DIGITAL TWIN HUB

DT Hub Digital Maturity Benchmarking Report

December 2021

Contents

Executive summary

As in 2020, DT Hub community members were, this year, again invited to complete an extended version of the Smart Infrastructure Index to better understand the digital maturity of the community and its members. The DT Hub version of the Smart Infrastructure Index is an online self-assessment tool which includes core questions that assess digital maturity across the asset lifecycle and an extension, developed in 2020, to focus specifically on digital twins in the context of the National Digital Twin programme (NDTp).

There were 57 responses to the Index in 2021 (up from 21 in 2020). Whereas in 2020 these responses came exclusively from asset owners / operators, in 2021 the survey was sent to the wider DT Hub community. While this increased the reach of the survey, it also influenced the scoring. The overall digital maturity score for the DT Hub community was **37.3 in 2020** and it decreased to **33.6 in 2021**. When looking at scores for asset owners / operators only, this decrease in digital maturity score was still evident, however, it was far less significant, with average score of **37.1 in 2021**.

Some key figures from this year's results are as follows:

- The highest scoring category was **Asset Management**, scoring **37.5**
- The lowest scoring category was **Asset Performance**, scoring **25.4**
- The category which saw the biggest decrease from 2020 to 2021 was **Customers**, which dropped by **10 to 37.0**
- The only category which increased from 2020 to 2021 was **Asset Performance**, albeit only increasing by **0.2 to 25.4**
- The most notable decreases in the **Digital Twin** extension category are in Alignment, Approach, and Technology, which decreased by **16**, **17**, and **13** respectively

However, there is reason to believe that despite the decreases in digital maturity scores, the overall digital maturity of the DT Hub community's member organisations has not necessarily dropped. There are two key factors which lead to this conclusion, the first being that the demographic of respondents has changed, with the survey being sent to vendors and academia as well as asset owners / operators. The second is that as the DT Hub community last year was much smaller than it is now, with far fewer organisations, it is likely that these members fall under the category being 'early adopters' of digital and specifically digital twins. In comparison, the more recent members of the DT Hub are likely to fall under the 'early majority', making them more likely to have a lower level of digital maturity and making the overall digital maturity score decrease.

In terms of recommendations to improve digital maturity, these can be summarised as follows:

- Improved communication around digital and digital twins could vastly increase digital maturity scores in several areas. Differences in scores between roles, responsibilities

and between asset owners / operators compared to innovators highlight a lack of common understanding.

- Asset owners / operators could better embrace digital tools and technologies to gather reliable, up-to-date data on the priorities of their customers and stakeholders, but they could also learn from the innovator community with respect to customer understanding, learning lessons from other sectors / industries.
- A modern approach to supplier / vendor management, encouraging innovation through sharing information on savings across the supply chain and appropriately assigning Intellectual Property, could benefit all parties.
- Regularly measuring digital competency levels, combined with horizon scanning and strategic planning to understand the future digital environment, can help organisations to stay ahead of the curve.
- Those interested in digital twins may have as much, if not more, to learn from exploring their failures and hearing about the failures of their peers as they do from their successes. Case studies should not exclusively focus on success stories.

Similarly, recommendations to improve the benchmarking process can be summarised as follows:

- Minor tweaks to the question set before next year's survey release may be needed, but major overhauls would not be advised to maximise the benchmarking data the DT Hub community now has with two years of data.
- Exploring new routes to distribute the survey could increase responses, improving the quality and granularity of insights.

1.0 Introduction

As they were in 2020, this year DT Hub community members were again invited to complete an extended version of the Smart Infrastructure Index to better understand the digital maturity of the community and its members.

The DT Hub version of the Smart Infrastructure Index (henceforth referred to simply as the Index) includes core questions that assess digital maturity across the asset lifecycle and an extension to focus specifically on digital twins in the context of the National Digital Twin programme (NDTp).

The objectives of inviting community members to complete the extended Index were to:

- Better understand the maturity of our members in relation to both digital transformation and digital twins,
- Explore relationships between digital transformation and digital twins,
- Compare and contrast DT Hub members with broader Index metrics,
- Draw comparisons between the DT Hub's asset owner / operator members and the wider community,
- Understand progress among the asset owner / operator members in the last year,
- Inform future areas of focus for the DT Hub and the NDTp.

This report provides overview of the approach, and analysis of the results including a comparison against the previous year.

2.0 Methodology

2.1 Digital maturity benchmarking

There are three main reasons why organisations should consider benchmarking their digital maturity:

1. **Understand digital transformation progress**
   Uncovering blind spots with a clear picture of current performance allows organisations to understand how ready they are for digital transformation, how they are progressing, and how their culture varies with regards to digital.
2. **Identify what to prioritise**
   By appreciating relative strengths, weaknesses, and dependencies between different aspect of digital, organisations can better prioritise interventions.
3. **Benchmark against the best**
   By testing themselves against best practice from other organisations, organisations can better understand their position in the industry and learn from their peers.

By assessing digital maturity across the DT Hub, aggregated responses allow for the realisation of group-wide benefits:

- Insights highlight common challenges faced by many / all in the community
- Recommendations can provide solutions to these challenges
- Benchmarking helps to identify community best practice, meaning case studies can then be shared to accelerate digital transformation for other members
- Community-wide capability gaps can become a priority focus

2.2 Smart Infrastructure Index

2.2.1 Background

Mott MacDonald, working with the Infrastructure Client Group (ICG), developed the Smart Infrastructure Index from Project 13 to measure the digital maturity of asset owners and their wider supply chains. Organisations who have completed the Index since its inception in 2018 represent over 40% of the UK National Infrastructure & Construction Pipeline and over £400bn of infrastructure assets.

Developed specifically for the built environment and infrastructure industry, the core Index provides a holistic view of digital maturity across seven categories:

- Customers
- Commercial
- Digital transformation
- Asset management
- Asset delivery
- Asset performance
- Continuous improvement

As the standard measure of digital maturity in the UK built environment, it is also used for benchmarking by the ICG, the Buildings Client Group (BCG) and many individual organisations.

2.2.2 Smart Infrastructure Index question set

The questions within the Smart Infrastructure index are hierarchal, such that the higher the perceived digital maturity of the respondent, the more questions they will answer:

- Category – E.g. Digital Transformation
    - Subcategories – E.g. Leadership
        - Q1: Does your executive board believe that digital transformation is fundamental to the success of your business?
        - Q2: Is your digital transformation focused purely on new technology?
        - Q3: Do you have digital leaders across your whole business who are empowered to drive change?
        - Qn-1: Does everyone understand how digital transformation impacts them individually?
        - Qn

Each question can be answered ‘Yes’, ‘Maybe yes’, ‘Maybe no’ or ‘No’.

The core Index question set currently comprises of 7 categories and 40 subcategories. In total there is currently 186 questions in the core question set.

2.2.3 Smart Infrastructure Index user experience

Users submit their responses to the Index via the website. Progression through the questions is dependent on the answers provided to prior questions within the subcategories. It is therefore not expected that an individual will answer all questions. Taking the above example, if a user responds “No” or “Maybe no”, they will move to the next subcategory. Only by giving the “correct” answer do users move further into the subcategory.

Responses to the Index are anonymous by default. Users can choose to provide personal details, but this is not required to complete the Index. Users are not individually identifiable in the results dashboards or any analysis.

To aid with result analytics, users are asked to provide profile information on their Sector, Region. Role and Primary Responsibilities.

Maturity is calculated at the subcategory level and is based on the combination of responses given to questions asked. Maturity for each subcategory is presented on a normalised scale between 0 and 100. All responses to the Index are given equal weighting when calculating organisational and sectoral maturity.

2.2.41 Smart Infrastructure Index output

At the end of the survey each user is presented a personal Index report that shows their responses compared with organisational and sectoral averages as well as a “best practice” indicator.
The best practice indicator is a composite score, combining the highest results from any organisation that has completed the index.

The personal report is only accessible by the individual user. Individual responses are aggregated for further analysis on the Index platform. All responses are then aggregated by Mott MacDonald and combined into an insights report, which can be accessed via the Moata platform (contact – enquiries@digitaltwinhub.co.uk – to arrange access).

2.3 Digital Twin Hub – index extension

2.3.1 2020 development work

The Centre for Digital Built Britain commissioned an extension to the Index in mid-2020 to determine maturity towards digital twins in the context of the National Digital Twin programme.

An additional category of questions was developed with input from the NDTp core team, the DT Hub steering group, and Index consultants. The question set respected the same hierarchical logic as the core Index question set and efforts were made to reduce duplication of similar questions in the core and extended question sets.

The question set was structured as follows:

- Category – Digital Twins
    - Subcategory 1: Approach
    - Subcategory 2: Communication
    - Subcategory 3: People
    - Subcategory 4: Data
    - Subcategory 5: Technology
    - Subcategory 6: Alignment
    - Subcategory 7: Design
    - Subcategory 8: Build
    - Subcategory 9: Operate
    - Subcategory 10: Integrate
    - Subcategory 11: Outcomes

Within each subcategory questions were developed with progressive maturity indicators relating to digital twins in the context of the NDTp. Where maturity indicators carried uncertainty in the progression from low to high maturity, ranking was based on the relative frequency of which indicators had been expressed during DT Hub member interviews.

In total 59 questions were developed for the 2020 DT Hub digital twin extension question set. The question set was provided to the Index delivery team for addition to the Index platform. A CDBB theme was also developed to provide a consistent look and feel from the DT Hub to the Index user interface.

The Index platform was configured to enable users to complete both the DT Hub extension and the Index core questions as one response.

2.3.2 2021 development updates

In mid-2021, CDBB commissioned the Mott MacDonald Index team to tweak the additional Digital Twin category produced in 2020. This category had been aimed at infrastructure asset owners & operators. The aim of the 2021 development work was to increase the accessibility of these questions, broadening them to allow any DT Hub member – including academia, vendors etc. – to respond.

For example, in 2020 a question in the technology subcategory read as follows:

- Does your organisation use technology to measure the performance of its assets?

In 2021, this was edited to read:

- Does your organisation (or your client/supply chain) use technology to measure the performance of its assets?

These changes have not altered the meaning of the questions, meaning that more users can respond, but comparisons can still be drawn between 2021 and 2020 responses.

3.0 Findings & analysis

3.1 Index timeline and response demographics

The Index went live on the 4th October 2021 to all DT Hub community members and remained open for responses until the 24th November 2021.

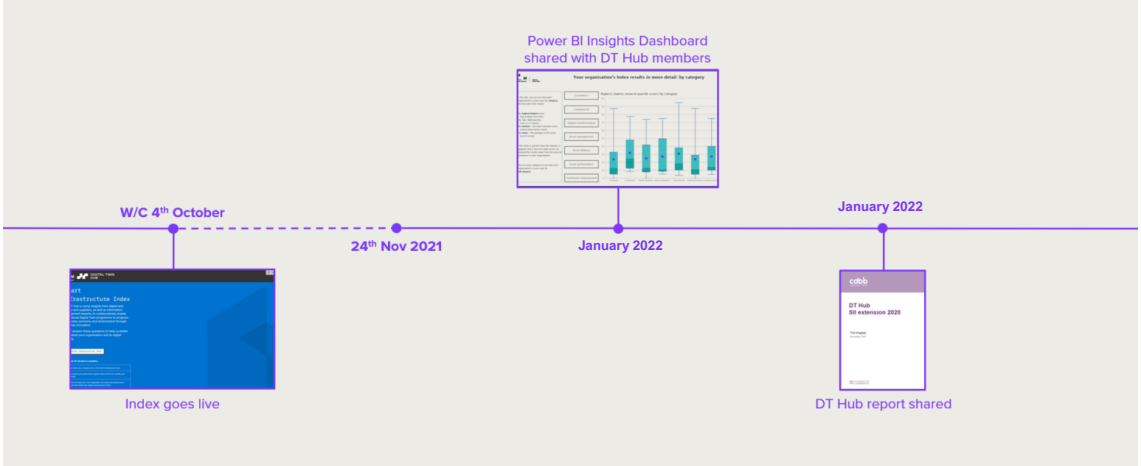

Figure 1- DT Hub Index 2021 timeline

Last year, the survey was sent exclusively to asset owner / operator members. This year, the survey was sent to all members. This is reflected in the responses and average digital maturity scores, which has been taken into consideration during analysis.

