

OPERATING IN UNCERTAIN TIMES

A REGIONAL ANALYSIS OF CLAIMS
AND DISPUTE CAUSATION

2021

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Foreword

Major capital projects are highly complex, as is the web of forces and failures that lead to costly delays, overruns and conflicts. Not only is that project complexity increasing, but contracts are also exposed to heightened uncertainty arising from the global coronavirus pandemic and its aftermath.

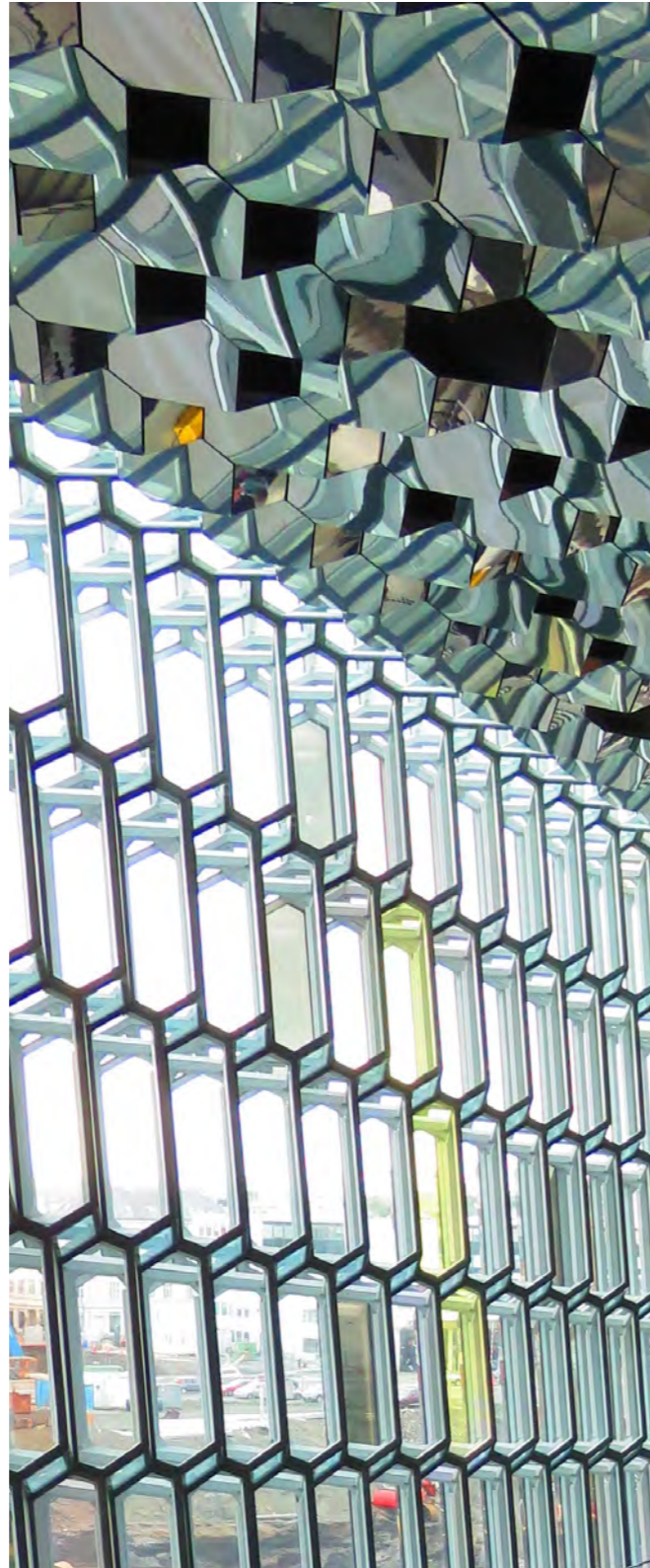
CRUX Insight 2021 identifies and analyses the principal causes of claims and disputes. It offers actionable insight and suggestions to help owners, contractors and the supply chain navigate the risks and minimise or avoid the problems we highlight.

The findings from this – the fourth annual CRUX Insight report – are based upon investigations of more than 1,400 projects in 94 countries. Combined, they represent a total capital expenditure of over US\$2 trillion.¹

Industry-leading HKA consultants have distilled the underlying causes of these claims and disputes, and their experience and expertise inform the measures we propose to reduce the time and money lost on capital projects worldwide.

The disputed costs on the projects analysed amounted to almost \$73 billion. Extensions of time sought would together stretch beyond 750 years. This toll is colossal.

In light of the extremely positive response from clients and the wider industry to last year's report, we have retained and refined its regional structure. Each chapter – covering Africa, the Americas, Asia, Europe, the Middle East and Oceania – combines analysis, commentary and suggested measures to avoid or reduce the most common causes of claims and disputes.

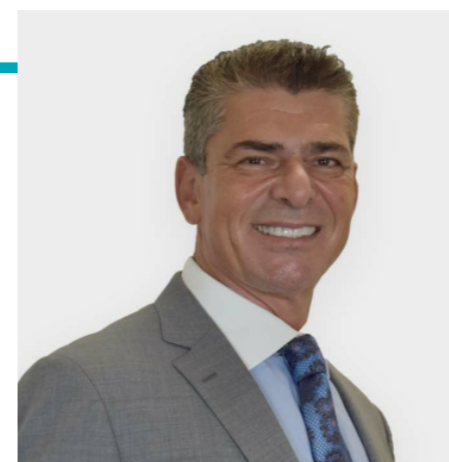


In addition, we compare the key factors affecting projects before and after the onset of COVID-19. We also delve deeper into the CRUX Insight dataset to explore project performance problems particular to each region.

Broader lessons for the construction and engineering industry are drawn in the concluding chapter of this year's analysis, 'Operating in Uncertain Times'. This examines the global forces buffeting the industry, and strategies to combat them.

Our purpose is to share the knowledge from our CRUX research programme so that capital projects can be delivered more effectively. The unmatched and growing CRUX data lake can be mined to benchmark performance by sector, gauge risks in different markets and regions, and identify areas for improvement. State agencies and professional bodies too can draw on this empirical and impartial evidence to promote better procurement, governance and delivery of major projects.

We encourage you to make full use of our analysis (and the CRUX Insight Interactive Dashboard) and welcome your feedback.



Renny Borhan
Partner, Chief Executive Officer

¹ Money sums are stated in US dollars (\$) throughout the report, except where indicated otherwise

Expert commentary

Revert to type or embrace change?

Over the last two years the focus has shifted towards pulling together and collaborating to 'keep building'. However, rising material costs and construction output around the globe, with pressures set to intensify, could be the perfect storm.

CRUX Insight 2021 is a timely analysis of the uncertainties faced by an engineering and construction sector trying to emerge from the global pandemic. What will be key is how we create our new normal. Will we revert to type – faced with continuing uncertainties, pressures on resources, and reach for contractual cover? Or can we learn from this experience to embrace change – innovate and drive improvements through efficiencies and good clienting – so we create lasting collaboration and a contractual supply chain that pulls together in the right direction?

The key will be the decisions we now make as clients, employers, contractors, and the wider construction supply chain. The CRUX report gives the baseline information to make better choices and decisions that could prevent or reduce claims and disputes. This allows us to create a positive expectation of the new normal and a turning point in the approach by the sector.

- Dr Amanda Clack, Executive Director and Head of Strategic Advisory, CBRE
Chair of the RICS Infrastructure and Construction Market Forum
Chair of Trustees for UCEM
Past President RICS

Overview

HKA consultants investigate and advise on claims and disputes – and their avoidance – on capital projects around the world. That real-world intelligence from more than 1,400 projects has been distilled for CRUX Insight 2021.

Our analysis identifies the most significant underlying reasons why claims and disputes arise on construction and engineering projects. From changes in scope and design failures to conflicting interpretations of contracts and mismanagement of subcontractors, many causes are recurrent and global. Regional variations and cultural factors affect causation too, as COVID-19 has, and will continue to do.

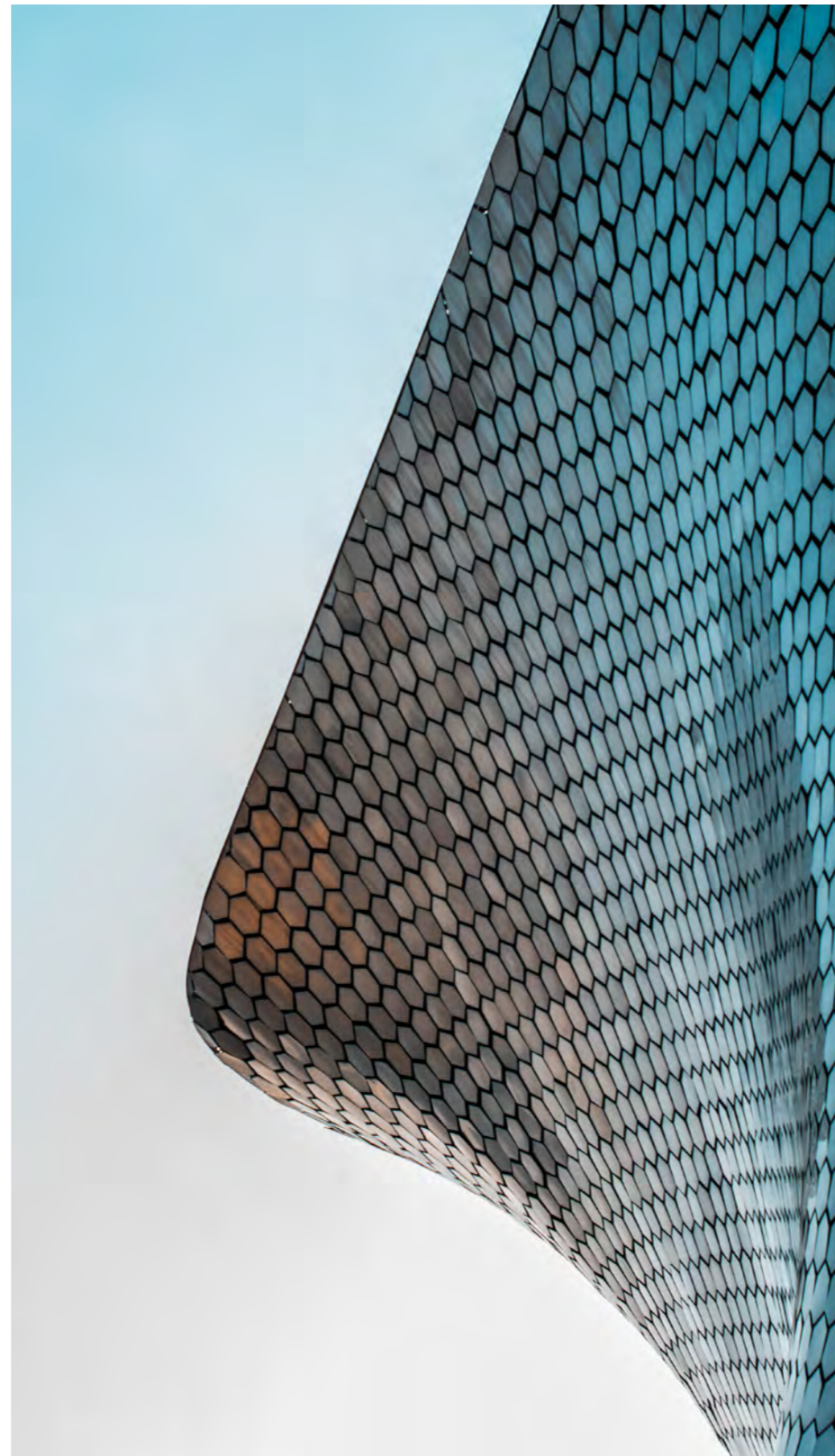
The impacts of claims and disputes on projects are hugely damaging. The value of claims amount to almost half of the budgeted capital expenditure – 46.3%, on average. Delays to completion are also chastening. Extensions of time claimed would typically protract a programme's schedule by a further 71.4%.

COVID-19 disrupted projects around the world to varying degrees. The pandemic also distorted the pattern of causation, feeding into some causes – such as restricted access to sites and labour, and constricted cashflow and payments. It also exposed the limitations of contract provisions for *force majeure* and changes of law.

There have been benign side effects too. Enhanced reporting has helped curb spurious claims and deficient workmanship in some cases. Advanced technologies such as drones and digital models have demonstrated their advantages. The industry can also learn how to be more agile from enforced changes in ways of working – including greater collaboration – that have improved outcomes.

We see a long COVID legacy of uncertainty and heightened risk from supply chain delays, cost inflation and skills shortages.

However, we see a long COVID legacy of uncertainty and heightened risk. Supply chain delays, cost inflation and skills shortages will drive further tension into contractual relationships, even where the construction and engineering sector is rebounding strongly. As more fragile contractors and suppliers face greater volatility in many markets an increase in insolvencies is looming.



Regional analysis

Having analysed the drivers of claims and disputes in their regions, our consultants outline practicable measures and interventions aimed at reducing the persistently heavy burden of cost and time overruns on projects.

Africa

- The growing use of Dispute Adjudication Boards and arbitrations is improving how disputes are managed and resolved. A similar maturing of the claims culture is overdue. The industry can learn the lessons of other regions by adopting best-practice protocols for delay and disruption and forensic schedule analysis.
- Employers should adhere to their contracts rather than allowing local deviations when processing claims. Contractors can ease their serious payment problems and build more robust claims by keeping comprehensive records. To assess and resolve large, complex claims within the contractual timeframe, both sides need to engage expert claims specialists sooner, while upskilling their own teams.

Americas

Many major projects are suffering unintended consequences from the push by owners / employers to design at pace, and rush to mobilise construction contracts, compounded by acute skills and materials shortages. Many of our recommendations entail a more proactive approach to anticipate and alleviate resultant problems.

- Risks should be managed up front by getting the parties together to review the contract, drawings, and schedule, flushing out issues before work starts on site. More employers and contractors also need to conduct risk analyses and be certain as to which party will own and mitigate risks.
- To combat a rash of design failures, scope needs to be more clearly defined and designs frozen at an agreed stage. Checks on design progress should be maintained during construction and constructability reviewed by the contractor, with provision for the designer to adjust the price according to the revisions required.

Asia

- In Asia, risk management practices could be adopted with greater frequency. The use of Risk Registers would help risks gauged during pre-construction and allocated to 'risk owners' early are cheaper to mitigate. Linked to project controls, a register's underlying assumptions are tested and adjusted during construction. Operational failures commonly seen after handover can also be pre-empted.

- A culture change is needed to streamline the handling of claims and defuse disputes. Formal independent avenues to resolution are not popular. A cost-effective alternative would be a standing committee of specialists, representing both contracting parties, with the necessary knowledge and authority to decide commercial, technical and contractual matters, agree on concessions, and settle claims and disputes before they escalate.

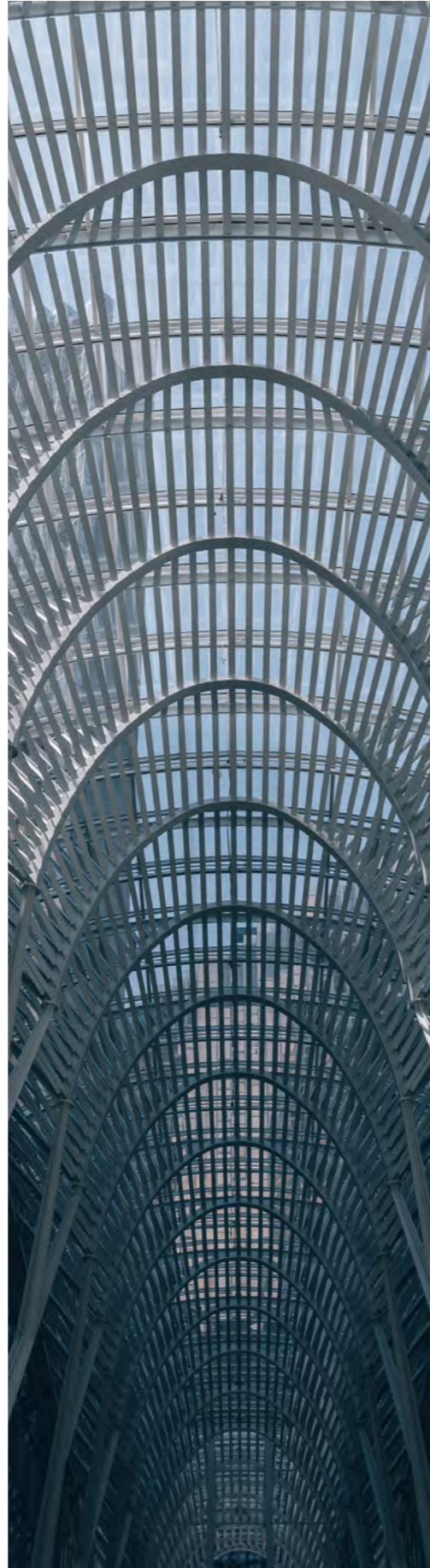
Europe

- Design errors have overtaken change in scope at the top of the region's causation ranking. Employers, contractors and design consultants are wasting time and resources debating potential claims without a rigorous assessment of the technical grounds. Appointing an independent expert at an early stage – as more owners and their legal teams are now doing – helps all parties to understand exactly what went wrong and why, and to avoid full-blown and costly disputes.
- A clear and logical handling process would also facilitate earlier settlement of claims overall – at 58.3% of total project CAPEX, the highest of the regional averages. Ideally developed jointly with the supply chain, this process needs to set out the obligations on both sides, along with timescales for submissions, decisions, and progression from site to senior levels before referral to a final dispute forum. Enacting the processes enshrined in the contract when parties are on good terms is also advised.

Middle East

Projects are subject to longer extension of time claims (equivalent to 84.7% of the schedule, on average) than in any other region. Pending more systemic change, tentative trends – more resources committed to design development, early contractor involvement (ECI), and third-party determination of disputes – are to be encouraged.

- ECI should cover design development, aligning this with a robust schedule, and agreeing on risk allocation and ownership. More employers also need to stress-test buildability, as is far more common in other regions.
- Investing more in people – including training and development of high-calibre professionals – will improve project governance and attract a new generation who can foster cultural change in project delivery.



Oceania

The construction booms in New Zealand and Australia (where current and planned infrastructure investment is unprecedented) raise exciting yet daunting prospects. A paradigm shift is needed to prepare the capital projects ecosystem for looming challenges in contracting capacity, skills and the supply chain.

- At a macro level, Australia's A\$110 billion pipeline is a once-in-a-generation opportunity to build construction and engineering capacity, and leave a lasting, sustainable legacy of skilled employment, prosperity, and environmental improvements. Infrastructure plans should be reviewed by independent experts to provide a robust, deliverable programme, coordinated and phased as part of a national capacity building and employment strategy.
- At project level, standard contract forms (such as NEC) and key performance indicators that foster collaboration can pave the way for a culture change. Partnership charters – committing parties to work to an agreed set of principles and outcomes – are also conducive to this new way of working.

The industry can learn lessons from CRUX Insight 2021 to stem the tide of avoidable conflicts, delays and losses on major capital projects.

Uncertain times

All regions will be affected to some degree by the global forces of cost inflation, supply chain bottlenecks, and labour and skills shortages, not to mention the ongoing threat of viral outbreaks and extreme weather events.

These risks and the over-arching lessons to be drawn from our regional analysis are examined in the subsequent section, 'Operating in Uncertain Times'. Here, we set out alternative approaches designed to put capital projects on a sounder footing, along with examples of their successful application.

The analytical evidence on why projects are heavily impacted by claims and disputes is increasingly clear. The corrective actions, techniques and tools are known. Individually and collectively, project partners and the industry can learn lessons from CRUX Insight 2021 to stem the tide of avoidable conflicts, delays and losses on major capital projects.



