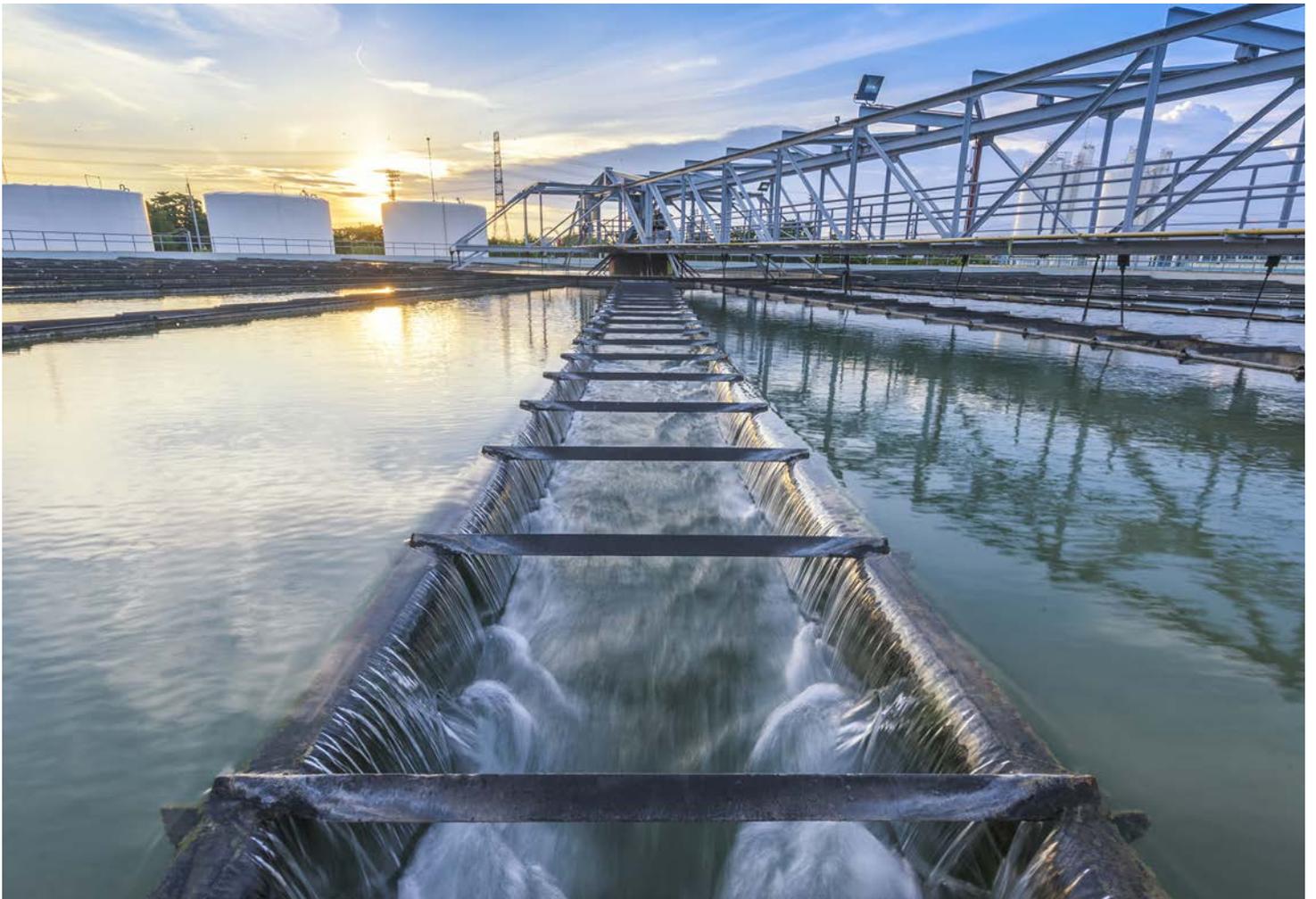


Anglian Water @one Alliance

Improving the construction and performance of infrastructure assets by forming an alliance of contractors and suppliers, and by taking a broad programme approach that enables standardized products



The challenge

Infrastructure for water and wastewater services has room for improvement and has to respond to the sector's key challenges – reliability, sustainability, affordability, and workforce health and safety.

In developed and developing countries, the water sector has to deal perpetually with a set of broad challenges: enhancing the infrastructure assets, while keeping their construction costs and lifecycle costs to a minimum; ensuring health and safety at sites; and minimizing any harmful environmental impact. At the same time, the water sector – in common with other grid-based, monopolistic infrastructure services – is tightly regulated in regard to both pricing and service levels. Against this background, companies have to make considerable efficiency improvements if they are to generate sustainable returns.