	2020	2021
Asset owners / operator members	124	375
Total members	578	2,793

There were **57 responses** to the Index in 2021 (up from 21 in 2020). This increase in responses represents a slightly smaller increase than may have been expected given the increase in DT Hub community membership. These responses can be broken down by role, where the majority of responses came from senior staff:

Role	Responses
Apprentice / Graduate	1
Operative / Professional	15
Supervisor / Manager	25
Board / Executive	17

Responses can also be broken down by responsibility. Note that the responsibility option in the Index is a multi-select question, as people often perform more than one responsibility, therefore the total adds up to more than 57:

Responsibility	Responses
Digital transformation	43
Asset / Facilities management	21
IT and information systems	19
Operations and maintenance	13
Capital delivery and planning	12
Customers and stakeholders	11
Business support functions	9
Executive leadership	7
Financial management	3
People and HR	2

These responses came from **51** different organisations. Of these, **12** were asset owners / operators (who had 19 responses between them). The others represent a variety of suppliers, academia and other stakeholders including consultants and industry group professionals (who each had one solitary response). Some respondents chose not to leave their organisation's details, these have been collated and marked as 'unknown':

Type	No. of organisations	No. of responses
Asset Owner / Operator	12	19
Other	39	33

For the purposes of the following analysis, when we refer to asset owners / operators 2021 responses, this refers to the 12 organisations which identified themselves as such.

3.2 Overall scores

The overall digital maturity score for the DT Hub community in **2020 was 37.3** and it decreased to **33.6 in 2021**. When looking at scores for asset owners / operators only, this decrease in digital maturity score was still evident, however, it was far less significant, with average score of **37.1 in 2021**.

Some key figures from this year's results are as follows:

- The highest scoring category was **Asset Management**, scoring **37.5**
- The lowest scoring category was **Asset Performance**, scoring **25.4**
- The category which saw the biggest decrease from 2020 to 2021 was **Customers**, which dropped by **10 to 37.0**
- The only category which increased from 2020 to 2021 was **Asset Performance**, albeit only increasing by **0.2 to 25.4**
- The most notable decreases in the **Digital Twin** extension category are in Alignment, Approach, and Technology, which decreased by **16**, **17**, and **13** respectively

The initial observation from this year's Smart Infrastructure Index results is therefore that on average, the digital maturity score of the DT Hub community has decreased. However, there is reason to believe that despite the decreases in digital maturity scores, the overall digital maturity of the DT Hub community's member organisations has not necessarily dropped. There are two key factors which lead to this conclusion.

First, the demographic of respondents has changed. In 2020, the respondents came exclusively from the asset owner / operator community. This year, the group of survey recipients was widened to include vendors and academia. When the 2021 results are filtered to show only asset owners / operators, the digital maturity scores are closer to those of last year. This may demonstrate that as we move further from the asset owner / operator group (either into the supply chain or 'sideways' to academia), there is less understanding of the digital maturity of the client organisation. This could be symptomatic of poor communication routes or a lack of common understanding about digital twins and digital more generally across different organisations within the DT Hub community.

However, even comparing like-for-like responses from last year to this year (i.e. asset owners / operators only), digital maturity scores this year are still very slightly lower. The second reason for thinking that overall digital maturity may not have dropped is that the DT Hub community last year was much smaller than it is now, with far fewer organisations. Therefore, it is safe to assume that those who were members last year are more likely to fall under the category of being 'early adopters' of digital and digital twins more specifically. Organisations who have become members of the DT Hub in the past 12 months, more likely to fall under the 'early majority' group, are then generally more likely to have lower digital maturity. As such, as more members have joined the DT Hub, the average digital maturity has decreased. Organisations may still be making progress in their digital transformation journeys, but the speed of growth in the DT Hub has made that progress harder to see at a community-wide level.

3.3 Analysis – Digital Twin extension

3.3.1 2021 vs 2020 comparisons

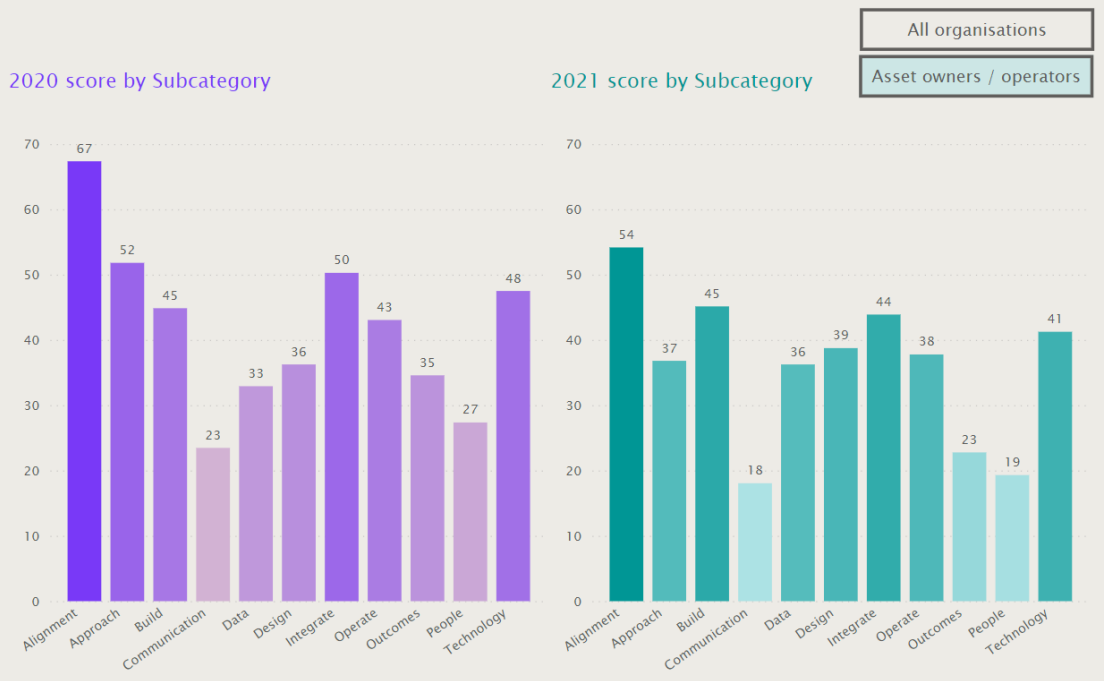

Figure 2 – Asset owners / operators Index Scores within the Digital Twin Category between 2020 and 2021

Figure 2 shows the difference in scores for the 11 subcategories of the Digital Twin category for asset owners / operators in **2021** compared to **2020**. The DT Hub asset owners / operators scored an overall score in this category of **35.8** this year, a significant decrease compared to last year's score of **41.8**.

Increases can be seen in the Data & Design subcategories, but both are only marginal increases – by 3 points in each. The Build subcategory scored the same in both years, while every other subcategory saw a decrease in score. The most significant of these were: Alignment, which dropped by 13; Approach, which dropped by 15; and Outcomes, which dropped by 12.

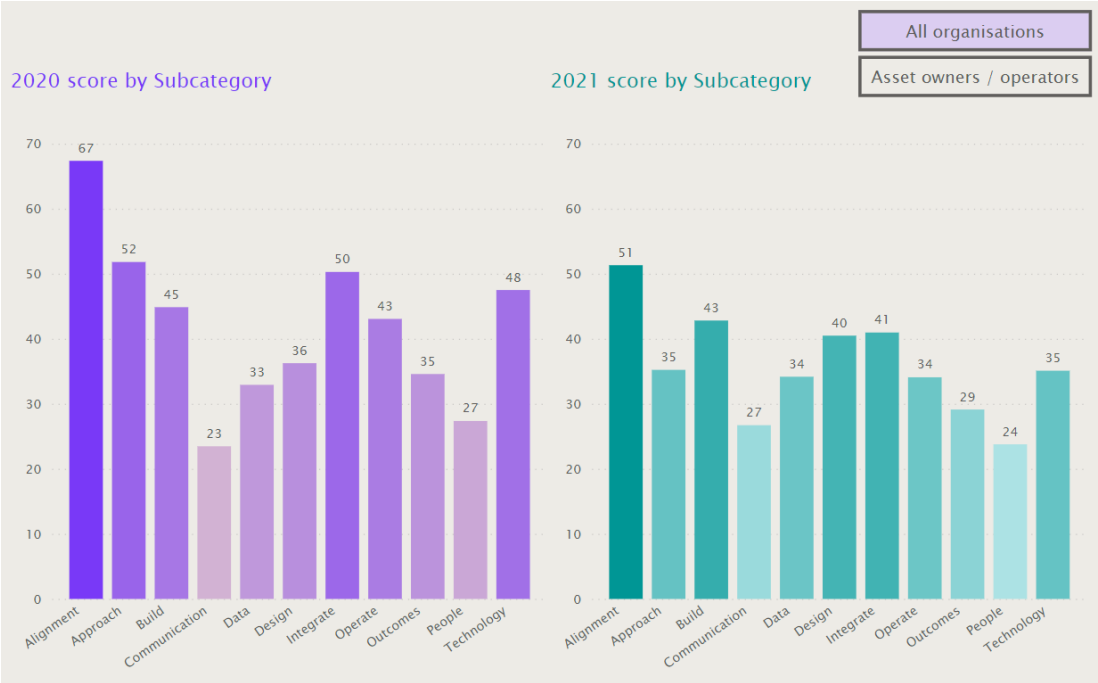

Figure 3 – All Organisations Index Scores within the Digital Twin Category between 2020 and 2021

The results seen in Figure 2 are largely comparable to those in Figure 3, which shows the overall results for all DT Hub community respondents. The overall score decreased this year, from **41.8 in 2020** to **35.8 in 2021**.

Increases can be seen in the Communication, Data, and Design subcategories. The most notable decreases can be seen in Alignment, Approach, and Technology, which decreased by 16, 17, and 13 respectively. Interestingly, both Approach and Technology saw an increase in scores this year for asset owners / operators, unlike the scores for these subcategories for the wider group. This suggests that there are different perspectives and ways of working between asset owners / operators and the wider DT Hub community. Disparity between individual questions within these subcategories will be explored in the following sections.

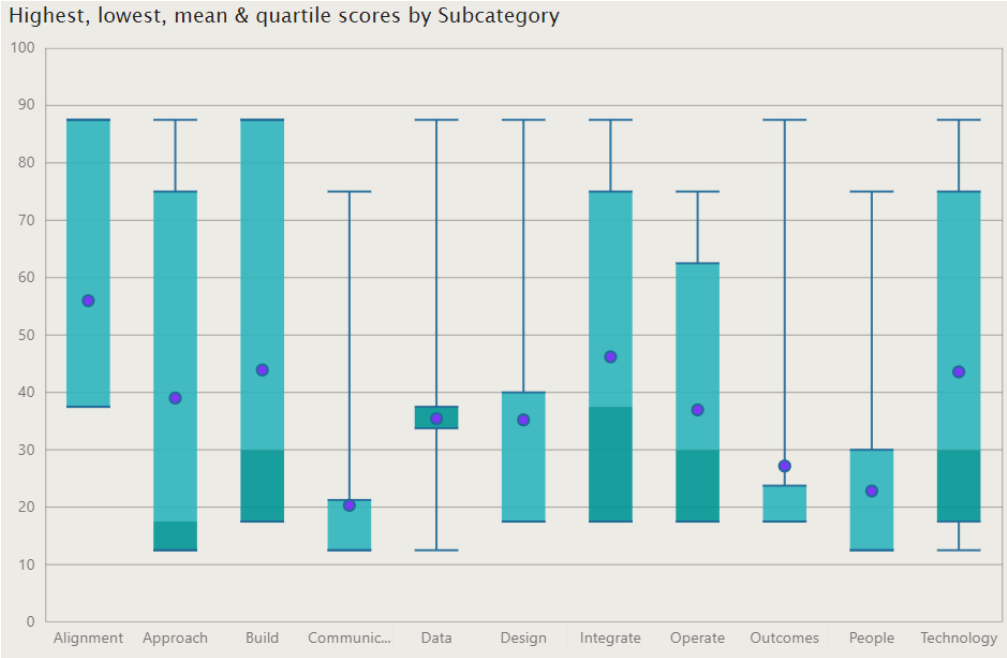

Figure 4 – Box Plot of the Subcategories within the Digital Twin category for Asset owners / operators

Figure 4 shows the highest, lowest, mean and quartile scores for each subcategory within the Digital Twin category for asset owners / operators. The highest and lowest score is shown by the top and bottom blue line, and the first and third quartiles are shown by the dark and light-coloured boxes. The median is where the coloured boxes meet, and the mean is shown by the purple circle, which is also the score used in the bar graphs in Figure 2.

For the Alignment and People subcategories, which are the two which saw the highest decrease in score between 2020 and 2021 for asset owners / operators, Figure 4 shows that there is a large distribution of scores – showing that there are very varied perspectives amongst these organisations. In particular, the People category saw some particularly high outliers compare to the mean and median scores. The following section will discuss insights from these two subcategories, as well as the rest of the Digital Twin extension category, by examining the results from individual questions, including those to which the responses were notably divided.

