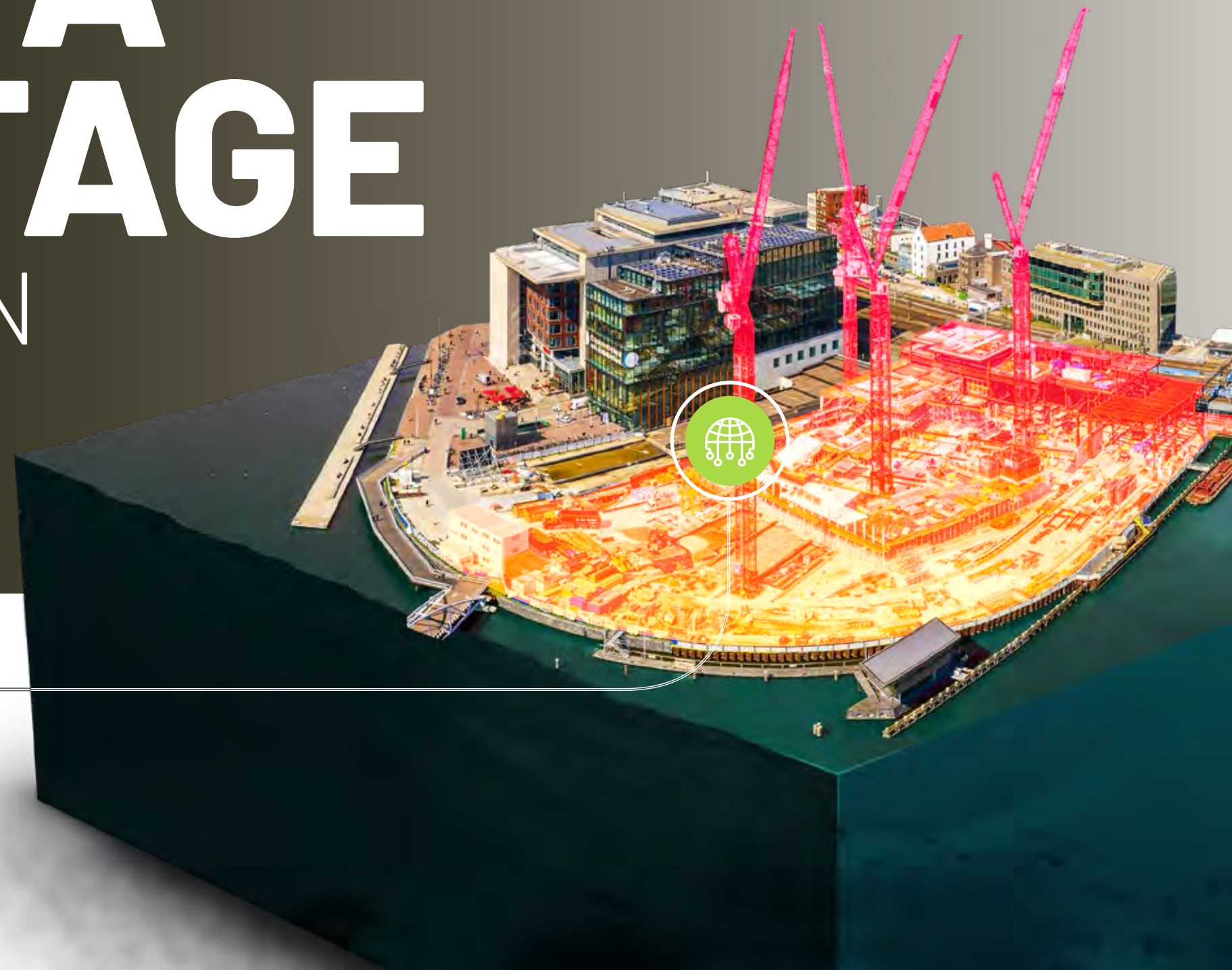# HARNESSING
THE DATA ADVANTAGE
IN CONSTRUCTION

Why adopting a data strategy can bring firms a competitive edge.

FMi | AUTODESK

FORWARD

Today's construction industry is under more pressure than ever to deliver projects that are on time and on budget—all while dealing with record global labour shortages, supply chain issues, and other challenging external constraints. Factors like accelerated construction schedules mean critical decisions must be made quickly by the project leaders working in the field and in the office. The quality of these decisions often determines a project's success or failure.

Technology adoption in our industry has rapidly accelerated in recent years and we're on a journey to full-scale digital transformation. As a result, the volume of project data has grown exponentially—with construction leaders identifying that their own data has doubled in just the last three years.

A key factor that empowers these leaders to quickly make critical decisions in the field is access to accurate project data.

To better understand how our industry is managing these challenges, Autodesk partnered with FMI to survey over 3,900 industry leaders worldwide to understand their current data strategies. The findings show that many in the industry agree—operating without a formal strategy for collecting, managing, and using data poses a significant risk for many firms. These are themes I have heard myself during conversations with leaders in the construction industry.

I invite you to review the results of our analysis and the guidance contained within this report. Ultimately, the real value that technology brings to your business is the ability to learn from each piece of data to help you achieve your business goals.

Jim Lynch

Jim Lynch
Senior Vice President & General Manager
Autodesk Construction Solutions
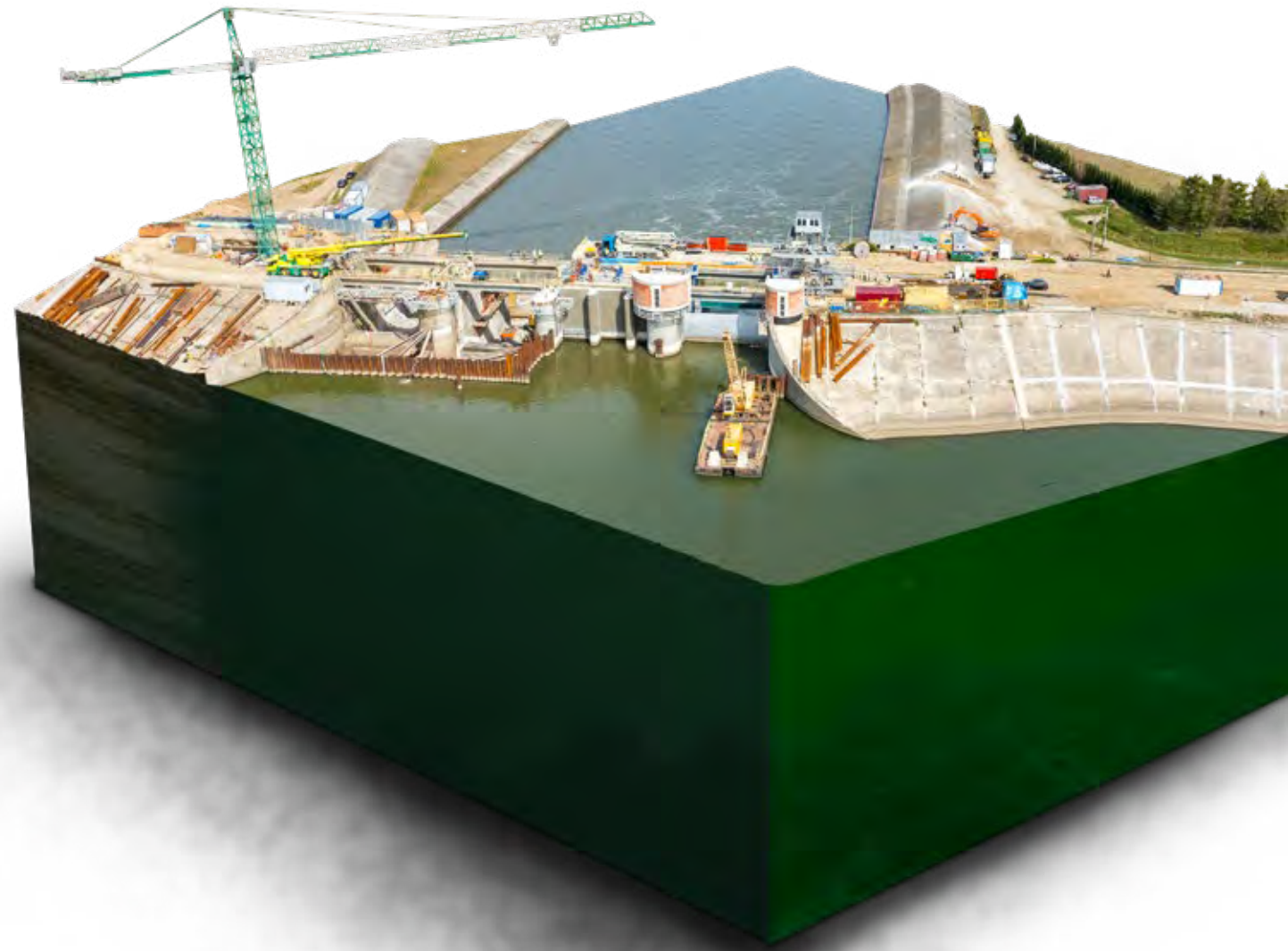
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KEY TERMS AND DEFINITIONS

This report includes several references to project-related data and information collected during the design and construction of buildings and infrastructure. For clarity, key terms and acronyms are defined below.

- **AEC** — Architecture, Engineering, and Construction

- **AI** — Artificial Intelligence

- **Bad Project Data** — Bad data is either inaccurate, incomplete, inaccessible, inconsistent, or untimely. In other words, it cannot be used to provide either usable information or actionable insights.

- **CDE** — Common Data Environment

- **Construction Technology** — Construction technologies include hardware (e.g., cameras, sensors) and software (e.g., BIM, SaaS tools, applications) that collects and/or creates project data.

- **CRM** — Customer Relationship Management

- **Data** — Project-related measurements, observations, or statistics, including building information modeling (BIM) inputs, material quantities, safety incidents, request for information (RFI) data, schedules, assigned staff, and cost data.

- **Data Strategy** — The framework for capturing and managing data.

- **Data Plan** — The actual implementation of a data strategy.

- **Information** — Project-related information that has been organised in a structured environment, providing context, revealing relationships, and making information understandable and usable.

- **Insight** — An understanding of what is causing the relationships or trends that information reveals, making the information actionable. With insight into project information, decisions should produce intended project outcomes and results.

- **KPI** — Key Performance Indicator

- **Usable Data** — Usable project data is readily accessible, consumable, understandable, and actionable. Usable data must be accurate and formatted effectively and efficiently.

SURVEY DEMOGRAPHICS

Survey respondents represent the opinions and experience of 3,916 global construction industry stakeholders (project owners, architects/engineers, managers, general contractors, and specialty trade contractors) across 18 countries and three regions: North America, Asia-Pacific (APAC), and Europe.

TABLE 1
Respondent distribution (3,913)

NOAM		APAC		EUROPE	
Canada	366	Australia	102	Belgium	100
U.S.A.	1,927	Hong Kong	102	Denmark	100
		India	102	Finland	106
		New Zealand	100	France	100
		Singapore	102	Germany	102
				Ireland	102
				Luxembourg	103
				Netherlands	101
				Norway	101
				Sweden	100
				U.K.	100

3,916
GLOBAL CONSTRUCTION INDUSTRY STAKEHOLDERS

- PROJECT OWNERS
- ARCHITECTS/ENGINEERS
- GENERAL CONTRACTORS
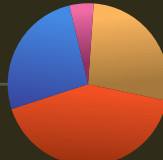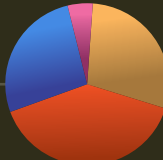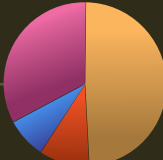- SPECIALTY TRADE CONTRACTORS

3
REGIONS

- NORTH AMERICA (NOAM)
- ASIA-PACIFIC (APAC)
- EUROPE

18
COUNTRIES

TABLE 2
Respondent distribution by region and organisation type.

	NOAM	APAC	EUROPE	TOTAL
■ Project Owner	8%	29%	28%	16%
■ Architect/ Engineer	10%	40%	43%	23%
■ Construction Manager/ General Contractor	49%	27%	24%	39%
■ Specialty Trade Contractor	33%	5%	5%	22%

TABLE 3
Respondent distribution by region and role.

	NOAM	APAC	EUROPE	TOTAL
Field Supervision & Project Management	55%	63%	50%	55%
IT Leader/CTO/CIO	5%	4%	3%	3%
Quality & Safety Manager	1%	1%	3%	2%
Construction Data Manager/ Data Scientist	4%	4%	6%	5%
Director of Innovation/ Innovation/Technology Lead	2%	1%	2%	2%
C-suite/Executive Team	3%	3%	6%	5%
Precon/Precon Manager	3%	3%	4%	3%
Business Development & Marketing	1%	>1%	2%	1%
BIM/VDC Manager	>1%	>1%	3%	2%
Operations Manager	2%	3%	10%	7%
Owner	23%	16%	9%	13%
Owner Representative	>1%	1%	3%	2%

TABLE 4
Respondent distribution by region and annual revenue in dollars.

|	NOAM	APAC	EUROPE	TOTAL
Less than $20 million	44%	12%	14%	31%
$20 million to $100 million	30%	28%	29%	29%
$101 million to $500 million	15%	42%	43%	27%
$501 million to $1 billion	6%	16%	11%	9%
More than $1 billion	5%	2%	3%	4%

EXECUTIVE SUMMARY

In construction, decisions are usually made in an environment where some amount of data is available to consider. But all too frequently, that data is not easily accessible for quick decisions, or even worse, the available data is simply bad*. Across the globe, the ability to utilise data in an insightful manner is no longer a nice-to-have, it has become a primary source of competitive advantage. Those who utilise their data to make informed decisions and gain performance insights from it will ultimately emerge as leaders in construction.

The research shows that adopting a data strategy can eliminate many avoidable costs in construction, both direct and indirect. It's clear that making decisions using "good" data can propel an organisation to a higher level of performance. Fortunately, the future

for a data-driven construction industry is bright—with many industry leaders identifying that hiring employees with data management skills is now a core component of their operating model.

Read on to learn more about the impacts bad data has on the construction industry. Throughout this report you will find insights from industry leaders on how to begin creating your own data strategy, including actionable steps that can quickly bring improvements to how your organisation manages data.
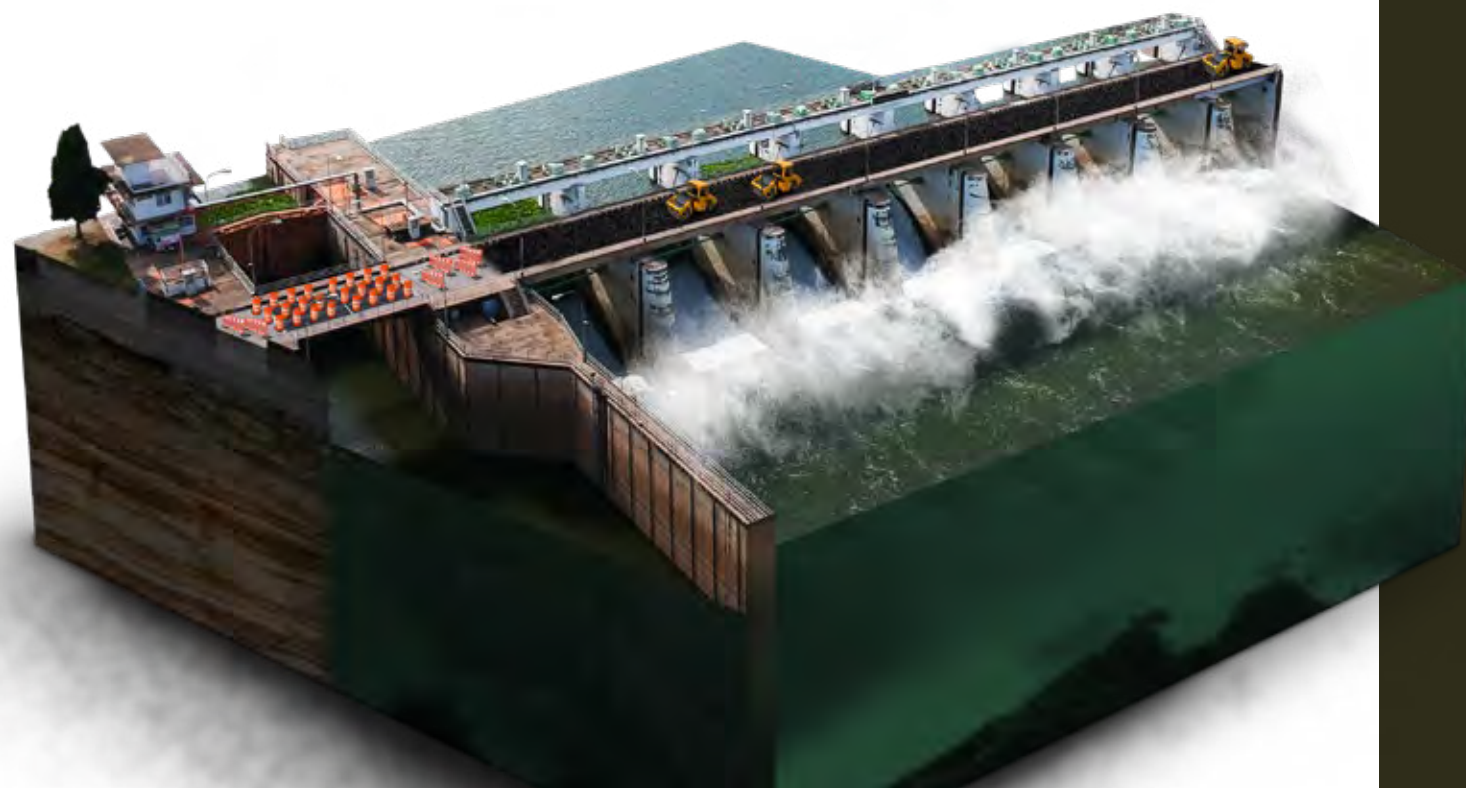
When asked about their current relationship with construction data, respondents indicated...

