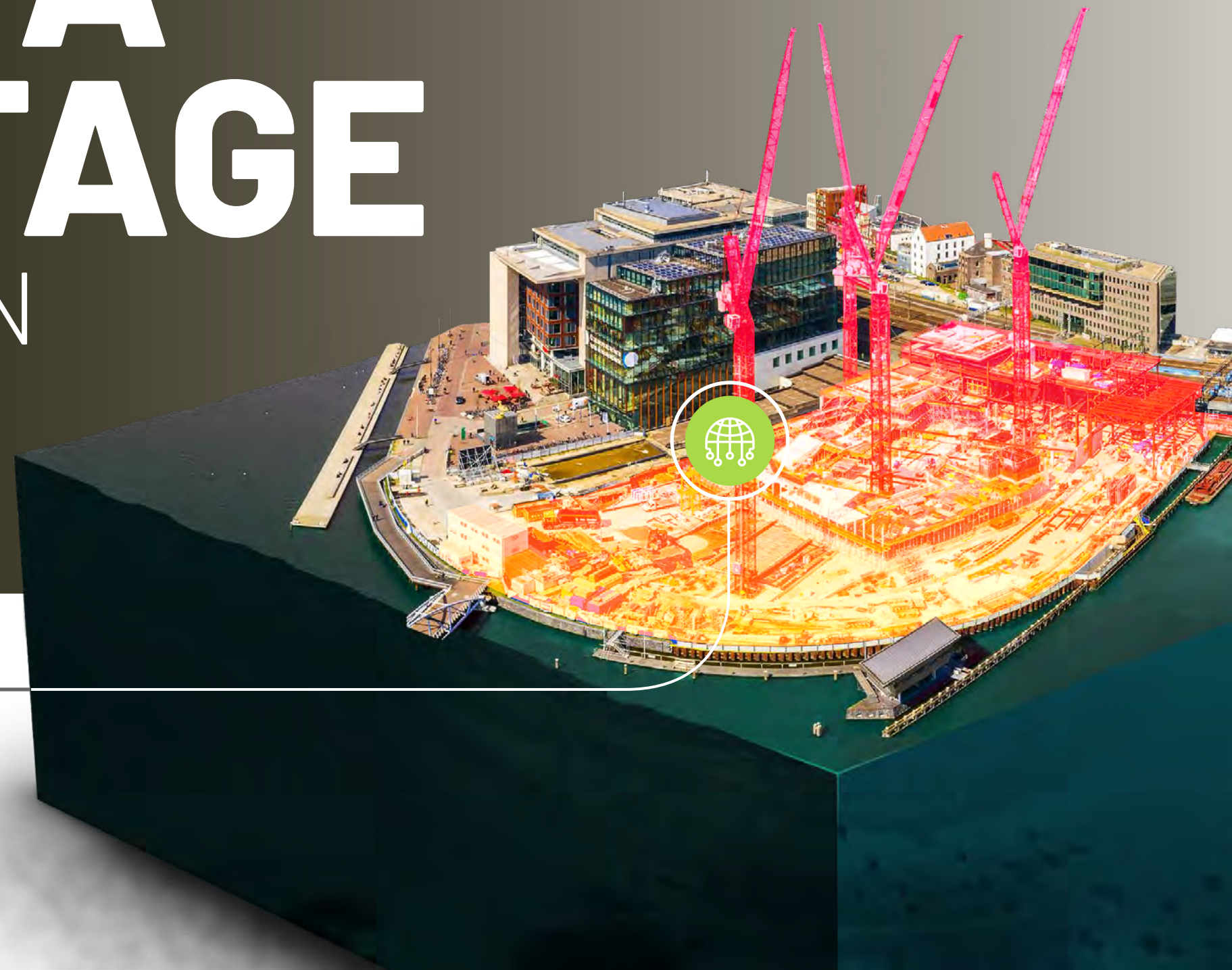


HARNESSING

THE DATA ADVANTAGE

IN CONSTRUCTION

Why adopting a data strategy can bring firms in Europe a competitive edge



FOREWORD

Projects are built on decisions. It might be owners choosing between two design routes – or subcontractors working out how to overcome an installation issue on-site. Whatever their size, all of these decisions combine to determine the overall success of the build, for the owners and every organisation involved.

These pivotal moments in the project can also create risk, whether it's adding cost, causing delays or even producing legal issues. And across the board, we're seeing more decisions taken during the build phase at the project manager level: staff who are often on-site and under significant time pressure.

The quality of every decision depends on data: having accurate, timely and complete information that you can use when you need it. But right now, data management is an area where many European firms are struggling.

We might be generating more information than ever before. But whether that's producing actionable insights – and better outcomes for the business – is another question.

We've surveyed 1,115 construction professionals and interviewed four contractors across Europe to understand their challenges in using data, as well as where they see the biggest opportunities for the future.

It's clear that using data can seem overwhelming. Many organisations don't know where to start – and with a lack of leadership and resistance to change, it can feel like an uphill struggle.

Using insights from businesses across Europe, this report shares simple steps that every business can take to overcome these hurdles, make more data-driven decisions – and start to realise the full potential of data in construction.

I hope you enjoy the report.

Mike Pettinella
Director of EMEA Sales
Autodesk Construction Solutions

TABLE OF CONTENTS

- 04 Executive Summary**
- 06 Demographics**
- 07 Definitions**
- 08 Chapter 1**
Construction data – is more always better?
- 12 Chapter 2**
Making decisions with data
- 16 Chapter 3**
The benefits and barriers to formal data strategies
- 20 Chapter 4**
Skills, culture and leadership are critical
- Region Perspectives**
 - 24 Benelux: Belgium, Luxembourg, Netherlands
 - 30 France, Germany
 - 36 Ireland, UK
 - 42 The Nordics: Denmark, Finland, Norway, Sweden
- 48 Conclusion**
The Four Steps of a Successful Data Strategy
- 49 What's next?**
- 50 Appendix**



EXECUTIVE SUMMARY

Construction firms are generating more data than ever before, but only a small proportion is usable.

- **82%** of professionals are collecting more data from construction technology today than three years ago,
- BUT
- **39%** say that less than half of that data is usable
- **40%** of the average organisation's data is bad – meaning
 - inaccurate
 - incomplete
 - inconsistent
 - untimely
- Professionals report problems with the whole process
 - **51%** don't know what data to collect
 - **52%** don't understand how to manage project data effectively

There is huge pressure to make decisions quickly, but often professionals make them without access to the data they need.

- **70%** of professionals say schedule compression means project managers and field supervisors need to make more rapid decisions
- **9%** always incorporate project data into their decision making
- WHILE
- **64%** do this sometimes, rarely or never
- **41%** of the time, on average, bad project data results in poor decisions

There is a clear divide between construction companies that are benefitting from a formal data strategy, and those unable to get started.

- **58%** of construction companies have a formal data plan in place
- BUT
- **33%** don't
- Companies with a data strategy say the biggest benefits are
 - fewer safety incidents
 - reduction in change orders
 - fewer missed schedules
 - less rework
- Most common reasons not to have a data strategy
 - **39%** A lack of applicability
 - **37%** Cost and resources
 - **35%** Not knowing where to start

Skills, culture and leadership will be central to pursuing successful data strategies, but many companies have barriers to overcome.

- **44%** of professionals say data management and analysis skills will be important for project management staff to do their jobs effectively in the future
- **36%** of companies are providing formal training in data analysis
- **34%** of companies cite a lack of leadership and organisational support as the reason they don't have a formal data strategy

By starting with a single project, construction businesses can make incremental progress in improving their data management.

DEMOGRAPHICS

This research is based on a survey and interviews conducted by research firms FMI and Censuswide in March 2021. The quantitative survey featured 1,115 construction professionals across Europe.

NATIONALITY

- Belgium 100
- Denmark 100
- Finland 106
- France 100
- Germany 102
- Ireland 102
- Luxembourg 103
- Netherlands 101
- Norway 101
- Sweden 100
- United Kingdom 100