Simon Moon
Partner, Chief Operating Officer

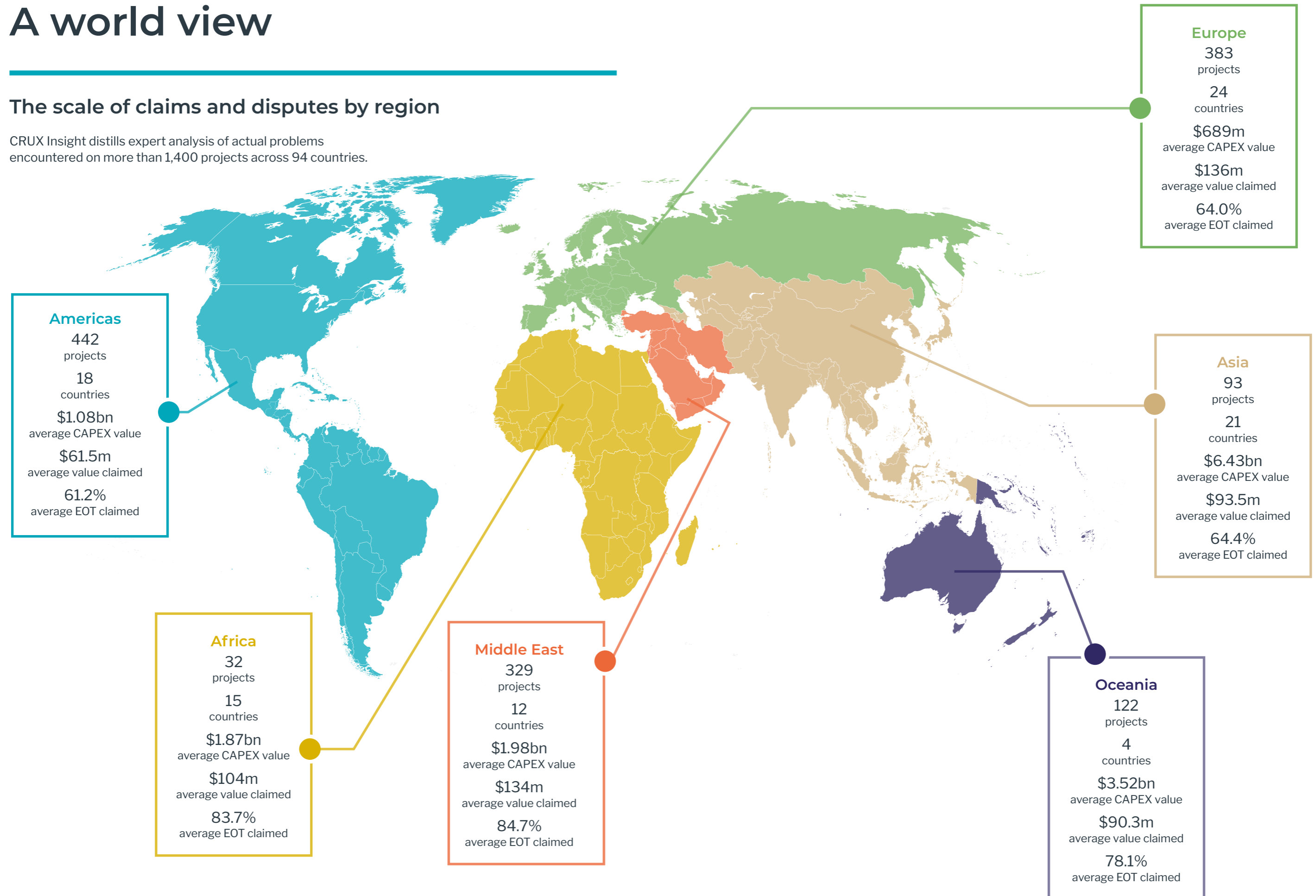


Toby Hunt
Partner, CRUX Sponsor

A world view

The scale of claims and disputes by region

CRUX Insight distills expert analysis of actual problems encountered on more than 1,400 projects across 94 countries.



CRUX findings - Global

Top causes of claim or dispute	Rank
Change in scope	1
Contract interpretation issues	2
Contract management and / or administration failure	3
Design information was issued late	4
Design was incomplete	5
Design was incorrect	6
Poor management of subcontractor / supplier and / or their interfaces	7
Physical conditions were unforeseen	8
Access to site / workface was restricted and / or late	9
Workmanship deficiencies	10
Level of skill and / or experience	11
Claims were spurious	12
Approvals were late	13
Cashflow and payment issues	14
Operational performance	15
Tender errors and / or inaccurate estimates	16
Materials and / or products were delivered late	17
Shortage of skilled and non-skilled workers	18
Installation failure	19
Targets and / or expectations were unrealistic	20
Weather conditions were exceptionally adverse	21
Inadequate responses to information requests	22
Poor interface management with a third party	23
Personality and / or cultural differences	24
Bias and / or failure to cooperate	25
Reporting was incomplete and / or incorrect	26
Late appointment of subcontractor / supplier	27
Other: socio-political / regulatory	28
COVID-19	29
Fraud	30

Expert commentary

Attracting a more diverse workforce

The construction sector has been key to sustaining employment over the last 18 months where other sectors have been in dire trouble in many geographies. Recent recoveries in construction and infrastructure projects have created huge demand, but have increased pressure on finding skilled workers, materials, and products, resulting in longer lead times and delayed project completions. In many geographies, workforces are ageing, exacerbated by insufficient succession planning. Women also still account for only a small proportion of the workforce. There are major social and economic benefits to ending the skills gap and attracting a more diverse workforce. One of the ways to gather talent is for the supply chain to work with governments to aim for parity of esteem between occupational and academic qualifications.

In addition, the industry's thought leadership should be a major part of the global bid to decarbonise the built environment. With climate change and new building safety rules likely to dominate the agenda for years to come, major opportunities exist for businesses that can adapt to this. Complementing this, governments can use their considerable leverage as the source of a large proportion of work done in the industry to drive safety and sustainability through procurement. Positive change can be achieved but requires collaboration across the supply chain in these continuing uncertain times.

- Justin Sullivan, Chair
Construction Industry Council (CIC)



1401
projects



94
countries



\$1.82bn
average
CAPEX



\$100m
average cost
claimed



71.4
average EOT
claimed (%)

Africa

Introduction

North African and Sub-Saharan economies alike have suffered bigger losses in output than other regions in the pandemic, and they face the greatest uncertainty, given generally low levels of vaccination against the COVID-19 virus. South Africa, the continent's economic powerhouse, shed construction jobs in large numbers, while in its most populous state, Nigeria, activity was further depressed by the knock-on effects of the oil price slump in 2020. Pockets of conflict, instability and corruption in the region are a further drag on economic development and investor confidence.

High public debt and modest fiscal stimulus packages will see continued reliance on foreign investment. International contractors too are attracted by Africa's natural resources, urbanisation, demand for energy and better connectivity through new infrastructure.

East Africa, with its comparatively fast-growing economies, is realising this potential with more than 130 major construction and infrastructure projects underway.

Our CRUX Insight 2021 analysis involved 32 projects in 15 countries with an average CAPEX value of \$1.87 billion. Reflecting the ongoing development of services across the continent, almost a third were power or utility projects, with onshore renewables the top sub-sector. Transportation infrastructure and buildings were

next in importance. On projects in Africa, the average cost claimed was \$104 million whilst contractors sought time extensions that would prolong programmes by almost 84% – a level exceeded only, and marginally, in the Middle East.

COVID and other causes

Despite the distinctive challenges facing the African continent, there is a high degree of commonality with other regions regarding the causes of claims and disputes. Change in scope, incomplete design and contract interpretation are perennial and pervasive sources of conflict – especially on complex projects that inevitably are one-of-a-kind and therefore intrinsically high-risk in terms of deliverability to time, cost, and quality.

Top causes of claim or dispute	Rank
Access to site / workface was restricted and / or late	1
Change in scope	1
Cashflow and payment issues	3
Design was incomplete	4
Contract interpretation issues	4
Claims were spurious	6
Level of skill and / or experience	7
Poor management of subcontractor / supplier and / or their interfaces	7
Contract management and / or administration failure	7
Approvals were late	10
Poor interface management with a third party	11
Shortage of skilled and non-skilled workers	11
Personality and / or cultural differences	11
Design information was issued late	11
Targets and / or expectations were unrealistic	15

Yet tender periods are extremely short for complex projects with a CAPEX of several billion dollars. Bidders are not given an adequate opportunity (if any) to assess site data provided by employers, or the comprehensive documentation essential for accurate pricing. Environmental assessments for hydropower projects are a notable example of this glaring omission. The same haste to get work started on site compresses contract negotiation periods, storing up trouble as critical issues and risks are not explored.

The high ranking of site access restrictions reflects the heavy impact of the pandemic on the construction and engineering industry, and almost endemic shortcomings in project planning (as well as the anomalous effect of one megaproject where work proceeded at an ill-advised location on an immature design).

Cashflow and payment problems also loom large in the region's 2021 CRUX ranking. Project funding constraints and inadequate budget allocations force employers to stall payments, impacting contractors' cashflow.

In the public sector, the regulatory framework of government bodies requires that variations pass various committees before instruction for settlement is passed.

Bureaucratic procedures can cause further hold-ups to the tendering and commencement of infrastructure and power and utility schemes, for example. Design approvals also take a very long time, in many cases, as can site handover – due to delays in land acquisition and resettlement of landowners by government.

Standard forms of contract (FIDIC, NEC and JBCC) have been widely adopted across Africa, although they are often heavily amended, and therefore require close management to ensure adherence to their conditions. They typically provide clear mechanisms for pursuing claims for additional time and payment, supplemented by a robust legal framework. Yet the site-based representatives of parties frequently agree to changes informally without documenting agreements, departing – sometimes drastically – from contractual procedures, which inevitably leads to challenges downstream.

Bespoke contract drafting often gives rise to ambiguity and interpretation issues, as can lack of experience in administering these contracts. A common confusion arises when letters of intent reference components of the contract that are yet to be finalised, when bespoke, so it can be unclear which takes precedence.



32

projects



15

countries



\$1.87bn

average
CAPEX



\$104m

average cost
claimed



83.7%

average EOT
claimed

Another factor is that the different working practices of international contractors also introduce cultural misunderstandings within project teams. This confusion can extend from ways of working and communication barriers through to understanding of contractual obligations.

The claims culture is less mature than in other regions – and spurious claims more often cause disputes.

Generally, the claims culture is significantly less mature than in other regions. Spurious claims are more often cited as the cause of disputes. Government employers flatly reject contractors' submissions, regardless of merit, so entitlement to extensions of time, additional costs or variations go unacknowledged. Yet contractors avoid initiating formal dispute processes for fear of being excluded from future tendering, not least as they are often unable to provide well-substantiated claims owing to inadequate record-keeping and poor knowledge of contractual terms.

On the horizon

It is foreseen that these underlying causes will continue to drive claims and disputes over the next 12 months and beyond.

Contractors have focussed on recovering their COVID-related losses, but as activity edges towards normal levels, claims and disputes arising from design and contractual differences, and poor management of subcontractors, are expected to surface again and become more prevalent.

Project workforces, like most of the population, will remain vulnerable to surges in coronavirus infection until there is a comprehensive vaccination rollout. Productivity will not be the only casualty, as the high incidence of cashflow and payment blockages may be a warning sign of impending bankruptcies to come among prime contractors and further down the supply chain.

Shortages of materials, labour and skills are likely to have an additional impact. Poor-quality materials, unskilled labour, and antiquated or damaged equipment already contribute to a disproportionate share of the region's claims and disputes.

Cross-border friction also delays the movement of goods and people, even into the major South Africa market. COVID has made the situation worse. Yet this may add further political impetus to the nascent Africa Continental Free Trade Agreement (AfCFTA). By spring this year, 36 of its proposed 55 member nations had ratified the deal for a common market serving 1.2 billion people.

The way forward

The hiatus in construction activity was also an opportunity for contractors to use the time to catch up on the planning their projects require. More proactive planning informed by a better understanding of the contract, drawings, specifications, risks and schedule would pre-empt many of the problems recurring on the region's projects.

If design work is not more advanced before construction commences, claims and disputes will continue to cascade through projects.

On multi-disciplinary works, the management of the interfaces between employers, contractors and subcontractors is a key area for improvement that would reduce the high incidence of restrictions on site access and at the workplace.

If design work is not more advanced before construction commences, claims and disputes will continue to cascade through projects – from changing scope and variations to the loss of designers' knowledge as constricted budgets run out. A major project promoter in the region notes that "doubling down on up-front design ahead of works has drastically reduced the level and severity of claims".

Africa's construction and engineering industry can learn the lessons of other regions by fostering a more mature approach to claims. Adopting international best practice – such as the protocols of the Society of Construction Law on delay and disruption and the Association for the Advancement of Cost Engineering's recommended practice on forensic schedule

analysis – would be a positive step in that direction. However, progress will also require the understanding and experience to know how to apply them and in which circumstances.

Employers should rely on their contracts and disallow any informal changes made at a site level when processing claims. To assess large and complex claims thoroughly within the contractual timeframe will often require early engagement (by both sides) of experienced contract managers or claims consultants.

Contractors could ease their vexed payment issues and build more robust claims by keeping comprehensive records regarding performance against programme, the number of workers on site at all times, and supply chain inputs. But contractors must also be willing to engage with the technical complexities involved in presenting high-value claims – including delay analysis and cost assessment – rather than seeking to negotiate entitlement on the back of opaque submissions.

Such changes, though modest, will face resistance but the cumulative impact would be significant. Developments in dispute resolution offer encouragement. We are seeing more Dispute Adjudication Boards and arbitrations, and they are proving efficient and effective in managing and resolving disputes. This trend is truly positive and points the way to an increasingly mature contracting culture in Africa.

Expert commentary

The way to manage and mature

At time of writing, COVID-19 vaccination levels in Africa remain below 10%, meaning pandemic uncertainty will continue for the foreseeable future. Public debt in most African countries was already high, even before governments began to roll out pandemic stimulus packages. Major infrastructure works are predominantly delivered by foreign firms, with project overruns all too common. Unfortunately, most budgets are prepared without the involvement of experienced technical experts – especially on foreign funded projects, where non-technical government functionaries often lead the negotiations

The most common causes of claims in the region include but are not limited to: change of scope caused by poor scope definition at inception and design stages of the project life cycle; incomplete designs; inadequate specifications and contract documentation; late approvals by statutory authorities; poor cashflows and irregular payments; poor project management; amendments to standard forms of contract; poor record keeping and; different working practices by teams from different cultural backgrounds – often owing to the dominance of foreign contractors. Fear of being denied opportunities to tender is among reasons why the claims culture has not matured.

The pandemic complicated this already difficult picture. Guidelines to prevent its spread have introduced a raft of new obligations. Cross-border closures have also led to delays.

In order to move forward, we must renew our commitment to competent and experienced project managers. We have to engage major stakeholders earlier in the project life cycle. The inclusion of knowledge transfer clauses in future contracts will facilitate adoption of good practices from other jurisdictions. Finally, we should look to non-adversarial means of dispute resolution, such as adjudication boards, to make the process more efficient and effective.

- Andrew Mandere, Managing Partner

Costek Alma. Formerly Chairman, Institute of Quantity Surveyors of Kenya

Regional focus

Bridging the main contractor / employer divide

In half of all projects in Africa analysed for CRUX Insight 2021, the claimant was the main / prime contractor, and the respondent was the client / owner. These claims accounted for more than \$1.31 billion.

Both sides need to improve their working practices and foster more mature relationships to avoid the most common causes of conflict (see table).

Projects where the claimant was the main / prime contractor, and the respondent was the client / owner

Top causes of claim or dispute	Rank
Change in scope	1
Design was incomplete	1
Access to site/workface was restricted and / or late	1
Claims were spurious	4
Approvals were late	5
Contract management and / or administration failure	5

It is often as true in Africa as elsewhere – project disputes are not caused, they are procured. Some of the most common causes of claims and disputes in the region flow from poor procurement decisions, whose impacts are felt downstream. Greater collaboration – not just within the project team but also with the employer / owner – will reduce the potential for these factors to occur.

Scope and design

Setting the right tone for the project is important, along with establishing a clear understanding of scope and of the responsibilities to be owned by the employer / owner and by the contractor.

A recurring problem on the continent is the lack of due diligence by EPC contractors when conducting feasibility studies. When these are not conducted thoroughly, contractors are more likely to assume responsibility for unnecessary risks.

In addition, when projects have to be accelerated, the design and construction / fabrication run concurrently to save time, often leading to major fabrication errors and further delays, followed by abortive work after copious redesigns.

Spurious claims

These typically occur where the contractor has failed correctly to price for risk. Employers should be wary of contractors who underbid to win the contract and then seek to recover the shortfall through inflated and / or unjustified claims for additional costs or variations. It is good practice for employers to challenge assumptions at the earliest stage of the tender review process to ensure they are not storing up problems further down the line. In practice, this means taking the earliest opportunity to understand where risks may lie and working this through in partnership with the contractor.

Late approvals

Where the contractor is relying on the performance of the employer / owner, it is important that the latter identifies and actively manages risks that may impact that performance. Where the employer is required to obtain consents and approvals from statutory bodies or authorities, or approve the contractor's design or material submissions, timely responses are essential to reduce the risk of claims from the contractor.

Contract management failures

Proactive planning and management of future work, as well as raising issues of concern early, allows the parties to analyse and manage problems. Implementing tools to detect problems immediately is essential to avoid issues festering and being escalated up through the formal disputes process. Good management is preventive medicine for conflicts and disputes.



Americas

Introduction

The coronavirus pandemic disrupted construction projects and employment to varying degrees across North America, but the US and Canada have embarked on a strong recovery. Yet, COVID-19 – echoing its societal and public health impacts – has exposed and amplified many of the underlying weaknesses of the construction and engineering industry, while also accelerating change, some of it positive.

In Latin America, where the human and economic toll was heavier than in other regions, recovery will be slower, and uneven. But unlike in North America, the construction industry in the rest of the continent can at least draw on a skills surplus to support its growth as national economies do begin to recover.

Whatever the final shape of the American fiscal stimulus package, the level of public and private investment expected in capital projects will test the mettle of contractors and the supply chain. This bright outlook for construction activity is clouded by uncertainties around project delivery amid lengthening supply delays, rising prices and widening skills gaps.

More than 440 projects in 18 countries across the Americas were analysed for CRUX Insight 2021. Some 40% of that total were new buildings, and two other sectors – transportation infrastructure and power and utilities – each accounted for a fifth. The remainder was shared among the

resources, industrial and technology categories, in that order. On average, the project CAPEX value was just over \$1 billion, while the average costs claimed amounted to \$61.5 million across all sectors. On average, contractors sought time extensions to take these projects more than 61% beyond their original completion dates.

The causes of claims

The perennial problems arising from changes in scope on major projects, especially when fast-tracked, have been exacerbated by the pandemic and market trends.

Top causes of claim or dispute	Rank
Change in scope	1
Physical conditions were unforeseen	2
Design was incomplete	3
Poor management of subcontractor / supplier and / or their interfaces	4
Design information was issued late	5
Design was incorrect	5
Contract management and / or administration failure	7
Workmanship deficiencies	8
Contract interpretation issues	9
Claims were spurious	10
Access to site / workforce was restricted and / or late	11
Operational performance	12
Installation failure	13
Weather conditions were exceptionally adverse	13
Level of skill and/or experience	15

Delivery methods are having to change mid-project to adapt to the current environment. This may involve bringing in new contractors to overcome blockages, rescheduling works due to labour shortages or supply chain delays, and alternative designs to accommodate different building materials to those originally specified, which may be unfamiliar to contractors.

Meanwhile, compressed schedules, poor up-front planning, and failures to meet contractual obligations continue to drive a large volume of claims related to designs that are inaccurate, incomplete, or communicated late.

The big push by owners / employers for design and build has brought unintended consequences.

