THE UK WATER PARTNERSHIP

# DIGITAL WATER

## UNDERSTANDING THE COMMERCIAL OPPORTUNITIES FOR UK PLC

A draft White Paper and Call to Action issued for consultation by the UK Water Partnership

DECEMBER 2019

# PURPOSE

The digital revolution is transforming the water industry – and with that transformation come tremendous commercial opportunities for UK plc. This draft document aims to capture the scope and scale of those opportunities and how we can capitalise on them.

Here at the UK Water Partnership we're keen to seek the views of everyone connected, directly or indirectly, with the water economy. So, please review the contents, consider the consultation questions on page 26 and send your responses to us using the contact details provided on page 27. Thank you, we appreciate your contribution.

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## ABOUT THE UK WATER PARTNERSHIP

The UK Water Partnership (UKWP) was established in 2015 and provides a strategic vision for the development and growth of the UK water industry.

The Partnership brings together diverse water industry and related organisations in a single coherent alliance, promoting mutual understanding, co-operation and coordination. It applies world-class research and innovation to address the challenges of global water security and the need for resilience in a changing environment – and to secure more of the $500 billion global water market. See page 28 to find out about the benefits of joining the UK Water Partnership.

# FOREWORD

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In an uncertain world, there are two things that we now know to be beyond dispute.

Firstly, that our planet is facing a growing water scarcity crisis, and that urgent, coordinated action is essential if we are to successfully address it. Secondly, that the digital revolution provides tremendous cause for optimism, that smart technologies, intelligently-applied at scale, can transform our ability to make real progress in the years ahead.

The UK water industry is respected throughout the world and many of the digital innovations that have changed so much of our personal and working lives have originated here.

**So, I welcome the UK Water Partnership's vision of galvanising UK stakeholders to come together in a focused, national effort to embrace the digital revolution in the water economy, to capitalise on the many commercial opportunities, and to help improve the planet's prospects for long-term water security and resilience.**

This draft White Paper and Call to Action summarises the issues and opportunities before us. We value the views and opinions of everyone in the water sector and so I encourage you to join our movement today, review this document and its proposals and respond to the consultation questions using the contact details provided on page 27.

**Rt Hon. Richard Benyon**
Chairman, the UK Water Partnership
*December 2019*

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# EXECUTIVE SUMMARY

Our planet faces an unprecedented combination of water security and resilience challenges. The UK Water Partnership (UKWP) is providing leadership and a unified approach to the UK's efforts to contribute to the development of sustainable solutions, and to ensure that the UK's experts, innovators and entrepreneurs are at the forefront of the global response.

The water sector will need to continue to embrace change in order to address the challenges and take full advantage of the opportunities. Adoption of digital approaches, techniques and thinking will play a pivotal role in the journey of innovation, change and transformation.

The digital revolution will reshape our industry and, in the process, presents emerging commercial opportunities for UK plc, requiring a focused, national effort to capitalise on those opportunities and deliver important benefits for the UK and the rest of the world.

## WE DEFINE DIGITAL IN WATER AS:

Exploiting data to create enhanced actionable insight and improved decision making.

Employing digital insight to improve business process performance by making individual steps more efficient, eliminating steps, or reconfiguring a business process as a whole.

Utilising digital techniques to enable creation of new markets.

Enabling the creation of entirely new value-adding products or services.

Digital thinking will impact every aspect of water, from management of sources, treatment technology and efficiency, consumption and customer engagement, through to re-use, collection and recovery of economically and environmentally important resources. In fact, it has the potential to revolutionise the water sector and its interaction with customers and the supply chain in ways that were previously unimaginable.

Innovative digital products and services are being developed in the UK and ongoing support is essential to help these companies flourish. However, there are also a host of digital opportunities for UK companies to significantly increase their global reach.

In particular, through collaboration between the water sector and areas of the digital economy where the UK enjoys global prominence, such as mobile communications and computer gaming. Further opportunities lie in the integration of smart, customer-centred approaches, commercialising niche applications and developing hitherto unappreciated applications.

The global sales opportunity is immense. The size of the "smart" water market alone was assessed as $20billion in 2014 and is projected to grow to $30billion by 2020. Enabling UK plc to capitalise on the global digital water opportunity requires a mix of activities, not least in defining and presenting our expertise, and the subsequent, co-ordinated promotion of that expertise in receptive markets.

This White Paper, Digital Water, is produced on behalf of the UKWP and seeks to contribute to the global debate. It explores these vital issues and opportunities, identifies focus areas for action by UK stakeholders and specifies a range of immediate next steps to build momentum.

The UKWP is committed to playing an enabling role in ensuring that progress is delivered at pace, working collaboratively with stakeholders to an agreed plan and timetable.

"I welcome the UK Water Partnership's vision of galvanising UK stakeholders to come together in a focused, national effort to embrace the digital revolution in the water economy, to capitalise on the many commercial opportunities, and to help improve the planet's prospects for long-term water security and resilience."

**Rt Hon. Richard Benyon**
Chairman, the UK Water Partnership

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# INTRODUCTION

The fact that our planet faces an unprecedented combination of water security and resilience challenges, caused by the cumulative impacts of population growth, increasing demand, declining resources, pollution and climate change, has been established beyond doubt.

The impacts have been described and analysed in forensic detail in numerous, authoritative research projects and reports.

The UK Water Partnership (UKWP) was specifically created to provide leadership and a unified approach to our efforts here in the UK, both to contribute to the development of sustainable solutions and to ensure that the UK's experts, innovators and entrepreneurs are at the forefront of the global response.

Against that background, this White Paper, produced on behalf of the UKWP, examines the contribution that the digital revolution can play in shaping our industry and the water economy and, in particular, highlights some of the emerging commercial opportunities for UK plc.

We seek to summarise what digital means in the context of water, how, where and when it can be applied in our industry and the benefits it can produce.

Most importantly we identify the actions that need to be taken to catalyse a focused, national effort to deliver commercial benefits for the UK at speed.

Our intention is that this paper has relevance across the water industry and its supply chain, for users of digital technology and for digital technology businesses already working in the sector, for those with aspirations to get involved, and for Government and regulators too.

Finally, we hope that it reflects the reality that infrastructure varies in maturity around the world and that the market opportunity is different accordingly.

However, there is huge potential for digital technology to play a game-changing role in addressing the challenges and taking advantage of the opportunities. We hope that this paper contributes to our collective efforts to make it happen.

# UNDERSTANDING DIGITAL WATER

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In collaboration with Accenture, in November 2016 Business in the Community published its report *A Brave New World: Why businesses must ensure an inclusive digital revolution*.

The report served as a call to action for UK businesses, NGOs and policymakers and highlighted that collaboration and innovation is essential if businesses and the UK as a whole are to fully benefit from the opportunities provided by the digital revolution.