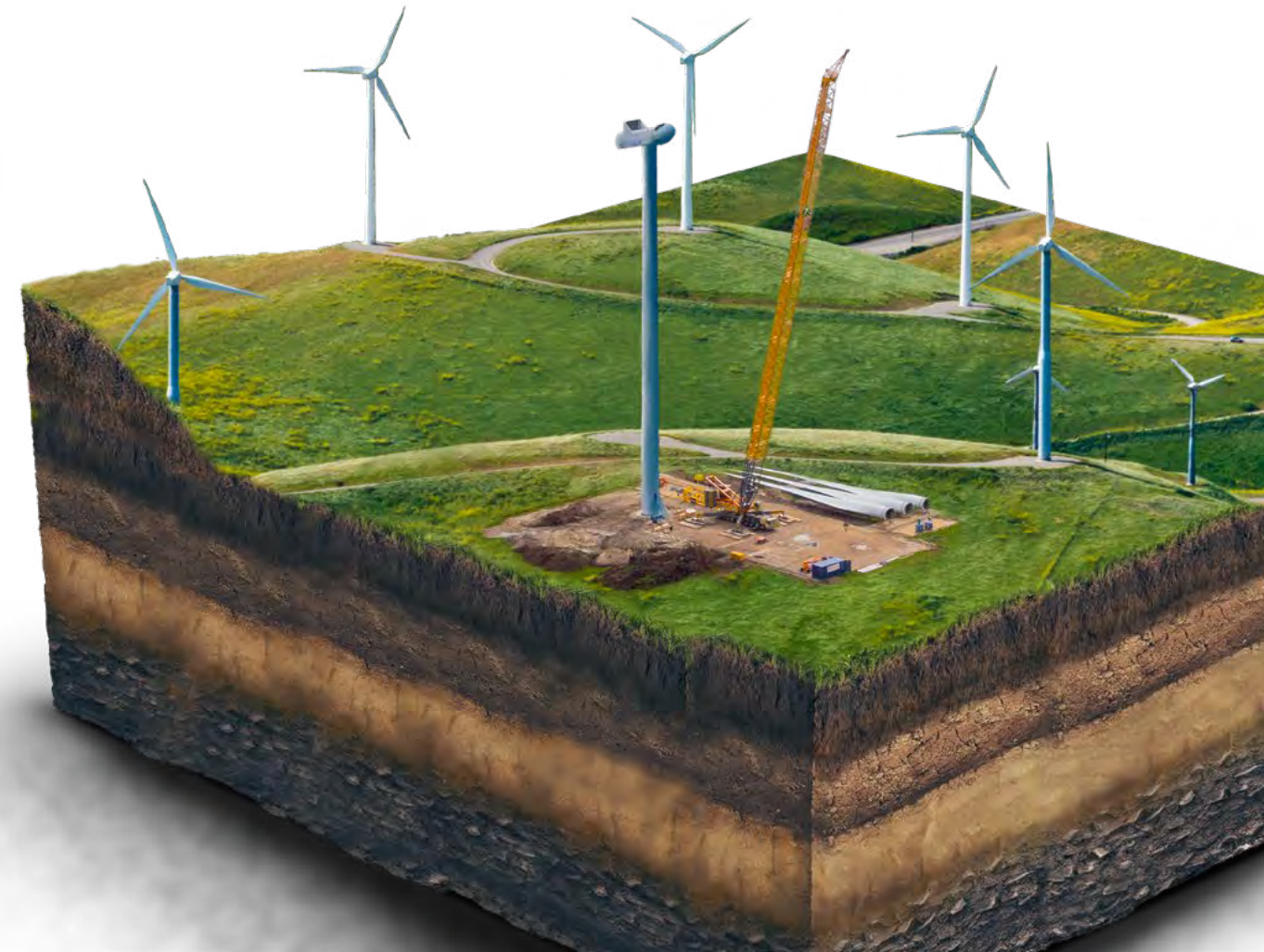
SPECIALISM

- Project Owner 28%
- Architect/Engineer 43%
- Construction Manager/
Main Contractor 24%
- Trade Contractor 5%



DEFINITIONS

- **Data** – Project-related data that represents measurements, observations or statistics. This might include BIM inputs, material quantities, safety incidents, assigned staff or cost data, for example.
- **Usable Data** – Usable project data is readily accessible, consumable, understandable, and actionable.
- **Bad Project Data** – Bad data is inaccurate, incomplete, inaccessible, inconsistent or untimely.
- **Construction Technology** – Construction technologies include hardware like cameras or sensors and software such as Building Information Modelling (BIM) tools that collect or create project data.



CONSTRUCTION DATA – IS MORE ALWAYS BETTER?

40% of the average construction business' data is bad

The use of technology in construction is growing – and one of the clearest consequences is that firms can access more data than ever before.

Most construction professionals (82%) agree their organisations are collecting more data from construction technology today than three years ago, with 43% reporting an increase of 50% or more. But when it comes to data, is more actually better – for projects and for the business?

Collecting and handling this level of information is taking up significant resources. The process can be split between multiple teams; as one main contractor in the UK explained, “Right now, our quality managers in the field and safety team capture all of the data we use. They give it to our data analytics team, who analyse it and build out the reports.”

On average, 49% of project management and field supervision staff's time is spent collecting, managing and analysing project data each week.

82%

ARE COLLECTING MORE DATA FROM CONSTRUCTION TECHNOLOGY TODAY THAN THREE YEARS AGO

The good, the bad and the unusable

Although more data is being collected, not all of it is usable. As one UK quality manager put it, “It's easy to just grab a lot of data, but this can cloud what you are trying to do.”

In fact, 39% of professionals say that less than half their data is “readily accessible, consumable, understandable and actionable” – or in other words, usable. Only 15% believe that three quarters or more of their organisation's data meets this definition.

Worse still, a significant proportion of this data is bad. On average, respondents characterise 40% of their organisation's data as “inaccurate, incomplete, inconsistent or untimely.”

There isn't a single outstanding issue causing this prevalence of bad data. When naming the biggest contributor, professionals are quite evenly split between inaccurate data (23%), duplicate data (21%), missing data (20%), wrong data (20%) and poor data quality (17%). Altogether, this can make data unreliable – creating problems, rather than adding value, for the business.



01

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Construction data – is more always better?

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Construction data – is
more always better?

Problems with the processes

From a process perspective, construction professionals are experiencing a number of challenges when working with their project data. The most common are that:

1. Data from one source cannot be easily combined with another source
2. There is too much data to know how to use it efficiently or effectively
3. Data is incomplete and missing certain aspects that would make it more usable

There are issues with the whole process of data management, from start to finish. Professionals point to problems with knowing what data to collect (51%), how to collect data efficiently (49%) and how to manage project data effectively (52%). Rather than pushing on with large scale data collection, taking the time to think specifically about these fundamentals may help businesses to get more from their data.

AUTODESK COMMENTARY

The rise of construction data means that companies can collect and access more data than ever before. But it's very clear that more isn't always better.

For example, project managers and field supervisors in Luxembourg spend the highest proportion of their time collecting, managing and analysing data (55%) – but nonetheless report the lowest proportion of usable data in the business across Europe.

Data management is often time-consuming and error-prone, and firms are concerned that they don't have the insight to improve the situation.

Thinking about data management strategically is the best place to start. Consider what project data is the most valuable to your team. Then think about ways to improve its reliability – for example, using cloud-based construction technology to record data more accurately on-site – then you can work from there. Incrementally, your data quality will improve.

MAKING DECISIONS WITH DATA

Poor data causes poor decisions 41% of the time

Decision making is one of the most pivotal parts of any project, but there are many factors that can create greater risk.

Experience and context can be key. When considering what adds the greatest risk to their decisions, construction professionals highlight a lack of experience with similar projects (35%) and failing to understand the project's relationship to the wider organisation (34%).

People also matter. A lack of input from others, particularly senior staff, (32%) and personal bias and conflict (25%) are also prevalent issues.

But overall, construction organisations point to time constraints as the single biggest risk to project decision making (38%). And this is a growing problem; 70% agree that because of factors like schedule compression and stakeholder requests, project managers and field supervisors need greater autonomy to make rapid decisions.

Which of the following areas presents the greatest risk to project decision making? Most popular response by country

Lack of experience with similar project decisions	Ireland ————— 40%
	Norway ————— 44%
Lack of input from others, especially senior staff	Luxembourg ————— 44%
	Finland ————— 41%
Failure to understand the relationship to other projects and the organisation more broadly	Belgium ————— 44%
	Denmark ————— 42%
	France ————— 50%
	Germany ————— 43%
Time constraints and urgent decisions	Netherlands ————— 37%
	United Kingdom — 40%



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Making decisions
with data

Gut feeling

Crucially, professionals often lack the data to make project decisions effectively. Only 9% always incorporate project data into their decision making – while 64% do this sometimes, rarely or never.

In fact, in many businesses, making decisions on-site based on gut feeling is a strong part of the working culture. “The level of decision making in the field has always been high, but these decisions have been made mostly on their experience and not analysis,” explained a BIM coordinator at a German main contractor.

Poor information-sharing within the organisation can be part of the issue. For example, the BIM coordinator noted: “The main challenge is always communication between the ones that collect the data and those that use it.”

So although it is being collected, data might not be making it through to those who need it – ultimately increasing project managers’ reliance on instinct.

Bad input, bad output

The issue isn’t just a lack of data in decision making. Worse still, data that’s inaccurate, incomplete, inconsistent or untimely actually compromises decisions. On average, construction professionals say that bad project data results in poor decisions 41% of the time.

Unsurprisingly then, a third say a lack of reliable data presents a key risk to project decision making (35%).

Information is one of the best ways to manage risks. But right now, employees on-site are under pressure to take decisions quickly, without easy access to the information they need – or worse, unsure if they can rely on the data they’ve been given.

AUTODESK COMMENTARY

Project managers have always been tasked with making decisions quickly. But with the Covid-19 pandemic disrupting projects across Europe, there’s more pressure on schedules than ever before.

Some countries are experiencing this acutely; in France, 50% of professionals say time constraints are adding risk to key decisions.

These are vital moments on projects. Making the wrong decision can cause rework, delays and extra costs, even making the difference between a profitable job and a loss for the partners involved.

It’s crucial that decision makers can access up to date, accurate project data whenever it’s needed. Cloud-based tools can be a valuable resource, and help to engage other stakeholders in the process. That way, professionals can be sure they are making the best decisions in the circumstances.

THE BENEFITS AND BARRIERS TO FORMAL DATA STRATEGIES

35% say their biggest data strategy hurdle is not knowing where to start

Construction companies are well aware that action is needed to get more from their data. Many are making specific efforts to ensure decision makers can access high quality information:

- 40% of construction companies regularly review data at set intervals for quality purposes
- 39% have established data reporting and monitoring practices at the time of collection and use
- 37% have structured data into a common data environment

Interestingly, a third have even created a formal position to oversee their data (33%), firmly entrenching data management in the business.

But companies are split when it comes to implementing a formal strategy to analyse data at an organisational level: in other words, putting a plan in place to collate insights from different projects and drive business-level improvements.

While 58% of construction companies have a formal data plan in place, a third (33%) don't. A further one in ten professionals (9%) don't know either way – suggesting that if strategies do exist, they aren't being well-communicated in the business.

Learning from the past

A data strategy is essentially a vision for how the company will use data to its advantage, so it can look very different from business to business.

