s suggests that the advance of computation technology and data science can drive planners into a passive position, with planning intelligence being data-driven rather than issue-led. The application of such data instruments is in fact laden with politics and ideology and will project different futures and promote certain visions. Ultimately, it is problem-framing and policy knowledge that helps to extract relevant planning intelligence. Smart technology cannot be effectively applied without smart management and smart people. The production of new forms of data does involve complex process of data mining and integration, which in turn requires complex data regulation and management to be in place. This will involve major institutional reform of our planning system and a major re-think of how planning can be conducted in a way that is adaptable to change. We have also to work out how best to train a new generation of planners and managers who have a strong grip of policy issues and being technically astute to deploy these technologies.

APPX2: Visions and Reflections – 8

Challenges and Opportunities for Local Authorities

Janice Morphet[i]

Introduction

Digital methods provide both challenges and opportunities for local authorities in the provision of their planning responsibilities. The opportunities to make planning processes more open and accessible, facilitating more public engagement and providing access to data that can be used for wider purposes are all objectives to be welcomed and developed. There are also opportunities to streamline the back office, improve regulatory processes including record keeping, notifications and historical records of decisions and change. In the pandemic, local authority planning committees quickly adapted to using online methods for decision making and public engagement and at the national level, the Planning Inspectorate National Service (PINS) moved quickly to on-line planning examinations, appeals and inquiries. Planning services are more advanced in achieving these approaches than others in local government and have been developing their front and back office approaches for a long period of time.

But there are also challenges. The planning service has suffered the greatest local government cuts in the Government's austerity period since 2010[17] and often councils have procured bespoke or proprietary planning systems for planning applications and consultation that have no access to more open source systems. Councils have also been somewhat hampered in providing more mapped and spatial data through the practices and regulations imposed by the Ordnance Survey. While local authorities have made good progress and adapted quickly, they also need to be aware of what more may be undertaken in planning using digital methods – for example consultation and to provide access to their public information for publicly accessible city data stores.

This short think-piece reviews progress so far and provides some examples of what might be able to be done in the future.

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Context

The development of digital methods to support government processes in the UK has been recognised as amongst the best in the world, topping the UN league table in 2016[18] and as second in the OECD e-government league table in 2018[19]. The development and enhancement of these approaches was supported by the Government's Comprehensive Spending Review 2002-2005 and has had a lasting benefit. The funding was focused both on direct engagement with citizens, organisations and suppliers as well as promoting back office integration. A taxonomy of processes was developed as well as common standards. The focus on the front end of e-government was greater than in some other countries – the United States for example[20], where there has been more priority given to the integration of internal data to create large data stores as well as predictive diagnosis of service needs and failures.

Within this UK context, the planning system has been one of the leading developers and users of e-government both in local and central government. In central government, PINS has devised the Planning Portal to enable planning application submissions on a common basis, record progress on local plans, appeal decisions and support the processes established to provide major infrastructure from the 2008 Planning Act. In the pandemic, PINS was quick to shift its operations so that planning appeals, inquiries and examinations could be held on line.

In local government, in the UK, less than half of councils employ a Chief Digital Officer[21]. The development of integrated planning systems varies in the four nations of the UK but has been particularly well-developed in England and Scotland[22] where the registration of planning applications could be made on line, applications checked by address to obtain planning histories and, in some cases, integrated into wider property data for each address. For plan making, councils have promoted some digital forms for consultation information on proposals, provision of evidence and local plan examination online. Many local authorities were already broadcasting planning committee meetings before the pandemic and there was an early and easy switch to online processes which enabled them to be used for council decision making as well as observation and comment as before.

Challenges to Digital Planning

In England, the role of digital planning was included in the Planning White Paper (2020) and was subsequently backed with some funding to support its development[23]. However, this extra emphasis has been undertaken at a time of continuing Government austerity policies in local government and where planning teams continue to suffer the greatest cuts in local government funding. In considering how to take forward and further develop digital means and methods in planning in local authorities, the issue of resources – of people and finance – remains. There are further challenges to develop the current systems to enable more digital working and these are considered both within the context of internal systems of local authorities and their outward facing role and responsibilities that enable digital tools to be used in working with their communities together with developers and their advisors.

"The planning service has suffered the greatest local government cuts in the Government's austerity period since 2010 and often councils have procured bespoke or proprietary planning systems for planning applications and consultation that have no access to more open source systems."

Internal

The first set of internal challenges for local authorities to develop more digital working in planning come from central government. These relate to uncertainty about changes in the planning system and the approaches of some quasi government agencies, while there is also a continuation of austerity policies for local authority funding. The Planning White Paper in England (2020) and changes in the planning system proposed in Scotland[24], coming within the context of the pandemic, will inevitably have left councils delaying decision making about further transformation and investment. Where the system is in flux, back office systems cannot be property configured to collect data and perform processes that comply with new or as yet specified and approved legal requirements. At the same time, some quasi government agencies such as Ordnance Survey have continued to operate a proprietary approach to spatial data that makes it difficult to have the same kind of open spatial data that is the backbone of big data systems in other countries such as the United States. An example of what can be achieved with open data of this kind is Transport for London (TfL), that once it was persuaded to open its data, saw a huge amount of innovation and research initiated by companies and interested individuals which was far greater than TfL could have supported itself or even imagined.

A second series of challenges for local authorities in terms of data integration within their organisations and between a range of organisations have largely failed. The various approaches to having common datasets for groups in society such as children have faltered in the past and while government agencies and local authorities have digitised much of their spatial data, this has not always been undertaken using common standards, including that for addressing, that would allow for more integrated use.

For local authorities, the IT systems that are used for planning applications are proprietary and often cannot be integrated with others. Local authorities will have entered into longer term contracts so that changes to the planning system at the behest of government can mean costs for contractual changes for local authorities to meet new government requirements without any supporting funding. Procuring any system can be difficult particularly where it is meeting central government requirements for regulation and this remains a challenge. A further concern is cyber security with the government investing in a new approach to this issue within local government[25] not least as some councils have been the targets of ransomware attacks. There can also be implementation challenges when new software is being tested such as demonstrated in Kent where live applications were put into a dummy system and were approved[26].

External

While local authority planning systems online are transactional, there are further developments that could increase public awareness and engagement although there is seldom enough time or funding to implement them. When central government in England changed the legislation to allow planning committee meetings and PINS to undertake their inquiries, appeals and examinations online during the pandemic, the legislation was not renewed despite considerable pressure and lobbying from the Local Government Association and local authorities. It is reported that many councils are still conducting their committee meetings online and finding ways to undertake decision making within the regulations. These approaches have also been used for other council meetings that involve planning such as overview and scrutiny[27].

A further challenge is the extent to which everyone can access online services – either because they do not have a smart phone or computer or because their Wi-Fi or phone system cannot support the downloads required of large documents and maps. The government is supporting the roll out of fibre and 5G and gradually this might see improvements nationally as new methods are used to boost connectivity such as embedding IT into street furniture[28]. There is some support to reduce the digital divide which is both social and spatial[29] and examples of how some councils have tried to overcome these challenges are available[30]. However, these issues remain and require a range of tools to ensure engagement across all social groups. Some councils are surveying their residents and businesses to determine what kind of improvements are needed[31].

Opportunities for Local Authorities to Provide More Digital Planning

The support for digital planning in all parts of the UK is significant, as exemplified by a recent statement by the Planning Minister in Northern Ireland[32]. In support of digital planning in England, ministers have launched two models for digital planning systems funded through its Local Digital Fund[33]. The first of these two projects is designed to reduce the number of invalid planning applications[34] which is being trialled by a group of councils led by the LB Lambeth. The second project, led by LB Southwark, is testing approaches to a much stronger back office function to include matters such as issuing Lawful Development Certificates. Another council, Milton Keynes, is developing an approach to validation of planning applications using a form of Artificial Intelligence[35].

In a more specific approach to consultation for plan-making and planning applications, there is now technology that allows digital targeting of individuals to make them more aware of these discussions – using push technologies rather than being reliant on information based approaches. While this might be attractive and a means of improving engagement, there are also concerns and the Information Commissioner's Office has issued new guidance on how this should be undertaken[36]. There are also different ways in which councils can support consultation such as that used by Cardiff which established a digital room that gave access to a wide amount of information and opportunities to comments to support the consultation on its local plan. The Lake District National Park won awards for its digital consultation methods in 2019[37] which have demonstrated methods of digital engagement in more sparsely populated areas[38]. Some argue that using digital methods of consultation enhances engagement while also reducing tensions and providing more consensual approaches to decision-making, by supporting conversations rather than episodic forms of consultation[39].

The Way Forward

In order to be able to progress increased use of digital technologies in planning in local government, there needs to be:

- A clear understanding and cost-benefit assessment of the contribution any specific digital process will make;
- If the governments in each nation wish to improve the use of digital technologies in planning them, they need to support this through specification of processes and funding;
- Planning processes should be underpinned by open source systems so that data can be accessed and used more widely;
- The information, knowledge and research used as evidence in making local plans and planning decisions should be available in easily searchable forms; the use of non-searchable PDFs should be banned;
- Proposals in plans, master plans and other planning policy documents should be accessible using GML so that communities and individuals should be able to access decisions and policies for a specific addresses in local authority areas;
- Local authorities should review their methods of consultation using a range of digital tools that can be used directly and finding appropriate and similar ways of consulting with those who do not have access to these tools;
- Each council should establish a data store for its spatial and other information so that this can be used by communities and other organisations for their own activities;
- Back office data should be used to monitor and evaluate the effects of spatial decisions and policies on different locations and should also be used to assess areas of high and low engagement so that it can be used as a tool of intervention;
- Local authorities should be using their push processes such as newsletters and citizen engagement tools to advise everyone of proposed changes in their areas rather than expecting engagement with more static on line information systems;
- Consultation should be regarded as a continuing conversation rather than being episodic so that there are opportunities for feedback and dialogue on responses and policy changes.

APPX2: Visions and Reflections – 9

Planning with Data at Scale

Volker Buscher[j]

The planning profession[40] needs to change to capture the potential for better planning decisions, transparency and innovation that modern data practices can offer.

The focus of this vision is that *"Data at Scale" requires comprehensive change across the profession*.

The Digital Task Force has outlined several grand challenges including the climate emergency, biodiversity, the pandemic and moving towards a circular economy. It has identified how integrated spatial planning is part of the solution for these grand challenges. "Data" itself is not new in this work. In fact, it is not only required for the grand challenges but it enables day-to-day planning decisions at national and local levels. One could argue that planning has always been about collecting information to inform better outcomes through the planning system and thus that the planning profession's status quo is already data enabled.

However, the planning community has not followed trends towards high volume, variety and velocity of data. Nor has the industry developed widespread use of advanced data science and cloud computing or more advanced approaches for data publishing and sharing. Planning as a profession is barely part of a growing venture community driving innovation in the built and natural world.

The planning community still largely relies on manual data observation, geospatial information systems, task-oriented software, spreadsheets and static visualisations. The industry has pursued digitisation of traditional methods and tools. Clients are not demanding data at scale and the industry is not leading the required change either.

At the same time the built and natural world is creating more and more data. Mobile phones, the Internet of Things, micro payment systems, e-commerce, open government, earth observation and so on are producing relevant and location specific data at high resolution. The manipulation of this data using cloud platforms and advanced data science and visualisation is proven in other industries. Cost and time to market for data enabled innovation is affordable for organisations in the built and natural world. Technology is reliable and affordable.

The digital future of planning must address this missed opportunity and align the emergence of data at scale in the built and natural world with vision and delivery in the planning profession. This will require comprehensive change for the urban and rural planning systems, government, organisations providing planning services and academia.

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What to Change

The move towards data at scale requires a comprehensive understanding of "why" and "what" to change. The Task Force has identified some of the reasons why the industry requires a strategy to move from the status quo towards value creation with data at scale. The list below shows some critical elements of what to change in two key foci at (1) industry and (2) organisational level:

"The focus of this vision is that "Data at Scale" requires comprehensive change across the profession."

(1) Industry Wide Change:

These are topics that should be addressed across the planning profession. They would act as a catalyst for innovation and growth across the community and act as a foundation or catalyst for organisations to work with data at scale.

a) **A Vision across Government and the Profession** regarding the role of data at scale in our planning systems is essential. One that can explain the value to the beneficiaries or users of the planning system. It should create buy-in across the profession which implies that the status quo is no longer the best way forward. This user-centric vision should address whether or not government and the profession agree that superlative change is required, i.e. across all aspects of the profession. These should be implemented in less than 5 years and are critical for better planning outcomes or if the changes can be organically absorbed over 10 years, more as an evolution of today's status quo. The distinction matters as transformation or superlative change requires an active choice and the appropriate leadership to succeed.

b) **A Trust Framework for Data Sharing.** The data ecosystem that is underpinning the planning community is large and growing rapidly. Cost and friction regarding access to data and effective sharing is higher than in other industries and does not enable innovation. A trust framework for decentralised sharing would establish the right balance across "bilateral sharing", "data pooling" and "decentralised sharing". This should be supported by carefully designed data institutions including an Open Planning Implementation Entity.

c) **Demand for Planning with Data at Scale.** National and local government, investors and other "users" need to demand planning services that compete based on the quality of the advice or insights rather than on compliance with historical models and tools. They should focus on better data provenance and resolution informing planning decisions.

d) **Venture Capital or PlanTech Innovation.** The built and natural world is starting to attract significant capital and expertise through tech investors. The planning profession is not sufficiently represented in this innovation ecosystem. It should more actively engage with both investors and organisations facilitating tech ventures. This should include place, industry and climate change focused ecosystems.

e) **The Foresight, Research and Education Community,** including the technology industry. A national program of research and foresight initiatives that bring together academia, third sector, planning businesses and the tech industry into research and education is required. This should include data infrastructure roadmaps and address the challenge of small to medium businesses to work with data at scale.

