EXECUTIVE SUMMARY

This report presents the research priorities for the Digitally Enhanced Advanced Services (DEAS) NetworkPlus in the transportation and mobility sectors. Recent developments in innovative digital technologies make it possible to monitor different modes of transport and user behaviour. The analysis of such data will help us move to the use of outcome-based digitally enhanced advanced services within transportation and mobility which have the potential to develop sustained value for the UK economy.

The DEAS NetworkPlus Team developed a theoretical framework to guide discussions between researchers and industry practitioners to identify the key questions facing the wider adoption of Digitally Enhanced Advanced Services within transport and mobility in the UK. These questions fall into the following research topics which will now form the basis for providing research funding through the DEAS NetworkPlus:

» How can innovative digital technologies enhance the communication, education and engagement of customers about DEAS within the transportation and mobility sectors?

» How can innovative digital technologies enhance communication, education and engagement within and between organisations about DEAS within the transportation and mobility sectors?

» How can innovative digital technologies allow us to identify suitable DEAS outcomes within the transportation and mobility sectors?

» How can innovative digital technologies enhance data management and analysis to allow improved decision making about DEAS within the transportation and mobility sectors?

» How can innovative digital technologies enhance data ownership and sharing to facilitate DEAS within the transportation and mobility sectors?

» How can policy, considering both local and national government, help us ensure that innovative digital technologies can be used to facilitate DEAS within the transportation and mobility sectors?

» How can innovative digital technologies allow DEAS to be delivered across organisations within the transportation and mobility sectors?

» How can innovative digital technologies enhance business model design, adoption and evaluation for DEAS within the transportation and mobility sectors?

» How can innovative digital technologies enhance productivity and growth of the UK economy through DEAS within the transportation and mobility sectors?

» How can innovative digital technologies enhance organisation and cultural change for effective adoption of DEAS within and between organisations within the transportation and mobility sectors?
2

CONTEXT

2.1 AN INTRODUCTION TO DIGITALLY ENHANCED ADVANCED SERVICES

Digitally Enhanced Advanced Services (DEAS) are a cluster of high-value business models that focus on the delivery of ‘outcomes’ to users of transportation and mobility services. These usually include (i) revenue payments structured around product, service usage and customer outcome; (ii) performance incentives (e.g. penalties for in-use product or service failure); and (iii) long-term contractual agreements between organisations (e.g. spanning five, ten or 15 years) and cost-down commitments. Well-known examples of DEAS in the manufacturing sector include Xerox’s Print Management offering, which bundles printing-equipment and maintenance-services whereby customers are charged for the use of the product-service-bundle (i.e. per print); or MAN’s Pay-per-Kilometre offering, which bundles truck, maintenance and driver-management services where customers are charged for the extent of the use of the bundle (i.e. distance driven). Alstom’s maintenance contract with Virgin Trains means they support the West Coast Mainline fleet 24 hours per day, 365 days per year. The government has announced that new rail franchises will be structured partly around on time performance. Digital technologies such as Artificial Intelligence (AI), deep learning and data analytics play key roles in the development and delivery of DEAS, where they can provide monitoring and analysis of the location, condition and use of different modes of transportation in addition to user behaviour.

The transformation of transportation and mobility organisations to develop, deliver, and ultimately compete through DEAS is a challenge to both practitioners and researchers. From a practical perspective, executives of transportation and mobility organisations face a raft of questions and unknowns, for example; What intelligence can or should be captured about our customers’ journeys? How can AI and data analytics provide insights into preferences and the decision process of customers? Which markets and customers are most suited to outcome-based transportation services? What should be the value proposition, revenue model, cost model and contract? What people and processes are needed to deliver such a value proposition? From the research perspective, on the other hand, to understand DEAS and recognise its potential, a transdisciplinary research approach is required that crosses many disciplinary boundaries (for instance computer science, engineering, business and management) to create a holistic approach. When pursuing this approach, there are two critical challenges facing the engaged scholars: (1) critical awareness; an understanding that each discipline has its own philosophy, methods, and processes, and (2) a strong grounding in disciplinary traditions, including familiarity with their language, theoretical and methodological approaches.
2.2 WHY DIGITALLY ENHANCED ADVANCED SERVICES ARE IMPORTANT TO THE UK ECONOMY

