ADEPT LIVELABS

ADEPT SMART Places Live Labs

White
Paper #2
March
2021

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DIGITAL INNOVATION IN LOCAL ROADS

Introduction

This is the second in a series of white papers from the £23million ADEPT (Association of Directors of Environment, Economy, Places & Transport) SMART Places Live Labs programme funded by the Department for Transport (DfT). These papers are part of our commitment to transparency and are intended to share learnings and insights as they happen. This will allow industry colleagues to capitalise on work done through what is a wide-ranging innovation programme covering the smart materials, energy, communications, mobility and environment spectrum. More details on our teams and their individual projects can be found on the Live Labs pages of the ADEPT website.

The white paper has been developed through a series of 'Chatham House rules' one-to-one discussions with our local authority Live Lab leads, and we thank them for their openness in sharing their experiences to date. We hope that this and future white papers are useful and will help accelerate innovation for local authorities across the transport, planning and environment sectors.

In a world that COVID-19 has made ever more digitally-focused, many of the Live Labs' projects and trials were already looking to the future in their use of data and digital tools. This paper focuses on the progress of each Live Lab up to and including the period of the delivery phase in Q4 of 2020.

Each Live Lab encompasses a range of different projects, but all inevitably use data to some extent. In preparing this paper, we discussed the rollout of these digital-led aspects in innovation programmes and identified some common opportunities and challenges.

The role of digital tools, platforms and data

Each of our eight Live Labs have planned and implemented their innovation trials separately in their own individual ways. However, the role of digital tools, platforms and data has emerged as a common thread within all the projects and trials.

Digital tools and data are being taken up in a variety of approaches which we can categorise in three ways:

Installing equipment such as sensors to generate datasets to make better decisions, automate and improve efficiency

Utilising pre-existing technology to generate datasets to make better decisions, automate and improve efficiency

Collecting data as part of the testing element within the trials

1. Most Live Labs come under the first of these descriptions - **using technology to generate datasets which can contribute to dashboards to automate services, improve efficiency and support better decision making**. Teams have installed a variety of sensors to monitor conditions such as air quality, road surface temperature, gullies and traffic movement. In some projects, the sensors form part of a wider Internet of Things (IoT) network, where they connect and exchange data with other devices, sensors and systems. The sensors and devices typically generate data which is collected and fed into dashboards. A number of Live Labs are consolidating and integrating various internal and external data feeds from multiple sources into a common dashboard or operational platform.

   Through these dashboards and platforms, the teams aim to provide a user-friendly way to understand and gain the maximum use out of the raw sensor readings and data. Users will be able to access the data and use it to support decision making in transport strategy, street lighting, gritting scheduling and routing, for example, but we have also found use cases in adult social care. Project teams are developing these processes to gain insights from data that might not otherwise have been identified. Ultimately, they are aiming to streamline procedures and reduce manual intervention, where appropriate, to enable some decisions to be automated. Alternatively, some Live Labs aim to produce dashboards which show real time analysis of what is happening within the local authority and on the road networks.

2. The second category of approach to data exists where Live Labs have **similar ambitious outcomes that have been achieved in different ways**. These teams are partnering with external bodies in the private and public sectors to utilise pre-existing technology and infrastructure, with the aim of revolutionising the services within the network. These trials involve purchasing the data generated by existing assets within the community that are not necessarily owned by a local authority. The data can be processed, stored and formatted without a council needing to have pre-installed their own assets within the networks. As with the Live Labs who are installing their own equipment, the purchasing of data will enable internal and external datasets to be brought together in new ways to offer advantages such as enhanced traffic management and control systems, and forecasting travel patterns, etc.

3. Within the third category are the **Live Labs that may not appear to be so data heavy on first glance**, however, these still rely on data collection of as part of their testing and trialling procedures. Data is commonly used across all projects to drive decision making prior to implementing new technologies. For example, databases formed using population demographics, income levels and household types, etc, have been deployed to compliment local knowledge to determine where to locate new technology. Another example has been the use of digital scanning tools to ensure the built environment is suitable for the implementation of Live Labs trials, particularly where innovative materials and techniques are being deployed.

   Data is also collected to ensure that new technologies are working as expected and to inform longitudinal testing. In addition, databases are being created to ensure that trial and testing information is stored in a consolidated format to add further future value.

In these coronavirus-impacted times, we cannot fail to mention the bearing digital tools have had on the way the Live Labs operate. Within the various COVID-19 lockdowns of 2020 and 2021, each team has faced the challenge of implementing remote working as business as usual. Inevitably, daily communication between project teams and partners - and the management of each project - has become almost 100% digital. Although video calling, SharePoint sites and virtual meetings could all be done previously, they were not utilised to the extent that they are now. The uptake of digital communication has arguably been accelerated by years and is more than likely here to stay.

What does the digital future look like?

