CRUX INSIGHT

Sixth annual report

# FOREWARNED IS FOREARMED

## Anticipating challenges, mitigating risk

HKA

A regional and sector analysis of claims and dispute causation

# Contents

# Foreword

**In today's volatile environment, all those involved in infrastructure and capital projects need to keep a wary eye out for tomorrow's threats. Effective risk management must also be informed by yesterday's lessons too. Especially when objective evidence of recurrent lapses in project planning and execution, and their impact, is laid bare.**

This is the purpose of CRUX, our integrated research programme.

As before, our Sixth Annual CRUX Insight Report scans the horizon for the global risks looming now and over the next 12 months and beyond. From the political, economic and social to the technological, legal and environmental – we outline some of the main challenges in our survey, Forewarned is Forearmed (pages 7-16).

The heart of CRUX is our analysis of the underlying causes of claims and disputes. We have distilled the findings of HKA consultants' investigations on major projects worldwide. This dataset now covers 1,801 projects in 106 countries with a cumulative capital expenditure (CAPEX) value of $2.247 trillion.[1]

In a period when the cost of capital has risen significantly, and its supply is more constrained in most markets, the impacts of project distress are all the more chastening. The total value of the sums in dispute exceeded $91.3 billion. Collectively, extensions of time sought by contractors would stretch beyond 876 years.

At the project level, the findings are no less disturbing. Claimed costs averaged out at more than a third of committed project CAPEX (33.6%). Programmes typically faced an overrun approaching 16 months – equivalent to two-thirds of the planned schedule (67.1%).

These are global, headline figures. Differences around the world are explored in the following chapters focusing on HKA's operating regions: Africa, the Americas, Asia, Europe, the Middle East, and Oceania. Our experts on the ground in these regions have reviewed the CRUX rankings of causes of claims and disputes, and how they differ from the rest of the world.

In this year's report we also focus on selected sectors – energy, resources and transportation; see central section (pages 35-42).

Our data analysis has produced other interesting comparisons, including intra-regional and sectoral differences, and emergent patterns post-pandemic. We also propose actions that parties can take to mitigate risk or pre-empt the most persistent sources of projects' distress.

The CRUX analysis is ongoing as we share insights beyond this report with all stakeholders:

- You can delve further using the CRUX Insight Interactive Dashboard.
- Our people disseminate the results through regional webinars and presentations.
- We discuss our findings with professional bodies so they can inform their members.
- By diving deeper into the CRUX data, we can help our clients better calibrate risks and benchmark performance.

There is a wealth of knowledge to explore using a wide range of parameters from market segments to countries, forms of contract to delivery period, as well as our taxonomy of causal factors.

We believe CRUX offers the most robust intelligence available on the world's diverse infrastructure and capital projects, based as it is on impartial and rigorous investigation of claims and disputes by experienced specialists (see Methodology, page 63).

I trust that you will find the Sixth Annual CRUX Insight Report informative and urge you to engage with us and its findings. Our industry can and must improve how it plans and delivers infrastructure and capital projects by managing and mitigating the many risks they face more effectively.

**Renny Borhan**
**Partner, Chief Executive Officer**

*We propose actions that parties can take to mitigate risk or pre-empt the most persistent sources of projects' distress.*

1 All values are expressed in US dollars throughout this report, unless otherwise stated.

# Overview

**Like major infrastructure and capital projects themselves, the web of causes entangling budget and schedule overruns is complex. Our Sixth Annual CRUX Insight Report sheds further light on that complexity.**

The latest CRUX analysis examines the impact of claims and disputes investigated first-hand by HKA consultants over a six-year period to August 2023. We have updated our global and regional rankings of the causes of conflict on the typically multi-year projects that we have been commissioned to investigate. **Also, we have – for the first time – plotted the percentages of these projects affected by specific factors, and in some cases, clusters of inter-related causes.**

Scope change again topped the global ranking but was not pre-eminent in all regions. Our analysis also makes it increasingly evident how design failures drive project distress directly and in conjunction with changing scope. CRUX's three design-centric factors – incorrect, late or incomplete design information – are clustered within the global ranking's top five causes. Further analysis revealed that this design triple whammy afflicted a greater proportion of projects overall (44.8%) than scope change alone (38.8%).

Last year's report argued the case for closer, constant management of scope change and greater investment of time and resources upfront in preconstruction planning to mature designs as far as practicable before starting work on site. In most regions, our local consultants again observed that design immaturity more than negated any apparent gains in the early stages of fast-tracked programmes.