- **Volume of available project data DOUBLED** in the last 3 years

- **75%** stated an increasing need for rapid decision-making in the field

- An alarming 30% shared that over **50%** of their data is **bad**

- Only **36%** have implemented a process for identifying bad data and repairing it

Bad Data = Bad Outcomes. Respondents stated...

- **55%** have implemented a formal data strategy for project data

- **12%** always incorporate project data into their decision-making
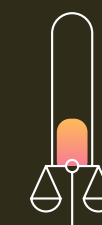
- **1/3** of all poor decisions were made as a result of bad data

The cost of bad data is high. In 2020 ...

Global GDP was
- **$84.5 TRILLION**[**]

Construction accounted for

13.2% of Global GDP **

- Bad data in construction may have cost **$1.84 TRILLION** due to poor decision making**

- Additionally, bad data may have caused **14%** of all construction rework**

  causing
- **$88.69 BILLION** * in avoidable rework worldwide*

What does this mean for you? Here's an example...

The total cost of bad data for a contractor performing **$1 BILLION** in annual revenue

- could be as high as **$165 MILLION****

- including **$7.1 MILLION**** in avoidable rework directly caused by bad data**

*Bad data is either inaccurate, incomplete, inaccessible, inconsistent, or untimely. It cannot be used to provide either usable information or actionable insights.

THE COST OF CONSTRUCTION'S DATA DILEMMA

Material waste and schedule overruns are common concerns in construction and those challenges are only increasing in scale over time. A recent study from Transparency Market Research projected that global construction waste will reach 2.2 billion tons by 2025[1]. And with mega-projects becoming increasingly common undertakings, McKinsey found that 77% of them are delivered at least 40% late[2].

In research from IBM, they estimated that bad data cost the US economy $3.1 trillion[3]. This startling figure represented 16.5% of gross domestic product (GDP) that year. When applying the ratio of bad data to the global economy in 2020—a GDP of $84.5 trillion—it may have had a global impact of nearly $14 trillion.

GLOBAL CONSTRUCTION WASTE BY 2025

2.2 BILLION TONS

77%
OF MEGA-PROJECTS DELIVERED AT LEAST
40% LATE

In 2020, Bad Data Cost the Global Construction Industry Over

$1.84 TRILLION

Taking into account projections by Reuters that construction accounted for 13.2% of global GDP[4] in 2020, bad data may have cost the industry $1.84 Trillion in 2020.

Calculating the cost of bad data.

	16.5%	The Percentage of Bad Data's Impact to GDP of United States in 2016[3]
×	$84.5 Trillion	2020 Global GDP
=	$13.94 Trillion	2020 Global Cost of Bad Data
×	13.2%	2020 Construction Sector Share of Global GDP[4]
=	**$1.84 Trillion**	Total Cost of Construction's Bad Data in 2020

When considering a contractor that performs $1 Billion in work annually, it indicates that upwards of $165 Million of their revenue could have been impacted by bad data.

What does this mean for you? Here's an example…

×	$1 Billion	Revenue of a $1 Billion General Contractor
	16.5%	Cost of Bad Data[3]
=	**$165 Million**	Cost of Bad Data for a $1 Billion Contractor

14% of all Rework in Construction Globally is Caused by Bad Data

Survey respondents clearly stated that the need for making quick decisions in the field is rapidly increasing—and with that increase, so will the costs of making those decisions using bad data.

An earlier study from Autodesk and FMI highlighted that poor project data and miscommunication is responsible for 48% of all rework in the United States[5]. And in 2020, the global cost of rework was estimated to represent 5% of all construction spending[6], or $625 billion according to Navigant.

While bad data is not the only factor that causes rework, a McKinsey study highlighted that 43% of organisations do not consistently make high-quality decisions[7]. Furthermore, our research uncovered that one out of every three (33%) poor decisions are made as a result of bad data. **This means decisions using bad data may have had a global rework cost of $88.69 billion, or 14% of all rework performed in 2020.**

Global rework caused by bad data.

	$12.5 Trillion	—— Global Construction Spend
×	5%	—— Construction Spending on Rework[8]
=	$625 Billion	—— The Cost of Rework Globally
×	43%	—— Firms Not Consistently Making High Quality Decisions[7]
=	$269 Billion	—— The Cost of Rework From Making Poor Decisions
×	33%	—— Bad Decisions Attributable to Bad Data
=	**$88.69 Billion**	—— The Cost of Rework Associated with Bad Data

When applying this model to the revenue of a $1 billion general contractor, they would have performed $50 million in rework in 2020. Assuming 14% of this rework was caused by bad data, it means that $7.1 million of waste could have been avoided by making decisions using accurate data.

What does this mean for you? Here's an example...

	$1 Billion	—— Revenue for a $1 Billion General Contractor
×	5%	—— Construction Spend in Rework[8]
=	$50 Million	—— Cost of Rework for a $1 Billion General Contractor
×	14.19%	—— Percent of Avoidable Rework Caused by Decisions Using Bad Data
=	**$7.1 Million**	—— Value of Avoidable Rework from Bad Data

CONSTRUCTION DATA—QUANTITY DOES NOT EQUAL QUALITY

The volume of data collected in the construction industry is rapidly rising due to the increased adoption of technology. This should prompt industry leaders to step back and ask themselves this important question: "How much of our data can be used to make informed and actionable decisions?"

More than 80% of respondents reported an increase in the project data their organisations are creating from construction technology over the past three years (see Table 5). Almost half experienced more than a 50% increase.

TABLE 5

How much project data (text files, model data, photos, satellite imagery, sensor data, etc.) do you estimate your organisation is creating from construction technology your organisation employs now compared to three years ago?

- More than 75% increase
- >50% but less than 75% increase
- 25–50% increase
- No change
- 25–50% decrease
- >50% but less than 75% decrease
- More than 75% decrease

1%
1%
4%
17%
30%
11%
36%

Despite the Masses of Data, Much Is Unusable

As a result of the dramatic increase in technology adoption, a substantial amount of data is being generated throughout the project lifecycle. Unfortunately, as Table 6 shows, more than 80% of all respondents describe at least 25% of their project data as unusable.

In contrast, only 17% of all respondents describe more than 75% of their project data as usable. For most respondents, about half of their organisation's project data are usable.

Respondents to the survey didn't indicate any single reason that explains what makes their project data unusable (see Table 7). Of the five potential data challenges presented, each option averaged a ranking of three out of five, meaning challenges are unique to each organisation. However, the inability to easily combine data from different sources was ranked either first or second by nearly 50% of all respondents.

TABLE 6

What percent of the project data that your organisation has access to would you describe as "usable" (readily accessible, consumable, understandable, and actionable) or something you can act on?
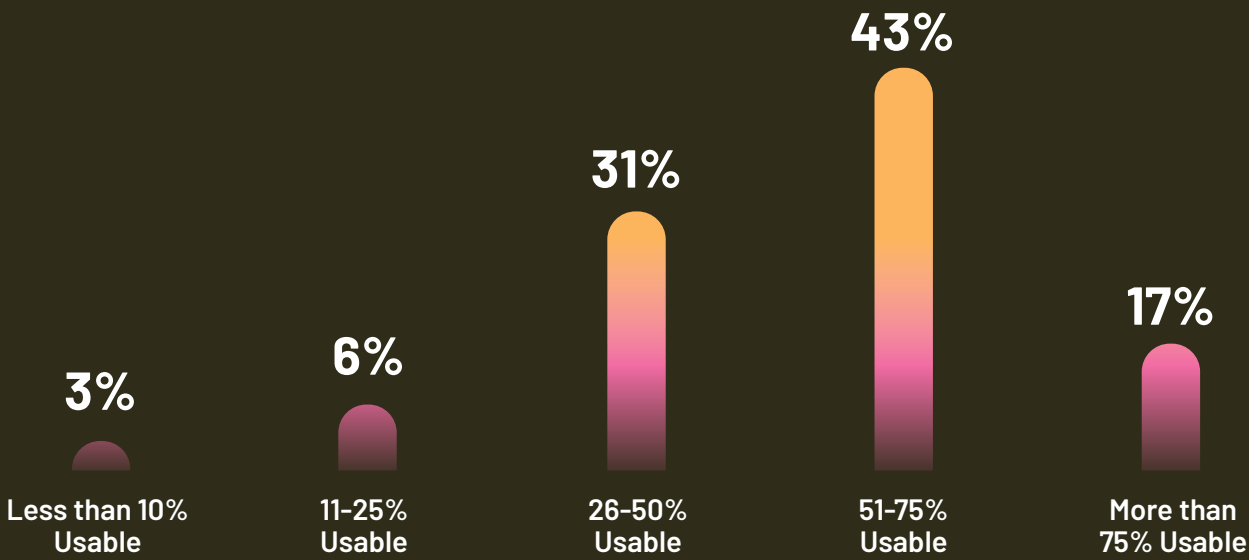
TABLE 7

How do you rank the following from most challenging to least challenging when working with your organisation's project data?

Less than 10% Usable	11–25% Usable	26–50% Usable	51–75% Usable	More than 75% Usable
3%	6%	31%	43%	17%

Data from one source cannot be easily combined with another source (e.g. data silos)

Data is incomplete and missing certain aspects that would make it more usable

Data is not easily accessible, either due to its structure or the unwillingness of others to share

There is too much data to know how to use it efficiently/effectively

Errors raise suspicion about that data and its usefulness/value (e.g. bad data)

1 Least Challenging   2   3   4   5 Most Challenging

Beyond Unusable, It's Bad Data

In this analysis, bad data are defined as inaccurate, incomplete, inconsistent, or untimely. Half of all respondents characterise between 20% and 50% of their organisation's project data as bad (see Table 8). Even worse, 30% of respondents indicated that more than half of their project data are bad.

30%
INDICATED THAT OVER
50%
OF THEIR PROJECT DATA ARE BAD

One third of respondents report that bad project data resulted in poor decisions more than 50% of the time (see Table 9). Similarly, half of all respondents suggest that bad project data resulted in a poor outcome in a third of their decision-making.

1/3
REPORT BAD PROJECT DATA RESULTED IN POOR DECISIONS OVER
50%
OF THE TIME

TABLE 8
What percent of your organisation's project data would you characterise as bad? Bad data is inaccurate, incomplete, inconsistent, or untimely data.
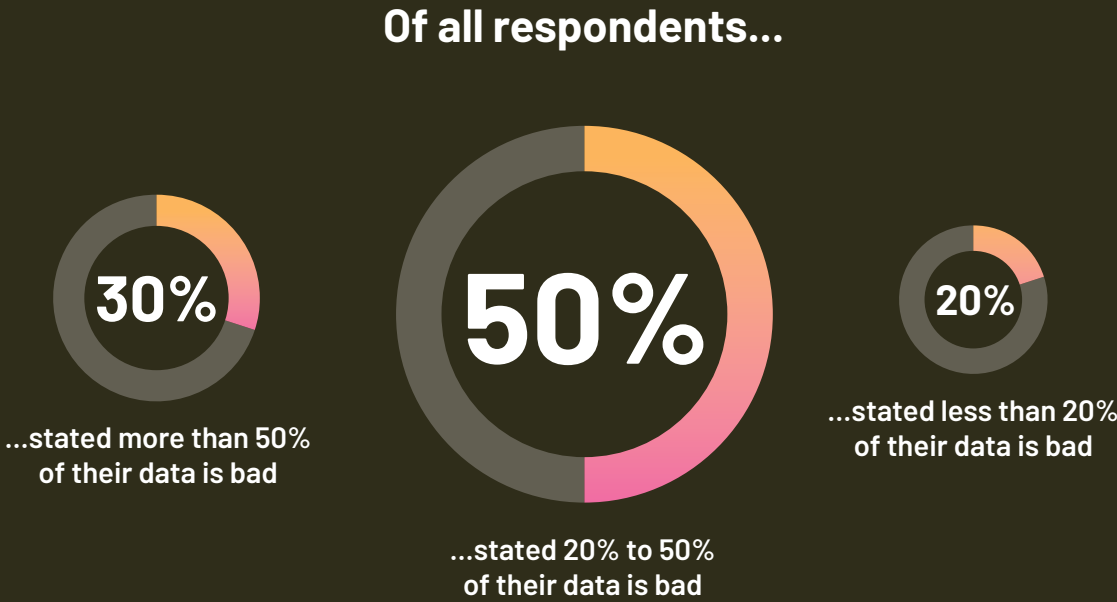
TABLE 9
How frequently does bad project data/ information result in poor decisions?

Of all respondents...

30%
...stated more than 50% of their data is bad

50%
...stated 20% to 50% of their data is bad

20%
...stated less than 20% of their data is bad

Of all respondents...

34%
...stated that bad project data resulted in poor decisions more than 50% of the time

66%
...stated that bad project data resulted in poor decisions less than 50% of the time
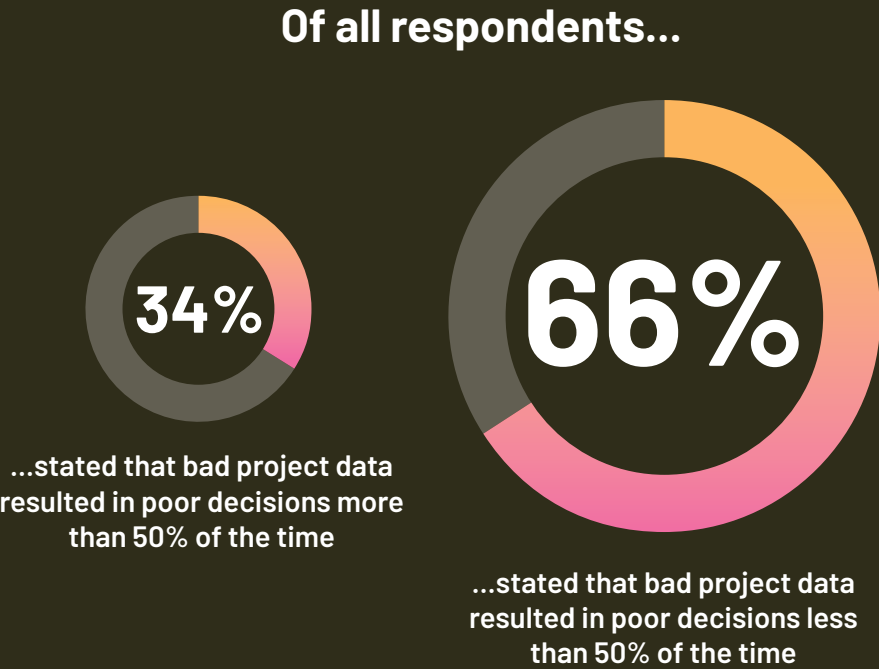
Why Do Good Firms Create "Bad" Project Data?

Since no single reason was selected as the main culprit for bad project data (see Table 10), it's clear that data management solutions and the challenges the industry faces are unique to each organisation's way of working.

**THE MOST COMMON
CONTRIBUTORS TO
BAD PROJECT DATA**

24% *
**INACCURATE/
INCORRECT DATA**

24% *
MISSING DATA

21% *
WRONG DATA

Note the following definitions:

- **Inaccurate/Incorrect Data** — Data collected with the right intention, but errors occurred along the way. For example, a measurement sensor was not calibrated, or a "5" was entered into a data field instead of a "6".

- **Missing Data** — Pieces of data being completely absent. For example a contractor forgot to upload progress pictures from the field or a vendor's phone number was not recorded.