Digital can mean different things to different people in different industries. This paper aims to explore digital opportunity across the wide spectrum of the water landscape, extending beyond the remit of municipal water and wastewater organisations, to include agriculture, industry and the economy as a whole.

For the purposes of this paper, digital in water is defined as:

a) Exploiting data to create enhanced actionable insight, which in turn leads to better decision making.

   Sensor technology continues to advance, offering the potential for acquisition of data from a more distributed and diverse range of sources.

   Developments in connectivity provides the means to move and combine vast amounts of real time data.

   Advances in data storage, analytics and processing power create the means of generating enhanced actionable insight.

b) Employing digital insight to improve business process performance by making individual steps more efficient, eliminating steps, or reconfiguring a business process as a whole.

   Developments in artificial intelligence, machine learning and robotics combine to provide the means to reconfigure business processes, increasing efficiency.

c) Utilising digital techniques to enable the creation of new markets, and hence the disruption of existing markets.

   Digital approaches can create new markets by making information visible, doing so in a timely way, and enabling transactions.

   MOSL, the not-for-profit company created to design, develop and operate a new business water market in the UK, built the central IT system (CMOS) that allows 1.2 million businesses, public sector and not-for-profit organisations in England to choose who supplies their services.

d) Enabling the creation of entirely new value adding products or services.

   Digital technology and techniques offer the potential to innovate.

   For example, the Twenty65 Programme, a consortium of six British Universities, is developing swarming autonomous robots, permanently stationed in pipes, to replace human intervention in the proactive monitoring and restoration of buried infrastructure.

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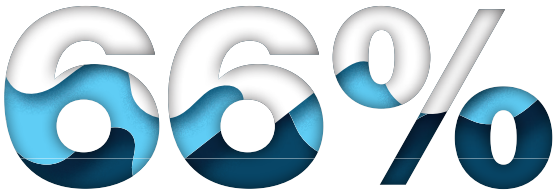
# WHY DIGITAL MATTERS

## MEETING THE WATER CHALLENGES

The water challenges facing our planet are well-rehearsed and documented in many authoritative reports. Here is just a small selection.

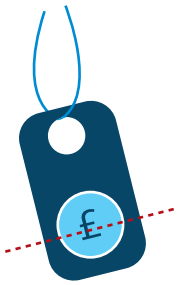
### PEOPLE AND THEIR NEEDS

- The global population will reach 10 billion by 2050, and potentially 16.5 billion by the end of the century, accompanied by a dramatic increase in demand for water and food
- Increasing urbanisation – 66% of the world's population will be living in urban areas by 2050, increasing pressure on water networks and infrastructure
- Access to clean water and sanitation is often reduced by urbanisation, with cities unable to cope with the needs of rising and ageing populations
- Attitudes to water are changing, with citizens willing to save water when public authorities demonstrate that they are fixing leaks, spending money wisely and ensuring that bills are affordable.




OF THE WORLD'S POPULATION WILL BE LIVING IN URBAN AREAS BY 2050

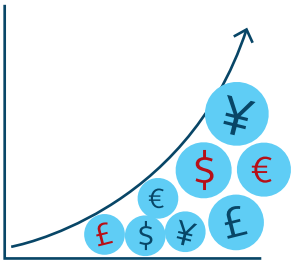
ATTITUDES TO SAVING WATER ARE CHANGING



ENSURING BILLS ARE AFFORDABLE IS ESSENTIAL

### ECONOMIC GROWTH AND DEVELOPMENT

- To feed, house and care for an ever-increasing and ageing population suggests that the world economy will need to continue to grow rapidly to keep pace, adding to the demand for water and energy and, where unregulated, contributing to increased pollution and diminution of natural water sources.



THE WORLD ECONOMY WILL NEED TO CONTINUE TO GROW RAPIDLY TO PROVIDE FOR AN EVER-INCREASING POPULATION

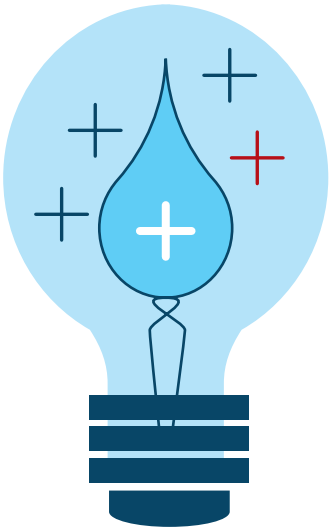
## THE ENVIRONMENT

- The effects of climate change are now clear, with extreme weather events, increased risks of flooding, droughts and water stress
- Groundwater is the most extracted raw material in the world – and supplies are dwindling
- Feeding a growing population requires more water and energy for food production and transportation, at a time when reducing carbon emissions is essential to meet tougher environmental standards and slow down climate change.

THE EFFECTS OF CLIMATE CHANGE BRING INCREASED RISKS OF FLOODING, DROUGHTS AND WATER STRESS

## UTILITY BUSINESSES

- Ageing infrastructure must be replaced and maintained
- Economic and regulatory pressures, and the need to keep bills affordable, means that investment in infrastructure is tightly controlled
- Innovation and the embracing of new technology is now at the heart of business planning and will play a central role in achieving water reuse and recycling targets, reducing energy demands and delivering more efficient and longer-lasting infrastructure.



INNOVATION AND THE EMBRACING OF NEW TECHNOLOGY WILL HELP TO REDUCE DEMAND FOR ENERGY

In order to address the challenges, as well as take advantage of the opportunities, the water sector will need to continue to embrace change. Adoption of digital approaches, techniques and thinking has the potential to play a pivotal role in the journey of innovation and change. It can transform how services are delivered, enhancing capital investment and operational efficiency, and benefitting customers, environmental performance, resource sustainability and employee wellbeing.

"Access to clean water and sanitation is often reduced by urbanisation, with cities unable to cope with the needs of rising and ageing populations."

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# APPLYING DIGITAL THINKING

## THROUGH LEADERSHIP, AMBITION AND FOCUS

Digital thinking has the potential to impact every aspect of water, from management of sources, treatment technology and efficiency, consumption and customer engagement, through to re-use, collection and recovery of economically and environmentally-important resources.

It could be argued that we already have the infrastructure we need, if we could use our water more sustainably and manage the infrastructure more effectively and efficiently. Digital thinking is key to making this happen, although achieving the benefits with constrained finances will be challenging and will require leadership, ambition and focus.

Digital thinking goes beyond technology, communication, data, analysis and decision making and has the potential to revolutionise the water sector and its interaction with customers and the supply chain in ways that were previously almost unimaginable.

A number of these opportunities and challenges are described here:


Operational activity has the potential to be transformed with enhanced digital capability driving efficiency and customer service. Greater situational awareness will be enabled through the application of sensors, Internet of Things (IoT) devices, metering and earth observation across water and wastewater systems, continuously measuring and controlling operational performance. The widespread deployment of sensors will also allow the monitoring of a broader range of assets, including the health and safety of employed human assets.