Anglian Water is the largest water and wastewater company in England and Wales (by geographic area). It serves about six million customers in the East of England, and has about 4,200 employees. In striving for ever greater reliability, affordability and sustainability, the company responds to customer requirements and to regulatory Outcome Delivery Incentives (ODIs), including its performance on service and pollution. For the current regulatory period of 2015-2020, the company aims to increase efficiency in infrastructure delivery (i.e. reduce capital costs) by over 15% relative to the 2015 baseline, to halve the time spent on-site relative to the 2009 baseline, and to lower embodied carbon (CO₂ emissions related to the construction phase, including the transport and installation of materials) by 60% and operational carbon (CO₂ emissions generated by the assets during the operations phase) by 27% relative to the 2009 baseline.

Viewed at the global level, the water challenge is obviously of a different order. Society is heavily dependent on the water sector for providing drinking water and irrigation in agriculture, and for enabling many industrial processes. In developed countries, the existing infrastructure often dates back to the early 20th century – the average age of water infrastructure assets in the UK is estimated at 70 years – necessitating ongoing investment in repair and upgrading. In developing countries, basic infrastructure is still missing in many regions: worldwide, over 660 million people lack ready access to drinking water, 2.4 billion people lack access to basic sanitation services, and more than 80% of wastewater resulting from human activities is discharged into rivers or the sea without any prior treatment.



The idea

Adopt an Alliance model based on effective collaboration in integrated teams, and take a broad programme approach that encourages product standardization and digitally enabled product lifecycle management.

To improve the quality, efficiency and sustainability of its infrastructure assets, Anglian Water realized that it could benefit by more effectively drawing on a great deal of supply chain expertise. To that end, it adopted an innovative collaboration model. Launched in 2005, the @one Alliance formally links Anglian Water Asset Delivery (Anglian Water's team responsible for the capital delivery process) with six key contractors – Balfour Beatty, Barhale, MMB (Mott MacDonald Bentley), Grontmij (Sweco), MWH and Skanska – and the wider supply chain through framework agreements. During each five-year regulatory period, the Alliance designs and builds the majority of Anglian Water's projects, numbering about 800 and costing about £1.2 billion (\$1.5 billion) in total.

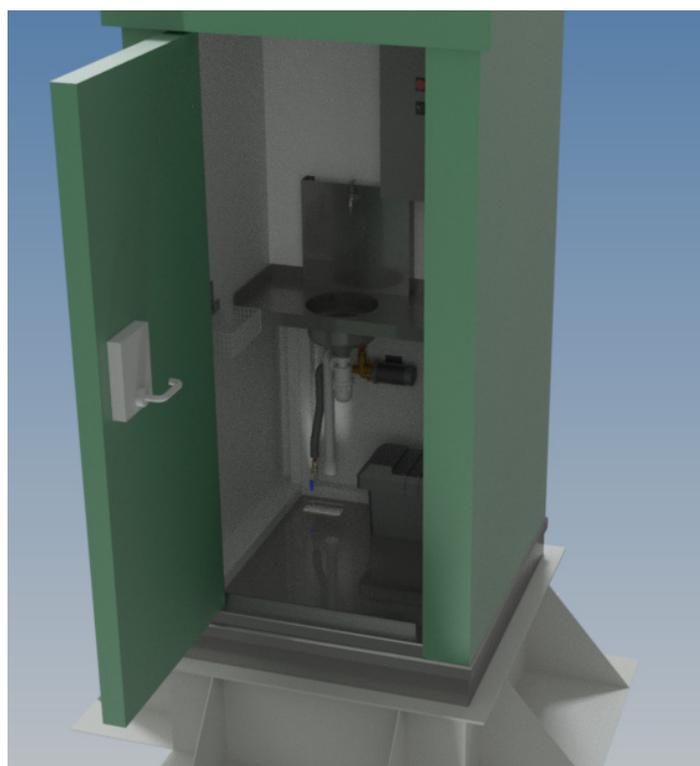
The @one Alliance was developed by analysing and benchmarking supply-chain models from different sectors (retail, manufacturing, etc.), and six key elements were identified as characterizing these models: alignment, incentives, collaboration, integrated teams, visible programmes and minimizing of waste. Anglian Water then conducted a selection process among relevant contractors (with preferred bidder status), assigning much weight to their collaborative ethos, and the Alliance was duly formed as a virtual joint venture. Each partner sends secondees to the integrated Alliance, contributes to the overall organization in proportion to its individual share and receives a proportional share of the joint profits. Every five years, Anglian Water and the Alliance Leadership team evaluate each partner's contribution. Based on this assessment, partners are renewed, replaced or supplemented.