Construction's cruel conundrum is that the level of design maturity is more controllable than many other triggers for claims and disputes. While allowing for site-specific quirks and contingencies where necessary, designs can be largely complete and construction-ready. CRUX also reinforces anecdotal evidence that extra time taken, amid the pandemic, to review and mature designs improved constructability. A comparison of design failure rates before and after the hiatus shows a global drop of 12 percentage points (from 47.6% to 35.5%), widening to 14 points in the Middle East and nearly 18 in Europe, where incorrect design was already the leading cause of claims and disputes.

Other insights and anomalies emerge from our analysis of market sectors and regions.

The global energy transition (see page 35) will require a tripling of annual capital investment by 2030 to get back on the pathway to the 2050 global warming limit of 1.5°C.[2] Renewable energy projects have different risk profiles and are attracting contractors reliant on experience in other fields. While the US climbs the offshore wind learning curve, markets in Europe and Asia have matured. Yet offshore wind farms in our global dataset were still more likely to be thrown off course by change in scope than other renewables projects and those in non-energy sectors. Approaching half of those offshore were disrupted (45.0%), triple the rate for onshore turbines (15.0%) and double the proportion of solar generation projects (21.4%).

Deficient planning and coordination largely explain the uptick we have seen in rail disputes. Change in scope was a primary or secondary cause of conflict in 57.1% of rail and transit projects worldwide; and even 41.3% of road schemes. Design failures were also to the fore, again more so on rail and transit. However, these are often symptoms of other pressures, including political commitments to delivery dates and provisional costings.

CRUX has repeatedly highlighted another fundamental concern – lopsided risk allocation and failure to scope risks, so programmes and pricing are unrealistic. The data suggests that the shift to all-risk engineering, procurement and construction (EPC) contracts may be compounding this risk-responsibility mismatch in the power and resources industries. While EPC contracts returned better outcomes on power projects than other forms of contract, the margin of improvement was lower than might be expected: EPC contracts overran by an average of 41.6% of the schedule, against 58.7% for other forms of contract.

Moreover, in oil and gas, the balance of advantage reversed, resulting in longer delays. Overall, time extensions averaged 73.0% on EPC projects – three percentage points worse than their non-EPC counterparts. Offshore there was little difference, but onshore alternatives to EPC limited their overruns to 60.1% of schedules – a full 11 points less than the EPC wrapper.

In terms of costs claimed, the EPC picture was somewhat more favourable for oil and gas. Sums in dispute on all non-EPC contracts averaged around nine percentage points higher (43.8%). But that gap narrowed – from 14% offshore to less than 2.5% onshore. If EPC contracts were set up properly, the number and value of claims on completion would be very low for both costs and time. Instead, employers must budget for significant overruns and reconsider whether they are achieving best value.

A high level of scope change compounded the challenges in this industry. Claims and disputes on more than half of oil and gas projects (51.1%) were traced to this cause. Revisions to operating specifications are seen as a major reason. The imperative to maximise extraction and efficiency from existing assets will continue as the world transitions away from fossil fuels.

CRUX also reveals some significant regional variations, explored in the following chapters.

## Africa

The impacts of claims and disputes were heavier than in other regions: disputed costs amounted to 63.0% of CAPEX, on average. Extensions of time prolonged schedules by 82.9%, inflated by heavier overruns in North Africa.

**Late or restricted access** to sites or workfaces topped the ranking, affecting 37.0% of projects. Although lower in the power sector (31.3%), which is crucial to the continent's development, this is far higher than for equivalent projects in other regions (17.2%).

A high incidence of **cash flow and payment** issues (30.4% of projects) reflects a lack of statutory adjudication regimes or prompt payment regulations, and rigid state approvals procedures.

## Americas

Sums in dispute tended toward a third of project CAPEX (32.3%), while contractors sought to extend schedules by more than half (58.8%).

**Changes in scope** (28.3%) and under-developed designs were the prime sources of conflict. **Incorrect design** impacted a fifth of projects (20.4%), as did **deficiencies in workmanship** (20.0%). Within North American transportation, such quality issues were more common in highways and roads (20.0%) than railways and transit (15.4%), but buildings (24.4%) were even more susceptible to these claims.