At the construction companies with a strategy in place, there are differences between what that plan includes:

- 52% of data plans outline the sources and collection methods for priority data
- 45% include the identification and description of the project data to be collected
- 45% have quality assurance and control methods
- 45% have standards for project data formatting and processing

Importantly, companies with a plan to analyse data at the organisation-level are seeing better outcomes on the ground, because they are able to learn from past outcomes.

As one main contractor in Spain explained, "By tracking issues on our construction sites, we hope to avoid the same in the future. It's not just avoiding project-related problems; it's about avoiding legal problems as well. It has taken time to gather data across many projects, but it has been a good investment."

Respondents point to a number of benefits, with the most common being fewer safety incidents, a reduction in change orders, fewer missed schedules or reduced delays and less rework.



The barriers to overcome

At the 33% of construction companies without a formal data strategy, respondents point to a number of barriers in the way. The most common is “a lack of applicability” (39%), which could suggest professionals are failing to see how data plans can add value to their business.

For other businesses, just getting underway is a hurdle. Professionals point to the cost and resources required to create a strategy (37%) and simply not knowing where to start (35%). Interestingly, 31% of construction professionals say that the firm’s limited use of construction technology is the main barrier – which might indicate difficulties with digital transformation across the board.

Businesses without a data strategy could be missing out on opportunities to learn from past projects and improve. One innovation and quality manager in the UK recalled an incident where “we had a project that went terribly bad. A couple of years later, we had the exact same project. But because we did not have ready access to any data related to the first project, we made the same mistakes all over. Everything that went wrong was avoidable had we had the lessons learned from the first project available to our team.”

Although it might take time and investment, creating a strategy to collate data across the business and make ongoing improvements can pay dividends in the long run.

AUTODESK COMMENTARY

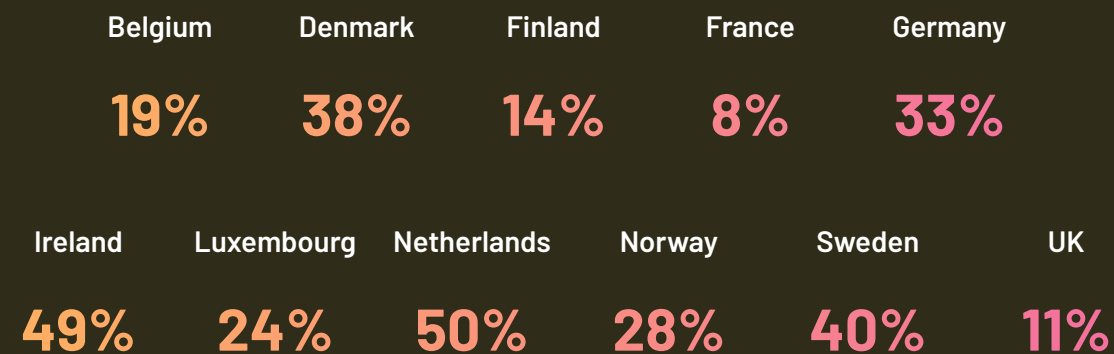
Many organisations are well-aware of their data management challenges and are making efforts to improve. For example, although construction companies in Denmark have a high proportion of bad data (47%), they are the most likely to have implemented a process for identifying and repairing that data (42%).

Taking insights from multiple projects is how organisations can make long-term improvements in the business. But there’s certainly no one size fits all when it comes to data strategies – and just knowing where to start can be a problem; 47% of UK companies without a data strategy say this is their biggest barrier.

The best approach is to start small, by focusing on the project data that you know can bring the most value to the business. Undertake a pilot project and progress from there.

It’s also important to use digital tools that are easy to integrate, in order to avoid data siloes and allow construction professionals to more easily build on data management processes for the future.

Why hasn’t your organisation implemented a formal project data plan or strategy? Answers for “Limited use of construction technology.”



SKILLS, CULTURE AND LEADERSHIP ARE CRITICAL

A lack of leadership blocks data strategies at 34% of businesses

Many construction firms are making greater use of technology and data than ever before. But success doesn't only come down to the digital tools and processes in place; it's about the people on the ground and creating the right company culture.

Businesses need employees who are ready and able to use new technologies – and many organisations are taking steps to upskill their staff today. Over a third of companies are providing formal training in data management and analysis (36%). It's also common to deliver training in technical skills (37%), safety (35%) and scheduling (35%).

The format of this training is important. Where organisations offer data management training, it is most commonly through formal third-party instruction (31%), informal on the job training (26%) or formal in-house training (26%). Offering multiple formats is valuable. "When you train people on it, you will need different methods," explained one data analyst at a UK main contractor.

Professionals highlight the importance of ongoing support for staff: "Training is not a one-time event. It has to be continuous." Some even see training as a competitive differentiator, with one Spanish contractor noting, "If we are not working towards having these skills in people, our competitors will."

Future skills

Many construction professionals believe digital skills will become even more valuable over time. In fact, 44% say data management and analysis skills will be important for project management and field supervision staff to do their jobs effectively in the future.

Across the board, professionals point to a number of analytical skills that will be important for the future of the industry, including data management strategy (43%), data analytics (39%) and workflow optimisation (39%).

As one contractor in Spain puts it, "Data analysis skills will be critical for the future construction workforce, because data and insights can create competitive advantage."

Interestingly, 32% of professionals point to data science and programming and 29% highlight machine learning – believing these relatively specialist skills today will become much more important in the years ahead.

At the same time, some believe that technology will be vital for attracting the next generation of talent into construction: "Young people are used to using technology and will expect it in their jobs."



Culture challenges

However, there are signs that in some cases company culture will present a barrier to making greater use of data in the future. Adopting technology represents a significant change – and for many workers, that can be difficult to accept.

One UK main contractor explained, “Some of our people just can’t get their heads wrapped around the reports – and it’s not because they don’t understand them: it’s more a culture change and shift in what people are used to. There has been a small minority that has been resistant to any change.”

Challenges with data management can make people even more reluctant to adopt new tools. A common issue reported by professionals is that errors raise suspicion about the data and its usefulness and value – which will in turn hinder efforts to make greater use of technology in the business.

Communication is an important part of encouraging technology adoption. “One of the early challenges we ran into was our approach,” recalled an innovation and quality manager. “We were giving iPads to our field staff for taking photos and completing forms. They initially felt like it was more work and that we were adding stages that were not necessary. We had to explain to them why we were doing it and how it would save them time – and now they are really happy.”

Leadership is critical – but this is one area where many businesses are falling down. Where organisations don’t have a formal data strategy in place, 34% point to a lack of leadership and organisational support as the main reason.

Construction leaders must make data management a strategic priority at the highest level, and support adoption across the business. Otherwise, it will be difficult to progress – and there is a risk of being left behind by competitors.

AUTODESK COMMENTARY

Technology is creating new opportunities in construction, but this in turn is changing the processes and skills needed in businesses. This often requires a significant cultural change too – but that change can be very difficult, especially in an industry that has worked in the same way for a long time.

Reluctance in the leadership team and across the business can be a major barrier. In Belgium, 40% of professionals say that the biggest barrier to creating a data strategy is a lack of support from leadership and their organisation. Meanwhile, in Denmark, 32% of professionals highlight conflict on projects – which suggests an atmosphere that might not be conducive to change.

Leadership will be vital to help employees adopt new tools and ways of working, whether that’s the senior leadership team or champions on every project. It’s also critical that companies support employees in gaining the skills needed for the future through formal training and proactive engagement.

Fortunately, many of today’s digital tools are designed to be intuitive and easy to use. With the right support, even less confident employees can begin to gain digital skills and help to unlock the benefits of data insights for the business. Additionally, younger recruits into the business can lend their digital skills to support their experienced colleagues working in the field.