One defining element of the @one Alliance is the emphasis on collaboration in pursuit of a common goal. The six partners are aligned with Anglian Water through a set of common objectives linked directly to customer outcomes. These are cascaded through the Alliance and the supply chain with an emphasis on improving performance and generating value. The Alliance is able to take a holistic and longer-term view, rather than just focusing on individual projects. This broader outlook is in keeping with Anglian Water's five-year investment programme – which is shared with the Alliance as a prioritized list of both maintenance works and quality improvements. The work within the programme is allocated to the various partners on a "best for task" basis. Performance of the Alliance is measured against a defined cost base, with each alliance partner receiving a share of the combined efficiency based on their respective shares in the alliance. The alliance model is contrary to the industry's usual approach – the classic bidding process, which is based on the belief that only competition can ensure cost-efficient solutions.

The collaborative model extends to suppliers. For the wider supply chain, the alliance sets up long-term framework agreements. These agreements mean that 80% of the Alliance is now covered by framework contracts or partnerships.

The culture of open collaboration contributes significantly to the Alliance’s success. All partners assign staff to the alliance, who then form integrated teams. Through this integration and constructive relationships, a highly productive exchange of information and experience takes place – often more effectively than happens within each individual company. Each project begins by creating a high-performance integrated team with inputs drawn from all partners based on this best for task approach. This approach frequently leads to valuable new ideas and innovations. While every partner in the project will benefit in various ways, any intellectual property emerging from it is retained by Anglian Water.

Another key enabler of the @one Alliance’s innovations and success is the longer-term perspective implicit in its programme of projects. Instead of tackling each project individually, the partners are able to identify repeatable tasks and standard products, and apply them inexpensively on a wide array of projects – taking advantage of off-site prefabrication for production. Following a comprehensive analysis, almost 200 standard products have subsequently been identified and developed in partnership with suppliers. Product-based delivery is now a cornerstone of the Alliance’s work. Based on the Alliance programme, workflows are revisited and value engineering is applied to develop new products before the demand from specific projects arises. All products are integrated into 3D product libraries for design, process calculations, and piping and instrumentation drawings (P&IDs), greatly facilitating the work of designers, project managers and process engineers.



This approach to product-based delivery can be illustrated by looking at a number of simple examples. First, there are the “sampling kiosks” used for checking the water quality at reservoirs. Traditionally, each kiosk was individually built on site on a large concrete base, and required a large lead time. Faced with the challenge of refurbishing or replacing about 50 kiosks in a short timeframe, the Alliance developed a new standard product – a space-optimized solar-powered booth manufactured off-site, which can be stored at Anglian Water’s sites and installed at short notice – and on a quickly-constructed metal base rather than on a concrete foundation.

The second example is that of “trickling filters” – biological wastewater treatment systems that use a biofilm to remove impurities from the water trickling through a bed of media. The new standard product is far quicker and cheaper to construct; it also dispenses with the traditional concrete base, with the side walls using low-carbon recycled plastic sheets, which are pre-fabricated and assembled on site into rectangular or hexagonal tanks.

Another great example is the Air Valve (AV) Standard Product (for clean water). Traditionally, Anglian Water used large ductile iron AVs that were difficult to maintain and often inefficient. Challenging its suppliers to reduce embodied carbon, a new reinforced nylon product was developed.

Finally, the product team is currently working with suppliers of kiosks and motor control centres for a Motor Control Centre (MCC) Kiosk & Trench standard product to harmonize sizing and avoid extensive civil works for concrete structures. To this end, the team visited the factories of its suppliers to better understand the manufacturing process and identify optimization potential.



The Alliance intends to enhance its standard-products strategy in the future by means of product optioneering (i.e., assessing different options) and by improving plug-and-play assembly. It will also simplify procurement by linking its product catalogue directly to suppliers – just like in online shopping. All that the project team then has to do is “add products to a basket and check out” – greatly facilitating budget calculation and automating procurement schedules. The outlook is that by 2020, 67% of capital spending will be on standard products, and 90% of projects will include at least one standard product. The Alliance is also working with other water companies to develop joint standard products, exchange best practices and work towards an industry-wide product catalogue that would enable further cost savings.