The advantages of the digital-led and data-led elements of the work are well understood across all projects and the potential benefits from these trials are extremely exciting. The ultimate ambition of the data-led elements in the trials is to revolutionise the service offered within the communities in which the Live Labs serve. The possibilities appear endless and many benefits are yet to be realised at this stage of the programme. However, we have grouped some of the main benefits alongside some examples.

1. **The potential to move away from manual and towards automated real time interventions.** Examples include:

   - Implementing self-reporting - if an integrated asset data management system could be set up to feed data from lighting sensors into a digital lighting platform, the system would be able to identify problems and arrange for them to be fixed with no manual intervention.

   - Automating gritting priorities - road surface temperature sensors data could automatically plan a targeted gritting strategy through any given winter night in a seamless and streamlined process, saving both grit and effort.

Automating maintenance schedules with a risk-based approach, enabling automated monitoring of Key Performance Indicators (KPIs), delivering targeted gritting routes and schedules, and introducing self-reporting equipment are outcomes many of our Live Labs are striving towards.

Not only will these reduce time and cost for local government, but also make our road networks safer and more efficient.
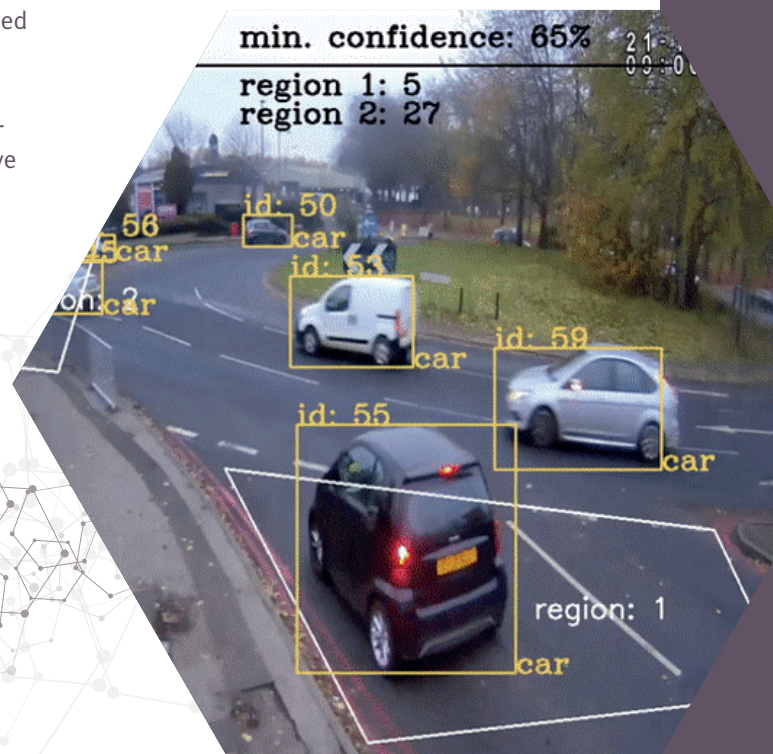
2. **To combine data sources into a common platform or dashboard to better manage and improve understanding of the road network, and personalise services.** A common decision-making tool or interactive dashboard could enable identification of trends that would previously have to be manually correlated. Datasets from mobile phone data, CCTV cameras, air quality sensors and more, could enhance traffic management and control systems, and offer more predictive and instant management. Some Live Labs are also looking to combine this with datasets built on wider behavioural analysis. Ultimately, local authorities will be able to use the integrated datasets to predict the impact of planned or unplanned events, personalise services to the individual user, and provide targeted messaging to communities. If these workstreams are successful, councils will have more efficient operations, decreased operating costs, safer roads, reduced emissions and healthier communities.

3. **The potential of the technologies to reduce maintenance costs**.
   Where some Live Labs are focusing on installing instrumented and smart kit within the network, others are focusing on maximising the potential of existing third-party infrastructure. Utilising mobile phone data is a prime example where the successful use of data, in partnership with mobile phone providers, will enable more efficient transport network management, personalised services and targeted communications. Use of mobile phone data services could result in some current roadside technology becoming redundant, enabling massive savings on maintenance budgets. However, this should be balanced by compromises where, for example, mobile phone data may not be as accurate as data received from roadside equipment. Many of the teams recognise that a combination of approaches (installing IoT networks and utilising existing infrastructure) will form what business as usual looks like in an Intelligent Transport Systems (ITS) future.

4. **The use of databases and digital tools to support daily decision making**. A common thread within the Live Labs has been to use data to drive decision making prior to implementing new technologies. Datasets are being generated and developed to aid understanding around new installations. For example, datasets covering population demographics can help determine locations for new technology and digital tools can monitor site suitability. The methodologies deployed in using data to support day-to-day decision making will form some of the outputs from the programme which local authorities will be able to implement in their own areas. These digital-led tools and databases will support accurate first time decision making, provide an evidence base, and save time and money.