The big push by owners / employers for design and build has, by relegating design consultants to the role of subcontractor, brought unintended consequences. Their cash-limited budgets often result in designs that are no more than 70% complete, compared with the 90-100% they tended to deliver as joint venture partners. Much of this design work could continue remotely during the pandemic, but in many cases, not the meetings and site walks required for design integration and completion.

The industry is also struggling to keep up with technical developments. Building and civil engineering codes and standards are not being reviewed and updated to take account of new construction materials, especially architectural products. For example, glass is being used far more in urban buildings in Canada and elsewhere, given the imperative to build up rather than expand their footprint; apart from supply chain shortages, international product standards and codes are applied inconsistently across regions. Also, employers may specify new technologies that only a specialist can provide, whether it is for a building façade or water treatment plant. Yet they expect contractors to assume responsibility if the design proves deficient due to poor quality of workmanship, upon completion.

Poor contract management is the trigger for a rash of problems that have been exacerbated by the pandemic, feeding into various types of claims. Lack of familiarity with the contract, which may have a different delivery method, means that trades and designers are not effectively incentivised or policed. Projects are also haunted by failures to include inflation clauses, assign appropriate contingencies, schedule correctly, or manage slack.



442

projects



18

countries



\$1.08bn

average
CAPEX



\$61.5m

average cost
claimed



61.2%

average EOT
claimed

Management of subcontractors and the supply chain was already challenging, given the rising complexity of projects and their multi-disciplinary delivery. The pandemic and its aftermath add further complications and delays, pushing back delivery dates.

We have seen contractors refuse to show a delay to schedule over the last 18 months on projects in the vain hope that the pandemic would be short-lived, or delays could be mitigated. Owners typically argue they have waived their rights to any recovery by belatedly declaring such delays.

Weather conditions are more unpredictable as extreme events increase in frequency and severity. CRUX 2021 shows that claims due to exceptionally adverse weather were more common in the Americas. Insurers confirm that claims related to water damage are rising, especially in urban areas with ageing infrastructure. Rehabilitation works and new drainage development by municipalities have been delayed in some cases by the pandemic, increasing flood risk.

Unforeseen physical conditions have also risen up the causation ranking (see breakout section). As the first work on the critical path, soil excavation all too frequently prompts a claim for delay – such as contaminated ground or tiebacks to an adjacent building that interrupt piling operations. No matter how extensive, site investigations cannot reveal every potential hazard in the ground or behind walls. COVID restrictions will also have curtailed or delayed some survey work.

Deficient workmanship is another growing concern. Skills shortages and some of the same management shortcomings contribute, but inspection regimes are also at fault. Site reviews are increasingly being outsourced to third parties, often engineering consultants. Frequently these checks are not ensuring that work has been carried out to codes and standards, which themselves may not reflect recent changes in owners' responsibilities. Site restrictions during the pandemic will also have prevented some of this work. Meanwhile, a lack of succession planning sees experienced inspectors retire without trained staff to replace them.

Other COVID effects

The pandemic has augmented some claims as well as spawning its own – not least around *force majeure*. In parts of the US, such as California, where sites were not restricted by governmental orders, owners and contractors are wrangling over liability for disruption and lost productivity that may or not be due to COVID.

As employers increase or enforce reporting requirements, the incidence both of spurious claims and workmanship deficiencies has fallen since the pandemic broke. Higher visibility means less scope for speculative claims and more opportunity to have defects remedied early. Management of third parties should also benefit from improved reporting.

Another side-effect is the boost to digital technologies, including BIM (Building Information Modelling). Drones have overcome practical obstacles to surveying sites and structures. Having facilitated contact tracing, RFID tags on badges and hard hats are likely to be useful in logging productivity, improving record-keeping, and claims analysis, though their use may be seen as obtrusive by workers concerned that their personal activities are being watched.

However, the biggest impact – on the supply chain – may also prove the most enduring.

On the horizon

On top of the lengthening lead times for many materials, their costs have already risen sharply. The hike in the price of lumber, steel reinforcement and copper, for example, has exceeded 30% in the US and Canada. Rising freight and energy costs will add to inflation and the number of disputes. Contractors will claim reimbursement for unforeseen costs where contracts have no inflation clauses. Where these do exist, costs that rise while mobilisation is delayed will also be contentious.

Shortages in human resources are the other prime concern for a booming construction and engineering industry likely to overheat.

Shortages in human resources are the other prime concern for a booming construction and engineering industry that is likely to overheat as government investment stokes up demand. Skills gaps are opening up across the board – from technical specialists to site labour. COVID-19 is thought to be hastening the retirement of many more experienced employees, who are not being replaced fast enough to ensure continuity across the sector. As a result, knowledge is not being passed down to more junior recruits. Anecdotal reports – such as a site losing crews during a basement concrete pour to an emergency project nearby offering better rates of pay – will become more common. Labour will migrate to states where remuneration is higher.

The secondary effects of these hot market pressures are likely to include weaker management of subcontractors, a less skilled workforce, failures in installing new technologies including renewable energy, and more defects and re-working, as well as cost overruns. These impacts will combine with

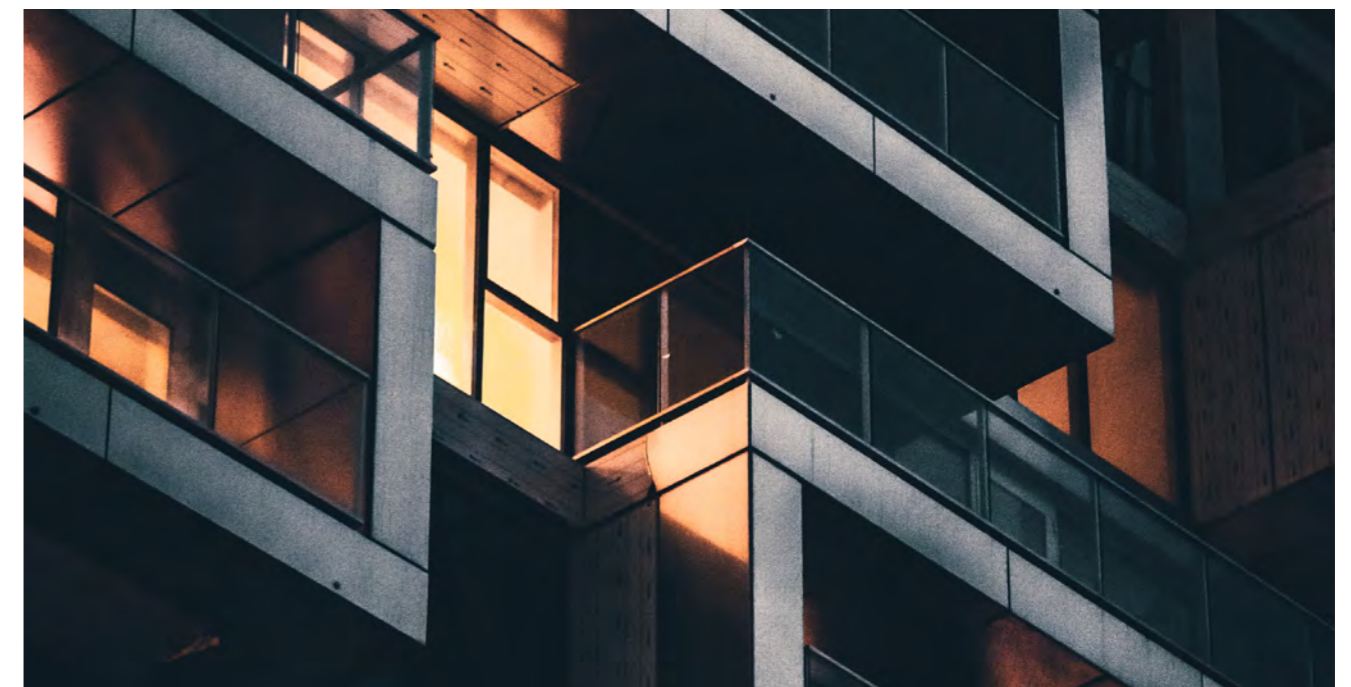
the other recurrent causes of claims and disputes portrayed in the current causation ranking.

The way forward

The contracting environment will be increasingly challenging for major capital projects over the next year. Technological tools such as BIM can, as they are more widely and expertly employed, support better collaboration, communication, and execution of integrated designs.

However, the cultural influences that bedevil the sector are vexed. The image of construction and engineering does not appeal to young talent, so students and colleges favour IT and tech courses, while graduates and manual workers alike gravitate to more glamorous and / or better-paid jobs. The industry's general obsession with driving down prices also perpetuates the cycle of claims and disputes.

These forces – and the global challenges involving supply, costs, and sustainability – are daunting, but there is still a variety of actionable measures that would help manage some of the market uncertainties, pre-empt many claims, and defuse disputes earlier.



Many of these recommendations follow the basic principle of being proactive rather than waiting for problems to escalate before intervening:

- Manage risks up front – by getting the parties together to review the contract, drawings, and schedule to flush out issues before a shovel goes into the ground; also, more owners and contractors should perform financial and risk analyses.
- Make the case for a price adjustment promptly – a client framing contractor, for example, justified the higher cost of timber to the employer, avoiding a dispute.
- Update Project Execution Plans (PEPs) thoroughly, with COVID impacts in mind, rather than recycling the same PEPs on new projects.
- Ensure all risks are identified and evaluated in bids, and allocated to the appropriate party even if not covered by the contract; delegate a risk register manager, and update monthly or more frequently, where necessary.
- Specify more frequent reporting requirements in contract documents to increase visibility of negative trends and allow early mitigation.

Other measures worth considering include:

- Updating contracts to include clauses to cover new COVID outbreaks or pandemics.
- Clarifying the scope definition and the need to freeze design at an agreed stage.
- Checking design progress during pre-construction – with a constructability review by the contractor, and an opportunity for the designer to adjust the price based on revisions.
- Training project leaders on commercial requirements and war gaming sessions to identify gaps in the contract and likely pitfalls.
- Factoring in extreme weather events in risk appraisals and estimating.

- Reviewing target costs and the schedule closely during the bidding and contract negotiation stages.

Expert commentary

High time for tech

A construction project brings together multiple stakeholders, widely dispersed supply chains, and large delivery teams – all of whom are frequently working together for the first time. When centred around one-off projects and temporary relationships, collaboration can be challenging, creating more project risk.

Project disputes arise in many ways. These include misaligned or even conflicting goals, unclear roles and responsibilities, unwillingness to take accountability, and low incentives for stakeholders to solve and prevent problems outside of their scope of work.

The bottom line is that current contracts are adversarial, where cooperation and collective problem-solving are actively discouraged. How can the industry reduce this uncertainty and risk and help build trust among project stakeholders? Technology and digitisation may be the answer. Enhanced auditability significantly mitigates risk and prevents costly and time-consuming disputes. As the industry moves away from transactional approaches towards collaboration, digitalisation will be a vital facilitator of new ways of working.

There are also contract management solutions in our industry that provide real-time visibility and control across the contract process, which helps ensure project team members are using the same information, mitigating project disputes and significantly reducing risk on any project.

- **Nathan Doughty, CEO & Co-Founder**
Asite

Regional focus

Comparable and contrasting causes

Delving deeper into the CRUX 2021 data, some notable commonalities and differences emerge in the pattern of causation across the Americas.

United States

Top causes of claim or dispute	Rank
Change in scope	1
Poor management of subcontractor / supplier and / or their interfaces	2
Workmanship deficiencies	3
Design was incomplete	3
Design information was issued late	5
Design was incorrect	5

Canada

Top causes of claim or dispute	Rank
Physical conditions were unforeseen	1
Change in scope	1
Design was incorrect	3
Design was incomplete	4
Design information was issued late	4
Access to site / workforce was restricted and / or late	4

Critical gaps exposed

Workmanship deficiencies and poor management of subcontractors feature in the top five causes of claims or disputes in the US, but not in Canada or Latin America.

These weaknesses are being exposed by shortages of resources – both material and labour – across the US. Poor management of

subcontracts may become even more of an issue as companies, that may not have the necessary managerial capacity, take on extra work generated by the fiscal stimulus package.

In Canada, contract management is a skill increasingly associated with successful construction and project management. The main focus has been on prime contract management. In our experience, clients are less aware of the rights and remedies that are associated with subcontractors. This has led to uncertainty about how to use the contract to police and remedy workmanship deficiencies, or even whether subcontractors are within their rights to raise a claim. But this is beginning to change within the industry.

What lies beneath

Access to site and unforeseen physical conditions are triggering large numbers of claims or disputes in Canada and Latin America, but less so in the US.

The risk of unforeseen ground conditions is invariably borne by contractors under the types of contracts used in Canada. However, they do not carry out geotechnical investigations and soil testing before submitting bids, and when appointed, therefore, have not accounted for any issues with ground conditions. Contractors do not want to spend the money upfront unless they are certain they will be awarded the work.

One notable by-product of the pandemic in the US is how it has pushed contractors and owners to a higher level of reporting against project controls. This is enabling fuller visibility of progress, cost and productivity, so negative trends can be corrected or mitigated sooner. Risk management is also being more heavily enforced, helping contractors and owners to identify risks and control them more effectively. As a result, more attention is being paid to challenges around site access (due to COVID impacts) or even unforeseen physical conditions (a common risk) during the estimating phase, and their status is being updated monthly in project risk registers.

Design and mismanagement

Design issues are to the fore among the main drivers of claims or disputes across both the US and Canada.

Construction management – namely, cost, schedule and efficiency tracking – has improved greatly in the last few decades. However, managing and tracking design has not. This failure has become increasingly apparent during the pandemic, exacerbated by designers working from home. A succession of cases handled by HKA Canada since March 2020 has hinged on alleged or actual design deficiencies. Defending or challenging these claims is difficult as the information is not being captured. We expect to see an overhaul of design management (akin to the progress in construction management) in the coming years.

In the current US environment, it is common for schedules to be compressed to meet unrealistic project turnover dates. This is making it harder to coordinate disciplines and ensure that drawings (30% complete / 60% complete / 90% complete / Issued for Construction) are issued per the schedule to meet installation or procurement dates and to minimise design changes. A clear definition of scope and ensuring that the design is frozen at an agreed stage are also paramount.

Incomplete or late design can be due to the need to re-design during the later stages to accommodate alternative and less expensive materials due to sharp increases in costs, or supply chain demand – increasingly common scenarios.



Asia

Introduction

With construction and engineering activity bouncing back strongly, the Asia region is fast returning to its path of long-term expansion. Led by China, a record construction growth of 6.6% is forecast for North-East Asia in 2021, though with a more sluggish recovery in other parts of the region. Several Asian countries are lagging due to the lingering effects of COVID-19, especially less mature markets and nations facing other intense pressures on state resources, such as India and the Philippines.

Many governments, however, are investing in infrastructure to stimulate their economies and better serve the transport and energy needs of their populations. This pipeline of opportunities for national and international contractors also carries various challenges that reflect sharp differences in the strength and market characteristics of national economies across the region. Labour and skills shortages are increasing, though pay rates have generally remained lower than in other regions, with some notable exceptions.

The spectre of the pandemic remains. Vaccination rates for Asia as a whole are behind those of most other regions, raising the risk of further waves. Meanwhile, projects must be delivered amid mounting global pressures on supply chain and input costs.

The CRUX 2021 Insight Report covers 93 projects in the region. With an average CAPEX of \$6.43 billion, Asia accounts for a disproportionately large share of the megaprojects analysed by our consultants.

The costs claimed on these projects averaged \$93.5 million, representing just over 34% of the original planned project cost. Claims for extensions of time typically approached 65% of the planned programme durations. The largest sector represented in our analysis was oil and gas, closely followed by power and utilities, and transport infrastructure.

The causes of claims

Not surprisingly, given the scale of the projects analysed, change in scope is the most commonly cited cause of claims and disputes in the region, as it is worldwide.

Top causes of claim or dispute	Rank
Change in scope	1
Access to site / workface was restricted and / or late	2
Contract management and / or administration failure	3
Poor management of subcontractor / supplier and / or their interfaces	4
Approvals were late	5
Level of skill and / or experience	6
Design information was issued late	6
Contract interpretation issues	8
Design was incomplete	9
Physical conditions were unforeseen	10
Design was incorrect	10
Claims were spurious	12
Cashflow and payment issues	13
Operational performance	14
Shortage of skilled and non-skilled workers	15

Although problems arising on projects, including technical issues, may not necessarily be triggered by the commercial environment, they can be exacerbated by its prevailing market forces. Fiercely competing contractors base their bids on assumptions, as the scope of projects may be poorly understood or ill-defined, and risks are not rigorously assessed, so cannot be allocated to the appropriate party. A heavy focus on cutting costs can also lead to deficiencies in contract management and coordination of subcontractors, which in turn, can then compound the various underlying causes of claims and disputes.

The changing scope of complex projects places a heavy onus on accurate design planning, and ability to manage the change process.

The changing scope of complex projects places a heavy onus on accurate design planning, and on the ability to manage the change process. If employers insist on seeking cut-throat prices and rushing schemes to market, it is more likely that deficient resources will be allocated for these design and management functions.

While managing subcontractors and supplier interfaces is always a challenge, the prevalence of a variety of Asian contractors working across the region adds cultural complications. Confidence in managing project partners tends to be eroded by communication strains, whether it is the consultant developing the design or a specialist subcontractor. On top of differences in working practices, these hurdles to mutual understanding and agreed interpretation of contracts arise more widely in Asia, mainly due to its different languages and business cultures. Japanese and Korean contractors, for example, are known to have encountered challenges with local consortium partners in aligning their commercial project objectives.

Knowledge sharing within the industry is also notably lacking compared with other jurisdictions so that, for example, databases on construction cost information are not readily available. These barriers may be due to competitiveness, culture or cross-border reasons. Lack of transparency and project precision causes problems on another level; for example, when awarding contracts, employers tend not to specify when performance information must be provided or by which party. Contractors welcome the ambiguity, but later often find they are unable to produce supporting evidence for claims.



93

projects



21

countries



\$6.43bn

average CAPEX



\$93.5m

average cost claimed



64.4%

average EOT claimed

On the horizon

Our consultants in the field foresee these causes – regardless of the effects of COVID – continuing to drive claims and disputes over the coming year.

Money will be at the root of most causes of claims and disputes, but for divergent reasons. Where governments invest in capital projects to stimulate their economies (as in Hong Kong and Japan) an overly rapid rollout increases the risk of variations, knock-on delays, and overruns.

By contrast, insufficient funding is a significant challenge elsewhere. More projects will have to be shelved. Even China's Belt and Road Initiative is not immune, as shown by the cancellation of a high-speed rail link between Singapore and Kuala Lumpur. Other countries (eg, Sri Lanka) have struggled to pay service payments post-completion, or schemes may be under-used (such as the Hong Kong-Zhuhai-Macau Bridge). Even where funding is assured for Chinese contractors, their over-reliance on local stakeholders and gaps in critical areas – namely project management, planning, and contract or commercial management – may still put projects at risk.

Cost inflation is another rising threat. Global shortages and sharply escalating prices for materials, such as steel, have already impacted projects in Pakistan and elsewhere. Such uncertainty bedevils cost estimating and tendering and leaves contractors' margins highly exposed, inevitably driving future claims.

Other COVID effects

Some of the other effects of the COVID-19 shutdowns should be more short-lived than supply chain disruption and cost inflation.

Comparing the causes of claims and disputes before and after the first wave of the pandemic early in 2020 shows that late approvals spiked in the wake of the hiatus and dispersal of critical staff from sites. Similarly, claims for incomplete design became more common, not least because coordination meetings could not take place.

It was no surprise to see a rash of these and other claims that were easier to prepare while works were suspended, compared – for instance – with contract and sub-contract management failures.