One final distinctive feature of the Alliance is its adoption of product lifecycle management (PLM). Used mainly in complex manufacturing industries, such as aerospace design, PLM leverages digital technologies to enable digital development and operations of assets and thereby reduce costs. Digital data are collected and integrated throughout a product’s lifecycle – from the design phase to operation and maintenance (O&M) and eventually to the dismantling stage – so it is now possible, for instance, to automatically



create a maintenance manual before the asset is actually constructed. The PLM process outdoes even building information modelling (BIM) in its emphasis on the customer and the operating environment. It starts by modelling customer or operator requirements, and then creates appropriate instrumentation diagram/drawing (P&IDs), integrates them into BIM 3D models and enables early collaboration across all teams, establishing integrated plans for Alliance partners and suppliers.

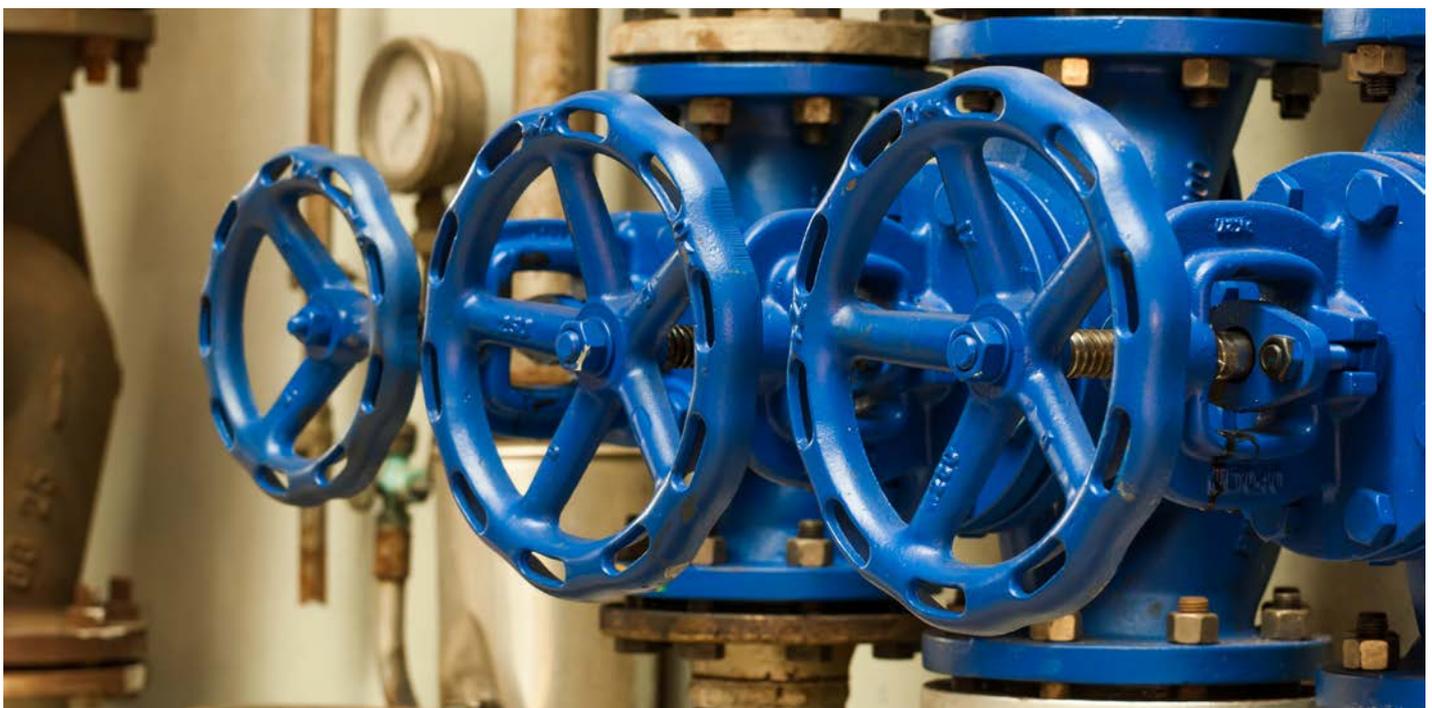
The BIM model can be reviewed virtually by the delivery team – including sub-contractors, suppliers, and health and safety specialists – and by the operating team in a digital rehearsal room using immersive technology (augmented reality) before construction even begins. (The safe-to-operate and safe-to-maintain reviews are likewise conducted virtually.) The design is then optimized virtually. Modular and off-site construction can then progress, with the help of integrated module-based procurement and pre-planned logistics. During the O&M phase, maintenance and service teams can access information remotely. This digital process has been successfully piloted on several projects now, and full roll-out across the programme is underway: the digital rehearsal room now serves as a gatekeeper for every new project.