Some Live Labs will take important steps towards achieving these goals and will be able to refine and develop the capabilities of the technology in future years. Many of these ambitions will also be realised within the programme. However, to be successful they will all need to prove a decent return on investment and evidence that they are valuable to both the authorities and the communities in which they serve.

Regardless of how the data is being generated (e.g. from sensors or existing assets), it will always have to go through an analytics process to yield benefits. It will take the collaboration and innovation that is at the heart of the Live Lab programme to capitalise and realise these advantages.

Key skills required to run projects with digital-led elements

Some of our Live Labs took inspiration and learnings from previous, smaller scale projects in their regions, and others took the plunge into technology and ideas in which they had little previous experience. There was also disparity in the skillsets within each of the local authorities and in the approach taken to close any gaps in the key skills required.

For the Live Labs that focused efforts on delivering workstreams with in-house data capability, there was recognition of a general lack of data skills within the industry UK-wide. One Live Lab team member pointed out that at the R&D level, their local authority was unlikely to attract applicants with the full skill level required to understand the technology and the way to build algorithms. The location of an authority was identified as a contributing factor to a lack of skill levels - other councils closer to clusters of data driven companies may not find this such a challenge.

Employing data scientists with the right skillsets within the constraints of public sector pay bands proved to be a challenge: these data-led innovations can require high skilled, in demand specialities that can command higher wages. Therefore, many of the Live Labs have had to bring in the required skills in a different way - by collaborating with a wide range of partners to fill any skills or knowledge gaps to add value to their projects. Some Live Labs have found that partnering with the private sector and academic bodies has enabled them to understand and access different levels of datasets, which they would not otherwise have had. One project lead acknowledged that these partnerships have been essential to the success of their schemes, and will be particularly useful where local authorities are quite traditional in their methods and may not consider real time data a priority.

Although each of the local authorities have experience in using data to inform and drive projects, the speed at which the Live Labs programme has been mobilised has been unprecedented for some teams. Getting the right people with the right technical expertise and bringing partners on board to deliver elements of a project have been imperative to success. A few local authorities have had no desire to build capability in house, so collaborations have led to upskilling and knowledge transfer, with all partners coming together to create best practice.

Live Labs has enabled commercial partners to be brought in to support key specialisms, such as platform development. Without this funding, such expertise can be unaffordable for local government R&D initiatives. Academic partners, can be significantly cost effective, providing high skills levels where programmes align with their academic interests. Many of the teams are keen to develop these relationships beyond the Live Labs programme.

The ambition of the programme is to have a series of learnings and best practices from which local authorities across the UK will be able to pick and choose depending on what is relevant to their own needs and capabilities. We cannot say - do X, Y and Z and you will end up with a successful project, as councils might not have people with the right skillsets. Equally, we cannot say that any individual Live Lab has taken the right or wrong approach. The variety of solutions deployed by each team to ensure the right skillsets are available will only contribute towards the learnings derived from this programme.

Alongside securing the required skillsets, the challenge of ensuring diversity has also been raised. Both highways industry and data-focused careers are traditionally thought of as being male dominated and consideration should be made into creating an environment that is inclusive and attractive for all.

Are current processes suitable for digital innovation projects?

As discussed in our Mobilisation White Paper, the Live Labs typically face many internal challenges associated with procurement, legal and financial systems.

Contracting with SMEs has been recognised as a particular challenge. Not only does this involve a substantial amount of administration, but many are young companies only experienced at pilot scale. They can find it difficult to produce at the larger scale required by the Live Labs to build and evidence a robust business case. Furthermore, to recoup their research and development costs, some SME price points are very high and there appears to be an unfortunate misconception that councils have big budgets, leading to some potential collaborations with SMEs being deemed unaffordable.

As with most new and innovative programmes, it has been difficult to price an individual project. This can be due to a lack of fixed outcomes and previous experience, leading to challenges in planning. Traditional accounting methods that forecast yearly spend are difficult to use, as spending can fluctuate significantly from one week to the next. Some data driven companies require payments to be made with more flexibility than the traditional purchase order.

The Live Labs generally agree that there will need to be an overhaul of legal, procurement and financial systems if local authorities want to continue doing innovation projects. The current systems work well for traditional construction work where hundreds of other projects can be used as a reference, but are problematic for innovation programmes such as Live Labs. There are occasional exceptions to this rule. In one example, rigid local authority procurement requirements forced a commercial partner to adapt the way they carried out their data collection tasks. As a result, the process for the partner became more cost effective and arguably produced better data.

Existing contracts between local authorities and private sector suppliers and partners can often be long lasting and archaic. In future contracts, there could be inclusions or caveats designed to embed the flexibility to take on new work or for partners to drive innovation projects themselves. Unless there is change, it will be hard to drive digital innovation without wasting scarce resources to ensure correct buy-in from across an authority.

