ADEPT Live Labs KCC Operations Management

Final Report

Executive Overview

Background and Context

Kent County Council (KCC) currently contract out their operational maintenance function to Amey Services, covering all reactive jobs and tactical works. These maintenance activities are generally assigned to operations by KCC's District Management depots, making the two areas intrinsically interdependent in providing a connective operations management and maintenance response capability.

Generally, Amey Ops respond to their incoming reactive workload, which is itself significant enough to leave little scope for any prioritisation or planning, making the operation largely a 'first come first served' proposition with Gangs responding reactively in accordance with priorities assigned by KCC Depots to the originating defects and customer enquiries.

If this reactive load can be both reduced in volume and closed more efficiently, more capacity can then be apportioned to other more preventative tactical and planned works. This in turn will help to mitigate the incidence of more costly reactive jobs, creating a virtuous circle by which overall performance and productivity can be progressively improved.

The overarching objective of this workstream is to provide a new digitalised view of incoming enquiries and jobs, with accompanying insights that will enable both KCC and Amey Services to respond more intelligently to the incoming workload. A further associated objective is to enable more effective monitoring of the maintenance response and associated operator movements, to address inefficiencies and facilitate improvements. There is also a particular focus on monitoring of emergency and urgent works, which can severely disrupt Amey Ops daily planning cycle.

Integral to creating this digitalised view, is connectivity with KCC's Confirm Asset Management System. In general terms, achieving this oversight of the operation involves a range of integrations with third party systems and services, including Confirm. The digital asset platform (HADMS) delivered under Live Labs is a natural fit for facilitating this integrated view of the service.

Approach

Our approach is based around bringing all operating data to a centralised platform where it can be converged with other relevant internal and external data sets to provide a single unified view of service performance and dependencies impacting this performance. The platform itself forms part of the wider HADMS (Highways Asset Data-Led Management Solution) data eco-system. As an overarching objective of the Live Lab, hosting all Live Lab Workstreams on this same platform ensures that all data sets acquired through the various innovation streams can be shared and integrated, thereby bolstering the potential scope of each Workstream.

The usage of HADMS as the foundation platform is also intended to facilitate easy extension to other Authorities in future, whereby the operations management functionality can be readily configured and deployed into a new Authority with minimum re-work. Based on this design principal, all features and functionality have been carefully vetted by KCC to ensure it is standardised enough to suit general use across local authorities.

Business Objective

There are three overarching aims for this Workstream :

1) Enable more effective generalised monitoring of the incoming operational workload and visibility of the underlying activities and factors that influence operational performance.

2) Track fleet vehicle telemetry movement, to observe the response of stewards and gangs to their respective workloads, and provide associated insights into resulting performance and productivity. This is intended to then equip KCC managers to make better informed assessments of service performance and provide more effective coordination and guidance to field operatives.

3) Provide higher level performance analysis in alignment with contractual measures, to enable more effective and automated oversight of the contracted service. This will improve KCC's overall resource efficiency, by reducing the current administrative overhead involved in contract management.

The above objectives are each fulfilled through functional features provided on the HADMS digital interface, as set out in the Solution overview section to follow

Solution

Here we outline the main architectural components and source data feeds of the delivered digital solution :

HADMS Platform
The HADMS cloud architecture provides the foundation for the solution. As well as the underlying structural and functional components (PostGres SQL database, with Flask and React front end) and AWS cloud services used to host and deploy the solution, HADMS also provides the standard design pattern for the solution, whereby this Operations Management solution forms part of a wider platform ecosystem. This ensures that the user experience and functionality is consistent with other workstreams on HADMS, to promote familiarity and minimise the need for specific training.

Mapbox
All HADMS pages are centred around a geospatial view of the KCC estate, to ensure a practical oriented view of the data can be facilitated. This map view is provisioned by the Mapbox Open source package

Confirm (WAMS) Oracle Warehouse
Data from KCC's Confirm Enterprise Asset Management system is sourced via data loaders that run at a set frequency (currently 6 hourly) to extract and import data into the HADMS SQL database. For this Operations Management workstream, this covers principally WAMS enquiries data and jobs and all associated status logs.