- **Wrong Data** — Data collected that cannot be used for its intended purpose. For example, a contractor might believe they captured data on how much time was required for rework completed, but later discover they only captured the cost impact. Making decisions from the 'wrong data' will prevent them from correctly estimating schedule impacts for similar rework in the future.
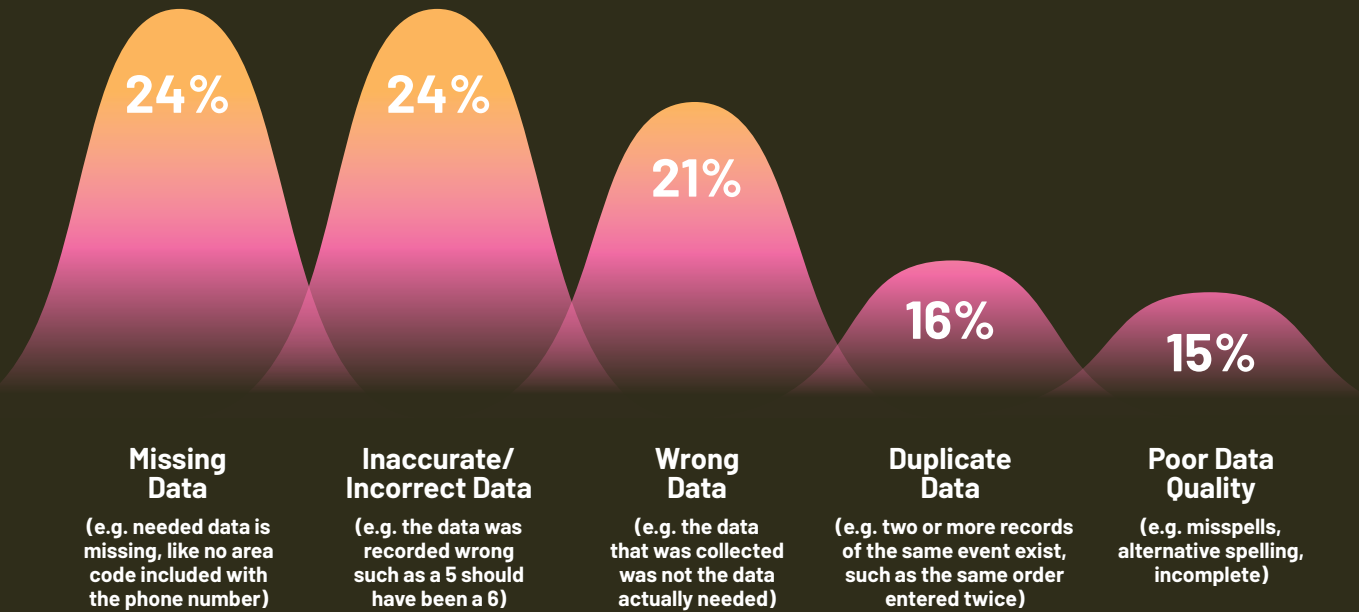
Our discussions with industry leaders suggest that the largest cause of "bad" data is from data entry inconsistencies. For example, several interviewees noted multiple spellings and punctuations for the same person, company, or address in common data sources like spreadsheets, customer relationship management (CRM systems), and email communication. Discovering and correcting problems with a specific designer, contractor, or supplier is difficult when consistent data standards have not been implemented across an organisation.

> "When we started to review the quality of our data, we encountered no fewer than 20 different spellings for the same supplier. Sometimes the first letter was capitalised, and sometimes it wasn't. Time and time again, we'd find instances of corporation vs. corp., company vs. co., and so on."

Chief Information Officer
General Contractor (North America)

TABLE 10
Which of the following do you believe most contributes to bad project data?

24%

24%

21%

16%

15%

Missing Data	Inaccurate/Incorrect Data	Wrong Data	Duplicate Data	Poor Data Quality
(e.g. needed data is missing, like no area code included with the phone number)	(e.g. the data was recorded wrong such as a 5 should have been a 6)	(e.g. the data that was collected was not the data actually needed)	(e.g. two or more records of the same event exist, such as the same order entered twice)	(e.g. misspells, alternative spelling, incomplete)

MAKING FIELD DECISIONS USING DATA IS CRITICAL

Although most respondents agreed that data-driven decisions are required for better outcomes, getting the data into a usable state is another common challenge. Hiring a data scientist may not be practical or economical for all companies, so managing the data has fallen largely on the shoulders of existing staff.

In addition to keeping projects and personnel on track, project management and field supervision staff are the ones collecting, managing, and analysing data each week. In our discussions with industry leaders, they indicated that when in the field, many project leaders are required to make fast decisions with increasing frequency, often without guidance from others.

Seventy-five percent of respondents agreed or strongly agreed that the need for quick, real-time decision-making is increasing at the project level (see Table 11).

With many construction projects, decisions often need to be made faster because of schedule acceleration/compression, emergency response, or stakeholder requests.

"
"Every project we're on seems to be on an accelerated schedule. Everything is moving so fast. Although our superintendents have always had a lot of autonomy to make project decisions, they always discussed them with the project manager or someone else, like the architect or owner. Now it seems they are making key decisions that could impact the schedule without a lot of input from others. That's where having good project data comes into play. It's the best thing to avoid a bad decision."

Chief Data and Innovation Officer
Executive Vice President, General Contractor (North America)

TABLE 11

Agree or disagree? The need for autonomy for rapid decision-making is increasing at the project manager and field supervisor levels due to such things as schedule acceleration/compression, emergency response, stakeholder requests, etc.

51%

24%

20%

4%

1%

Strong
Agree

Agree

Neither Agree
nor Disagree

Disagree

Strongly
Disagree
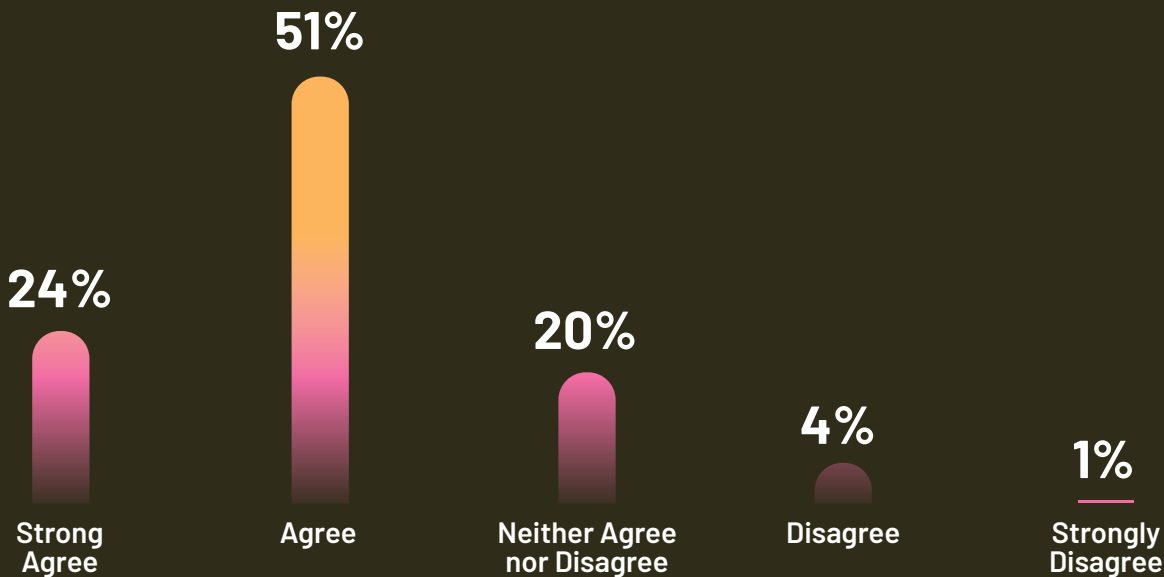
"Good" Project Data for Successful Decision Making

Respondents indicated that having readily available data is essential to accurate project decision-making. As Table 12 illustrates, "time constraint/urgency of decision" was most selected as the greatest risk (43%) to project decision making. This indicates that the quality of project data needs to improve if project leaders are to make critical decisions in the field quickly and autonomously. Respondents also indicated that an absence of reliable data and not having experience with similar projects brought considerable risk to their projects.
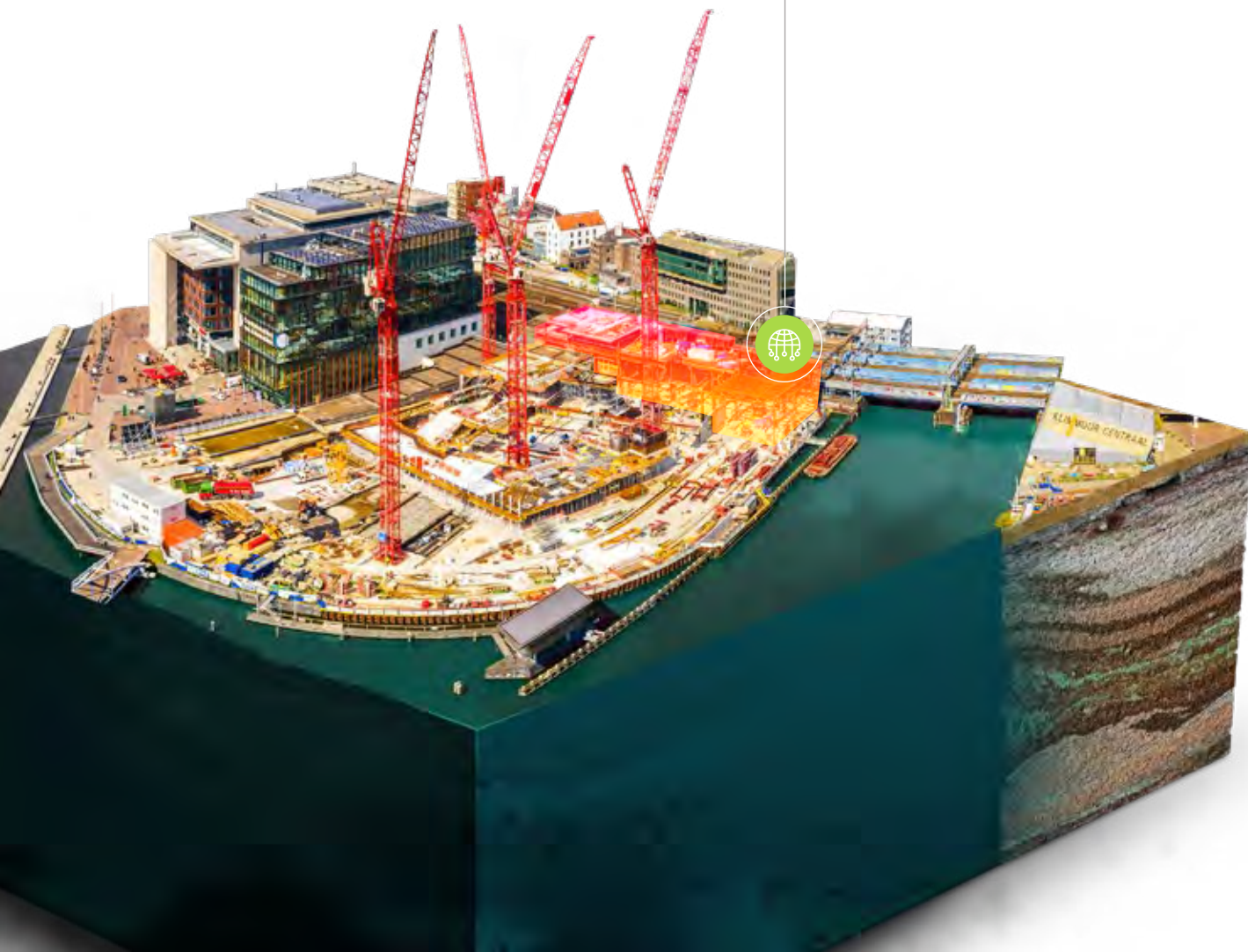
"We are using project data to alert us to things before a problem arises. For example, we can track the number of encountered defects. We know once they exceed a certain number, the schedule is going to be delayed. Having these insights allows us to address things when we can still do something about them."

BIM Coordinator
General/Main Contractor (Europe)

TABLE 12
Which of the following two areas presents the greatest risk to project decision-making?

Time Constraint/Urgency of Decision — **43%**

Lack of Reliable Data — **36%**

Lack of Experience with Similar Project Decisions/Issues — **36%**

Lack of Understanding the Relationship to Other Projects and organisation More Broadly — **33%**

Lack of Input from Others (Particularly Senior Staff) — **29%**

Personal Bias/Conflict — **22%**

Data Management and Analysis Skills are now a Requirement

Hiring staff with data management and analysis skills continues to be a critical competitive advantage. Teams that train both their existing staff and new hires to better capture, manage, and analyse project data will further widen that advantage.

Thirty-nine percent of respondents stated that data management and analysis skills will be "extremely" or "very" important for project management and field supervisors to work effectively in the future (see Table 13). For those already incorporating project data into their decisions, 60% believe data management and analysis skills will be important. For those who do not consistently incorporate project data in their decision-making, just 20% believe these skills will be important.

Organisations that do not recognise the importance of data management and analysis skills today will have to acquire them in a more costly manner tomorrow. As firms look for ways to improve how they analyse their data, they must also evaluate their existing processes and standards for data capture. It's important to understand where your firm's existing data is bad or incomplete. That insight will help you further define how new data is captured and improve the quality of information available to your project leaders when they're making quick decisions in the field.

Most respondents thought workflow optimisation will be the most important project management and/or analytical skill in the future of the construction industry (58%) (see Table 14). Data management strategy and data analytics were also considered important to 51% and 47% of respondents, respectively.

TABLE 13

How important do you think data management and analysis skills will be for your project management and field supervision staff to do their job effectively in the future?

- Extremely Important
- Very Important
- Moderately Important
- Neutral
- Slightly Important
- Low Importance
- Not at All Important
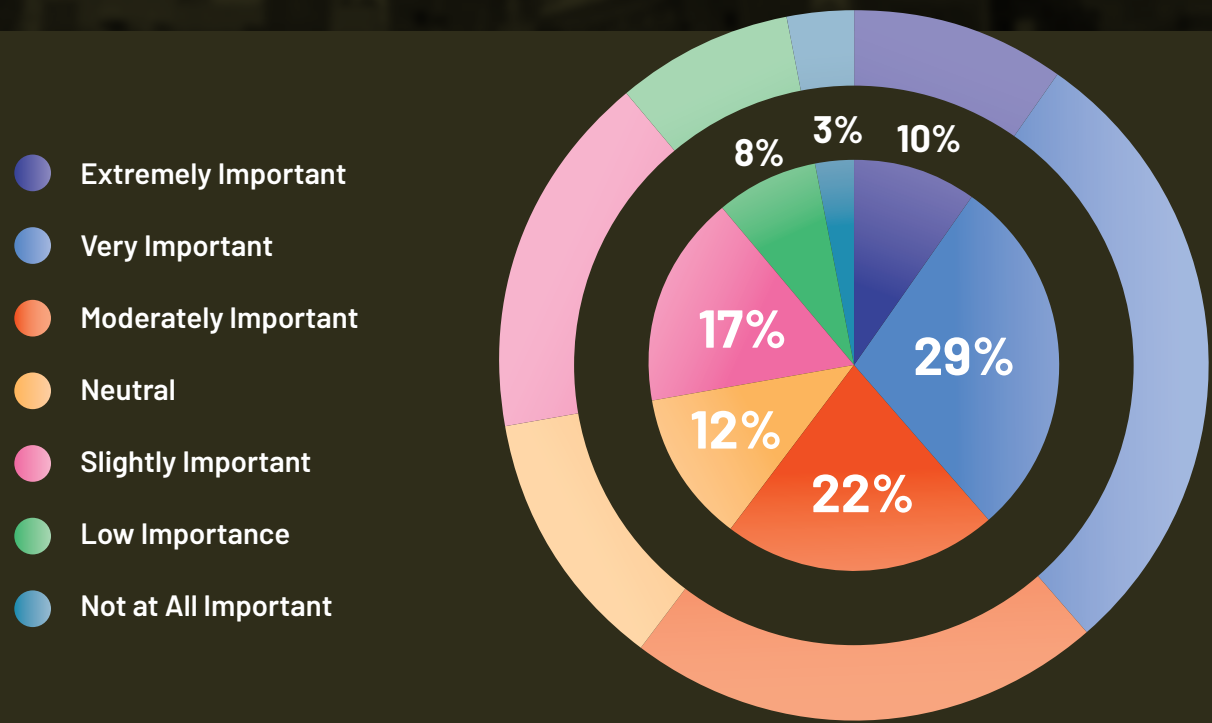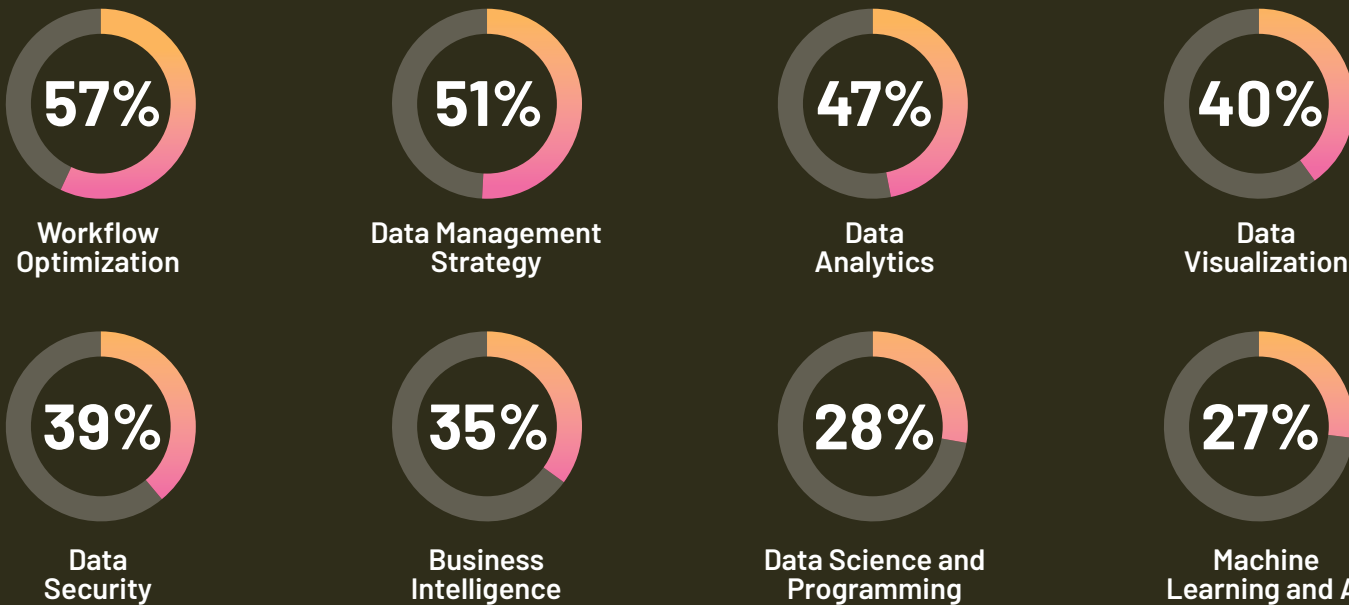
8%   3%   10%
17%   29%
12%
22%

TABLE 14

What project management and/or analytical skills do you think will be most important in the future of the construction industry?