REGIONAL PERSPECTIVES

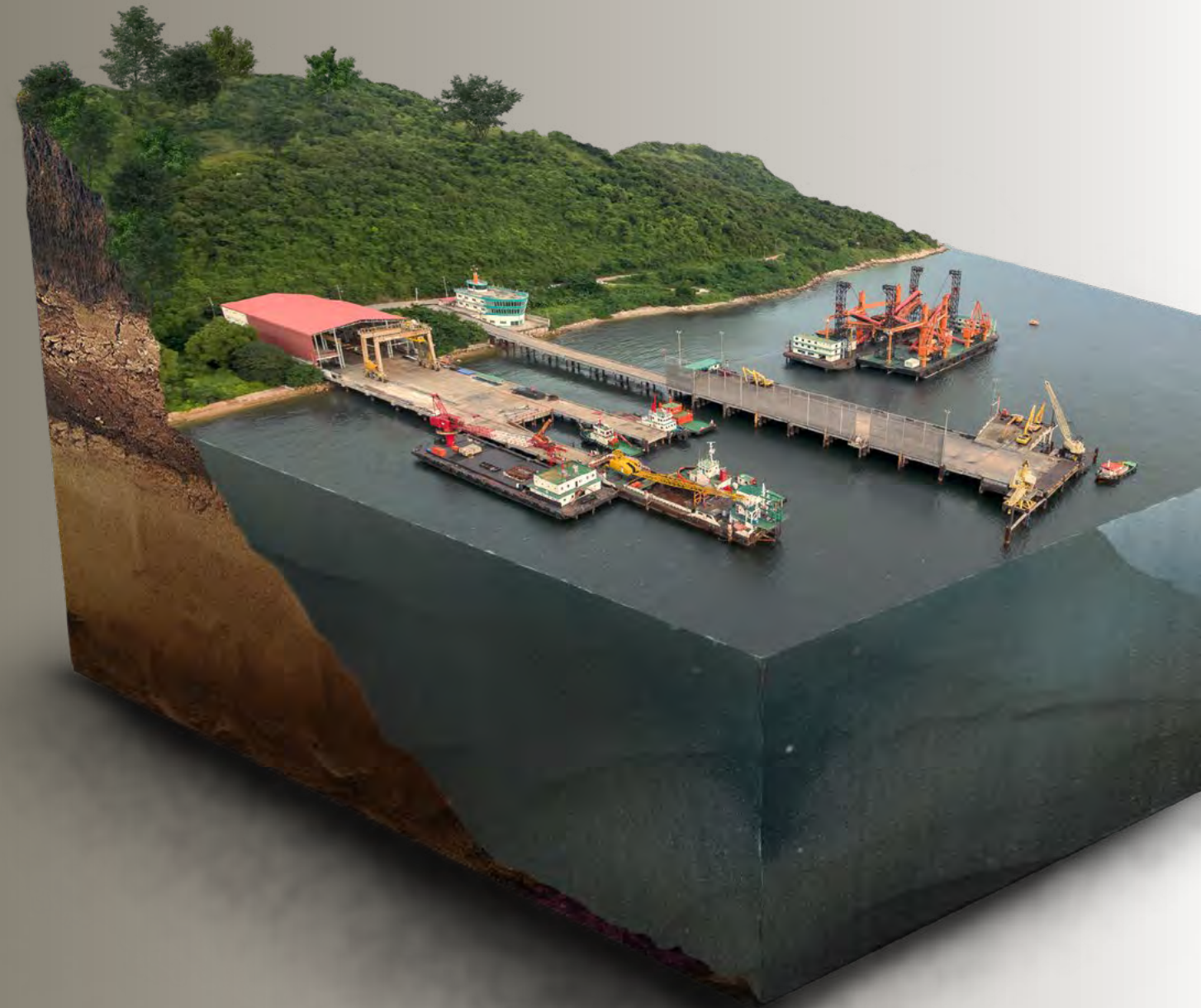
BENELUX: BELGIUM, LUXEMBOURG, NETHERLANDS

The last 12 months have been challenging for Benelux construction companies, although each country in the region was uniquely impacted by the Covid-19 pandemic. In Luxembourg, construction was particularly badly hit by the first wave of the pandemic, with activities falling by 55% between February and April 2020 when most project work was suspended.

By contrast, in the Netherlands, construction sites remained open with reduced activity. As a result, by April 2021 the sector had returned to pre-crisis productivity levels, and confidence was high. Belgium has fallen somewhere in the middle; the economy as a whole grew at the start of 2021, but construction only grew by 0.1% compared to the same period in 2020.

● When it comes to the risk factors organisations face daily, different issues surface in each country. Construction professionals were asked about the two factors that pose the biggest risks for their project decision making:

Belgium	Luxembourg	Netherlands
<p>44%</p> <p>Time constraints and urgent decisions</p>	<p>44%</p> <p>Lack of input from others, especially senior staff</p>	<p>37%</p> <p>Lack of reliable data</p>
<p>40%</p> <p>Lack of input from others, especially senior staff</p>	<p>38%</p> <p>Failure to understand the relationship to other projects and the organisation more broadly</p>	<p>36%</p> <p>Lack of experience with similar decisions</p>



Data in decision making

To explore how construction companies in Benelux use data, respondents were asked how often project data is incorporated into their companies' decision making. Luxembourg is one of the countries that does this least often across Europe:

- **Belgium: 28%** always or often incorporate project data into decision making
- **Luxembourg: 24%** always or often incorporate project data – but 43% say rarely or never
- **Netherlands: 44%** always or often incorporate project data

Respondents were asked how much of their data they would characterise as bad – inaccurate, incomplete, inconsistent or untimely – and how often that results in poor decisions, producing broadly consistent results across the region.

- **Belgium: 38%** of the data is bad – resulting in poor decisions 41% of the time
- **Luxembourg: 46%** of the data is bad – resulting in poor decisions 47% of the time
- **Netherlands: 43%** of the data is bad – resulting in poor decisions 44% of the time

Interestingly, looking back over the last three years, construction companies in Luxembourg report the lowest increase in data from construction technology in the business across Europe (just 31% say it has gone up by more than half). Luxembourg companies also report the lowest proportion of usable data in the business in Europe, and indicate that their biggest data management challenge is knowing what project data to collect (56%).

However, Luxembourg is one of the counties where the highest proportion of project management and field supervision staff's time is spent collecting, managing, and analysing project data each week. This takes 55% of staff time in Luxembourg, compared to 38% in Belgium and 50% in the Netherlands. This suggests that companies in Luxembourg are still reliant on manual data gathering processes, which may in turn explain why project data is so rarely used in decision making.

Data strategy divides

As in every region, there is a clear divide between construction companies that have a data strategy, and those that don't. Companies without a formal data strategy in place were asked what their biggest barrier is, with some pointing to limited use of construction technology.

Dutch companies without a data strategy are the most likely to say that a lack of construction technology is a key barrier – perhaps suggesting a significant divide between companies with digital tools and data strategies, and those lacking either:

- **Belgium: 19%** point to limited use of construction technology
- **Luxembourg: 24%** point to limited use of construction technology
- **Netherlands: 50%** point to limited use of construction technology

Companies with a formal data strategy in place were asked about the benefits they receive from it, such as less rework and fewer missed schedules. Belgium is the country where companies with a data management plan are the least likely to be realising these benefits from it; by comparison, in Luxembourg, companies are amongst the most likely to report advantages.

So, although companies in Luxembourg might be struggling with data management, the few with a formal strategy in place are seeing a clear advantage.

The view from Benelux

Sander Lijbers

**District Manager – Benelux and Europe East
Autodesk Construction Solutions**

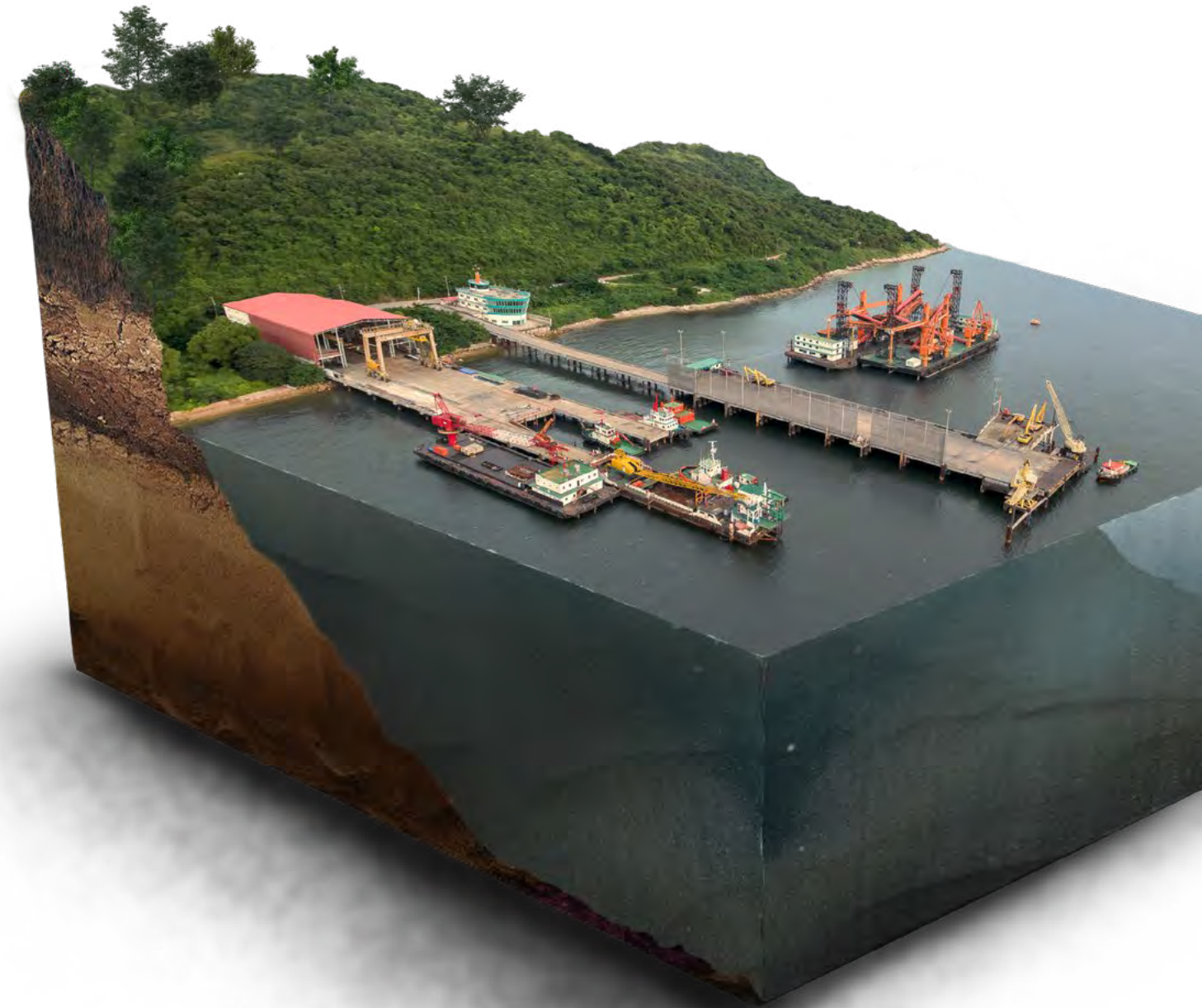
There's a mixed picture when it comes to data management in the Benelux region. Dutch construction companies have long been seen as forerunners in their use of digital technology and data, but there are some signs that the rapid pace of digitalisation has been slowing.

The challenge in many organisations seems to be working out the next step to take: data is being collected on the ground, but now it's not clear how it should be used to drive wider improvements. For many Dutch companies, disjointed systems are a significant hurdle.