Vehicle Telemetry API
The platform is integrated with the API of KCC and Amey's existing fleet telemetry service provider (Navman) which is updated on an hourly basis. This API can be easily re-pointed at any alternative provider, to suit the service environment, which is an important design factor to ensure extensibility to other local authorities.

Streetworks API
The Streetworks feed (works and closures) is also integrated to provide an additional context layer for assessing performance data. This Streetworks API also has a variety of other uses across HADMS.

Contract Performance Measures
All contractual KPIs are pre-loaded from originating service agreements, as provisioned by KCC in conjunction with its term maintenance provider, Amey.

Below we outline the core functional features of the delivered digital solution, as shown in the attached live visuals of the built platform. The visuals below show monitoring of 'Job completion' rate, monitoring of 'Gang vehicle response movements', and 'Depot KPI' dashboarding, all as examples of the HADMS platform interface design, which is representative of the approach that is consistent across other pages.

Spatial & Temporal Navigation

All functional features are accessed via a standard map-based interface and accompanying date-time control whereby the user can select any desired historical time window. This general interface is consistent with other workstreams on HADMS to provide a uniform consistent experience.

Map Layers

Data sets are generally visualised on a layered basis, whereby the user can select to activate one or more layers of their choosing, with a dedicated reference colour key provided for each layer. The overall geographic view can also be optionally restricted to a single District if desired. Additionally, a search function is provided to enable rapid navigation to a specific location of interest.
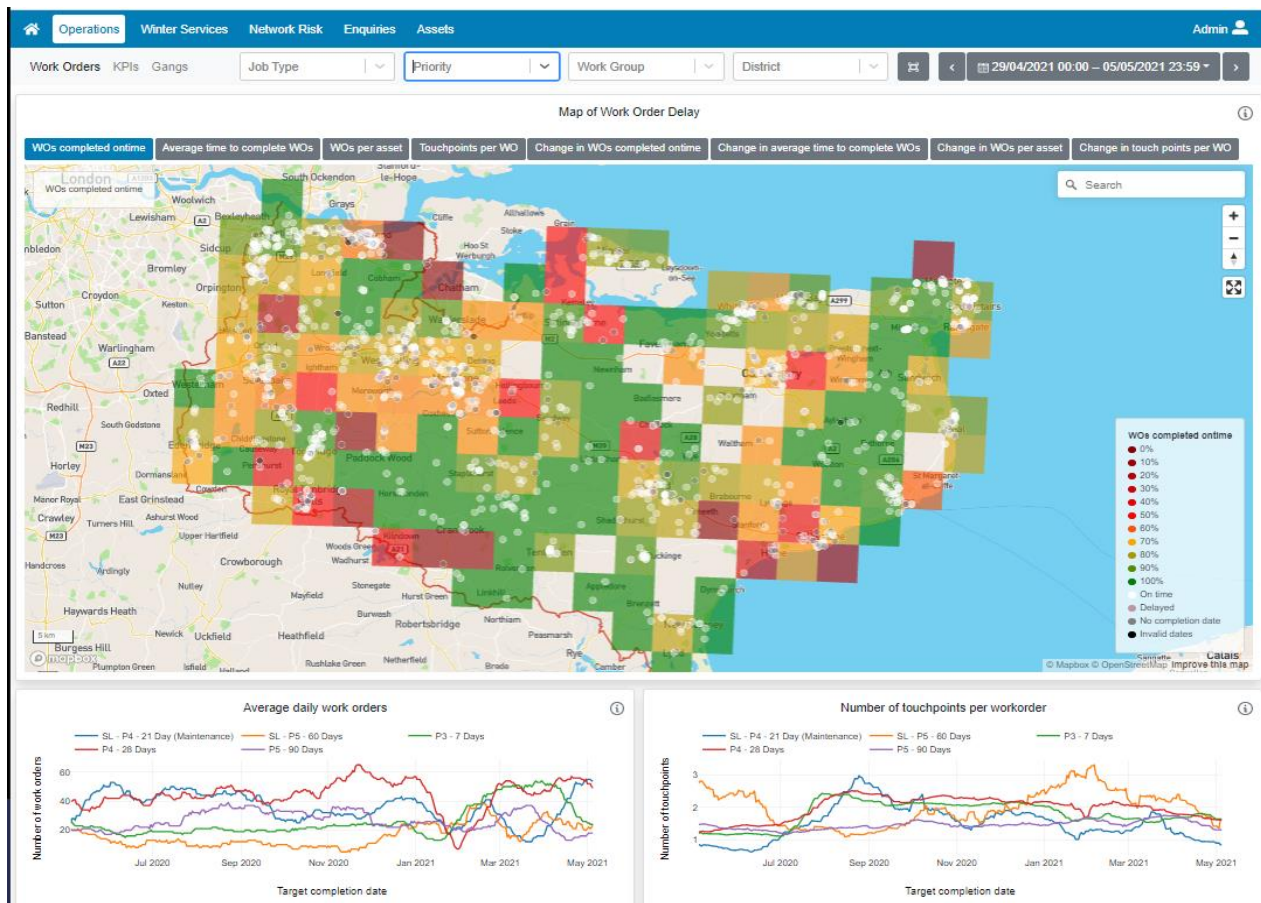