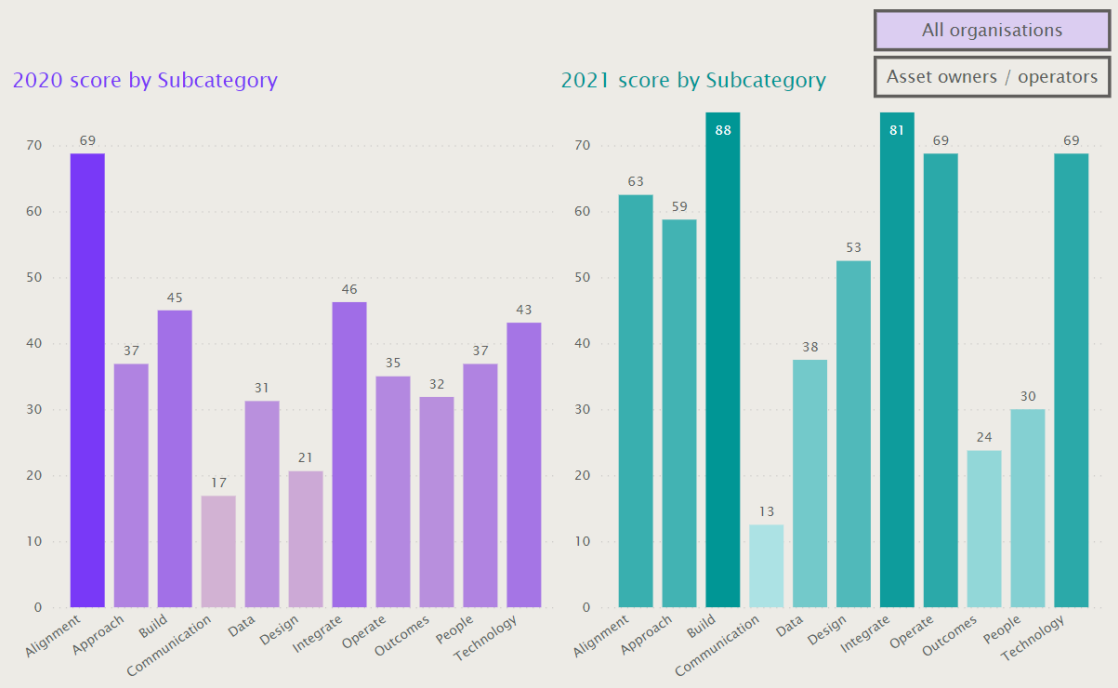

Figure 5 – Scores in the Digital Twin category in 2020 and 2021 for organisations that completed the Index both years

When looking at the scores in the Digital Twin category for the organisations that completed the Index both years, it can be seen in Figure 5 that there is a significant increase in score for the category, with an overall score in the category rising from **37.5 in 2020** to **53.1 in 2021**. The most significant increase in subcategory for Digital Twin was in Build, the score for which increased by 43. Other notable increases in subcategory were for Design, Integrate, Operate, and Technology. The subcategories of Alignment, Communication, Outcomes and People all saw a minor decrease in score, of 8 or less.

The organisations that completed the Index in both 2020 and 2021 also saw an increase in score for the majority of other categories, with the largest increase being in Continuous Improvement which increased by 32, from **36.0 in 2020** to **68.0 in 2021**. Another noticeable increase was in Asset Delivery, which rose by 21.4 from **36.4 in 2020** to **57.8 in 2021**. The categories of Commercial and Customer both saw a minor decrease of 6.6 and 10.7 respectively.

3.3.3 Observations and insights

Alignment

Within the Alignment subcategory, there are 3 questions. Below are the three questions with their accompanying results.

Question 1_6_1: Does your organisation apply the Gemini principles when creating digital twins?

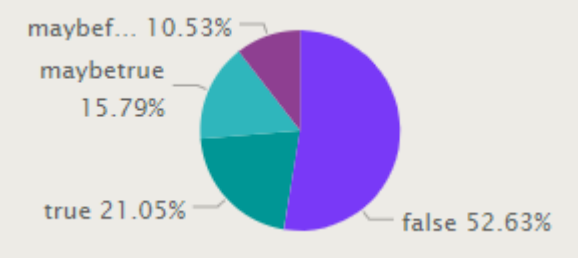

Figure 6 – Pie chart of results for question 1_6_1 for asset owners / operators

Figure 6 shows that responses to this question were divided, with the majority answering no. However, a quarter said maybe yes or maybe no, showing that even amongst asset owners / operators there was uncertainty.

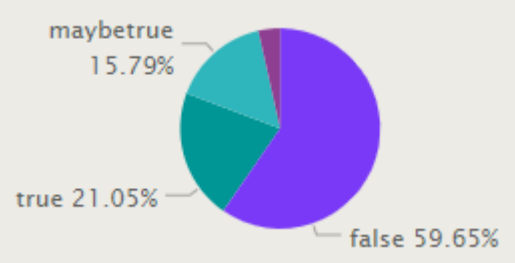

Figure 7 - Pie chart of results for question 1_6_1 for all organisations

Figure 7 shows responses to the same question for all organisations in the DT Hub community. Fewer people from the wider group answered no/maybe no when compared to only the asset owners / operators, albeit the overall split reflected a similar divide. This breakdown of responses was relatively consistent across all roles and responsibilities.

Question 1_6_2: Does your organisation share its digital twin experiences (successes and failures) with other organisations?

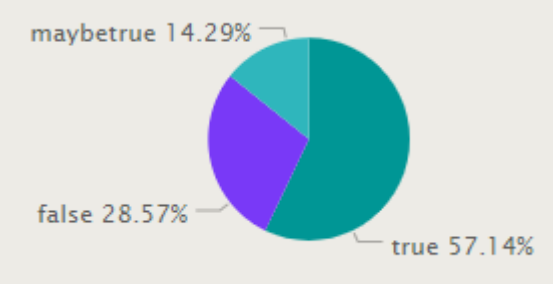

Figure 8 – Pie chart of results for question 1_6_2 for asset owners / operators

Figure 8 shows that there was more agreement for this question, with 100% of those at board / executive level answering yes, and only a third of those at operative / professional and supervisor / manager level answering no.

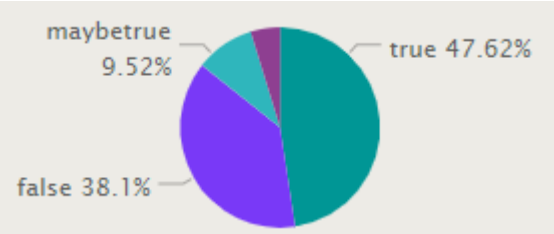

Figure 9 – Pie chart of results for question 1_6_2 for all organisations

Figure shows responses to the same question for all organisations in the DT Hub community and shows a higher percentage of respondents answering no or maybe no. A recommendation here would be to encourage knowledge and experience sharing of digital twins across the entire DT Hub community – asset owners / operators cannot make digital twins happen on their own.

Question 1_6_3: Does your organisation apply the Information management frameworks when creating or developing digital twins?

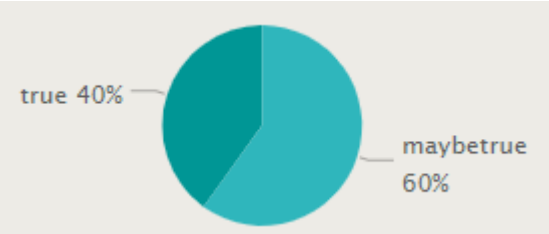

Figure 10 – Pie chart of results for question 1_6_3 for asset owners / operators

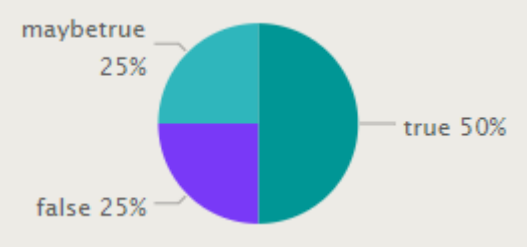

Figure 11 – Pie chart of results for question 1_6_3 for all organisations

Figure 10 shows agreement across all responses from asset owners / operators, but when looking at all organisations there is a group of 25% that disagreed. However, even amongst the asset owner / operator community, 60% of respondents said maybe yes, indicating that they are unsure about the application of the information management frameworks within their respective organisations.

People

The second subcategory that saw a significant decrease in score for asset owners / operators was People. Below are insights and divisive questions within this subcategory.

Question 1_3_1: Does your organisation understand its current and future capability requirements for developing, delivering, using and/or maintaining digital twins?

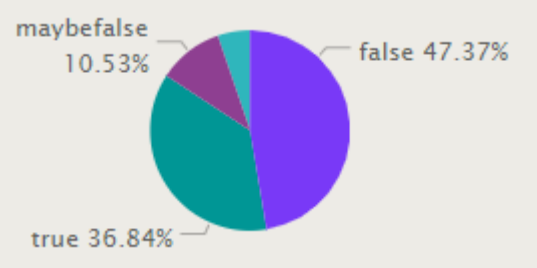

Figure 12 – Pie chart of results for question 1_3_1 for asset owners / operators

Figure 12 shows that this question was divisive amongst asset owners / operators, with this same divide in opinion apparent across most roles. This split was also apparent across responsibility levels, apart from for the board / executive level, where 100% answered yes. This suggests that whereas the highest level of many organisations in the DT Hub community understand their current and future capability requirements for digital twins, this understanding isn't filtered throughout the organisation. Realistically, it is likely that if supervisors / managers and those "on the ground" do not understand their current and future capability requirements, then neither will the wider organisation. However, it may be that at board / executive level there is an excellent understanding of capability requirements, which have not been cascaded throughout the organisation. In which case, a recommendation here would be to increase communication between board / executive level and other responsibility levels, so that there is a shared understanding of the current and future digital twin capability requirements across all roles within each organisation.

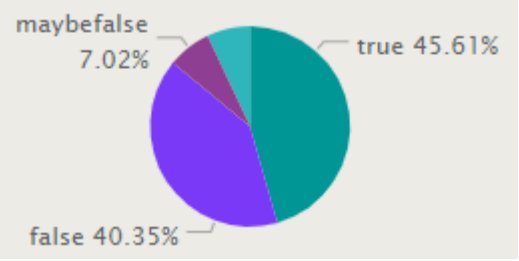

Figure 13 – Pie chart of results for question 1_3_1 for all organisations

Similar trends can be seen cross the wider DT Hub community; Figure 13 shows a similar divide in perspective for this question. As with asset owners / operators, this split in answers is true of all roles, but there is a higher percentage (75%) of those at board / executive level who answered yes or maybe yes.

Approach

Question 1_1_2: Does your organisation (or your client/supply chain) have a strategy on the creation of digital twins?

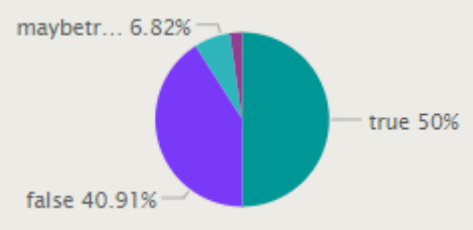

Figure 14 – Pie chart of results for question 1_1_2 for all organisations

Figure 14 shows a clear divide for this question, and this split was apparent across all roles and responsibility levels. When looking at just asset owners / operators, this split was still apparent, but with a slightly higher percentage of respondents answering yes. The recommendation here would be for asset owners / operators to provide more communication around digital twin strategies, including sharing it with organisations in the supply chain.

Build

Question 1_9_1: Is all of your (or your client/supply chain's) construction information developed using a common framework of standards and requirements?

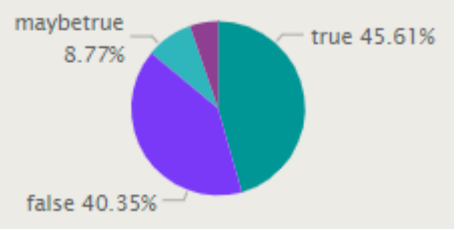

Figure 15 – Pie chart of results for question 1_9_1 for all organisations

Figure 15 shows a relatively high percentage of 45.61% of respondents answering no or maybe no to this question. However, for asset owners / operators only, there was a much higher percentage of 79.03% answering yes or maybe yes to this question. The recommendation here would be to encourage communication about common frameworks of standards and requirements used in the development of construction information across the supply chain.

Communication

Communication was a subcategory that scored lower compared to other subcategories in the Digital Twin category, despite being an increased score from the previous year.

Question 1_2_1: Does your organisation communicate to its employees about digital twins on a regular basis?