In Belgium, the use of cloud tools has accelerated – matching and even outpacing the Netherlands in some respects. The pandemic has driven greater interest in data-sharing tools,

with some Belgian companies taking the opportunity to progress into augmented and virtual reality technologies. There is however a divide in many businesses, between younger, digitally native employees and those who might be older and more reluctant to change. Meanwhile, in Luxembourg, most companies are at an early stage in their digital journeys.

Throughout the region, construction companies should focus on integration as they adopt more digital tools and continue with their transformation. Selecting a platform that can be easily integrated with other systems will be key for getting the most value from data in the future. At the same time, upskilling – to ensure that the workforce is supported and engaged with digital tools – will be a marker of success.



REGIONAL PERSPECTIVES

FRANCE, GERMANY

Construction businesses in France and Germany have faced quite different prospects over the last twelve months. During the first wave of the Covid-19 pandemic, most French construction sites closed down – with industry-wide activity plummeting by 64% from February to April 2020.

More sites were able to remain open during subsequent lockdowns, although in April 2021 construction in France was still more than 5% lower than pre-crisis levels. Permits for residential and non-residential buildings fell sharply in 2020, suggesting further challenges in the future pipeline.

- In fact, these issues seem particularly prevalent compared to the other countries surveyed; when asked what presents the greatest risk to project decision making, France was the country in Europe most likely to point to time constraints, whereas German companies were the most likely in Europe to highlight a lack of reliable data:

France

50%

Time constraints and urgent decisions

36%

Lack of reliable data

Germany

43%

Time constraints and urgent decisions

41%

Lack of reliable data

By contrast, in Germany construction sites remained open; despite some delays due to social distancing, there was almost no decline in construction activity. Confidence is high and the industry is expected to grow by 2.8% in 2021, with infrastructure projects like the Fehmarn Belt underwater tunnel, linking Denmark and Germany, underway.

However, construction professionals in both countries are very aligned when it comes to the greatest risks faced on individual projects: lack of time and lack of information.



Data in decision making

To explore how French and German construction companies use data, respondents were asked how often project data is incorporated into decision making. France is the European country where professionals report using data the most often:

- **France: 55%** always or often incorporate project data into decision making
- **Germany: 41%** always or often incorporate project data into decision making

Respondents were asked how much of their data they would characterise as bad – inaccurate, incomplete, inconsistent or untimely – and how often that results in them making poor decisions. Both countries performed very well by this measure, with German companies reporting the lowest proportion of bad data and French companies reporting the joint fewest resulting bad decisions in Europe:

- **France: 33%** of the data is bad – resulting in poor decisions 28% of the time
- **Germany: 30%** of the data is bad – resulting in poor decisions 31% of the time

COMPANIES

GERMANY

REPORTS THE LOWEST PROPORTION OF BAD DATA

FRANCE

REPORTS THE JOINT FEWEST RESULTING BAD DECISIONS

Data strategy divides

Companies were asked whether they have a formal data strategy in place – and if so, what it encompasses. Alongside Ireland, Germany is the only country where most data plans include standards for project data formatting (58%), collection methods for priority project data (52%) and quality assurance measures for collected data (54%), suggesting a mature approach to data management.

Companies without a formal data strategy in place were asked why not – and whether a lack of construction technology was the main barrier. Interestingly, in France the fewest companies cited a lack of technology as an issue, possibly pointing to higher adoption across the sector:

- **France: 8%** point to limited use of construction technology
- **Germany: 33%** point to limited use of construction technology

German construction companies are the most likely in Europe to have structured their data into a common data environment (45%). Moreover, alongside Ireland, Germany is the country where companies are most likely to give formal training to project managers and field supervisors on data management and analytics (44%), supporting longer term efforts to improve data management.

GERMANY, A MATURE APPROACH TO DATA MANAGEMENT

58%
PROJECT DATA
FORMATTING

52%
COLLECTION METHODS
FOR PRIORITY
PROJECT DATA

54%
QUALITY ASSURANCE
MEASURES FOR
COLLECTED DATA

The view from Germany and France

Marvin Theissen

**District Manager – Western Europe
Autodesk Construction Solutions**

Data management is hugely significant for construction businesses in France and Germany. Projects in both countries face acute time pressures, with French companies compensating for pandemic-related delays and Germans meeting high demand. Fortunately, businesses recognise the value of good quality data for making informed decisions at pace.

It's interesting that many French companies report using data to make project decisions, but there's still progress to be made when it comes to standardisation across the business. That means adopting good practices, such as standard data formatting and quality assurance measures, as well as investing in formal training. That will enable companies in France to gain the most insight from data at an organisational level – and boost their productivity in the long-term.

Germany is one of the most mature countries with regards to data management, and a key driving force is demand from public and private sector clients. Importantly, many German companies are already benefitting from common data environments (CDEs), which can eliminate siloes and enable leaders to get business-wide insight. This will give the German industry an excellent platform for further transformation, and help the whole construction ecosystem – from design through to facilities management – to take advantage of data.



REGIONAL PERSPECTIVES

IRELAND, UK

After a difficult year, construction companies in Ireland and the UK are looking forward to a strong recovery in 2021. In Ireland, the industry as a whole is predicted to grow by 15% over the course of the year – and while this won't mean a return to pre-crisis levels, it is a significant rise over 2020.

Although Irish companies continue to face a skills shortage, there are signs that the sector could be well-placed to attract talent in the longer term; pay in construction is good compared to other EU countries, reaching close to the national average wage. Importantly, Brexit has not so far resulted in widespread challenges for Irish companies receiving equipment and materials.

- Interestingly, a lack of information is a challenge that both Irish and UK professionals point to across their projects, when asked about the factors posing the biggest risks to decision making. In fact, the UK is the country most likely to point to a lack of reliable data:

Ireland

40%

Lack of experience with similar decisions

39%

Lack of understanding of the relationship to other projects and the business

United Kingdom

40%

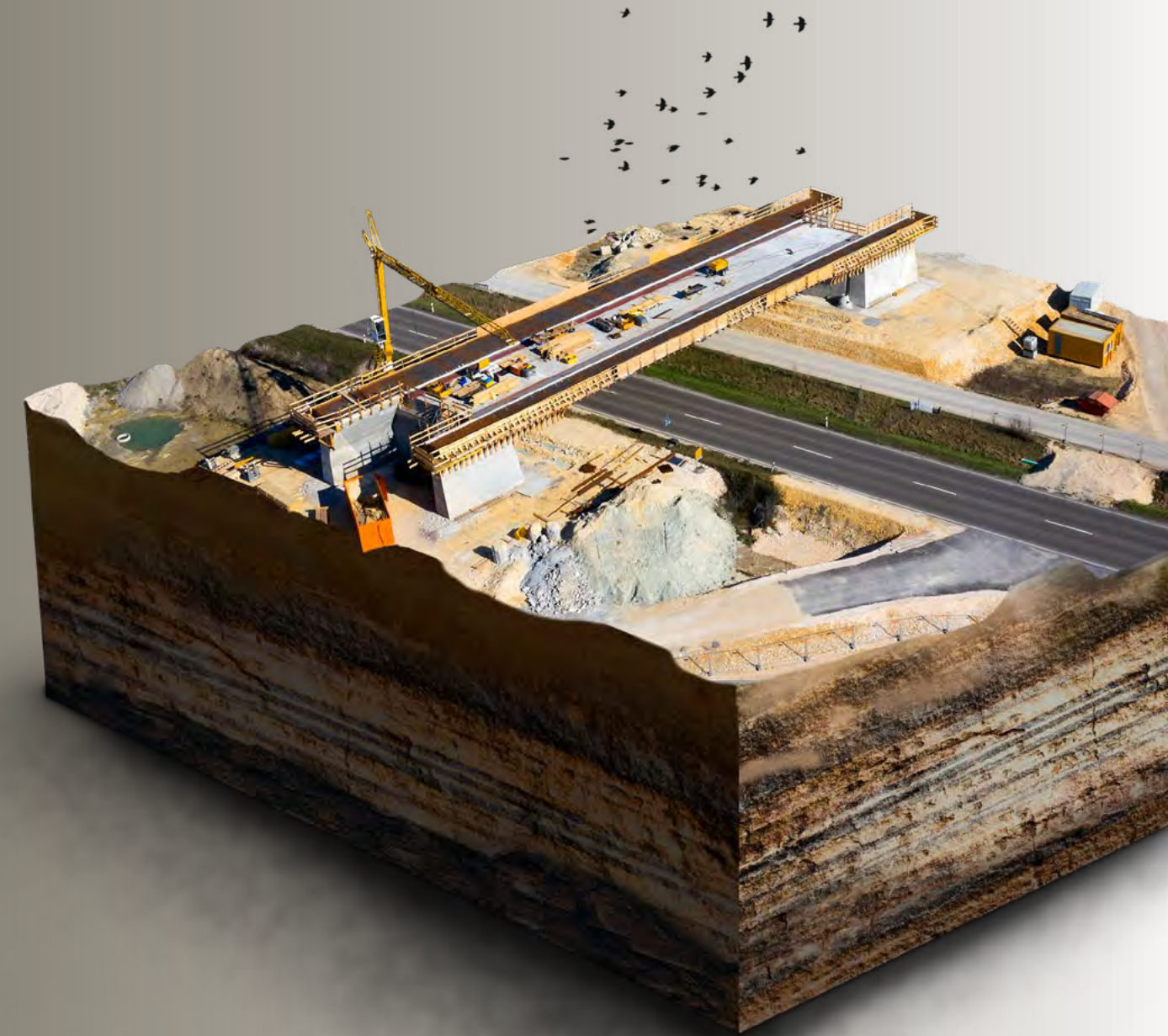
Lack of reliable data

39%

Lack of experience with similar decisions

Construction businesses in the UK can also look ahead to some recovery in 2021, with growth of 12.9% forecast across the industry. The infrastructure sector is set to perform especially strongly, with projects like HS2 and utilities upgrades underway.