Workload Monitoring and Insights

For both enquiries and work orders respectively, the daily workload is presented geospatially for the selected location and date-range, with a RAG-style encoding to visualise whichever performance or demand measure has been activated, with options such as rates and speed of completion, volumes per asset and activity levels. Historical trend plots are also provided to assist with longer term monitoring and capacity management.
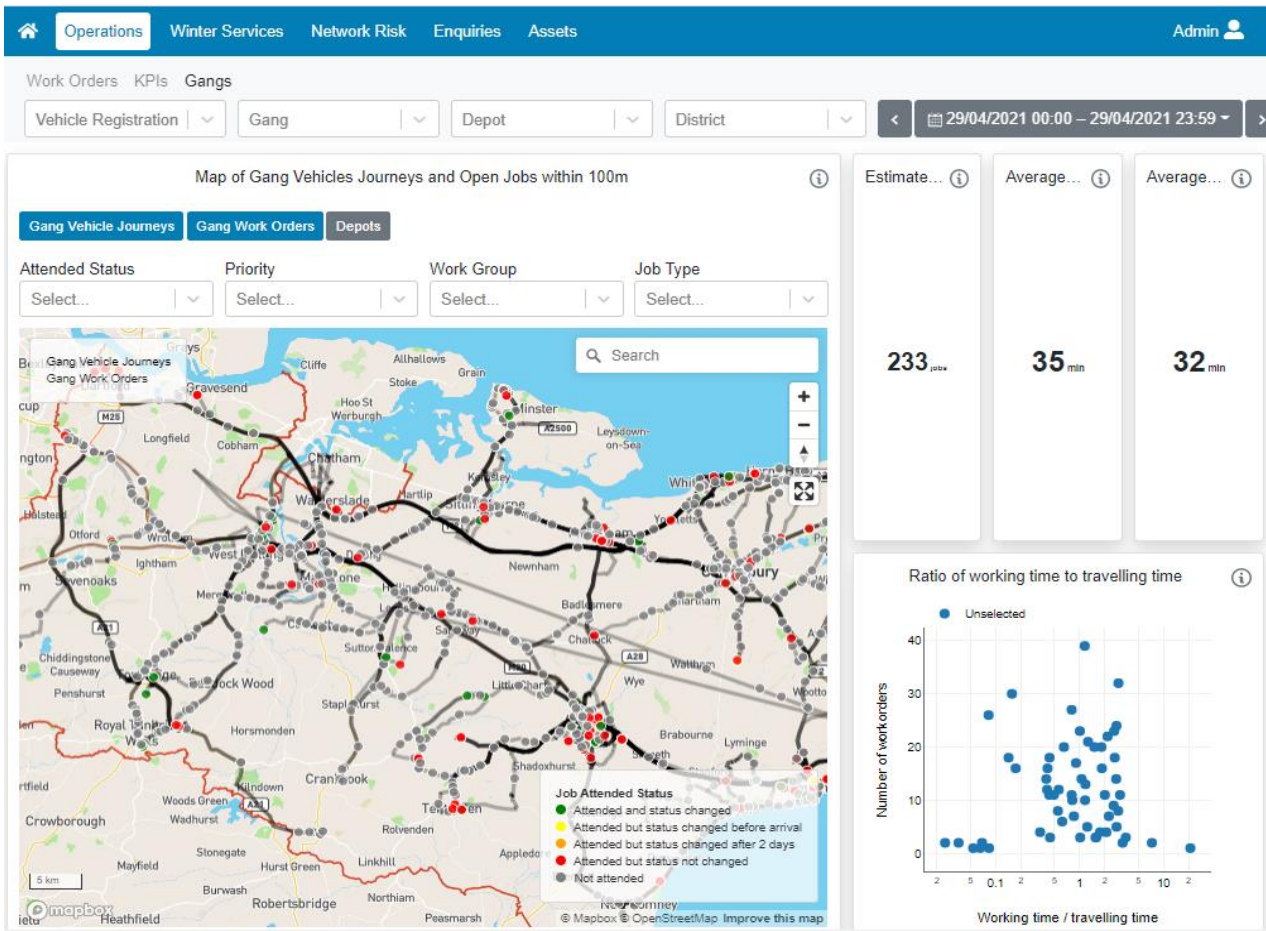
Vehicle and Group Tracking