57% Workflow Optimization

51% Data Management Strategy

47% Data Analytics

40% Data Visualization

39% Data Security

35% Business Intelligence

28% Data Science and Programming

27% Machine Learning and AI

IMPLEMENTING FORMAL DATA STRATEGIES

The first step in supporting project staff who are tasked with data management and analysis is implementing a formal data strategy. Having a framework in place will lift the burden from busy supervisory staff and it will improve data consistency and insights moving forward.

When asked if a formal data strategy was a part of their organisation's approach to managing data, only 55% of respondents indicated they've implemented one (see Table 18). The question then becomes, why haven't the other 45% of organisations implemented their own strategy?

Project Data is not Consistently Informing Decision-Making

Despite the increased reliance on project management and field supervision staff to make good project decisions quickly, only 12% of respondents' organisations always incorporate project data into their decision-making. More than 50% do so occasionally or not at all (see Table 15). For the organisations committed to quality data, the three most common efforts or investments made to ensure decision-makers have access to actionable, high-quality data are:

ONLY
12%
ALWAYS INCORPORATE PROJECT DATA INTO THEIR DECISION-MAKING

- Regularly reviewing data at set intervals for quality purposes (40%)

- Having established data reporting and monitoring practices, both at the time of collection and use (38%)

- Structuring data in a common data environment (38%)

TABLE 15

How frequently does your organisation incorporate project data into your decision-making?

Never	Rarely	Sometimes	Often	Always
4%	**16%**	**34%**	**34%**	**12%**
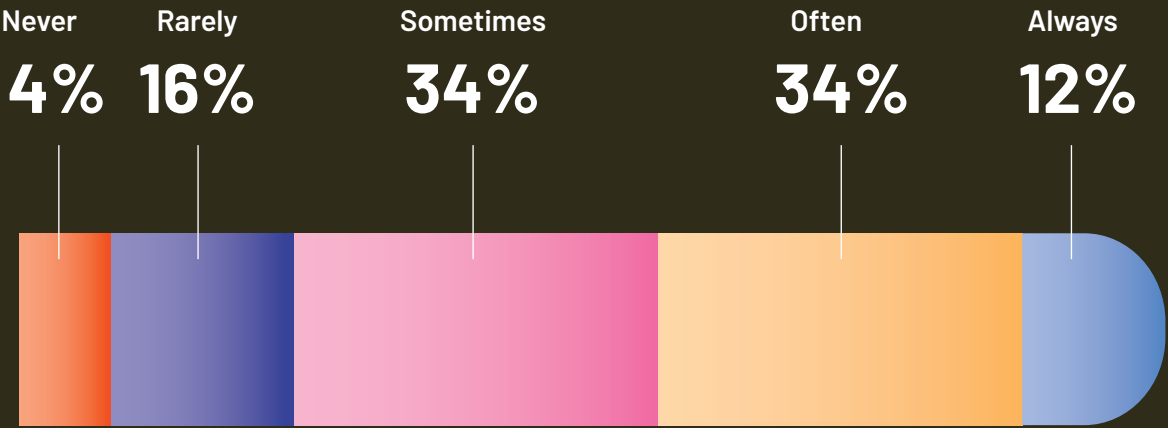
Why Isn't More Being Done to Reduce Bad Project Data?

With the technology and tools leveraged throughout all stages of construction projects, most organisations can create and capture more project data than ever before. However, when discussing this with industry leaders we learned that the sheer volume of project data available is overwhelming and can cause a state of decision paralysis. The absence of a formal data strategy may be a contributor to this.

Only 30% of respondents' organisations implemented a process to identify and repair bad data (see Table 16). The large percentage of unusable and bad project data may be why so few respondents always incorporate project data into their decision-making.

When considering respondents that have implemented a formal data strategy, they more frequently attempt to reduce the volume of bad project data captured.
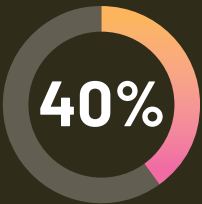
ONLY

30%

**OF ORGANIsATIONS
IMPLEMENTED A
PROCESS TO IDENTIFY
AND REPAIR BAD DATA**

"

"You have to have a single data solution. If you allow each job to choose their own data solution, they are all going to choose a different one. Then you can't roll up the data into a single framework. You need this if you want to analyse RFIs, change orders, etc."

Chief Information Officer
General Contractor (North America)

TABLE 16
What efforts or investments has your organisation made to ensure decision-makers have access to actionable, high-quality data/information/insights?

40%
Regularly review our
data at set intervals
for quality purposes

38%
Established data reporting and
monitoring practices both at
the time of collection and use

38%
Structured our data in a
common data environment

30%
Implemented processes
for identifying bad data
and repairing it

28%
Created a formal position
to oversee our data
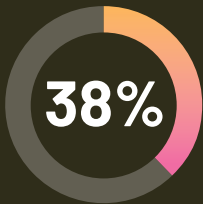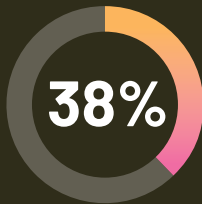
10%
Don't know/
Unsure

Another common action our respondents took to reduce the volume of bad project data (38% was adopting a common data environment (CDE. The industry leaders we interviewed indicated that when access to project data was centrally located, it improved their ability to accurately capture data and in turn, analyse it.
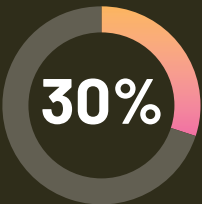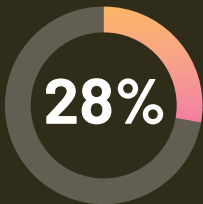
In general, larger organisations (i.e., revenue more than $500 million are more likely to have made investments to ensure decision-makers have access to actionable, high quality data (see Table 17. Finding success from leveraging project data when making decisions doesn't appear to be limited to the size or type of organisation—everyone can benefit from the investment in a data strategy, which will ensure critical decisions made in the field are leveraging accurate data.

TABLE 17
Which of the following two areas presents the greatest risk to project decision-making?

	BY REVENUE		BY organisation			
	>$500M	<$20M	Architect/ Engineer	Construction Manager/ General Contractor	Project Owner	Specialty Trade Contractor
Created a formal position to oversee our data	34%	20%	18%	16%	16%	11%
Structured our data in a common data environment	45%	34%	20%	21%	22%	26%
Regularly review our data at set intervals for quality purposes	41%	40%	22%	23%	23%	27%
Established data reporting and monitoring practices, both at the time of collection and use	47%	32%	21%	24%	20%	24%
Implemented processes for identifying bad data and repairing it	36%	22%	19%	16%	18%	13%

Formal Data Management Strategy

When asked if they had a formal data strategy, only 55% of respondents selected "yes".

Respondents that "always" or "often" incorporate project data into their decision-making were more likely to have a formal data management plan or strategy (see Table 19).

TABLE 18
Are you able to effectively use data captured from multiple projects at the organisation level?

- Yes
- No
- I don't know/Unsure

13%
31%
55%
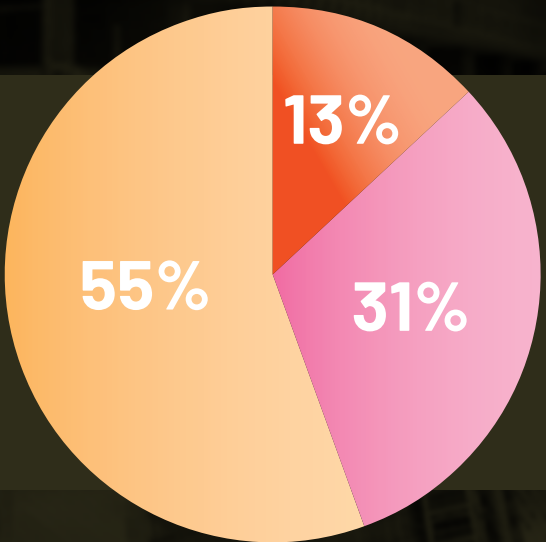
TABLE 19
Existence of a formal plan/strategy and frequency of project data incorporated in decision-making.

● APAC ● Europe ● NOAM

2x
MORE LIKELY

3x
MORE LIKELY

	Always	Often	Sometimes	Rarely	Never

50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%

Implementing Formal
Data Strategies
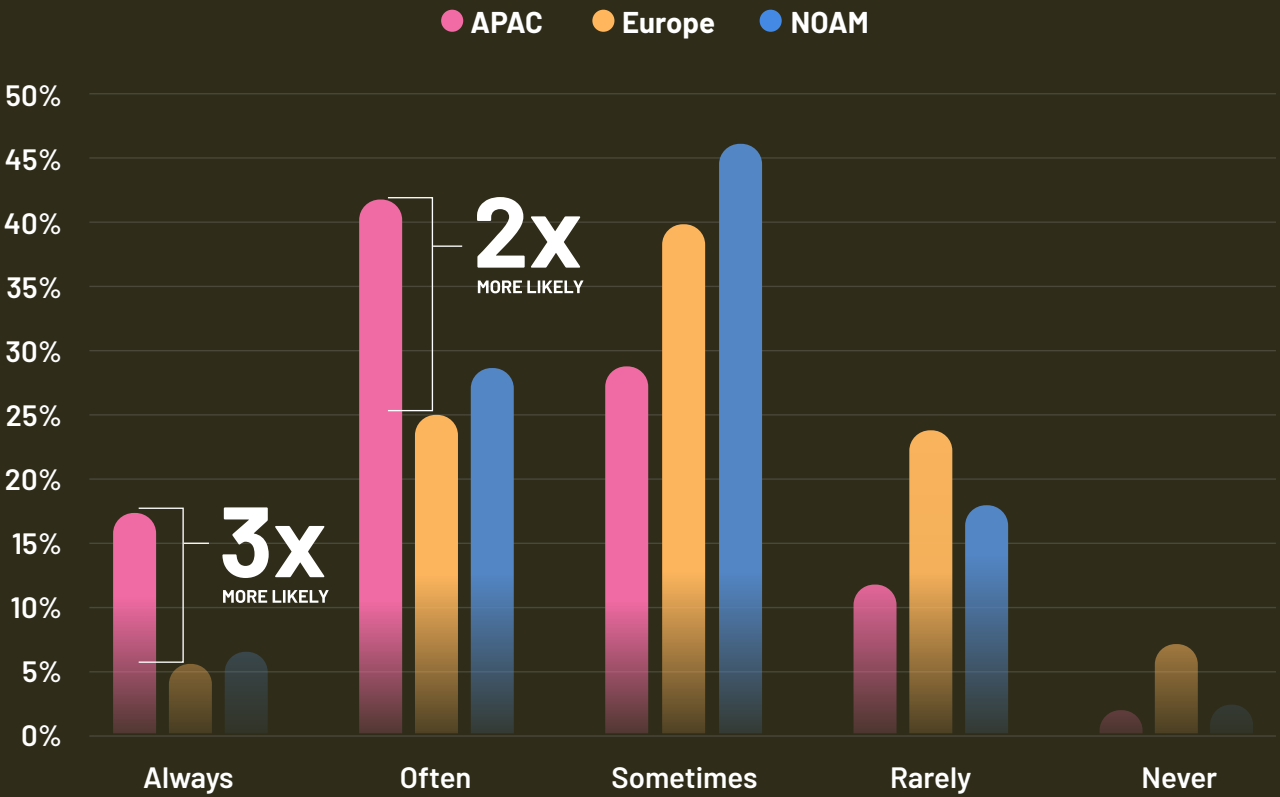
For the organisations that have a formal data strategy, they have achieved this through a diverse set of process optimizations and improvements. Table 20 shows the variety in reasons selected.

When asked about project data management challenges, respondents selected 'how to manage' and 'how to collect' project data (Table 21). A data strategy needs to clearly address both of these common challenges, ensuring that the collection is efficient and the management is effective.
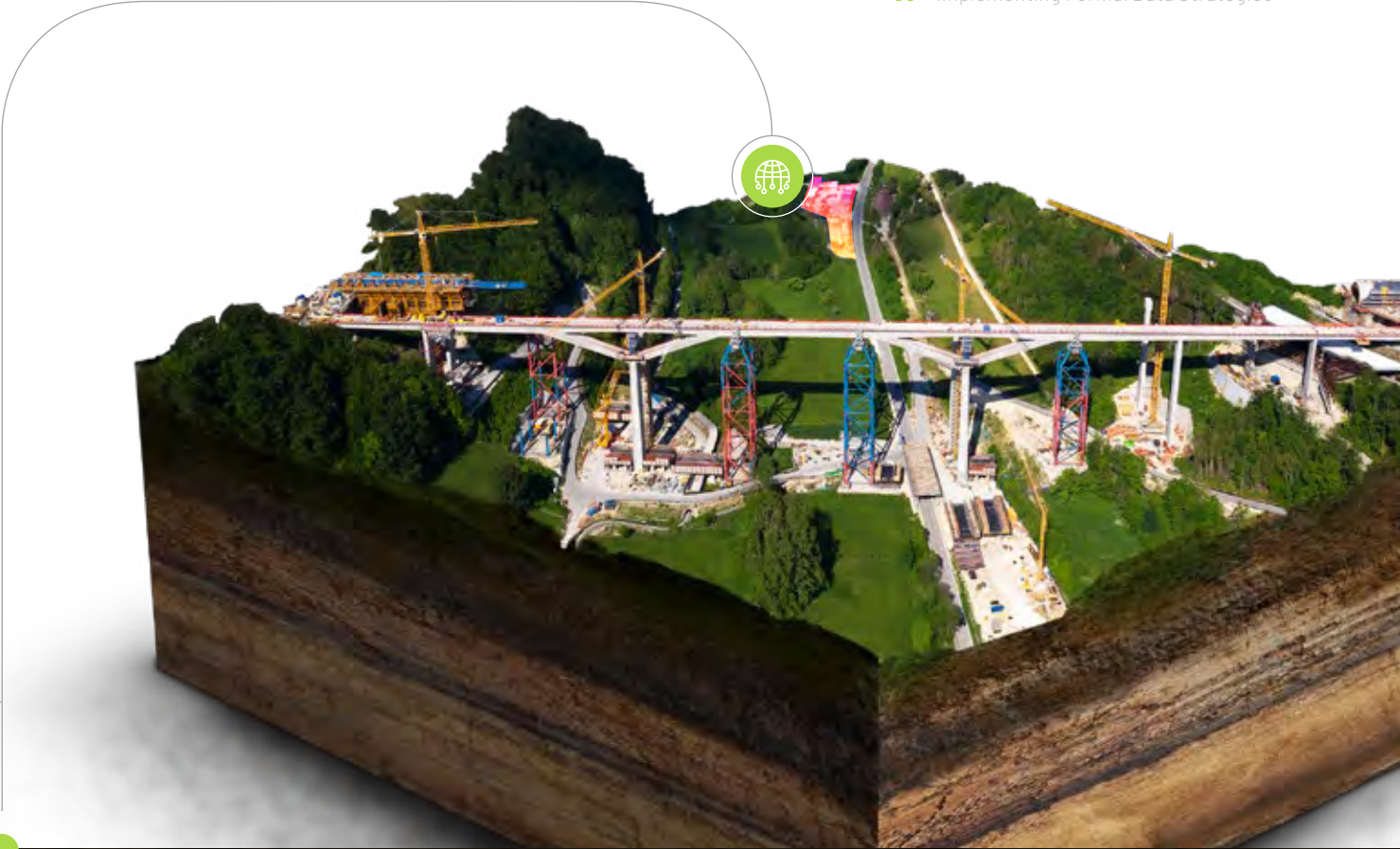
TABLE 20

Which of the following does your organisation/ project data plan or strategy include?