(2) Organisational Change

The application of data scale will require individual organisations to change how they work, not just in terms of the use of technology. It will require vision, leadership and a desire to change. Larger organisations will be able to both lead and invest in their internal data enabled transformation. The emergence of Chief Data Officers or similar across the built and natural world is indicative of this trend. It is not clear how small to medium sized planning organisations will be able to follow this trend as they currently lack leadership expertise, skills and capital. Special attention for the SME planning sector might be required.

Changes at the organisational level might include:

a) **Vision and Strategy** for organisations in the planning industry. Individual organisations require their own user centric vision and strategy to have clarity of purpose and to sustain implementation over several years. A clear commercial narrative is imperative and provides excitement and context in the competition for digital talent. Strategy needs to differentiate and choose between superlative or organic change. Feedback from this work should feed into the industry wide vision outlined on the previous page.

b) **Leadership and Capacity** is required to execute the vision. Executive leadership is critical for superlative change. Competency for data at scale will require a combination of new people and development of existing planning professionals. Incumbent digital skills e.g. GIS or transport planning tools imply knowledge that needs to evolve and be augmented with data with competencies at scale.

c) **Data Enabled Innovation** – Organisations will need to develop new data enabled products/tools. Innovation should cover a) structured methodologies to take ideas from inception to impact, b) partnering and ecosystem management and c) the ability to implement new business models. These products / tools should augment professional services and judgement with data products and platform technologies. Access to digital ventures would accelerate this process.

d) **Technology** – Data enabled innovation and newer business models have a dependency on Data Infrastructure, Platform and Data Science development. They require well organised programs addressing the development of people, process and technology required for data scale. The 'newer' technologies would both align with and replace existing planning tools.

e) **Knowledge, Culture and Practices** developed over the past 10-15 years in other industries should be applied. They need to cover the above and include Data Governance, Data Ethics, and Data Literacy. Organisations might also consider Data Foresight and Research. Cultural change is one of the main obstacles in the planning industry as current business and technical leadership sustain the status quo. Change has to start either by bottom-up demand, or from business or technical leaders.

APPX3: Case Study 1

Ordnance Survey Roof Aspect & Green Roofs Algorithms

The Rapid Prototyping Team[a] • Ordnance Survey

a Communicated by Donna Lyndsay, Ordnance Survey.

Introduction: Ordnance Survey's Rapid Prototyping Team set out to test whether new technologies could be used to determine building roof pitch and aspect by combining novel data science insights with aerial photography and digital surface models. For the chosen test regions, the team's algorithm achieved 97% accuracy when identifying flat vs non-flat roofs (target: 80%) and a similarity score of 0.66 when identifying constituent face polygons (target: 0.5). Knowledge of roof aspect and pitch provides valuable data for solar panel providers, telecommunications companies, and insurance underwriters. An algorithm for identifying roofs that are green or have overhanging vegetation was also developed.

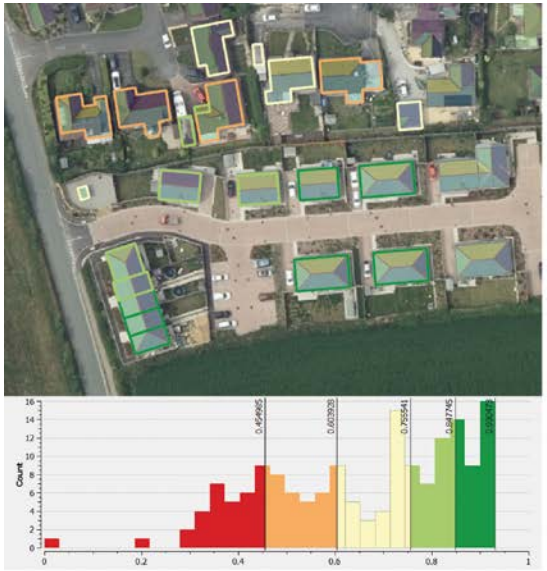
Challenges: There are several challenges when trying to determine roof aspect and pitch using digital surface models. The main challenges arise due to the resolution and presence of noise in the digital surface models. Many roofs are also not visible from aerial imagery due to overgrowing vegetation. Validation datasets for roof aspect and pitch are not available, making it difficult to utilise supervised learning methods.

Solution/Innovation/Method Used: The solution that Ordnance Survey's Rapid Prototyping Team developed used vector geometry algorithms to determine valid roof configurations using OS MasterMap polygons. The new geometries formed during this analysis could be used to sample the underlying digital surface model and calculate not only the dominant aspect and pitch of the roof of a building, but also the configuration of its individual roof faces and each of their surface areas / aspects / pitches. Green roofs could be identified by intersecting building polygons with an NDVI (normalized difference vegetation index) layer.

Benefits: The characterisation of roofs by pitch and aspect is required in order to estimate the potential scalability and implementation of domestic solar panels. By having each roof face polygon analysed separately, these estimates can be made with even more precision. For example, if a roof has an area of 20m² facing south, it might seem like a viable space to install a solar panel, however, the geometry of the roof face may be highly fragmented by dormer windows and not actually be suitable. Roof face polygons allow us to analyse geometrical attributes, like compactness, so that realistic estimates of solar panel capacity can be made.

Lessons Learned: In practice, 25cm DSMs (Digital Surface Models) are not sufficient to be able to be easily distinguish between roof faces – primarily due to the resolution and noise. However, in combination with vector geometry analysis methods, DSMs can be sampled to give reasonable estimates of pitch and aspect.

Further Work: With more time, the roof polygon extraction algorithm could be tested over a larger test region so that the tuneable parameters (affecting the conglomeration of roof faces) can be refined.



Left: Results from the roof face estimation algorithm. The individual roof faces are shown shaded by their aspect (e.g. yellow is North, dark purple is East). The outline of each building is coloured by how accurate the algorithms results are - these are summarised for the whole test region in the histogram underneath. Right: Results of the flat vs pitch (not-flat) algorithm for a district of Newcastle.

b Associate Director, Planning & Environmental Consenting, Atkins Global.

Atkins Pangea

Fiona Wilson[b] • Atkins Global

APPX3: Case Study 2

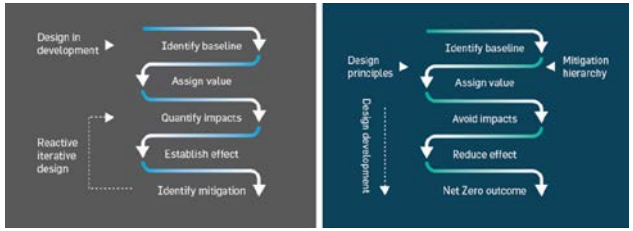
Client Challenges: Many infrastructure and other large-scale development projects must undergo an environmental impact assessment (EIA) as part of their consent process. However, in many cases, the EIA and environment are only considered once the design processes have begun, which can lead to issue challenges through the process. As EIAs have historically been document and paper-driven, they can lead to bottlenecks in the process and lack flexibility as they require people to read long reports. This combined with different stakeholders having different foci, objectives and concerns can lead to conflicting targets and issues at the design stage. This in turn can lead to extensive delays in the design stage due to there being a need for reactive and iterative changes to be made. The delays caused by these changes at the design stage will have a ripple effect across the whole project delivery cycle, often resulting in not only extensive time delays but increased costs and resource requirements, often resulting in a negative public perception around the project due to increased disruption.

Our Approach: To help our clients overcome this we have developed a tool designed to work on an outcome-based approach that focuses on environmental features or receptors, rather than topic based, underpinned by technical evidence. It has been built to focus on real problems by utilising a parameter-based approach and understanding the current baseline to provide users with a proactive set of outcomes. Pangea puts data at the centre of the approach rather than locking it within reports and enables users to identify environmental assets and receptors in the project area which in turn help identify environmental risks, constraints and opportunities, but in significantly less time than using a paper-based approach. It will also provide evidence for the feasibility of the project, the design and selection of potential options and inform value management and risk associated with consenting.

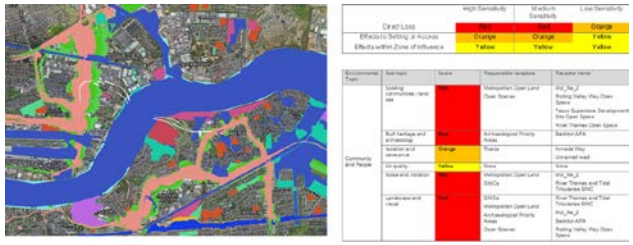
Being a data driven tool, Pangea can significantly improve 3 key areas within the EIA process:

- The approach, exploring receptor-based outcomes rather than topic-based outcomes
- The function, harnessing the power of data driven digital technology
- The behaviours, enabling significantly better collaboration and moving away from individual silo-based approaches

Outcomes Delivered: Pangea has the ability to deliver a whole range of benefits to users. Its primary focus is to provide clearer insights into the environmental risks and opportunities associated with a project, only much faster than the traditional document/paper-based approach. Because all the data is held digitally, it allows for much simpler control of information and with the data being held in a live environment it removes the restrictions that would be encountered as a result of any design freeze situations occurring, such as risk of inconsistency, clashes or double counting. Because the data is live, users can benefit from real-time monitoring and evidence that enables smarter, faster, better decision making to take place, which can be hugely significant when deployed early in a project design phase. By using a common data environment, this further reduces the time required to analyse and produce information that can be used to influence the design stage, leading to significant efficiencies supported by robust evidence using the most recent data available to the end user. This results in designs being right first time and ensures that collaboration across the project delivery team is improved, resulting in an overall better outcome in a much reduced timescale.



Flow Diagrams Comparing Traditional Reactive Design and New Proactive Outcomes-Based Design Based on Pangea.



Environmental Receptors and Associated Risks within the DLR Thamesmead Project Area.

APPX3: Case Study 3

Cutting CO2 Emissions from Buildings: The 3DStock Method

Philip Steadman[c] • University College London

c Energy Institute, The Bartlett, University College London.

Buildings are responsible for around 40% of all carbon emissions in the UK. They represent a major challenge for decarbonisation, because they are very diverse - especially non-domestic buildings - and are in the hands of millions of landlords and householders. Also, our knowledge of the non-domestic stock is far from complete. The decarbonisation of the electricity grid will do much of the work, but buildings themselves must be converted to using just electricity, and possibly hydrogen. The energy efficiency of many buildings also needs to be radically improved.

Past models of the building stock have relied on extrapolation from sample surveys, and on the use of simulation to predict energy performance. However, energy simulation, especially of complex buildings, has proved to be a very inexact science. And the diversity and highly skewed distribution of sizes of buildings makes sampling difficult.

At the Energy Institute at University College London we have, over the last ten years, developed a method for modelling the building stock which we believe overcomes these problems. The method is called 3DStock. It brings together a number of public data sources to build 3D digital models automatically of all buildings in a locality or region, located on a map base. These sources include Ordnance Survey maps which give building footprints, addresses and site boundaries; Valuation Office Agency commercial rating data, which give floor areas and details of activities for most non-domestic buildings; and LiDAR data (laser measurements from overflying aircraft, made by the Environment Agency) for the geometry of building form. Other information comes from Energy Performance Certificates, and from UKBuildings, a commercial database that provides information on building age and materials of construction. Our group has worked extensively for the Department of Business, Energy and Industrial Strategy (BEIS), who have let us use actual annual gas and meter data from the supply companies, under strict conditions of confidentiality. All these data are matched together by addresses.

3DStock thus overcomes any problems of sampling, by covering all buildings, in effect taking a '100% sample'; and the method relies on actual energy use data, not on predictions from simulation. 3DStock models have been constructed so far for the towns and cities of Milton Keynes, Swindon, Leicester, Tamworth and Sheffield. In 2018 our laboratory was commissioned by the Greater London Authority to produce the London Building Stock Model. This extends out to the M25 motorway and covers some 1.5 million houses, 1.9 million flats, and around 250,000 non-domestic premises. It is being used both by the GLA and London Boroughs to frame and implement policy to improve energy efficiency and reduce fuel poverty.

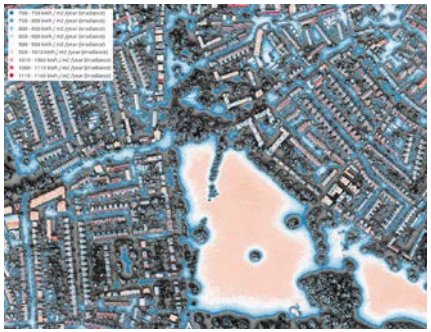
In a parallel project for the GLA in 2019 we developed the London Solar Opportunity Map. This gives estimates of the total annual direct and diffuse solar radiation falling on all roofs and areas of open land, taking account of over-shading from adjacent buildings and trees. The Map is presented in a web interface which gives estimates of the potential electrical output of PV installations, and hot water output from solar thermal installations (https://www.london.gov.uk/what-we-do/environment/energy/energy-buildings/london-solar-opportunity-map/).

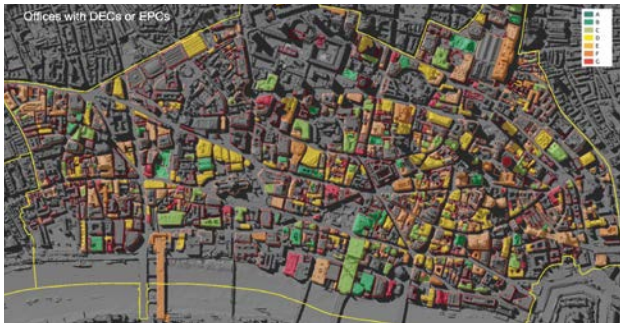
We are just embarking on the development of a model for the whole of Wales for the Active Building Centre. And we have recently been commissioned by BEIS to start work on a model of all non-domestic buildings in England and Wales, to improve knowledge of the stock, and to support the Department's zero carbon policies.

Since 3DStock describes every building in considerable detail, it possible to plan routes to zero emissions that are tailored to each of those buildings individually.

We are presently working for the Borough of Islington to help them get their own housing stock to net zero in the coming decades. 3DStock also allows a whole variety of more theoretical scientific studies, for example of the relationship of urban density to energy use in buildings, and of the great increase in energy intensity with height in office and residential towers.