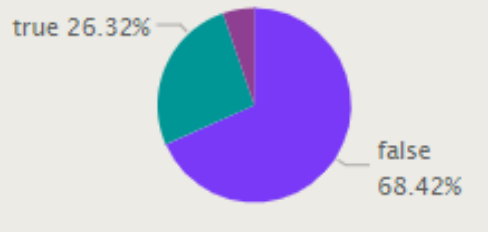

Figure 16 – Pie chart of results for question 1_2_1 for asset owners / operators

Figure 17 – Pie chart of results for question 1_2_1 for all organisations

Figure 16 and 17 show high responses of no or maybe no for this question, and similar responses can be seen for other questions about communication in this subcategory, with most respondents across different roles and responsibilities answering the same way. The recommendation here would be to increase the amount and frequency of communication around digital twins across all organisations, in order to create a common understanding with employees, customers, and other stakeholders. As highlighted in previous questions – improving communication about digital twins more generally could have far-reaching positive impact.

Data

The respondents for questions within data were mostly positive, with the majority of people in agreement that data is regularly used to inform decision making, is well collected and maintained, and is valued across organisations. The only question that saw a higher percentage of respondents answering no was as follows:

Question 1_4_2: Is data regularly used to inform decision making?

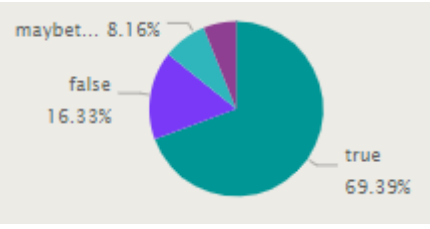

Figure 18 - Pie chart of results for question 1_4_2 for all organisations

Figure 18 shows that 22.45% of respondents thought that data was (or maybe was) not used regularly to inform decision making. Although this is a relatively low percentage, it is still worth noting that it would be beneficial for data to consistently be used across all roles and responsibility levels when making decisions.

Design

Question 1_8_1: Does your organisation (or your client/supply chain) use accurate digital models of your existing assets as the basis of design?

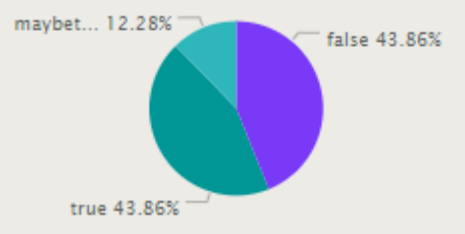

Figure 19 – Pie chart of results for question 1_8_1 for all organisations

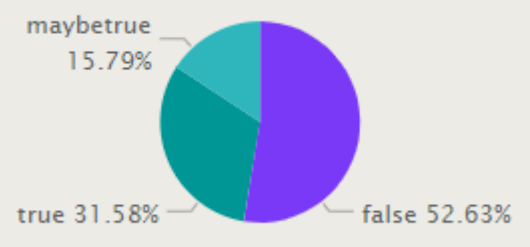

Figure 20 – Pie chart of results for question 1_8_1 for asset owners / operators

Figure 19 shows that the majority of respondents across all organisations felt that their organisation or their client's organisation use accurate digital models. However, 52.63% of asset owners / operators disagreed. Clearly, asset owners / operators are the best placed to own digital models of the assets that they own / operate. It may be that their supply chains are expecting accurate digital models to be the basis of their designs, but this is not always the case.

Integrate

The most divisive question in this subcategory was as follows:

Question 1_11_5: Do you (or your client/supply chain) publicly share metrics and quantified benefits related to the use of digital twins to improve citizen quality of life?

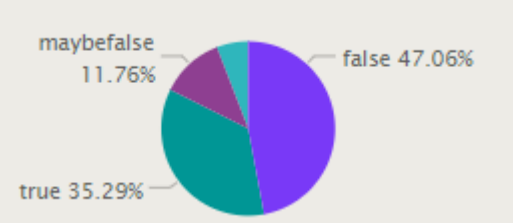

Figure 21 – Pie chart of results for question 1_11_5 for all organisations

As Figure 21 shows, the majority of respondents answered no or maybe no to this question. This was consistent across roles and responsibility levels, and most asset owners / operators answered the same way. The recommendation here would be to ensure that metrics and quantified benefits are shared widely, as this will increase the awareness around digital twins

and how they can improve quality of life for citizens. Understanding the potential benefits of adopting digital twins (as well as the risks of not doing so) will be critical in securing funding for initiatives in the space.

Operate

Question 1_10_1: Do your organisation (or your client/supply chain) make use of real time information to monitor the performance of any of its assets?

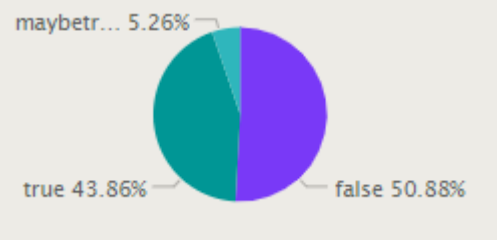

Figure 22 – Pie chart of results for question 1_10_1 for all organisations

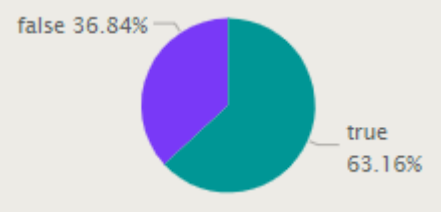

Figure 23 – Pie chart of results for question 1_10_1 for asset owners / operators

Figures 22 and 23 show that this question was divisive amongst both asset owners / operators and the wider DT Hub community. These results were also fairly consistent amongst different roles and responsibility types. Again, the organisations who would be positively impacted the most by real time asset condition monitoring would be the asset owner / operators, however more than half are saying that they currently do not use this to monitor any of their assets – let alone across their asset base.

Technology

The responses for questions in this subcategory were mostly positive, with the question receiving the most no or maybe no answers being as follows:

Question 1_5_6: Does your organisation (or your client/supply chain) make use of machine learning to continually improve its digital twins?

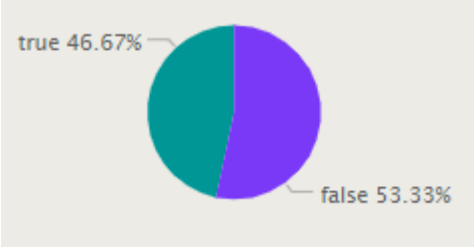

Figure 24 – Pie chart of results for question 1_5_6 for all organisations

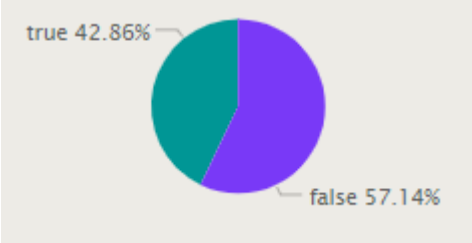

Figure 25 – Pie chart of results for question 1_5_6 for asset owners / operators

The responses from this question as seen in Figures 24 and 25 suggest that machine learning isn't commonly used to improve digital twins. This response is fairly consistent between different roles and responsibility levels. The recommendation here would be to learn from examples of when organisations have used machine learning to improve other aspects of their operations, to understand how this could be applied to digital twins.

3.4 Analysis – core Index questions

3.4.1 2021 vs 2020 comparisons

This section will explore the other 7 categories in the core Smart Infrastructure Index: Customers, Commercial, Digital Transformation, Asset Management, Asset Delivery, Asset Performance and Continuous Improvement; comparing this year's scores with last year's scores between asset owners / operators as well as the wider DT Hub community.

Customers

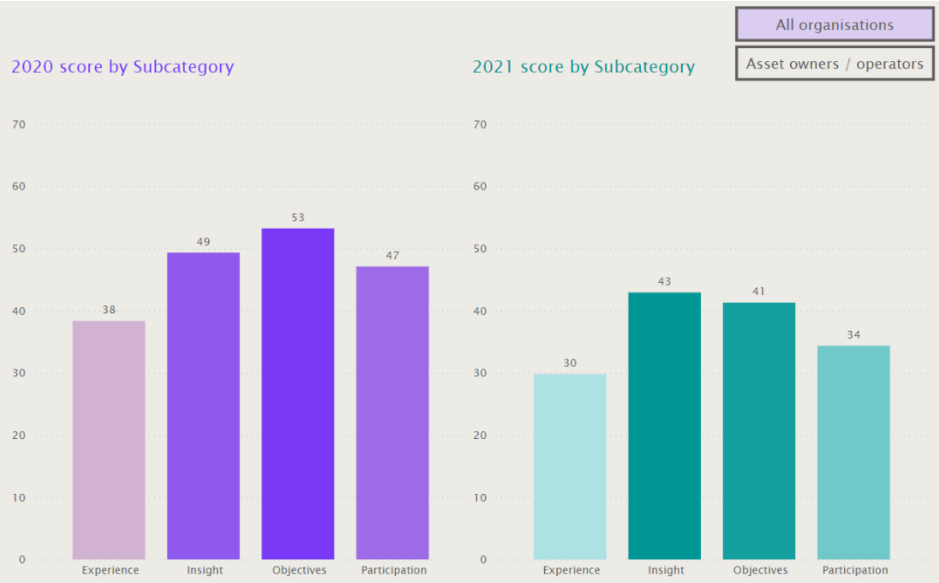

Figure 26 – Bar graph showing scores in Customers for all organisations

There was a significant decrease in overall score for the Customers category for the wider DT Hub community, from a score of **47.0 in 2020** to **37.0 this year**. In fact, all subcategories had a decrease in score, with the largest change being in Participation, which decreased by 13 since last year.

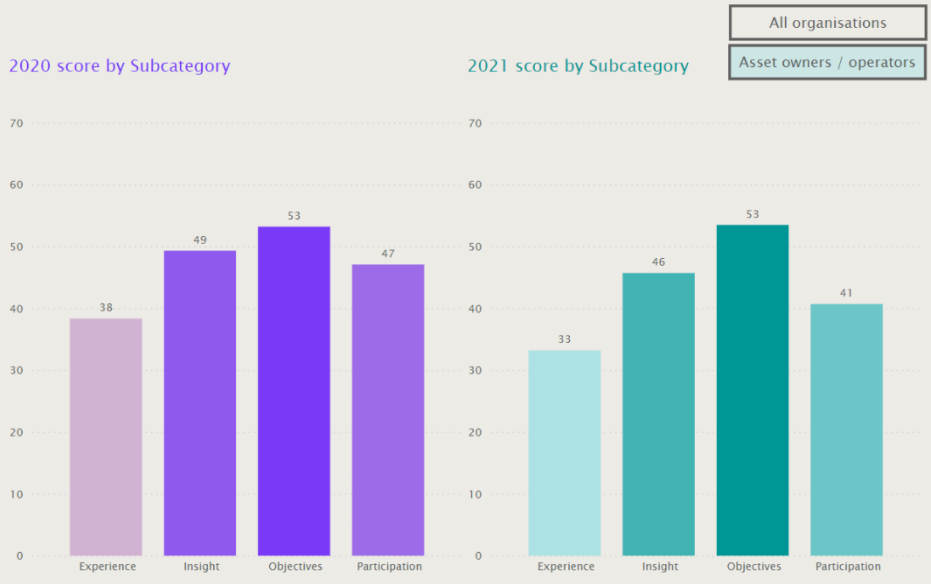

Figure 27 – Bar graph showing scores in Customers for asset owners/operators

When looking exclusively at asset owners / operators, there is a larger decrease in this category, with a score of **47.0 in 2020** and **43.3 in 2021**. As with the wider group of organisations, most subcategories within Customers had a decrease in score (Objectives remained the same), but with the most significant change in Participation, which had a decrease of 6, as can be seen in Figure 27.

Commercial

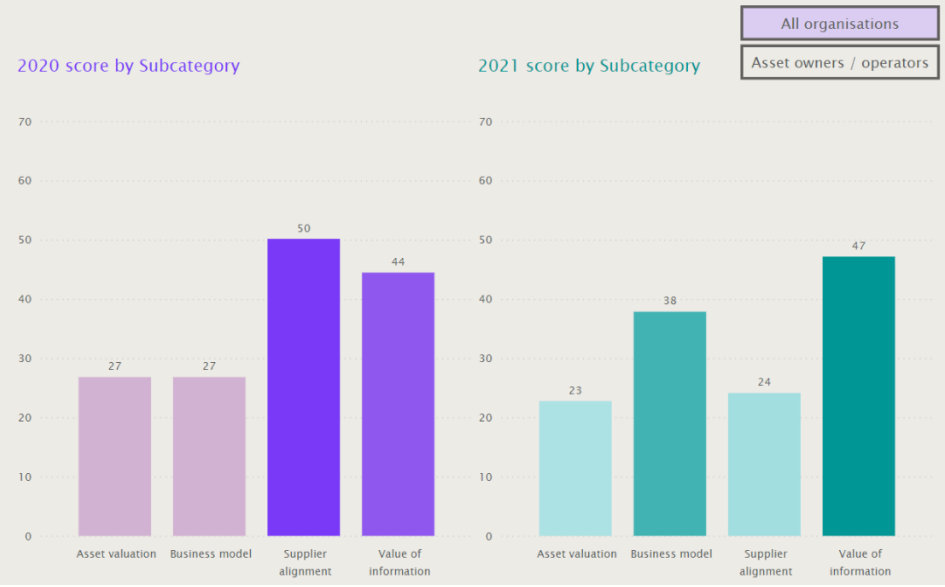

Figure 28 – Bar graph showing scores in Commercial for all organisations

The overall score for Commercial decreased by 2.9, from **37.0 in 2020** to **34.1 in 2021**. There was a lot of change within the subcategories, however, with an increase in Business Model from 27 to 38, but a significant decrease in Supplier Alignment from 50 to 24.