However, UK organisations are facing longer term changes: for example, the continuing impact of Brexit on talent and the supply chain. Equally, the government's Construction Playbook will require businesses to use digital tools and data to support public sector bids, which will mean changes for many organisations.



Data in decision making

To explore how data is used by Irish and UK construction companies, respondents were asked how often project data is incorporated into decision making:

- **Ireland: 34%** always or often incorporate project data into decision making
- **UK: 44%** always or often incorporate project data into decision making

Respondents were also asked how much of their data they would characterise as bad – inaccurate, incomplete, inconsistent or untimely – and how often that results in poor decisions. The UK performed very well by this measure, reporting the second lowest proportion of bad data and bad decisions in Europe:

- **Ireland: 41%** of the data is bad – resulting in poor decisions 46% of the time
- **UK: 32%** of the data is bad – resulting in poor decisions 31% of the time

Across Europe, Irish companies reported the highest recent increase in project data generated by construction technology; 58% say that data has increased by at least half in the last three years.

However, this has a resource implication. In Irish businesses, project managers and field supervision staff spend the most time in Europe on collecting, managing and analysing data, occupying 62% of their time compared to 39% in UK.

58%

SAY THAT DATA HAS INCREASED BY AT LEAST HALF IN THE LAST THREE YEARS

Data strategy divides

Companies were asked whether they have a formal data strategy in place – and if so, what it encompasses. In Ireland, where companies do have a data strategy in place, there are likely to be several good processes set up.

Alongside Germany, Ireland is the only country where most data plans include standards for project data formatting (55%), collection methods for priority project data (50%) and quality assurance measures for collected data (55%).

Likewise, UK companies also have good data practices established. After Germany, UK is the country where companies are most likely to regularly review data at set intervals for quality purposes (45%), to improve the information available to decision makers.

However, in both countries there are companies without data strategies in place – and for some, a wider lack of construction technology in the business is the main reason. In fact, in Ireland, this is the most common blocker for those companies that don't have data strategies, whereas in the UK it's relatively uncommon:

- **Ireland: 49%** point to limited use of construction technology
- **UK: 11%** point to limited use of construction technology

DATA PLANS IN IRELAND

55%
STANDARDS FOR PROJECT DATA FORMATTING

50%
COLLECTION METHODS FOR PRIORITY PROJECT DATA

55%
QUALITY ASSURANCE MEASURES FOR COLLECTED DATA

The view from Ireland and the UK

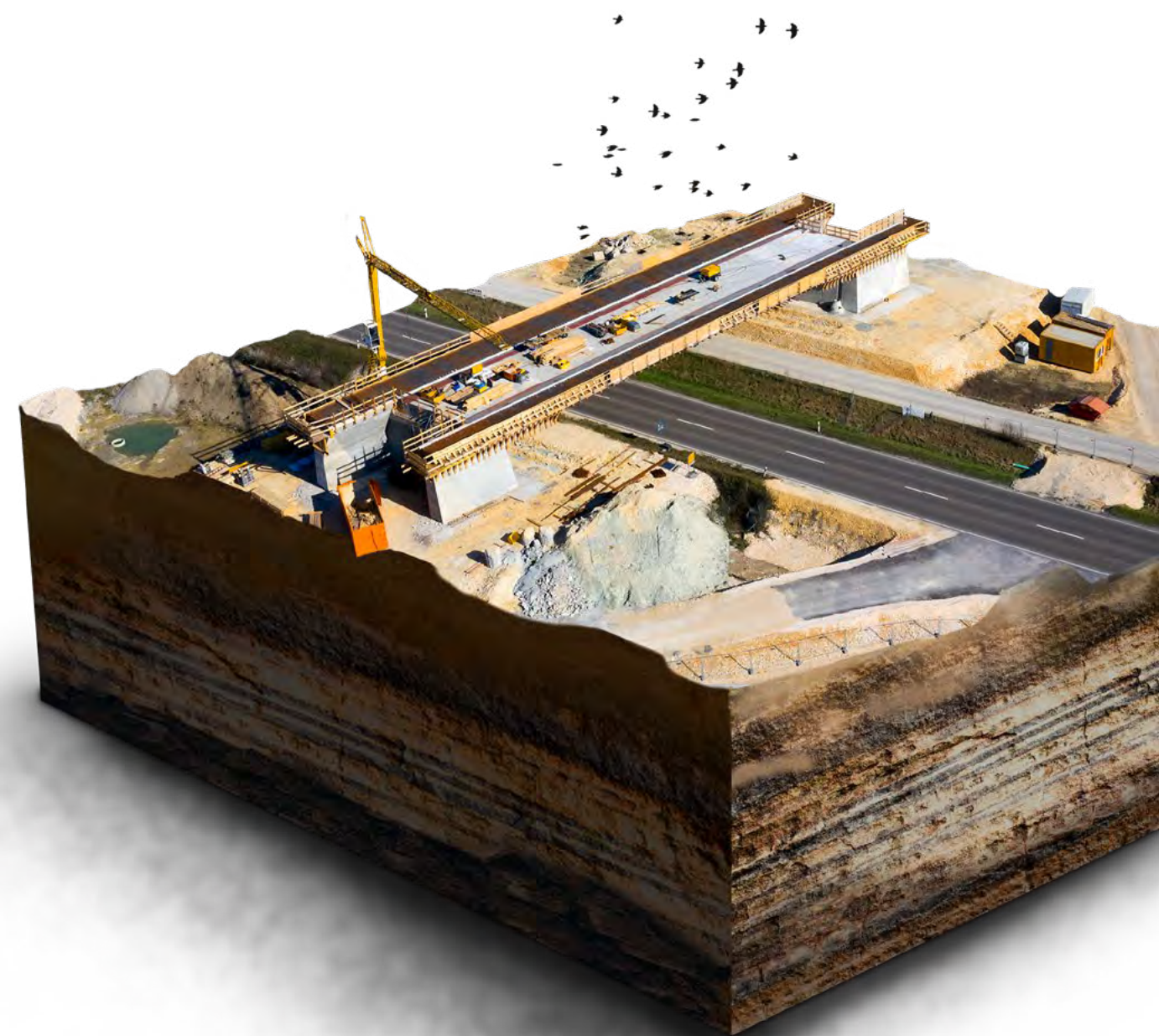
Marek Suchocki
Industry Engagement Lead
Autodesk

Construction companies in Ireland and the UK are increasing their focus on data management. In Ireland, we're seeing a rapid rate of change as companies transition from analogue to digitalised processes and begin to make use of project data. Client maturity, rising awareness and the need to deliver a high workload with limited resources are all likely to be driving this digital adoption.

It's positive that advanced companies in Ireland are developing comprehensive data plans. Generally, however, there's still plenty of work to be done in most businesses, as shown by the relatively high proportion of bad data and the relatively high effort required to gather it. Focusing on adopting and embedding digital tools for the site will help businesses to collect data efficiently and accurately, while providing formal and informal training for project managers will ensure they can use this data to drive decision making.

In the UK, client demand and appetite for change are driving technology adoption across the sector. Owners are demanding digital workflows and data handover, while the government is now mandating BIM adoption for public sector projects.

And positively, organisations are responding by incorporating data more closely into their projects. In fact, it's really encouraging that construction professionals highlight poor data as the biggest risk that they face, as in fact this shows an increasing reliance on data for project execution. The next stage will be for businesses to ensure that they can use insights from multiple projects to drive internal improvements, from productivity and quality to safety. This will help both UK and Irish businesses to meet ongoing uncertainty in the months ahead.