If the global pandemic was a largely unforeseeable event – at least in contractual terms – further outbreaks and new variants are not for contracts awarded in 2021. It is to be expected that contractors will seek wider provision for contingencies in contracts now being drafted, which may need to be covered by more accommodating insurance policies. They would also benefit from more robust *force majeure* provisions allowing both for extra time and costs. Parties need to be clear too on COVID-related legislative instruments and regulations if they are to optimise entitlement.

Measures to mitigate the impact of future viral waves need to be identified and paid for. Better health and safety surveillance systems would detect infections early before they spread project-wide. To be effective, the site owner or operator's procedures should be clear and succinct, and again, aligned with consistent guidance from relevant ministries and state agencies.

Diversifying supply chains and using locally engaged technical specialists where possible, or at least identifying alternatives, would also be advisable.

The change required to cut the toll of cost and time overruns must be cultural.

The way forward

Other causes of claims and disputes across the region are so embedded in ways of working on capital projects that the change required to cut the toll of cost and time overruns has to be cultural; for example, in some Asian cultures, there is a stigma attached to issuing notices of claim to the project employer.



Projects are more likely to succeed if any protocols to be followed by contractors are made clear at the outset. Contractors' own lack of tried and tested in-house protocols means success achieved on one project is less likely to be repeatable, and wholly contingent on the competence of the current team. Without rigorous project setup and clarity as to contractual obligations from the outset, conflicts are going to arise. Planning and project management will be hampered also unless there is ongoing investment in training and professional development – including commercial management and planning as well as other technical and delivery skills.

Parties' knowledge of their contract is often deficient. Workshops or other engagements involving the owner and contractor could enhance each side's familiarity with the contract and promote mutual understanding.

The need for accurate record-keeping to substantiate or rebut claims is obvious and has already been noted. Records not only need to be comprehensive, but they should also be centralised. Our consultants have observed how information that is not recorded promptly after an event or issue is lost by the time it is needed. Or commercial teams have to gather the facts from site teams that use incompatible systems or formats. This collation is particularly important in the case of prolongation claims that rely on records that may be held on different accounting systems.

Two further proposals would have an even more far-reaching influence over the outcomes of projects.

- Risk registers are rarely seen on projects in Asia, yet they are a valuable tool for managing uncertainty at each phase of the project lifecycle. Often thought

unnecessary when project budgets are constrained, a register is a sound investment that acts as a comprehensive means of monitoring risks and can mitigate exposures early on by allocating them to ‘risk owners’.

Registering and gauging risks in the pre-construction phase helps identify likely pitfalls and inform the allocation of contingencies. Properly managed and linked to project controls, a register’s underlying assumptions are tested and adjusted during construction. Risks addressed early are cheaper to resolve. Adopting such an approach also pre-empts the operational problems we see after handover when plants have not reached their performance criteria.

- Another culture-changing step would defuse and streamline the handling of claims and disputes on major projects. Dispute Adjudication Boards and other independent formal resolution mechanisms are not popular in the region, where they are seen as an expensive add-on. A cost-effective alternative would be to set up a standing committee with members representing both contracting parties covering contractual, technical, and commercial disputes. These committees should comprise specialists who, while aware of the project, are not immersed in it and will have the authority to agree upon commercial issues and make concessions towards an amicable resolution. This would avoid claims and disputes escalating – and the consequent toll in time and costs on major projects across Asia.

Expert commentary

Mediate to remediate

The risks and uncertainties affecting major Asian projects have been exacerbated by the COVID-19 pandemic and its consequences. Given the challenges faced by project owners and contractors alike in delivering projects on time, to cost and of quality, project participants should consider the viability of moving away from traditional contracting models to collaborative contracting. The principles of risk-sharing and co-operation, and pain / gain share arrangements that underpin collaborative contracting could facilitate a more effective resolution of project risks and issues in the post-pandemic era. This contrasts with the ‘blame and claim’ culture that typifies traditional contracting models.

Alternative modes of dispute resolution such as mediation could lead to the resolution of project disputes in a more timely and cost-effective manner. Mediation is also consonant with the Asian preference for resolving differences in a non-confrontational manner. The enforcement of settlements reached through mediation has been bolstered by the recent Singapore Convention on Mediation whose signatories include key Asian jurisdictions such as, China, India and Saudi Arabia.

- **Sathiaseelan Jagateesan, Partner**
Allen & Gledhill LLP

Regional focus

Avoiding disputes in power and utilities

In Asia, just under 22% of the projects analysed for CRUX Insight 2021 were in the power and utilities sector. They accounted for a combined CAPEX of more than \$8.90 billion.

Power & utilities projects

Top causes of claim or dispute	Rank
Level of skill and / or experience	1
Contract interpretation issues	2
Physical conditions were unforeseen	3
Contract management and / or administration failure	3
Poor management of subcontractor / supplies and / or their interfaces	5
Access to site / workforce was restricted and / or late	5
Claims were spurious	5

Notwithstanding the disruptive effects of the COVID-19 pandemic, conventional factors continue to plague these projects. As the causation table shows, the primary barriers to progress and successful completion are lack of skill and experience, poor performance, and contract administration failures.

When appointing a contractor or supplier, an ‘all in one package’ may not always be possible without compromising on competence and experience. In such circumstances, outsourcing to specialists would be wise, especially where it involves new technology or areas such as renewables.

Tools to pick up poor performance early include constant project monitoring, S-Curve projections, ‘lookaheads’, identifying areas of concern, and tracking manpower loading. Contract administration failures can be avoided with good project team training and knowledge transfer from experienced colleagues.

Other common areas of contention include site issues, such as accessibility and ground conditions. As with other risks, these need to be better understood and managed by negotiating appropriate risk allocation in the contract.

We have observed there is a tendency for parties to submit ‘overinflated’ claims to gain leverage for negotiations. These can be spurious if not developed robustly with appropriate substantiated evidence.



Europe

Introduction

Europe experienced some of the worst economic and human losses in the pandemic, as whole industries shut down. Construction activity rebounded strongly where the lockdowns had been most severe – such as in Spain and France – whereas others, like Germany and the Netherlands, were not so seriously disrupted in the first place. The differences in the level of fiscal support for companies and workers have also been substantial, which may widen the economic divergence between national markets.

Despite the region's overall return to growth, significant uncertainties remain over the strength of demand in some areas in the wake of the crisis, as well as potential future waves of the coronavirus, acute materials shortages, and rising input prices. Emerging skills gaps are also a concern, apparently felt most keenly in the UK, partly as a result of Brexit.

As some sectors stall, such as commercial office and residential development, major contractors will rely more on long-term infrastructure projects and works associated with the EU Recovery Fund priorities of clean technologies, sustainable transport and broadband.

Digitalisation is advancing. Developers in Germany and France are foremost in driving the adoption of BIM (Building Information Modelling), though the UK has more construction companies that have already made the technological leap.

An even more fundamental reinvention of traditional construction methods will be required to achieve sustainability, given the challenging net zero carbon targets of the European Union and UK government.

More than 380 projects in 24 countries across Europe were analysed for CRUX Insight 2021. Buildings was the largest category, followed by power and utilities, transport infrastructure, industrial and manufacturing, and the resources and technology sectors. The average outturn project CAPEX cost was \$689 million – a lower figure than in other regions, as a result of a larger proportion of smaller residential development projects. Conversely, for projects in Europe, the average cost claimed (\$136 million) as a percentage of CAPEX was 18% higher in this region than the average for all other regions. However, the average disputed time extensions were 64% of the planned programme durations, less than the global average of just under 72%.

The causes of claims

Design errors have overtaken change of scope – the singular cause for most claims and disputes globally – in the latest European analysis. However, a comparison of the situation before and after the pandemic shows that clashes over contract interpretation were even more prevalent than scope and design issues before COVID-19's onset at the start of 2020.

Inaccurate design can be blamed largely on human error, and it rapidly spawns issues when works commence on site before design issues are resolved. The disruption caused by the pandemic will also have distorted what the parties felt able to claim, as well as potentially clouded the underlying causes of projects' difficulties. The nexus of scope change and design will continue to drive more disputes and feed into other causes of conflict.

Many underlying causes are embedded in the structural fault lines of the industry's high-risk, low-margin operating model.

Top causes of claim or dispute	Rank
Design was incorrect	1
Change in scope	2
Contract interpretation issues	3
Poor management of subcontractor / supplier and / or their interfaces	4
Contract management and / or administration failure	5
Workmanship deficiencies	6
Level of skill and / or experience	7
Design was incomplete	7
Design information was issued late	9
Physical conditions were unforeseen	10
Claims were spurious	11
Operational performance	12
Cashflow and payment issues	13
Tender errors and / or inaccurate estimates	14
Installation failure	15

At their roots, many of these underlying causes are embedded in the structural fault lines of the industry's high-risk, low-margin operating model.

Owners and employers all too often enter into contracts before the scope is fully defined for the outcomes they want to achieve. This may be due to planning or funding pressures. Also, circumstances and priorities can change, giving rise to legitimate changes that require management; for example, if a new development merits an additional junction on a highway scheme, or drainage is to be upgraded in light of climate change.

Contractors can, at times, bid over-aggressively and take an overly optimistic view of outcomes. Constrained by contracts' onerous terms, they may be incentivised to take a harder view on change orders, triggering disputes over scope. This adversarial culture, which is still favoured by many employers, and especially global players, breeds more claims and more contentious disputes.



383

projects



24

countries



\$689m

average
CAPEX



\$136m

average cost
claimed



64.0%

average EOT
claimed

Compared with the global pattern, European projects are only slightly less prone to conflicts over contract interpretation but more likely to succumb to difficulties over supply chain management, quality of workmanship, and skills levels. Shortages of people with the right qualifications and experience are increasingly apparent – from design and planning teams through construction and operations, and across multiple sectors, notably energy and renewables. This is true even of established owners and contractors in oil and gas, who are looking to exploit new, more sustainable energy demand, let alone the newcomers to this burgeoning market.

Some of the design skills shortage stems from a drop in trainees dating as far back as the 2008 crash. In the UK, in addition to Brexit reducing numbers further, young recruits are not entering the workforce in sufficient numbers to provide continuity for the medium and long term.

An even deeper root cause of many design-related claims is how projects are set up as if the design was a product to be taken off the shelf, finished and guaranteed, ready for use. Failure to acknowledge the complexity of design and how it is developed, particularly on larger projects, sets the scene for inevitable design clashes and variations.

Ongoing supply chain disruption also fuels design-centric claims and disputes over poor specialist workmanship, as well as holding up projects. In addition, substitute materials, whether agreed or not, may be inferior or unfamiliar to specialists, forcing them to adopt different working practices. Rectifying resultant problems after installation will be costly and cause big delays, especially if equivalent materials to those originally specified – and available only on a long lead time – must be used.

Effects of COVID

Our consultants in the field predict a long legacy from COVID, with or without further outbreaks that may necessitate lockdowns.

Claims over the application of contract clauses on changes in law and *force majeure* are

still being worked through. Many contracts predating the pandemic have resulted in harsh outcomes for contractors desperate to recover costs. New clauses are being drafted that have yet to be interpreted or tested.

Volatility and fragility in the construction market will be much greater over the coming 12 months.

Volatility and fragility in the construction market will be much greater over the coming 12 months. From small specialist suppliers to major contractors, many companies are weaker and for many, the outlook is more uncertain. Such financial stress and threats of insolvency will likely drive more aggressive behaviour by owners and contractors, giving rise to more problems and conflicts on projects.

Many projects have been postponed, but political pressure to launch works that stimulate national and local economies will intensify. As compressed timelines for planning, procurement and mobilisation are already shown to set the scene for claims and delays downstream, more cost and completion overruns can be expected on these public sector projects.

The prospect of a strategic re-set in the industry's approach to capital projects may also be fading. There has been a growing discussion around the need for more effective contracting mechanisms and risk allocation. However, the events of 2020 may be casting a long COVID shadow over the prospects for such a shift, as employers become even more risk-averse. We are seeing more liabilities pushed down to contractors in offshore wind and other sectors. As these risks tend not to be reflected in prices, contractors will find it more difficult to make money without maximising claims.

The way forward

Against this backdrop of recurrent claims, rising costs and general uncertainty, new approaches are needed. From their first-hand experience, our consultants recommend the following measures to reduce time and cost overruns on capital projects.

1. Claims handling

Setting out a clear and logical process for handling claims should facilitate earlier settlement and avoid escalation – as exemplified by a UK transport organisation and an international developer client. In each case, a bespoke process details the obligations on both sides, along with timescales for submissions, decisions, and progression from site to senior levels before referral to a final disputes forum. This affords ample opportunities to reach an agreement informally or commercially. Developing the process jointly with the supply chain helps secure contractors' buy-in. Enshrining it in the contract when the parties are on good terms is also advisable.

2. Disputed designs

Gaps in scope usually result in a blame game with the design team or consultant. Time is then wasted discussing a potential claim without a rigorous assessment of the technical grounds. Appointing a technical expert at an early stage can help all parties understand exactly what went wrong and why. The combination of commercial, legal and technical knowledge brought to bear by technical experts can pre-empt or resolve such disputes. Owners and their legal teams are showing more willingness to engage technical experts in this way. An added advantage is that a fresh, independent perspective can resolve an impasse reached by parties in entrenched positions.

3. COVID lessons

The global pandemic set back many projects, but potentially valuable lessons can be taken from the crisis too. It demonstrated the benefits of digitalisation – from remote meetings and working to drone surveys and BIM – and accelerated adoption. Site layouts, labour rosters, works sequencing, canteens, logistics, site surveying and a host of other functions were revamped rapidly to keep projects going or re-boot them. Learning from what processes, controls and innovations worked well, construction can become more agile and boost its low productivity.

4. Project set-up

Calls for greater time and resources to develop scope, mature designs, evaluate procurement options, and involve contractors earlier are now a familiar refrain from successive CRUX reports.

Other supporting measures that would enhance project outcomes if adopted during the pre-construction phase include:

- A more interactive design process involving all stakeholders to ensure its fitness for purpose.
- More thorough setting up of commercial and delivery teams who need to be in place for the project duration to ensure continuity.
- A good BIM model managed by a competent team to allow changes in scope to be incorporated and assessed far more easily.
- Careful consideration of how COVID-19, or other pandemics, will be treated under future contracts so that the commercial implications for all parties in the supply chain are understood and planned for.
- Resilience checks on logistical as well as financial vulnerability to such shocks.
- Re-assessing *force majeure* provisions not just concerning pandemic risk, but also matters such as climate change – remembering that the past is now a far less reliable guide for the future, and what was a 1-in-100-year event might be 1-in-10 or more.

The global pandemic set back many projects, but potentially valuable lessons can be taken from the crisis too.

Regional focus

Renewables sector needs its own transition

Renewable energy is a burgeoning sector and Europe is at the forefront.

Power & utilities offshore renewable	
Top causes of claim or dispute	Rank
Change in scope	1
Physical conditions were unforeseen	2
Contract interpretation issues	2
Poor management of subcontractor / supplies and / or their interfaces	4
Contract management and / or administration failure	4

Power & utilities onshore renewable	
Top causes of claim or dispute	Rank
Poor management of subcontractor / supplies and / or their interfaces	1
Design was incorrect	2
Installation failure	3
Workmanship deficiencies	3
Contract management and / or administration failure	3
Claims were spurious	3
Level of skill and / or experience	3

Ranging from on- and off-shore wind to solar and hydro, renewables already account for 90% of new power capacity expansion globally. That growth is also accelerating. In May, the IEA (International Energy Agency) had to upgrade its 2021 forecast for nearly 40% higher growth than expected a year earlier, putting installed wind and solar capacity on track to match installed gas capacity globally by 2022.

Effective contract management is crucial to the successful delivery of any project. In turn, it depends on the availability of suitably experienced staff and provision for them in project budgets (owners' cost allowances and contractors' tenders).

Europe's leading position has inevitably strained its supply of resources, both human and material. As the number of renewables projects continues to rise, skilled resources must transfer from other sectors (such as oil and gas) to ease the shortfall. However, both owners and contractors need to provide adequate training for teams taking on significantly different work.

Budgets will require a sufficient cushion for unforeseen events, as well as contract management. Owners need their own capable team, not least when reviewing tenders to understand the contract management resources that contractors intend to provide. In a very commercially driven market, strength in this area is vital.

Mismanagement of subcontractors and suppliers – a major source of conflict both on- and off-shore – is driven by the same industry pressures on materials and skills. The other primary cause is a lack of control over programmes and interfaces.

The supply challenge is being addressed. We are seeing more sector-wide investment in supplier capability and capacity.

Supply management requires more effective and proactive planning at all stages, by both owners and contractors. From the lead-in, interfaces are critical on renewable projects. Too often the impacts from design changes and other factors are not addressed. Strong programme control and management are essential to ensure interfaces, supplies, subcontractors and others are managed both to control the effect of change and to deliver projects efficiently. Project planners need to be involved at all stages and to work closely with contract and site management.



Many renewables projects also rely heavily on high levels of project finance debt to reduce overall costs, but this can magnify any problems that cause cashflow issues. So, with larger, more complex projects, extra care needs to be taken for scenario planning if everything does not go according to plan.

Learning from other sectors

The sector's mix of newcomers and companies established in other fields is unique, especially in the context of a wider and rapid energy transition. This is coupled with tight funding models and contracting relationships that are also novel. Yet, it is considered that lessons learned in other sectors are transferable to renewables.

Set funding models may make it challenging for owners to award variances to the programmes and /or contract prices outside of budget allowances.

Early Contractor Involvement (ECI) has frequently been shown to add value to the project delivery process, as both owner and contractor gain a better understanding of project risks, and this allows the design to be optimised regarding buildability and supply.

Also, an enhanced focus at the award stage on supply chains and resilience of delivery models can help ensure on-time delivery.

Dispute avoidance programmes and boards, and adjudication agreements and boards, are not commonplace in the sector. On other energy and infrastructure projects, these processes have proved effective in reducing cost and time overruns and reducing formal dispute processes following completion.



Expert commentary

UK market – Government view

The period since May 2020 has seen a strong rebound in construction activity across Europe, including in the UK, where construction output regained pre-pandemic levels by March 2021, and has remained at around this level for the past six months. There has been a strong recovery across all subsectors, starting with infrastructure, new housing and the domestic repair, maintenance and improvement sectors, and more recently, increased commercial and industrial investment.

However, the supply chain for products, materials and labour has struggled to keep pace with rapidly increasing demand. Products and materials producers and merchants have faced a number of challenges, including ongoing disruption to operations caused by COVID-19, increased costs and longer lead times due to problems in the shipping and logistics industries, and more recently, energy price increases. This has resulted in average product and materials price inflation of around 20%, with some products seeing significantly greater increases. Prices for most products are not expected to fall until 2022.

The construction workforce is also less mobile, due to various restrictions, and there have been reductions in some markets as workers have returned home due to the pandemic. Whilst there has been some uplift in capacity as workers have returned from furlough schemes, labour and skills shortages led to an increase in wages in recent months. The industry has also been affected by the shortage of HGV drivers in the UK.

However, the construction sector has proved resilient and able to adapt to these challenges. Firms have demonstrated the ability to introduce new site safety measures, plan work, and identify and adopt new technologies and techniques that have improved productivity. They have also diversified their supply chains, and many have invested in workforce skills to address skills shortages. Whilst it is likely that challenges will remain, the industry is well-placed to contribute to economic growth in the UK in future years.

– Fergus Harradence, Deputy Director

Infrastructure & Construction at Department for Business, Energy and Industrial Strategy (BEIS)

Middle East

Introduction

Construction activity continued without the general shutdowns seen across other regions during the pandemic, at least in the Gulf states. Their resilience, and a range of government measures designed to keep the construction and engineering industry operating, ensured that there was a concerted effort to minimise the impact of the pandemic on the progress of major projects.

The region has a rich pipeline. Significant investment is being funnelled into infrastructure, utilities, and energy – notably in the Kingdom of Saudi Arabia – to diversify the oil-driven economy.