"Greater visibility of consumption – and patterns of consumption – will allow consumers to make choices about how they use and re-use water."

Dynamic pricing could also be used to encourage the best use of resources and water infrastructure. In resilient, smart cities of the future, the water system will be integrated with energy/renewable energy and other infrastructure systems enabling circular economy principles to overcome resource limitations and have a net positive environmental and ecological impact.

Digital systems will be facilitators to the infrastructure technologies that will make this happen, and the interface to the people that will operate the systems and use the services.

The water utility of the future will be able to respond in real-time or predictively to changing circumstances, rather than reactively as is the current default position. This will in turn enable optimised performance, made possible through the application of real time analytics. Even greater efficiencies within systems will be seen through the roll out of automated operational control systems and decision making, leading to automated operational responses to changing circumstances.


Artificial Intelligence (AI) ranges from simple automation of routine tasks, such as a spreadsheet macro, a workflow or satellite navigation, through to its use in developing new ways customers might experience products or services. An autonomous vehicle uses AI to analyse its situation in real-time and make its own decisions about what it should do next according to pre-programmed rules. Autonomous construction vehicles are already operating in this way.

In the water sector, AI will be used to manage the water network, utilising machine learning to take proactive decisions on optimisation, maintenance and customer service. The future will see utility treatment and network assets self-learning from data and optimising activity. Those assets will then be able to work in sequence or in a group, sharing data, thinking together and self-optimising overall performance.

AI will become a tool that supports the management of the water network by those that understand it best, using their knowledge to better inform the AI response and likewise learning from AI to take lessons into other areas of the business. It is an enabler for all of us in managing water resources.

Alongside a Digital Twin, AI provides us with the capability to work with autonomous, machine learning systems that can make considered and correct decisions on the management of the water network. In scenario planning, a Digital Twin approach allows us to see what impact a major weather event would have on an asset, a site, a DMZ or DMA. Coupled with AI this provides the capability for us to test the machine learning's reaction to that scenario and understand how the scenario would be managed by AI. The benefit of this is in being able to retrain the machine learning algorithms or the models that underpin the AI to ensure the most effective response.

Customer service is already being enhanced by digital thinking with new channels for communication now available. Chatbots and intelligent virtual robots are being used to respond to routine queries and, in addition to websites and email, they provide several options for routine communication, freeing time for human interaction on more complex issues.

## DECISION MAKING

Water businesses already have a plethora of data available to them and there is a major opportunity to better use that data for informed decision making, using decision support tools to drive targeted operational activity.

The available data streams can be used to better understand the water system and reveal root cause opportunities that drive better value totex solutions, rather than focusing on construction or renewal of assets. This is particularly true where there are multiple stakeholders involved, as there are in the water cycle.

As we gain more experience of big-data analysis, the demand for data will grow and the range of data sets from which system benefits can be gained will expand. These will include data sets from other related industries, such as power, agriculture, food production and wider industry, allowing a broader system view to be better understood and refined.

"The available data streams can be used to better understand the water system and reveal root cause opportunities that drive better value totex solutions."

## ENGINEERING AND CONSTRUCTION

Digital ways of working in engineering and construction are dramatically changing how the water industry designs and constructs new assets. Major UK water and wastewater companies are starting to specify information requirements on new assets, and driving the use of Building Information Modelling (BIM). BIM4Water is a UK hub of knowledge and expertise in this space and connects 20 of the UK's water and wastewater companies with experts from across the supply chain.

Digital delivery using BIM has many benefits in the implementation of capital projects, including reduced wastage and cost through efficient collaborative design and modelling intelligence, such as collision detection. BIM also facilitates improved delivery times by enabling off site construction, reduces time on site and improves health and safety outcomes, through the use of time scheduling and project planning, commonly known as 4D.

Significant benefits are also to be found during the operational phase. BIM in capital delivery sets out the foundation architecture for robust information models and enables the development of digital twins. These digital representations deliver further benefits by enabling interaction with real time process and asset data, informing improved decision making and operational responsiveness.

## ROBOTICS

Advances in robotics will facilitate robots being used to automate tasks or augment human activity. Whilst it is likely that they are currently used in the supply chain to manufacture and manage the logistics of products used by the sector, the use of robotics in construction and maintenance has enormous potential.

The robotics arena also includes nano-technology, where miniature robots could be deployed to make in-pipe repairs to live networks, for example.

## CYBER SECURITY

The water sector, along with other UK critical national infrastructure, faces credible cyber threats. Increased automation and connectivity reduce the scope for standalone or manual operation of the water supply system in the event of a targeted cyber-attack or a more general failure of the infrastructure and communication platforms that connectivity relies upon.

These could lead to serious consequences and resilience of critical operations should always be a major consideration in adoption of digital thinking.

## THE PACE OF CHANGE AND POTENTIAL DISRUPTION

Digitally-driven businesses implement change at a pace that will be uncomfortable for more traditional enterprises with fixed infrastructure. For example the High Street versus Amazon, traditional taxis versus Uber or video rentals versus Netflix. Failure is often the price of innovation. Digital thinkers act fast and iterate quickly to identify and build on ideas that gain traction and drop the ones that don't.

"Water asset owners can ill afford to fail with public and environmental health and safety at risk."

The burden of historic assets and employment models creates opportunity for new thinking or technologies to rapidly change the business landscape, allowing new norms for performance and customer expectations to be established. Digital thinking will not replicate the water infrastructure that exists today, but it may generate technologies or waste management approaches that render much of the infrastructure obsolete and tempt customers with local and more environmentally-sustainable water supply and management solutions.

## TAKING ADVANTAGE OF THE OPPORTUNITIES

Having a sustainable supply of water is a major competitive advantage. In countries with limited water resources, investment in technology has allowed scarce water resources to be better measured, managed and for the value of water to be recognised.

Taking advantage of the range of opportunities that digital thinking presents requires a change and a business transformation mindset, with ethical leadership.

Adoption of digital thinking to improve environmental stewardship and customer service is ultimately an organisational issue which is likely to have a significant impact on the affected workforces, almost certainly requiring organisational redesign and retraining to achieve the service improvements.

There is an opportunity for the water sector to make targeted investment to grow the digital-operating regime in a managed way. Whilst this is going to be a considerable challenge, there are substantial benefits to be realised in relation to environmental stewardship, operational activity and customer service.

## REGULATION OF NEW TECHNOLOGY AND DISRUPTIVE BUSINESS MODELS

Rapid traction and uptake of new technologies is often ahead of regulation. With environmental and public health and safety in mind, this makes the movement to more digitally-enabled living a challenge.