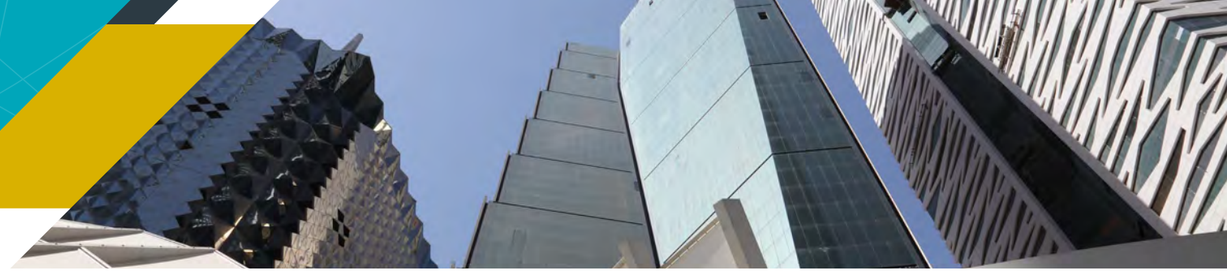
Design shortcomings were more prevalent in Canada, where 41.8% of projects experienced one or more of the three design-centric failures – versus 35.7% in the US. Yet, the impact of claims overall was lower north of the border: sums in dispute averaged 22.0% of CAPEX (34.4% in the US) and claimed prolongation was typically lower too (53.4% versus 60.3% of American projects).

## Asia

With the largest megaprojects, averaging $5.32 billion CAPEX, contractors pushed time extensions towards two-thirds of planned schedules (63.6%, on average), near the top of the global scale. Sums in dispute fell toward the other end of the range, averaging 27.3% of project CAPEX.

2 An updated roadmap to Net Zero Emissions by 2050 – World Energy Outlook 2022 – Analysis - IEA

# Overview



**Central Asia** was the weakest performing sub-region in terms of projects affected by the top ten causes of project distress and schedule overruns. **South Asia** had the lowest average for costs claimed (13.7%).

The after-effects of COVID-19 are still being felt across Asia. This is the only region where disputes arising from client-side **management failures** increased on projects due to complete after the pandemic (43.3%), compared with those scheduled to end before (29.7%). The spike in **contract**-related claims and disputes – from 9.4% to 26.7% – was also sharper than elsewhere. It has become increasingly clear that many contracts were overly rigid and unfit for purpose, not only for pandemic scenarios, but also the price escalation since.

## Europe

Average values for disputed time and money fell toward the middle of the global spectrum. Extensions of time sought by contractors averaged 60.4% of scheduled programmes, while cost of claims amounted to 36.2% of CAPEX.

In Europe, **incorrect design** has the dubious distinction of topping the CRUX causation ranking, disrupting the delivery of one in three projects (32.3%). The region's design market is under a lot of pressure as design consultants are squeezed on budgets and programmes.

**Workmanship deficiencies** were the third-ranked cause of conflicts, and – as in North America – most common on buildings, particularly residential schemes (38.3%). Although workmanship deficiencies were cited more often on UK projects (27.4%) than the rest of Europe (16.1%), other distress factors were less prevalent.

Counter-intuitively, **skill and experience** levels were also associated with a lower level of claims in the UK (12.2% versus 29.9% elsewhere in Europe). However, the CRUX analysis does indicate that, where skills gaps gave rise to disputes – claimed extensions of time were considerably longer on projects scheduled to complete post-Brexit, compared with those on pre-2020 timescales. It is not yet possible to separate the effects within this significant prolongation of workforce pressures from the pandemic and other factors.

## Middle East

Projects faced heavy overruns, averaging 82.0% of planned programmes (only exceeded, slightly, in Africa). Sums in dispute were more moderate, but still amounted to more than a third (35.1%) of average project CAPEX.

Proportionately, more projects are stymied by **scope change** (57.3%) than in any other region. The universal nexus of causation with **design** failures (53.7% of projects) is also evident. In terms of discrete causes, **late design** information ranks second (but eighth in the rest of the world) and triggers claims on almost twice as many projects (34.9%).

**Late approvals** (on 27.1% of projects) and slow resolution of claims have negative ongoing effects on programme and costs. Again, more than one in four projects (26.6%) were embroiled in **cash flow and payment issues.**

Despite this, we discern changes in contracting approaches, including Dispute Adjudication Boards (DAB) and early contractor involvement (ECI), though the pace seems to be lagging as markets overheat and demand expands, giving rise to more traditional methods of dispute resolution. Cost claims on oil and gas projects have ballooned to 46.2% of CAPEX. There are also sharp intra-regional contrasts in project performance, notably with Qatar.