Higher oil prices will boost producing countries in 2021 while depressing those reliant on oil imports. Lower-income countries have also seen their fragilities compounded by COVID-19. National indebtedness and slower vaccination programmes will hinder their recovery.

As Gulf states re-open to foreign workers, its hotter markets face skills shortages and rising wage costs in addition to the global pressures on supply chains and input prices. Companies seeking to hire personnel from abroad are also having to navigate complex travel vaccination requirements, taking into account the type of vaccine administered in recruits' home countries.

In total, 329 projects in 12 countries across the Middle East were analysed for CRUX Insight 2021. More than a third were building projects – making commercial buildings the single biggest sub-sector – while the transportation

Top causes of claim or dispute	Rank
Change in scope	1
Design information was issued late	2
Contract interpretation issues	3
Design was incomplete	4
Contract management and / or administration failure	5
Cashflow and payment issues	6
Approvals were late	7
Access to site / workforce was restricted and / or late	8
Poor management of subcontractor / supplier and / or their interfaces	9
Physical conditions were unforeseen	10
Design was incorrect	11
Level of skill and / or experience	12
Tender errors and / or inaccurate estimates	13
Claims were spurious	14
Inadequate responses to information requests	15

infrastructure and resources sectors were also well represented, along with power and utilities. These projects had an average CAPEX of just under \$2 billion, with an average sum in disputed costs of \$134 million. The extensions of time claimed typically amounted to 84.7% of a project's scheduled programme duration – the highest figure of all six regions.

The causes of claims

As the causation ranking shows, the same top five drivers of claims and disputes across the globe are at work in the region, though their relative impacts vary. Design and contract management are at their root, and our consultants see first-hand how deficiencies in one area can trigger conflicts in the other.

Design changes and variations are a perennial source of contention as owners force the pace of project development and tendering. However, claims and disputes related to changes in scope do not always stem from owners' decision-making. Projects put back for commercial reasons often come to fruition with outdated designs that are no longer compliant with technical standards, advancing technology, and regulations. These include the requirements of utility providers and civil defence authorities, and new fire safety regulations specific to cladding.

Similarly, problems over contract interpretation stem from a mix of cultural and specific factors. Employers enjoy a dominant position and compliant contractors take on significant risks. A particular problem is the tendency to apply 'sticking plaster' clauses to new contracts that were designed to address issues that occurred on previous projects. Failure to take a holistic view of the contract provisions leads to conflicts in wording – and interpretation.

Clients, consultants and contractors also fail to understand where design risk lies and, in particular, the distinctions between traditional contracts, design & build, and EPC (Engineering, Procurement & Construction) arrangements. The prevalent use of shop drawings to finish the design as projects progress leads to disputes over who instigated or is responsible for design changes.

Late approvals loom larger in the region than elsewhere. Employers' consultants may lack a full understanding of contractual obligations or a willingness to comply. The results tend to be detrimental to projects' progress and outturn costs.

Cashflow and payment issues are notably more prevalent in the Middle East than in other regions.

Cashflow and payment issues are notably more prevalent in the Middle East than in other regions. A historical problem, contractors continue to be squeezed, often because already over-long payment timeframes are still not honoured. This is compounded by a lack of statutory remedies, and access to quick resolution processes, such as adjudication, which are available in other regions, or Dispute Adjudication Boards that are still very rare.

As with many other project ills, a higher incidence of tender errors largely stems from the region's extremely tight tendering periods – the haste to 'get on site' and show progress trumps clarity over design and understanding of



329
projects



12
countries



\$1.98bn
average
CAPEX



\$134m
average cost
claimed



84.7%
average EOT
claimed

how risk is best apportioned. This problem is likely to increase as giga-projects in the region come to fruition in a short period of time.

Similarly, the common misunderstanding or denial of contractual obligations results in more claims over inadequate responses to information requests, as employers and designers try to push risk to contractors. In some cases, employers and consultants avoid responding, or only do so verbally, for fear that a documented response would provide the basis for a claim.

The effects of COVID

The pandemic prompted some employers to tighten their belts, further constricting cashflow. We have seen payment periods lengthen and more outstanding claims remain unsettled.

Many contracts and their *force majeure* provisions – often heavily amended to be less favourable to contractors – did not allow for the potential effects of a global pandemic, the closure of airports, and loss of productivity due to disrupted supplies or non-availability of specialist staff or technical support.

As with payment delays, failures in contract management, late approvals, and unforeseen physical conditions all rose in importance during the public health crisis – part of the collateral damage as project teams grappled with unprecedented challenges.

COVID-19 will continue to pose risks. It is a positive development to see relevant contract clauses – including those relating to *force majeure*, hardship, and changes in law – being clarified for better risk allocation. Some parties are attempting to re-negotiate cost-sharing for pandemic-related impacts rather than just extensions of time.

While these risks will be highest in countries lacking comprehensive vaccination programmes, we expect the same pre-COVID pattern of dispute causation to prevail over the coming year and beyond, but with some new variations.

On the horizon

Design-centric factors, if anything, are likely to become even more dominant with the rising complexity of projects and accelerating diversification of the energy market towards renewables and other technical challenges unfamiliar to contractors. Meanwhile, regulatory requirements are shifting while the industry as a whole tends to be slow to adapt to emerging technologies. The pandemic has helped demonstrate the advantages of digitalisation and the use of BIM (Building Information Modelling), but many specialist contractors and suppliers lack that capability.

Cost inflation is a growing concern, and it should be for contractors used to operating in a low-inflation environment and bound by contracts that do not share the associated risks equitably. On some projects in this region, we have seen a quadrupling of shipping container prices and six-month delivery delays. Similar or worsening supply chain impacts could have serious consequences for those unable to recover significantly higher costs.

A lack of skills and experience is likely to impact more projects and push up costs further. The United Arab Emirates has already begun losing talent at all levels to the more buoyant Saudi Arabia market. Shortages of qualified personnel and skilled workers manifest themselves in all aspects of project planning and delivery, amplifying the other common causes of claims and disputes, not least standards of workmanship.

Competition for people is likely to raise payroll costs, which could also be inflated by the need to pay a premium for vaccinated recruits or cover the workforce's vaccination costs.

The way forward

Despite these challenges, the overall prospects for the region's construction and engineering industry remain extremely positive. However, the heavy toll in project overruns and disputed losses will continue rising with this workload unless lessons are learned and these persistent causes are addressed.

Cultural change is never rapid but there are encouraging signs of a shift in some of the ingrained attitudes that sow the seeds of conflict.

Our consultants report that some enlightened employers are committing more resources and time to design development. They recognise that paying more for a highly experienced design team and ensuring the maturity of the design before tendering will save money down the line.

Another HKA client, an international energy facility developer with bases in the region, commissioned a 'lessons learned' programme to identify failures and successes on past projects, which were then shared with staff in relevant departments across the organisation, from procurement and contract administration to project management. This has led to a better appreciation of different ways of working that can help prevent frictions escalating into claims and disputes. In addition, we have witnessed some employers adopting early contractor involvement with a view to stress-testing buildability. Whilst this practice is relatively popular in other regions, we have yet to see it fully embraced in the Middle East.

Arbitration remains a key means to resolving disputes in the region. However, the time and cost of arbitration remain a serious concern, so that there has been a very tentative movement towards third-party expert determination, whether binding or not. We have seen a handful of high-profile, government-backed employer organisations adopting this as a cost-effective method of resolving matters before they flare up into protracted or costly disputes. With the increasing need for auditability around the settlement of claims, we expect that expert determination will continue to be used throughout the Middle East.

More profound change will be required to transform procurement models and foster a healthier contracting environment.

More profound change will be required to transform procurement models – such as alliancing and partnering arrangements – and foster a healthier contracting environment for capital projects. This would see employers focussing on the capacity and capabilities of their project partners to deliver desired project outcomes, rather than the short-sighted goal of the 'lowest price' tender. They would give careful consideration to alternative procurement methods that could be better suited to their projects, and seek to allocate risks to the parties best placed to manage them.

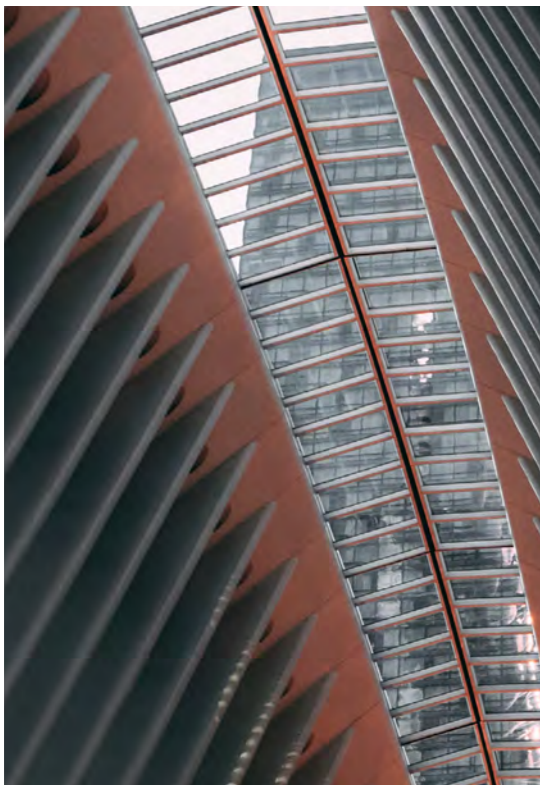
Both sides should be more proactive, tackling issues as soon as they arise, rather than allowing disputes to escalate. The embers of a problem left unattended tend to flare up into more serious issues later – as on one project when a relatively small design variation forced by a change in legislation culminated in serious project delays and cashflow problems.

Other specific measures worth consideration include:

- Spending more time agreeing upon project outcomes, as well as the attendant design, so that this can be frozen, enabling greater clarity over contractor deliverables.
- Clearer contract drafting with greater consideration of proposed amendments to standard forms, taking independent advice, where necessary, on the potential implications.
- Building up capabilities within a more local supply chain to reduce reliance on imported skills.
- Earlier contractor involvement, not least in design development and its alignment with a robust schedule, while also obtaining agreement over risk allocation and ownership.
- Investing more in people – high-calibre professionals and staff training and development – to improve project governance and attract a new generation who can foster cultural change.

- Improving record-keeping to substantiate claims, especially given the risk of ongoing disruption and lost productivity due to further COVID outbreaks.
- Preparing solid claims informed by expert opinion on liability so the employer's engineer can determine them early on, avoiding full-blown disputes.
- Commissioning more rigorous quality inspections to avoid serious defects after handover.
- Developing up-to-date costings to ensure final accounts can be settled expeditiously to ease cashflow.

These relatively modest measures would alleviate some of the unnecessary burdens of delay and costs associated with claims and disputes on major projects across the Middle East, and pave the way for more systemic change.



Expert commentary

A call for cross-industry collaboration

Complexity has always been a factor in major capital projects, which have continuously resulted in overruns and conflicts. This has been exacerbated by the COVID-19 crisis and its aftermath.

Having shown resilience and determination in the face of the unprecedented challenges of the pandemic, the Middle East's high vaccination rates and economic stimulus have bolstered investment and business confidence in the region, and paved the way for a swift recovery in the sector.

While there are plenty of opportunities for growth in the post-pandemic era, there are also several challenges, uncertainties and risks that come from the need for companies to be more agile. The world is changing rapidly, and with that, investors are naturally cautious with their investments. As the construction industry needs certainty, navigating this can be tricky for the industry.

The future shape of the construction industry is still being formed, and there is more consideration being given to investment in the longer term than before. It is essential to focus on efficiency in portfolio optimisation and the resilience of supply chains. There is an enormous amount of inefficiency and crossover in terms of scope in projects. Operational efficiency can be achieved by cross-industry collaboration to lead the charge for change and bringing in new technologies to overcome some traditional shortcomings. As the pace of change evolves with digitalisation, there is a great need to quickly adopt a more collaborative approach to construction projects.

- **Anas Bataw, Director**

**Centre of Excellence in Smart Construction,
Heriot-Watt University Dubai**

Regional focus

Administering FIDIC – meeting the gold standard

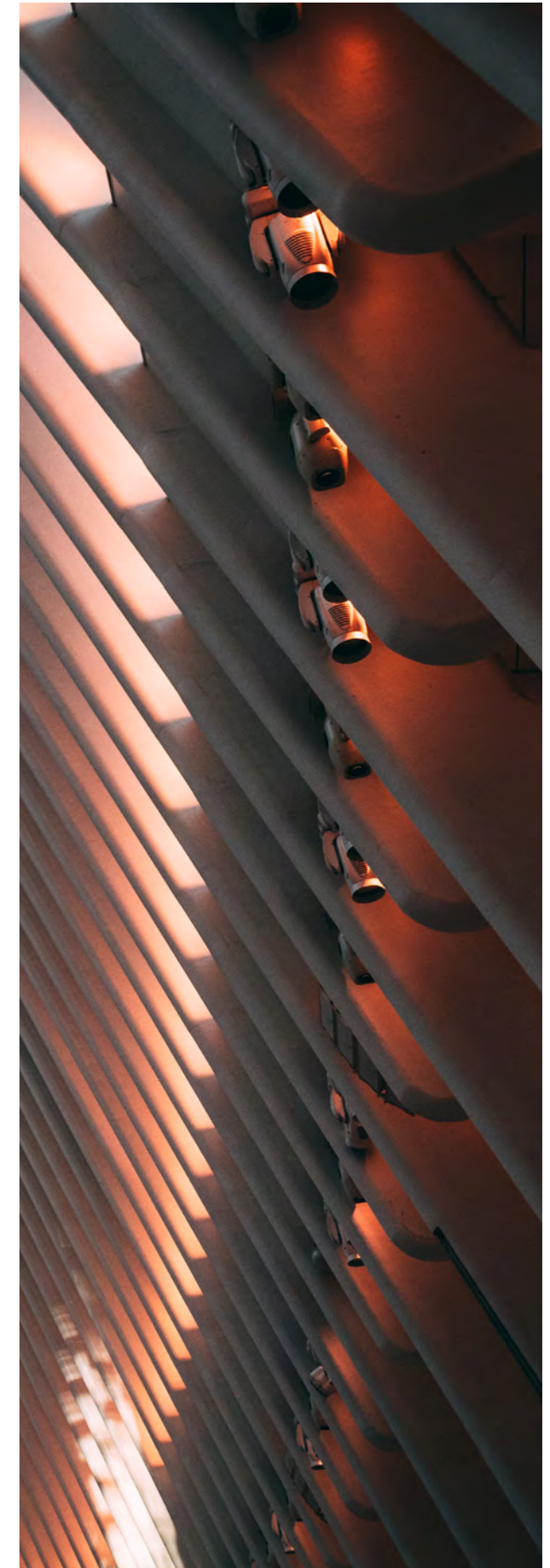
Of the projects in the Middle East analysed for CRUX Insight 2021, more than a third (113) – with a total CAPEX of over \$138 billion – used one of the FIDIC Suite of General Conditions of Contract as the basis of their agreement. This form is typically adopted in sectors such as building construction and infrastructure, though the majority of contracts are heavily amended.

The FIDIC suite of contracts is seen as offering a balanced approach to the allocation and management of risk, but as with any standard form, project success depends heavily on how the contract is administered. The starting point when negotiating, and thereafter, administering the FIDIC contract must be an awareness and understanding of FIDIC's fundamental principles.

Change in scope is the top cause of claims or disputes for FIDIC contracts in the Middle East. To address this, it is essential to use the correct form of FIDIC for the procurement route and delivery strategy preferred by the employer. If, for example, design certainty is crucial and the employer designs the project, it is considered that the FIDIC Red Book would be the most appropriate to use.

However, if the Red Book is used where the design obligations are amended to allow the contractor to fully develop and complete the design, then it raises the question of how 'complete' the design was in the first place and its sufficiency for use on what is essentially a construct-only contract. It is in these situations when design changes and changes in scope become problematical and contract management challenges start to creep into the project.

In simple terms, respect the FIDIC contracts and adopt the right set of conditions for the circumstances they were created for. The risk of dispute will be significantly reduced.



Oceania

Introduction

Oceania's construction market has never been so buoyant. Australia had previously set a five-year record of output for emerging economies (7.6% in 2014-19) and the bow wave of investment has gained momentum since – A\$110 billion in public transport infrastructure alone is planned for the 10 years from 2021. The region's other major economy, New Zealand, is also in the midst of a construction boom.

Alongside this unprecedented development, citizens have also been learning to live with the rising expectation of bushfires, drought and flooding. This too has given rise to urgent new critical infrastructure needs. However, if emergency public works require funds and resources to be diverted in response to environmental events impacting infrastructure assets, other planned and live public projects could be delayed and disrupted, resulting in claims and disputes.

While the economic outlook is incredibly positive for the construction industry as a whole, such high demand is faced with significant local and regional supply-side constraints in materials, equipment, and resources. Infrastructure Australia's 2021 market capacity report has confirmed that demand for the workforce skills, equipment and materials needed to deliver the public infrastructure proposed will exceed supply, especially on the east coast of Australia. There is concern that this will result in cost blowouts on public infrastructure projects without well-structured commercial management; the costs for labour and materials are already rising.

Equally, a shortage of appropriate labour and material could also give rise to significant delays to project start dates.

Our analysts reviewed 122 projects, mainly in the two dominant economies of Australia and New Zealand, and a small number of contracts in the South Pacific. The resources sector, transportation infrastructure, and buildings accounted for the majority of projects, with rail and mass transit being the top sub-sector. Large projects dominate, with an average CAPEX value of just over \$3.5 billion and claimed costs averaging \$90.3 million. Claims for prolongation would extend planned project schedules by just over 78%.

The causes of claims

CRUX Insight 2021 shows that the pattern of causation in Oceania is similar to that for claims and disputes in the rest of the world, though there are distinctive antipodean market characteristics.

Top causes of claim or dispute	Rank
Change in scope	1
Contract interpretation issues	2
Contract management and / or administration failure	3
Access to site / workforce was restricted and / or late	3
Design was incorrect	5
Design information was issued late	6
Claims were spurious	7
Design was incomplete	8
Poor management of subcontractor / supplier and / or their interfaces	9
Physical conditions were unforeseen	10
Workmanship deficiencies	11
Tender errors and / or inaccurate estimates	12
Level of skill and / or experience	13
Shortage of skilled and non-skilled workers	13
Operational performance	13

Scope of services and scope of works are the two least well-understood aspects of capital contracts. Project promoters may lack the necessary technical or engineering insight to appreciate the implications of poorly defined and / or understood scope. Several other contributory factors are seen in the region. Large projects typically go quickly to market, and to a relatively small pool of contractors. To secure the award, bidders offer 'value-engineered' options that do not stand up to scrutiny when reviewed during construction.

Despite technological advances and digitalisation, the pace of construction is often out of synch with design development.

Despite technological advances and digitalisation, the pace of construction is often out of synch with design development. BIM (Building Information Modelling) is continuing to make inroads on some major projects, but its promised benefits are not yet being fulfilled to their greatest potential. Digital models are only as effective as the weakest link among all the contracting and supply partners. Even if that is a small subcontractor, problems still arise as the 'one source of truth' is fragmented.

Undue haste to start on site also often leaves insufficient time for site investigation. This may lead to works grinding to a halt on the discovery of contaminated ground or due to other unforeseen conditions, such as unmapped utility services or ancient remains.

Owners' insistence on bespoke contracts and resistance to more collaborative approaches – such as those offered by the NEC contract suite – leads to a contracting environment that remains, for the most part, adversarial. However, there is a growing interest in procurement reform and contracting partnerships as shown by several clients, including Sydney Water and WaterNSW.

The increasing complexity of projects is testing the capabilities of delivery agencies and contractors alike. With works broken down into multiple packages, managing and integrating the interfaces is far more difficult than in the past. Shortcomings in contract administration and commercial management are also being exposed.