In 2017, the Chief Economist of the Bank of England, Andy Haldane, gave a speech to the London School of Economics in which he referenced the ‘productivity puzzle’. Since 2008, UK productivity growth has underperformed consistently, relative to forecasts, and indeed productivity has hardly improved at all in the last ten years. Part of the root of this problem is historical; initiatives to improve productivity have tended to focus on improving the efficiency of ‘inputs’ (i.e. reducing time and costs), rather than increasing ‘outputs’ (i.e. increasing value created), and today there is a danger of repeating this mistake with digital technologies.

The value creation potential of digitalisation is immense, with a total estimated global economic impact of £800 billion to £2 trillion per year by 2025. There is, therefore, much excitement around the potential of digital technologies to enhance the efficiency of the organisations that adopt them and to transform all sectors of the economy. Additionally, since 1948 the demand for services has grown exponentially while the proportion of GDP from production and manufacturing has contracted. Within the UK, for example, approximately 80% of GDP now comes from services-based activities. Furthermore, the nature of services is changing; we are in a world where fewer people are buying conventional products and services, and instead more and more are seeking to buy the ‘outcomes’ that these enable. Quite simply, rather than ‘buying an engine’ customers want to buy ‘thrust’, rather than ‘buying a car’ they want ‘mobility’, rather than ‘buying insurance’ they want ‘reassurance’. In this way, the world of ‘selling things’ is giving way to one of “provision of outcomes”. Indeed, a survey published recently by ServiceMax from GE Digital found that 77% of respondents (600 IT decision makers and field service management leaders) believed that Generation Z (those born from 1994 onwards) will be the last to experience a product-dominated economy.

A recent report for the National Infrastructure Commission and the Cities of the Northern Powerhouse on the impact of improving transport links between major cities indicated that reducing journey times between the cities improved total earnings for the region substantially. The development of the use of underpinning digital technologies for the purposes of delivering DEAS is the key research challenge adopted by this NetworkPlus.

---


2 Bustinza, O; Bigdeli, A; Baines, T and Elliot, C. 2015, Servitization and Competitive Advantage: The Importance of Organizational Structure and Value Chain Position, Research-Technology Management, Volume 58, 2015 - Issue 5


2.3 THE EPSRC DEAS NETWORKPLUS

Our vision is that the UK should be the internationally leading research hub for the innovation of Digitally Enhanced Advanced Services and that this capability will significantly amplify the productivity, growth and resilience of industry in the UK. The aim of this Network Plus is to:

‘Create a cohesive community of researchers and practitioners, working collectively across disciplines (e.g. computer science, engineering and business) and industry sectors, to accelerate the innovation of DEAS and improve UK productivity’.

This Digital Economy NetworkPlus will deliver a vibrant community that will position the UK as the internationally leading research hub for Digitally Enhanced Advanced Services. Rather than focus on the product that is delivered, DEAS focuses on the capability that the product provides. This is a major change in how firms earn money and is being enabled by transformative digital technologies that allow for example, payment per use or availability or outcome. The impact of these changes will be on organisational and company productivity. The traditional focus of productivity (outputs / inputs) is on internal efficiency but digital technologies applied to advanced services also transform the value of the output and outcome.

The DEAS NetworkPlus comprises an integrated programme of activities as summarised in Figure 1. There are five technical work packages (WP1-5), which run concurrently. WP1&2 focuses on processes for identifying and attracting researchers and practitioners, WP3 is then a programme of co-creation activities, with WP4&5 creating roadmaps for research and impact. This programme will be overseen throughout by a management work package (WP6).
THE DEAS NETWORK PLUS WILL DELIVER FOR THE UK:

» A new, interdisciplinary community progressing the topic of DEAS,

» A road-map articulating a thematic research agenda and priorities for international leadership in this topic,

» An equivalent road-map illustrating the opportunity space for maximising impact on different sectors based on their level of maturity e.g. manufacturing, transport and financial services, and

» A portfolio of innovative research projects that will accelerate the impact of DEAS in collaborating companies.