The impact

The Alliance’s approach has reduced costs, carbon emissions and accidents substantially, and continues to boost customer value.

Ultimately, the Alliance’s performance is measured by Anglian Water’s success, in respect of customer outcomes and generally increasing value for clients. However, the Alliance has also set its own targets relating to project delivery, including workers’ welfare. Broadly, the organization has three key objectives: efficiency, sustainability, and health and safety.

Efficiency has increased impressively. Thanks to effective collaboration of partners and suppliers, the conscientious use of standard products (and hence off-site construction) and PLM, the Alliance achieved annual savings of 2 to 3% while increasing quality of service delivery to its customers over the last 10 years, considerably outperforming the sector.



Sustainability has improved substantially too, mainly through the Alliance's Sustainability in Design initiative. Embodied carbon (CO₂ emissions related to the construction phase, including the transport and installation of materials) was reduced by 54% from 2010-2015, against a 50% target; and operational carbon (CO₂ emissions generated by the assets during the operations phase) was reduced by 41%, against a 20% target. These figures serve as a benchmark for the entire infrastructure sector.

Regarding health and safety, the Alliance's performance improved from being at industry average in 2005 to being an industry leader today. The @one Alliance partners work collaboratively to exchange best practice with one another and with suppliers. Overall, the accident frequency rate rate of more than 7 days has plummeted from about an accident every 300,000 hours worked to one every million hours worked.

These improvements can be attributed largely to the standard products strategy. Taking the product examples again: the sampling kiosks are today produced and installed at a cost of just 77% relative to the 2005 cost, embodied carbon has declined by 11%, and operational carbon is now zero, thanks to the use of solar power. As for the trickling filters, they cost just 70% relative to the traditional solutions, and involve only 45% of the embodied carbon. Finally, the new reinforced nylon air valves constitute a step change compared with the previous metal-made components: they only weigh 1kg instead of 25kg, increase ease and safety of installation, save 90% on embodied carbon and 36% on costs, and have a longer design life thanks to their corrosion resistance.

The barriers to innovation, and the solutions

Success depends on changing the traditional mindset, culture and procurement models, and on pursuing effective collaboration, long-term partnerships and a continuous improvement philosophy.

The immediate obstacle facing the Alliance was the old-fashioned culture and mindset of the engineering and construction, and utilities sectors. First, the leadership team had to convince senior executives at all partner companies, including Anglian Water, that collaboration was indeed the best approach; that effective collaboration would lead to better outcomes than project-level competition (the latter being the norm in such a project-based industry). Second, the team had to adapt everyone to product-based thinking instead of approaching each project individually. The focus is now on product development – once a product is developed design engineers have to become product optimization and integration engineers. Some experienced professionals can struggle with the idea of choosing from a product catalogue rather than designing and planning from scratch. Recent graduates find it much easier, of course, and this cultural adaptability is reinforced in the training sessions for new hires.

The new digital technologies (forged by the PLM), being so unfamiliar to most employees, and the rapid pace of change, have obviously presented challenges of their own. The Alliance team continues to drive that change by nurturing an open and innovation-friendly environment, in which employees can test and develop new ideas. Recent examples include individuals developing digital apps for the optimization of installed treatment processes. The role of the Alliance itself is changing as a result of the digital technologies: it is becoming more and more an integrator of different technologies in an open system. As such, PLM is designed as a very open system, able to integrate different software solutions and thereby avoid becoming dependent on any one provider.

A related challenge was to create a continuous-improvement organization, much more closely resembling a manufacturing company. Previously, the view had been that any efficiency would be limited by diminishing returns, and that initial progress after its set-up was just the Alliance benefitting from low-hanging fruit. The Alliance leadership, having learned from the continuous improvement approach of other sectors, including from some of the world's top manufacturing companies, has tried to instil the new approach into the organization. Improvement initiatives now constitute a core component of the business plan. As part of the continuous improvement efforts, project teams are encouraged to suggest ideas for improving products or processes. If an idea is considered promising, it might be tested by a "pathfinder project", for which the team gets full client and leadership support. If the pathfinder is successful, the solution is quickly rolled out to the entire organization.