In developing digital thinking and applications it is therefore important that public safety is at the heart of everything we do, and strong ethical leadership will be required to avoid harm while regulation is developed. Standardisation and regulation of digital applications, technologies and systems in the water sector will reduce costs and encourage platform independent communication, data exchange and integration of new devices into established platforms.

## NEW BUSINESS MODELS

Digital thinking has the potential to disrupt traditional business models. Blockchain is an example of how digital thinking has evolved a new way of doing business in the case of Bitcoin, for secure financial transactions. Blockchain technology is bringing radical changes to all activities that rely on trusted third parties. It also has the potential to manage many other secure transactions leading to speculation about what other assets could be held and transacted through blockchain, with some major potential consequences for accounting and auditing practices. It could be argued that Bitcoin is a proof of concept for blockchain technology and serious global attention and investment is driving the development of new, real-world solutions that may challenge the existence of trusted institutions.

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# COMMERCIAL OPPORTUNITIES FOR THE UK

Britain has not been one of the leading players in the evolving global water market in recent years, in part due to the conservative nature of its home market. Exports of goods and professional services account for 1.5% of the global municipal and industrial market, excluding operating expenditure. The introduction of digital technologies and techniques into water and wastewater management is creating opportunities for UK companies to significantly increase their global reach, especially through collaborating with areas of the digital economy where UK companies have a global leadership.

## KEY THEMES

Smart water technologies and techniques are being developed to meet the challenges of climate and demographic change. The combination of smart data acquisition and management through to site and remote sensing can cut operating and energy costs by 25-35%, while lowering capital spending by 15-30% through the more efficient deployment of extant and planned assets.


There are notable UK companies providing innovative digital products and services and ongoing support is essential to help these companies flourish. However, UK companies are to some extent late entrants to areas traditionally associated with smart water, especially household water meters.

Nonetheless, particular opportunities lie in the integration of smart approaches, creating customer-centred approaches, commercialising niche applications and developing hitherto unappreciated applications. Eleven exemplar ‘smart water’ themes are considered here, both for their growth potential and for UK companies to benefit from.

Refer to case study > 7 on page 19

## VIRTUAL AND AUGMENTED REALITY

Virtual reality (VR) and augmented reality (AR) allow the viewing of extant or planned assets. Maintenance teams can obtain a detailed picture of pipes and how they relate to other underground assets, minimising the disruption caused when these need to be inspected, replaced or maintained. New or upgraded treatment works may be comprehensively trialled and examined without the need to develop prototypes. The UK is one of the world leaders in developing VR and AR gaming systems and software.

## IRRIGATION MANAGEMENT

This involves monitoring of soil moisture in real-time and linking this with weather data, including sap monitoring for high value applications such as vineyards. There is a particular need to develop low cost applications for developing economies. The UK has a particular strength in satellite and meteorology.

## UTILITY TARIFFS AND BENEFITS

When utilities can access benefits data, they are able to offer customers social tariffs, in order to pre-empt or minimise late or non-payment due to affordability concerns. Smart data management links each customer’s circumstances to each utility’s social tariffs. The UK is potentially well placed here as this service is currently being considered for electricity customers.

## MINIMISING MAINTENANCE AND OPTIMISING NETWORK PERFORMANCE

83% of England and Wales’ water and sewerage assets in replacement value terms are located underground in the form of 349,000 km of water distribution mains and 624,000 km of foul, storm and highways drainage systems. Instead of assuming what condition these assets are in, smart systems, linked with remote monitoring approaches, inform utilities about what actually needs to be done and in order of priority, the most cost-effective approach.

Smart pipeline monitoring approaches have reduced mains leakage, while driving down mains burst rates along with reducing pumping costs and optimising asset lives.

Digital techniques are evolving which combine smart approaches with nanotechnology and the Industrial Internet Of Things to create new decision-making insight on asset condition and remaining asset life.

Refer to case studies > 1 2 3 on page 18

## MONITORING AND OPTIMISING WASTEWATER TREATMENT

Wastewater treatment can be optimised by the near real-time monitoring of the volume and loading of the effluent inflow. This avoids over-treating for nitrification during off-peak periods and under-treatment during storms. The Bactest monitoring system has seen a halving of ammonia in discharge at peak times and a 10-20% reduction in aeration energy needs.

## FLOOD RISK MANAGEMENT

Smart flood management involves developing a real-time and localised appreciation of current and future flood vulnerabilities and the most effective ways of reducing vulnerability at the household, local and regional level. This will maximise flood warning periods and allows for unlimited scenario development and analysis. Through the digital simulation of storm events, resilience planning can evolve to deal with a myriad of eventualities.

Refer to case study > 4 on page 18

## HEAT MAPPING OF LEAKAGE

Remote imaging of pipes can be used to identify heat anomalies in the ground, showing where water (a cool patch) and sewer (a warm patch) leaks are occurring, which cannot be seen from above ground. This data can be integrated with other network condition monitoring systems for a better understanding of how these hidden assets are performing. This is particularly effective where there are large differences between the heat of the fluid and the surrounding soil.

## WATER RISK MONITORING AND MANAGEMENT

Water scarcity risk management is an emerging need for utilities and industrial and agricultural customers. Planet (USA) is currently generating 7 TB of earth images each day, allowing a global picture of risk to be updated daily. The data is available to other companies and the water applications have yet to be considered. The resolution is limited by country standards (e.g. 1 pixel per 25 cm for the USA), which is suitable for river, lake and reservoir monitoring.

## SEWER AND SEWERAGE MONITORING

As legislation raises the standard of wastewater treatment (most notably in Europe) other sources of water pollution need to be addressed before complying with legislation such as the EU's water framework directive.

A sewer meter allows the utility to compare the daily volume of water supply, wastewater discharge and rainfall for its property, identifying internal leaks and finding where rain and foul water connections are interconnected. By linking this data to the wastewater network and wastewater treatment plants, exceptional effluent flows can be effectively predicted.