Success will be measured through: (i) the scale and diversity of the community we develop, (ii) the level of activity and participation across this community on publications, events, workshops, and research agenda and (iii) the relevance and direct impact on industry.
3

PROCESS

3.1 AIM
This report establishes the research agenda for the Digitally Enhanced Advanced Services NetworkPlus in the transportation and mobility sectors.

3.2 METHODOLOGY
The DEAS NetworkPlus Team (see Appendix 1) have established the required characteristics of the developed research agenda as being:

- **Broad** to cover a wide range of related areas including organisational change, digital technology, techniques, and processes;
- **Inclusive** to look at the challenges from a range of disciplines;
- **Balanced** in order to be guided by theory to ensure a sensible range of topics;
- **Exploratory** to be aligned with the overall objectives of DEAS NetworkPlus, and
- **Relevant** to lead to impact on business and make contribution to knowledge.

To ensure that those characteristics are built into the research agenda, the team adopted the following process:

**Step 1** – The groundwork: to make sure that the research agenda is broad and balanced the DEAS NetworkPlus Team developed a theoretical framework. The foundation of this approach is the Empathise phase of the design thinking methodology. The framework is designed to enable us to (1) capture inclusive viewpoints on the challenges, (2) classify the empirical discussions in a structured way, and (3) synthesise an agenda for future projects.
Step 2 – Workshop: In September 2019, a DEAS NetworkPlus Transportation and Mobility Workshop was held at Cranfield University at which researchers from each of the identified disciplines (i.e. computer science, engineering, business and management) could listen to, question and discuss with practitioners from industry and government who have experience of developing and delivering Digitally Enhanced Advanced Services. See Appendix 2 for a list of the practitioners and Appendix 3 for the list of researchers.

The overall question for the workshop was, “How can transformative digital technologies accelerate the innovation and success of advanced services within the transportation and mobility sectors?”.

At the workshop, each practitioner was invited to describe their company and its development toward advanced services using the Technology–Organisation–Environment Framework (Figure 2) as defined by these questions:

- What is your company and what advanced service offering do you (aspire to) have (or enable)?
- What organisational challenges do you have / anticipate in achieving this?
- What technological and data challenges do you have / anticipate in achieving this?
- What business environment challenges do you have / anticipate in achieving this?

After these introductions to the companies and the services they offer, the researchers were split into two multi-disciplinary groups and were given the opportunity to discuss advanced services with the practitioners: Keelan Fadden-Hopper (Transport for West Midlands), Adam Orchard (Esoterix) and Huw Thomas (Magway).

The researchers were then split again into two different groups, this time based on their research discipline: one group comprised engineers and computer scientists, while the second group had researchers from business, digital technologies and management. Again, each group had an opportunity for questions and discussion with the representatives from industry and government.

All the discussions were captured in a list of comments and questions which firstly set out a broad portfolio of research and then, further research discipline focussed discussions developed a deeper understanding of where the research issues lie. These discussions were also captured by a visual scribe in a series of mind-maps, synthesising the essential elements of the event into a combination of words and images.

Step 3 – The comments and questions from Step 2 were validated and refined using a Delphi methodology.

---

Figure 2

---

As a result of following the methodology described in Section 3, researchers have identified ten research topics which are described in detail in the following pages. The ten topics are:

4.01 How can innovative digital technologies enhance the communication, education and engagement of customers about DEAS within the transportation and mobility sectors?

4.02 How can innovative digital technologies enhance communication, education and engagement within and between organisations about DEAS within the transportation and mobility sectors?

4.03 How can innovative digital technologies allow us to identify suitable DEAS outcomes within the transportation and mobility sectors?

4.04 How can innovative digital technologies enhance data management and analysis to allow improved decision making about DEAS within the transportation and mobility sectors?

4.05 How can innovative digital technologies enhance data ownership and sharing to facilitate DEAS within the transportation and mobility sectors?

4.06 How can policy, considering both local and national government, help us ensure that innovative digital technologies can be used to facilitate DEAS within the transportation and mobility sectors?

4.07 How can innovative digital technologies allow DEAS to be delivered across organisations within the transportation and mobility sectors?

4.08 How can innovative digital technologies enhance business model design, adoption and evaluation for DEAS within the transportation and mobility sectors?