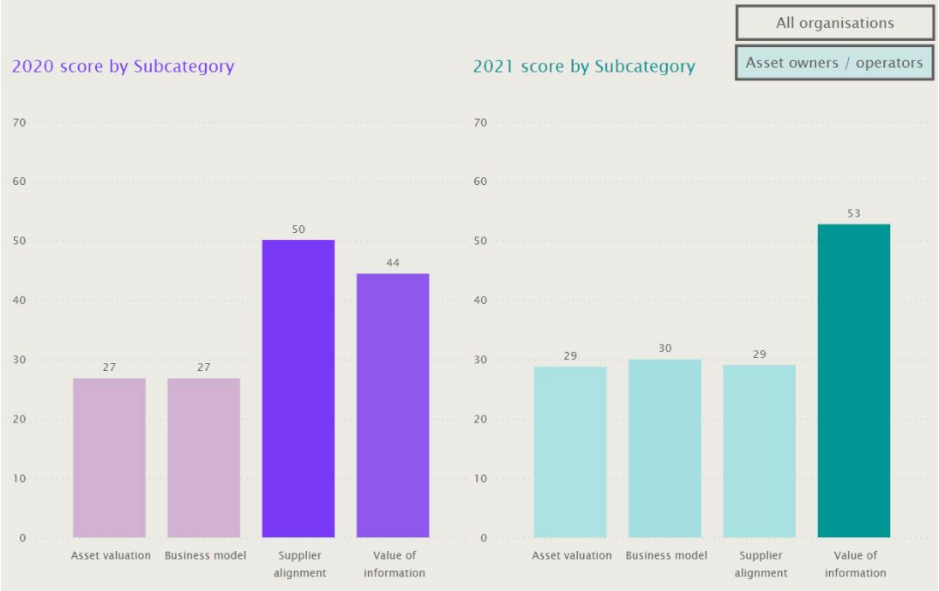

Figure 29 – Bar graph showing scores in Commercial for asset owners/organisations

The overall category score for asset owners / operators saw a smaller decrease, from **37.0 in 2020** to **36.6 this year**. Three of the four Commercial subcategories – Asset Valuation, Business Model and Value of Information – saw an increase, with the latter being the most significant rise at 9. However, Supplier alignment decreased substantially, by 21 points.

Digital Transformation

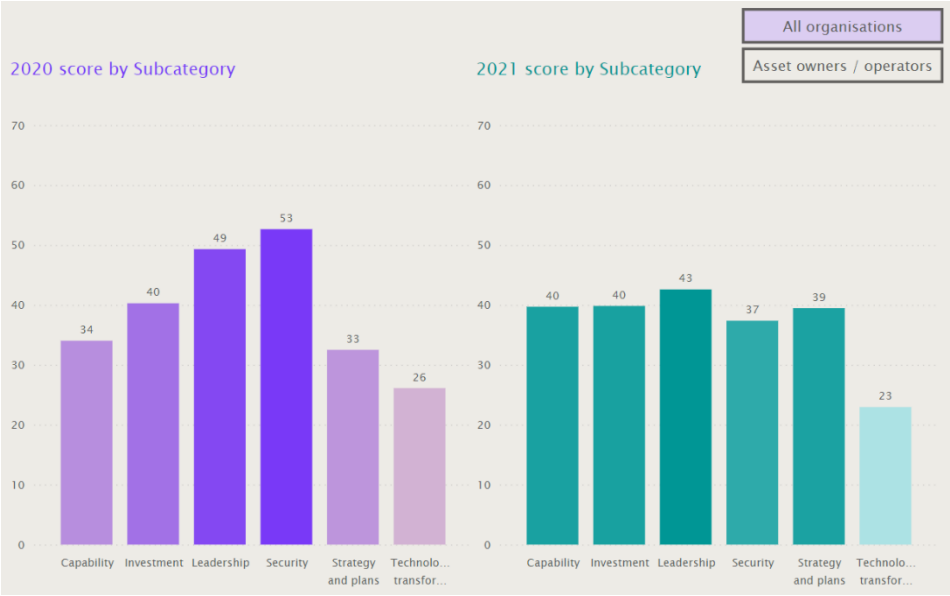

Figure 30 – Bar graph showing scores in Digital Transformation for all organisations

The category of Digital Transformation saw only a small overall decrease for all organisations, dropping from **39.1 in 2020** to **37.0 in 2021**. The subcategory that had the biggest change in score was Security, which decreased by 16 from 53 to 37. However, the Capability and Strategy and Plans subcategories increased in score this year.

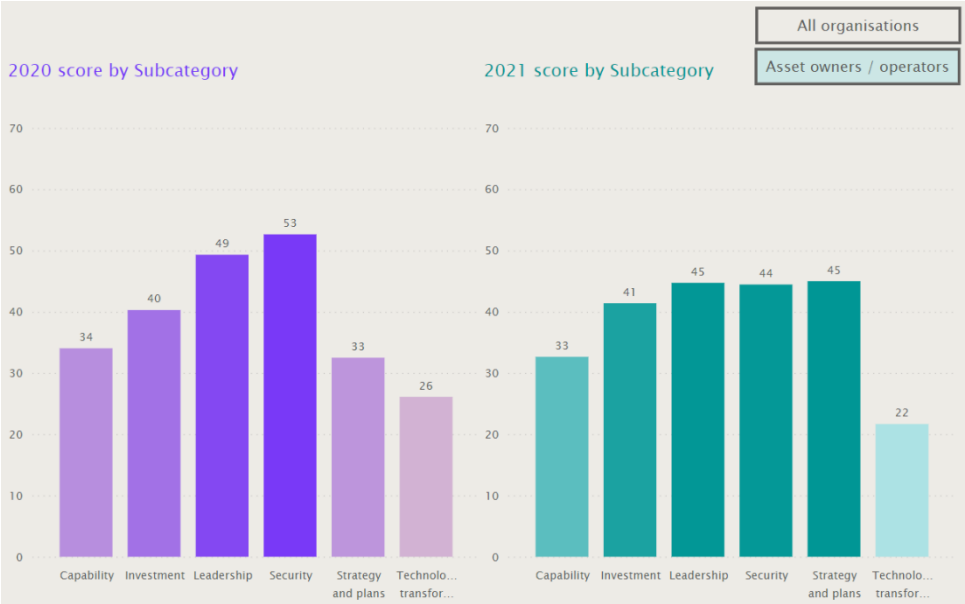

Figure 31 – Bar graph showing scores in Digital Transformation for asset owners / operators

The overall score in Digital Transformation for asset owners / operators also only had a small decrease, from **39.1 in 2020** to **38.3 in 2021**. The biggest changes in terms of subcategories were in Strategy & Plans – which increased by 12 – and Security – which decreased by 9.

Asset Management

Figure 32 – Bar graph showing scores in Asset Management for all organisations

The category of Asset Management also saw a decrease, with the average score going from **45.4 in 2020** to **37.5 in 2021**. This decrease was fairly consistent across all subcategories, as can be seen in Figure 32.

Figure 33 – Bar graph showing scores in Asset Management for asset owners / operators

In contrast, when looking at asset owners / operators, there was an overall increase in score for the category of Asset Management, which went from **45.4 in 2020** to **49.9 in 2021**, as can be seen in Figure 33. There was an increase in most categories, with Leadership, Operating Model and Strategy & Plans each increasing by 9 points. There was a smaller increase in Resilience, which increased by 4, while Capability remained the same as in 2020. The only subcategory which decreased was Suppliers, which dropped by 4 points.

Asset Delivery

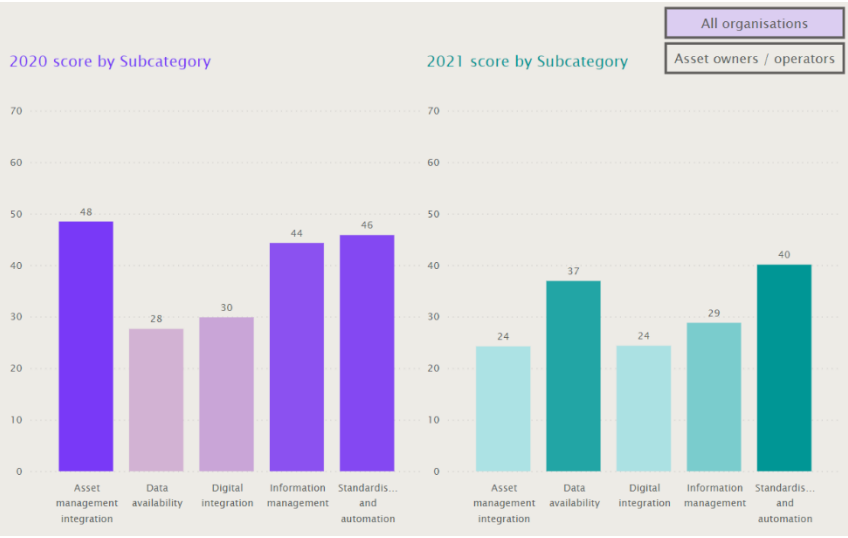

Figure 34 – Bar graph showing scores in Asset Delivery for all organisations

The overall score for the Asset Delivery category went down on average this year, from a score of **39.2 in 2020** to a score of **31.2 in 2021**, as can be seen in Figure 34. This decrease can be seen in all subcategories, apart from Data Availability which saw an increase of 9.

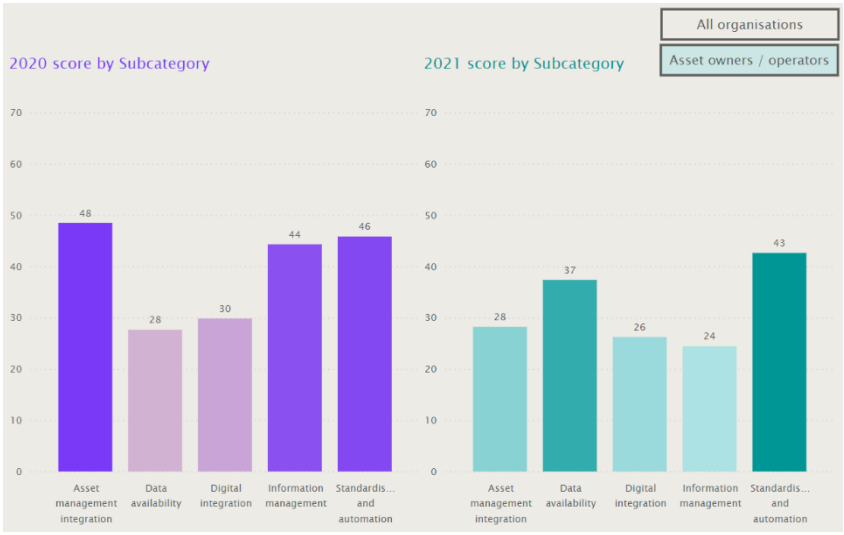

Figure 35 – Bar graph showing scores in Asset Delivery for asset owners / operators

The overall score for this category for asset owners / operators saw a smaller decrease, from **39.2 in 2020** to **31.9 this year**, as can be seen in Figure 35. Like the wider community, a subcategory that saw an increase was Data Availability with an increase of 9, however, the decrease in Information Management score was even more pronounced for this group, dropping by 20 points.