Refer to case studies > 5 6 on page 19

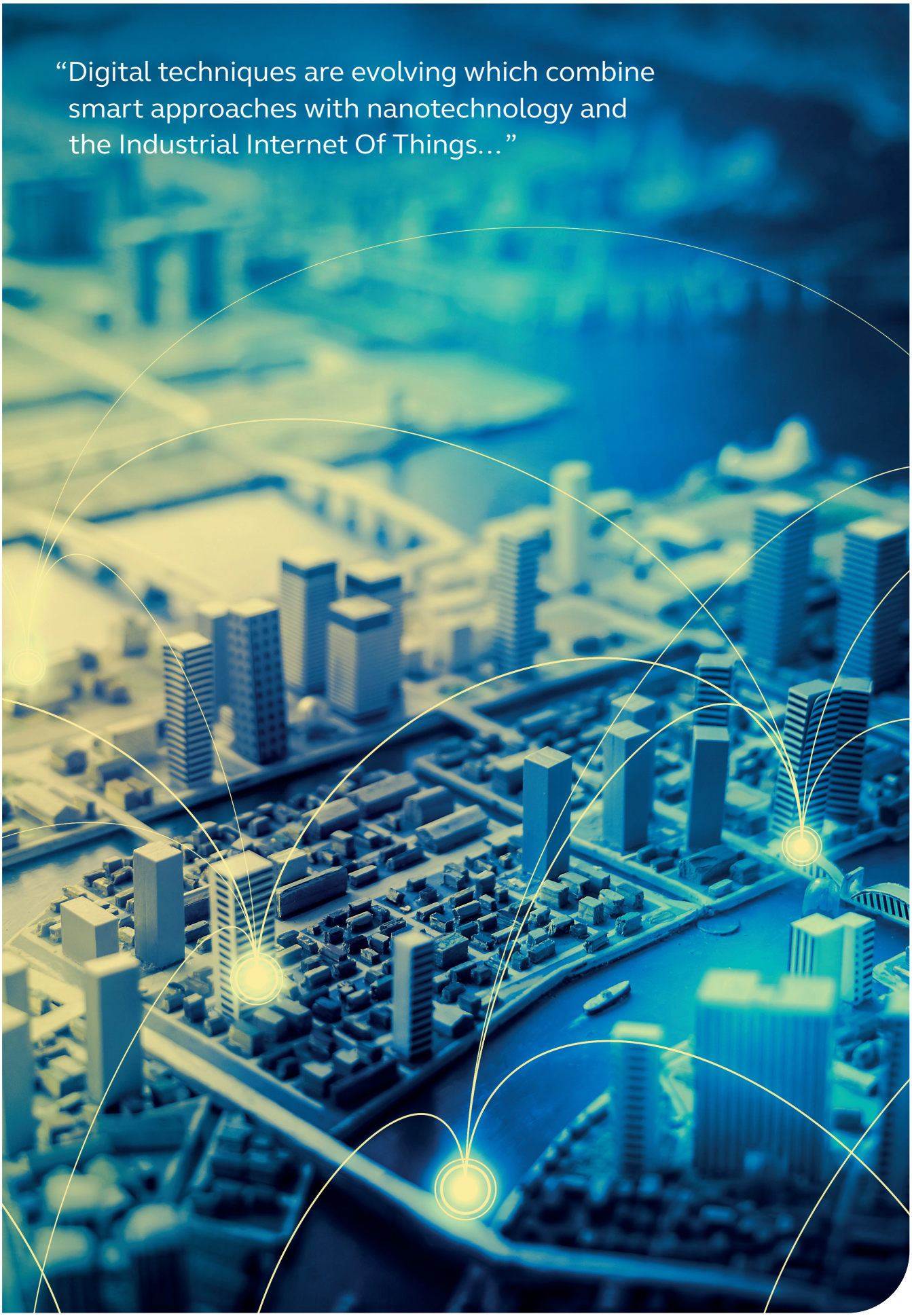
## SELF-DIAGNOSTIC WATER PUMPS FOR DEVELOPING ECONOMIES

The greatest challenge for hand pumps in rural areas is monitoring their performance and condition. The Waterpoint monitor developed at Oxford University has a small, low-cost accelerometer which tracks the arching movement of the pump's handle to estimate water usage, sending the data via SMS to a web-based dashboard to identify how and why pumps fail and how to address this. The average repair time has fallen from a month to two days, with the time that pumps were functioning rising from 67% to 98%.

The accelerometer data has also been used to assess groundwater levels so that users can have advance warning of potential resource depletion. Improved service has meant that the willingness to pay for maintenance has risen from 20% to 80%.

## SMART SERVICES FOR DEVELOPING ECONOMIES

Vodafone is pioneering ways that mobile telephony can benefit utility customers in Africa. In Tanzania, the Dar es Salaam Water and Sewerage Corporation (DAWASCO) started accepting mobile payments for utility bills in 2009, via Vodacom Tanzania. By 2013, DAWASCO's revenues had increased by $0.54 million through improved revenue collection. The service allows customers to pay their bills at the time of their choosing.


“Digital techniques are evolving which combine
smart approaches with nanotechnology and
the Industrial Internet Of Things…”

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## CASE STUDY

### COST EFFECTIVE ASSET CONDITION ASSESSMENT – PODDS

Pipe maintenance and replacement is expensive, so pipe conditioning offers a viable low-cost alternative. The PODDS (The University of Sheffield, Prediction of Discolouration in Distribution Systems, podds.co.uk) predictive modelling system simulates long term biofilm regrowth onto a pipe surface. In a smart network, the utility can also manage flows in relation to current and predicted pipe condition. Trials with Wessex and Northumbrian Water identified cases where conditioning could be used instead of replacement, swabbing, flushing or jetting, reducing assumed costs by 28-98%.

SMART PIPELINE MONITORING APPROACHES

2

## CASE STUDY

### WATER PRESSURE MANAGEMENT AND LEAKAGE DETECTION – I2O

The greater the pressure within a water network, the more water will be forced out of the pipes through any leaks in the system and pipe life lowered due to the stress induced upon them. Pressure management can reduce leakage by ensuring that pressure within a distribution system does not exceed its optimal level in real time. i2O's (i2owater.com) oNet in the UK and Malaysia has achieved 26-36% reductions in leakage and a 40-48% lower mains burst rate. Optimising water pressure also reduces pumping costs.

OPTIMISING WATER PRESSURE REDUCES PUMPING COSTS

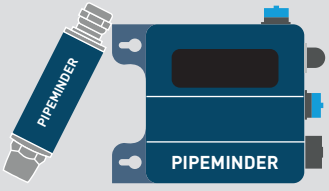
3

## CASE STUDY

### REDUCING LEAKS AND BURSTS – SYRINIX

Working across North America, the UK and Europe, Syrinix's PipeMinder-S and C solutions are helping utilities to reduce leaks and bursts on their supply networks and to respond more quickly to failures on their wastewater networks.

Monitoring pipelines continuously at more than 100 samples per second, Syrinix's solutions are helping utilities identify the sources of pressure surges caused by pumps, valves and major users. In providing utilities with a data-led insight into their activities, working with organisations including Anglian Water, Thames Water and East Bay Municipal Utility District in the San Francisco area, Syrinix is enabling a rapid shift from reacting to leaks and bursts to actively reducing their causes and extending pipeline lifetimes.




MONITORING PIPELINES AT MORE THAN 100 SAMPLES PER SECOND

4

## CASE STUDY

### PYTERRA AND IMGEOSPATIAL

PyTerra (pyterra.co.uk, Concepture Limited) is developing smart-enabled risk water management systems by integrating water risk data onto a common platform based on GIS, satellite imagery, Big Data and hydrological modelling through its in-house optimisation system. The output is updated when new data becomes available.