## Oceania

Although the overall impact of disputes remains significant, the region had the lowest averages for claimed time and costs – 48.7% of planned schedules and 25.6% of CAPEX.

**Change in scope** was almost as prevalent a driver of claims and disputes as in the Middle East, affecting more than half of projects (53.5%).

**Restricted or late access** to sites and workfaces was also elevated, ranking second in Oceania, and impacting one in four projects (25.5%). Although **design-related** causes rank lower than elsewhere, each of the three factors – **inaccurate, late and incomplete design** – affected around a fifth of projects.

The CRUX analysis signals a growing maturity in how projects are being delivered. However, shifting government priorities in Australia and New Zealand, market under-capacity, and political imperatives to accelerate delivery amid tougher economic conditions will put a heavy onus on strategic planning and phasing of projects, procurement strategy, and client capabilities.

In this as in other regions, both perennial and emerging risks must be managed to avoid significant overruns on infrastructure and capital projects. Meanwhile, the engineering and construction industry will have to prove its capacity to deliver complex energy projects at scale, while building climate resilience into all infrastructure and buildings.

**Toby Hunt**
Partner, CRUX Sponsor

**Josephine Guckian**
Partner, Chief Marketing and Communications Officer

**Global top causes of claim or dispute**

| | Percentage of projects that had this cause | Rank |
|---|---|---|
| Change in scope | 38.8% | 1 |
| Design was incorrect | 23.0% | 2 |
| Contract interpretation issues | 19.8% | 3 |
| Design information was issued late | 22.5% | 4 |
| Design was incomplete | 21.7% | 5 |
| Contract management and/or administration failure | 19.5% | 6 |
| Poor management of subcontractor/supplier and/or their interfaces | 19.4% | 7 |
| Access to site/workface was restricted and/or late | 17.9% | 8 |
| Physical conditions were unforeseen | 17.8% | 9 |
| Workmanship deficiencies | 17.5% | 10 |
| Cash flow and payment issues | 14.9% | 11 |
| Approvals were late | 15.3% | 12 |
| Level of skill and/or experience | 13.7% | 13 |
| Claims were spurious | 13.6% | 14 |
| Operational performance | 12.8% | 15 |
| Materials and/or products were delivered late | 10.1% | 16 |
| Installation failure | 10.0% | 17 |
| Tender errors and/or inaccurate estimates | 9.7% | 18 |
| Shortage of skilled and non-skilled workers | 9.0% | 19 |
| Weather conditions were exceptionally adverse | 8.9% | 20 |

For further information see our CRUX Methodology.

# Forewarned is Forearmed

**The global shockwaves unleashed by the pandemic gave contractors, financiers, and other players in major capital and infrastructure projects good reason to pause and scan the far horizon intently. But the probability of further black swans should not distract risk managers from already existing and emerging threats.**

**Forewarned is forearmed** – resilience, project outcomes, and competitive advantage all hinge on effective mitigation of more immediate risks over the next 12-24 months.

Here we survey some of these risks, while the rest of the report provides a global view of the causes of claims and disputes, and a region-by-region analysis, supplemented this year by a sectoral perspective on energy, resources and transportation infrastructure.

## Prey to political cycles

Public investment and infrastructure priorities are prey to the short-term political cycles of democracies.

One year in, Australia's Labor government looks set to jettison many approved but unbudgeted projects in the pipeline of the country's booming construction sector. However, investment ahead of the 2032 Brisbane Olympics is assured (unlike Victoria's cancelled 2026 Commonwealth Games) and the tripartite 'AUKUS' nuclear alliance could result in A$100 billion for submarines and naval facilities over the longer term.

Elections loom in many other Asia-Pacific countries, including New Zealand (October 2023), where a change of administration is more likely to spur investment. Taiwan will change its president (January 2024) against the backdrop of intensifying pressure from China. Elections follow in Indonesia (February 2024) and Singapore (by November 2025). Developing countries are funnelling more fiscal resources to infrastructure, housing, and – following Singapore's lead – healthcare. Across the region, power infrastructure will remain a top priority, with public projects less likely to be shelved, though private financing could stall.