Category	%
Sources and collection methods for priority project data (e.g. when and where)	52%
Standards for project data formatting processing etc.	51%
Identification and description(s) of the project data collected	50%
Quality assurance and control measures for collected project data	49%
Methods and platforms for collecting assessing and sharing project data	45%
Archiving of project data	38%
Format project data management roles and responsibilities	13%

TABLE 21

Which of the following do you consider to be the most challenging aspect of a good, on-going project data management plan?

58% — How to manage the project data effectively	
53% — How to collect the project data efficiently	
45% — Knowing what project data to collect	
42% — How to best use the data	

BUY-IN FROM THE ENTIRE ORGANISATION IS VITAL

Even if organisations understand the benefits of having a data management strategy, the path to implementation may be littered with roadblocks.
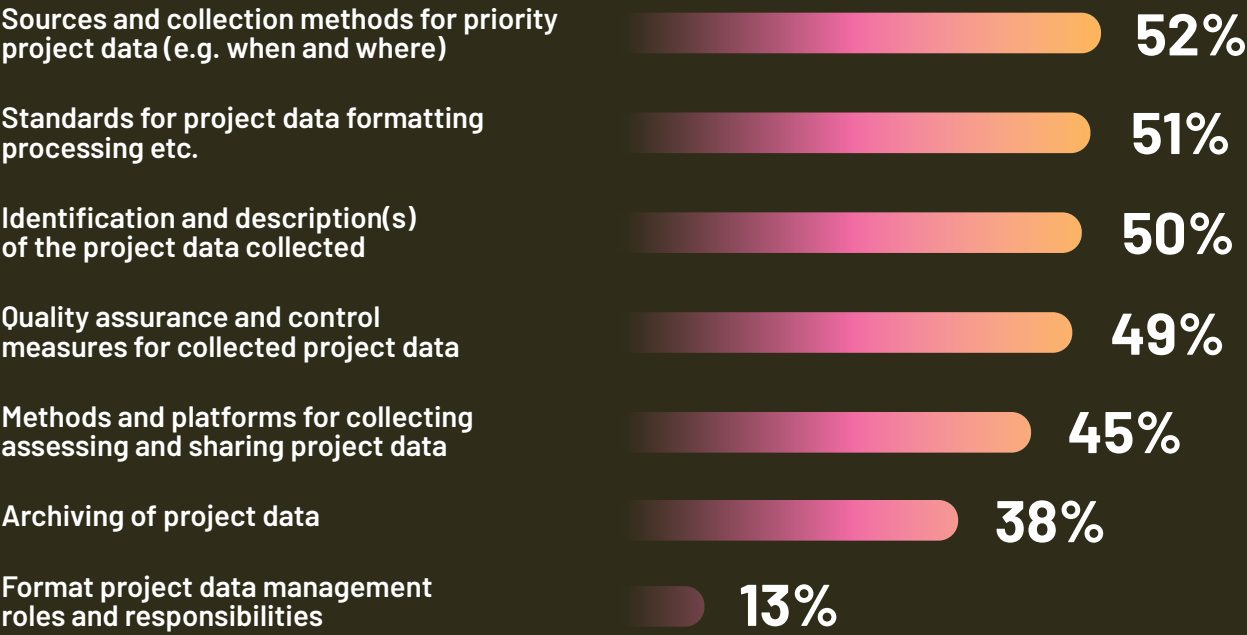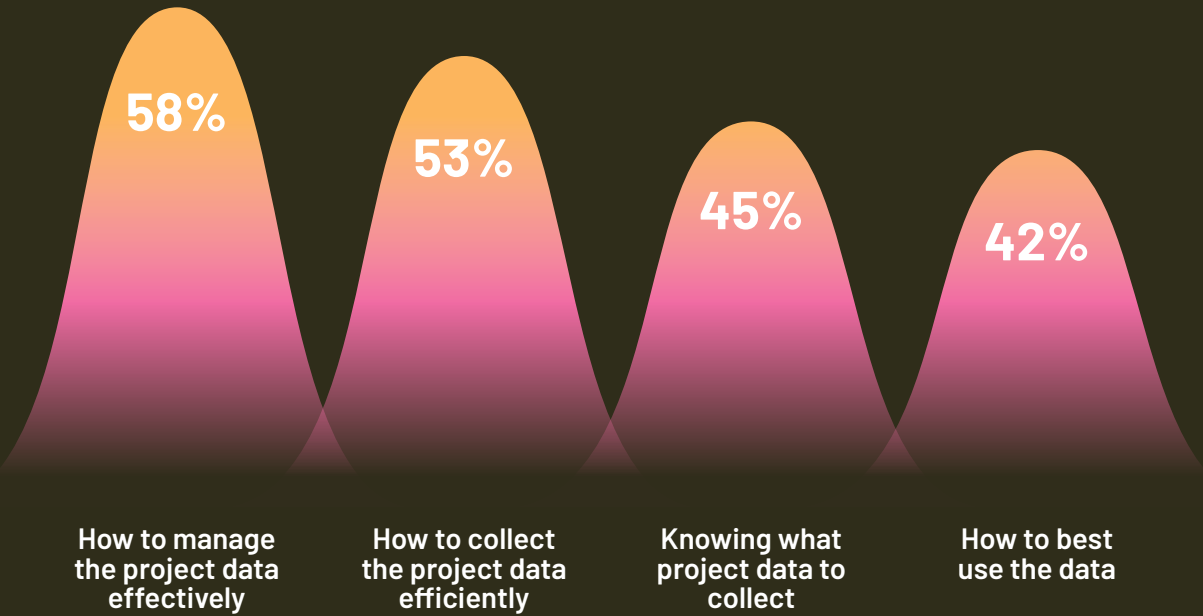Clearly, project management and field supervisors should require a plan to collect, manage, and analyse data. However, without knowing what investment is required or where to begin, leadership may not back the project. Obtaining buy-in from all key stakeholders is necessary for the successful roll out of a data management strategy.

For those respondents whose organisation has not implemented a formal project data strategy, the most cited reason was the cost and/or required resources (40%). For 36% of respondents there was a lack of organisational support for implementing a formal data strategy. The same number (36%) also expressed that their teams feel overwhelmed and unsure of where to begin (see Table 22).

Given the importance of a robust project data strategy, everyone should aspire to improve—even those teams uncertain of where to start.

THE MOST CITED REASON FOR NOT IMPLMENTING A FORMAL PROJECT DATA STRATEGY

40%

COST/REQUIRED RESOURCES

36%

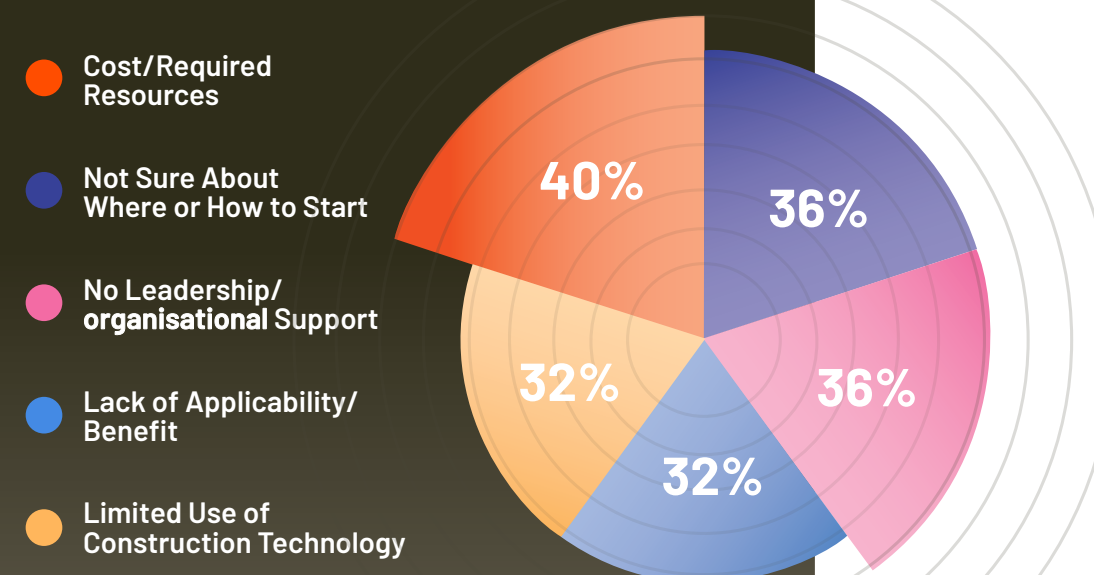**LACK OF ORGANISATIONAL SUPPORT**

36%

TEAMS UNSURE OF WHERE TO BEGIN

TABLE 22
Why hasn't your organisation implemented a formal project data plan/strategy? Select all that apply.

- **Cost/Required Resources**
- **Not Sure About Where or How to Start**
- **No Leadership/ organisational Support**
- **Lack of Applicability/ Benefit**
- **Limited Use of Construction Technology**

40%
36%
36%
32%
32%

Respondents with revenue greater than $500 million were much more likely to suggest, "No leadership/organisational support", as the reason for not implementing a formal data management plan/strategy (see Table 23). The research did not uncover the reason behind this difference, but it may be tied to how different the challenges manifest when comparing a large construction firm against a smaller one.

Large organisations typically have more stakeholders to consider and gain approval from, which can slow the adoption of new data management practices at the project level. In contrast, smaller organisations may be more nimble to make changes with a smaller number of key decision makers to consider.

Larger firms must find a way to achieve alignment across the entire leadership team. Smaller firms must be shown that it's more costly not to have a formal data strategy in place, despite hesitation associated with the costs of implementation.
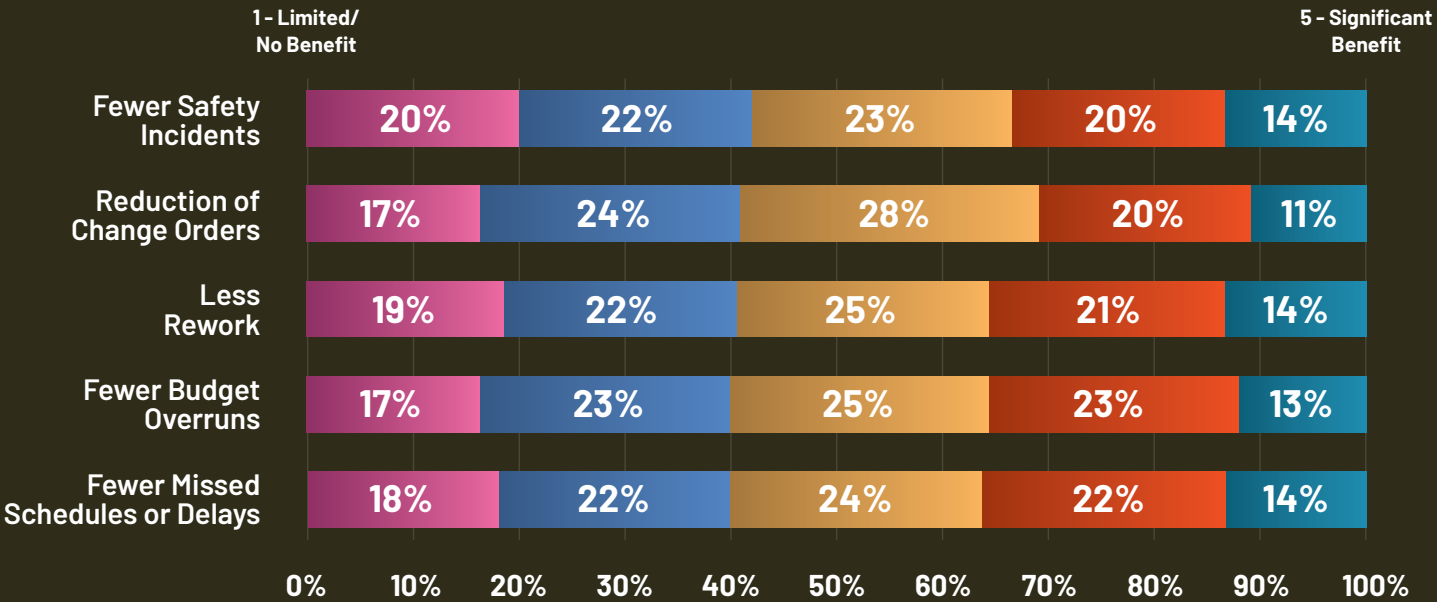
Not All See Benefits to a Formal Data Strategy

On average, 34% of respondents saw a significant benefit from a formal data strategy compared to 41% of respondents indicating they saw limited, or no benefit at all. The even split between the perceived benefits appeared consistently across multiple respondent characteristics (see Table 24).

TABLE 23
Reasons for not implementing a formal data management plan/strategy by revenue.

	>$500M revenue	<$20M revenue
No leadership/**organisational** support	**49%**	**26%**
Cost/required resources	**37%**	**44%**
Lack of applicability/benefit	**27%**	**22%**
Limited use of construction technology	**40%**	**26%**
Not sure about where or how to start	**37%**	**35%**

TABLE 24
What has been the greatest benefit of your project data plan/strategy?

1 – Limited/No Benefit ... 5 – Significant Benefit

	1	2	3	4	5
Fewer Safety Incidents	20%	22%	23%	20%	14%
Reduction of Change Orders	17%	24%	28%	20%	11%
Less Rework	19%	22%	25%	21%	14%
Fewer Budget Overruns	17%	23%	25%	23%	13%
Fewer Missed Schedules or Delays	18%	22%	24%	22%	14%

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Formal Data Management Training is Lacking

Could the underwhelming perceptions of a formal data strategy be caused partly due to a lack of formal training?

Formal data-focused training is provided by only 38% of respondents (see Table 25), while 50% of respondents provide their staff with formal safety training. Clearly, the importance placed on formal data management training needs to be improved.

Training in data management/data analysis is much more common in organisations that:

- Have a formal data management strategy (48%)

- Always or often incorporate data into decision-making (47%).

Training in organisations without a formal data plan/strategy occurs only 27% of the time.

TABLE 25
Do you provide formal training in any of the following areas to your project managers, field supervisors, estimators, or preconstruction staff?

Category	%
Safety	**50%**
Technical Skills	**47%**
Scheduling	**40%**
Data Management/ Data Analysis	**38%**
Leadership	**36%**
Custom Relationships/ Business Development	**34%**
Financial Management	**32%**

TABLE 26

Types of training implemented at organisations, broken down by respondents' data utilisation and revenue.

Legend:
- Always/often incorporate project data in decision making
- Sometimes incorporate project data in decision making
- Formal data plan/strategy
- No formal data plan/strategy
- >$500M revenue
- <$500M revenue

For the respondents that did have training in data management, half had access to informal on-the-job training, 42% had formal in-house training, and 35% had formal third-party instruction (see Table 27). Increasing access to formal training for project-level staff instead of relying on informal on-the-job training would yield better results when implementing a data strategy.

TABLE 27
In what format is data and information management training currently provided and how?