PyTerra presents a single, unified view of events through a base layer of open data. Premium data tools are then available for commercial users, who can choose their specific data outputs.

IMGeospatial (imgeospatial.com) has developed a self-updating digital terrain model (data map) using data from satellites, maps and planning applications to create Flood Hazard Maps, Optimization, Leakage and other alerts for the water sector. IMGeospatial is working with the European Space Agency, the World Bank, Anglian Water and Affinity Water to show how this fully automated system can improve the experience of the water sector's customers.

## 5 CASE STUDY

### MONITORING FOR SEWER OVERFLOWS – DETECTRONIC

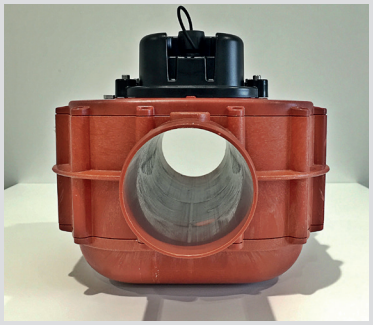
Detectronic's (detectronic.org) ultrasonic flow sewer meter system integrates rainfall and sewer level data and is blended with external weather, sewer asset and historic data and analysed via DetecData Plus. It is designed to accept old data from other monitors to provide historic benchmarking data. Trials with the system found 31 confirmed predictions per 100 monitors against 4-11 pollution incidents detected per 100 monitors. The 160 pollution or flood preventing interventions saved their clients £5 million in potential fines, along with reputational damage and post-event remedial works, against an £225,000 investment.

THE POLLUTION OR FLOOD PREVENTING INTERVENTIONS SAVED CLIENTS FROM BEING FINED AND REPUTATIONAL DAMAGE

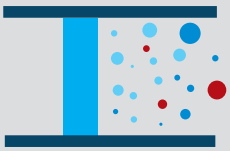
## 6 CASE STUDY

### SMART WASTEWATER METERING – DYNAMIC FLOW TECHNOLOGIES

A microwave domestic wastewater flow monitor developed by Dynamic Flow Technologies Limited (dynamicflowtech.com) is being trialled by Wessex Water, removing the blockages associated with physical wastewater metering techniques.



*A Dynamic Flow Technologies Limited wastewater meter.*



REMOVING BLOCKAGES ASSOCIATED WITH PHYSICAL WASTEWATER METERING

## 7 CASE STUDY

### DRIVING THE ADOPTION OF DIGITAL TWINS – AIIMI

Digital Twins provide the capability to replicate physical systems and processes through data. The opportunity for the water industry to manage the water network through a more accurate understanding of how it works in real time will improve energy efficiency, leakage management, the environment and the service it delivers to customers.

Aiimi (aiimi.com) believes the adoption of Digital Twins is about more than understanding the relationship between the virtual and the physical through data, but also about the people and processes in place to use a Digital Twin in the effective management of the water network.

Working with Anglian Water, Essex and Suffolk and Northumbrian Water, Aiimi has begun developing a roadmap for the adoption of Digital Twins. This defines the steps needed to drive transformation and provide the capabilities for successfully adopting Digital Twins to deliver the right outcomes for customers.

"As utilities strive to reduce leakage, a key difficulty is an inability to accurately monitor pipe deterioration over time."

# 08 WHO CAN BENEFIT?


However, these players may not be so well placed that they wouldn't consider the unconsidered, for, as the iPhone demonstrates, what was unknown one day can be an essential the next.

The case studies on pages 18 and 19 highlight individual areas where potentially global niche players are emerging. It is also evident that UK-based expertise in mobile communications, meteorology, computer graphics and gaming, when integrated with water technologies, offer expanded opportunity. Gaming in particular allows utilities, planners and policy makers to develop almost unlimited scenario analysis over the medium and longer term.

Attractive opportunities are likely to be found in these emerging and niche areas, which in time could be substantial. Building on these current areas of excellence in the UK, goods and services can be developed which reflect what customers want, rather than what innovators feel they need. This will involve integrating smart approaches into client-focused goods and services, that are intuitive and client customisable.

For example, the NERC funded Hydro-JULES is a collaborative platform for 3D modelling of the water cycle for UK academics and researchers. It seeks to advance forecasting and modelling capabilities for long-term resilience and for developing new sensors. It has the potential to make UK-based data management and sensing companies globally competitive.

Regulators and industry bodies could help by establishing common standards which enable interoperability of a diverse range of data inputs and sensors, including how data is transmitted and securely managed. Smart City, ISO and BSI standards offer a potential way forward.

To date, the emphasis has been on specific applications. The next step could be services that integrate data both for utilities, regulators and customers and allow users to customise the data and its interpretation and display it as they wish. Systematic real-time data integration across the water cycle may provide unforeseen insights and enable new approaches that optimise service delivery to customers, operating efficiency, affordability, environmental information and sustainable resource management.

## WHAT IS THE SIZE OF THE MARKET?

In England and Wales, water and wastewater network rehabilitation costs in 2016-17 were £3.7 billion, £2 billion on capital spending and £1.7 billion on operating services. Water accounted for 60% of this (Company Annual Performance Reviews for 2016-17). Frost & Sullivan estimates the European wastewater network rehabilitation market to be worth €11.5 billion in 2016, growing at 5.2% each year to €14.9 billion by 2021.

According to Global Water Intelligence (GWI), capital spending on municipal water and sewage infrastructure is set to rise from $226 billion in 2016 to $311 billion in 2023, a compound annual growth rate (CAGR) of 4.7%. GWI estimates that meeting the sustainable development goals for water and sanitation utilities between 2018 and 2030 will cost $1,785 billion for rehabilitation and $4,056 billion for new infrastructure.

THE SUSTAINABLE DEVELOPMENT GOALS FOR WATER AND SANITATION UTILITIES BETWEEN 2018 AND 2030 WILL COST

**$1,785 bn**

FOR REHABILITATION

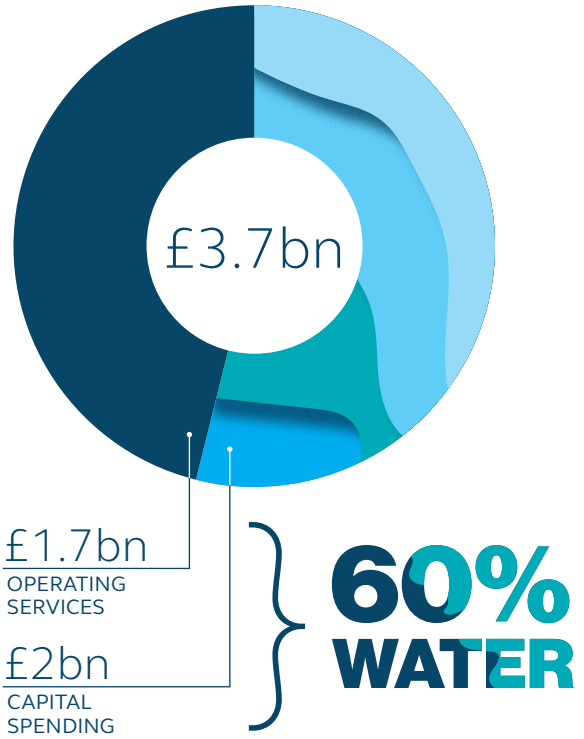
**$4,056 bn**

FOR NEW INFRASTRUCTURE

Definitions about what is covered by 'smart' or 'digital' water can be quite elastic, but with 37 market surveys identified, a realistic picture can be drawn. Only surveys published since 2014 (30) have been analysed as this is a swiftly-evolving market.