Political uncertainty is intensifying in North America ahead of the US presidential race (November 2024) and federal elections in Canada (a year later). Investment in renewables and automotive battery manufacture surged following President Biden's Inflation Reduction Act, but the flow is far slower for infrastructure and projects that would 'Build Back Better'. Upgrading transport infrastructure commands a degree of bipartisan consensus, though a Republican administration could cancel projects not yet allocated cash, while overturning other priorities, including decarbonisation.

In Canada, recent years have seen strong support for transport and healthcare facilities. However, the construction and engineering industry must factor in not only changes in political priorities and the level of federal funding but also how provincial governments choose to allocate these resources.

Elsewhere in the Americas, the destabilising effects of electoral cycles on frail economies may be seen in Ecuador and Argentina (where a populist, anti-establishment frontrunner threatens sweeping changes). Next in line are Mexico (July 2024) and Uruguay (October 2024).

Political imperatives distort other risks – from interest rates and public investment to labour laws and immigration controls. The tensions are most acute in the sphere of energy and the environment.

War in Ukraine and Russian trade sanctions increased the premium on energy security. With demand for oil still growing but expected to peak before the end of the decade,[3] producer nations can make the most of their fossil reserves. Revenues fuel diversification into clean energy as well as other infrastructure. Major oil and gas companies switch back investment from renewables to existing fields and some new ones.

3 Growth in global oil demand is set to slow significantly by 2028 - News - IEA

# Forewarned is Forearmed

For importing countries, higher oil and gas prices should reinforce the business case for accelerating investment in cheaper renewables, though their development has also been hit by cost inflation. National policy changes can scupper oil and gas (or other) projects at any stage of their development, raising complex legal questions for financiers, developers, states and contractors, sometimes transcending jurisdictions.

High-emitting activities are susceptible to challenge on ecological grounds at various points in their lifecycle, from initial financing to final approval. Yet, at the same time, heavily polluting plants powered by coal, gas and oil that were slated for closure may be reprieved as governments backpedal on the clean energy transition.

This raises many difficult questions for the capital projects market. What degree of political consensus is there for the sustained investment needed to decarbonise entire economies? Where projects are aborted, who carries the cost of capital up to that point? And can governments assemble a visible and secure project pipeline that will give private financiers, contractors and the supply chain the confidence to build capacity?

## Economic conditions tighten

From Latin America to Europe, as central banks tighten monetary policy, economic growth stalls and investors lose confidence. The sharp downturn is global – with 1.7% growth predicted this year, 2.4% in 2024 – and will be harder and longer in developing economies.[4]

Rapid inflation is proving particularly stubborn in the UK, where government borrowing now exceeds GDP. Economic weakness puts both existing programmes and future investment at risk. Following the controversial cancellation of northern extensions to the HS2 high-speed rail line, £36 billion in savings have been promised for more modest rail and road schemes to boost the under-served regions of the Midlands and North of England. Concerns remain

over the funding of this and potentially more significant investment by a new UK government (after elections due by early 2025). Economic recovery will also continue to be hampered by Brexit's burden on UK trade and the decline in tax receipts from the City of London, as financial trading shifts to New York, Frankfurt and Paris.

Keynesian stimulation – harnessing capital projects to drive economic growth, from the US to some Asian states – becomes more difficult with rising interest rates, domestic borrowing and construction inflation. The cost of working capital costs has, inevitably, risen. While the prices of some materials have flattened or fallen back, concrete, insulation and other materials have continued to squeeze margins and blow out budgets over the last 12 months.

At the macro level, deflationary medicine may not work. Global forces and high oil prices are driving up the cost of living. Public sector wage increases merely correct years of real-term decline. Private sector employers compete to fill skills gaps, again bumping up rates of pay in tight labour markets. Falling property prices, output and employment may portend stagflation.

At the project level, contracts' price escalation formulae are mostly too simplistic or partial to compensate for fluctuations over the life of long programmes, and require in-built flexibility to allow for changes in future circumstances. Risk-sharing requires that owners and contractors negotiate additional agreements to safeguard project delivery and enhance resilience in the supply chain; such agreements can, however, prove difficult to reach once original contracts are signed.

However, employers who push back against the demands of contractors and suppliers to hold down costs may jeopardise their project's delivery date. Undue pressure on the supply chain, or delayed payments, can have a punitive flow-down effect, breaking cash-starved companies. Some consolidation in the supply chain, especially among smaller players, is inevitable. 'Fire sales' of cash-hungry divisions will be necessary to insulate parent companies.