The processes involved with sharing data between partners has also been raised as a concern. Some contractors have been found to keep access to data tightly restricted for commercial reasons, limiting its usefulness.

Winning hearts and minds

There has been a general buzz of excitement surrounding many of our projects. Now that some of the developing business cases are demonstrating that the data being collected is valuable and useful, stakeholders are supportive and accepting that these innovative trials are the way forward. Trials involving improvements that show direct and visible benefits for communities, such as improving air quality using sensors, appear to require very little encouragement to get buy-in.

Inevitably, as with any change, there will always be some resistance. This has been found most often where traditionally manual tasks are becoming automated. In some cases, there has been a perception amongst local authority staff that they will lose their jobs to new data driven processes, or that their specialisms are being undermined. However, this is often a misconception and project teams have had to reiterate the message that the new dashboards will only support and improve capabilities.

Communication, engagement and getting staff to work closely with the new systems have been invaluable in getting buy-in from key stakeholders. To succeed, there needs to be an open and honest dialogue with all stakeholders, from senior management to terms suppliers. Complex technical or academic jargon needs to be eliminated from these discussions, with teams explaining clearly in layman's terms what these technologies do, the impacts on the local authority, and how they can save money. In opening these conversations, a number of our leads have recognised that staff should be involved in a testing and feedback process from the outset. Any negative feedback will only improve the end product and aid in its refinement. Furthermore, a sense of ownership is established when the processes are developed through collaboration.
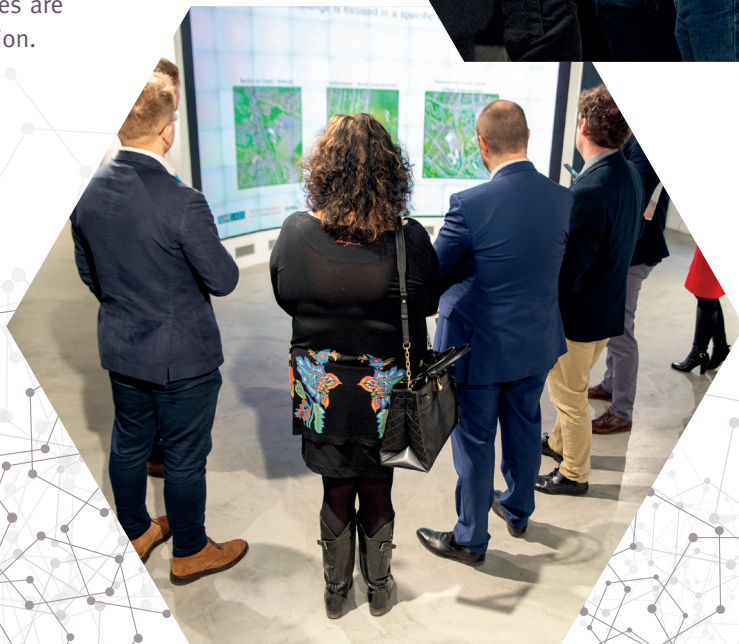
Basic challenges need to be overcome in working with new IT systems before the new digital-led processes can be rolled out. Users of the technology require training and time to build their confidence in operating new systems. Training needs to ensure staff from all levels - from senior management to frontline - are 100% on board and that this knowledge will not disappear with personnel changes. Inevitably, this will depend on support from forward thinking councillors who understand the benefits of the innovations, and also by breaking down silo cultures within local authorities.

The innovations coming out of the Live Labs projects also need to be communicated externally, and new services promoted to the public. Buy-in from the public can be key to a workstream's use of digital tools and processes to influence behavioural change and incentivise specific travel choices.

Some Live Lab teams have found that bringing in partners can assist in getting key messages across, as experience has shown that local government messaging is not always the most effective. Partners who engage with social media and incentivise the use of innovations can bring an expertise that does not typically exist within a traditionally slow to change highways sector. These commercial partners are used to selling their products and services and so can reach people in a completely different way to local government. Bringing in partners who already have trusted customers paying for their services can offer a new perspective.

Buy-in from the public is also dependent on trust around security and General Data Protection Regulation (GDPR) compliance. It is generally recognised that installing devices that look like cameras in multiple locations across a small area may send the wrong message, and so much care and consideration is going into communication and engagement. To help overcome this, the Live Labs have focused on implementing good governance of data. Indeed, many have been working with local privacy rights groups and local forums so that people are aware of what they are doing and why.