A recent journal paper on 3DStock and the London models: https://journal-buildingscities.org/articles/10.5334/bc.52/





Top: Part of the London Solar Opportunity Map for the GLA. The colours code for the amounts of solar radiation falling on roofs and areas of land annually. Blue is low, red is high.

Bottom: Part of the London Building Stock Model for the GLA, showing the City of London. Colours show office buildings with Display Energy Certificates (DECs) or Energy Performance Certificates (EPCs).

APPX3: Case Study 4

AI in Urban Planning in Singapore

Huang Zhongwen[d] • Urban Redevelopment Authority, Singapore

d From 2017 to 2021, Zhongwen led URA's Design & Planning Lab in harnessing digital technology and Big Data to enhance the organisation's planning capabilities. He is currently on secondment to the Prime Minister's Office, Smart Nation and Digital Government Office, as Director (Smart City Projects Office).

In today's rapidly changing and increasingly uncertain climate, planning for the future has become more important than ever. Our planners in the Urban Redevelopment Authority (URA) will have to be more data-informed in the way they plan, to respond quickly to changes and identify optimal land and infrastructure options, so as to meet the needs of our communities and businesses of today and tomorrow.

To this end, Artificial Intelligence (AI) capabilities can be harnessed to support the development of robust plans that will safeguard Singapore for current and future generations. In fact, employing technology in urban planning is not new to Singapore. Since the 1960s, Singapore's urban planning processes have been comprehensive and systematic, in order to ensure a high-quality living environment for all. The nation was one of the world's first movers in using planning technology. And in our pursuit to meet the evolving needs of our citizens, we have sustained the relevance of our planning processes by keeping abreast of technological advancements and fusing our local innovations with global expertise.

Integration of computing technology for urban planning in Singapore began in the 1980-90s with the adoption of computerisation and Geospatial Information Systems (GIS). In the 2010s, we embarked on digitalisation to tap into the recent availability of digital data, data science tools, and advanced GIS capabilities such as 3D simulation and viewshed analysis. These have laid a strong foundation for us to further push the frontier of our digital toolkits with meaningful AI solutions.

We will now outline three ways that AI solutions can be used to strengthen how we plan for Singapore and its people.

1. AI solutions will expand and strengthen our planners' toolkits

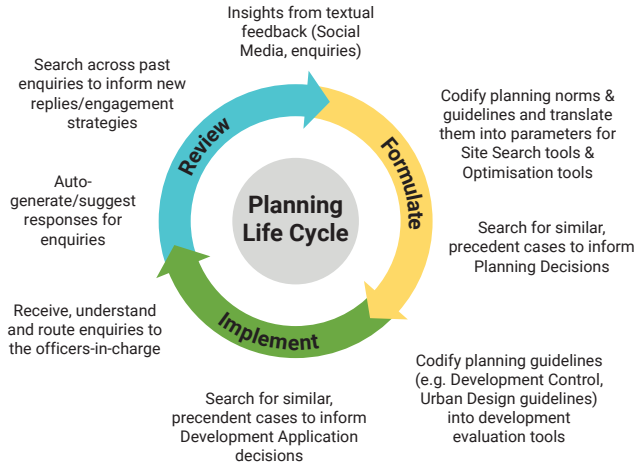
Many people might not know this, but AI solutions are all around us in our daily lives – in our use of search engines, social media, e-Commerce sites, and much more. For instance, how internet searches return relevant results or how Google Map recommends the best route options are based on equations and algorithms. AI works silently in the background to make searching and retrieving information more convenient and efficient.

Ten years on from Marc Andreessen's[1] claim that "Software is eating the world", AI technologies have since been assimilated into almost every aspect of the working world. For instance, they are used by professional gamers to hone their skills and to develop new tactics. In similar ways at the URA, we see potential for AI capabilities in areas such as information retrieval to enhance the way urban planners work.

We are using AI to develop a knowledge base which can then be used to model planning information and establish relationships between topics and cases. This would not only assist planners in sieving out relevant information from large volumes of data, but also allow industry stakeholders to search for planning information more efficiently. As such technologies mature, they also present potential for further applications. In the longer term, we foresee planners using smart assistants to study a wider range of scenarios and their trajectories, and to evaluate planning options.

AI solutions are also commonly found in the supply chain sector to aid in the planning of the most efficient delivery sequences and routes. In a similar vein, we are deploying Robotic Process Automation (RPA) and Natural Language Processing (NLP) across URA, to help us conduct our operations in a more resource-optimised manner. This has given rise to the automation of routine tasks, which could include for example, chatbots that can respond intelligently to public queries, and the sorting and textual analysis of large datasets such as planning decisions and public feedback data.

As effective as AI is, the ability for planners to understand stakeholders and their pain points remains integral to the work we do at the URA. As such, it is important that we spend less time on labour-intensive tasks that can automated or sped-up through AI, so as to spend more time on in-depth analyses and engaging communities. By implementing tools such as RPA and NLP at URA, this enables planners to allocate time and effort for more meaningful work.



NLP tools can be incorporated into the formulation, implementation, and review of urban planning tasks.

2. AI-enabled urban planning enhances responsiveness to changing needs

AI solutions are also widely used in trend monitoring and anomaly detection. One example lies in the use of algorithms to detect patterns in large time-series data. These are used often by those working in the engineering and finance sectors. At URA, these aid urban planners in identifying and anticipating changes in activity patterns and user behaviours.

Using AI-enabled spatial and data analytics helps us to develop rich insights into utilisation patterns of public spaces and amenities. This is especially important in land-scarce Singapore, where data-informed planning is needed to judiciously optimise our limited land.

Optimisation models can be employed to assess siting, sizing, and timing options for adding or re-developing facilities and infrastructure. For example, we are already piloting the use of AI models to analyse and estimate future town demography, project demand for future social community services, and assess options to optimise the placement and service catchment of facilities. This will continue to go a long way in enabling us to meet the needs of an ageing population in a more targeted and effective way.

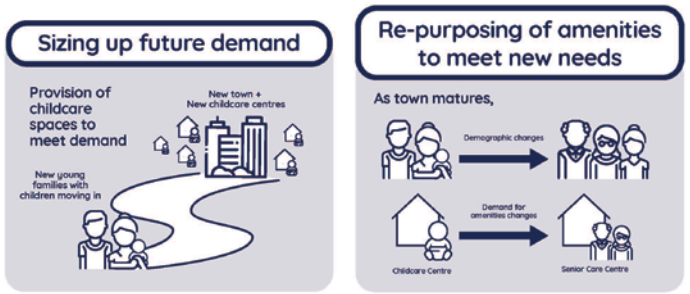
AI tools thus support the URA's work in optimising land use, improving citizens' accessibility to services and amenities, and managing utilisation of infrastructure. In the long term, this helps us to plan in a more anticipatory and agile manner to meet ever-evolving needs. This then brings me to my next point. To ensure that we continue to plan well in the long term, we also need to contribute to building a stronger urban planning community that is capable of tapping into the benefits of AI.

3. Building a stronger planning community and innovative ecosystem

Investing in people and shared planning capabilities puts us in good stead to build a more resilient and future-ready Singapore today, and for the decades to come. We hope to shape a new generation of planners and industry professionals who will leverage AI to foster an innovative and data-enabled planning ecosystem.

In continuing to facilitate knowledge-exchange with industry, this will allow professionals such as architects, engineers and developers to tap on our AI solutions to assess the performance of design options more easily and identify ways to improve their designs.

We are excited by the possibilities that AI can bring, and trust that with our partners in industry and academia, we can together create the art and science of urban planning in the age of AI.



Planners must assess how amenities can be repurposed to address future needs.

"We hope to shape a new generation of planners and industry professionals who will leverage AI to foster an innovative and data-enabled planning ecosystem."

e City Planning Manager, Plymouth City Council.

The Plymouth Plan and Its Use of Data

Rebecca Miller[e] • Plymouth City Council

APPX3: Case Study 5

Introduction: The Plymouth Plan is a ground-breaking plan which looks ahead to 2034. It sets a shared direction of travel for the long-term future of the city, bringing together a number of strategic planning processes into one place, helping to achieve an ambition to become one of the most vibrant waterfront cities in Europe where an outstanding quality of life is enjoyed by everyone. It talks about the future of the city's economy; its plans for the city's transport and housing needs; it looks at how the city can improve the lives of children and young people and address the issues which lead to child poverty; it sets out the aspiration to be a healthy and prosperous city with a rich arts and cultural environment; and it sets out the city's spatial strategy, incorporating the Plymouth-specific elements of the Plymouth and South West Devon Joint Local Plan.

Challenges: Back in 2011, the Council took a bold decision to try and do something that no other local authority in the UK had done before – to bring together partners, plans and strategies into one place in one single strategic plan for Plymouth that would be about both people and place, providing one vision, one strategy and one overarching message about Plymouth's direction of travel, and which our partners and the whole city would help create and own. The Plymouth Plan brings together over 140 strategies and plans that are a statutory requirement, national practice or local decision. It was identified that most were working to different timelines, based on different datasets, with differing and sometimes conflicting visions and agendas. This was costly and confusing. The challenge was how could the city speak with a single voice?

What if we were able to have a single strategic plan that presented one version of the truth where one vision was owned by all of the city? What if we could align the plan to our corporate planning and budget setting? What if we could redefine what a plan is so that it is not simply a paper document but an interactive resource, something that communities felt they were truly able to influence and own, a plan that the user could enter in a way that meets their particular needs – whether a local resident, investor or visitor?

Solution/Innovation/Methods Used: The Plymouth Plan was first adopted in 2014 and is kept under regular review. It was amended in January 2021 to align with the declaration of a climate emergency. As part of the Plan, a suite of high-level indicators were developed to monitor progress towards the strategic outcomes and objectives. This is a deliberately limited indicator set, structured around the Measures of Success set out in the plan. Indicators provide insight as to how the city is progressing on delivering against the plan's objectives and highlights where further deep-dive analysis is needed to understand what is preventing sufficient progress and whether interventions are needed. The annual insights also enable reviews and refreshes of the plan to take place, to ensure it remains relevant to current challenges and that focus is given to those areas that are not yet showing improvement. These are reported on each year in the Plymouth Plan Annual Report.

The annual report forms part of a wider suite of data alongside the Plymouth Report and Authorities Monitoring Report (AMR). The Plymouth Report provides an overview of the needs and issues facing the city and contains the Joint Strategic Needs Assessment (JSNA) whilst the Authorities Monitoring Report (AMR) sets out key information in relation on the delivery of the Plymouth and South West Devon Joint Local Plan.

The data that we use to monitor progress is held in several locations, including Data Place Plymouth. This is a central open data portal where we host data about our city from the Council, partners and other organisations. This data covers a wide range of topics and themes, including the Plymouth Plan. The visualisation of Plymouth Plan data, as well as other key facts and figures about the city, is available on our Data Plymouth platform.

Benefits: In addition to the obvious benefits of one single strategic plan for the city where there is a clear and consistent vision, the Plymouth Plan and our data storage and visualisation platforms ensure that there is consistency in the data being used to inform decision making across the Council and our partners. This promotes confidence about 'one version of the truth' so that all users can be sure that the data is the most up to date and accurate.

Websites:

The Plymouth Plan: https://www.plymouth.gov.uk/planningandbuildingcontrol/plymouthplan/

Plymouth interactive plan: https://theplymouthplan.com/

Data Place: https://plymouth.thedata.place/

Data Plymouth: http://www.dataplymouth.co.uk/

APPX3: Case Study 6

Carbon-Neutral Development: Cornwall Development and Decision Wheel (CDDW)

Alex Rainbow[f] • Cornwall Council

f Carbon Assessment Specialist, Carbon Neutral Cornwall Team, Cornwall Council.

Introduction: As part of Cornwall Council's drive to become net carbon neutral by 2030, a new tool – the Cornwall Development and Decision Wheel – was developed in-house to help reshape project and policy development and decision-making to formally encompass a wide range of environmental, social and economic factors that were not previously considered in such depth.

Solutions: Cornwall Council chose to co-opt the concept of *Doughnut Economics*, a theory put forward by economist Kate Raworth[2], as the basis for the tool to assess a wide variety of social and environmental boundaries as a measure of sustainable development. To adapt it to the Council's needs, the Carbon Neutral Cornwall Team scoped out what areas were pertinent to its main policy drivers and powers as a local authority and added / changed various segments of the doughnut model to suit this. Titles of segments were also changed to make them easier to understand. Experts within the council were approached to help craft questions in each of the segments that would prompt users to consider potential impacts in these priority areas as a way to test any decision being made. For example, the Air Quality segment focused mainly on car journeys and indoor mould, the two largest sources of air quality issues for Cornwall. A simple 1 to 5 RAG (Red-Amber-Green) rating / scoring system was implemented with which users would score each segment against based on the answers to the questions they provided. An initial version of the tool was developed in Excel which produced a coloured wheel graphic, which then fed into Cabinet Reports for consideration by members.

This system, however proved clunky when it came to using the tool early in the project and policy planning cycle and open to misuse due to users' self-scoring. A second version, based in the Council's Sharepoint system using Web Forms and Power BI, software to access information and data anywhere as a basis, was developed. It features a self-scoring mechanism dependent on the answers given to the questions posed and produces a graphic report at the end for use in decision making less independent oversight; it is being embedded at the business case stage of project and policy planning.

Benefits: The new version of the tool allows users to identify major negative impacts early on and mitigate against them if possible. It also identifies where more evidence will be needed to fully understand a potential impact and for that evidence to be gathered. Having to accumulate this evidence from other teams in the Council is helping to break down siloed working habits. The graphic is extremely popular with both Officers and Members, making use of the tool more engaging and allowing decision makers to quickly access key impacts through the visual summaries. The user interface is also a massive step up from the previous CIA which, although the new tool may require more work than the previous one, means people are more willing to use it.