4.09 How can innovative digital technologies enhance productivity and growth of the UK economy through DEAS within the transportation and mobility sectors?

4.10 How can innovative digital technologies enhance organisation and cultural change for effective adoption of DEAS within and between organisations within the transportation and mobility sectors?
INTRODUCTION

There is a need to raise awareness of what Digitally Enhanced Advanced Services are and how such services add value in general. The opportunity to provide advanced services occurs when the service providers align the offer with the customer’s concept of value. It is a huge change to switch the basis of the relationship from the customer buying tickets (from multiple organisations) for a journey for themselves or their goods, to selling them the outcome provided by those tickets. Digital technologies have the potential to help a customer understand the value of the outcome provided by the journey and consequently how a DEAS can help them (the customer) better use the transportation and mobility systems.

How can innovative digital technologies enhance the communication, education and engagement of customers about DEAS within the transportation and mobility sectors?
KEY QUESTION
How can digital technologies be used to raise the benefits of DEAS to their customers?

POSSIBLE RESEARCH PROJECTS
» How to educate the customer so they can see the value in the DEAS offer?
» How can innovative digital technologies get the customer to understand their new role in a DEAS partnership?
» Considering new risks associated with the introduction of DEAS, what would assure customers? How would DEAS work across different markets and different modes of transport?
» Can gamification help a customer understand the value of DEAS?
» How does the customer view the value of their data created during the use of a DEAS transportation or mobility service?

CHALLENGES
How can an organisation define a DEAS offer if they don’t have input from their customers and how can the customer express their needs if they don’t understand the concept? If an organisation has not yet developed a DEAS offer, how can it justify the expense of developing one if its customers will not understand the offer? How can innovative digital technologies provide tools to enable an organisation to demonstrate the value of a DEAS offer in terms that the customer will understand?
How can innovative digital technologies enhance communication, education and engagement within and between organisations about DEAS within the transportation and mobility sectors?

INTRODUCTION

Many different commercial and governmental organisations are involved in enabling mobility. Having safe, well-lit streets to walk along, comfortable waiting areas, accurate information and reliable buses, lorries, trams and trains results from the efforts of a diverse range of companies and agencies. Yet, passengers need all these to work in harmony to get to their destination on time. We need transport and mobility providers to move from competition to collaboration: to share risks and rewards if users are to benefit from outcome-based services.
KEY QUESTION
How can digital technologies allow organisations to engage their partner organisations and communicate the benefits of adopting DEAS?

CHALLENGES
Many journeys require the use of multiple modes of transport (walking, bus, tram, train, boat): how can digital technologies enable multiple organisations to partner and so deliver the desired outcome to the customer? How to encourage customer participation so they are willing to share their data (e.g. destination and journey preferences)? How to use the exchange of data between organisations to ensure fair reward for each as they work together to deliver the desired outcome for their shared customer?

POSSIBLE RESEARCH PROJECTS
» How can digital technologies facilitate collaborative working for DEAS in the transport and mobility sectors?
» What are the challenges associated with sharing organisational and customer data with multiple partners delivering a DEAS outcome?
» What new commercial models can digital technologies enable that get different providers to work together for DEAS in transportation and mobility?
» How should we use technology (e.g. IoT) to improve the visibility of collaboration in a DEAS value network delivering transport or mobility services?
» How to develop a shared vision for DEAS between management, frontline staff and back office teams of multiple organisations?
How can innovative digital technologies allow us to identify suitable DEAS outcomes within the transportation and mobility sectors?

INTRODUCTION

Tickets for public transport systems often allow the user access to the system but do not guarantee that specific services will run or that the user will arrive at their desired destination on time. In addition, the ticket will get you to your chosen bus or tram stop: the transport system is not, currently, concerned whether you get to your appointment on time. Use of private transport has similar constraints: driving yourself to work also does not guarantee that you will arrive when you need to.

What outcome does each system user require? What factors are involved, and do they have the same importance for every journey?
KEY QUESTION

How can digital technologies be used to identify the outcomes that a customer wants?