*Figure1*

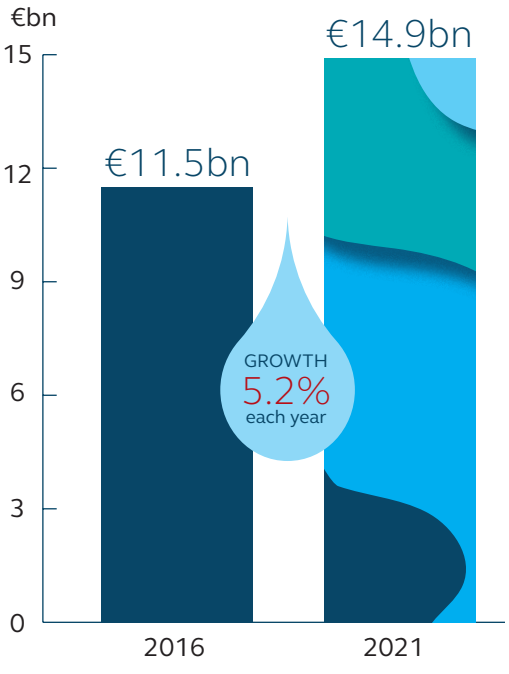
WATER AND WASTEWATER NETWORK REHABILITATION COSTS 2016-17




*Data source: Company Annual Peformance Reviews for 2016-17*

*Figure 2*

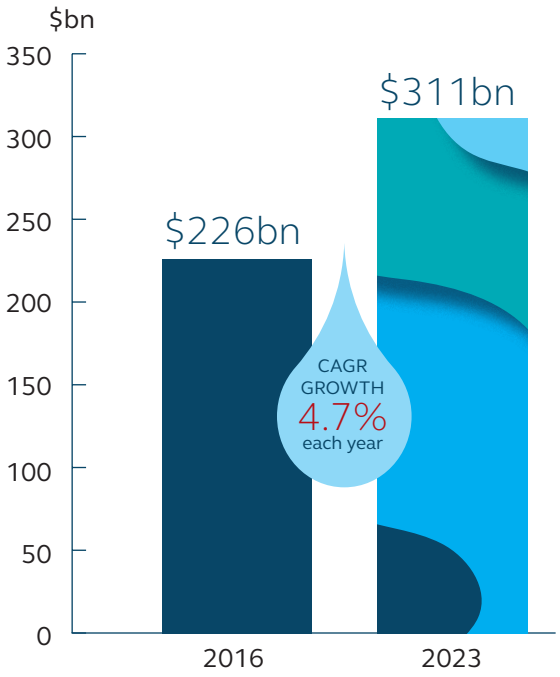
VALUE OF EUROPEAN WASTEWATER REHABILITATION MARKET




*Data source: Frost & Sullivan*

*Figure 3*

CAPITAL SPENDING ON MUNICIPAL WATER AND WASTEWATER INFRASTRUCTURE




*Data source: Global Water Intelligence*

The digital water CAGR is well above GWI's 2018 estimate of global municipal water and wastewater market spending growth in 2016-23 of 4.7% per annum. Reviewing the individual surveys, there has been a consistent increase in the market size estimates over time, while forecast growth rates have at least been maintained. This points to real rather than hoped-for progress. The best analogy is the development of mobile telecoms from the late 1980s from a niche to a norm.

"There has been a consistent increase in the market size estimates over time, while forecast growth rates have at least been maintained."

*Table 1*

SMART WATER MARKET SEGMENTATION AND PROSPECTS (BASED ON ANALYSIS OF THIRD-PARTY DATA)

| | Market size | | CAGR |
|---|---|---|---|
| $ billion pa | 2016 | 2020 | % |
| Flood management | 0.07 | 0.15 | 21.0% |
| Water quality monitoring | 0.10 | 0.15 | 10.7% |
| Irrigation | 0.55 | 1.00 | 16.1% |
| Customer services | 0.23 | 0.50 | 21.4% |
| Smart networks | 3.35 | 6.20 | 16.6% |
| Smart meters | 1.80 | 3.50 | 18.1% |
| VR & AR | 0.10 | 3.25 | 138.8% |
| Overall | 6.20 | 14.75 | 24.2% |

Smart water is also a sub-set of 'digital water' (GWI) with a market worth $20 billion in 2014 and projected to grow to $30 billion pa by 2020 (7.0% pa).

Putting the smart water figures into context, surveys in 2017 and 2018 forecast the Smart City's market (covering all urban services) will be worth $2.0-3.5 trillion by 2025-26.

THE SMART CITY MARKET (COVERING ALL URBAN SERVICES) WILL BE WORTH

$2.0-3.5 tn

BY 2025-26

09

# HOW TO CAPITALISE ON OPPORTUNITIES PRESENTED BY DIGITAL WATER

## OUR RECOMMENDATIONS

Addressing the challenges ahead and enabling UK plc to capitalise on the commercial opportunities presented by the global digital water economy, requires a mix of activities to define and showcase the nation's digital water expertise – and the promotion of that expertise in receptive markets.

We make the following recommendations as key components in the delivery of this programme:

1. **Focusing Digital Water research funding on the primary areas of commercial opportunity for the UK –** essentially linking national funding to drive national economic outcomes
2. **Establishing mechanisms to facilitate collaboration across the digital water economy, aligned with national ambitions –** involving a concerted effort across the water sector including research bodies, innovation agencies, supply chain organisations and customer end users
3. **Promoting the adoption of the National Infrastructure Commission's report 'Data for the Public Good' and 'The Gemini Principles' from the Centre for Digital Built Britain –** enabling the water sector to take full advantage of digital innovation
4. **Promoting a new water sector Data Information Task Force –** to enable water sector organisations to adopt a common national approach to data capture and management
5. **Building a web-based user-friendly register of UK Digital Water supply chain companies, enabling potential customers to readily understand what the UK has to offer –** this could be accomplished utilising the wider supply chain database that UKWP is enabling
6. **Producing a compelling briefing pack on UK Digital Water capability, available for DIT staff and others to showcase overseas –** if we don't inform UK representatives and others overseas how can they help us?
7. **Ensuring the UK's voice is heard in a global market –** a proactive Digital Water customer engagement campaign devised and driven by UK water economy stakeholders
8. **Promoting collaboration between organisations in the UK and overseas, who have procured UK Digital Water products and services, to showcase the UK's capability. Pre-packaged visit plans to be available off-the-shelf –** joined up activity to promote UK interests
9. **Adopting a strategic approach to exploiting UK Digital Water capability, delivered as a coherent, integrated and long-term programme of activities –** rather than as a one-off exercise
10. **Establishing a mechanism to track sales of UK digital products and services at both domestic and international level –** generating insight to enable performance.