The movements of each fleet vehicle is displayed geospatially, alongside a point rendering of those jobs or enquiries that were attended by, or were on-route of the vehicle, with a further RAG-style encoding to indicate stage of completion. Accompanying metrics are also provided in both graphical and tabular form to indicate relative rates of productivity and travel between the vehicles. This information is all navigable by district and depot to enable usage by individual area managers.
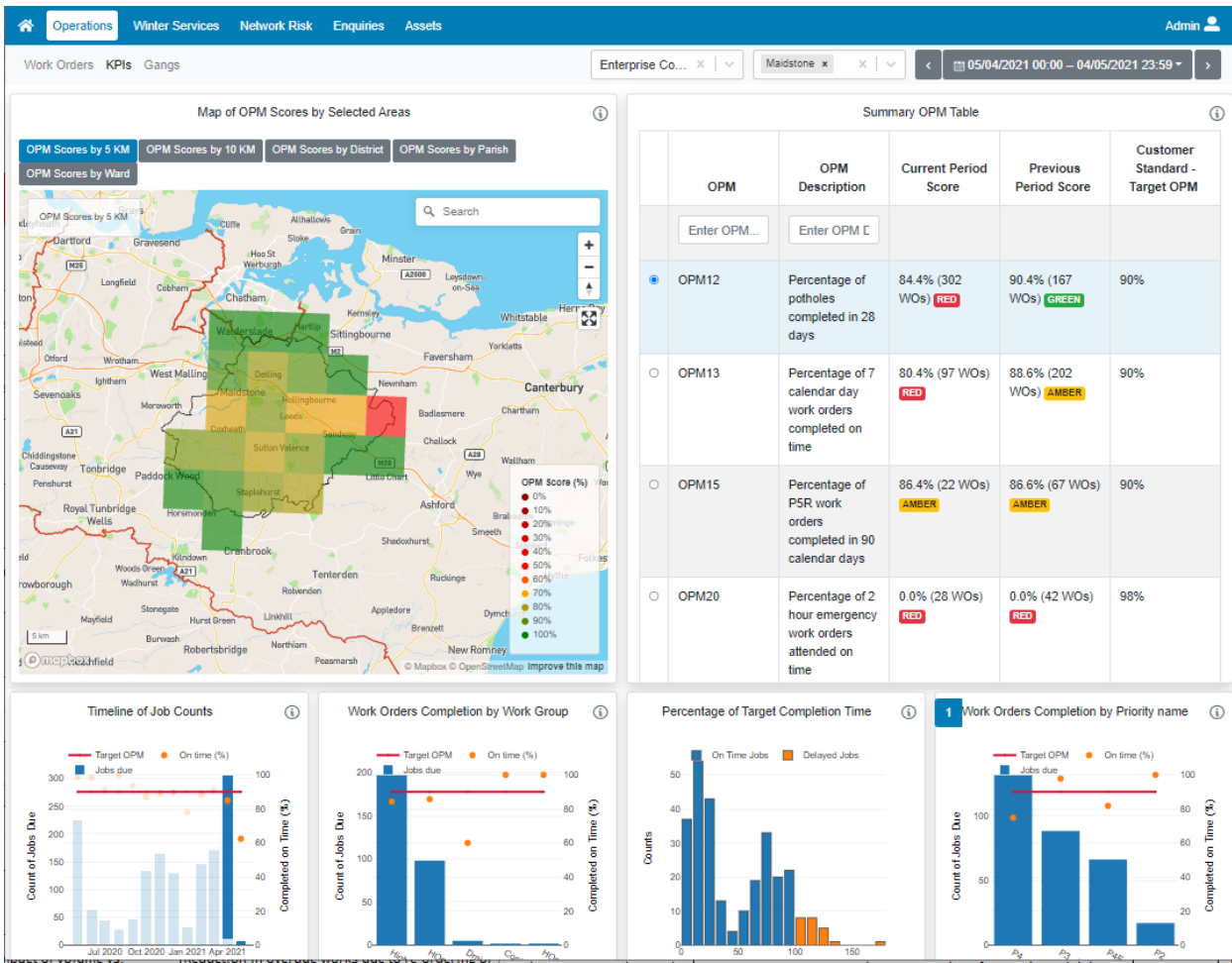
KPI Geospatial dashboard