Asset Performance

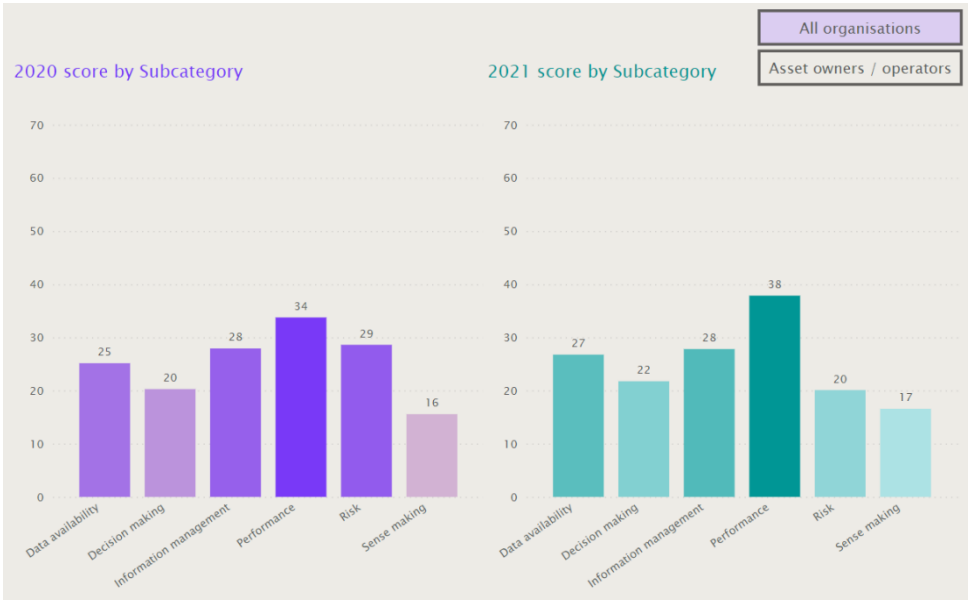

Figure 36 – Bar graph showing scores in Asset Performance for all organisations

The scores in the category of Asset Performance for all organisations in the DT Hub were mostly consistent, with the average score going from **25.2 in 2020** to **25.4 in 2021**. The subcategory that saw the largest change in score was Risk, which decreased by 9 in 2021.

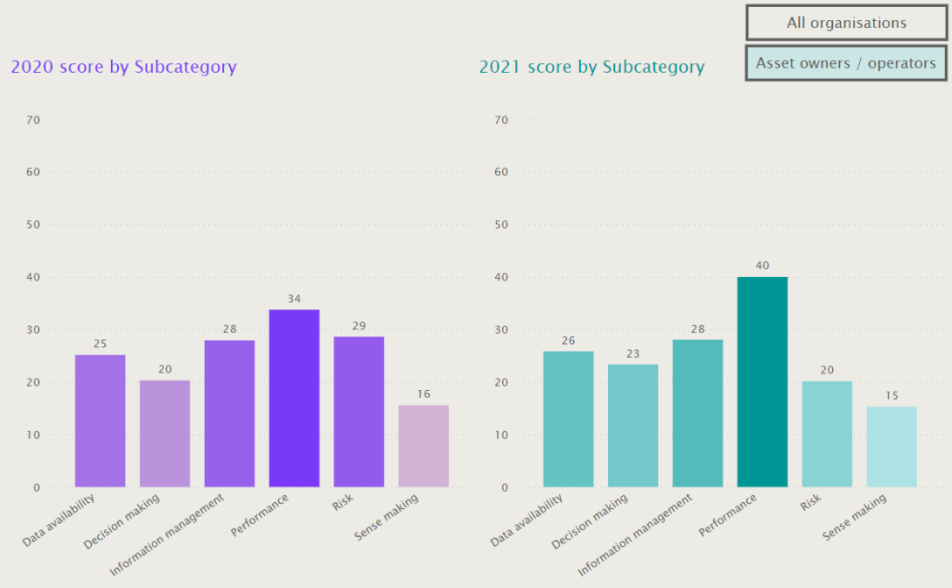

Figure 37 – Bar graph showing scores in Asset Performance for asset owners / operators

The overall score for asset owners / operators saw a similar minor change, albeit in a positive direction, from **25.2 in 2020** to **25.4 in 2021**, as can be seen in Figure 37. The biggest increase was seen in Performance, which rose by 6 points. Risk was the subcategory that saw the largest negative change, with a comparable decrease to the wider group of the DT Hub with a decrease of 9.

Continuous Improvement

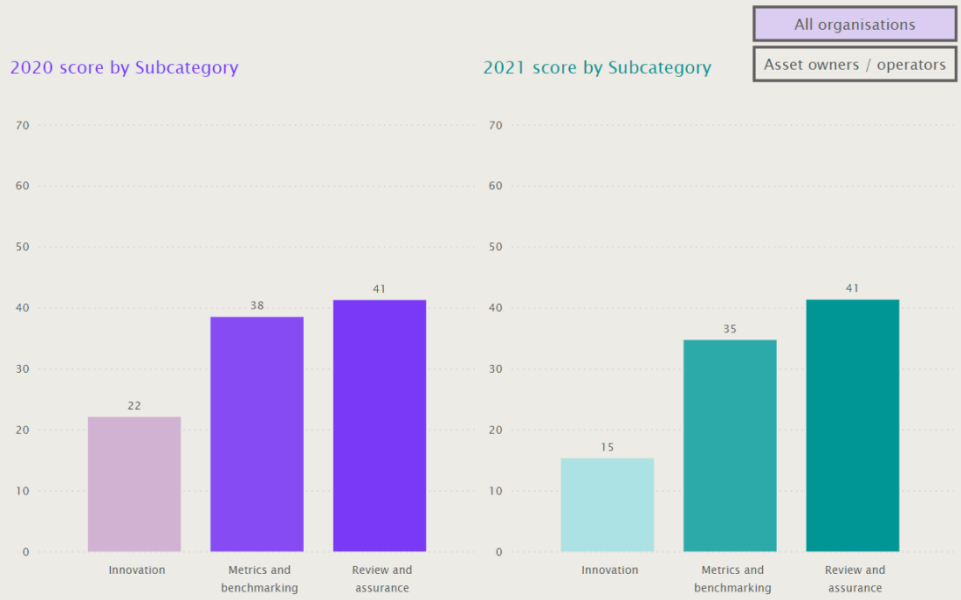

Figure 38 – Bar graph showing scores in Continuous Improvement for all organisations

The Continuous Improvement average score was close to that of last year, with an overall score of **33.9 in 2020** and **31.6 in 2021**. This consistency is seen in the subcategories as well, with the biggest change being a decrease of 7 in Innovation.

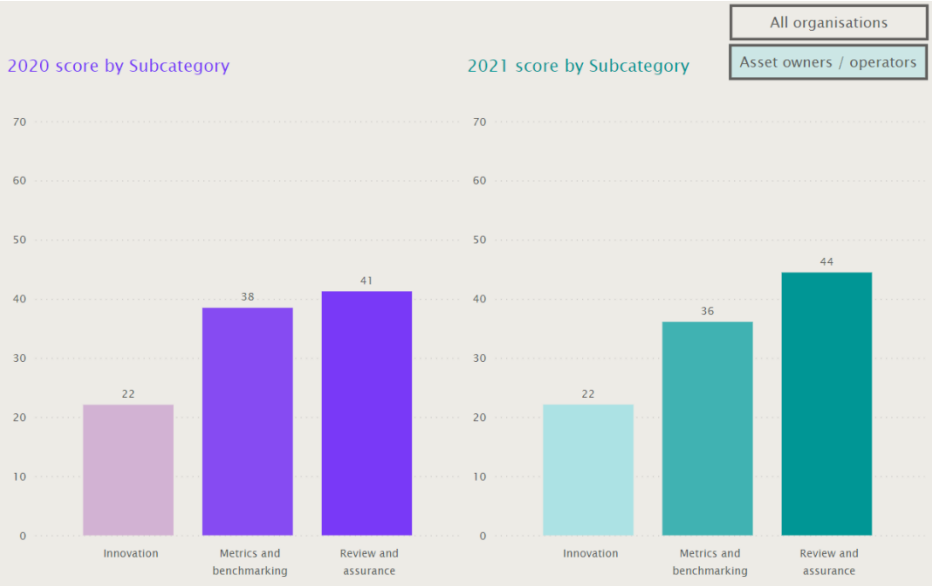

Figure 39 – Bar graph showing scores in Continuous Improvement for asset owners / operators

There was an increase in overall score for Continuous Improvement for asset owners / operators, moving from **33.9 in 2020** to **35.5 this year**. The consistency between years is even more pronounced for this group. Innovation scores remained the same as last year, with Metrics and Benchmarking decreasing by 2 and Review & Assurance increasing by 3.

3.4.2 Observations and insights

Customers

Question 2_3_2: Do you understand different customer groups' priorities?

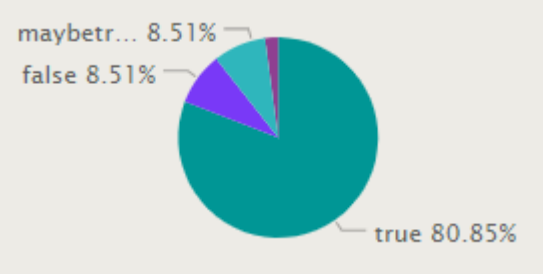

Figure 40 – Pie chart of results for question 2_3_2 for all organisations

Question 2_3_3: Is that understanding data-driven, based on insights from how they use your services?

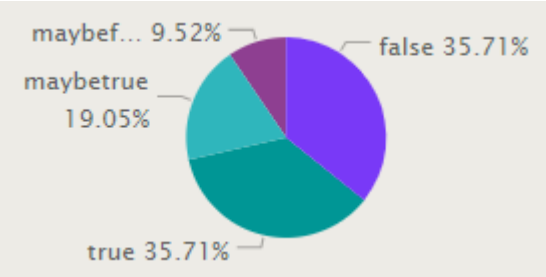

Figure 41 – Pie chart of results for question 2_3_3 for all organisations

Figure 40 shows a very high rate of yes or maybe yes responses for a question about understanding different customer groups' priorities, but Figure 41 shows that 45.23% of those thought that this understanding wasn't data-driven or based on insights from how they use their services. A similar divide was seen in the responses from asset owners / operators as well. This suggests that many organisations' understandings of their customer are based on instinct or assumptions. The recommendation here would be to gather reliable, up-to-date data on the priorities of customers and stakeholders, through engagement such as surveys, to ensure that these priorities are thoroughly and consistently understood.

Commercial

Question 3_2_1: Do you encourage your suppliers to innovate by sharing savings with them?

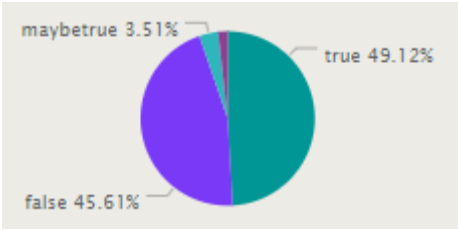

Figure 42 – Pie chart of results for question 3_2_1 for all organisations

Figure 42 shows that this question was divisive, with almost a 50/50 split between respondents. This split can be seen across all roles and responsibilities but is less divisive when looking at asset owners / operators only, with 73.69% answering yes or maybe yes. The recommendation here would be to encourage sharing information on savings with suppliers, and to communicate the benefits of doing this amongst all the organisations in the DT Hub to encourage innovation.

Question 3_3_4: Is information managed as an asset with a comprehensive inventory and investment that reflects its value to the business?

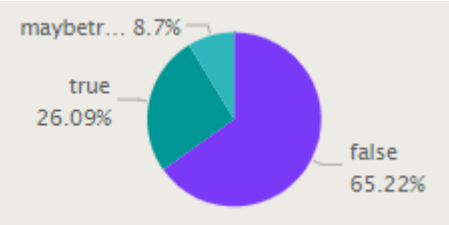

Figure 43 – Pie chart of results for question 3_3_4 for all organisations

Another interesting question which received a relatively high rate of respondents answering no was a question about information being treated as an asset, as seen in Figure 43. The same can be said for asset owners / operators, where 70% answered no to the same question. A recommendation here would be to communicate the benefits of timely and accurate information so that the value is realised, and so that it can begin to be treated as a valuable asset. A comprehensive inventory would support this.

Digital Transformation

Question 4_1_4: Does everyone understand how digital transformation impacts them individually?

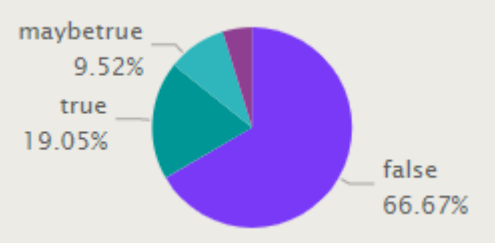

Figure 44 – Pie chart of results for question 4_1_4 for all organisations

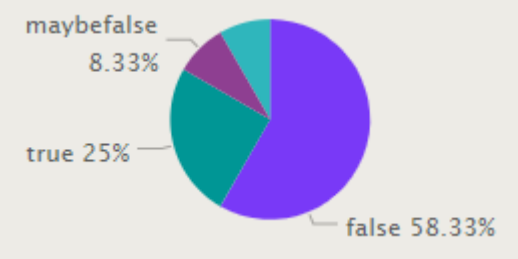

Figure 45 – Pie chart of results for question 4_1_4 for asset owners / operators

This question resulted in a high rate of no or maybe no responses, with 71.43% of the wider DT Hub community and 66.66% of asset owners / operators answering in this way. This suggests a potential blocker for the uptake and understanding of digital transformation, as many don't understand how digital impacts them individually. When people do not understand the individual benefits of any change, they are less likely to successfully adopt that change. This is equally as true for digital transformation as it is for any other transformation.