Fragmentation is complicating the design process too, especially under the design & construct project delivery model. Tendered on a speculative basis to design consultants – the norm for infrastructure both in New Zealand and Australia – the resultant level of design detail tends to be



122

projects



4

countries



\$3.52bn

average
CAPEX



\$90.3m

average cost
claimed



78.1%

average EOT
claimed

found wanting on site. The hoped-for design innovation from subcontractors is not happening, and design integration problems are increasing, as with multiple parties involved, risks arise at each interface. This is affecting construction quality – a growing concern in Australia.

On longer-term framework contracts, lack of forward visibility of the pipeline means that contractors and designers are unsure what resources to commit, and there are knock-on impacts on the level of technical input, pricing accuracy and execution of the works themselves.

Effects of COVID

The COVID-19 crisis highlighted Australia's reliance on skilled labour from abroad. The latest estimate is that up to two million skilled migrants are required in a country with a population of 25 million. In Australia, the federal government's commitment to keeping the construction industry operating, for economic and political reasons, also ushered in a more pragmatic approach to contract administration.

BIM and digital platforms will also have helped, though it is hard to quantify how these facilitated the continuation of project planning and management, as well as design, through the pandemic.

Restricted access to sites supplanted other issues in the top 10 causes of claims and disputes. Spurious claims and contract management conflicts faded away amid more scrupulous recording of site activities and easier relationships.

On the horizon

As construction booms in Australia and New Zealand, the already evident shortages of materials, equipment and skills are worsening in the wake of COVID and will continue at least into the medium term.

The industry depends on equipment and other imports from China. Sino-Australian tensions in the political and naval spheres may add further friction to trade.

The pressures on prices and salaries increase the dangers of an overheating construction and engineering industry. Whatever the inflated budgets or under-estimates within Australia's multi-billion-dollar pipeline, it will increase the stress on the market, driving more of these recurrent claims and disputes.

Rolling investment out from the major cities to the regions, while positive for local economies and communities, will also add further stresses to providers and budgets. The higher cost of travel over long distances, servicing inaccessible locations, and allowances for working away from home increase the costs of constructing dams, offshore wind farms, and other infrastructure.

There is also a political imperative to subcontract work to regional and local providers including micro-businesses. Running multiple small works is challenging. When mismanaged, the cost of re-work and the reputational damage are disproportionate.

The way forward

The prospects for infrastructure and other forms of development in the region are exciting, but daunting. A concerted effort will be required to deliver state and private sector investments at scale while navigating uncertainty and avoiding the pitfalls and conflicts that will culminate in cost blowouts, lengthening overruns, and decreasing value for money. This means focusing on targeted measures without losing sight of the bigger picture.

Such measures could include:

- Fluctuation clauses to share risk more equitably and more transparently, affording contractors increased protection against sharp and unavoidable price hikes.
- A duty to cooperate – currently a contractual rarity that can shift parties away from brinkmanship towards a more collaborative approach for the benefit of the project.
- More forward-thinking delivery models supporting productivity and innovation.

- More and earlier contractor involvement to advise on scope and constructability.
- Improved visibility and transparency to anticipate risks and optimise resources and equipment.
- Encouraging greater design maturity before commencement.
- Better testing and technical information on materials to detect sub-standard elements before building.
- New clauses that provide wider and less contentious grounds for extensions of time and recovery of additional expense arising from the impacts of climate change, public health crises, green energy policies, political turmoil, restricted travel, and weakened supply chains.
- The use of expedited expert determinations to resolve commercial matters in a less disruptive manner.
- Investment in digitalisation, which so far has focussed on new construction. The cost-benefits of retro-fitting BIM when augmenting an asset, such as a hospital or utility network, need to be demonstrated.
- Other mechanisms are required on capital works not large enough to justify investing in BIM, involving a more collaborative approach to avoid delivery gaps and sub-optimal performance due to a transactional mindset to 'do only what is in scope'.

Nothing less than a paradigm shift will prepare the capital projects ecosystem for the looming challenges and uncertainty.

Valuable though these and other steps would be, nothing less than a paradigm shift will prepare the capital projects ecosystem for the looming challenges and uncertainty. This holistic change encompasses people, relationships and the operating environment of the construction and engineering industry.

People

The people challenge is not just a numbers game, it is also about raising capability.

That means attracting and training a new generation of high-calibre professionals capable of delivering projects now and in the future. A modernised construction industry needs digital natives, not least as designers and project managers. But it must also pass down the site-savvy know-how of experienced colleagues before it is lost through retirement.

Operating at full capacity, the industry has to open up to international contractors. It cannot afford an exodus of foreign workers as travel restrictions ease and will rely on inward migration at least into the medium term, and longer without an effective home-grown talent strategy.

Relationships

The aim should be to move away from the default adversarial working relationships of the owner, contractor, and supply chain. A collaborative model – based on real engagement with the market, a fair allocation of risks and rewards, and greater transparency – would be more productive and improve resilience within the industry. This will lead to more effective partnerships, including longer-term portfolio relationships as opposed to one-off project commissions (akin to 'serial marriage and divorce', as one of our experienced consultants put it).

The more collaborative approach – signalled back in 2018 by the New South Wales government's '10-point commitment to the construction industry' – is percolating through to contracts. Federal government contracts have begun to favour risk-sharing and cooperation, partly in response to the pandemic and a desire to minimise shutdowns. That lead needs to be followed. Another encouraging signal is the strong interest shown in New Zealand and Australia in Project 13 (the new business model based on sustainability, innovation and skills championed by the UK's Institution of Civil Engineers).

There are different and better ways of procuring capital works, as shown by Sydney Water's P4S (Partnering for Success) approach (see [page 59](#)).

Operating environment

It is for owners and delivery agencies to create an environment in which the parties are encouraged and able to work together to deliver the best overall outcomes on projects.

At a macro level, Australia's A\$110 billion pipeline is a once-in-a-generation opportunity to transform the construction and engineering industry, build capacity, and leave a lasting, sustainable legacy of skilled employment, prosperity, and environmental improvement for citizens. Federal and state infrastructure plans should be reviewed by independent experts to provide a robust, realistic, and deliverable programme. The long-term gains will be maximised if this programme is coordinated and phased as part of a national capacity building and employment strategy.

At a project level, standard contract forms (such as NEC) and key performance indicators that foster collaboration will help drive this culture change. Partnership charters – committing parties to work to an agreed set of principles and outcomes – are also conducive to this new way of working. Project organisations require teams with the right people, relationships and skills to be aligned on outcomes and a willingness to collaborate and be innovative. Sponsor organisations and their suppliers must create an environment and ways of working for project teams to take ownership of the complexity of their projects and interfaces between parties.

A modern, progressive operating environment will allow more systems thinking and an engineering and technical focus on complex problem-solving to inform risk mitigation. It will also harness technological advances such as artificial intelligence and digitalisation. As our work analysing what goes wrong on projects shows, BIM is, in itself, no nirvana. Digital models do not just facilitate collaborative working, they demand it if they are to be fully effective.

An overheating industry needs new thinking and delivery models equal to the unprecedented opportunities and uncertainties ahead. Fundamentally, the right conditions should be created for participating organisations to work together to share knowledge, skills and lessons and optimise resources to deliver the best possible outcomes.

It is for owners and delivery agencies to create an environment in which the parties are encouraged and able to work together to deliver the best overall outcomes on projects.

An overheating industry needs new thinking and delivery models equal to the unprecedented opportunities and uncertainties ahead.



Regional focus

Transport infrastructure: A lessons interchange

For transportation infrastructure projects around the world, the top three causes of claims and disputes are change in scope, unforeseen physical conditions and incomplete designs (see table). However, a comparative analysis of the CRUX 2021 dataset reveals that most projects in Oceania are avoiding the latter two pitfalls.

Transportation infrastructure Oceania:

Top causes of claims and disputes	Rank
Change in scope	1
Access to site / workforce was restricted and / or late	2
Poor interface management with third party	3
Contract interpretation issues	3
Claims were spurious	5

Transportation infrastructure rest of the world:

Top causes of claims and disputes	Rank
Change in scope	1
Physical conditions were unforeseen	2
Design was incomplete	2
Access to site / workforce was restricted and / or late	2
Contract interpretation issues	5

Site investigations

To enhance understanding of physical conditions, a commitment to undertake early and detailed site investigations with extensive boreholes has been made by major transport infrastructure owners and delivery agencies.

Such investigations are often conducted long before the business and investment cases for projects are finalised; or, at least, in advance of

environmental and planning approval, as with the A\$16 billion North East Link major roads and tunnel project, and Sydney Metro West. In the case of the A\$50-plus billion Suburban Rail Loop underground metro system, investigations started the same day it was formally announced in November 2019.

This approach reflects difficult lessons learnt in the transport sector from billion-dollar contractor claims for relocating utilities, and changes in regulations on soil contamination and disposal – sometimes made after contracts were signed. Governments and delivery partners also sustained lively media criticism due to high community expectations for transport infrastructure and environmental management.

Design performance

Equally, transport agencies have addressed many challenges of design performance by adopting a different approach to procurement.

Australian governments have had a long-term preference for procuring projects via Public-Private Partnerships and Alliancing. These standard models enable greater collaboration and insight from delivery partners to reduce risk prior to awarding contracts. They also provide a mechanism for driving innovation and value for money.

The owner can take partially progressed designs to market and thereby leverage the collective capabilities, decision-making and governance of the delivery partnership in detailed design and for buildability. This helps solve complex designs involving engineering (geotechnical, tunnelling and structural) and technology (telecommunications and control systems).

Any form of collaborative delivery partnership should also help minimise interfaces, drive innovation and lead to a smarter-built product. Encouraged by solutions-focused and gain-share incentives, this capability has grown over time in Australia with the increasing scale of transport investment and project complexity. Governments and infrastructure advisory bodies continue to review these models to increase consistency and value for money.

Notwithstanding these collaborative benefits, transport infrastructure projects in Oceania are being hindered more often than those in other regions by poor interface management, contract interpretation issues and spurious claims.

Managing interfaces

To manage interfaces successfully, challenges arise that need to be addressed in preparing designs, gaining approval, ensuring works are delivered in line with authority requirements, and cascading a common understanding of contractual requirements and quality outcomes across the supply chain.

Measures that would improve interface management include:

- **Integration & delivery approach:** Adopting a 'system of systems' view of project planning and delivery. This would have various benefits allowing:
 - The design of a whole-of-project integration strategy, together with associated delivery processes
 - The establishment of integrated teams embedded into a clear delivery organisation
 - The identification of interfaces where differences in contract interpretation might arise, such that these could be addressed
 - The use of programme management with clear milestones and development of artefacts, based on delivery fulfilled in an integrated manner
- **Tools, systems & processes approach:** Enhanced project and programme management operations – as part of the whole-of-project capability building and innovation agenda – would be facilitated by:

- The development of project controls, tools and systems
- The use of functional and delivery planning
- The adoption of data analytics capability
- **BIM and digital engineering strategy:** Making project and asset information modelling 'business as usual' across the project lifecycle. This could be enacted by:
 - Project information modelling
 - Interoperability of non-graphical asset information and its relationship and accessibility to the graphical information (3D design, 4D time and 5D cost)
 - Disruption and scenario modelling

Implementation of these measures requires up-front investment in strategic and organisational capability and a collaborative culture amongst partners. The industry is moving in this direction with, for example, the appointment of an integration and delivery partner on Sydney Metro Western Sydney Airport, and Victoria state's Digital Assets Policy and Digital Asset Strategy, which mandate BIM on public works greater than A\$10 million in value.

The 'race to the bottom' across the industry and Government procurement processes ... result in minuscule margins.

Spurious claims

The 'race to the bottom' is widespread across the industry, both in terms of owners' expectations and market competition. Government agencies conduct lengthy procurement processes and afterwards drive prices down further with a 'best and final offer' (BAFO) system. This has resulted in minuscule margins for contractors and professional service providers and fostered a culture of using variations and claims to increase project profitability. The industry has been calling for better margins. Abandoning BAFO would relieve a stress point in the tendering process.

A related challenge is the preference for bespoke contracts and their owner-bias when allocating risk. The reform agenda of governments and advisory bodies (on procurement, market capacity and productivity) needs to be broadened to include common and best practice commercial arrangements, standard contract forms, and delivery approaches to infrastructure to reduce risk and improve value for money.

Panel arrangements with agreed margins are gaining traction as a procurement model. They have minimised commercial debate and associated project risks, and boosted capability across the panel suppliers, as the market engages and contributes better solutions.

Expert commentary

Collaboration on track

The Australian infrastructure market's risk appetite has changed. It hasn't happened overnight, but it's now certainly front and centre, especially since the impact of COVID-19 and the global changes we are experiencing as we emerge from the initial changes driven by the pandemic. The correct and equitable apportionment of risk is at the forefront of all proponents' strategic engagement planning on any major piece of work currently being developed, and will most definitely drive future engagement, as Australia moves into the unprecedented volume of construction activity and megaproject delivery requirements over the next few years.

The Australian Rail Track Corporation (ARTC) has recognised this and, utilising our position of influence in developing the Inland Rail mega-infrastructure project, has established a collaborative market engagement approach, not quite Alliance, but very much aligned with the lessons interchange component of this paper.

We, at ARTC, are delivering Inland Rail 'in collaborative partnership' with our contractors and associated governmental agencies, and other parties. It is my firm opinion that the approach of divulging information and working collaboratively with our delivery partners, and permitting early resolution of the issues inherent in such a complex and large programme, is the best way to:

- drive innovation, in scope, methodology and best-for-project issue resolution.
- optimise resourcing requirements (especially in a post-COVID-19 world resources will be scarce and fiercely competed for, locally and internationally).
- optimise collaborative, solution-based risk apportionment and similarly identify concerns and potential claims early to avoid these 'coming to a head' and implement 'early call' collaborative solutions.
- apportion risks and tasks to the parties best suited to manage these, mitigating adversarial, and costly, claims, disputes and loss recovery.

- **David Watt, Head of Commercial
Inland Rail**

Operating in uncertain times

“ If history repeats itself, and the unexpected always happens, how incapable must Man be of learning from experience. ”

– George Bernard Shaw

Since March 2020, COVID has wrought havoc on lives, ways of working, and economies around the world. Some projects have been cancelled, whilst many others have been impacted by funding changes or prolonged by disruption. The global construction market is expected to continue to grow strongly and approach \$11.5 trillion in value in 2021, and increased tensions across the industry from COVID impacts are likely to result in greater disruption and increased claims and disputes.

Amid the uncertainties impacting the sector, it was encouraging to see clients adapt their ways of working and adopt technology to navigate this uncertain period. Employers and contractors have been forced to take stock of the disruptive short-term impacts. Now they must consider the longer-term implications affecting all aspects of future project delivery.

However, the shocks from COVID only add urgency to questions about poor productivity already crying out for answers:

- Why are construction projects regularly delivered late and at too high a cost?
- Why can't the associated risks be identified earlier enough and mitigated effectively?
- Why is the construction sector less productive than many other industries, including manufacturing?

Our hope is that these questions and the CRUX 2021 Insight analysis will stimulate wider industry engagement and discussion beyond COVID's impacts, and that sharing this learning can point the way to higher resilience and productivity in the delivery of capital projects.

Observations and trends in 2020 / 21

Of the many forces buffeting the construction and engineering industry in 2020 / 21, some are being felt across the majority of regions and with potentially profound effects:

- **COVID-19** – direct impacts disrupting the movement of people and goods.
- **Shortages of skills** – a dearth of available skills, causing projects to stall.
- **Shortages of raw materials** – giving rise to price escalation and project delays.
- **Technology adoption and digitalisation** – varying levels of adoption and standardisation.
- **Political drivers** – pressures to fast-track infrastructure projects and changing capital investment priorities.
- **Sustainability and climate concern** – ever-increasing regulatory requirements and extreme weather events.

COVID-19

COVID has unilaterally stalled the movement of people and goods within and between regions, slowed production of materials and products, altered conditions for workers, imposed new constraints, and negatively impacted the industry's productivity. Employers and contractors are experiencing increased project delays and disruption, cost overruns, and divergence from business case estimates.

Impact: *As in-flight projects take longer to be delivered, claims and outturn costs mount. The projects analysed for the CRUX 2021 Insight included 46 in 19 countries where COVID-19 was cited as a direct cause of claim or triggering contract clauses on force majeure or change in law. More than one in six projects begun after the onset of the pandemic were affected (16%). With a combined CAPEX value exceeding \$151 billion, most of these are multi-year projects. Yet the costs claimed already averaged 26.7%, while claimed extensions of time reached to 47.6% of the average schedule. We are expecting that many more COVID-related claims and disputes will follow in 2022 / 2023 as the effects are fully understood and quantified.*

Skills shortages

Over the last decade, many international organisations delivering capital projects have come to rely on highly mobile personnel and labour. This trend was enabled by cheaper travel, legislative environments allowing freedom of movement, and expansion of recruitment and supply channels across and between continents. The pandemic, along with international variations in vaccination levels and requirements, has raised barriers. High demand is also exposing scarcity in human resources, particularly in developed economies where the construction and engineering industry is unable to attract sufficient new blood to replenish its ageing workforce.

Impact: *Abnormal hikes in market pay rates as demand and competition surges for skilled labour. Our CRUX 2021 analysis reveals that more than one in three projects have been hampered by*

deficits in human resources over the four years that data was captured. In all, 499 of the 1,401 projects – with a combined CAPEX of \$556 billion – have faced claims associated with skills shortages and related factors, such as inexperience and poor workmanship. This is a challenge for the industry that continues to impact its ability to perform optimally. For these projects, the consequences of workforce gaps inflated the sums in dispute to around \$95 million per project, an average increase of 47.8% on their planned outturn costs.

Shortages of raw materials

To drive efficiency and eliminate waste, many organisations have adopted lean production principles, such as Total Quality Management, and just-in-time logistics, whose successful operation is dependent on the use of complex, international supply chains. Operating in this way not only requires investment in supporting systems, but also intensive planning and scheduling, and detailed awareness of strategic risk. Before the pandemic, the prospect of such a shock to the global economy and capital project ecosystem was not on the risk management radar or catered for in standard forms or bespoke construction contracts.

Impact: *Material and transportation prices have increased, and projects cannot be guaranteed timely access to essential materials. The effects on project completion dates have yet to emerge in the CRUX Insight data pool. Up to our data capture cut-off in August 2021, just over one in 10 projects (11.3%) had been hit by late delivery of materials and / or equipment. That impact rate was little different for projects that commenced amid the pandemic. Given that CRUX Insight 2021 shows that parties claimed to prolong these 159 projects across 32 countries by more than 61%, on average – at least in part due to late arrival of resources – the drag on current projects imposed by global supply chain disruption can only grow in significance.*

Technology and digitalisation

There is a pressing need for greater innovation and technological application in the industry including smarter and wider use of BIM.

One positive impact of the COVID crisis has been the accelerated adoption of digital communications and technologies. This has not only enabled remote working but has afforded projects access to a wider talent pool, with a potentially global reach for certain skills. Digital models, drones, robotics, virtual / augmented reality, and other advanced systems have also found new advocates and applications in a traditionally conservative industry.

However, most of the benefits from technology have been seen in management, planning and design, modelling and professional services. Other parts of the construction process have slowed the pace of project delivery due to bottlenecks in logistics, stock, sequencing, and on-site labour. Also, the use of BIM is often not sufficiently comprehensive, understood or supported to realise its full potential. The lagging productivity of the construction and engineering industry is largely due to sluggish adoption of technology and resistance to change.