On-the-Job
Training
(Informal)
50%

Formal In-house
Training
42%

Formal Third Party
Instruction
(Online or in Person)
**35%**

Self-directed
Training
18%

None
1%

KEY FINDINGS BY REGION: APAC

The data collected in this study spanned three regions: North America, Asia-Pacific (APAC), and Europe. Up until this point of the report, all statistics have been from a global perspective. What follows includes key insights into data management strategy for the Asia Pacific region. In addition, country-specific findings are given where data are available.
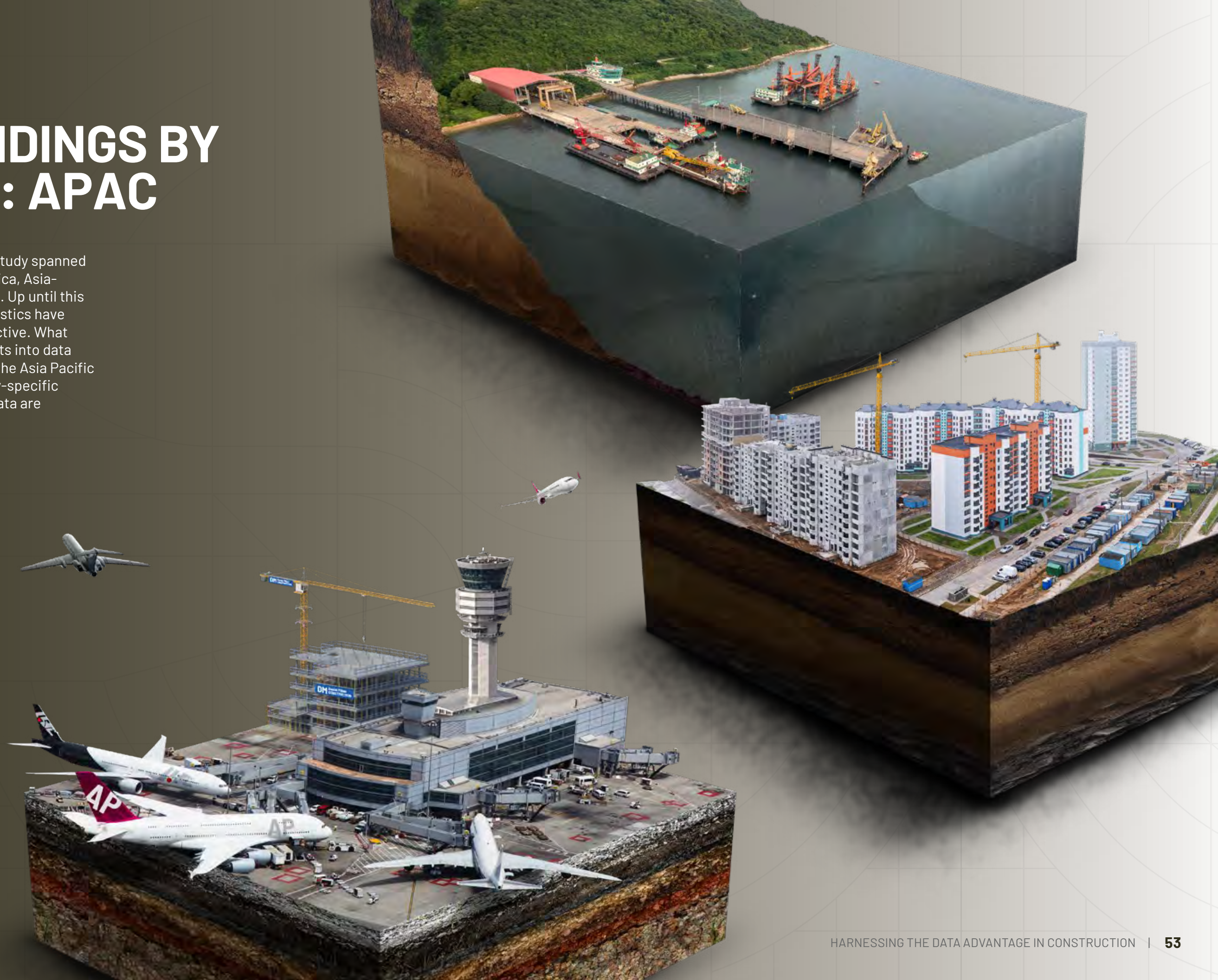
DATA STRATEGIES & STORIES

ASIA PACIFIC

Respondents in APAC were located in
Australia, Hong Kong, India, New Zealand,
and Singapore. In general, APAC appears
further along in their efforts to address
their project data needs than Europe
and North American respondents. They
also took a more formal approach to
planning and training, meaning project
management and field supervision staff
spend much of their time each week
working with data.

However, APAC respondents weren't
leveraging project data for decision-
making at a high frequency. As a result,
APAC respondents report fewer benefits
from their data management efforts.

- Australia
- Hong Kong
- India
- New Zealand
- Singapore
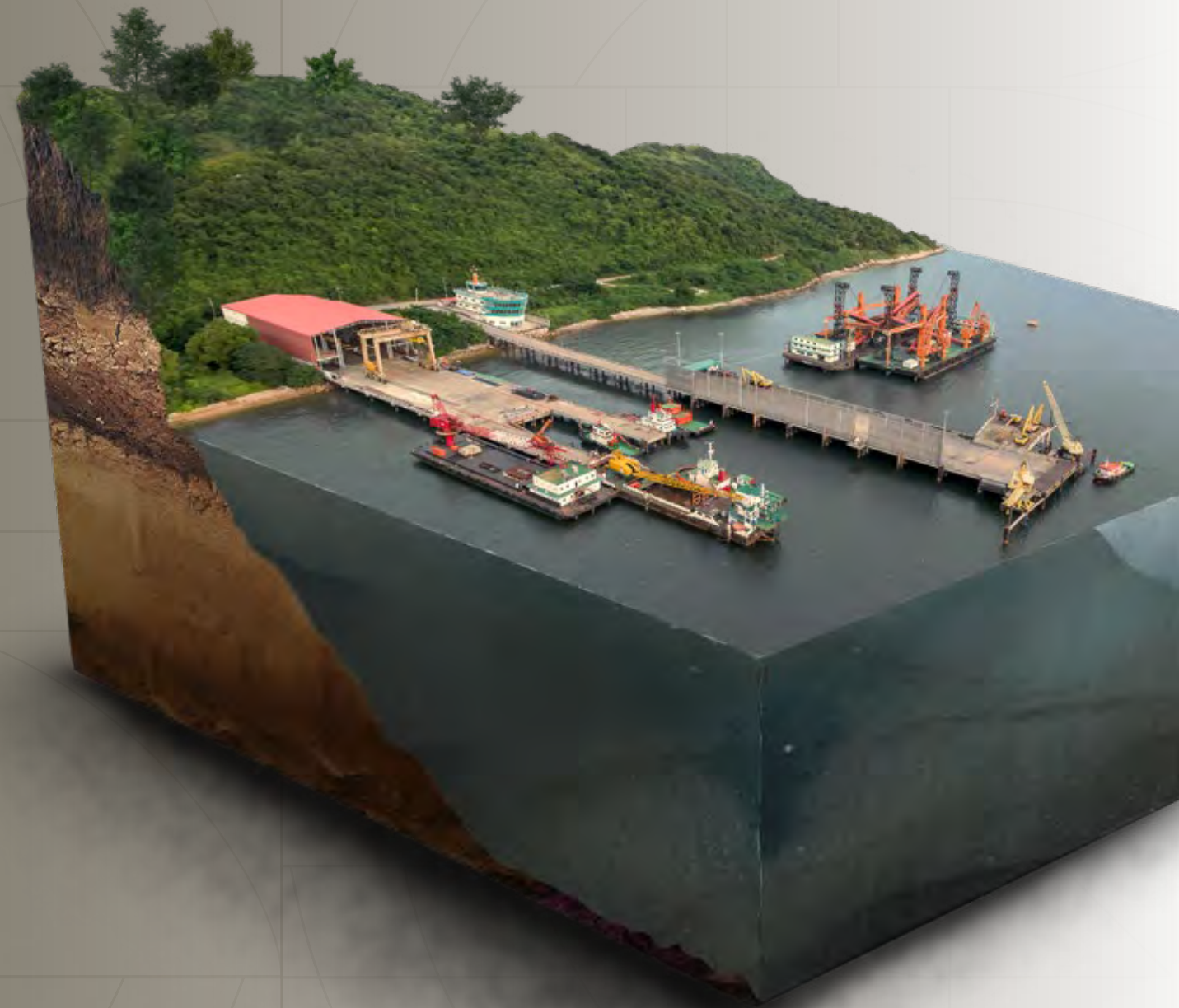
More Effort in APAC to Collect Quality Data

APAC survey respondents have made more effort or invested more to ensure decision-makers have access to actionable, high-quality data/information/ insights than respondents from the other regions. For example, (see Table 28), more APAC respondents implemented processes for identifying bad data and repairing it (40% in APAC versus 27% in Europe and 19% in North America). They also review data at set intervals for quality purposes more regularly (49% APAC vs. 38% Europe and 36% in North America).

Respondents in both Hong Kong and Australia reported that their largest challenge was data not being easily accessible, either due to its structure or the unwillingness of others to share. India, New Zealand, and Singapore found their largest challenge to be errors, which raised suspicion about the data and its value.

All APAC respondents reported an increase in available project data when compared to the volume they collected three years ago.

- India reported the largest increase in data collection, with 36% seeing an increase of 75% or greater.

- India had the most challenges when compared to other APAC nations with how to manage project data effectively and how to best use it.

- Australia and Hong Kong indicated their largest challenge was with managing project data effectively.

- New Zealand and Singapore struggled the most with knowing what project data to collect.

TABLE 28

What efforts or investments has your organisation made to ensure decision makers have access to actionable, high quality data/information/ insights?
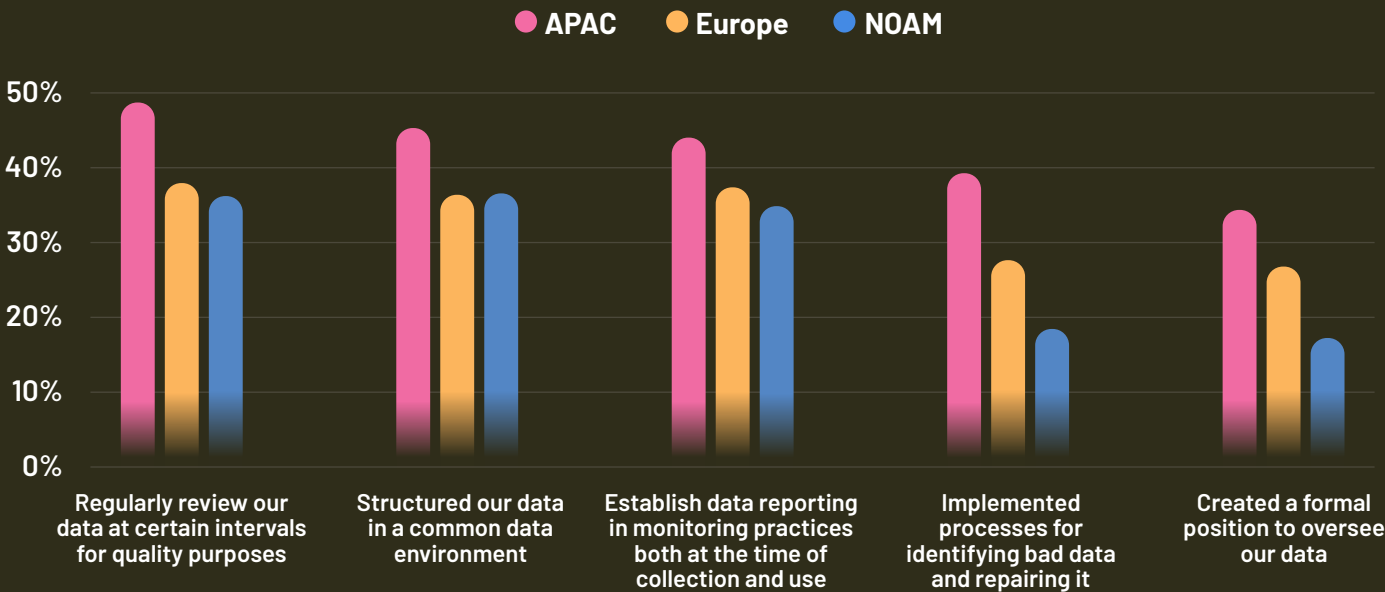

Legend: ● APAC ● Europe ● NOAM

Categories:
- Regularly review our data at certain intervals for quality purposes
- Structured our data in a common data environment
- Establish data reporting in monitoring practices both at the time of collection and use
- Implemented processes for identifying bad data and repairing it
- Created a formal position to oversee our data

TABLE 29

Which of the following do you consider to be the most challenging aspect of a good, ongoing project data management plan?

	Australia	Hong Kong	India	New Zealand	Singapore
Knowing what project data to collect	40%	45%	40%	56%	53%
How to collect the project data efficiently	56%	57%	44%	58%	55%
How to manage the project data effectively	57%	60%	63%	48%	51%
How to best use the data	47%	37%	53%	38%	41%

APAC More Likely to Have a Formal Data Strategy

Table 30 shows a larger percentage of APAC respondents have a formal plan or strategy to collect and analyse data across their projects (60%) compared to those in Europe (54%) and North America (51%).

When asked whether their organisation had a formal plan or strategy to collect and analyse data across projects:

- 86% of respondents from India said "yes," the highest in APAC.

- 70% of Australian respondents and 62% of New Zealand respondents also said "yes."

- Respondents in Hong Kong were the most likely to respond "no," at 37%.

In terms of the details, respondents in India were most likely to have a plan that included identification and descriptions of project data collected (63%), methods and platforms for collecting, accessing, and sharing project data (53%), and formal project data management roles and responsibilities (49%).

Hong Kong and New Zealand were less likely than the other APAC respondents to have quality assurance and control measures for collected project data (50% and 44%, respectively). All other APAC nations reported 60% or greater.

TABLE 30

Are you able to effectively use data captured from multiple projects at the organisation level? Percent answering "yes."

● APAC ● Europe ● NOAM

60% **54%** **54%**
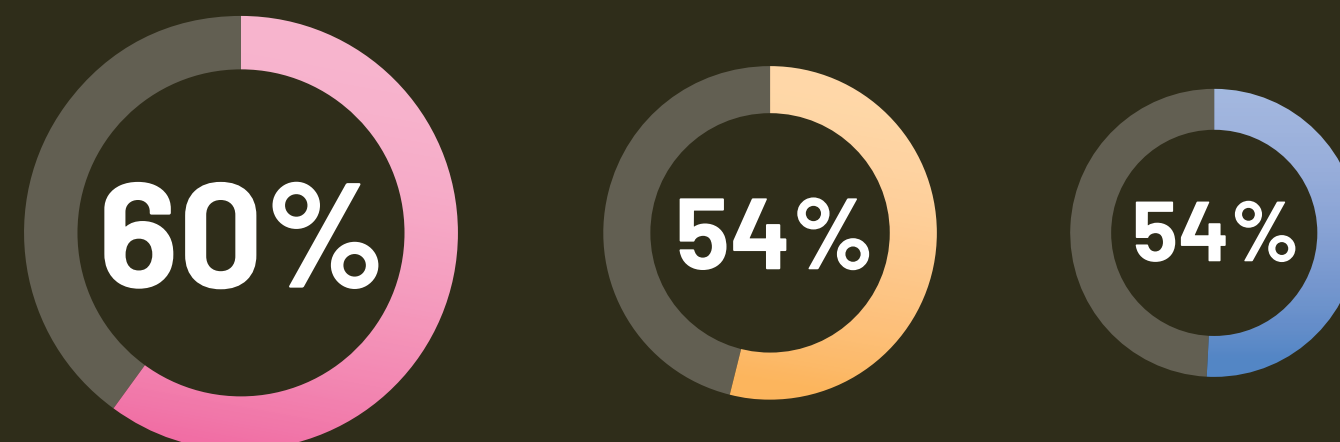
CASE STUDY

Approaching Those Unwilling to Share Data

For one contractor in APAC, resistance to change quickly arose. The contractor characterised this as the human challenge. "People are afraid to share data. This may be for different reasons. Some people do not want to lose the power they are perceived as having by owning some piece of data. Others may be afraid that data will be used against them if they make a mistake. This causes resistance to an open data environment. You have to show them the personal value of participating," he said.

To combat this resistance, the contractor focused on training that incorporated a bigger picture perspective of why change was necessary. This included heavily emphasising the personal benefit. "You have to take a human-centric approach. You have to show them that you are reducing the amount of time wasted for them personally. If you are cutting down on their work by reducing time spent on administrative tasks, people are more likely to make the transformation," he said.

The contractor wanted to demonstrate that this business transformation was as much about improving the employee experience as the corporate outcome.

The choice of technology also played a role. "One of the things we found during our transformation was the power of what they defined as 'shiny new toy syndrome.' We issued our people tablets and iPads instead of laptops. We found they responded better to tablets and started using them right away." The contractor noted this was particularly true when bringing on those less familiar with digital technology.

"You have to take a human-centric approach. You have to show them that you are reducing the amount of time wasted for them personally. If you are cutting down on their work by reducing time spent on administrative tasks, people are more likely to make the transformation."

Senior Digital Delivery Manager
General Contractor, APAC

Data Strategy Roadblocks in APAC

Australian respondents indicated they had not implemented a formal strategy most often due to cost/required resources (62%). Respondents from India, Hong Kong, and New Zealand stated they were not sure about where to start (56%, 42%, and 46%, respectively).

New Zealand respondents also reported a limited use of construction technology as a common blocker to the implementation of a data strategy. Respondents in Singapore agreed, with 56% of respondents stating limited use of construction technology.

Time Spent Managing Data in APAC

APAC project management and field supervision staff spend more time each week collecting, managing, and analysing project data compared to their European and North American counterparts (see Table 32). APAC respondents estimate that management staff spend an average of 52% of their time on data-related tasks compared to 44% in Europe and 40% for North America.