## WHAT HAPPENS NEXT

Following the consultation and feedback period (see pages 26 and 27), UKWP will convene a series of stakeholder workshops to devise tailored action plans to deliver each of the recommendations. It is envisaged that important early steps in these action plans will include:

**Building a broad coalition of stakeholder support**

**Formulating a Digital Water stakeholder map, identifying key influencers and organisations**

**Establishing a database of UK Digital Water supply chain companies**

**Devising a customer engagement campaign, with objectives, activities and timetable**

**Creating marketing communications assets showcasing UK Digital Water expertise.**

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# CONSULTATION AND FEEDBACK

The UK Water Partnership has issued this draft Digital Water White Paper and Call to Action for consultation, with the aim of galvanising UK stakeholders to come together in a focused, national effort to embrace the digital revolution in water and to capitalise on the many commercial opportunities it presents.

Through consultation and collaboration with stakeholders, we would like to:

- achieve a consensus that a focus on digital water has value for the industry, and represents a major opportunity for the UK to capitalise on the many commercial opportunities it presents
- gain endorsement for our recommendations and next steps and/or identify further actions
- secure stakeholders' commitment and tangible support to deliver the recommendations.

We welcome your response to the questions set out below **by close of business on 28 February 2020**. Respondents are encouraged to provide evidence or data which supports their response. Please tell us if you are responding as an individual or on behalf of an organisation or group. There is no obligation to respond to all of the questions, but we would appreciate it if respondents could use the appropriate question numbers in submissions to enable analysis.

QUESTION 1

Do you agree that fully embracing digital capability has the potential to reshape the water sector? If so, how advanced do you think the UK water sector is in embracing digital thinking, and what do you think are the biggest areas of opportunity?

QUESTION 2

Do you agree that the introduction of digital technologies and techniques into water and wastewater management creates substantial opportunities for UK companies to grow and significantly increase their global reach? What are the biggest areas of opportunity?

QUESTION 3

What are your views on the commercial opportunities which could arise through closer collaboration between areas of the UK digital economy, in which the UK has global leadership, and the water sector?

QUESTION 4

Do you agree that the recommendations described in Section 9 are the correct activities to pursue, in order for the UK to capitalise on the global digital water opportunities? Are there other activities not identified which you think should be considered?

QUESTION 5

Do you agree that the immediate next steps (What happens next) described in Section 9 are the high priorities to pursue in order for the UK to capitalise on the global digital water opportunities? Are there other high priority activities not identified which you think should be considered?

QUESTION 6

Would you and/or your organisation be willing to play a part in delivering the activities described in Section 9?

## RESPONSES

Please email your response to:

tom.doyle@theukwaterpartnership.org

or submit them online at:

www.theukwaterpartnership.org/initiatives/digital-water

The UK Water Partnership will make all responses publicly available after the consultation, unless you have specifically requested that we keep your response confidential. We will not publish names of individuals who respond.

In accordance with the Freedom of Information Act 2000, we may be required to publish your response to this consultation but will not include any personal information. If you have requested your response to be kept confidential, we may still be required to provide a summary of it.

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# THE BENEFITS OF BEING A MEMBER OF THE UK WATER PARTNERSHIP

The UK Water Partnership was established in 2015 to provide a strategic vision for the development and growth of the UK water industry. It brings together a wide cross section of UK water sector stakeholders in a single coherent alliance to support research excellence, promote collaborative innovation and secure the UK a greater share of the $500 billion global water market.

Joining the UK Water Partnership gives you the opportunity to increase your influence, visibility and access to cutting edge research and innovation in the UK water sector, which will help you to grow your organisation and reduce business risk.

## OUR MEMBERS:

- work directly with government departments, engaging with officials and Ministers, to shape the government's priorities for research, innovation and capability in the water economy and to promote increased commercialisation both here and overseas
- access new insights and strategic networks – for businesses this means scientific and technical information and capability, while for the academic community, connections to a wide end-user community which will help accelerate the uptake and impact of research
- help to shape the debate and the way forward, in partnership with other stakeholders, through involvement in activities and events, and collaborations with fellow members
- raise their profile through participation on our website, facilities register, newsletter features, logo placement in UK Water Partnership literature, and invitations to events.
  **www.theukwaterpartnership.org/member-login**

Members of the UK Water Partnership have the opportunity to participate in one or more of our strategic Delivery Groups, which are driving transformative change in the UK water industry. In addition to Digital Water, the partnership is currently focused on:

- **LITSoN (Linking innovation to societal needs)** – creating a single source of data on innovation activity in the UK and using this to create solutions for societal needs
- **Water Accelerator** – connecting innovation activity in the UK to accelerate the development and implementation of new technology in the water sector
- **Supply Chain Database** – working in partnership with British Water, the Future Water Association and the Department for International Trade to develop a comprehensive supply chain service for the UK water sector
- **Test Facilities Register** – improving access to testing and research facilities in the UK
- **Flood Resilience** – promoting a high quality, UK-wide flood resilience industry and providing a unique forum to help tackle one of today's biggest natural threats.

## OUR FOCUS:

Our Delivery Groups strive to:

- promote applied research excellence
- improve the ability to model and simulate urban water systems
- facilitate and accelerate the route to market for innovations in the water sector
- encourage research and testing capability in the UK
- drive engagement with Government, BEIS and the Industrial Strategy Challenge Fund
- improve the alignment of UK innovation with the UK water industry
- identify how global needs link to UK expertise
- develop the UK offer on flood resilience.

## HOW WE ARE FINANCED

The UK Water Partnership is a public-private not-for-profit company limited by guarantee with its operations funded by financial contributions from its members.

Private sector contributions are used to carry out core operational activities such as administration, marketing and promotion, as well as planning and hosting events that help promote the UK water economy both at home and overseas.

The Partnership is indebted to its members, not just for their continued financial support, but also for their substantial gifts of time and for their willingness to co-design our emerging products and services.

## CONTACT

For more details go to
**www.theukwaterpartnership.org/join-us**

Or email
**info@theukwaterpartnership.org**

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