Impact: *More project planning, design, administration and even monitoring can be performed remotely with the support of systems and digitisation. But there remains a pressing need for greater innovation and technological application in the construction and engineering industry, including smarter, wider, and more collaborative use of BIM. The consequences of this digital deficit and drag bear most heavily on designs, though human error and other factors also play a part. The CRUX Insight analysis reveals that incorrect and incomplete designs gave rise to claims on 537 projects – more than 38% of the total.*

Political factors

Many Governments see investment in infrastructure as a viable method of stimulating their economies. As well as the short-term benefits in trading activity and jobs, there are longer-term gains in terms of connectivity, business productivity, community services, revenue streams, and asset portfolios with enhanced environmental performance. However, a bow wave of large-scale projects being let to the market requires careful management, execution, and integration with other developments if value for money is to be achieved. This combination of well-planned activity and a properly structured pipeline – that can be relied on by the supply chain – is essential to ensure that demand can be met without overstretching the industry or overheating the market.

Impact: *Governments have approved projects and sought to accelerate planning and delivery during the pandemic. Strategic portfolio planning and genuine engagement with the supply chain are essential so that industry can gear up to provide the necessary capacity and capability. Capital project timetables slip when there is a lack of clarity on when resources will be committed, whether due to socio-political or regulatory factors. More than 50 projects across 27 countries in the latest CRUX Insight analysis faced delays for these and other reasons – accounting for claimed extensions of time exceeding 79.3% of their average planned duration.*

Sustainability and climate concern

From Germany and Belgium to Australia, and from North America to India, flash floods, forest fires and other extreme weather events have borne out the increasingly stark warnings of the international scientific community. The increase in gas and oil prices is forcing companies and organisations of all sorts to recalibrate their energy budgets and usage. Pressure is increasing for government and regulatory intervention to promote sustainability in all sectors, not least construction and the built environment.

Impact: *Rising energy prices increase the costs of producing and transporting construction materials and inflate input as well as operating costs. In addition, more projects will be disrupted by severe weather events. Generally, owners, contractors and contract terms do not allow for these increasing risks. One in four projects – more than 350 – in the CRUX 2021 dataset, encountered claims related to exceptionally adverse weather as well as unforeseen physical conditions.*

A change of approach

Major projects are complex and the potential for claims and disputes to arise is significant. There is a need for the multitude of risks and uncertainties to be recognised, evaluated, and managed at each stage of the project life cycle from inception through construction, to completion, handover, and operation.

Delivery of these projects on time, within budget and to the required quality, hinges on the right mix of capabilities being deployed at the right time. Success is more likely when owners and contractors work together to create a working environment where skills, subcontractors, and technology are harnessed for the benefit of the project and everyone involved. One of the many tools available to all parties, as part of good project management, is the use of diligent and proactive contract management, so when issues arise they can be managed efficiently to avoid the potential for them escalating into disputes.

If that sounds idealistic or unattainable, the disruptive effects of the very real challenges summarised above – and the CRUX Insight 2021 findings – should give everyone pause to seriously consider alternative approaches.

Collaborate to enhance productivity

Major projects are unique, and no single formula can provide perfect certainty that intended outcomes will be achieved. Therefore, owners must take a strategic, risk-based approach when planning projects to minimise and manage the uncertainties. From the outset and through the design, procurement and

construction phases, decision-making must be based on reliable and accurate data to guide progress towards the desired outcomes.

The World Economic Forum estimates that a rise in the global construction industry's productivity of just 1% could result in savings of \$99 billion a year.

We see an outcome-based, collaborative approach as the key to unlocking productivity on projects (and avoiding much of the even more significant lost costs and time laid bare by CRUX). This would see a shift in the collective focus towards early detection and correction of divergences. Risks – from labour shortages and supply delays to evolving sustainability regulations and unforeseen conditions – would be rationally allocated to the appropriate party. Such fundamental change is possible. We are encouraged by moves towards flexible pricing mechanisms with a greater emphasis on collaboration, programming, and monitoring – similar to those under the NEC contractual framework, for example.

Manage and improve liquidity

The construction industry generally experiences a proportionally greater number of insolvencies due to suboptimal cashflow – collection cycles are longer than in other industries – and supply chain risks. We foresee these risks and bankruptcy rates rising. If employers and contractors collaborate to find mutually acceptable, commercial ways of working, this should help expedite progress payments and smooth the path to successful project delivery.

Where possible within the boundaries of contractual terms, there would be benefit in finding ways of ensuring payments can be made on time by employers to contractors, so as not to impede cashflow. Where the parties are willing to discuss changes to contracts for new projects, options could include: immediate, advanced, and / or more frequent payments; removal of retention monies; relaxation of unduly punitive contractual terms; and payment of reasonably incurred additional costs arising directly from COVID-19.

Construction firms could gain full visibility over their commitments through effective cashflow monitoring and forecasting. Staff, including frontline managers, could be trained to engage proactively with employers so that positive relationships can be maintained while enabling prompt payment. This should help enhance their financial standing under the given contractual terms without compromising their client relationships. By building a healthier cash position, contractors would gain a potentially vital buffer against unforeseen disruptions and fluctuating supply chain costs. Not only will operations be more resilient, freed up working capital can be invested in the business, technology, and talent.

Manage suppliers proactively

Commercial distress is likely to be an increasing problem across supply chains. Companies need to be alert to the danger signs and monitor their subcontractors and suppliers to protect themselves from business failures. It seems that owners and contractors alike are seeking appropriate guarantees, warranties, and bonds from their supply chain partners. We also see a greater level of financial due diligence and scrutiny being imposed throughout the market to validate the financial wellbeing of suppliers.

Other prudent measures to manage project budgets and contingencies include:

- An approved 'live' baseline budget agreed upon by all parties.
- Central control measures and reporting of KPIs aligned to the delivery model.
- A robust subcontractor management regime setting out clear expectations and procedures for escalating and resolving issues.
- Clear records shared between all relevant parties to ensure a mutual understanding of progress against schedule, cost, and quality.
- Contingency plans to ensure continuity of delivery in the event of any breakdown in the supply chain.

Harness the power of data

We observe that both owners and operators are impacted by the effects of data – its quality, availability and use – on project performance, both good and poor. In light of this, it would be beneficial for both owners and employers across the industry to accelerate the capture of data in common formats, so it can be more easily analysed and acted upon. Such analysis could identify opportunities for improving operational efficiencies and reducing waste. Other benefits could include insights into enhancing asset performance and decisions about asset replacement, as parties would have an informed understanding of the total operating cost of assets.

It is up to sector leaders to find ways to capture, store, and synthesise the wealth of data generated daily on projects. The aim should be to use the data to refine working practices, and, in turn, the quality of the data captured and analysed, so that data gathering, analysis and project operations are linked in a virtuous cycle of continuous improvement. This will not happen at the press of a button. For the full power of data to be harnessed – and for improvements to be achieved – the data must first be understood. This will then determine which data should be collated, analysed and then acted upon so that meaningful changes can be made to delivery performance. In addition, there is potential to capture data whose apparent value might not yet be clear, for such data may prove crucial to failure analysis and the adoption of future technological applications.

It is recognised that meaningful investment in digital is a seismic mind-shift for the industry, especially when a quick return on investment is not expected. However, digital disruption is happening now, and early adopters can be expected to gain a competitive advantage. There is already evidence that those who harness the power of data analytics and technology sustain downturns far better than their peers and outperform the industry average in the long term.

Invest in talent

Return on investment in technology is likely to be considerably enhanced where it is used

by people who are both tech-savvy and understand the dynamics of the construction and engineering industry. This combination of skill and experience will enable these professionals to take actions informed by the data and newly adopted technology. However, the industry struggles to attract them – along with skilled professionals and tradespeople in many roles. In mature markets especially, fewer people are entering the workforce to replace the construction professionals reaching retirement age.

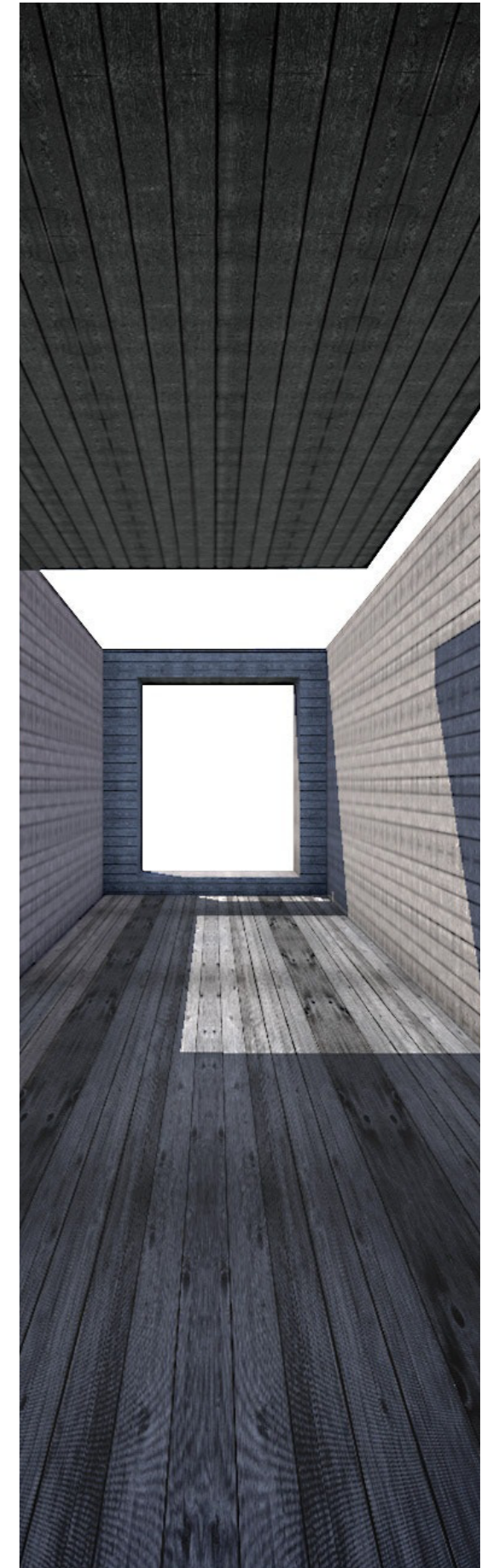
The industry's talent crisis is a systemic and cultural challenge with no quick fix, as migration of professionals between countries may be neither feasible nor sustainable. A multi-faceted response is required. Enlightened initiatives underway need to be scaled up – ranging from outreach to school pupils and young women considering career options, to more apprenticeships that will lure school leavers and workers experienced in other sectors with qualifications from technical to graduate-level across all functions. Other modernising measures described in this report will contribute to the cultural change and image overhaul from which the construction and engineering industry would, arguably, benefit.

Fairer terms and risk-sharing will allow contractors with less fragile finances to invest more in people.

In addition, fairer terms and risk-sharing will allow contractors with less fragile finances to invest more in people. Greater use of data and technology will reshape job roles in a range of disciplines that should enhance the appeal of the industry to a new generation of workers in markets suffering skills shortages. An industry that is seen to be part of the sustainable solution to the problems posed by the climate emergency will offer young people careers with purpose.

Billions of dollars are already being lost each year unnecessarily to recurrent, predictable, and avoidable causes, as CRUX Insight 2021 shows. And the stakes are rising, amid the uncertainties unleashed by the coronavirus crisis and the other market forces we have outlined.

Like the CRUX analysis itself, these global changes in approach that we propose – and the practical measures suggested by our consultants to address challenges in their regions – can help guide all parts of a capital projects environment that is operating in uncertain times.



Lessons learnt – and applied

This report's observations and recommendations are rooted in hands-on experience investigating and resolving claims and disputes and advising on how capital projects can be set up to succeed. These projects show how the principles discussed have been applied in practice to achieve the most successful outcomes possible.

Sydney Water, Infrastructure development scheme, Australia



Sydney Water engaged HKA to support the design and delivery of their innovative partnering commercial delivery model Partnering for Success (P4S).

At the heart of this award-winning model was the need to create certainty of outcomes for customers and promote collaboration across the supply chain. We helped the client adopt learning from the UK Institution of Civil Engineers' Project 13 and foster client-contractor collaboration through an NEC4 form of contract.

Challenges centred on gaining support for a new form of contract and changing the way that goods and services have traditionally been procured.

To address these challenges, we designed, developed, and implemented the new P4S commercial delivery model and led the programme, including the procurement of partners and business transformation to adopt more collaborative working arrangements.

The new P4S delivery model and regional partners were successfully onboarded in July 2020.

Southern Power Generation, Natural gas-fired power project, Malaysia



Developed by Southern Power Generation (SPG), this 1.44GW plant is equipped with advanced power technologies, including the world's first GE 9HA.02 gas turbines, specified for their high efficiency and low carbon emissions.

SPG retained HKA early in the life cycle of this complex project to provide advisory expertise on the management of the Engineering Procurement and Construction contract, awarded to a Taiwanese and French consortium.

HKA's brief was to facilitate the avoidance of claims and disputes through risk monitoring and perform real-time progress reviews to mitigate delays and costs. In the early stages of the project, HKA's in-house engineering experts were also consulted to investigate technical elements of the works that gave rise to contractual issues.

The focus of our work changed in March 2020 when the first delays to the programme were reported following the COVID-19 outbreak and

the introduction of movement control orders by the Malaysian government. We then began investigating a series of *force majeure* claims for costs as well as extensions of time. Our analysis demonstrated how claims presented for delays and loss and expense were not entirely substantiated as a direct consequence of the *force majeure* event.

HKA's contract management expertise was instrumental in identifying problems early and devising mitigation measures. Our experts vetted claims as they emerged, challenging or substantiating extensions of time, cost claims, variations, and other losses.

The US\$1.1 billion power plant successfully commenced commercial operations in January 2021

Norwegian contractor, Double-track railway line development, Scandinavia



Our client was engaged to construct a highly complex and challenging rail project comprising 22km of double-track railway line between Oslo Central Station and the public transport hub at Ski. The project includes a 19km railway tunnel (twin-bore), extensive works at Oslo Central Station, construction of a new station at Ski, and realignment of the existing Østfold Line.

Work was progressing, but in March 2020, the national government took drastic measures to curb the spread of COVID-19. This caused delay and disruption to the progress of the works, which had a major impact on the performance of the contractors and respective supply chains. This led to the need for an independent review of how each party could address the implications of these circumstances.

The employer and main contractor jointly employed HKA to provide an independent opinion on delay, disruption and quantum issues relating to the impact of COVID-19 on the project's schedule. Our team collated and reviewed all relevant contemporaneous data on project delays, disruption, and additional costs. We then facilitated joint working sessions in a virtual environment. These were structured as collaborative discussions with a view to both parties agreeing on how these challenges could be addressed.

HKA helped the parties establish a means of minimising project risks as far as possible and successfully brokered a negotiated agreement to address the consequences of the COVID-19 outbreak.

Port authority, Bridge construction, North America



A new six-lane bridge was a central element of a multi-billion capital programme to upgrade a nationally important seaport in the US and its access to an interstate highway.

The contractual complexity of the project, which also involved the demolition of an existing bridge, saw HKA appointed to provide on-site forensic schedule evaluation, claims avoidance advice, and project controls support services.

We worked closely with the client to evaluate claims processing, claims and schedule analysis, cost analysis, related geotechnical evaluation, and dispute strategy.

To enhance commercial practice, we evaluated the project's existing dispute resolution procedures, analysed relevant contractual requirements, and

developed recommendations for implementing a more effective dispute resolution process.

The recommendations and ongoing support helped keep this important and highly visible project moving forward while minimising costly disputes and preserving collaborative relationships among the project team.

This collaborative approach enabled the bridge to open to traffic in 2020.

Chinese construction company, Residential development, Kingdom of Saudi Arabia



Our client, a top-tier Chinese construction company, formed a consortium with a local contractor to construct more than 790 high-quality villa homes in eastern Saudi Arabia. Part-way into the five-year project, this contractor went bankrupt.

HKA was initially retained to advise on our client's contractual position as it assumed sole responsibility for the delivery of the scheme. Our support expanded to provide a strategic review of the entire project and advise on the best course for completing the programme.

Working collaboratively with the client, we:

- Calculated the scheme cost to completion, drawing on assessments of damage to part-built properties and requirements for materials and labour.
- Reappraised the project schedule, devised a robust 10-month delivery plan, and communicated this to all stakeholders.
- Reviewed subcontractors' performance and identified that more than 90% of the 20 subcontractors would need to be replaced due to

non-performance. Alternative suppliers were selected under tight timescales to complete a single package of 20-25 villas each. From 80-90 personnel on site, manpower rose to some 2,200 over the first four months of the revamped programme.

- Managed contracts, claims and disputes. As the client's 'approved project controls manager', we drew up handover plans for each villa and oversaw subcontractor performance against the programme. With sound project controls in place, we managed subsequent subcontractors claims. As mutual trust had been established, these were negotiated amicably, in some cases by releasing additional works in return for discounted prices.

The project is on course for completion, confirming the realism of the revised schedule and the value of the contract management and project controls we instituted.

How to use CRUX

Our CRUX integrated research programme captures empirical evidence on the proven causes of claims and disputes. The purpose of this CRUX Insight report is to share this knowledge – combined with our consultants’ insights – to help clients and other industry stakeholders improve their project outcomes.

Previous CRUX Insight reports have been referenced in panel discussions, webinars, speaking engagements, interviews, and articles published around the world.

Industry and professional bodies are encouraged to disseminate CRUX’s lessons widely. Governments can apply them in legislation, policy, and practice – as proposed in the UK, where a parliamentary inquiry into management of major state projects cited the findings of CRUX Insight 2018.¹

Employers, contractors, insurance providers, designers, suppliers, financiers, lawyers, and other stakeholders can gain also from further analysis of CRUX. This report’s high-level findings are underpinned by what we believe is the most comprehensive, fact-based analysis of claims and disputes on engineering and construction projects worldwide.

New insights emerge from tailored analysis, helping clients shape strategy and set priorities for planning, procurement, and project controls and governance.

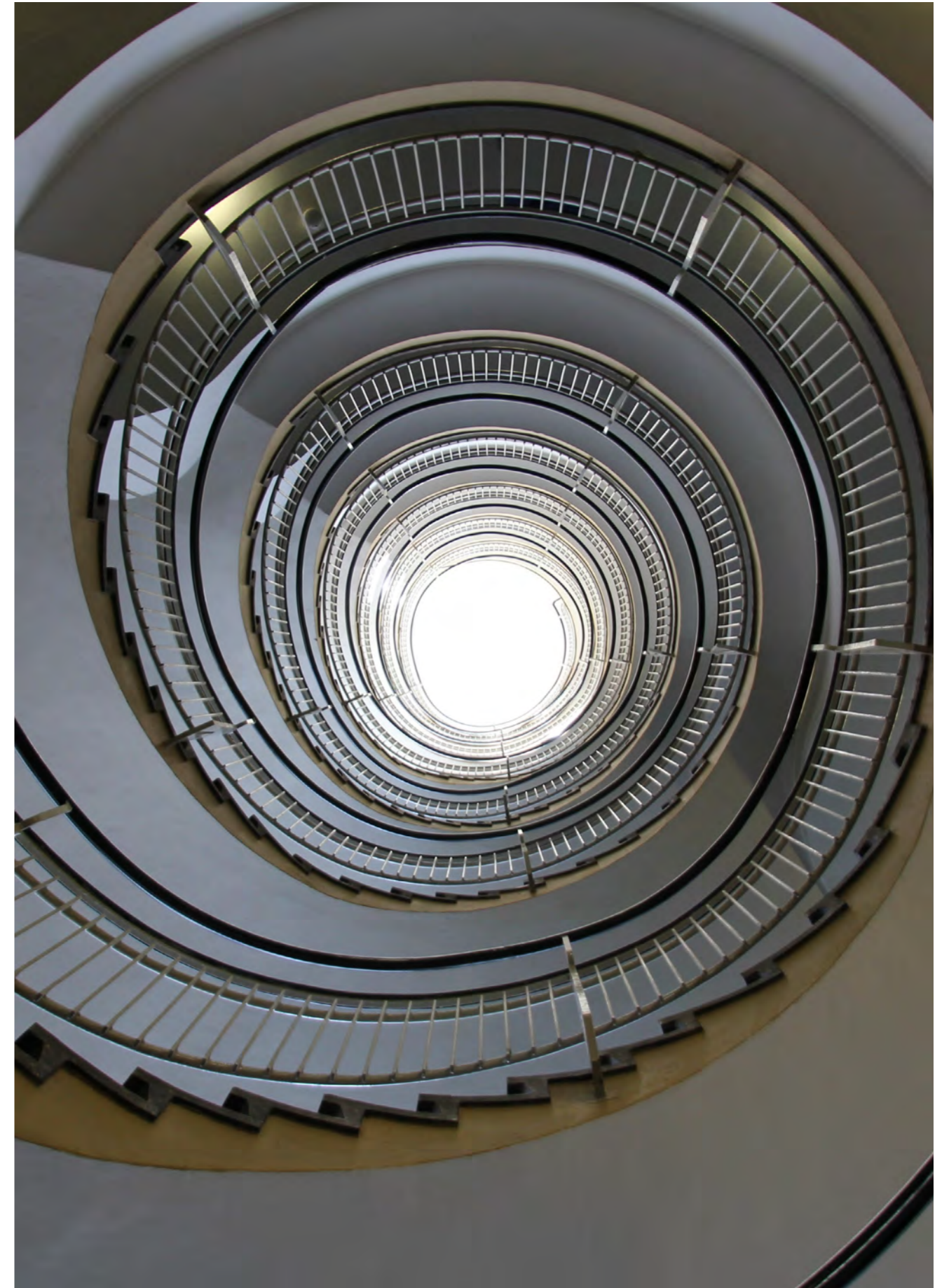
CRUX can answer a multitude of questions posed by clients – such as how project outcomes vary by contract type; the proportion of disputes settled in particular jurisdictions; typical dispute values on different types of renewable or fossil energy projects; or the length of time extensions sought on infrastructure projects by region.