Lessons Learned:

- Sponsorship at the highest levels is very important, with Cornwall's Chief Executive being a major proponent in developing and embedding the tool.
- The process of crafting the questions in conjunction with in-house experts in those fields is an extremely instructive and worthwhile exercise and will help shape any similar tools to the exact needs of each Local Authority.
- The basic theoretical framework for such a tool, including the questions and developing an initial version in Excel is a relatively low resource-intensive effort.
- Those creating projects and policies are often blinkered to any negative impacts their work may have. Some level of independent oversight is necessary to help users over this psychological hurdle.

Further Work: The tool continues to be refined and rolled out to new areas. The underlying values in it are also filtering up to help inform the overall strategic values of the Council. Using the wheel has also helped to identify that there are certain areas where so little is known about potential impacts that it is a struggle to even formulate questions about them. One such area is Climate Change Adaptation, something that has led to a collaboration with the University of Exeter on a piece of work to understand both what the expected effects of climate change will be for Cornwall but how these will affect public health.

g Innovation Lead Donna Lyndsay and Charles Draper, Ordnance Survey.

Ordnance Survey and Riskaware: UrbanAware and Population Dynamics

Robert Gordon and Donna Lyndsay[g] • Ordnance Survey

APPX3: Case Study 7

The team at Riskware are experts in incident modelling solutions. They work closely with government departments and other organisations globally to provide actionable intelligence and decision support to key stakeholders in mitigating security, environmental, and biological threats. Ordnance Survey (OS) are dedicated experts in location intelligence, and by bringing the two capabilities together, we could enable Riskaware to add value for their customers.

The Problem: Riskaware are specialists in CBRN (Chemical Biological, Radiological and Nuclear) and HazMat situational awareness tools and decision support. Working together with partners, they continuously develop and expand their capabilities. Their work spans some of the most critical domains for security and human challenges to society, including environmental, cyber, and epidemiological threats.

Ordnance Survey's Innovation team reached out to Riskaware as it knew the problems they were trying to solve and understand were well positioned in that OS has the internal capability to help solve them. Riskware discussed some of the challenges they faced in obtaining some location insights to support their emergency planning to OS's Innovation team. Two areas of need were behavioural analytics, and building construction type, to predict permeability to the hazards, i.e. how at risk were people inside buildings to the hazard and when. They were also using non-OS data sources which has the potential to cause challenges when their UK-based customers were more used to using OS data.

Solutions: "Following a demonstration of Riskaware's *UrbanAware* capability to Ordnance Survey, it became clear that their Innovation team had the potential to significantly enhance some of the underlying data layers. Working directly with their Rapid Prototyping Team, who worked through and distilled Riskaware requirements, we could immediately see the value of using OS expertise in location data to provide high quality dynamic population analytics and building permeability estimates, both of which are critical in gaining a detailed understanding of risk and impact. The team at OS also supported Riskaware in becoming an OS Licensed Partner so we can now offer OS data directly to our customers through the APIs. This enables our customers to use the data they are used to, know the quality of, and which they can trust to give them accurate location information critical to emergency scenario planning.

The Project: Riskaware expressed a need for improved behavioural analytics and richer building attribution for the purposes of disaster contingency modelling and planning for its software suite, *UrbanAware*. OS's Rapid Prototyping Team developed models to provide situational intelligence on indoor and outdoor populations during day (2PM) and night (2AM) scenarios for a test region of Newcastle.

Challenges: The number of people in a location at any given time varies across the day and is dependent on what that location is used for. Official Population Statistics report population at a coarse resolution, for example a typical census output at Middle Super Output Area level, cover 19 sq km on average, and represent only one time of the day. To respond effectively to emergencies, these generalized large scale totals are not sufficient. Additionally, highly localised real-time population estimates, for example from mobile phone use, may raise privacy concerns.

Solution/Innovation/Methods Used: Ordnance Survey developed a model using their data to understand places people might be found in an area and a range of open government datasets to understand the total number of people expected to be in a region. We modelled how the geospatial distribution of people changes throughout the day, including detailing how many were indoors vs outdoors, resulting in predictions down to the level of an individual building or park.

Benefits: Our model uses trusted government data, which is prepared in a privacy preserving way, to still account for changes in population distribution across the day. Being able to differentiate between the number of people inside or outside a building is very important when understanding the impact of different threats – this is a significant benefit over using large scale aggregated population values.

Lessons learned: Redistributing aggregated population totals requires several assumptions to be made, which can be hard to validate in the real world. For example, how to match up the categories given to people with the categories given to buildings, or how to account for the variation in people outside due to the weather.

Further Work: Future developments might include accounting for seasonal differences, such as school holidays; using footfall data to validate the results in shopping districts; and accounting for additional times of day, such as commuting periods.

Indoor population estimates at a building level for day and night for a sample region

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Transforming Places Together – Scotland's Digital Strategy for Planning

Liz Pringle[h] • Scottish Government

h Head of Digital Planning, Planning and Architecture, Scottish Government.

Planning changes places and in so doing it changes people's lives and livelihoods. Effective planning is about positive change. That is why planning matters to people – each of us individually, and collectively within our families and communities. In reforming our planning system, change is not just about how we do things. It is much more about why.

Scotland's new Planning Act defines the purpose of planning in legislation: to manage the development and use of land in the long-term public interest. That is not simple. Planning is charged with a multitude of great expectations to achieve many different things on very different scales, and sometimes with priorities and aspirations pulling in different directions.

The choices and decisions we all make through our planning system need to help guide our journey to net zero. They will help us realise the clear benefits from high standards in placemaking for our physical and mental health and wellbeing. Our choices need to ensure we have the homes that people need, in the right places with easy access to work, education, services, utilities and leisure – the vital components that help us form strong, well-functioning communities. So we need to be ready to make good choices.

Over the last three years, we have been talking to those who work across the whole planning sector, those that regularly interact with it, as well as those in communities with interests in planning and place. We have heard the issues that many experience of participating in planning, about what works well and what could work better, and the opportunities that a digital transformation programme could deliver. We have shaped our strategy to digitally transform Scotland's planning system based on those insights.

Our vision is for Scotland to have a world leading digital planning system that helps connect people with their places to deliver a prosperous, green and fair country. Our Strategy establishes a framework of Five Missions, with set Goals and Priority Actions, which we believe together will digitally enable Scotland's planning system:

Mission 1: Unlock the value of planning data – our focus on understanding, improving and drawing insight from data signals the importance we place upon this aspect of digital transformation. Unlocking the value of data will be key to realising an open and smart planning system.

Mission 2: Deliver an end-to-end digital planning experience –we will develop new digital services, platforms and tools that will deliver a complete digital planning service experience, using next generation technologies. By focusing on the whole journey through planning, we will be able to develop the interoperability between systems to facilitate a truly digital planning system.

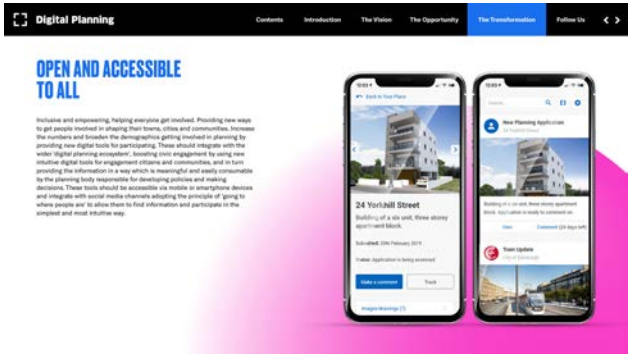
Mission 3: Create the conditions for digital to flourish – we will integrate digital fully into our processes and ways of working, support the development of high-quality digital skills in planning and create the conditions for digital transformation to succeed.

Mission 4: Use digital tools to drive collaboration and engagement – we will develop digital tools to support greater digital participation and inclusion in planning, using them to drive collaboration and engagement with people and places.

Mission 5: Embed a culture of digital innovation – by doing this we will secure a long-lasting legacy; allowing the planning sector to continuously improve and quickly respond to the emergence of new technology.

There are huge benefits to digitising the planning system of Scotland for local communities, businesses and Government organisations.

The new system will provide information in an easy to access way, in one place. There will be real-time tracking of plans, it will be possible to explore potentially suitable sites for development, to become more involved in the planning process – being able to get involved in local place plans; we will have a voice in shaping place as an individual or community. There will be a more consistent and coordinated planning process across different geographic areas. Digital skills will be uplifted and the creation of up to 1,600 jobs and £200m generated in economic benefits, so significant savings will emerge for prospective developers per application, plus cost reduction through decreasing invalid applications, amongst other things. None of this will be possible without collaboration in partnerships across private, public and academic sectors and we are working hard to foster such partnerships and collective thinking to create the best possible outcomes.



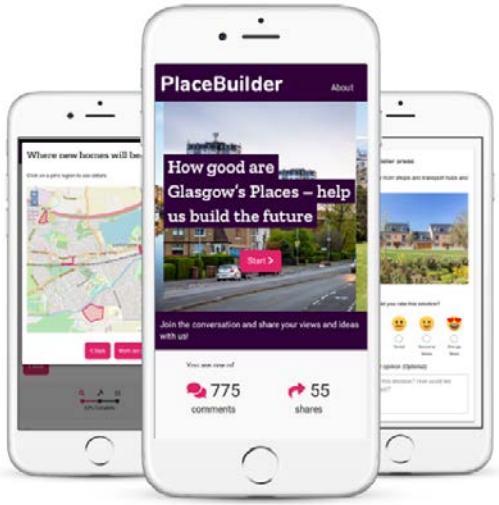
Our guiding principles, our values, are already helping us deliver the ambitions of these benefits by providing greater clarity about the spirit by which we work, establishing common goals and a clear purpose. In doing this we will (and do):

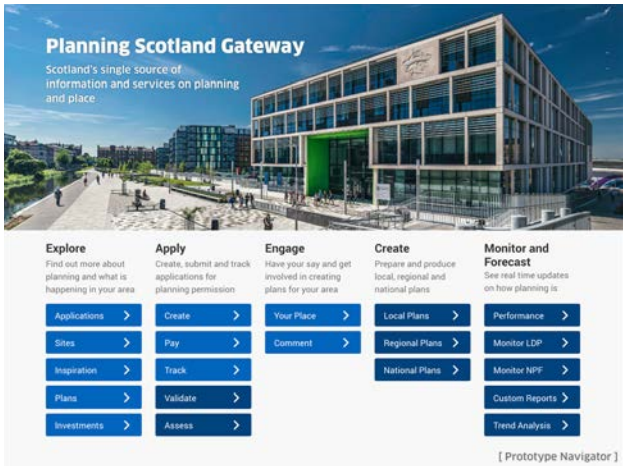
- Work with users to design and develop together
- Collaborate and work in partnership
- Put data at the heart of planning to inform decision-making
- Deliver early benefits and capabilities of transformation by delivering new features and improvements to existing services
- Be responsive to change, ready to learn and adapt
- Stimulate creativity and harness innovation
- Make it easier for planning authorities to integrate new technology within a digital ecosystem where apps and services can be adopted and reused as components of a flexible, cloud-based, modular platform
- Take a holistic approach to designing services, working across organisational boundaries and bringing Development Planning and Development Management together to enable a plan-led system; and finally
- Value and integrate non-digital interactions

To bring this to life our focus in the first year of delivery concentrates on 7 key priorities:

- We are putting in place technology solutions that will improve the digital planning application process
- We have been developing digital support and website development during the production and completion of Scotland's fourth National Planning Framework
- We are working with RTPI and EKOS to establish a digital skills programme for partners, ensuring we are building capability for the future planning system
- We are clearly, and systematically laying the technical foundations for the programme
- We are supporting some communities to produce plans with PlaceBuilder through the distribution of subscriptions
- We will begin a programme of improving and making planning data accessible for collaborative place-based planning

And we are developing a proposal to create an incubator of next generation digital thinking - the PlaceTech Innovation Lab will establish a physical space to enable cross sectoral collaboration on place-based challenges. These are exciting times for planning in Scotland. Our digital future is embedding the new practices and culture of our reforming planning system, and supporting the ways we face up to new global and local challenges in planning for our places. To read more of what we are doing, and to see the full digital strategy document please visit: https://www.transformingplanning.scot/digital-planning/





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Digital Site Identification and Assessment in Hounslow

Daniel Mohamed[i] • Urban Intelligence

i Founder & CEO, Urban Intelligence.

The London Borough of Hounslow (LBH), like many Local Planning Authorities (LPAs), is under ever-increasing pressure to find land to meet the growing demand for homes. This has been exacerbated by the recent target uplift in urban areas, which has more than doubled LBH's target for the next 10 years to 17,820 homes. Of these, the London Plan now stipulates that 15% must be delivered on sites smaller than 0.25 hectares. Until now, planning officers have assessed potential development land manually, which can take up to one hour per site. Consequently, officers focus less on small sites, as these are less likely to yield many units. The traditional manual approach to site identification is no longer compatible with the need to meet increasing targets and statutory requirements to build on smaller sites.

Urban Intelligence (UI) spent 8 months co-designing a digital solution to LBH's site-finding dilemma with local planning officers, funded by the Greater London Authority. This culminated in "***PlaceMaker***", an AI-driven web platform built on 6 years activity in R&D by UI and invaluable input from Hounslow's planning officers. In LBH, ***PlaceMaker*** has been used to analyse 119,000 land parcels (a 217 fold increase on the 2020 HELAA (Housing and Economic Land Availability Assessment which assessed 548 sites) for suitability, availability and achievability. The software sifted these sites, identifying 4,200 as suitable for development, subject to further consideration.

Search for Sites

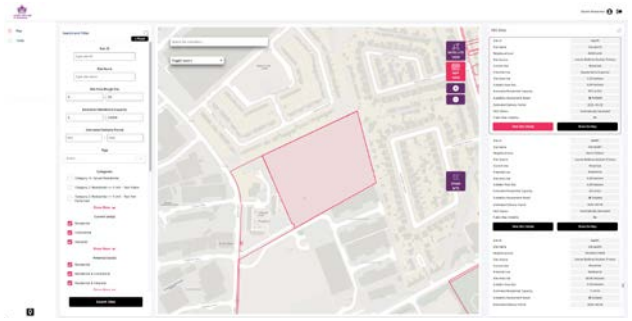
PlaceMaker's principle benefit is that it significantly increases the scale and scope at which sites are analysed. The tool gives planning officers an instantaneous, strategic overview of all suitable sites and their constraints, which can be shared with the public. The public can also submit sites, which are instantly added to the map and analysed. This makes for a more transparent 'Call for Sites' exercise, as it is focussed on extracting details on the land's availability from landowners, rather than constraints, which are already analysed by ***PlaceMaker's*** using open source and UI data, along with the co-created development appraisal algorithm.