CHALLENGES

For each individual, priorities change depending on which journey is being made so, how to define the outcome for each, specific journey? Different people making the same journey may have different desired outcomes. Experience from Transport for West Midlands shows that people’s stated preferences before a journey often do not match their behaviour during the journey itself. Tracking is in use however this doesn’t explain why people are moving. If an organisation, or a group of organisations, is to provide an outcome-based transportation service, what is the outcome they need to deliver?

POSSIBLE RESEARCH PROJECTS

» How to use digital technologies to model and then predict passenger behaviour when making a journey?

» What value do customer preferences have when designing a DEAS transportation or mobility service?

» How to optimise the system if people don’t have cost signals for each choice?

» How can digital technologies manage and plan for individual differences / preferences for travel?

» Is it possible to design a DEAS transportation or mobility service that caters for the multiple and diverse outcomes desired by the service users?
4.04

How can innovative digital technologies enhance data management and analysis to allow improved decision making about DEAS within the transportation and mobility sectors?

INTRODUCTION

In a DEAS system, we are likely to need to capture not just data to monitor the system and its components but also data about the activities of transportation or mobility system users and providers. What data needs to be collected? Who owns this data? Who needs to access it and use it? The ability to turn data into decisions will be the source of value. This is an opportunity for big data and artificial intelligence. What controls need to be in place?

KEY QUESTION

How to extract meaning from the huge volumes of data that are generated by devices connected across a transportation or mobility system to deliver a DEAS?

CHALLENGES

As soon as we fit our transportation and mobility systems with sensors and arrange for them to send measurements back to our control centre to monitor the movement of packages and passengers, we face a deluge of data. For example, readings of location, ambient temperature, status of the vehicle, package or passenger can be sent every minute from thousands of devices. How to recognise which data is important - not only for today but for the potential new DEAS of the future? How to present that data in a way so that informed decisions can be made?

POSSIBLE RESEARCH PROJECTS

- How do we represent our level of confidence in the data and its interpretation? What happens if it is non-deterministic?
- How do you represent complex datasets from DEAS to the right people in the right way? How can they be adapted for the user of the data?
- Should transportation and mobility service providers be triangulating data sources across the DEAS value network to measure what they really want?
- In DEAS, do we need complex datasets to make decisions?
- How can data from DEAS value networks be used to identify patterns of use and to identify new services?
Transportation & Mobility Theme Research Agenda

Is car data personal?

Is the future of data open?

Integrate data streams & intelligent use

Full price or pay per use

Who is the customer?

Society's conversations can drive outcome
How can innovative digital technologies enhance data ownership and sharing to facilitate DEAS within the transportation and mobility sectors?

INTRODUCTION
Transport / mobility data is very valuable. Organisations potentially have lots of data (such as the ability to know in each micro-second where each package and passenger is) but they don’t know what to do with it. There is a battle to control the data and there is a battle to control the direct relationship with the users. Some data is open, and some is private which introduces lots of ethical questions. There is a public reluctance to share their private information as they are unsure who will have access and what they will use the data for. Data security is an ongoing issue.
KEY QUESTION
How to securely share and ethically manage the data needed to facilitate DEAS among customers and organisations?

CHALLENGES
What about users owning their own data? What value does individual data have? Lots of data can be generated but what do we need? How can this data be valued and what is the market for these data streams? What control does / should an individual have over their mobility data? In a connected world, how does the interaction between different organisations work?

POSSIBLE RESEARCH PROJECTS
» Can digital technologies be used to value personal mobility data in real time? Can that value be shared with each individual so they can choose whether to disclose their mobility actions and preferences?
» What data is really needed to design and operate DEAS transportation and mobility services?
» What are the risks and rewards of having a central data repository containing individual mobility actions and preferences?
» Can AI be used to predict how passengers will actually behave on a journey?
» Is there a way to capture and use real time preference data to optimise the operation of a DEAS transportation or mobility service?
4.06

How can policy, considering both local and national government, help us ensure that innovative digital technologies can be used to facilitate DEAS within the transportation and mobility sectors?

INTRODUCTION

It is difficult for organisations to devote time, energy and resources to evaluate the potential benefits of new and unproven digital technologies. What can be done to make it easy for organisations in the transportation and mobility sectors to transform their business model to adopt Digitally Enhanced Advanced Services? Many journeys require the use and coordination of many transport systems. Is it possible to use policy or regulation to encourage collaboration by transportation and mobility organisations?
KEY QUESTION
Can local and national government develop and maintain policy and legislation that would facilitate DEAS and keep up with evolving digital technologies?