This intelligence can help clients to:

- Benchmark current performance.
- Analyse and mitigate project risks more accurately.
- Gauge risk in new target markets.
- Re-calibrate risk at corporate level, by region or sector.
- Improve commercial decision-making.
- Compare procurement options.
- Evaluate dispute resolution methods.

The [CRUX Interactive Dashboard](#) and data analysts enable this ongoing application of our research.

¹ House of Commons Public Administration and Constitutional Affairs Committee review of government management of major projects



CRUX methodology

Overview

The 2021 CRUX Insight report presents the high-level findings from our analysis of claims and disputes on over 1,400 projects in 94 countries worldwide from January 2017 to August 2021.

How has this report dealt with projects before and during COVID-19?

Due to COVID-19 and the potential impacts it might have on a macro and micro-economic level, HKA decided to separate COVID and non-COVID projects. Therefore the 2020 report only captured the data on projects up until February 2020. This year's data capture was on all projects which were in construction or started on or after February 2020 up until August 2021. Therefore, in 2021 only projects concurrent with COVID-19 have been captured in this report and analysed against the dataset from 2018, 2019 and 2020 not affected by COVID.

What are the main causes of claims and disputes?

As stated in the 2018 and 2019 CRUX reports, we are committed to continual refinement of our defined causation factors for claims and disputes to reduce subjectivity and improve reliability. In 2019, the CRUX team compared the causation taxonomy against 57 peer-reviewed academic publications, industry reports and other available sources worldwide. This yielded a list of 1,750 causes of construction and engineering claims and disputes.

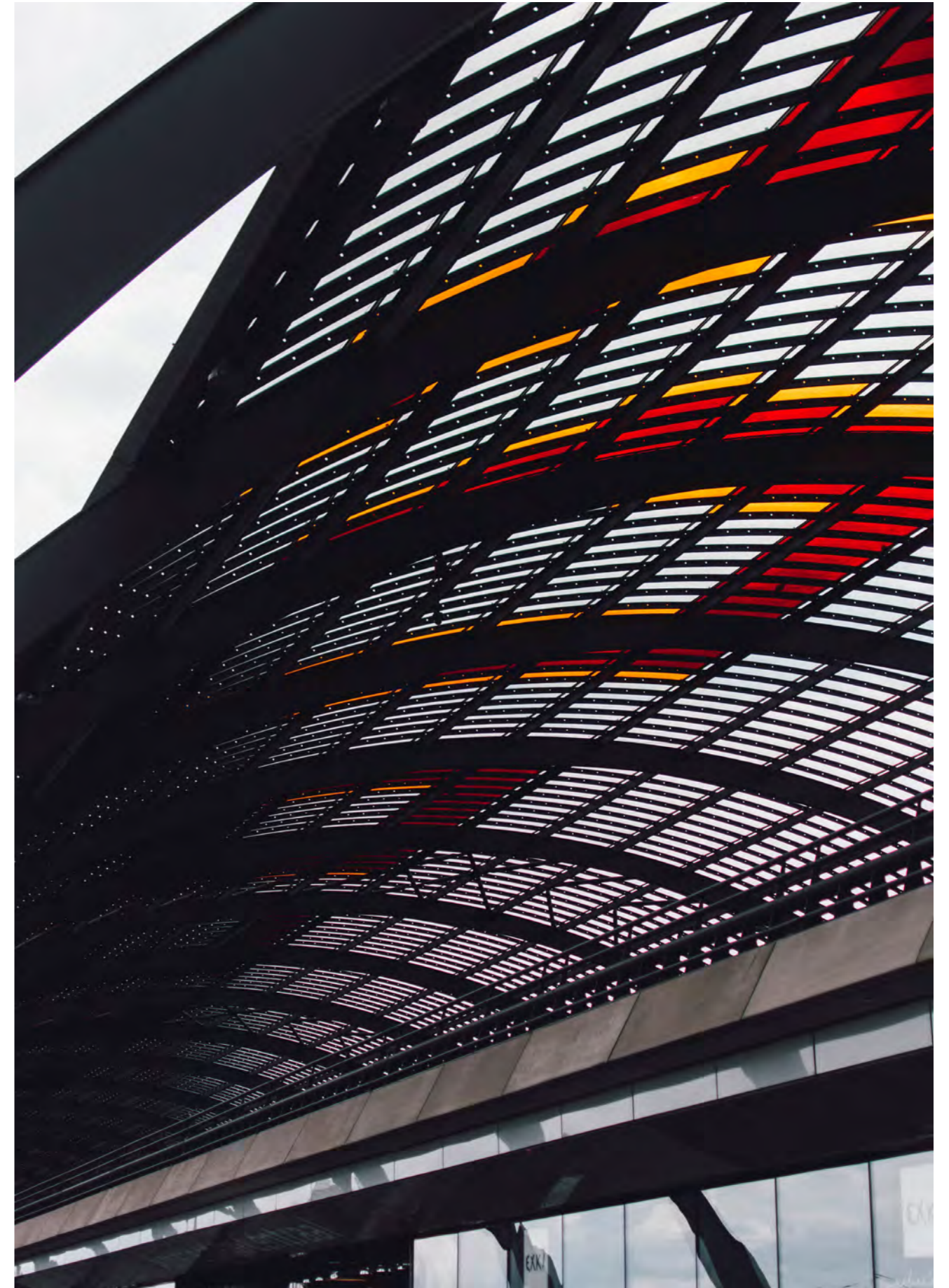
Through detailed analysis and mapping for trends and variations in terminology, we were able to rationalise these causes into 50 coherent, individual causes of claim or dispute. The list was then reviewed by a HKA Expert Review Panel to test these often-theoretical factors against practical experience of live projects. This exercise produced a refined list, which the panel ranked according to frequency rather than gravity to give the top 30 most common causes of claim and dispute.

The list was then shared more widely with HKA experts from all disciplines and regions to ensure that the causation factors used in our questionnaire would be comprehensive and representative of the disputes and projects handled across the business. This led to further refinements in 2020, for example, the addition of three causes to cover claims and disputes relating specifically to COVID-19, before final agreement on the list of top causes in the questionnaire for this year's report.

Analysis and assessment of the findings

As the number of projects analysed expanded, we separated out Africa from the Middle East and Oceania from Asia, bringing the number of regions to six. The findings including the top causes of claims and disputes for each region were presented to HKA CRUX interviewees for review. Experts, consultants and advisors were drawn from all disciplines and HKA offices worldwide to provide insights and sector perspectives based on their knowledge and expertise.

If you would like to know more about the methodology of our reports, please contact CRUX@hka.com.



CRUX interactive dashboard

CRUX, HKA's integrated research programme, is building a unique bank of knowledge on the causes of claims and disputes on major capital projects across the globe. This is a potentially valuable resource for decision-makers – from owners and financiers, insurers and legal advisors, to contractors and suppliers – and all parties to construction and engineering contracts.

The CRUX Interactive Dashboard allows you to explore this dataset on more than 1,400 projects with a combined value exceeding \$2 trillion. You can review the top causes of claims and disputes in your region and sub-region, and sector or sub-sector. Or compare the patterns of causation across regions and

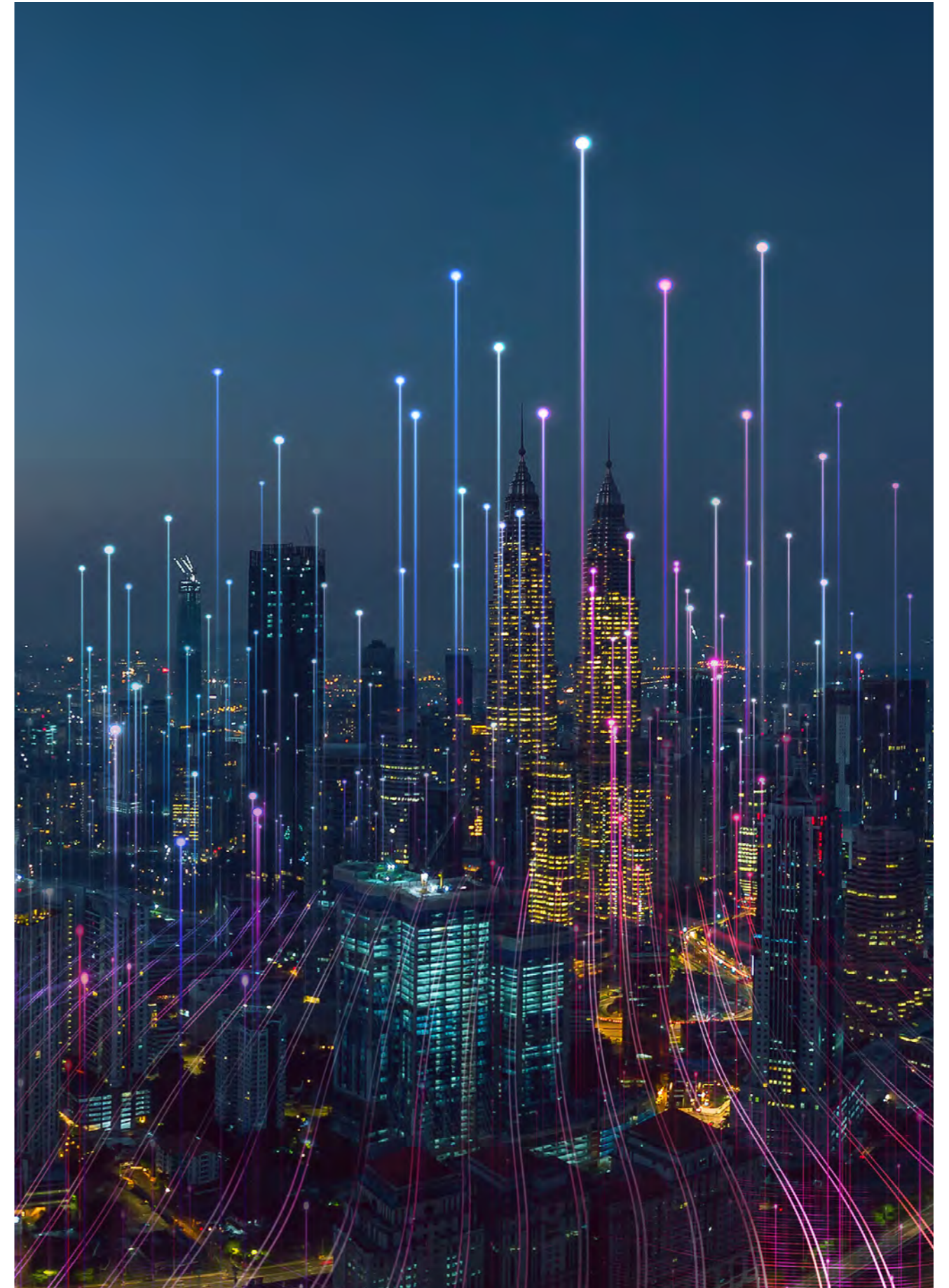
sectors. The 2021 dashboard now also allows you to select a data range for your analysis by specifying start and end dates for construction.

We urge you to engage with the CRUX research programme's findings so that the planning, procurement, project governance and controls for your project will be informed by the lessons that can be drawn from this empirical data and our analysis.

The CRUX team will be delving deeper into the dataset and sharing new insights through various media. Please feel free to contact a member of the CRUX team should you be interested in collaborating with us.



Scan the QR code or visit
www.hka.com/crux-interactive-dashboard



Who we are

HKA is the leading global consultancy in risk mitigation and dispute resolution. We draw on our multi-disciplinary expertise to provide a comprehensive set of expert, claims and advisory services for the capital projects and infrastructure sector.

We also offer forensic accounting and commercial damages services for all types of contracts, including commercial and investment treaty disputes.

Cybersecurity and privacy is an additional and expanding HKA specialism. We protect critical systems and data, help our clients comply with legal and contractual standards, and train their IT teams.

Our other area of specialist expertise is in US Federal Government contracts. HKA consultants support contractors and suppliers operating in this complex business and regulatory environment.

We help clients navigate through the complexity that spirals with scale, multiple interfaces and new technologies.

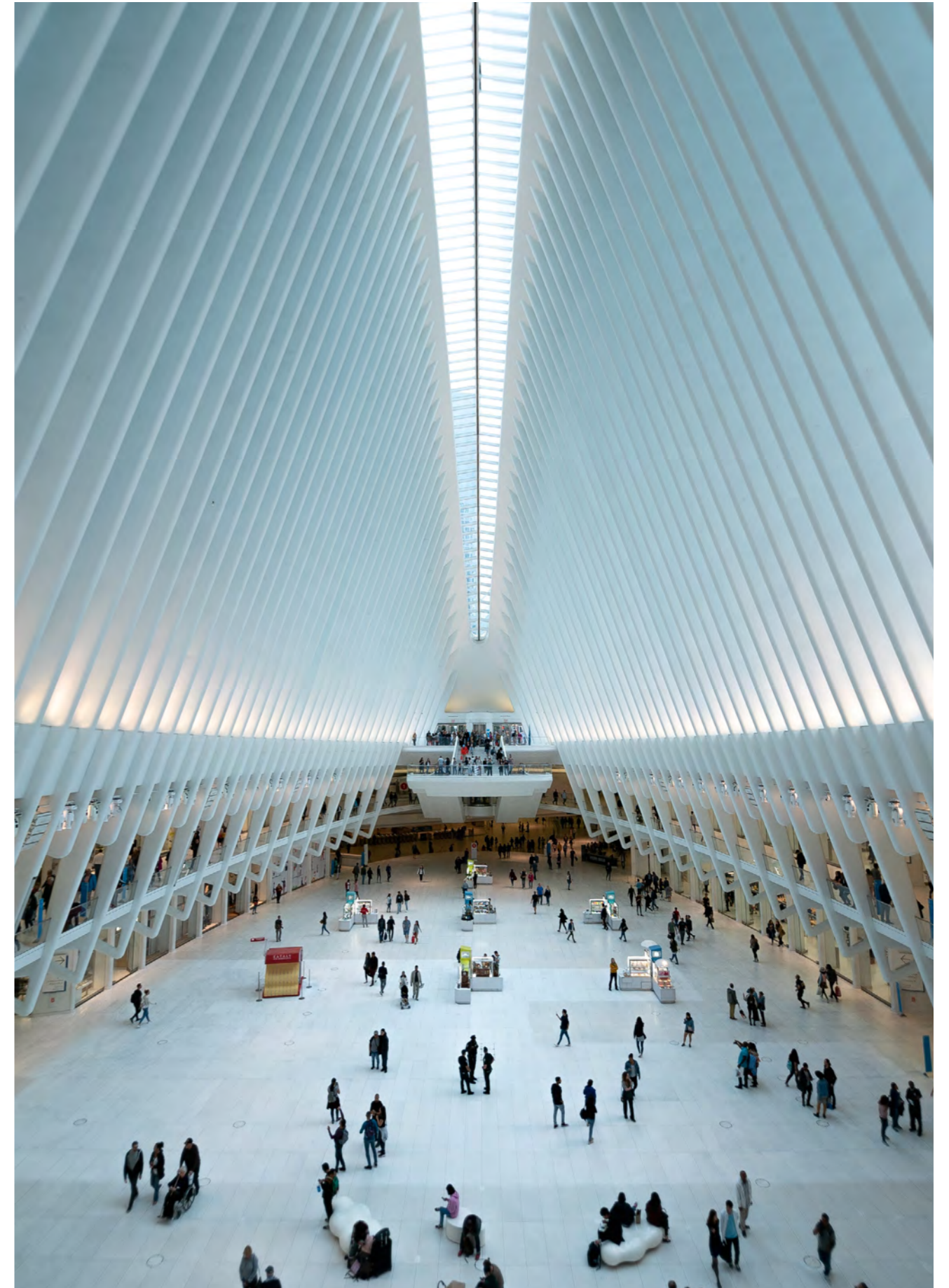
HKA brings a proud record of excellent service and high achievement to bear on today's challenges. As trusted independent consultants, experts and advisers, we help clients manage disputes, risk and uncertainty on complex contracts and challenging projects.

We work with government agencies, local authorities, contractors, legal firms and other professional service providers, as well as owners and operators, financial institutions and insurers. Clients have access to leaders and problem-solvers who decode complexity through collaborative working and innovative thinking, making the best possible outcomes a reality for our clients, every time.

As well as more than 500 expert witnesses, HKA now has in excess of 500 advisors and consultants – across 40+ offices in 15 countries – with the skills and experience that are essential to get to the heart of even the most complex issues. Our people have vast first-hand experience spanning all major industries and the world's most complex megaprojects, as well as an international track record of achieving successful outcomes.

HKA's global portfolio includes some of the world's largest and most prestigious commissions across a wide range of industries including buildings, industrial & manufacturing, oil & gas, power & utilities, transportation infrastructure, technology, financial services, government contracts and non-profit.

Achieving successful and fair outcomes is our passion, so we have the confidence always to provide impartial advice as well as expert insight. We are proud to make the difference that benefits clients and their projects, our industry and society at large.



CRUX interviewees

Below are our CRUX experts, drawn from all HKA disciplines and offices, who were interviewed as part of the research process. They have contributed their expert insights and regional perspectives based on direct experience working on some of the world's largest and most complex engineering and construction projects.



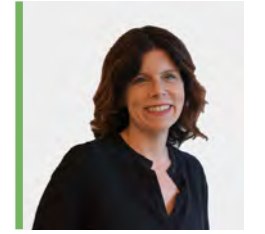
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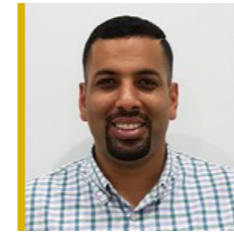
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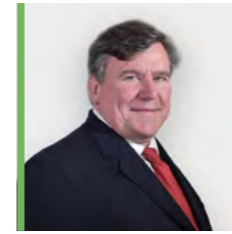
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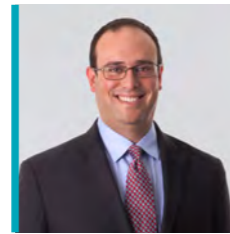
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