The KPI page provides an aggregated view of each designated performance statistic over the date-range duration selected, typically one month to support periodic reviews. A RAG style colour encoding is applied to convey this performance in relation to the contract targets. This information is provided geospatially at varying degrees of granularity depending on the preferred scope of the user, with additional supplementary plots to provide further insight into the how this performance was factored across constituent asset classes, work groups and priorities.

Business Case

The ongoing cost for maintaining and supporting the HADMS platform is minimal – estimated in the region of £7K to £15K per month as the platform is progressively expanded into the KCC operation. This is also a central cost pooled across the various workstreams - accordingly, this Operations Management workstream will constitute only a component of this monthly maintenance fee.

Based on this minimal cost footprint, the following direct and in-direct benefits more than justify its ongoing usage. Although these are <u>estimations only</u>, based upon KCC's current operating costs, even allowing for a healthy margin for error the benefits will readily exceed the cost of maintaining the solution :

Benefits in Performance & Productivity - Ready insights into activities (response movements, job conversion, touchpoints) provides greater opportunity for improvements in planning and coordination to be identified and realised. This in turn enables more rapid attendance to issues and jobs, and increases the overall quantity of works addressed each day to the benefit of the customer in improved network reliability availability, and to the benefit of KCC in terms of improved overall productivity

Estimated at ~5% x £1.5M economic cost of network unavailability = ~**£65K** per annum

~5% x £2M total cost of maintenance operations = ~**£100K** per annum

Benefits in Efficiency – Operating performance measures are now readily accessible, saving time and effort spent gathering and assembling data for both general and contractual reviews of performance

~10% x £400K total FTE cost of District Management = ~**£40K**

Conclusion & Recommendation

The main benefit of this workstream is in the geospatial digitalisation of the operations workload, enabling managers to more rapidly gain and maintain oversight of the operation, and obtain the performance information and measures needed to support regular review points without the need for manual data processing. Being able to view this information directly alongside associated fleet vehicle movements also enables greater insight into the logistical factors that underly this performance. Accordingly, a further key benefit lies in this convergence of data between disparate systems.