CHALLENGES
Delivering a passenger or package to their destination from the nearest transport hub can be expensive. How does policy / regulation impact how different organisations act? Are there regional or local differences from national government? Data security implies control, but competition needs people to be able to easily switch provider. How do you ensure competition with dominant technology providers? Ethics – How can we ensure people are still in control of their own movement? Speed of technology change is so fast. How can policy keep pace?

POSSIBLE RESEARCH PROJECTS
» Can policy encourage digital technologies that regenerate the corner shop to be the “last mile” hub and incentivise local people to make local deliveries for their neighbours?
» Can AI be used to predict behaviours and model the impact of different policies on DEAS for transportation and mobility services?
» What is the desired role of government in the creation, collection, sharing and analysis of transportation and mobility data?
» Can policy be used to encourage competing organisations to collaborate and deliver outcome-based DEAS transportation and mobility services?
» Can digital technology provide simulation tools to advise policy makers on the impact of various options as they make their decisions?
INTRODUCTION

Many organisations collect data about the movement of people and packages not only those directly involved in transportation and mobility but also mobile telephone companies and online vendors, such as Amazon. If used together, all this data could provide insight to the use of the transportation and mobility systems in the future or even, locally, in real time. The data collected by each organisation is specific to their needs, presenting challenges to combine data and extract useful information providing, of course, that the organisations are willing to share their data.

How can innovative digital technologies allow DEAS to be delivered across organisations within the transportation and mobility sectors?
KEY QUESTION
How can organisations work together to facilitate DEAS within transportation and mobility networks whilst still maintaining competitiveness?

CHALLENGES
The challenge is to create an ethical but dynamic marketplace for transportation and mobility data in which people and organisations can be rewarded for sharing data as much as for creating useful information from it. To what extent does the competitiveness of each organisation depend on the data that they have? What value does sharing data have for the development and delivery of DEAS transportation and mobility services?

POSSIBLE RESEARCH PROJECTS
» What are the key inter-organisational barriers to / enablers for DEAS implementation?
» Are competitive forces alone sufficient to encourage appropriate collection and sharing of data and information for the development and delivery of DEAS transportation and mobility services?
» Can data science provide models of transportation and mobility data to reveal the value of the data and encourage an open market for it?
» Can AI be used to predict the behaviour of different, competing organisations engaged in the delivery of a DEAS transportation and mobility service?
» To what extent does a DEAS transportation or mobility service rely on data sharing between organisations?
How can innovative digital technologies enhance business model design, adoption and evaluation for DEAS within the transportation and mobility sectors?

INTRODUCTION

Mobility as a Service is not an app or a subscription (e.g. season ticket). Rather, it delivers an outcome not a product (i.e. actually getting from A to B; not selling a ticket for the journey). There is, however, the marginal cost problem: that the extra passenger at off peak time can be near zero cost but at peak time the extra passenger may cause significant extra cost. An enhanced business model for transportation needs everyone involved to look at the complete system, the whole city, as the optimisation of transport relies on the power and data networks to support mobility. It takes time for users to adapt to new transport choices (e.g. bus companies typically allow 18 months for a new route to become profitable).
KEY QUESTION
How do you combine digital technologies, engineering and business organisation to deliver value through DEAS?

CHALLENGES
Digitally enabled services are becoming increasingly complex and digitally enhanced means looking outside the existing business model for opportunity. There is a need to consider the whole business model, e.g. canals and railways are very efficient at moving things: it is the high cost and time taken to load / unload, and financial cost of the goods remaining unsold in transit, that makes them uncompetitive for the complete journey. There is a challenge to invite multiple organisations and agencies to adopt a single business model to deliver a DEAS transportation or mobility service.