Most teams are at the data collection phase, but as projects progress to adding value to the data, the internal stakeholder and public engagement efforts will increase. When this happens, the foundations laid by initial communications and engagement will aid them in addressing and overcoming any further concerns.
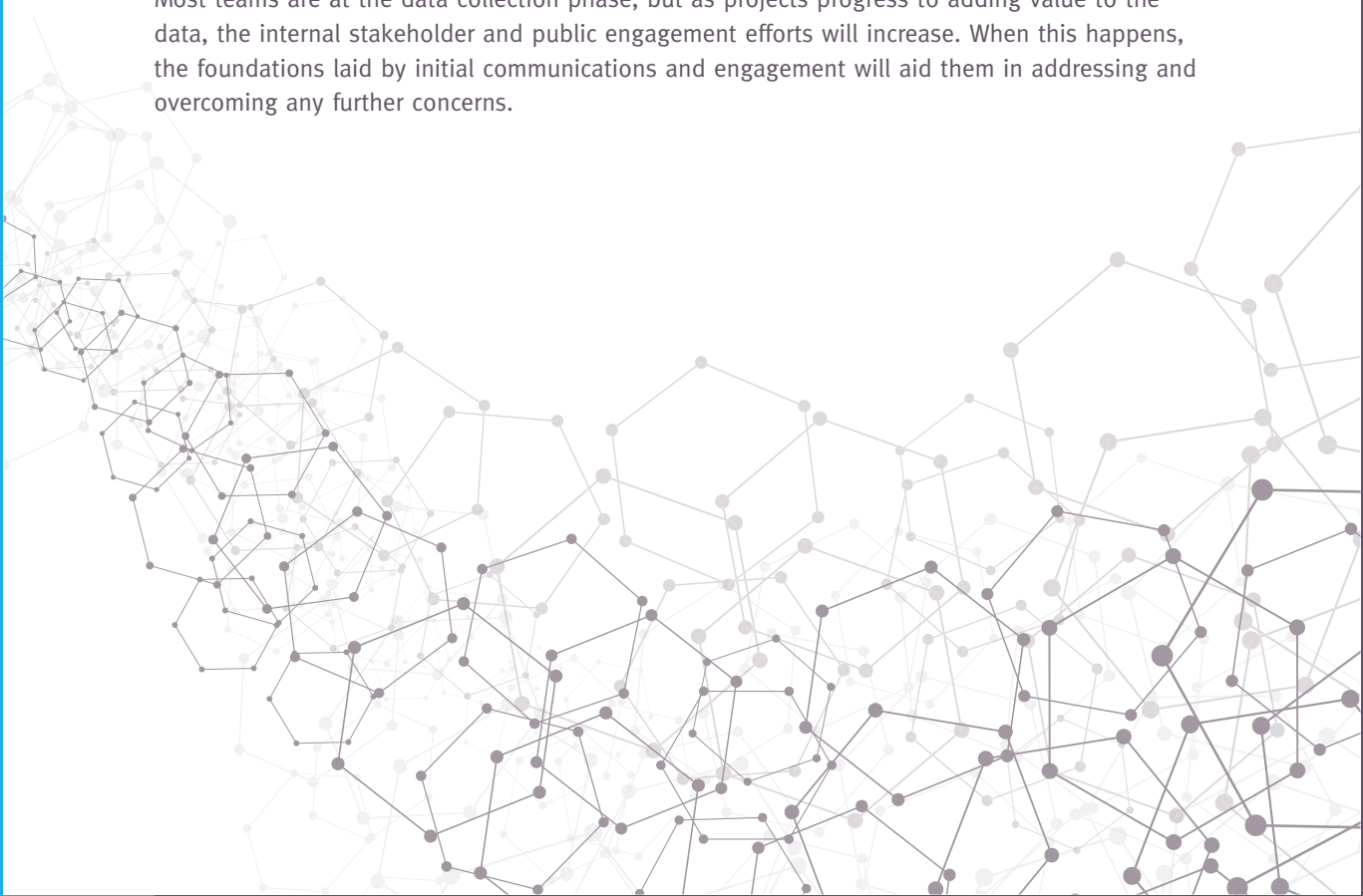
Challenges and Opportunities

As with any innovation project unexpected challenges have emerged.
The Live Labs have not only worked with their partners to overcome these,
but have been sharing learnings between the teams.

Standardisation of data has been considered within the programme and could be further supported by central government. External datasets from partners have had to be made compatible with internal datasets and systems. In one case, two Live Labs teams were working with a common partner to receive external data. A request from one Live Lab to update the partner's data caused an inadvertent knock-on impact on both the second team and other existing users. Ensuring better standardisation across UK bodies would reduce the likelihood of this happening. However, there needs to be a balance between guidance on data standards from central government and enabling flexibility within industry. Technology moves so quickly that any perfect standard may quickly act as a constraint, so a delicate balancing act is needed between promoting and inhibiting innovation.

One Live Lab has suggested that data standards could be created based on the project outputs. The information collected could contain a layer of standardised data to enable it to be picked up in the same format for later use cases.