Another potential barrier was the old standard procurement procedure, which excludes suppliers and contractors from the early planning and design phases. The Alliance overcame that barrier by adopting a long-term relationship model – on the one hand, the shareholder principle of the core partners, and on the other, framework agreements with the wider supplier network. This model allows the contractors and suppliers to participate in developing the designs, rather than being "dragged in" at a later stage to work on the delivery.

The long-term relationship model has several interesting features to avoid typical shortcomings of traditional procurement practice. On the contractor side, alliance partners, after studying the White Book initiative plan, decide if they can generate a return and participate in the Alliance. If so, they are set performance-based minimum requirements instead of traditional detailed engineering specifications – a huge step for a utility company, and are expected to work in a very collaborative way, and only use standard products as far as possible.

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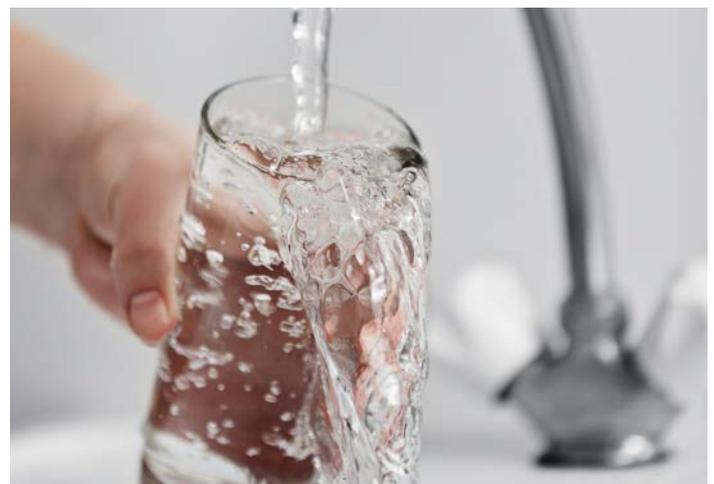
On the supplier side, the Alliance welcomes new suppliers that want to enter into a framework agreements, allowing a constant inflow of new ideas and avoiding complacency among the incumbents. Specifically, the Alliance engages with suppliers and screens their proposals by means of the open Water Innovation Network, a free membership network for suppliers in the water industry to develop innovative solutions. Anglian Water poses specific challenges for optimizing its products and everybody is encouraged to submit their business case – often the best ideas come from outside the water industry.

Lessons learned

- **Collaborate to the maximum, and share best practices with your partners**
The success of the @one Alliance proves the value of open collaboration and best-practice sharing in the E&C industry, both within a company and between companies. So much depends on breaking down silos and siloed thinking – allowing for integration and collaboration across all project teams, departments and companies as a whole.
- **Take a programme approach and strive to develop standardized products**
By taking a longer-term and more holistic approach to capital projects, organizations can identify repeatable tasks and potential synergies between similar projects. That was the basis on which the Alliance was able to define standardized products and move from traditional design and construction to assembly and integration. The Alliance could guarantee suppliers an order for a fixed quantity of units over a five-year period, and the suppliers could then confidently invest in production capacity. The use of standard products allowed for off-site prefabrication and improved quality control, and thereby led to large efficiency gains.
- **Adopt a continuous-optimization mindset**
From other manufacturing industries, the Alliance has learned the value – and the methods – of becoming a continuous improvement organization, rather than just focusing on the delivery of individual projects. Two crucial aspects are: working closely with suppliers; and creating a conducive environment for employees to develop new ideas.



- **Adapt procurement models that foster collaboration**
The Alliance favours close collaboration from the very start of a project, during the planning stage. That attitude is incompatible with traditional procurement models, in which suppliers begin their involvement much later, during the bidding process. The Alliance has found that framework contracts, aimed at forging long-term relationships, help to intensify and sustain collaboration, and also generate appropriate incentives to improve performance.
- **Leverage digital technologies across the entire product lifecycle**
The Alliance’s PLM approach shows the potential of fully leveraging digital technologies throughout the entire lifecycle; virtually testing and operating assets with the help of augmented reality before construction allows to optimize design before construction is initiated. In addition, quality and effectiveness of operations and maintenance can be enhanced substantially through a fully integrated BIM model.
- **Foster cultural change to embrace new mindset of continuous improvement and product-based delivery**
Success of the Alliance is reliant on the change in mindset required on the side of Anglian Water as well as the Alliance partners and suppliers. Being conscious about this challenge and leading it through dedicated initiatives (e.g. improvement initiatives) and providing training for new hires and especially for experienced professionals were key to instil the new way of thinking.



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