The enduring effectiveness of the delivered solution will be dependent upon the reliability of these data feeds (Navman in particular) – however even where data feed issues arise, the tool itself enables these data service issues to be identified and mitigated much more rapidly. Thus, in general the solution facilitates much greater awareness and responsiveness by the business to maintain a viable performance management footing.

It is recognised, however, that performance management based on retrospective insights is not realising the full potential of HADMS. To fully embed the platform operationally, it is crucial that the data pathways (the Confirm integration in particular) are enhanced to a more real-time footing whereby HADMS can also be used for daily operational triaging, prioritisation and planning. This will answer the more immediate daily challenges faced by operators, and in so doing will encourage uptake of the further performance management functionality we have already delivered.

Finally, we also see great potential in further leveraging HADMS role in converging data services. By incorporating additional data sources such as 3rd party works, road and asset condition, traffic volumes, demographics, amenities, network risk and planned maintenance schedules, the platform can be used by operators to make more informed prioritisations around the incoming workload.

The five cases Live Labs considerations

Strategic case

National, regional and local policy fit: What are the policies that this intervention addresses (key sources – DfT policies, local transport plan, economic plans etc.)?

This innovation fits with the objective of the DfT 2021-22 Outcome Delivery plan to "Build confidence in the transport network… and improve transport users' experience, ensuring that the network is safe, reliable, and inclusive", with a focus on improving the timeliness and effective prioritisation of works response and the public confidence that a consistent positive experience will elicit.

The case for the intervention that meets those policy needs and priorities: How did the intervention address the policies identified?

Through more robust and comprehensive monitoring of issues arising on the network, and more effective intelligence-led management of the operational maintenance function, district & operations managers are able to identify and enact a more effective prioritised and coordinated response that will improve overall network and customer outcomes.

The national, regional and local set of background needs and challenges: What were the background challenges that led to the intervention, linking back to the original pitch?

Works and enquiries data can already be accessed within Confirm, and Confirm also provides a basic level of activity and performance reporting. The challenge for managers was being able to view this information on a network and district wide basis, and in general terms it was felt there is significant opportunity for better targeted insights to be provided, particularly in aligning these with vehicle movements which, although already available through other services (such as Navman) are very time consuming to access, process and assemble into any useful form to support analysis.

The wider case for the intervention in meeting specific local needs and challenges: How did the intervention address those local needs and challenges, what have the successes been in doing so, what have been the failures?

By converging all these sources onto HADMS, operators now have a single point of entry, and a platform which further integrates other contextual data (such as Streetworks) to provide a cohesive view of performance across the operating districts. As well as general monitoring and insights, importantly it enables operators to access relevant targeted data quickly and efficiently when needed.

Economic case

The public value of the benefit of the intervention and associated investment: What are the wider benefits realised from the intervention? These can be tangible benefits (such as availability of an asset) or intangible (public confidence)

The core value to the public is through improved reliability and safety outcomes that arise from more effective and timely maintenance management of their local network.

Public costs and benefits analysis: What were the broad costs of the intervention (this does not need to break any commercial confidences and can be broad brush) and what direct benefits did they bring?

The HADMS platform delivery under Live Labs comprised of multiple workstreams, including Network Risk, Winter Services, Asset Management as well as this Operations Management function. The platform was implemented as a unified programme of works, at a total delivery cost of ~£870K over a 16-month period, inclusive of all initial discovery and engagement, project management, data exploration and technical solution delivery.

Although there is no explicit division of costs, a fair attributable estimate for the Operations Management workstream is ~35% of this effort, or approximately £300K. This is also a one-off solution development cost. It does not require to be repeated for further uptake by other Authorities.

The ongoing cost for maintaining and supporting the HADMS platform is minimal – estimated in the region of £7K to £15K per month as the platform is progressively expanded into the KCC operation. This is also a central cost pooled across the various workstreams including this Operations Management workstream.

Demonstration of benefits through qualitative and quantitative analysis: What are the measurable benefits associated with the intervention that you have observed and measured – this can be qualitative (perceptions, views etc.) and / or quantitative (cost savings, time savings etc.)