Getting the balance right between cost vs quality of the IoT sensors has provided a further challenge.
Sensors range widely in price, raising the question - do we need more cheaper sensors or fewer at high cost? As a result, work is underway to determine whether the trends provided by lower cost options suffice. Ultimately, this will depend upon the technology and the application. For air quality sensors, determining trends is vital, so local offices do not need to spend thousands on sensors that are incredibly accurate. Conversely, for road temperature sensors, accuracy is more important as specific temperatures may initiate set actions for gritting in winter. The cost of sensors and other equipment, such as batteries, can also make a massive difference in terms of maintenance costs, so this has also been an important consideration. Therefore, a use case led approach, which might need different spend depending on the timeliness and / or critical needs of the potential outputs, should be taken.

Extensive data sharing can also present a challenge.
Data needs to be shared in such a way that it improves and informs; changing people's behaviour for the better and improving the environments in which we live and work.

Alongside the challenges, there have of course been opportunities. Perhaps the biggest overall challenge throughout the course of the Live Lab programme has been the **impact of COVID-19** and lockdowns. However, some of our Live Labs have been able to capitalise on the technologies they are trialling. Traditionally, local authorities predict travel movements for 30-40 years based on their pre-COVID baselines, however it is now hard to predict which transport schemes should receive investment over the next two-three years, as travel habits have changed so significantly. The Live Labs data collection has enabled some of our authorities to monitor constantly changing travel patterns that could be used to inform decision making in the near future.

A couple of our Live Labs have also used the programme to **break down internal silos** within their authorities to support their Adult Social Care services using digital connectivity. If successful, this unexpected opportunity could link some of the digital aspects of the programme and offer expansion into in-home sensors and protect the vulnerable outside their home. Not only will this benefit users and enable them to remain independent for longer, but also give families and carers peace of mind and reduce visits from care workers. Without the digital networks being built for highway services, these capabilities may not have been realised.

The stringent procedures around **GDPR compliance and security risks** associated with data collection have been integral to the programme. For teams that have partnered with external organisations to gain data (e.g. via CCTV cameras and mobile phones), a big piece of bureaucracy has been avoided through transferring the data pre-anonymised. In addition, local authorities don't have to invest further in servers to ensure the data is secure. This has alleviated some privacy concerns and has also meant fewer cameras being deployed, particularly where there could be public unease about creating a 'Big Brother' state. Working in collaboration with privacy rights groups and local forums has been important to communicate intention and address concerns. Although yet to be examined extensively within the Live Labs, it may be beneficial in the future to encourage people to voluntarily share data around travel movements.
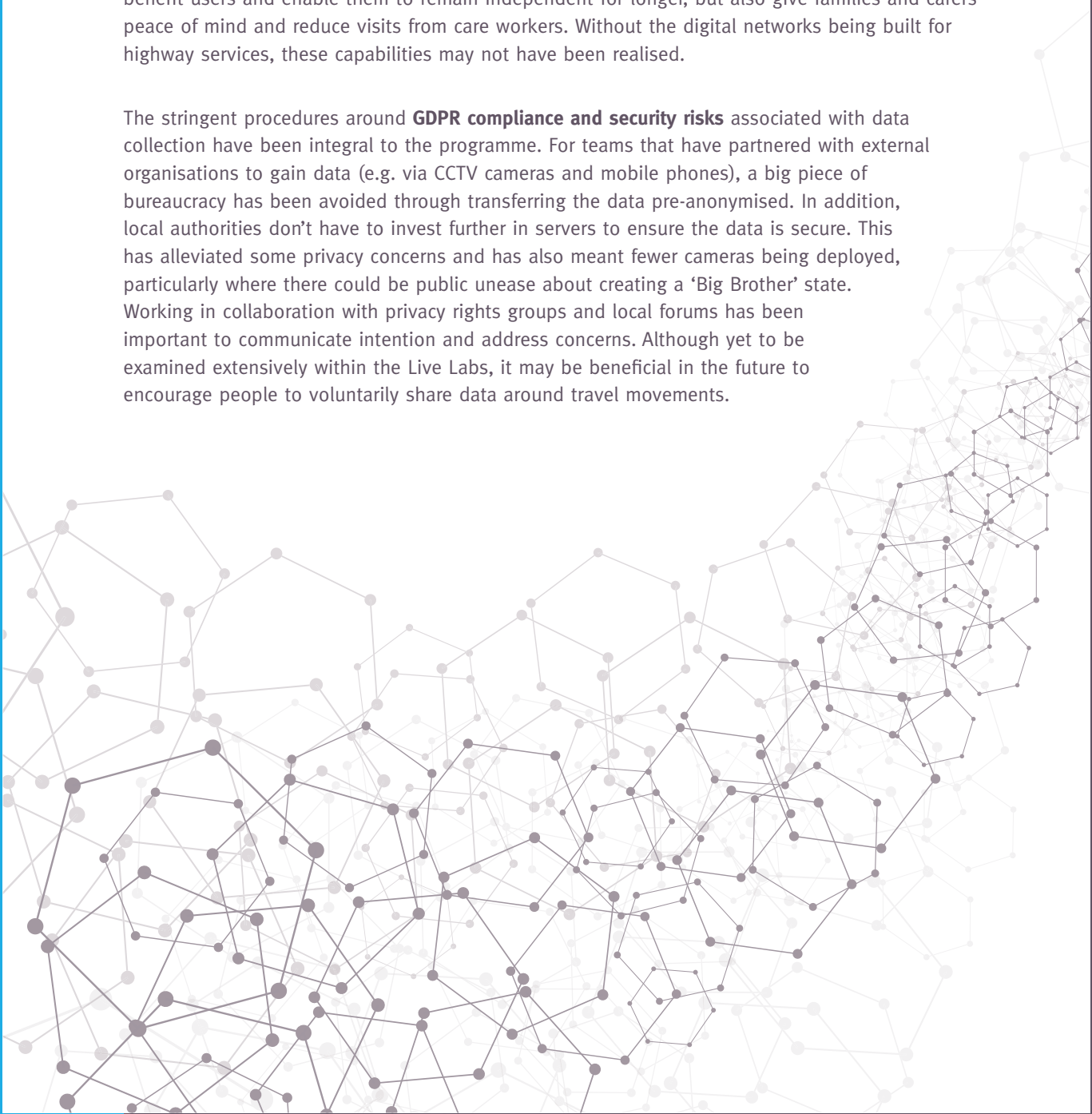
Key learnings to date