Going forward, ***PlaceMaker*** can be applied as a flexible tool in the Council's work. Planning officers can tweak how sites are analysed, for example by changing density or sales price assumptions. They can also draw new sites or sub-plots that are analysed instantly, as well as tag and comment on sites. Sites can be added to lists so that the Authority can test different policy scenarios.

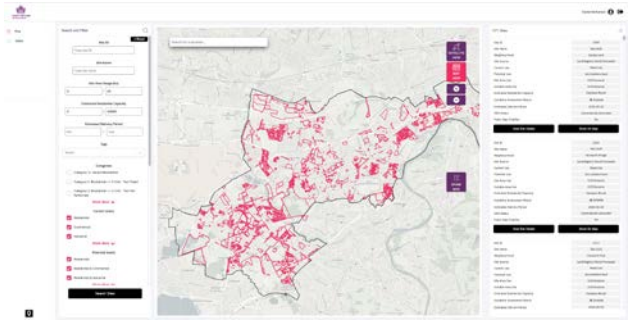
A key lesson learnt from local officer input during the LBH project was that tools such as ***PlaceMaker*** should improve organisational transparency. Based on officer feedback, UI designed co-working functionalities into ***PlaceMaker***, including the option to comment, view a site's edit history and to share sites with colleagues in other departments. These features can help overcome organisational issues such as siloed working and contribute to more joined up strategy and policy design.

Public Web Map View of Sites

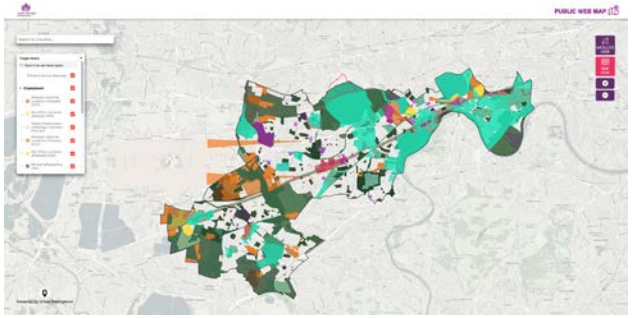
LBH and UI won the award for Digital Transformation Project for this project at the 2021 Proptech Awards, along with VU.CITY, with whom they are developing a 3D module. The ***PlaceMaker*** solution delivered for LBH is only the beginning of UI's journey in empowering the planning and development sector to assess land more efficiently. The ***PlaceMaker*** solution is now being used by Birmingham City Council for their Local Plan review. At the time of writing (November 2021), ***PlaceMaker*** is also being implemented by Tonbridge and Malling Borough Council and the London Borough of Haringey, with numerous other LPAs seeking the solution. UI has further exciting product releases and projects on its roadmap over the coming months, which will contribute to digitising and streamlining the making of Local Plans and their evidence bases.



Search for Sites



Site Map View



Public Web Map View of Sites

j Lecturer, School of Architecture, Planning & Landscape, Newcastle University.

Digital Planning in Newcastle and Gateshead

Alexander Wilson[j] • Newcastle University

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This case study briefly outlines some headline digital planning initiatives being taken by Newcastle City Council and Gateshead Council at the intersection of digital technologies, place and urban planning. This intersection covers a broad range of technologies, from smart city technologies to those used to improve back-office processes. We will briefly note a number of initiatives, but it is not intended to be exhaustive, but simply gives the reader an idea of the diversity of applications in the digital realm.

Current Use of Technology in Planning

The first, and commonly used digital technology, is the use of digital document management systems to provide more transparent decision making and formal opportunities for engagement.

Digital Document Management for Transparency
By Idox for Gateshead Council

- Gateshead Council use a system provided by Idox for their end-to-end management of planning applications.
- The technology allows for planners to easily work together without reliance on paper.
- Through a portal, citizens can view documents related to planning applications, and the status of decisions.

As these documents are phrased in the same way that planners use (for example, in technical language), opportunities have been recognised for more citizen centric approaches. These technologies thus provide lower-barrier opportunities for involvement.

Citizen-Friendly Opportunities for Engagement
Commonplace, Newcastle City Council

- Typically map-based engagement platforms allow people to add their comments to maps using both free text, responses to closed questions and iconic representations. Gateshead Council use a system provided by Idox for their end-to-end management of planning applications.
- These tend to be used for one-off engagement opportunities (such as when determining cycling investment), but their use in more formal planning engagement is limited.

A Note of Caution from Newcastle: The posting of thousands of false comments on a consultation led by Newcastle City Council presents an interesting case study of what might become more commonplace in the future. In February 2021, it was discovered that an attempt was made to 'skew' the results of a consultation through the creation of 1,894 'fake accounts'. The consultation platform they were using, to facilitate engagement on closing a bridge to motor vehicles, has "7,131 faked comments, as well as a further 176,036 agreements, which were used to strengthen public sentiment for the bridges to be re-opened to traffic". As the role of digital technologies grows, digital tools could be increasingly targeted by vested interests. More open and accessible means of engagement can be in tension with the identity and location checks that are currently necessary for statutory consultation processes.

Technologies Related to Place

In 2018, Newcastle City Futures commissioned a report by Urban Foresight to explore Newcastle's ecosystem of urban services and systems. The report profiles Newcastle's urban digital ecosystem, and outlines how these can be harnessed for enhanced working practices that better utilise digital technology.

Newcastle's System of Systems
Newcastle City Futures; Newcastle City Council; Urban Foresight

The report provides a series of recommendations for Newcastle City Council to kick-start their increased use of digital technologies. It provides a series of important recommendations on how urban technologies are adopted, and the local authority's role in attracting and utilising digital tools:

- A challenge-based approach should be taken, without a technology solution.
- Develop a series of investment-ready projects along a strategic trajectory, rather than the ad hoc.
- Early attention needs to be given to intellectual property, data sharing practices and ownership to harness opportunities provided by open data avoiding vendor lock-in.
- A more strategic use and vision can be implemented by developing an innovation partner that can act as a bridge between external organisations and the local authority.
- New working practices should be developed alongside the use of new digital technologies – the focus should be on service transformation and user-experience rather than established practices and organisational structures.

There are a number of technologies that are used in matters that could, with an expanded understanding of what planning is, easily be considered related to planning. These projects, which are not currently a part of the statutory planning system, could become a contributor in future approaches to planning that engage more with the opportunities presented by digital technologies.

Urban Observatory Newcastle University
Funding: EPSRC and DAFNI

- The aim of Newcastle's Urban Observatory is to understand cities through monitoring large-scale data.
- The largest dataset of open data in Europe. Sensors collect real-time data on several variables: from traffic and air quality to river level and electricity usage.
- Used in a number of projects, such as that noted below.

How Busy Is Toon?
Newcastle City Council; Urban Observatory, Newcastle University; North of Tyne Combined Authority; Northumberland County Council; Funding: £167K from Local Digital COVID-19 Challenge Fund.

- 'How Busy Is Toon' uses city-sensors to aggregate metrics (number of people, car parking spaces, live traffic cameras) that provide lightweight systems to inform people's decision to visit the city centre.
- The aim is that people can understand how busy the city centre is (and therefore the ease of physically distancing from others).

Smart Street Demonstrator, Summer 2018
Newcastle City Councill; CISCO; other partners

- Implementation of a number of technologies to implement 'the smartest street in the UK' through monitoring waste on the street (bins), parking management, air quality, street lighting, and predicting when the road surface might need repairing.
- The aim of the demonstration was to understand how such technologies might be rolled out on a city-wide scale.

Virtual Newcastle Gateshead (VNG)
Northumbria University; Newcastle City Council; Gateshead Council.

- VNG is up-to-date three-dimensional model of the urban centres of Newcastle and Gateshead.
- In the past the model has been used to understand the visual impact of developments, but has uses to expand well beyond, through, for example, visualising data attributes.

Exploring the Future Use of Technology in Planning

Both Newcastle and Gateshead have been successful in achieving funding to explore both the opportunities presented by digital technologies, and their barriers to being integrated within their planning departments.

Newcastle City Council Digital Planning Discovery
Newcastle City Council; FutureGov

- A scoping exercise with FutureGov to explore user-centred approaches to planning that deliver 'value' to Newcastle residents.
- Led to four 'insights' on their readiness for transformation to more substantially engage with the opportunities presented by digital technologies.
- Identified the need for wider changes in planning to take advantage of digital opportunities, as well as the need for those procuring technologies to better understand a planner's duties.

Newcastle City Council have partnered with an external organisation for the delivery of their digital agenda. Two of these partners are listed below:

- Urban Foresight: Newcastle City Council have appointed Urban Foresight (UF), a Newcastle-based smart city consultancy, as their Innovation Partner. Through the partnership, UF will identify opportunities to nurture innovative projects.
- FutureGov: Newcastle City Council and FutureGov worked together to explore the implications and opportunities presented by the planning white paper and digital transformation.

Virtual London: Visualising Digital Twins for Urban Planning and Design

Andrew Hudson-Smith[k] • University College London

k K. Professor of Digital Urban Systems, The Centre for Advanced Spatial Analysis, University College London.

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Introduction: **Vi**rtual **LO**ndon, ViLO for short, is part of ongoing research in CASA at UCL into 3D virtual environments with real-time data for collaborative urban planning. Developed as part of the Mayor of London's *Smart London Board* and in collaboration with the *London Legacy Development Corporation* and initially funded by the *Future Cities Catapult*, it focuses on a technology showcase of digital data around the Olympic Park in Stratford, East London.

Challenges: The main challenge was to use Game Engine technology, in this case the Unity platform, to provide access to the flow of near real-time data in the Olympic Park – Transport, Environmental Sensing (via the Internet of Things) and Events-based data while also supplying long term data – on Building Usage – within an innovative but easy to use interface applicable to desktop, augmented reality and virtual reality use. The tools have the potential to inform a variety of perspectives on local planning and urban design.

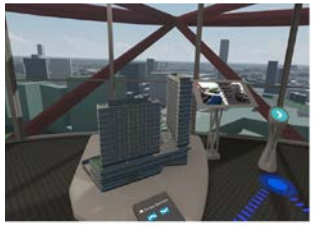
Solutions: ViLO, arguably, is one of the first Digital Twins in the UK combining The Internet of Things, Geographic Information Systems (GIS), Building Information Models (BIM), Planning Information and Game Engines into a single package. It also allows import into true multi-user environments, and visualisation in both augmented and virtual reality, representing a system that could be used by all players in the planning process, from onsite logistics and developers through to public participation. Interactions include three-dimensional view-sheds, cut-through building views via BIM models, site visualisations, the ability to query building level data, the inclusion of sub-surface data, and dynamic object placement.

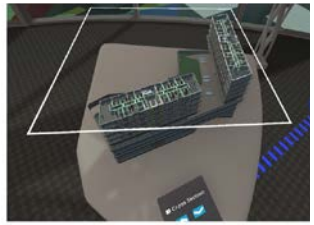
Benefits: The system allows all those involved in the planning system to view and collaborate on a Digital Twin in real-time, regardless of their physical location. It creates a sandpit for urban exploration as well are providing an 'at a glance' view of the current data associated with the Olympic Park. In addition, it leads to the understanding of the need for skills required to develop and understand such systems. New educational initiatives at UCL in Connected Urban Environments have also been directly influenced by ViLO allowing such tools to be integrated into new teaching modules on Virtual Reality, Realtime Data, and Virtual Environments with the aim of training the next generation of developers in digital urban applications.

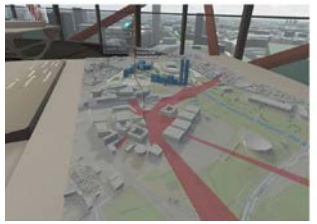
Lessons Learned: Three dimensional building data in the United Kingdom is still hard to come by and the market has been filled with private providers (such as VU City) while the Ordnance Survey, arguably, remains predominantly two dimensional in its approach to digital data and Digital Twins. Other countries, such as the Netherlands, have a national, open 3D data system. The United Kingdom has arguably been left with a data void and with it a void in skills for planning in 3D dimensions. Funding is also an ongoing issue for such systems that require longer term investment for true integration into the planner's tool kit.

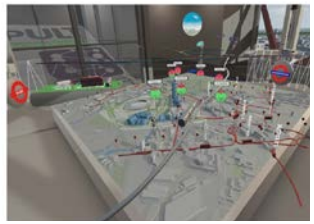
Further Work: There are currently over 160 companies developing collaborative, multi-user worlds, known as Metaverses. Facebook, recently renamed as 'Meta', has a focus over the next 10 years to build Digital Twins of places and spaces, twins that via systems such as ViLO could be used for urban planning. ViLO was made to be easily ported into these new Metaverse environments and the concepts developed at CASA are continuing to develop into these new emerging technologies for digital planning and the next generation of digital planners[3].

Website: https://connected-environments.org/portfolio/vilo-platform/









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Greater Cambridgeshire Shared Planning Service and the Digital Local Plan

Nissa Shahid[I] • Greater Cambridge Shared Planning, Cambridge City and South Cambridgeshire District Councils

I Digital First Lead, Greater Cambridge Shared Planning, Cambridge City and South Cambridgeshire District Councils.

The Greater Cambridge Shared Planning Service (GCSP) provides the planning service for South Cambridge District Council and Cambridge City Council, including developing the first joint local plan of the area. This will be a Digital Plan, in line with the UK Government's push for Local Authorities to modernise the planning process and adopt visual, map-based digital technology - moving to a standardised process with digitally consumable rules and data.