Respondents in India and Singapore reported that their project management and field supervision staff spent 58% and 56% of their time collecting, managing, and analysing project data each week. All other APAC respondents reported less than 50%.

TABLE 31

Why hasn't your organisation implemented a formal project data plan/strategy?

	Australia	Hong Kong	India	New Zealand	Singapore
No leadership/**organisational** support	24%	37%	33%	42%	44%
Cost/required resources	62%	29%	44%	27%	19%
Lack of applicability/benefit	33%	21%	44%	38%	37%
Limited use of construction technology	24%	21%	33%	46%	56%
Not sure about where or how to start	33%	42%	56%	46%	37%

TABLE 32

What percent of your project management and field supervision staff's time is spent collecting, managing, and analysing project data each week?

● APAC ● Europe ● NOAM

52%   44%   40%
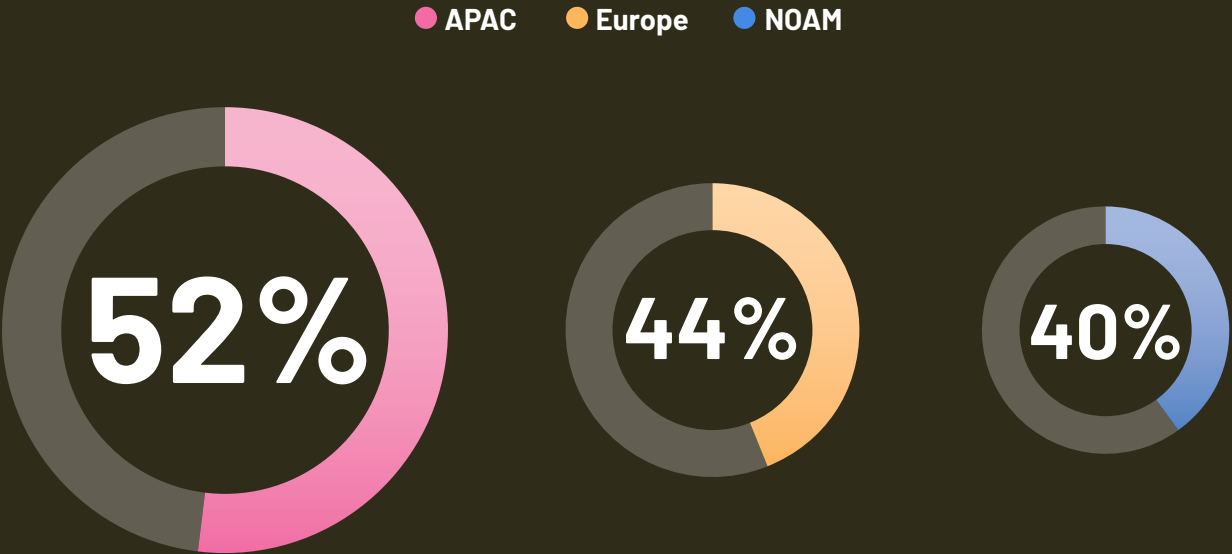
Duplicate and Missing Data in APAC

Nineteen percent of APAC respondents indicated that missing data was the primary contributor to bad project data, compared to 25% in Europe and 31% in North America. Duplicate data was the primary contributor for 20% of APAC respondents, compared to 15% in Europe and 9% in North America (see Table 33).

APAC Respondents Preferred Formal Training

Half of APAC respondents provide formal data management/data analysis training, compared to 35% in Europe and 33% in North America. No APAC respondents utilise self-directed training, whereas 39% of North American respondents do (see Table 34).

Hong Kong and New Zealand reported that most of their training was formal in-house training (42% and 23%). This was in stark contrast to Australia, India, and Singapore, which reported most training was informal and done while on the job (34%, 38%, and 34%).

TABLE 33

Which of the following do you believe most contributes to bad project data?

● APAC   ● Europe   ● NOAM

19% 31% 25%
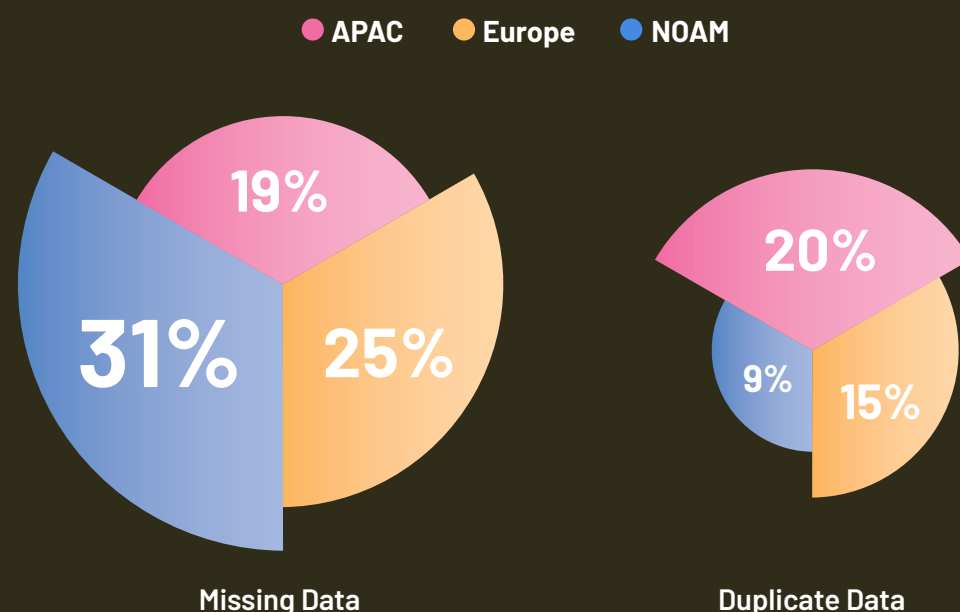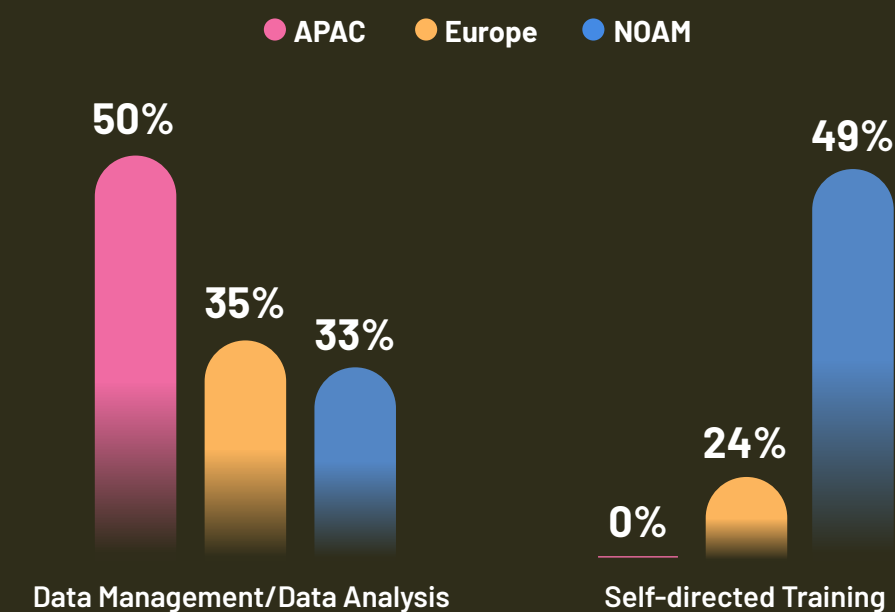**Missing Data**

20% 9% 15%
Duplicate Data

TABLE 34

Do you provide formal training to your project managers, field supervisors, estimators, or preconstruction staff in data management/data analysis? AND In what format is data and information management training currently provided?

● APAC   ● Europe   ● NOAM

50% 35% 33%
Data Management/Data Analysis

0% 24% 49%
Self-directed Training

Transitioning to Higher Level Skills

APAC respondents have made greater efforts to develop data plans/strategies and implement formal training, which could be why more of them view data science, machine learning, and Artificial Intelligence (AI) as important to the future of the construction industry. Forty-four percent selected data science and programming as the most important future skill, compared to 25% in Europe and 20% in North America. Machine Learning and AI were the most important for 36% in APAC, versus 25% in Europe and 22% in North America (see Table 35).

Over 60% of respondents in India and New Zealand think data management and analysis skills will be important for project management and field supervision staff to do their jobs effectively in the future. Only 49% of respondents from Hong Kong believed the same.

When asked what specific project management and/or analytical skills will be most important in the future, India responded with "data management strategy" more than any other nation in APAC. They also indicated more than others that data security will be increasingly important.

Data analytics was selected as the most important skill by respondents from Australia and Hong Kong. Respondents in Singapore highlighted data science and programming as the most important skills.

TABLE 35
What project management and/or analytical skills do you think will be most important in the future of the construction industry?
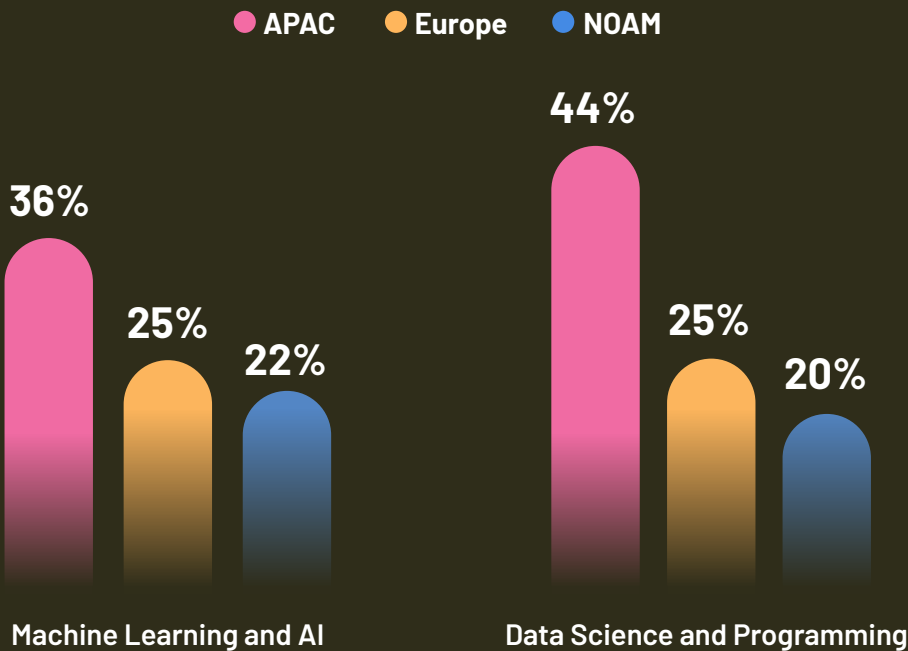

● **APAC**   ● **Europe**   ● **NOAM**

Machine Learning and AI: 36% (APAC), 25% (Europe), 22% (NOAM)
Data Science and Programming: 44% (APAC), 25% (Europe), 20% (NOAM)

TABLE 36
What project management and/or analytical skills do you think will be most important in the future of the construction industry?

	Australia	Hong Kong	India	New Zealand	Singapore
Data management strategy	50%	56%	63%	44%	43%
Workflow optimization	52%	52%	58%	43%	34%
Data analytics	52%	68%	52%	41%	43%
Data security	48%	46%	58%	35%	40%
Business intelligence	33%	32%	51%	29%	32%
Data science and programming	42%	40%	52%	35%	47%
Machine learning and AI	38%	34%	48%	35%	21%
Data visualization	38%	40%	45%	43%	43%

Less Frequent Use of Project Data in APAC Decision-Making

Respondents from Hong Kong and Singapore were less likely to agree that the need for autonomy for rapid decision-making is increasing at the project manager and field supervisor levels due to such things as schedule acceleration/compression, emergency response, and stakeholder requests.

Overall, APAC respondents incorporate project data into their decision-making less frequently than North America and Europe, though not by a large margin (see Table 37).
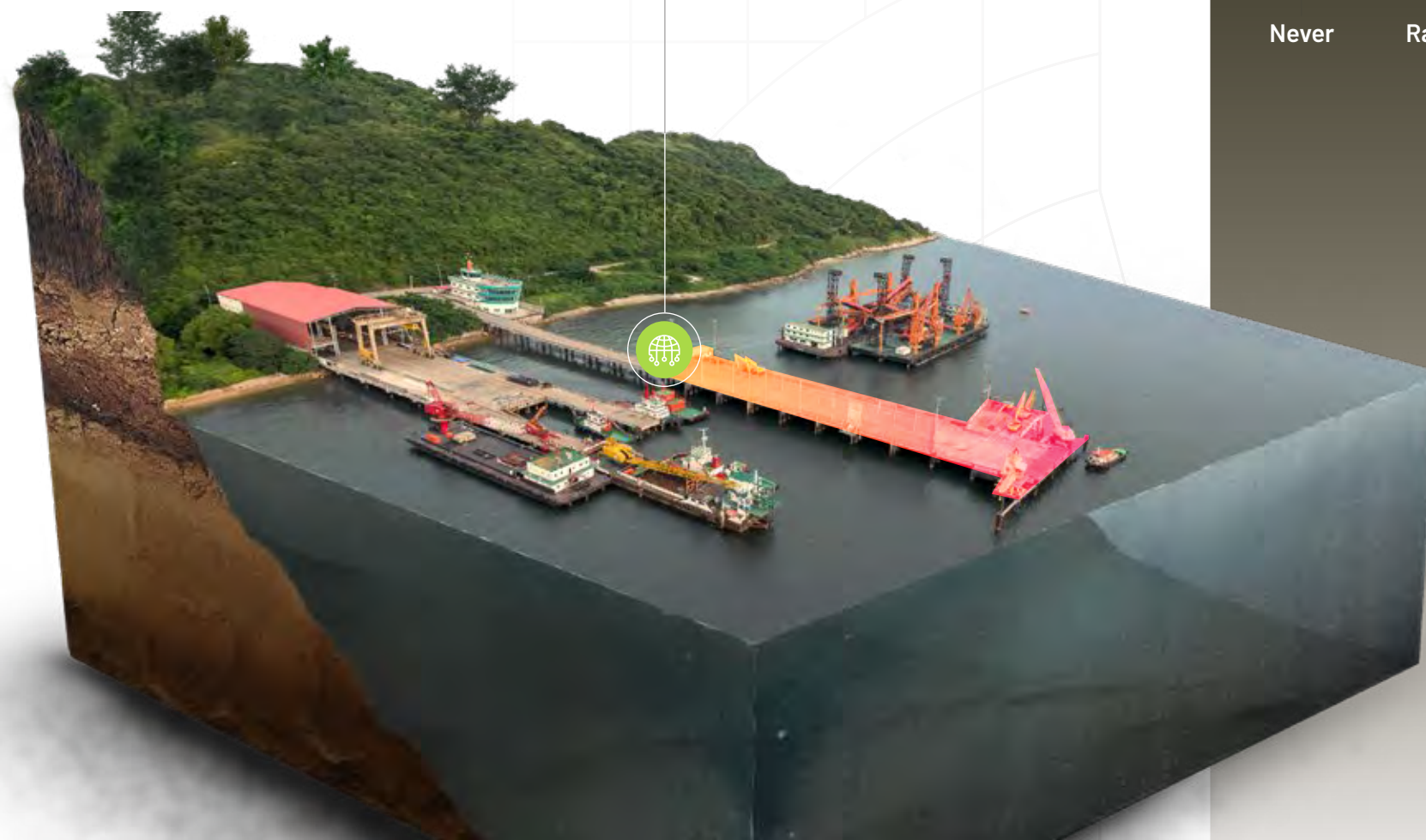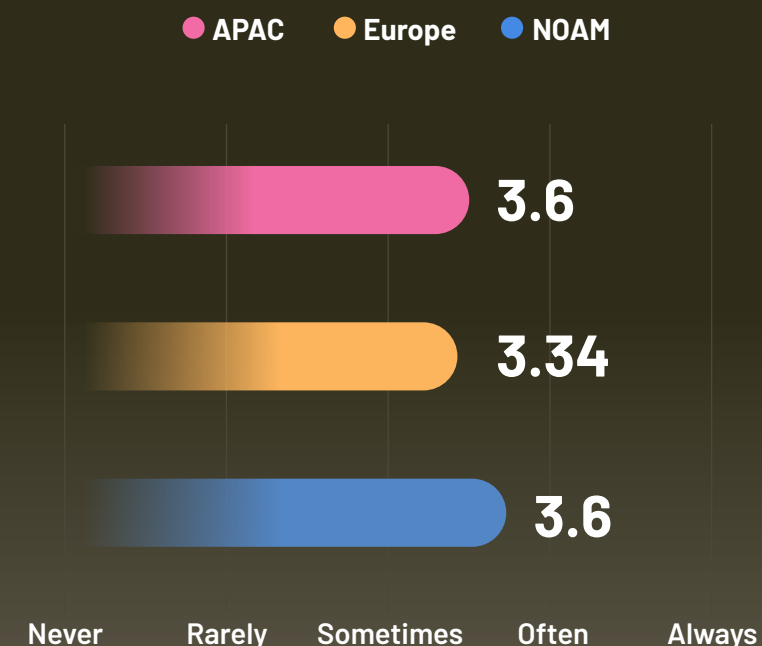
TABLE 37

How frequently does your organisation incorporate project data into your decision making? Shown as the average response out of 5.