POSSIBLE RESEARCH PROJECTS
» Can digital technologies help enable the inclusion of DEAS mobility services to low income areas that are unprofitable for conventional bus services?
» How can digital technologies facilitate different models of payment, such as salary sacrifice, tokens, exchanges, etc in DEAS transportation and mobility services?
» Can we use digital technologies to group customers together to get more efficient use of DEAS transportation and mobility services?
» Can digital technologies and AI be used to encourage early adoption of new DEAS transportation and mobility service?
» Can digital technologies build dynamic business models that take account of economic, environmental and personal factors associated with the delivery of DEAS transportation and mobility services?
How can innovative digital technologies enhance productivity and growth of the UK economy through DEAS within the transportation and mobility sectors?

INTRODUCTION

Andy Haldane (Chief Economist of the Bank of England) in his report on the productivity puzzle (essentially stagnant growth since the financial crash) argues that despite the advent of the digital age and the adoption of digital technologies by some leading companies, there is a very long tail of poorly productive firms across all sectors. In addition, there is a growing preference to purchase services on a subscription basis. Many companies are, however, using all their available resources just to stay in business. What can be done to make it easy for companies to transform their business model to adopt DEAS within the transportation and mobility sectors?
KEY QUESTION
How can digital technologies and engineering combine to enable transportation and mobility organisations in the long tail of poorly productive firms benefit from DEAS?

CHALLENGES
The challenge is to provide these firms with tools so that they can explore how the switch to DEAS can provide increased and sustained value to them and their shareholders. This needs to be done quickly and effectively as they will need to divert resources from their current core business in order to establish: what advanced services they can offer; how their products can be adapted to enable DEAS; how their organisation needs to change and how to sell this new concept to their customers.

POSSIBLE RESEARCH PROJECTS
» Develop an online tool to allow an organisation to build a business case for a switch to DEAS transportation and mobility services.
» What can be done to help smaller companies take the DEAS step? Can larger organisations help?
» How does an SME identify / assess the appropriate technology for DEAS in the transportation or mobility sector?
» How can SMEs be aware of / learn what is available to implement DEAS given less resources?
» How to develop skilled people that can apply big data and AI techniques to developing DEAS for transportation and mobility services?
4.10

How can innovative digital technologies enhance organisation and cultural change for effective adoption of DEAS within and between organisations within the transportation and mobility sectors?

INTRODUCTION

Organisations, particularly SMEs, are often reluctant to adopt new systems because they are unsure of their own readiness for the change. Companies who are considering DEAS systems not only need to know the requirements and habits of external members of their value networks to be confident, they also need to know they have the internal conditions and personnel in place to achieve operational effectiveness. Can innovative digital technologies enable organisations to assess their own requirements and develop confidence that they have the right conditions and people in place to optimise DEAS implementation?

KEY QUESTION

Can we enable organisations so they can assess their own requirements, necessary partners and develop confidence that they are ready for DEAS implementation?

CHALLENGES

The challenge is to develop a reliable understanding of the most important factors affecting uptake and effective adoption of DEAS systems and to develop practical tools that organisations can apply to self-assess their current circumstances and identify what they need to put in place to optimise DEAS implementation.

POSSIBLE RESEARCH PROJECTS

» What are the key organisational barriers to / enablers for DEAS implementation?
» What are the internal direct user requirements for DEAS implementation?
» How can these factors be measured to evaluate an organisation’s current readiness for DEAS?
» How can personnel skills be developed using innovative digital technologies to optimise DEAS integration?
» How can organisational conditions (environment, culture, etc) be developed for DEAS integration?
This report has presented an overview of Digitally Enhanced Advanced Services and their potential benefit to the UK economy. In addition, this report has described the process by which the essential research themes have been identified by researchers in the fields of computer science, data science, engineering, business and management. Working together across these academic disciplines and alongside practitioners in industry and government, projects based on these research themes will identify tools and techniques to enable small, medium and large businesses across the UK to benefit from Digitally Enhanced Advanced Services.