Please refer to the earlier **Business Case** section for a detailed coverage of the envisaged benefits. These benefits will need to be measured over an extended period, by assessing works response productivity and performance over time, and by generally reviewing its utility by District and Operations Managers, particularly in terms of regular reporting.

Although these direct and in-direct benefits have only been estimated at this stage, based upon KCC's current operating costs, even allowing for a healthy margin for error these benefits will readily justify its delivery and ongoing usage

Key metrics: What are the wider key metrics – jobs created, people upskilled etc.

These measures are as detailed in the Business Case section :

- Increased works response rate (enquiries and jobs)
- Increased steward and gang productivity (attendance to issue and jobs in the field)
- Reduced overhead – operators and managers freed up to focus on their core value-add activities, ultimately improving job satisfaction

Indirect and induced impacts: What have the indirect impacts been of the intervention – unexpected consequences, knock on effects etc.

There have been no unexpected consequences or knock-on effects

Commercial case

Demonstrating that the intervention will result in a viable procurement and attractive deal for the market: What was your procurement journey for the intervention – from specification to deployment?

This innovation was always envisaged as a core component of the wider HADMS digital platform offering. It does not involve any procurement channels, other than the choice of Cloud service provider in AWS (Amazon Web Services) – however this service cost is minimal (under £1,000/month) and the choice of provider largely incidental. Had another provider, such as Google, been utilised this would have had essentially zero impact on the nature or scope of the solution, and will have minimal impact on cost.

Rather than other Authorities needing to repeat or emulate our entire solution implementation, which would require software consultancy costs, the premise is that HADMS can simply be offered on a ready built basis, enabling LHAs to gain benefit from the solution with minimal entry costs other than initial integration and minor adaptation if needed.

How did the market respond to the opportunity?

Not applicable. The solution was designed and implemented in-house by Amey Digital Consulting in partnership with KCC.

Implementation efficiency: How did you deliver the intervention?

The project was delivered using a standard agile adaptive methodology involving frequent progressive releases of HADMS as the solution evolved over time. This allowed KCC operatives to provide regular feedback to actively guide the solution, thus ensuring the end product is fit for practical operating use and meets the expectations of the business.

What lessons have been learned through delivery?

Confirm business alignment – has evolved over the course of the Live Lab, including a number of acquisitions of the Confirm business which has made this alignment particularly challenging due to significant changes in their business strategy. It's important that we maintained a regular dialogue with these integration partners to ensure HADMS is effectively complementing KCC's solution landscape.

Procurement strategy and delivery schedule: What lessons have been learnt with regards to procurement and market reaction?

The solution was designed and implemented in-house by Amey Digital Consulting in partnership with KCC, so there are no particular lessons in relation to procurement. However, it is useful to note that KCC through their partnership with Cantium have already invested to an extent into the Microsoft Azure cloud service for various other KCC initiatives, so from a procurement standpoint this Live Labs would have benefited from standing up HADMS on Azure, rather than Amazon (AWS). This is not a major issue as it will be fairly straightforward to re-platform the solution, but it is worth noting as a learning to try and align these technology and CTO roadmaps early on.

Financial case

The intervention is affordable for the public sector and can be funded through a viable financial agreement: In retrospect do you deem the interventions to be affordable, if so why, if not why?

The built digital solution was designed with guidance from KCC to ensure its suitability for general use cases across the wider Authority market. The architecture has been designed to facilitate easy configuration and deployment into other LHAs, with minimum need for customisation and development

Therefore, in terms of future implementations for other Authorities, these should be deliverable at significantly smaller cost, with costs mainly covering integration (adapting to different APIs). Any functional enhancements are anticipated to be minor, and will be carefully vetted to ensure that any new features or processes are suitable for general use by wider Authorities

If deploying again, how might you consider a structuring an at-scale package which could be attractive to the market.

As already explained, a principal purpose of this workstream, and the HADMS platform generally, is to facilitate subsequent extensibility to other LHAs in the wider UK market. It was important to validate and pilot the new functionality within one Authority first, to minimise risk. So even with hindsight, this was the correct approach, which sets the foundation for reliable expansion.