- APAC
- Europe
- NOAM

	Value
APAC	3.6
Europe	3.34
NOAM	3.6

Never   Rarely   Sometimes   Often   Always

CONCLUSION

THE FOUR STEPS OF A SUCCESSFUL DATA STRATEGY

Interviewees and survey respondents alike shared feeling overwhelmed by the volume of project data their organisations collect. Not surprisingly, many are also uncertain on how they would begin an initiative to leverage their data more effectively. To make implementing a data strategy easier, we've documented a four-step process on how to get started.
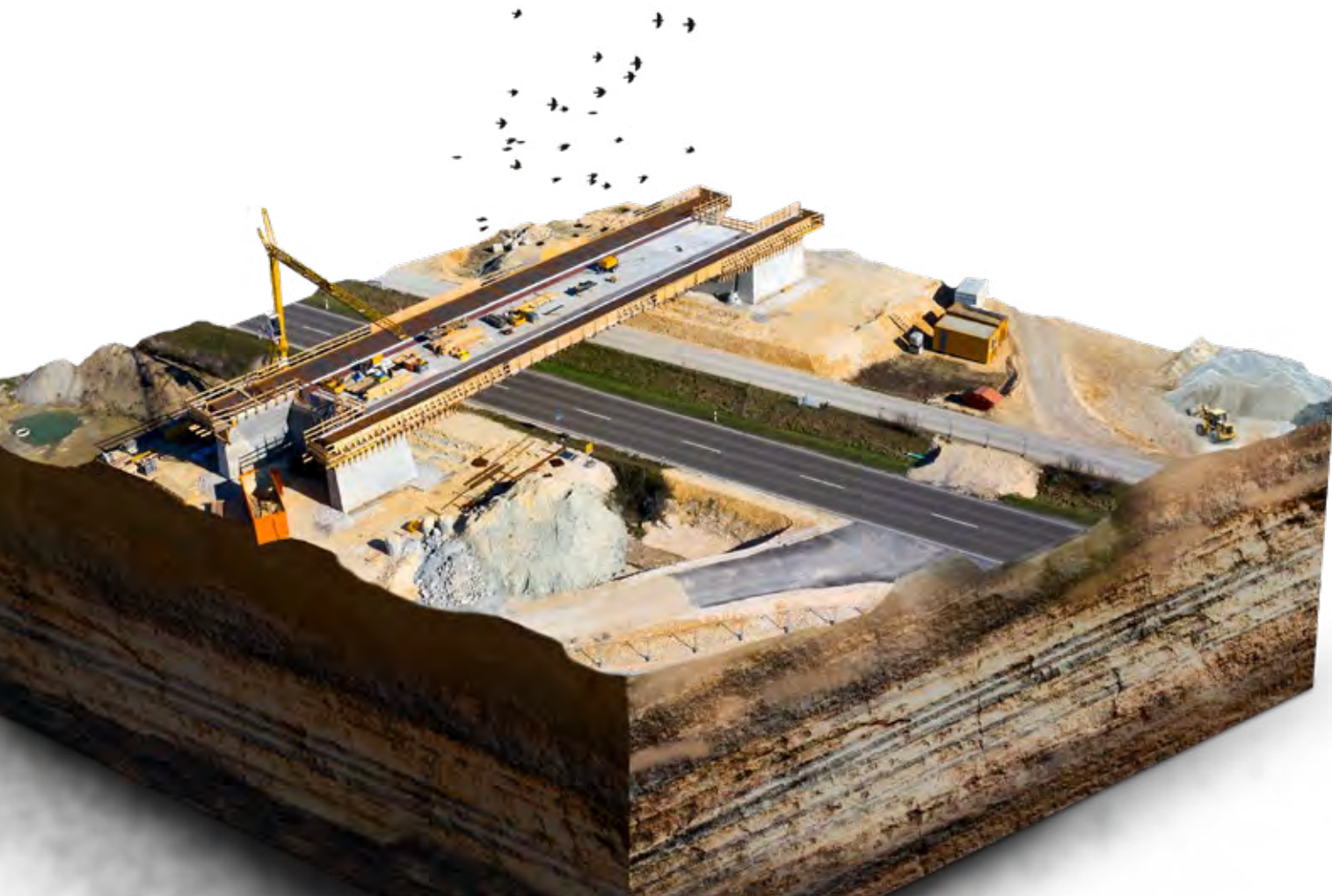
1 Select a Single Point of Focus

Decide where the organisation could benefit most from data-driven insights. To maximise return on investment (ROI) and to encourage organisational buy-in, your first attempt at data process improvement must have clear value. For example, several industry leaders we interviewed began with quality assurance and safety, two areas where data was readily available. Having a single point of focus directs the efforts of individuals and can accelerate the impact of the improvements.

To apply learnings to future areas, it's also important to consider what must be done to ensure data is structured and captured in a central location. Digitizing other high-impact processes such as RFIs or design reviews will ensure that your data is captured in a consistent way. This consistency will create data that is actionable as you move to the next area that needs improvement.

CLEAR VALUE TO DATA PROCESS IMPROVEMENT

— **MAXIMISE ROI**

— **BUY-IN**

EXPERT ADVICE

Before selecting your initial point of focus, clearly articulate your organisation's aspirations with data. Answer the following questions to understand your "why":

- What do you want to do better?

- What would look different if you were able to leverage your project data and generate insights?

- Who could you consult to ask for advice when beginning this process?

- What tools already exist to help accelerate your data strategy implementation?

2 Get Buy-in to Reduce Hesitancy

Implementing data-driven insights into project decision-making was described by many as a cultural shift within their organisations. Achieving buy-in and including your project team in the decision-making ensures they will not be biased against the proposed changes.

Buy-in requires continual reinforcement and open discussion. Formal training can help and is a common part of a successful data strategy implementation. Learnings are then reinforced through additional on-the-job training. organisations need to share how data-driven insights have improved project decision-making and project outcomes to continually ensure buy-in.

FORMAL TRAINING

A COMMON PART OF A SUCCESSFUL DATA STRATEGY IMPLEMENTATION

EXPERT ADVICE

Organisations that have successfully achieved buy-in for their data strategies share how you can do the same:

- Buy-in from all potential users is a requirement because the success or failure of a plan relies on the adoption by and execution of the frontline staff. Gather feedback from end-users, and constantly demonstrate the benefits of the plan to each person's daily tasks.

- Buy-in can be accelerated when you explain to people how their own actions impact a colleague. Communicating the purpose of the plan and how all actions, roles, and responsibilities are connected is key.

- Reinforce the positive outcomes from your improvements in data management with training and sharing your stories of success.

3 Standardise Your Data Capture Across All Projects

Survey respondents stated that more than one-third of their organisations' data is bad (i.e., inaccurate, incomplete, inconsistent). They also reported feeling overwhelmed with the volume of data being collected and at a loss for where to start. Only 36% of all respondents had implemented a process for identifying bad data and repairing it. Several industry leaders stated that it took up to two years to completely "clean" their own data.

To prevent this time-consuming undertaking to clean your data, organisations need to be standardising how data is captured.[9] When implementing or improving data processes, it's critical to examine how the data will be leveraged to ensure it will create accurate, actionable insights.

ONLY
36%

IMPLEMENTED A PROCESS FOR IDENTIFYING BAD DATA AND REPAIRING IT

EXPERT ADVICE

To increase the likelihood of company-wide adoption, your data standards and data strategies should include:

- Resources (e.g., money, people, and tools).

- Metrics to track performance throughout implementation.

- A champion empowered to lead the way.

4 Keep Project Data in a Common Environment

Interviewees stressed the importance of a common data environment and a preference for a single solution, or complementary technology solutions with robust integration capabilities to facilitate the flow of project data. Adopting a common data environment facilitates collaboration between project team members and helps avoid creating more bad data.

COMMON DATA ENVIRONMENTS

IMPROVE COLLABORATION BETWEEN PROJECT MEMBERS

AVOID CREATING MORE BAD DATA SILOS

EXPERT ADVICE

Industry leaders shared three best practices on data quality to give you a head start on your strategy:

- Ensure the data collected are accurate and in a standard format.

- Choose a single, open technology solution that supports integration.

- Be prepared to pivot as you implement your plan.
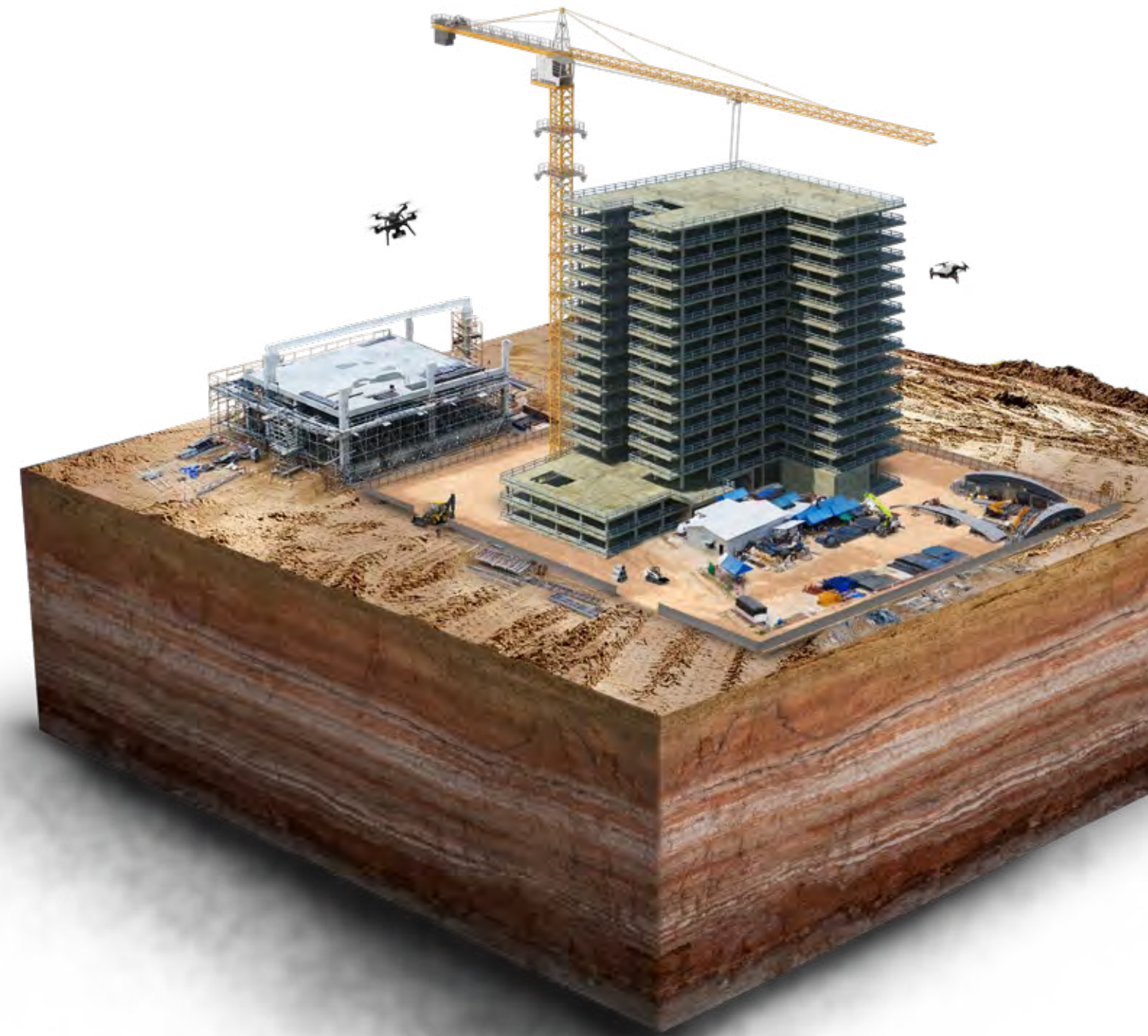
In Conclusion: Plan to Invest in a Data Management Strategy

Considering that respondents selected time constraints/urgency of decisions as the largest risk to project decision-making, followed by a lack of reliable data as the second greatest risk, organisations need to have a plan moving forward. Readily available, accurate, standardised data are required to make decisions quickly, correctly, and under increasingly accelerated schedules.

Capturing project data is not enough. organisations need to understand how to use the data effectively, which requires formal training. Education and constant communication before and during implementation will maximise buy-in across your organisation. Having all stakeholders on board will ensure that the investment made isn't for naught.

With margins continuing to narrow, having a data strategy can help improve outcomes by allowing for faster, more accurate decisions supported by data. In effect, the strategy is a means of reducing poor decisions, rework, and lost profits with a global impact of $1.848 trillion in 2020. Planning to use data effectively by committing to a formal data management strategy is an important way you can remain competitive.
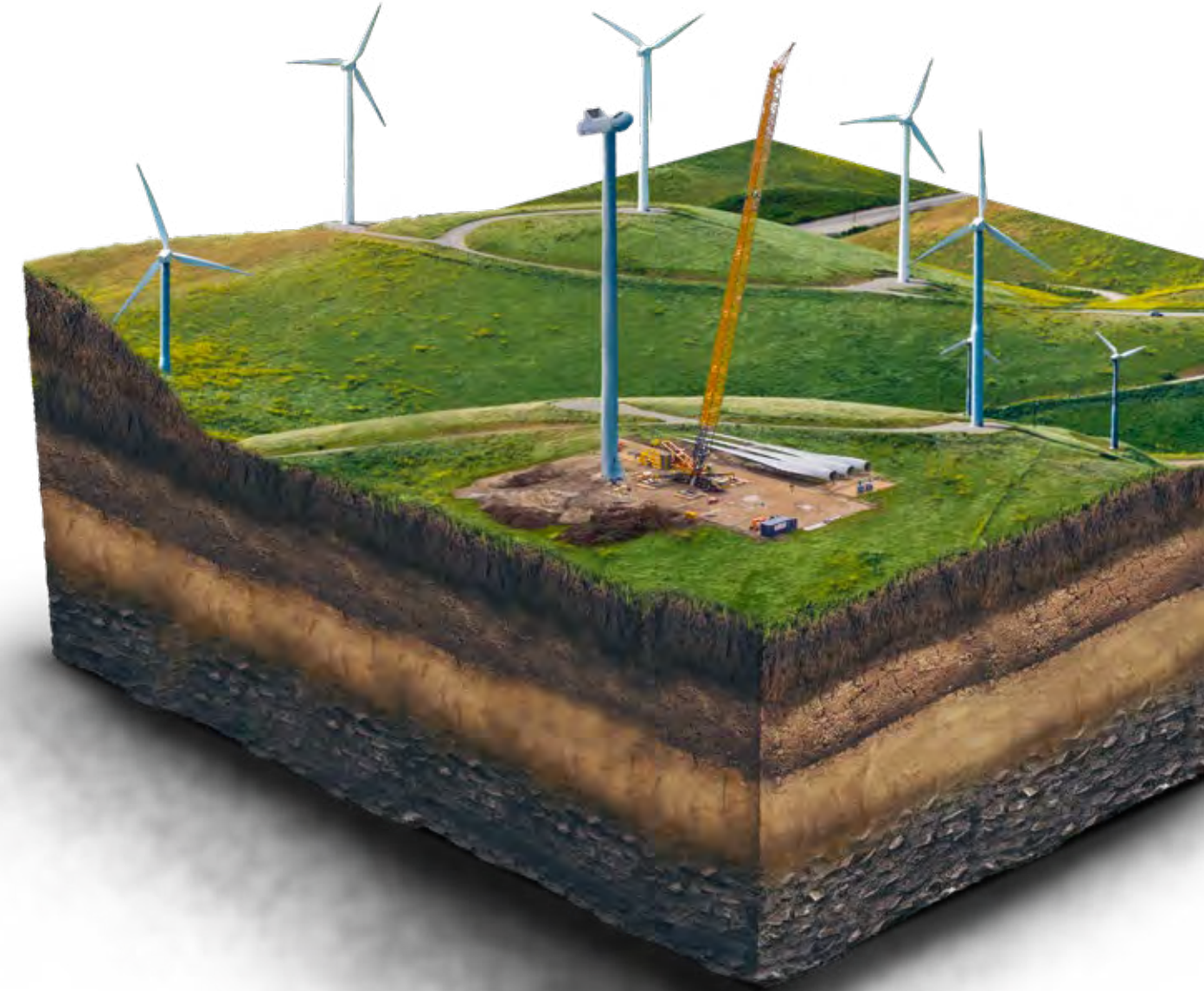
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