The GCSP has adopted a 'digital first' approach to its plan making process, which seeks to use the best aspects of new digital processes to support traditional plan making. This ranges from new digital engagement processes, through to automated data collection, down to the interactive visualisation of plans and options. The aim of adopting this process is to ensure a better user experience for residents interacting with the Local Plan and for planners on the Local Authority side developing the vision for the future.

The team has taken on an agile, iterative approach and begun by developing an HTML website version of the Local Plan, in a conscious attempt to move away from PDF-based, non-machine-readable online publishing format. This is the starting point on which to build and will ensure that the adoption of further digital process builds upon a solid, interoperable foundation.

To date, three versions of digital plans have been tested and incrementally built upon:

- The first iteration was the Issues and Options consultation in 2019. This placed the Local Plan content online as a series of structured HTML webpages, with the ability to provide simple comments directly within the page. This consultation had a greater rate than previous consultations, with 53% of users accessing it from a mobile device.
- The second iteration adapted the format for the North East Cambridge Area Action Plan (AAP) draft consultation in 2020. This utilised a themed version of the standard consulting platform to guide users through the AAP document as a series of structured HTML webpages, with the ability to provide formal comments (that linked to the back-end consultation platform) directly within the page. However, the content provided was all required to be uploaded by external specialists as there was no user-friendly interface available.
- The third and current iteration is for the Local Plan Preferred Options consultation in November 2021 and will work on improving the back-end process so that the consultation platform is structured within a mobile-first, content management system (CMS) that planning officers have control over – reducing the reliance on third party software engineers to upload content. The other key innovation is planned interoperability between planning policies text and the GIS map information, to provide a level of interactivity impossible in analogue formats.

Barriers to the adoption of a digital plan range from lack of digital and data skills within planning departments through to acquiring the funding. Scrutiny on planning is high and any process change that results from digital transformation needs to be done with caution and constant testing against wider planning objectives internally and externally (i.e., with PINS). To address these challenges the project has been developed with a realistic vision of what is achievable now and seeks to prepare the groundwork for the next generation of innovation. It was developed with the intention of ensuring that in modernising the plan and adopting digital processes, it did not create further bottle necks of unforeseen issues that could delay the plan. The next stage will undertake a discovery of data contained within the local plan (who holds it, needs it and wants it) to build in a data-led approach into the next iteration.

The website gives details of what has been accomplished so far: https://www.greatercambridgeplanning.org/localplan

Waltham Forest's GovTech Catalyst Challenge: Housing Monitoring

Oliver Norman[m] • London Borough of Waltham Forest

m Principal Planning Policy Officer, GovTech Lead, London Borough of Waltham Forest.

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Introduction: Monitoring of housing delivery is a key part of the planning process. It enables decisions to be taken that are well-informed and grounded in an understanding of the effectiveness of policy based on evidence. This project, funded by the *GovTech Catalyst Challenge*, took on the challenge of improving, standardising, and where possible automating the process of data collection surrounding the monitoring of development sites.

Challenges: There is a lack of consistency in method between authorities. Every Local Planning Authority has their own methods, and though there are similarities throughout, there is limited sharing of systems or methods. Monitoring is highly resource intensive and manual, requiring significant data entry and cleaning. There is a lack of quality assurance and management of the process. In the absence of specific guidance on what information needs to be recorded, planning authorities have tended to treat the task of monitoring housing as one of a survey, to be completed in order to fill out a return, or provide data for a monitoring report. This has not generated local data of sufficient quality or accuracy to enable the analysis which is necessary. A longitudinal approach to monitoring sites, such as tracking a site from first engagement with the planning system, right through to completion of any development, would be far more effective in delivering the insights which are needed to diagnose the locally specific characteristics of housing delivery.

Solution/Innovation/Methods Used: The solution that the Council is proposing is in development, with a private beta version of the software running until July 2022. There is not a shared, centralised point at which information about the development status of sites can be accessed. Trust in and access to the data of other teams is limited, leading to a multiplication of similar work to visit or collate information about site status. The solution will provide this single point of access to information about development site status.

A lack of shared identifiers and the existence of identifiers at the level of granularity required is the main technical challenge to overcome. There is also a significant institutional hurdle to overcome, that the data associated with various stages in the development process is distributed across the Council, among several directorates and teams. There is process change and innovation required to ensure that all data produced can be integrated, and a full picture of development status built up.

In addition to better relating the data produced by the council or published as open data to understand development site status, with one of our suppliers (Astrosat), we have been exploring the potential for the application of satellite acquired data to provide an additional source of assessment of site progress.

Benefits: The vision is to be able to collect data relating to the development process for sites of all sizes and types. This has multiple benefits:

- We can track the development of homes as planned
- Build a shared view of a development within the LA and outside at any given time
- Identify bottlenecks to inform data-driven decisions related to housing delivery
- Provide more and better quality data enabling analysis which can improve models in use
- Reduce time spent by planners and across the Council visiting sites and collating information
- More easily identify breaches of planning control

Lessons learned: Data foundations: The project has highlighted how making full use of standards such as UPRNs (Unique Property Reference Numbers), and implementing these properly to relate and store data can unlock more complex operations. Without viewing the maintenance of data such as this, and properly resourcing the updating and validation of data produced by, but not critical to existing business processes, substantial barriers exist to implementation of any technical solution.

Institutional sponsorship: Our work on user needs and outline business cases has clearly identified a substantial need for the solution within the authority. Despite this, eliciting participation remains a challenge. Ensuring there is a clear directive from management and resources allocated so that all potential users can be involved in a meaningful way, is vital.

Further work: Phase 2 of the Challenge is ongoing, from July 2021 – July 2022. Regular updates about the project will be available at the Council's website, and 'Show and Tell' events will be held throughout the rest of the year 2021.

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Case Study
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DATA Place Plymouth and Open Data

Tim Binding[n] • Plymouth City Council

n Data Science and Innovation Planning Officer, Plymouth City Council.

Introduction: Originally an idea developed from a DATA Play event (an event series looking at specific challenges or themes, using data to drive innovation and potential solutions), the Data Place Plymouth became the open data portal for the council, developed in conjunction with the Data Place (a social enterprise based in Plymouth).

Since then, over 145 datasets have become now available, from nine different entities, including council departments, Devon and Cornwall police, and the new NHS Devon Clinical Commissioning Group (CCG), there are frequent updates on the platform, and this will only grow over time.

Challenges: One of the largest challenges with an open data platform comes from the cultural change needed to really drive data sharing and enabling more uploaded data onto the Data Place platform. This is a key challenge to overcome, especially in a far more connected world than previously, and with more digital reforms on the horizon. Other challenges include ensuring reliable and decent quality data is uploaded and making sure it is kept refreshed on a regular basis.

Innovation: Simply by having an open data platform available within the council, this helps encourage staff to behave in a far more innovative way and to try new things, especially when they know that there might be data on the platform that can help.

As the idea for DATA Play and DATA Place came from within the planning function, this department has become a hot bed for innovation, including the experimentation of having a data scientist embedded within the team.

There are other elements of innovation still to come, from enabling the platform to work within a smart city context to enabling the platform to work in harmony with other systems.

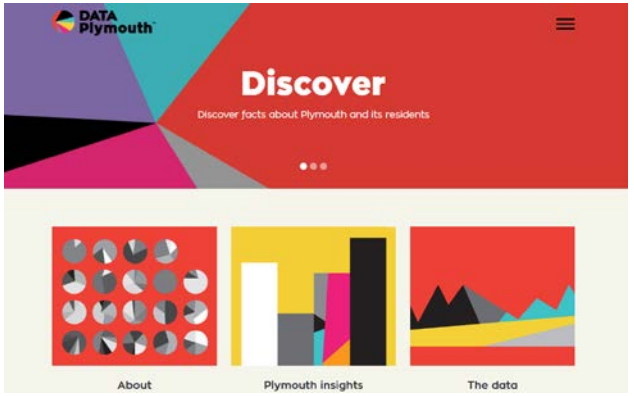
Benefits: with open data, the non-financial benefits are just as important as financial, if not more. The use of the platform by nine different entities, including those external to the council, is a huge benefit, and allows a closer working relationship by sharing and uploading data together.

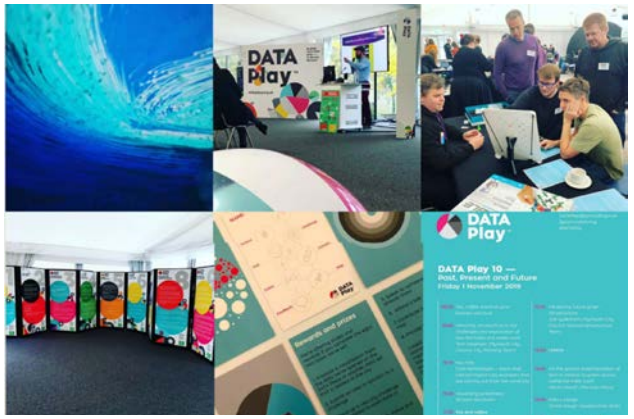
It is difficult to understand the financial benefits of open data but work by the ODI (Open Data Institute) estimates GDP benefits of circa 0.5% - 2%. Open data fosters innovation and allows creative solutions to problems that would otherwise be impossible to achieve if data were hidden and locked away.

Lessons Learned: start opening data as soon as you can, and promote the platform, both internally and externally. Clean data is best, but sometimes raw data is valuable. Both have a value in being open. An open attitude to data sharing is key to making open data work for all involved data decays over time, so keep it refreshed on a regular basis, and do not forget to review what is already there (are all the columns needed? are others now needed?). Open data means anyone can access the data; if there are technical acronyms or other such language, it can explain what it means (using the metadata for this).

Further Work: there is always work to refine and redevelop the platform, from ensuring data is up to date, to encouraging more uploaded data. Some work in the pipeline is the introduction of a web-based GIS platform within the council, and how can we tie the two together, in a way that does not detract from either. The value for planning comes in the ease of displaying layers or geospatial data in a way that makes sense and can be done quickly.

Websites: DATA Place Plymouth https://plymouth.thedata.place/ and DATA Plymouth http://www.dataplymouth.co.uk/





o Senior GIS Consultant, Aerospace, Defence, Security & Technology (ADS&T), Atkins Global.

Atkins Spatial Common Data Environment (sCDE)

Sarah Doughtyo • Atkins Global

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Challenge: With so much data now created throughout the stages of most of our projects across the client and supply chain, understanding the data and maximising its use to deliver improved projects outcomes has become increasingly complex. Putting data at the heart of a project enables planning decisions to be taken with a holistic understanding of the issue at hand.

The traditional model of project data management, and of planning authority departments, is for discipline specific data to be held by the originating party and then copies of the material are stored by other teams for separate use. This creates silos of data, which can lead to a patchy understanding of the project, obsolete data being used as the basis for decisions, or mismatched conclusions between different teams. To produce better planning outcomes, data needs to be held in one place and accessible to all.

Our Approach: we utilise a data platform we have developed called the spatial Common Data Environment (sCDE) to enable a full project and client team to view data at every stage of development, including a wide array of open-source datasets providing detailed constraint and opportunity information. The system operates as an automatic ongoing log of decisions through ISO 19650 compliant data versioning, providing an audit of conclusions and the information available to those decision makers at each stage of the process. The sCDE functions as a single-source-of-truth data reservoir across the project, and puts data understanding at the forefront through two methods, intended for two distinct user groups. The first is for planners without specialist GIS knowledge, who might otherwise have to request a PDF of a data view for each decision and wait for that to be delivered. As part of the sCDE, a WebGIS is made available in browser form, accessible by a secure username and password. Users can view and overlay all of the data, and conduct a simple digital desk study by creating buffers, clipping out data, measuring distances and areas, and visually assessing patterns. For the second set of users, specialist data users with CAD or GIS desktop functionality, data can be accessed directly through their existing software for analysis.

Benefits: The sCDE is primarily an engine for collaboration and therefore for quality of results. In prior projects, such as the A9 Dualling, Havant Reservoir, and East-West Rail, the power for teams to simultaneously access data has proven to be a key agent for rapid decision-making, and a closer relationship between environment and design, with fewer cycles of rework and more project harmony. From strategic masterplan stages, where diverse data sparks creative thinking, to implementation of planning requirements during construction, use of the sCDE has succeeded in raising the bar for the objective of high-quality planning at work for all.

Further Work: As we continue to develop the sCDE, we are continuing to place collaboration at the heart, with integration of new technologies that enable ever closer and clearer communication. Our Next Generation sCDE integrates 3D viewpoints for an immediate understanding of the baseline environment as well as proposed changes, and leverages spatially-driven dashboards to enable planners to view progress on the project, or to interrogate key metrics such as habitat types in certain small areas, or path distances within a map extent.

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The Planning London Datahub

Michael Glasgow[p] • Atkins Global

p Principal Strategic Planner, Infrastructure, Atkins Global.

Client challenge: London is made up of a number of planning authorities who each periodically report to the Greater London Authority (GLA) on planning permissions that they have issued via the London Development Database (LDD). The LDD is key to monitoring a range of activities including housing delivery, the type and tenure of new homes and the growth/reduction in employment land across the Capital.

However, the client had cited concerns around whether the data captured was providing meaningful insights into how effective the planning system was at dealing with major issues across London and on how regularly and consistently data was being input. LDD relies on data being manually entered from different sources which opens it up to human error whilst also being hugely time consuming to process the vast amounts of data being received. The client came to the conclusion there had to be a faster, more efficient way to process this data, but did not have the time or resources to develop a system in-house that was capable of doing it.

Our Approach: In 2018, the GLA planning team launched a project to build a new network of systems that would have the ability to automate large portions of data processing while also making it open, accessible and updated in real-time. In essence a move from document-led to a data-led approach was needed.

While engaging with the key stakeholder groups from across London including planners, infrastructure providers and developers, we worked to understand their challenges, objectives and the positive outcomes that would make the system deliver their requirements. This was done through a series of open sessions and working in close collaboration with the end user groups, ensuring that at each stage of the process they were engaged and bought into the approaches that were being proposed.