Financial model: If you were implementing again, what considerations would you make in developing your financial model for an at scale set of similar interventions?

Now that we have completed this initial build phase, positioning the operations management package for other LHAs will be fairly straightforward, as it can be structured at a smaller cost limited to configuration and integration into whatever data service environment that LHA happens to occupy

Funding sources: Besides Live Labs funding have you levered any other funding sources (this can include contributions in kind as well as capital / revenue funds)

A further ~£35K was more recently commissioned with KCC for enhancing HADMS integration with Confirm, in order to reduce the latency of Confirm data (such as jobs and enquiries) to a much smaller 30min update frequency. This work is nearing completion and will facilitate further functional expansion of HADMS to support other operating use cases.

Management case

The intervention can be implemented using best practices in programme and project management: What did you do with regards to project management programming, practices and skills?

The project was run using a hybrid of Prince2 methodology, on top of an agile software delivery framework making use of Azure DevOps functionality. A stage objective delivery programme was set out early on, to guide the overarching delivery, with 2 weekly agile sprints employed to iteratively progress the solution in regular consultation with KCC stakeholders. The end solution has been deployed as a pilot initially in order to validate its fit for usage prior to incorporating into KCC's operations management functions.

In retrospect, what would you do differently?

We could have benefited from tighter collaboration with KCC's supply chain partners – particularly those responsible for fleet telemetry hardware. Ultimately, we did not have any issues with generally sourcing and integrating data as the project progressed, however its possible such collaboration could have benefited the project in terms of ideation and general planning of the wider connected innovation landscape, to cater for emerging dependencies.

Delivery plan: Thinking back to your original pitch, how did your delivery plan differ from what you planned?

Based on the premise of HADMS as principally a data convergence, insights and analytics platform, our original scope had included a component of data analytics in the form of forecasting. The intention was, in addition to providing insights into the recent and historical workload, this would be augmented with a view of the predicted future incoming workload based on statistical modelling.

A small trial was undertaken early in the project to assess the viability of this modelling approach. Although it showed promise it was clear that workload is predominated by a seasonal pattern, and by spikes following severe weather events. As operators are already aware of these factors there was limited tangible benefit in persevering with a machine learning model.

What lessons have been learnt?

The HADMS platform was originally envisaged as primarily an insights platform, to enable data-led decision making and management. While this remains the core capability of the platform, upon piloting of the platform in KCC district management it became clear that there is also a strong appetite for using HADMS for active monitoring of the operation, particularly due to the increasing resource challenges and budget constraints which has limited the capacity for operators to move beyond their immediate reactive workload. Tackling this direct incoming workload as efficiently as possible is therefore a critical priority.

Accordingly, more focus is now being applied to tightening HADMS integration with data sources, particularly with the Confirm enterprise asset management system, in order to expand the scope of HADMS to address these more immediate operating use cases

Project management team and qualifications: In retrospect, what roles, skills and qualifications would a deliver team need to deliver this intervention at scale elsewhere?

To repeat or emulate our entire solution implementation will require skilled IT/software consultancy capability. Our particular choices of framework (in SQL, React and Bootstrap) and cloud platform (AWS) are arbitrary – whatever framework is chosen, competent database and application developers will be required. However, the whole premise of implementing HADMS, is that this platform can now simply be offered on a ready built basis, enabling LHAs to avoid such implementation effort, and gain benefit from the solution with minimal entry costs other than initial integration and minor adaptation if needed.

We took steps to ensure that this solution will complement KCC's existing and emerging solution landscape, particularly in terms of the Confirm integration which is a core pivotal component of the solution. At the time of project inception it was clear that there was no equivalent geospatial insights platform offering connected with the Confirm platform.

We are working in a fast moving industry, with a complex and dynamic supply chain that is increasingly adapting to new technology and software capabilities. If we were to repeat this project again, we would need to undertake a significant phase of industry engagement to carefully position our solution within the current environment. We are confident that the solution, as currently delivered, is still a unique offering for Local Authorities, and we are now looking to incorporate additional data services into HADMS to further augment its positioning in the Market.