Finally, we asked our cohort if they had any top leanings to share to assist others contemplating taking on similar data-led innovation challenges:

- **A new challenge will present itself every week and these are best dealt with using a collaborative approach.**

- **Use data to drive decisions where practicality problems occur and vice versa.**

- **Scaling up trials is required to show any abnormal trends that don't necessarily appear at a smaller scale.**

- **Consider how applicable these trials are to other local authorities who may wish to implement innovations across different areas, e.g. rural, urban or coastal.**

- **Before sharing data, consider who to give access to in case the raw findings could be open to misinterpretation.**

- **Consider how the innovations could complement other existing workstreams.**

- **Don't underestimate how much work can go into whittling down potential innovations. There will not be the budget to achieve absolutely everything, so prioritise what is most important.**

- **The sheer amount of organisation, planning, coordination and delivery cannot be underestimated. Unfortunately, the full budget can't only be spent on innovation.**

- **Pulling in other funding streams can be very useful. Using experience gained from the initial stages of the programme can help with bids for more funding sources.**

- **Never lose sight of the individual behind the data - this will benefit them and they should be prioritised.**

- **In data-led projects, most of the key findings and opportunities will be realised towards the end of the project, after the immense effort to build and integrate data platforms has been completed.**

- **Testing new technology is key - and should ideally be done independently.**

Digital communication has been embraced due to lockdowns.

COVID-19 has accelerated this change but has not changed its direction of travel.

Conclusions

Ultimately, digital tools and processes have been deployed so extensively within the Live Lab programme because they offer an unparalleled opportunity to increase our understanding of what is happening within our communities. With greater understanding, better decisions can be made on how networks are managed.

Part of the value of the programme is that it provides a unique opportunity to experiment without the burden of failure. We accept that not all trials will be successful and regard that as a learning in itself - one that can be passed on to other local authorities contemplating how to deploy digital technology and data analytics. We want them to be able to consider and replicate the tools and processes that offer the most value and are most suited to their own areas.

Our teams are still to determine the value of digital tools, but if proven to contribute to a robust business case, they could improve efficiencies within highways through reducing costs, and materials wastage. If they are shown to offer a good return on investment and that there is little risk associated with relying on digital technology, then the potential for take up within local authorities is significant.

Being able to provide real time data on air quality and more robust data sets to understand trends could inform decision making and have a direct impact on public health, as well as enabling individuals to make well-informed travel choices. Automated management systems that enable rapid repair of street lighting will help to keep our streets safer, and as potential uses in adult social care have demonstrated, the impact of using digital tools could go far beyond highways and local roads. We are yet to explore the opportunities sensors could offer across other sectors including education and health.

The decarbonisation of place infrastructure is a huge task, but again the findings from Live Labs will offer new opportunities and fresh thinking, particularly in relation to the needs of local roads and how infrastructure integrates with wider transport and mobility eco-systems.