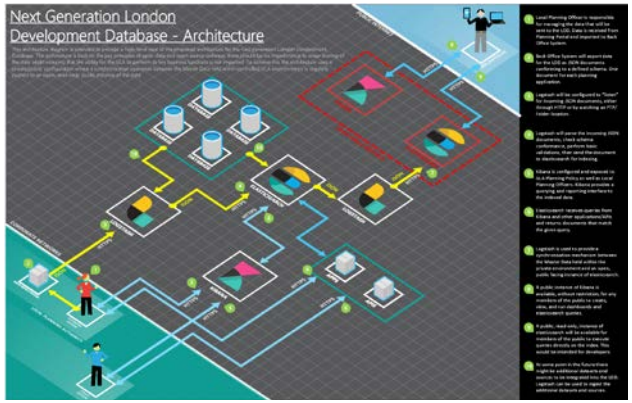
Throughout the process, we looked to draw on our information management expertise combined with our detailed understanding of what the critical data was, how it needed to be recorded and demonstrated and how end users wanted to access and utilise it. By taking this holistic, collaborative approach throughout the process, we delivered the Planning London Datahub (PLD). The PLD is a real-time dataset that links to the back-office systems of the respective Local Planning Authorities so that it is updated incrementally as planning applications are validated. PLD is open source and can be accessed, and the data interrogated, by anyone via a website, providing increased flexibility of access and with a new, easy to use interface that can present large amounts of data in an easy-to-understand visual way.

Outcomes Delivered: PLD delivered some great outcomes which had an almost immediate impact on those using the system, helping them to access data faster, more easily and in the knowledge it is more accurately captured.

At a high level it provides a much clearer understanding of how London is changing. For the GLA and Local Authorities, it will simplify their formal monitoring processes and will support faster, better strategic decision making, while for the public it provides a simple, easy to use platform where they can fully understand what development activity is due to happen in their area.

Because the data is updated in real-time, users know they are getting the most up-to-date information possible, helping to accelerate projects while also keeping the public fully informed of future activities. Importantly, the digital systems that underpin PLD allow it to be easily adapted and new functionality added in the future.

The project was the winner of the 2021 RTPI 'Excellence in Tech within Planning Practice' award.



q Head of LandEnhance, LandTech.

LandEnhance: Integrating Data Resources

Grace Manning-Marsh[q] • LandTech

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At ***LandEnhance***, the mission is to use technology to speed up and modernise access to planning information, data and policy. The planning system is complicated and risky, yet it plays a vital role in the development system, enabling places to grow and thrive. There is a vast amount of data held within the planning process, but access to this data is incredibly difficult. At ***LandEnhance*** we are changing this, by unlocking huge amounts of data that can be accessed instantly, ***LandEnhance*** accelerates planning research and enables planners and property developers to create robust planning arguments faster.

LandEnhance is part of the ***LandTech*** suite of products that brings together data to generate some much-needed agility to the planning and development process. The platform has two other products:

- LandInsight: to help find and assess off-market opportunities
- LandFund: to help with financial planning for a development

LandEnhance has been developed to tackle the issues faced by planners in finding the right information needed for planning applications. At present planning application history, policy information, appeals data and other planning related documents are spread across multiple, difficult-to-use websites. There is no standard on how policies and maps are displayed and much of the information is static and impossible to search through. This means that for the user, it is difficult and frustrating to find information. This '***planning administration***' takes up so much time it prevents planners being able to really add value to the projects they work on. This is what we at ***LandEnhance*** want to change.

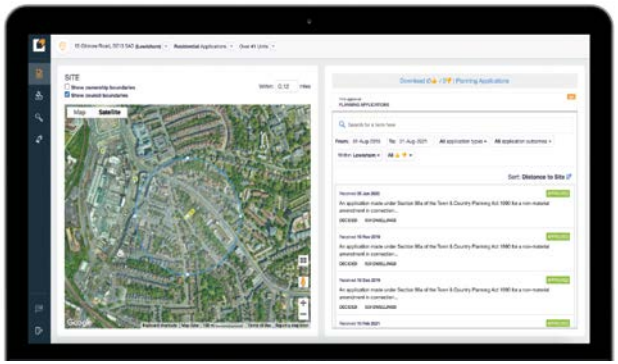
At ***LandEnhance***, we have developed easier ways to gather the information, using Natural Language Processing (NLP), Optical Character Recognition (OCR), GDAL translators, PostGIS and digitisation, to unlock valuable data in seconds.

- Using OCR, we have turned static PDF documents into searchable accessible documents. Using keywords it enables vast amounts of planning data to be searchable and instantly filters through millions of documents to identify comparable applications, appeals and policies
- Using PostGIS and GDAL, we have digitised all adopted and emerging local plan maps and created a mapping standard to ensure consistency across each Local Authority. Allowing the user to easily search for policy designations in relation to their site
- We collect all historic and current planning applications and appeals, and using NLP, they can be filtered by key terms and types allowing precedent documents to be uncovered in seconds
- We provide a monitoring workflow tool which allows users to save relevant documents and information, monitor changes to the planning landscape of a site, and download for their planning reports

This makes it considerably faster to gather the information needed, ensuring that users can be more efficient, freeing up time to work on more valuable parts of the planning process.

This process has not been easy. The format of existing data has made it difficult for us to collect. There is no consistency to the way the data is created across local authorities, so we have to develop multiple ways to collect the same data from all the different local authorities. To digitise a single Local Authority Local Plan PDF policy maps, it can take several weeks due to the sheer size and complexity of the maps. These are all things that could be improved on and made easier going forward.

There needs to be a more consistent approach to the way data is collected by local authorities, to ensure that the data can be used to its optimum. The key thing we have learnt is that to truly transform the planning process, we need to be looking beyond digitising what we have, but to fundamentally overhaul the process and create a system that easily allows the sharing and use of data and information, is one of our key goals. This will allow much better analysis of data that can help to shape the developments of tomorrow, along with streamlining the planning process and helping to deliver the much needed homes and communities the country needs.



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Ordnance Survey's Building Stock Database

Rapid Prototyping Team[r] • Ordnance Survey

r Communicated by Donna Lyndsay, Ordnance Survey.

Introduction: Ordnance Survey's Rapid Prototyping Team engaged with The Building Research Establishment (BRE) to develop a proof of concept to provide building stock and improved building metadata capabilities. The primary motivation for creating this dataset was to provide better information on the total salvageable material contained within GB's buildings in order to support a circular economy.

Challenges: Many useful building attributes that would help to quantify salvageable and reusable materials are difficult to derive from existing OS MasterMap attributes or aerial imagery. For example, wall construction material, presence of double glazing, wall thickness, internal wall area, building age etc. These attributes are not only difficult to derive, but models that could be developed to estimate them are difficult to validate without an abundance of pre-labelled data.

Solution/Innovation/Method Used: The solution was to utilise EPC (energy performance certificate) data which is collected by on-the-ground surveyors whenever a non-commercial building is sold or rented. EPC records include information such as building age, construction type, presence of chimneys, presence of double glazing etc. and align very well with many of the desired attributes for this project. The coverage of EPC records is variable and not all buildings have one. In order to attribute all of the buildings in an area, an interpolation algorithm was developed that could estimate the age/construction/double glazing etc. for a building, based on the buildings that do have an EPC nearby. If a house is within a 1960s estate, then it is likely to have been built in the 1960s, for example.

Other attributes could be determined or estimated from OS MasterMap alone – these include the contiguity status (whether a building is detached, semi-detached, or terraced), the number of floors, the building internal volume, and the external wall area.

Benefits: There are already models that enable the calculation of the carbon value and mining potential of buildings. However, there is a need for better location data and building stock data, in order to calculate the total salvageable material for a given area, and provide value for various clients, including cities, local authorities, demolition, and retrofitting companies. The insights the tool provides are also automated and scalable. Though the tool was developed for a small test region, the approach could work elsewhere in the UK, saving customers effort on tasks that were previously conducted manually.

The same data could also be pivoted to support retrofitting activities and other sectors and contribute to a social good. This is because meeting the challenges of the climate emergency will require considerable investment in the opportunities of the circular economy, encouraging reuse of salvageable materials wherever possible.

Lessons learned: Deriving attributes that are invisible to aerial photography is very challenging. By using existing data from EPC records, it is possible to make reasonable estimates for building age/construction/double glazing etc. for most non-commercial buildings across GB – this method is reliant, however, on the quality of the EPC records.

External Wall Volume in Camden Test Region

Contiguity Status in Camden Test Region

Wall Construction Results in Camden Test Region

Building Age Results in Camden Test Region

s PIA (Planning Institute of Australia) PlanTech Working Group, Faculty of the Built Environment, UNSW Sydney, Australia.

APPX3: Case Study 19

A Digital Planning Agenda for Australia

Claire Daniel[s] • The University of New South Wales, Australia

In 2019, with the blessing of their professional institute, a group of urban planners from Sydney, Australia got together to start the work required to address the looming spectre of digital disruption, and the associated implications for urban planning. By this time, Australia had already seen several years of 'Smart Cities' conferences and initiatives, conversations from which planners had been notably absent. While some within the Smart Cities movement cited frustrations with planners' reluctance to engage with digital technology, the movement's primary concern with real-time sensor technologies did little to speak to broader planning aims of ensuring long-term sustainability for cities and regions. Despite this, it was becoming clearer that the ever-increasing digitisation of professional work posed significant changes to the way planning would be undertaken in the near future. It was decided a new conversation was needed to ensure planners would be equipped to participate in the digital transformation process rather than swept away in the sidelines.

The group set out with the ambition to understand digital transformation in planning. Drawing inspiration from prior initiatives in the UK, the group was named "The PlanTech Working Group" with the end goal to develop a strategy for the state branch of the institute (New South Wales) identifying how planners could play a role in shaping the technology of the future profession. Over the course of a year, the group conducted a review of current initiatives, interviews with key stakeholders, a membership survey[4], and workshops with practicing planners. Counter to the commonly held belief that the planning profession is by and large indifferent to digital technology, planners were found to be enthusiastic participants, foreseeing significant changes to work including increasingly data-driven evidence, greater use of digital design and communication tools, and widespread automation of administrative processes.

The final strategy took the form of a set of ten principles[5] to help the planning profession. Importantly these principles demonstrate that the role of planners in digital transformation extends far beyond greater office productivity, requiring people to carefully consider how values are encoded into increasingly digitised systems to ensure good planning outcomes[6]. Amongst other things, the principles advocate the use of open technology to allow for greater transparency and accessibility of planning systems, and to encourage planners to be intentional about how they re-orient their work to tackle the bigger challenges of sustainability as more mundane administrative tasks are automated.

The principles were positively received and resulted in digital planning becoming fully integrated into the work of the National Institute in 2021. Two new advisory committees have been set up attracting prominent planners both young and old from across the country[7]. Having officially endorsed the principles, they have now set to work on several initiatives aimed at updating university accreditation requirements and building capacity and connections across the different state and local planning organisations that span this large country. In reflecting on the humble beginnings of this process, no doubt there will be things to improve and refine as momentum builds and we put the principles into practice, but it has been a good start with a promising future.

The 10 principles are:

1. Planners must be prepared for wide-reaching change to their day-to-day work
2. Planners must be central to the design of digital planning infrastructure
3. Digital planning infrastructure should be public infrastructure built with open technology
4. Ambitious programs can be implemented to improve social and environmental outcomes
5. Outcomes for communities and places must be considered alongside efficiency of approval processes in the development of digital planning systems
6. Ethics, accountability and transparency must be built into digital decision systems
7. Digital planning applications should be developed in a human-centric way
8. Communication of planning content and processes to non-planners should be reimagined
9. Collaboration should be prioritised in the development of underlying digital planning infrastructure
10. A culture of innovation and sharing should be promoted

Participation in Digital Planning in a workshop held at the Australian National Planning Congress in 2019 on the Gold Coast, Queensland, Australia.

APPX3: Case Study 20

Using Behavioural Science to Transform Energy Policy in Wales

Paul Chadwick[t] • University College London

t UCL Centre for Behaviour Change, University College London.

Introduction: Changing the way that homes are heated will be essential for reaching Net Zero in the UK. Heating currently accounts for around a third of the UK's carbon emissions. Households of all kinds will need to be supported to make low-carbon changes, which will mean retrofitting homes at a national scale. In 2019, the UCL Centre for Behaviour Change worked with the *Decarbonisation of Homes in Wales Advisory Group* to develop a plan for the decarbonisation of housing in Wales[8].

Challenges: Whilst there have been a several initiatives to increase uptake of energy efficient modifications, none have delivered results at the scale required. Analysis of the lack of impact of previous policies suggested that a successful strategy needed to tackle three critical challenges.

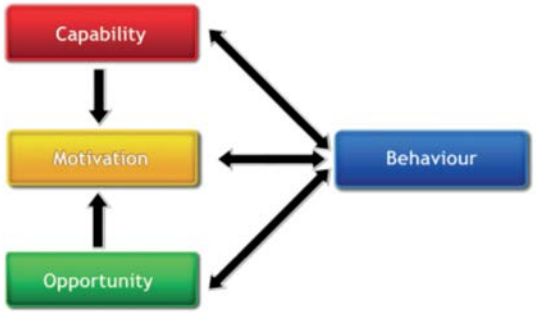
- The lack of long-term policy certainty. There have been 13 significant changes in UK residential energy efficiency policy since the introduction of the Energy Efficiency Commitment in 2002, causing uncertainty and confusion. A stable policy environment is required to create the necessary conditions in the energy ecosystem to allow homeowners and industry to understand what needs to be done and to believe that it is both necessary and beneficial.
- The need to recognise the role of human behaviour. The behaviour of people within homes will make a critical contribution to the success of decarbonisation efforts. Inhabitants of homes need to behave in ways that reduce the demand for heating in the first place, and the adoption of low carbon heating technologies will only deliver benefits when people install and use them correctly within homes. Therefore, it is important to design energy efficiency policy with an understanding of the behaviour of owner-occupiers, landlords and tenants at its heart.
- The need to understand retrofit behaviour in terms of the wider energy ecosystem. Previous initiatives have focused predominantly on the actions of owner-occupiers, landlords and tenants, neglecting the role of other actors in the energy system, such as banks, building societies and builders. To achieve the use of low-carbon heating technologies at scale the actions of all actors in the system need to work in a coordinated way. Taking a systems perspective can help to improve decision-making and avoid unintended consequences that have characterised previous low-carbon heat policies.