Question 4_3_3: Can you quantify the benefits already realised from your digital transformation?

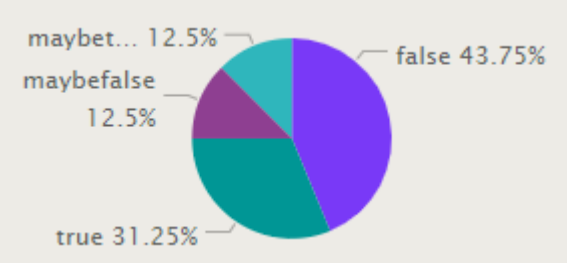

Figure 46 – Pie chart of results for question 4_3_3 for all organisations

The results from Figures 44 and 45 are linked to those in Figure 46, where 56.24% of respondents agreed that benefits were not or were probably not realised from their digital transformation. Once the wider benefits of digital transformation are realised, they then can be related to individuals specifically, which will increase overall awareness and understanding of the importance of digital transformation. Quantifying benefits from previous digital transformation can also be hugely useful when attempting to secure investment for future transformation, as previous benefits can be used to predict future benefits more accurately.

Question 4_5_2: Do you systematically assess the digital competencies of all staff across your business?

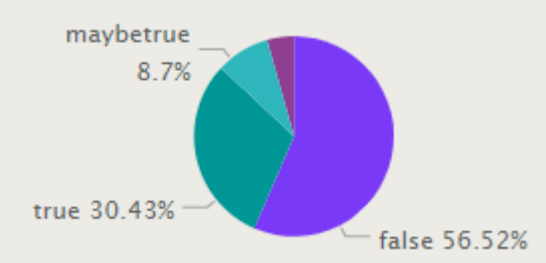

Figure 47 – Pie chart of results for question 4_5_2 for all organisations

Another hugely important – and often overlooked – area of digital transformation is regularly and systematically assessing digital competencies of staff. 80.71% of respondents answered that they did understand the digital skills gaps of their organisation, which is no surprise as only 39.13% felt that digital competencies were systematically assessed. A recommendation here would be to introduce a regular way of assessing digital competencies, to better understand gaps in capability and competency, such that training can be implemented where needed, and the digital skills gap can therefore be reduced.

Asset Management

Question 5_4_1: Are roles and responsibilities for asset management clearly defined?

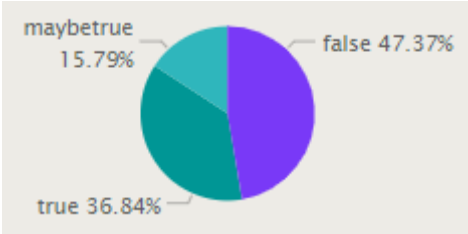

Figure 48 – Pie chart of results for question 5_4_1 for all organisations

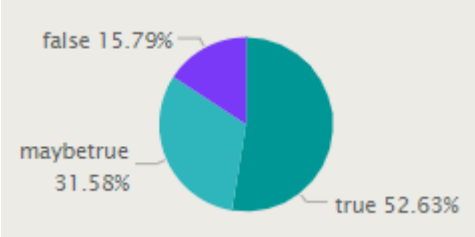

Figure 49 – Pie chart of results for question 5_4_1 for asset owners / operators

This question within the Asset Management category was divisive amongst the wider community, but less so among asset owners / operators. This suggests that although roles and responsibilities may be defined within asset management, this is not communicated with other organisations in the DT Hub community.

Asset Delivery

Question 6_1_1: Do investment decisions consider interactions and synergies between different assets operating as a system?

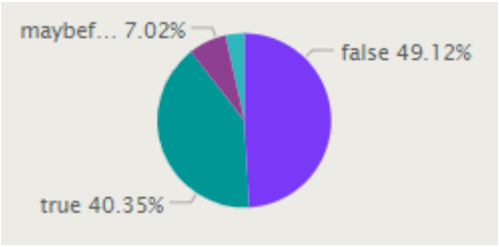

Figure 50 – Pie chart of results for question 6_1_1 for all organisations

One of the most divisive questions in this category was a question around synergies between different assets. The majority answered no or maybe no, and 47.37% of asset owners / operators answered no for this as well. Making investment decisions without considering the interactions and synergies between different assets makes the adoption of digital twins more complicated and expensive.

Question 6_3_1: Are reality capture technologies (e.g. LiDAR, photogrammetry) widely used for data collection?

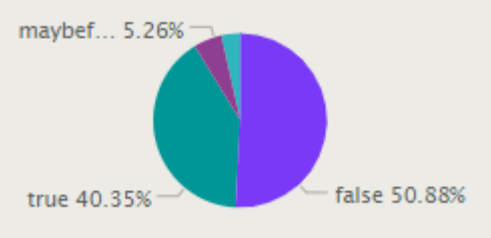

Figure 51 – Pie chart of results for question 6_3_1 for all organisations

Another question in this category to which most respondents answered no or maybe no was a question around the use of collection technologies, where 56.14% answered no or maybe no, as seen in Figure 51.

Asset Performance

Question 7_3_1: Are you able to effectively anticipate asset failure?

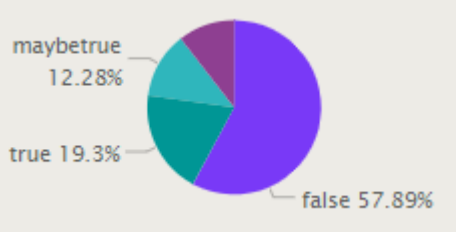

Figure 52 – Pie chart of results for question 7_3_1 for all organisations

Question 7_3_2: Is that only based on your staff's personal experience?

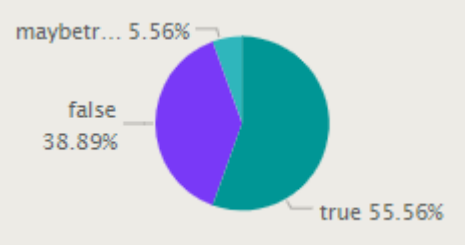

Figure 53 – Pie chart of results for question 7_3_2 for all organisations

Question 7_6_1: Are most decisions made on the basis of experience and instinct rather than informed by evidence?

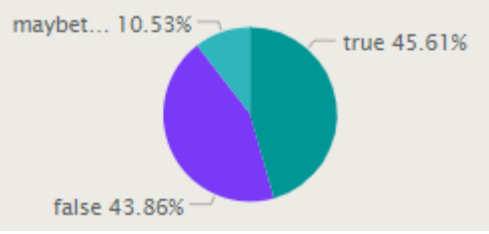

Figure 54 – Pie chart of results for question 7_6_1 for all organisations

Figure 52 shows that 68.42% of respondents answered no or maybe no to the question about effectively anticipating asset failure. Interestingly, 61.12% answered yes or maybe yes to the follow-on question about anticipation of asset failure being based on staff's personal experience, as can be seen in Figure 53. Expanding on this, when asked if most decisions were made on the basis of experience and instinct rather than informed by evidence, 56.14% answered yes or maybe yes as seen in Figure 54. These results suggest that up-to-date data is often not made readily available to be used to anticipate asset failure, and that those make decisions around asset failure anticipation do it based on personal experience. This can cause problems down the line as the reliance is on people rather than data, meaning it is harder for it to be transferred, verified, and built upon. The recommendation here would be to focus on this area of Asset Performance going forward.

Continuous Improvement

Question 8_1_2: Do you feel you take enough time to review past business performance?

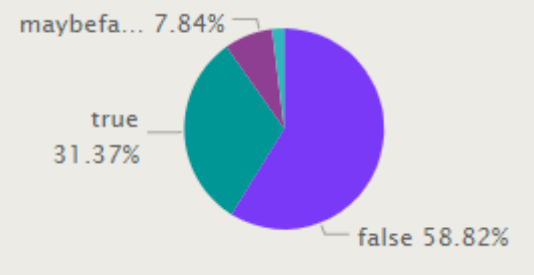

Figure 55 – Pie chart of results for question 8_1_2 for all organisations

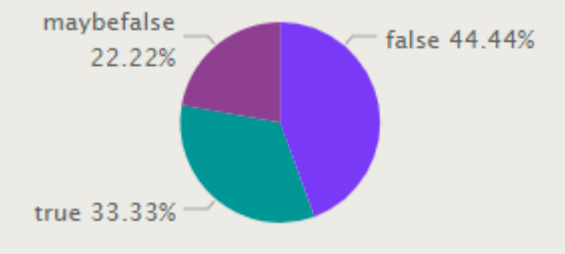

Figure 56 – Pie chart of results for question 8_1_2 for asset owners / operators

Figure 55 shows a high rate of 66.66% of respondents answering no or maybe no to the question about taking time to review past business performance. Similarly, when looking at asset owners / operators only in Figure 56, the same percentage of respondents answered no or maybe no. Learning from past business performance is hugely important in the context of digital transformation, just as it is in the wider business context. Just as organisations can learn from the benefits of previous transformation, so they can learn from previous successes and failures to implement best practice and avoid common pitfalls.

Question 8_3_3: Do you benchmark performance externally against your peers?

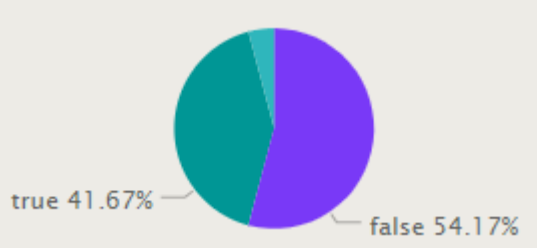

Figure 57 – Pie chart of results for question 8_3_3 for all organisations

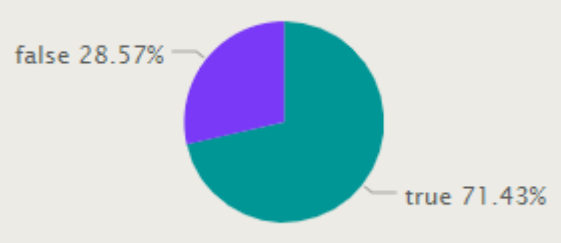

Figure 58 – Pie chart of results for question 8_3_3 for asset owners / operators

This question shows a difference in opinion between asset owners / operators and the wider DT Hub community, with 54.17% percent of respondents in the wider group answering no or maybe no (Figure 57) and only 28.57% of asset owners / operators answering the same way. This suggests that asset owners / operators mostly benchmark their performance against each other, but not against those in the wider group. Similarly, it suggests that many of the non-asset owning organisations do not compare themselves against any other organisation in the DT Hub community. Going forward, the Smart Infrastructure Index can be used to benchmark within the wider group, and the findings of this report should be shared amongst all organisations, which will hopefully increase uptake of the survey next year.

4.0 Conclusion & recommendations

4.1 Conclusion

The overarching observation of this year's Smart Infrastructure Index results is that on average, the digital maturity score of the DT Hub community has decreased. This decrease in score is consistent across the eight categories, with the most minor decrease being in Asset Performance, and the most significant decrease being in Customers. When looking comparing asset owners / operators only, the decrease in digital maturity scores was less noticeable, in fact, in the Asset Management, Asset Performance and Continuous Improvement categories there were increases in average scores this year. The Digital Twin category is that with the most relevance for the DT Hub community, added specifically for the community last year. As shown in this report, there was a decrease in score for this category for both the asset owners / operators and the wider DT Hub community.

However, as discussed in Section 3.2, there is reason to believe that despite the decreases in digital maturity scores, the overall digital maturity of the DT Hub community's member organisations has not necessarily dropped. There are two key factors which lead to this conclusion: first, that the demographic of respondents has changed, with the survey being sent to vendors and academia as well as asset owners / operators; and second, that the DT Hub community last year was much smaller than it is now, with far fewer organisations, who likely fall into the category of 'early adopters' of digital twins and digital more generally.

4.2 Recommendations

4.2.1 General recommendations for future benchmarking

To generate a stable baseline, it is recommended that significant changes are not made to the question set in 2022. With access to two years of data, the DT Hub community now has a benchmark to use in future cycles. Radically changing the question set could mean that this benchmark becomes outdated. Evidently, minor tweaks may be needed to keep the question set relevant.