REGIONAL PERSPECTIVES

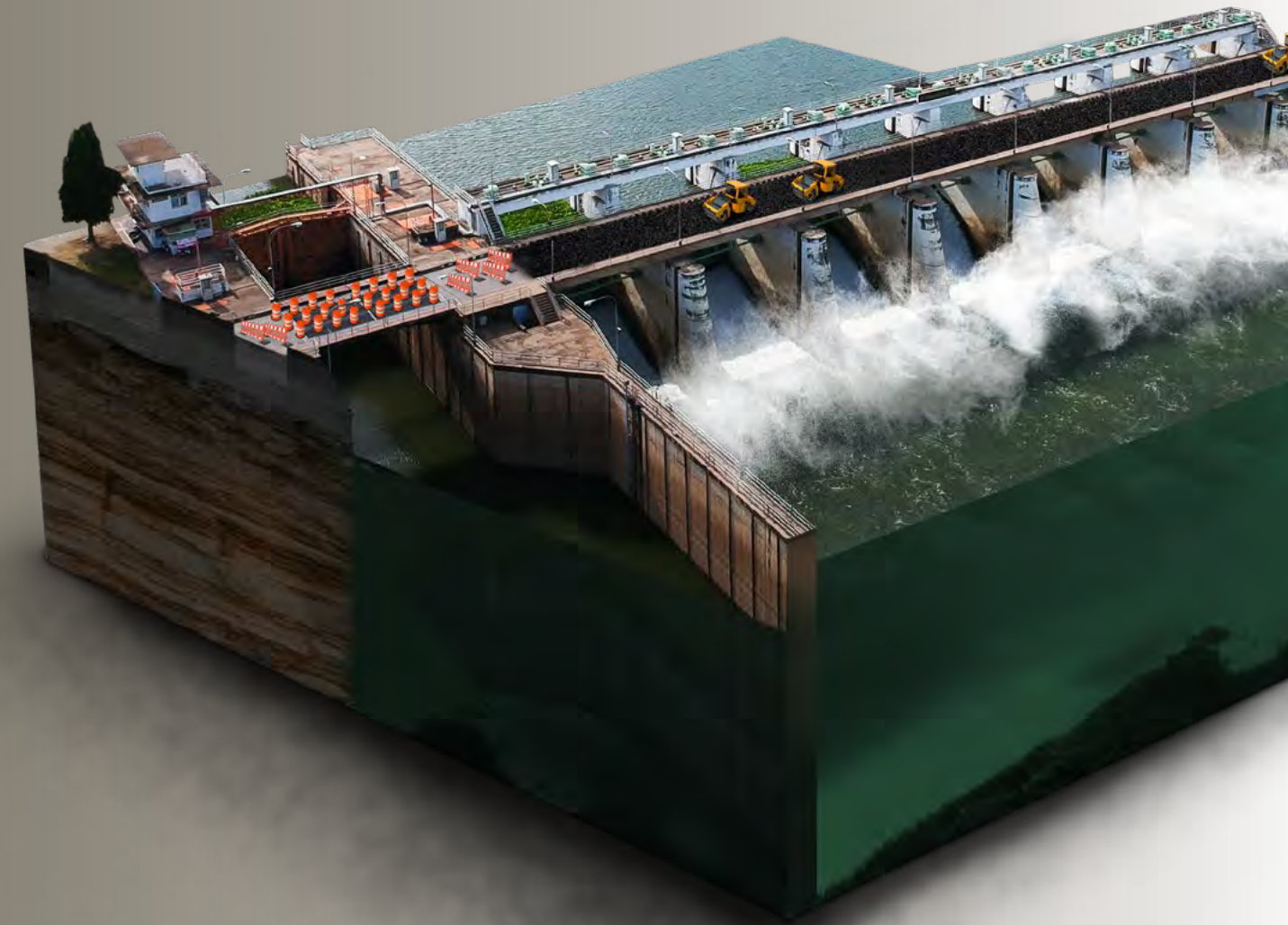
THE NORDICS: DENMARK, FINLAND, NORWAY, SWEDEN

In the Nordics, construction industries have been less severely impacted by the Covid-19 pandemic than some other European countries, due to a lower proportion of lockdown closures. Between February and April, construction activity in Finland dropped only moderately - while in Denmark and Sweden, it actually increased. Despite a year of challenges, by April 2021 Finnish and Swedish companies had returned to pre-crisis activity levels.

However, Nordic construction companies face wider changes: all four countries have committed to taking a leading role in the global green recovery, with the respective Prime Ministers underlining the role of both public and private sector organisations in this transition to sustainable development.

- From project to project, Nordic companies tend to point to time constraints, lack of experience and communication challenges as posing the greatest risk to their decision making:

Denmark	Finland	Norway	Sweden
42%	41%	44%	42%
Time constraints and urgent decisions	Failure to understand the relationship to other projects and the organisation	Lack of experience with similar decisions	Time constraints and urgent decisions
39%	36%	36%	36%
Lack of experience with similar decisions	Lack of experience with similar decisions	Lack of input from others, especially senior staff	Lack of input from others, especially senior staff



Data in decision making

To explore how Nordic construction companies use data, respondents were asked how often project data is incorporated into decision making. While Finland and Sweden perform well, Norway is the country that does this the least often in Europe:

- **Denmark: 34%** always or often incorporate project data into decision making
- **Finland: 45%** always or often incorporate project data
- **Norway: 20%** always or often incorporate project data – but 51% say rarely or never
- **Sweden: 40%** always or often incorporate project data

Respondents were also asked how much of their data they would characterise as bad – inaccurate, incomplete, inconsistent or untimely – and how often that results in poor decisions. Again, Norway performs the worst of any country in Europe by this measure:

- **Denmark: 47%** of the data is bad – resulting in poor decisions 47% of the time
- **Finland: 45%** of the data is bad – resulting in poor decisions 44% of the time
- **Norway: 49%** of the data is bad – resulting in poor decisions 48% of the time
- **Sweden: 38%** of the data is bad – resulting in poor decisions 39% of the time

Alongside Germany, Denmark is the European country most likely to have a process for identifying and repairing poor data (42%) – so although companies identify a high proportion of bad data, there are measures in place to address it.

Data management appears to be particularly time consuming in the Nordics. In all four countries, more than half of project management and field supervision staff's time is spent collecting, managing and analysing project data – Denmark: 51%, Finland: 51%, Norway: 53% and Sweden: 55%. Outside the Nordics, this is only the case in Ireland and Luxembourg.

Data strategy divides

When it comes to whether companies have a strategy for data management, there is significant variation across the region. In fact, Sweden is the only country in Europe where the majority of construction companies don't have a formal plan for collecting and analysing data across projects – 42% have a plan, and 58% don't – compared for example to Denmark where 73% of businesses have a formal data plan.

Companies without a formal data strategy in place were asked why not – and some pointed to limited use of construction technology as a barrier. By this measure, Sweden looks to have the largest proportion of companies where a lack of technology is hindering data management:

- **Denmark: 38%** point to limited use of construction technology
- **Finland: 14%** point to limited use of construction technology
- **Norway: 28%** point to limited use of construction technology
- **Sweden: 40%** point to limited use of construction technology

Finland is the only country in Europe where most companies without a data strategy point to the cost and required resources as the biggest problem, at 57%.

Norway is the country in Europe where companies are the least likely to have structured their data into a common data environment, at 27% compared to 45% in Germany. On the other hand, Norwegian companies are the most likely to have created a formal position to oversee data; Norway is almost twice as likely as Denmark to have done so (42% compared to 22%). Likewise, Norway's construction companies are the most likely in Europe to offer formal third-party training on data management (45%).

The view from the Nordics

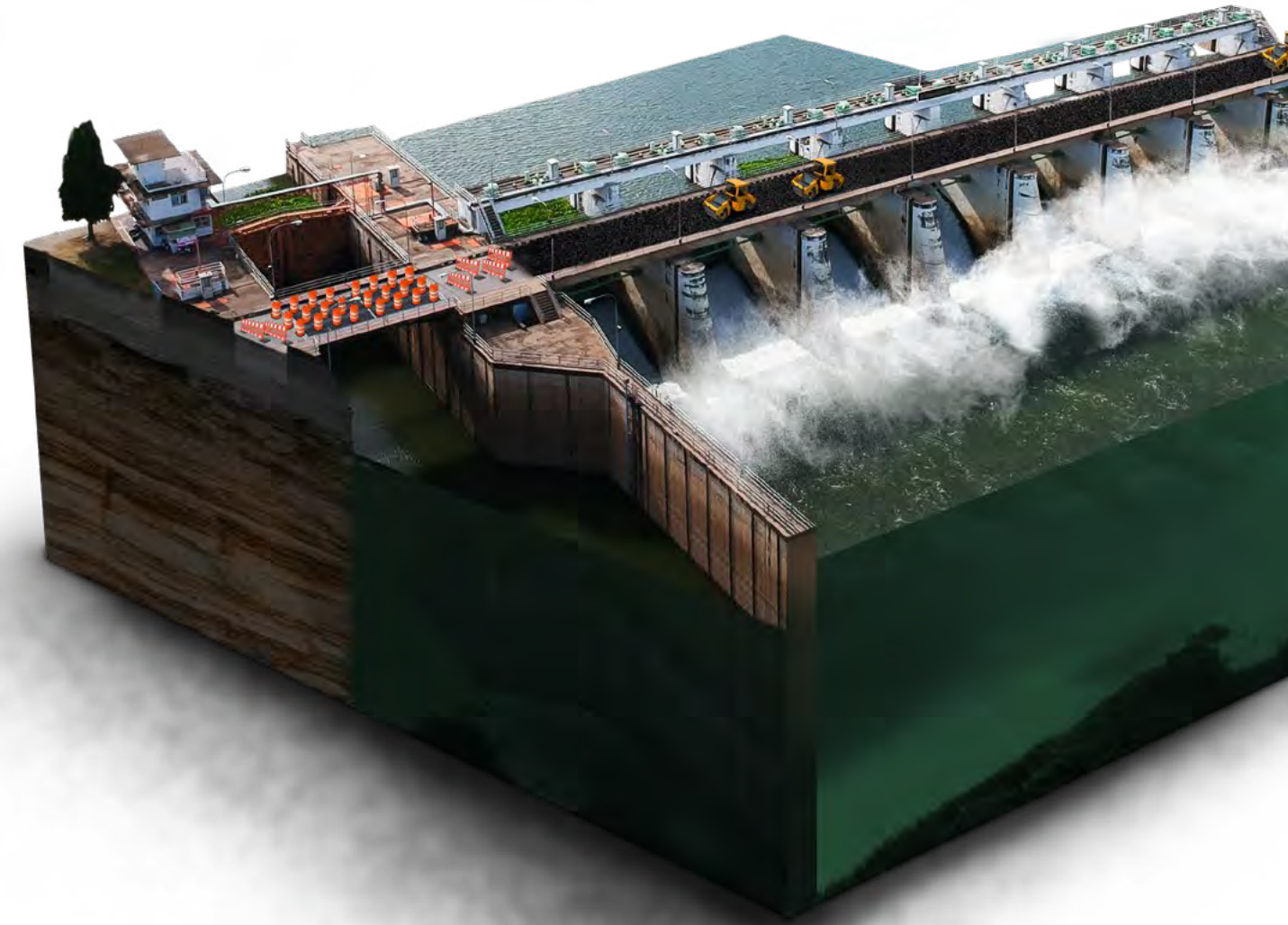
Nicholas Kloholm

**District Manager – Nordics, Baltics and Poland
Autodesk Construction Solutions**

Data management is a challenging problem – and right now, no construction company in the Nordics has quite managed to solve it. Organisations are trying different things and many separate initiatives have been set in motion. But so far, these measures are pretty siloed: there's no overall plan from a C-level perspective, and that can leave people feeling like they're fumbling in the dark.