Solutions/Innovations/Methods Used: Behavioural Systems Mapping. Previous approaches to decarbonisation policy have focussed primarily on behaviours of homeowners. However, the behaviour of homeowners are influenced by the behaviours of other actors in the system, such as those responsible for advising them on which technology to retrofit, and the actions of local and national government officials who might set tariffs and outline standards, costs and competencies for retrofit activities. The group used Behavioural Systems Mapping to identify the key actors, behaviours and influences involved in energy use within the Welsh housing system, illustrating the interplay between local and national government, supply chain and financial services. An example of the maps developed can be found here: the behavioural systems map[9].

Using behavioural science to identify and change critical behaviours involved in reshaping the energy system: The maps of the energy system were used to identify which behaviours needed to be modified to increase the likelihood of decarbonisation. The COM-B model[10] was used to identify the factors that needed to be in place for key behaviours to be enacted. This simple model of behaviour states that three factors that need to be present for any behaviour to occur: capability, opportunity, and motivation (see figure on the right). These three factors form an interacting system with behaviour. If just one of these is not in place the desired behaviour will not occur. The model was used to generate policy that would remove barriers and put in place enablers to enacting behaviours that to increase the likelihood of retrofit. This formed the basis for drawing up the recommendations to create a stable policy context outlined in the *Better Homes, Better Wales, Better World* Report[11].

Implications for digital transformation of planning: Successful and sustainable digital transformation of planning requires professionals across the planning system to modify their behaviour. Approaches from behavioural science can help identify the critical actors and behaviours required for sustainable transformation and support the development of co-ordinated actions across the planning ecosystem. Placing human behaviour at the centre of transformation plans is likely to lead to more sustainable change with fewer unintended consequences.

Further Resources: A summary of the method we used to develop the recommendations in *Better Homes, Better Wales, Better World*, as well as further information on using the Behaviour Change Wheel framework can be found in *Achieving Behaviour Change: A Guide for National Government*[12].



The COM-B Model

APPX4: Glossary & Acronyms

The digital world is full of new phrases, cliches, and acronyms. Many of these are listed here.

1 Glossary

Analytics is a collection of computational techniques that exploit the mathematical and statistical structure of data in the analysis of meaningful patterns in data.

App (short for Application) is usually a small computer program that is frequently used for software on mobile devices, often downloadable from some platform which delivers software for devices with different operating systems. Not to be confused with an API which stands for 'application programming interface' which enables different software to communicate with each other.

Artificial Intelligence (AI) is the creation of automated procedures for discovering patterns in data that are unlikely to be unearthed by traditional scientific methods, with such patterns often displaying plausible human intelligence. Invariably AI depends on big data which is generated in real time on ever more powerful computer systems. AI is not and never can be human intelligence and sometimes this is referred to as 'weak' AI in comparison with 'stronger' AI which attempts to mimic human intelligence.

Automation is the creation and application of technologies which enable the production and consumption of manufactures and services with minimal human intervention. Most automaton now depends largely on digital computation but traditionally it refers to any procedure that reduces the time taken to make, construct, design and implement any human-inspired process.

Big Data is usually defined as data that is large in volume, delivered rapidly in near real time, which makes it much larger than traditional survey data which takes time to collect. It is defined colloquially in terms of the so-called 7-Vs: volume, velocity, variety, variability, veracity, visualization, and value.

BIM is a **Building Information Model** originally developed by AutoCAD which is a software system that collates the data pertaining to the design , construction and operation of a building and the software that is used to make such functions operational. Sometimes referred to as **Building Information Management**.

CAD or **Computer-Aided Design** is the process of using computers to explore and develop designs for future cities, usually at the scale of urban design or building design where visualisation is key to their communication.

Cloud Computing is a variant of very large scale decentralised computing where the storage of data and the running of programs takes place in locations remote from the user. Cloud systems often link computational facilities of many kinds together to enhance performance for the user across the net. The Cloud is frequently accessed with respect to computing services of many different kinds that are too esoteric or expensive or difficult to provide locally.

Crowd Sourcing is the activity whereby both expert and none expert publics are able to create relevant content and participate using digital technologies in better understanding, policy making and design.

Data Science is an interdisciplinary approach based on multivariate statistical methods, often referred to as algorithms, applicable to many different domains that deal with structured and unstructured data.

Design Codes are modular systems for the design of development based on best practice that is widely agreed to reflect good urban design. Increasingly these codes are embodied in CAD and automated plan-making, reflecting visual and numerical standards to be aspired to.

Digital Devices are defined in the context of ICT as tools that let users connect up and access computational facilities which may be contained in the devices themselves but also enable connections to networks that deliver such facilities. Typically these are smart phones but every standalone computational machine from the PC, laptop and tablet to large scale supercomputers and even peripherals such as printers are referred to generically as devices.

Digital Transformation represents the rapid, all-pervasive transition in global society from a world dominated by manual technologies to one in which computer, networks and sensors, underpin routine and strategic actions and interactions.

Digital Twins are simulations of a physical system such as city or a building which operates in parallel to the real thing and are designed to get as close as possible to the real thing without merging with it.

Disruption is intrinsic to the digital transformation with key trends in cities revolving ling around new patterns of physical transport and digital delivery such as Uber, Airbnb, and so on, all of which are changing the distribution of production and consumption.

End User is anyone who adopts a product or service for their own or some collective use, which in the context of digital is usually a software service or product.

GIS or **Geographic Information System** (sometimes **Science**) is a collection of data which is georeferenced to some coordinate system defining the cartography of some place or set of places. The data comprises attributes of the map base and the system is composed of many functions that enable to the user or performance spatial analysis on the system and to visualise it in different ways.

Hardware is the computational infrastructure of any computer system which sometimes embraces the networks that are now used to link different infrastructure together.

Metadata are data what provides information about other data, but not the content of the data. It originated from Library cataloguing systems. In spatial data context, it provides a simple way to understand geospatial data by providing key descriptions of the data contents.

Models are abstractions that are simplification of a real system by extracting its essential elements so that these might be used in prediction. A model may be a Digital Twin but many are not.

'Net' is the generic term used to define the **Internet**, the network of networks that is constructed as a set of links to and between web sites. The **World Wide Web** is the main interface to the Net which in its most usual form is visual as a set of web pages. The typical location of a web page is given by a locator such as https://www.rtpi.org.uk/ .

Online Public Participation involves various kinds of web and media access where plans, policies and individual responses can be communicated directly to government and industry. **PP-GIS** is a set of early applications to public participation in which GIS is used as the enabling technology.

Open Data is data that is free to use and can be distributed to any potential user or public who require its use for any legitimate purpose. It may be subject to open-ended licenses such as that promoted by the Creative Commons. Costs are no greater than those used to store and redistribute the media.

Open Data Institute (ODI) is an agency in the UK which promotes the openness of data, largely data from government and the public sector where the market for data is not well-developed. The ODI deals with privacy, IPR and copyright issues in public and private data.

PlanTech refers to a series of initiatives based on using information and communications technologies (**ICT**) for automating the process of making applications for planning permissions and thence decisions about development. It is also used to refer to companies and agencies operating in these domains. It can be contrasted with **FinTech**, **PropTech** and **GovTech** see below.

Platform is currently defined as a set of technologies that enable computational functions to be executed usually in a networked context. Traditional in computing, the hardware and its software of a computer have comprised the platform as networking of computers has become writ large, platforms are increasingly organisations delivering services and products across the network to diverse sets of users. Platforms now define the dominant mode of organisation within industrialised and post-industrial economies.

PropTech is the term used to refer to **ICT** which support help individuals, companies and related organisations to research, buy, sell and manage real estate. Other Techs are similarly defined such as **FinTech** (to enable banking and financial services) and **GovTech** (the digitisation and automation of public sector services and processes).

PSS or **Planning Support Systems** are integrated collections of plan-making tools that enable planners, designers and policy makers to explore evaluate and measure the impact of plan scenarios using a wide array of digital tools.

Real-Time Streaming is the process of generating and sensing data in real time and using this data to monitor the operation of some continuing process.

Social Media is the collective term for accessible, interactive technologies available for desktops and smart devices that that connect different users together. They facilitate the exchange and communication of data and information, usually but not exclusively for social purposes, using web-based services.

Simulation usually refers to computer models that predict processes of change through time. These are invariably digital models although early versions of simulation in planning were manual, particularly those based on gaming simulation.

Software presents set of programmable structures that are organised for computation on various hardware, accessible through various devices. As computers have evolved, there has been a switch from hardware domination to software, and now increasingly to data and to organisational structures using digital machines and devices.

Visualisation is the process of translating spatial and non-spatial features associated with cities and their plans into a form that can be communicated in pictorial and/or diagrammatic terms. Invariably visualisation is now accomplished digitally although traditionally it was the main medium for graphic communication using artistic and manual cartography.

2 Acronyms

AI	Artificial Intelligence
AMR	Authorities Monitoring Report
ARPANET	Advanced Research Projects Agency Network
ATI	Alan Turing Institute
CCG	Clinical Commissioning Group
CIA	Comprehensive Impact Assessment
CMS	Content Management System
COPS26	Conference of the Parties Number 26
CPD	Continuous Professional Development
CST	Council for Science and Technology
DC	Development Control
DLUHC	Department for Levelling Up, Housing and Communities
DSMs	Digital Surface Models
EIA	Environmental Impact Assessment
EIP	Examinations in Public
EPC	Energy Performance Certificate
EU	European Union
GCSP	Greater Cambridge Shared Planning Service
GLA	Greater London Authority
GLC	Greater London County
GML	Geographic Markup Language
HIA	Health Impact Assessments
HRA	Habitat Regulation Assessments
HTML	Hypertext Markup Language
ICT	Information and Communications Technology
IEMA	Institute of Environmental Management & Assessment
IM	Information Management
INSPIRE	iNfrastructure for SPatial Information in euRopE
IoT	Internet of Things
IPBES	Intergovernmental Science-Policy Platform on Biodiversity & Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
IT	Information Technology
LAN	Local Area Network
LB	London Borough
LCC	London County Council
LDD	London Development Database
LiDAR	Light Detection And Ranging (data)
LPA	Local Planning Authority
NDVI	Normalized Difference Vegetation Index
NEPC	National Engineering Policy Centre
NHS	National Health Service
NIC	National Infrastructure Commission
NLP	Natural Language Processing
NSIP	Nationally Significant Infrastructure Project
NUA	New Urban Agenda
OCR	Optical Character Recognition
ODI	Open Data Institute
OGC	Open Geospatial Consortium
ONS	Office for National Statistics
OS	Ordnance Survey
PC	Personal Computer
PDF	Portable Document Format
PINS	Planning Inspectorate for England
PLD	Planning London Datahub
PostGIS	Software for supporting PostgreSQL object-relational database functions
PP-GIS	Public Participation GIS
PSGA	Public Sector Geospatial Agreement
PSS	Planning Support
RAE	Royal Academy of Engineering
RICS	Royal Institution of Chartered Surveyors
RPA	Robotic Process Automation
RS	Royal Society
RSRE	Royal Signals and Radar Establishment in Malvern
RTPI	The Royal Town Planning Institute
SA	Sustainability Appraisals
sCDE	spatial Common Data Environment
SDGs	UN Sustainable Development Goals
SEA	Strategic Environmental Assessments
SHLAA	Strategic Housing Land Availability Assessment
SME	Small and Medium Enterprise
TCPA	Town and Country Planning Association
TfL	Transport for London
TPI	The Town Planning Institute
UKRI	UK Research and Innovation
UPRN	Unique Property Reference Number
URA	Urban Redevelopment Authority Singapore
XML	Extensible Markup Language

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40 The planning profession defined here are those working in the UKIMEA (UK, India, Middle East and Africa) region (Arup's definition)

Case Studies

1 Marc Andreessen is an American entrepreneur and software engineer who led a team that invented one of the first commercially available web-browsers–Mosaic–and subsequently co-founded Netscape, see Why Software Is Eating the World, *The Wall Street Journal*, August 20, 2011

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4 Results of the survey have been published as a peer-reviewed paper by C Daniel and C Pettit available at https://www.tandfonline.com/doi/abs/10.1080/07293682.2021.1920995

5 The full principles have been published by the Planning Institute of Australia https://www.planning.org.au/policy/plantech-national-working-groups/pia-plantech-principles (pending a website update). An article introducing the principles by C Daniel, C Pettit, J Dodson & A Marsh published at https://thefifthestate.com.au/urbanism/planning/here-comes-plantech-to-help-transform-our-cities-but-how/

6 Planning being public-purpose work, the final principles also draw inspiration from work done in broader public-centred innovation efforts – such as seen in various government "digital innovation labs" across the world.

7 Full list of committee participants published https://www.planning.org.au

8 https://gov.wales/independent-review-decarbonising-welsh-homes-report

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10 Capability-Opportunity-Motivation-Behaviour model: https://www.qeios.com/read/WW04E6

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Digital Task Force for Planning

The Digital Task Force for Planning is an independent panel set up by Michael Batty and Wei Yang in February 2021. The Task Force is comprised of an interdisciplinary panel of 10 influential thought leaders drawn from a broad spectrum relating to planning and digital technology.

The mission of the Task Force is to promote an integrated digitally enabled approach to Spatial Planning. It is a prelude to a wider ongoing debate about how planning needs to fit into the wider framework of development of our towns, cities and rural areas to tackle the grand challenges of our times, and at the same time create beautiful, sustainable, resilient and inclusive communities for us and for our future generations.

This report and other project outputs can be viewed at: **www.digital4planning.com**