The next steps are to host a commissioning workshop where we will invite bids for research projects based on these research topics:

- How can innovative digital technologies enhance the communication, education and engagement of customers about DEAS within the transportation and mobility sectors?
- How can innovative digital technologies enhance communication, education and engagement within and between organisations about DEAS within the transportation and mobility sectors?
- How can innovative digital technologies allow us to identify suitable DEAS outcomes within the transportation and mobility sectors?
- How can innovative digital technologies enhance data management and analysis to allow improved decision making about DEAS within the transportation and mobility sectors?
- How can innovative digital technologies enhance data ownership and sharing to facilitate DEAS within the transportation and mobility sectors?
- How can policy, considering both local and national government, help us ensure that innovative digital technologies can be used to facilitate DEAS within the transportation and mobility sectors?
- How can innovative digital technologies allow DEAS to be delivered across organisations within the transportation and mobility sectors?
- How can innovative digital technologies enhance business model design, adoption and evaluation for DEAS within the transportation and mobility sectors?
- How can innovative digital technologies enhance productivity and growth of the UK economy through DEAS within the transportation and mobility sectors?
- How can innovative digital technologies enhance organisation and cultural change for effective adoption of DEAS within and between organisations within the transportation and mobility sectors?
FURTHER INFORMATION

For more information about the DEAS NetworkPlus visit www.deas.ac.uk

To become a member of our Digitally Enhanced Advanced Services NetworkPlus community sign up to our mailing list www.jiscmail.ac.uk/DEAS
Appendix 1

THE DEAS TEAM

Dr Ali Bigdeli
Senior Lecturer in Industrial Service Innovation, Aston Business School, Birmingham.

Professor Roger Maull
Professor of Management Systems and Academic Director of INDEX (Initiative in the Digital Economy at Exeter) at University of Exeter, London.

Professor Tim Baines
Professor of Operations Strategy and Executive Director of The Advanced Services Group, Aston Business School, Birmingham.

Professor Robert John
Professor of Operational Research and Computer Science, ASAP Research Group, University of Nottingham.

Dr Sarah Fletcher
Senior Research Fellow, Centre for Structures, Assembly and Intelligent Automation, Cranfield University.

Dr Zena Wood
Senior Research Fellow, INDEX (Initiative in the Digital Economy at Exeter) at University of Exeter, London.

SUPPORT TEAM

Fran Lumbers
Project Officer DEAS NetworkPlus, INDEX (Initiative in the Digital Economy at Exeter) at University of Exeter, London.

Dr Phil Godsiff
Senior Research Fellow, INDEX (Initiative in the Digital Economy at Exeter) at University of Exeter, London.

Gill Holmes
Senior Research Manager, the Advanced Services Group, Aston Business School, Birmingham.
Appendix 2

THE PRACTITIONERS

Transport for West Midlands:
Keelan Fadden-Hopper

Transport for West Midlands serves to connect all public transport in the West Midlands area working in partnership with local authorities and transport operators to ensure that all bus, rail and Metro services are easily accessible to most people in the West Midlands. By providing improved timetable information at bus stops and improved maps and journey information wherever services meet, people can plan and complete journeys with confidence, including switching between bus, rail and Metro.

Esoterix:
Adam Orchard

Esoterix fuse data and dig deeper to find unmet demand for shared mobility by simulating operating parameters, service economics, and passenger choices. They specialise in discovering and designing services that deliver social impact so that everyone in society can access work, healthcare, shops, entertainment and leisure.

Magway:
Huw Thomas

Magway is a company developing a revolutionary delivery utility which will transport standard size loads between distribution centres and consolidation centres through HDPE pipes. When completed, the system will be capable of fulfilling over 90% of online orders, plus all online groceries, so reducing HGV traffic between distribution centres and consolidation centres.

Appendix 3

THE RESEARCHERS

Dedy Ariansyah    Cranfield University
Tim Baines        Aston University
Ali Bigdeli       Aston University
Phil Davies       University of Reading
Marcus Enoch      Loughborough University
Conor Fahy        De Montfort University
Ip-Shing Fan      Cranfield University
Carol Featherston Cardiff University
Sarah Fletcher    Cranfield University
Phil Godsiff      University of Exeter
Danica Greetham   The Open University

Robert John       University of Nottingham
Christina Latou   Cranfield University
Andrew May        Loughborough University
Glenn Parry       University of Surrey
Haris Pervaiz     Lancaster University
Alma Rahat        Swansea University
Victor Guang-Shi  University of Sheffield
Chris Turner      University of Surrey
Zena Wood         University of Exeter
Alexandros Zafeiriadis University of Warwick