In my opinion, the biggest blocker for true digital transformation in the Nordics is the way we organise our projects. Every team can decide on the processes and tools that they want to apply on each project, choosing whatever suits their individual needs best; this is completely autonomous from the wider company objectives, because we don't have a strong top-down approach in place. In turn, the data harvested from each project is only shared internally at the end – but rarely looked at again to gain insights and knowledge.

A lack of understanding about data management across organisations is a key issue. There are ways to gather insights more efficiently: for example, using BI (business intelligence) modules to gain an overview of all the organisation's data. Nordic construction companies need to gain an understanding of the approaches available – and look for digital platforms that make it easy to integrate their data. I believe that will help them to take the next step in their data management.



CONCLUSION

With the rise of construction technology, organisations can access more data than ever before.

There are significant advantages for the businesses that can use this data well. On projects, teams can make better decisions and mitigate risk, to finish on time, on budget and realise a profit.

At a business level, firms can take learnings forward from project to project to avoid repeating past mistakes, make evidence-led improvements and even spot issues before they occur.

But reaching this point certainly isn't easy. And with ongoing project pressures, many businesses can find it hard to simply get started.

In the meantime, bad data can have far reaching consequences. Industry data suggests that:

- Globally, bad data may have contributed to a total global industry cost of €1.58 trillion in 2020.
- When considering a contractor that performs €1 billion in work annually, this indicates that upwards of €165 million of their revenue could have been impacted by bad data.
- Decisions made using bad data may have had a global rework cost of €75.82 million, or 14% of all rework performed in 2020.
- Applying this to a single €1 billion contractor, €7.1 million of waste could have been avoided by making decisions using accurate data.

However, every construction business can make incremental progress to improve their data management – and below are some simple steps for getting underway.

WHAT'S NEXT?

1 Start small and begin with data selection before data collection

Improving your data management can seem overwhelming, so it's best to start with one small and clearly defined project. Focus on the place where your organisation could most benefit from data-driven insights: for example, tracking the most common snags or safety issues on-site. Consider whether your business can gain measurable and demonstrable value from this analysis, which is often at the points where impact meets speed.

Having this single focus helps to direct attention and minimise distractions; in the end, intentionally gathering a smaller volume of actionable data points is more valuable than a larger volume of unactionable data points. Once you've refined your process and can show clear results, you can then take lessons from this onto the next data management area.

2 Focus on buy-in to gain organisational support

Integrating data insights into project decision making represents a significant cultural shift – so getting the buy-in of the project team is critical. Creating a communication plan is key.

Articulating why changes are happening, encouraging open discussion and providing continual reinforcement will help to achieve buy-in over time.

3 Poor data equals poor results, so put quality first

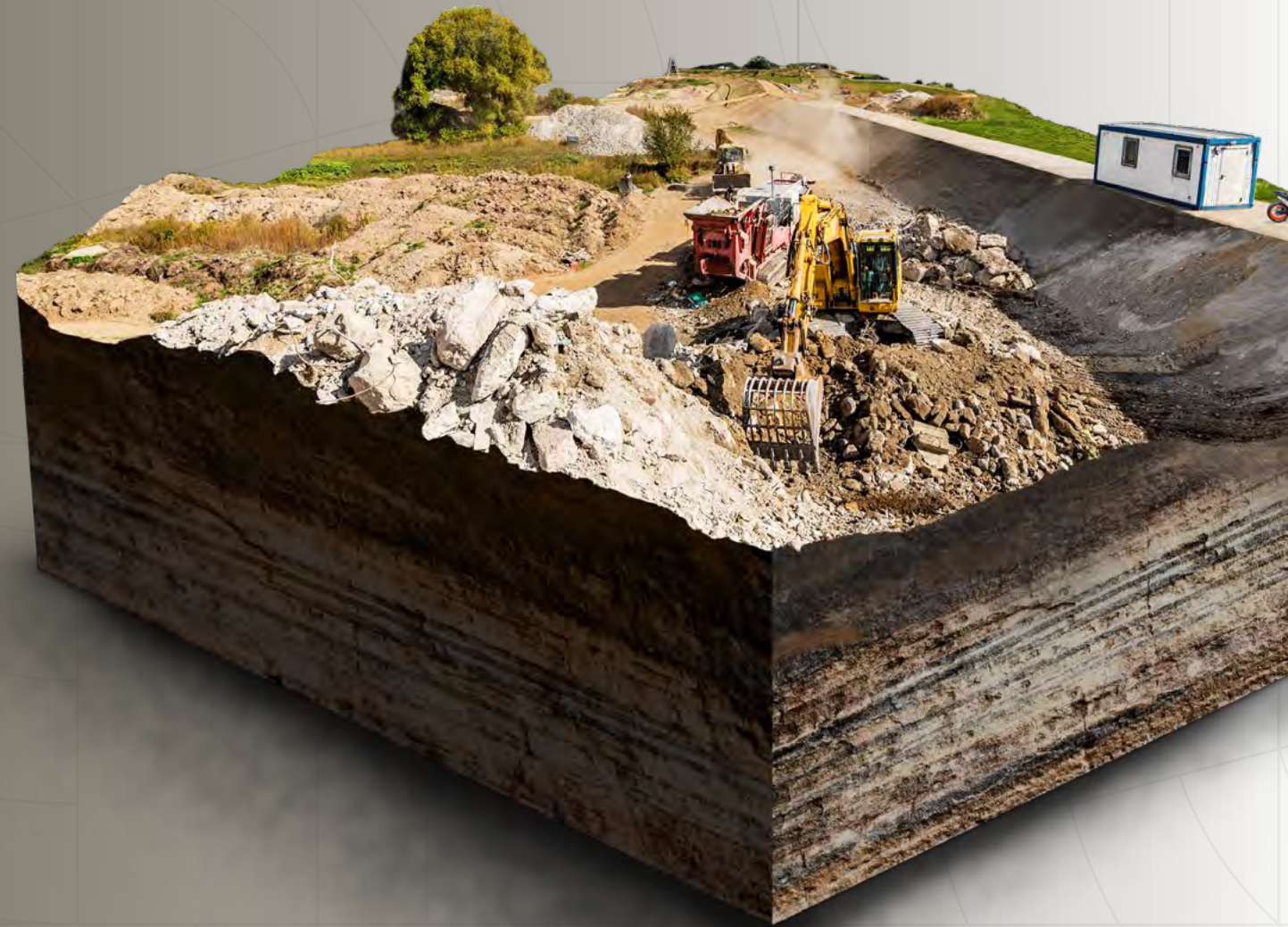
For data to be valuable – and even usable – it has to be accurate and consistent, and that takes proactive effort. Even small inconsistencies, like multiple names or spellings for suppliers, can limit the value of the whole undertaking. Define clear processes for capturing good data – and ensure that this is a foundation of your overall strategy.

Consistency is key for gaining organisation-level insights, so it's critical to be able to combine project datasets. Bear this in mind when choosing your technology partner. A common data environment and either a single technology platform or integrated technology platforms are needed to support the flow of data – and to form the basis for your long-term data ambitions.

APPENDIX

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

Research from IBM estimated that bad data cost the US economy \$3.1 trillion in 2016. This startling figure represented 16.5% of gross domestic product (GDP) that year. When applying this ratio of bad data to the global economy in 2020 – GDP of \$84.5 trillion – bad data may have caused a global impact of nearly \$14 trillion, or €12 trillion.





In 2020, Bad Data Cost the Global Construction Industry Over

€1.579 TRILLION

Taking into account projections by Reuters that construction accounted for 13.2% of global GDP in 2020, bad data may have contributed to a total industry cost of \$1.848 trillion or €1.579 trillion.

Calculating the Cost of Bad Data

$$\begin{array}{r}
 16.5\% \text{ — The Percentage of Bad Data's Impact to GDP of United States in 2016}^3 \\
 \times \quad \text{€84.5 Trillion — 2020 Global GDP} \\
 \hline
 = \quad \text{€13.94 Trillion — 2020 Global Dollar Cost of Bad Data} \\
 \times \quad 13.2\% \text{ — 2020 Construction Sector Share of Global GDP} \\
 \hline
 = \quad \text{€1.84 Trillion — Total Cost of Construction's Bad Data in 2020}
 \end{array}$$

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...

$$\begin{array}{r}
 \times \quad \text{€1 Billion — Revenue of a $1 Billion General Contractor} \\
 \quad \quad 16.5\% \text{ — Cost of Bad Data} \\
 \hline
 = \quad \text{€165 Million — Cost of Bad Data for a $1 Billion Contractor}
 \end{array}$$

14% of all Rework in Construction Globally is Caused by 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. And in 2020, the global cost of rework was estimated to represent 5% of all construction spending, or €534 billion (\$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. Furthermore, one out of every three poor decisions are made as a result of bad data. This means decisions using bad data may have had a global rework cost of €75.82 million (\$88.69 million), or 14% of all rework performed in 2020.

Global Rework Caused by Bad Data.

$$\begin{array}{r}
 \text{€12.5 Trillion — Global Construction Spend} \\
 \times \quad 5\% \text{ — Construction Spending on Rework} \\
 \hline
 = \quad \text{€625 Billion — The Cost of Rework Globally} \\
 \times \quad 43\% \text{ — Firms Not Consistently Making High Quality Decisions} \\
 \hline
 = \quad \text{€269 Billion — The Cost of Rework From Making Poor Decisions} \\
 \times \quad 33\% \text{ — Bad Decisions Attributable to Bad Data} \\
 \hline
 = \quad \text{€88.69 Million — The Cost of Rework Associated with Bad Data}
 \end{array}$$

When applying this data to the revenue of a single €1 billion 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