The value of the Live Labs programme will also lie in the data, insights and evidence it provides. These will demonstrate where changes within local authorities can work to offer the public improved services and better value for money. We have touched on procurement and financial systems, but specifically, the ability to use Section 151 rules to contract faster and with more flexibility than Live Labs has demonstrated has important ramifications for local government.
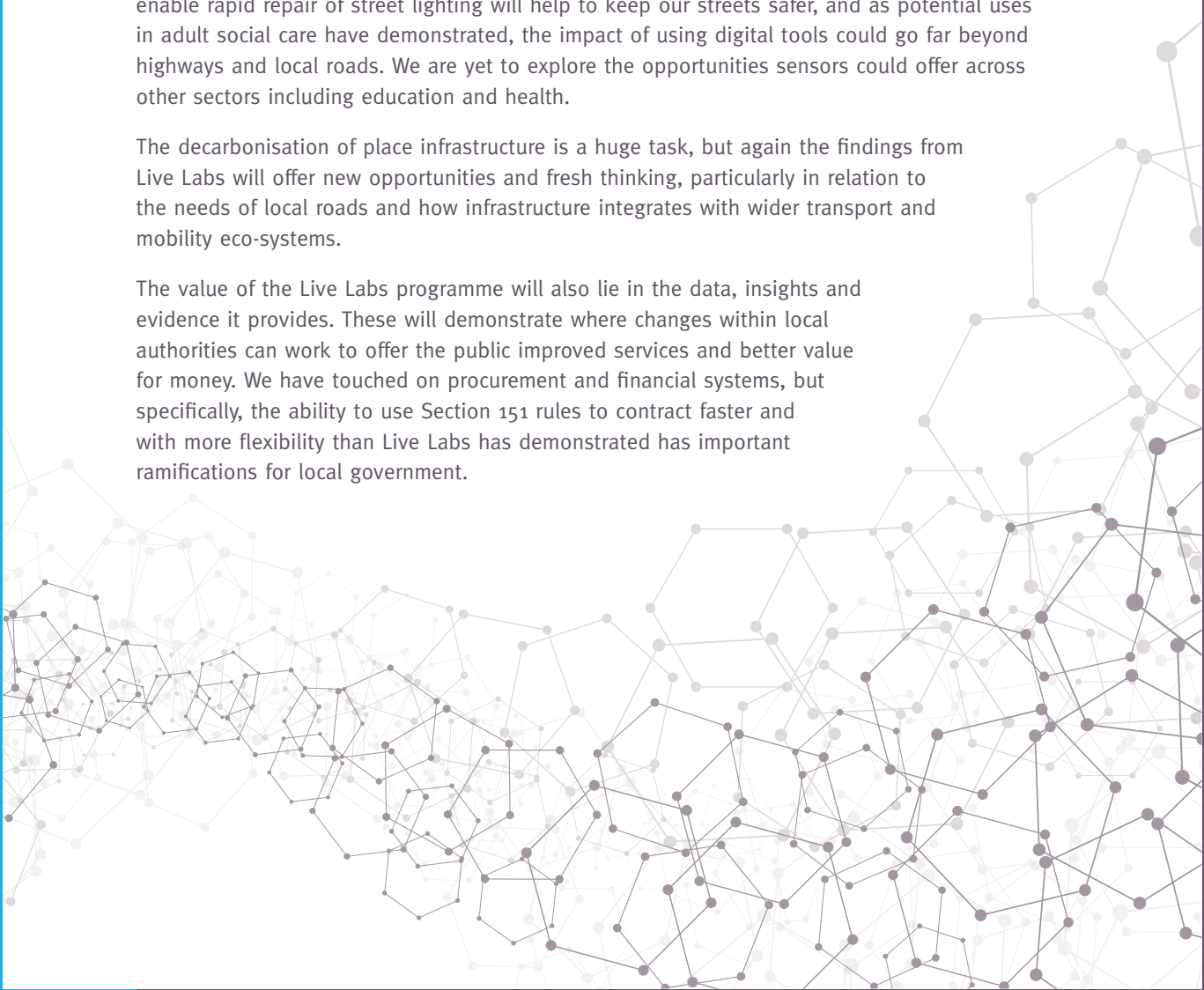
The ability to enter partnerships with SMEs that also meet their needs, and to be able to work closely with academia, can enable local authorities to innovate right across their organisations. This flexibility is critical in making local government fit for the future. It is widely understood that local authorities are experiencing skills shortages, particularly in the development and application of digital technology, and it is unsurprising that the findings of our Live Labs teams have borne this out, However, it is in understanding the different approaches taken to solve this problem that Live Labs also offers potential solutions.

Within ADEPT, these findings will be used to support its work with government on moving towards outcome based commissioning. As well as featuring the learnings from our Live Labs in upcoming ADEPT events, we will use our subject and sub-national boards to discuss them in more depth. We want to promote and share the emerging outcomes with members across our different workgroups to firmly embed the practical innovations being tested by each programme both within the Association and across the sector through our networks.

COVID-19 has brought many things to light – our ability to take advantage of digital platforms to work collegiately, to work smarter and adopt technology faster. It has also shown the importance of our local neighbourhoods and the need to improve the health of our communities through better air quality. If Live Labs can provide the evidence that enables widespread adoption of thermal roads, kinetic pavements and of course, digital tools and data analytics, we will have smarter and more efficient places able to be more flexible in response to the many challenges we face as a society. We will be better equipped to meet net zero targets and ensure that our communities are as healthy and safe as possible.

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White Paper #2 March 2021

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