As with last year, more responses would have enabled a greater granularity of insights from the results. Although there were more responses this year, the increase did not match the proportionate increase in DT Hub community membership. In future years, it is recommended that the DT Hub community explores other routes to gathering responses. The Infrastructure Client Group, for example, asks its representatives to gather responses from their organisations. DT Hub community members could be asked to do likewise within their member organisations in advance of the survey going live.

4.2.1 Recommendations to improve digital maturity scores

Digital Twin category

The overarching recommendation in this category is around communication. The discrepancy in digital maturity scores between asset owners / operators and the innovator community highlights that there is a lack of common understanding across those different groups who are needed to make a National Digital Twin a reality.

There are several ways in which to improve communication around digital twins. Small scale activities like encouraging knowledge and experience sharing across the entire DT Hub community, and large-scale initiatives like reviewing and improving the communication and digital strategies of asset owners / operators could both have a big impact on digital maturity scores across the DT Hub community. Those organisations who have digital twin strategies should be sharing these with their supply chain and wider.

It is clear from the differences in responses from different roles that there is no shared understanding of digital maturity within organisations. There will be some digital capabilities – such as Strategic Planning and Horizon Scanning – which the Board / Executive level respondents will have clearer sight of. Contrarily, there are other digital capabilities – such as Data Science and – which those in Operations are better placed to understand. In which case, increasing communication between board / executive level and other responsibility levels, so that there is a shared understanding of the current and future digital twin capability requirements across all roles within each organisation, would help organisations plan for a more digitally enabled future.

Core Index questions

As with the Digital Twin extension, improved communication could have a significant impact on digital maturity scores in future years. There are, however, other improvements which could be made.

Last year, results highlighted a possible link between those organisations which best understand their customers and their priorities. Therefore, one recommendation would be that asset owners / operators embrace digital tools and technologies to gather reliable, up-to-date data on the priorities of their customers and stakeholders, through engagement such as surveys, to ensure that these priorities are thoroughly and consistently understood. However, asset owners / operators could also learn from the innovator community with respect to customers. In many cases, innovators will be sector or industry-agnostic – meaning that there may be many lessons to be learned about customer understanding and preferences in other areas.

Commercially, one recommendation which would benefit the entire DT Hub community would be for asset owners / operators to share information on savings with suppliers and innovators, as well as to take a forward-thinking approach to the sharing of Intellectual property (IP). IP can be a sticking point for many innovators, who are more likely to bring their best innovation to the table if they have what they perceive as a fair allocation of IP. Clear communication of

the benefits of this kind of approach to vendor and supplier management from those who have attempted it will be crucial to encourage others to follow suit.

In the end, it is people, not technology, who will make initiatives like the National Digital Twin programme (NDTp) happen successfully. Therefore, understanding the digital competencies of the people within the DT Hub community's member organisations is critical. Regularly measuring digital competency levels, combined with horizon scanning and strategic planning to understand the future digital environment, can help organisations to stay ahead of the curve. There are tools available to support with this, including the NDTp's Skills and Competency Framework.

Finally, more focus on learning lessons from past performance in terms of digital initiatives will be vital moving forward. Often, case studies focus on successful pilot projects. However, those interested in digital twins may have as much, if not more, to learn from hearing about the failures of their peers as they do from their successes. An open approach to sharing these lessons could allow the industry to move forward quicker as a whole. A "fail fast", "Agile" approach can only be successful when time is taken to understand the reasons behind each failure. Benchmarking exercises, such as completing the Smart Infrastructure Index, can complement the lessons learned process by highlighting areas in which to focus to find best practice or weaknesses.

Annexe

This year, many of the questions in the Digital Twin category were updated to be more relevant for the wider DT Hub group, which includes non-asset owners/operators. The below table shows the 2020 questions alongside their corresponding 2021 updated question within each of the Digital Twin subcategories.

Index Category	Index Subcategory	2020 Original Question	2021 Updated Question
Digital Twin	**Approach**	Does your executive board believe that the creation of Digital Twins is fundamental to the success of your business?	Does your executive board believe that the creation of Digital Twins is fundamental to the success of your (or your clients') business?
		Does your organisation have a strategy on the creation of digital twins?	Does your organisation (or your client/supply chain) have a strategy on the creation of digital twins?
		Is it clear who is responsible for the strategy?	Is it clear who is responsible for the strategy?
		Does your organisation have a clear programme to deliver digital twins?	Does your organisation (or your client/supply chain) have a clear programme to deliver digital twins?
		Is it clear who is responsible for delivering the programme?	Is it clear who is responsible for delivering the programme?
		Is sufficient investment being made to deliver digital twins in alignment with your strategy?	Is sufficient investment being made to deliver digital twins in alignment with the strategy?
	Communication	Does your organisation communicate to its employees about digital twins on a regular basis?	Does your organisation communicate to its employees about digital twins on a regular basis?
		Do the communications focus solely on technology?	Do the communications focus solely on technology?
		Do the communications create a common understanding on topics relating to digital twin across all areas of your business?	Do the communications create a common understanding on topics relating to digital twin across all areas of your business?
		Do people in your organisation understand how digital twins will benefit your organisation, including how it will deliver outcomes for your customers?	Do people in your organisation understand how digital twins will benefit your organisation, including how it will deliver outcomes for your customers?

		Does your organisation communicate to its customers about digital twins on a regular basis?	Does your organisation communicate to its customers about digital twins on a regular basis?
	People	Does your organisation understand its current and future capability requirements for developing, delivering, using and maintaining digital twins?	Does your organisation understand its current and future capability requirements for developing, delivering, using and/or maintaining digital twins?
		Do third parties assist your organisation in developing, delivering and maintaining digital twins?	Do you collaborate with other organisations in developing, delivering and maintaining digital twins?
		Is your organisation investing to develop and/or acquire talent required to develop, deliver and use digital twins?	Is your organisation investing to develop and/or acquire talent required to develop, deliver and use digital twins?
		Is your organisation adjusting competencies across all roles to increase capability in data literacy?	Is your organisation adjusting competencies across all roles to increase capability in data literacy?
		Is your organisation recognising and rewarding people at all levels who are contributing to the implementation of digital twins?	Is your organisation recognising and rewarding people at all levels who are contributing to the implementation of digital twins?
	Data	Does your organisation value its data?	Does your organisation value its data?
		Is data regularly used to inform decision making?	Is data regularly used to inform decision making?
		Does the quality of data present regular challenges?	Does the quality of data present regular challenges?
		Is data collected, managed and maintained so that it can be relied upon for the creation of digital twins?	Is data collected, managed and maintained so that it can be relied upon for the creation of digital twins?
		Is data collected at appropriate frequencies to maintain an accurate digital twin?	Is data collected at appropriate frequencies to maintain an accurate digital twin?
		Does your organisation share data with other organisations for the creation of digital twins?	Does your organisation (or your client/supply chain) share data with other organisations for the creation of digital twins?
	Technology	Does your organisation use technology to measure the performance of its assets?	Does your organisation (or your client/supply chain) use technology to measure the performance of its assets?
		Does your organisation use technology to consistently manage and share its asset data?	Does your organisation (or your client/supply chain) use technology to consistently manage and share its asset data?

		Does your organisation use technology to analyse its asset data to provide insights to support decision making?	Does your organisation (or your client/supply chain) use technology to analyse its asset data to provide insights to support decision making?
		Does your organisation make use of visualisation technology to present complex information in the context of 3D asset models?	Does your organisation (or your client/supply chain) make use of visualisation technology to present complex information in the context of 3D asset models?
		Does your organisation make use of mobile technology to improve the effectiveness of asset interventions?	Does your organisation (or your client/supply chain) make use of mobile technology to improve the effectiveness of asset interventions?
		Does your organisation make use of machine learning to continually improve its digital twins?	Does your organisation (or your client/supply chain) make use of machine learning to continually improve its digital twins?
	Alignment	Does your organisation apply the Gemini principles when creating digital twins?	Does your organisation apply the Gemini principles when creating or developing digital twins?
		Does your organisation share its digital twin experiences (successes and failures) with other organisations?	Does your organisation share its digital twin experiences (successes and failures) with other organisations?
		Does your organisation apply the Information management frameworks when creating digital twins?	Does your organisation apply the Information management frameworks when creating or developing digital twins?
	Outcomes	Has your organisation been able to show any positive financial outcomes (including productivity gains, reductions in cost) from its investment in digital twins?	Has your organisation (or your client/supply chain) been able to show any positive financial outcomes (including productivity gains, reductions in cost) from its investment in digital twins?
		Has your organisation been able to show positive environmental outcomes from its investment in digital twins?	Has your organisation (or your client/supply chain) been able to show positive environmental outcomes from its investment in digital twins?
		Has your organisation been able to show positive social outcomes from its investment in digital twins?	Has your organisation (or your client/supply chain) been able to show positive social outcomes from its investment in digital twins?
		Has your organisation created new products or services from its investment in digital twins?	Has your organisation (or your client/supply chain) created new products or services from its investment in digital twins?
		Has your organisation created new jobs and capabilities from its investment in digital twins?	Has your organisation (or your client/supply chain) created new jobs and capabilities from its investment in digital twins?

	Design	Does your organisation (or your supply chain) use accurate digital models of your existing assets as the basis of design?	Does your organisation (or your client/supply chain) use accurate digital models of your existing assets as the basis of design?
		Is all of your design information developed using a common framework of standards and requirements?	Is all of your design information developed using a common framework of standards and requirements?
		Is all of your design work developed using a secure common data environment?	Is all of your design work developed using a secure common data environment?
		Do you validate that all design information conforms to your standards and requirements?	Do you validate that all design information conforms to your standards and requirements?
		Do you regularly assess your supply chain's capability for delivering design information using digital techniques?	Do you regularly assess your supply chain's capability for delivering design information using digital techniques?
		Do you analyse design information across multiple projects to make decisions on asset performance and/or cost?	Do you analyse design information across multiple projects to make decisions on asset performance and/or cost?
	Build	Is all of your construction information developed using a common framework of standards and requirements?	Is all of your (or your client/supply chain's) construction information developed using a common framework of standards and requirements?
		Do you use a secure common data environment to enable the secure sharing of information between client, design teams, construction team and the supply chain?	Do you use a secure common data environment to enable the secure sharing of information between parties (ie between client, design teams, construction team and the supply chain)?
		Can you demonstrate an improvement in safety during construction through the use of digital technologies?	Can you (or your client/supply chain) demonstrate an improvement in safety during construction through the use of digital technologies?
		Can you demonstrate an improvement in quality during construction through the use of digital technologies?	Can you (or your client/supply chain) demonstrate an improvement in quality during construction through the use of digital technologies?
		Can you demonstrate an improvement in productivity during construction through the use of digital technologies?	Can you (or your client/supply chain) demonstrate an improvement in productivity during construction through the use of digital technologies?
		Do you regularly assess your supply chain's capability for delivering construction using digital techniques?	Do you regularly assess your supply chain's capability for delivering construction using digital techniques?
		Do you analyse construction information across multiple	Do you analyse construction information across multiple projects to

		projects to make decisions on asset performance and/or cost?	make decisions on asset performance and/or cost?
	Operate	Does your organisation make use of real time information to monitor the performance of any of its assets?	Does your organisation (or your client/supply chain) make use of real time information to monitor the performance of any of its assets?
		Is real time information used to predict and avoid disruption of services?	Does your organisation (or your client/supply chain) use real time information to predict and avoid disruption of services?
		Is real time information used to increase the operational performance of your assets?	Does your organisation (or your client/supply chain) use real time information to increase the operational performance of your assets?
		Does your organisation make use of real time information to monitor the performance of most of its assets (25% to 75%)?	Does your (or your client/supply chain) make use of real time information to monitor the performance of most of its assets (25% to 75%)?
		Does your organisation make use of real time information to monitor the performance of the majority of its assets (≥75%)?	Does your organisation (or your client/supply chain) make use of real time information to monitor the performance of the majority of its assets (≥75%)?
	Integrate	Is information from across design, build and operate used to make future planning decisions?	Does your organisation (or your client/supply chain) use information from across design, build and operate to make future planning decisions?
		Do you consume data from other organisations to make better decisions about the services you deliver?	Does your organisation (or your client/supply chain) consume data from other organisations to make better decisions about the services it delivers?
		Do you share your data with other organisations through open data agreements?	Do you (or your client/supply chain) share your data with other organisations through open data agreements?
		Do you share your data with other organisations through data sharing agreements?	Do you (or your client/supply chain) share your data with other organisations through data sharing agreements?
		Do you publicly share metrics and quantified benefits relating to the use digital twins to improve citizen quality of life?	Do you (or your client/supply chain) publicly share metrics and quantified benefits relating to the use digital twins to improve citizen quality of life?

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