Insolvencies are rising, with a 21% increase predicted for 2023 globally, and around double that in the US and France.[5] Governments cannot afford to extend the support offered to distressed companies during the pandemic. Amid slower economic growth, we expect the heightened rate of business failures to continue for several years until interest rates and the cost of working capital moderate.

Globalisation continues to allow investors and companies in the construction and engineering industry to seek opportunities in more buoyant economies, emerging countries, or growing markets, such as the energy transition sector.[6] Meanwhile, organisations are also regionalising supply chains in response to the disruptions wreaked by the pandemic, Russian-Ukraine war and geopolitical tensions between the superpowers. Both strategies call for rigorous risk mitigation to be successful. Diversification may avoid stagnation but poses cultural, competitive and/or technological challenges. Shortening supply chains may impact quality as well as further inflating costs.

Can inflation be tamed without turning the slowdown into a slump? And can financiers, owners and contractors strike a fair balance between risk and reward?

## Social challenges and opportunities

Social and demographic factors – from skills shortages to rising affluence and widening disparities in wealth – are also directly or indirectly impacting national policy and the direction of state investment.

4 Global Economic Prospects: Sharp, Long-lasting Slowdown to Hit Developing Countries Hard (worldbank.org)

5 2023_04_11_Insolvency-Report_AZ.pdf (allianz.com)

6 Javier Milei: Far-right outsider posts shock win in Argentina election | CNN

# Forewarned is Forearmed

The growing affluent middle class in Asian countries fuels demand for long-haul travel and airport infrastructure. At the same time, many governments are introducing means-based assessments to provide income support to disadvantaged households.

In developed countries with tight labour markets, such as in North America, Europe and the UK, migration is increasingly contentious. Opponents warn of the burden on housing and public services; proponents cite rising labour costs and worker shortages – eventually prompting the UK government to loosen post-Brexit restrictions to permit more workers with specific skills to work in construction and certain other sectors. It remains to be seen if the eventual compromise over the participation of UK scientists in the EU Horizon Europe innovation programme is a precursor of collaboration in other sectors such as construction. In Canada, meanwhile, with its strong unions, collective pay bargaining and traditional reliance on domestic labour, employers resort to persuading key workers to stay on past retirement.

Africa, by contrast, has massive untapped human capital, natural resources, and development opportunities. Despite the prospect of foreign government funding (mainly from the US and China), the continent's construction industry struggles to get projects off the ground, not least for the green energy transition. Lack of electricity generating capacity is holding back economic and social progress. Load shedding in South Africa could spark social unrest if the problem was to worsen. While solar and wind would provide a cheaper and more sustainable alternative to oil and gas, coal is also abundant and relatively inexpensive to extract.

The potential for capital and infrastructure projects to engineer societal change alongside economic development is writ large in the Middle East. The Gulf States have a long pipeline of major projects designed to expand and diversify national economies away from hydrocarbons. Economic certainty is in greater supply along with the advanced information the market needs to build capacity. The region is also becoming more diverse as more women join the workforce in both public and private sectors.

Saudi Arabia – inspired by its hugely ambitious Vision 2030 strategy – is leading on localisation, aiming to raise local input from 30% to 70%. Social pride is growing, along with the demand for supporting social infrastructure (including housing and transport) for the workforce. Foreign enterprises have limited opportunities to trade with public agencies if they do not set up regional headquarters locally, while tax breaks are also available.

All regions face shortages of skills and labour to varying degrees. The desire for workforce localisation and concerns around immigration limit employers' flexibility to draw on foreign workers. With an ageing workforce, the construction and engineering industry struggles to attract homegrown talent, especially when more glamorous and high-tech sectors have greater appeal for young people entering the jobs market. In the US, for example, filling vacancies is a 'major challenge' for a majority of employers in construction.[7]

The challenge is how to recruit, retain, train and retrain the talent needed to sustain a modern and efficient construction and engineering industry. This applies across traditional and new roles, where the gap in skills is already wide and risks undermining companies' ability to exploit digital and other technologies.[8]

## Harnessing technological power

With building information modelling (BIM) mandated in many major contracts, increasing use is being made of software tools to manage construction projects. Not all stakeholders are engaging with BIM however, or reaping its potential benefits.

The pandemic and related ongoing skills shortages spurred the adoption of diverse smart digital tools, from drones, and sensors or cameras on hard hats and cranes, to robots for measuring and setting out sites. Besides the potential for saving labour and boosting productivity, these tools – like BIM – also generate vast quantities of data needed for the next giant digital leap. In addition, settling on the use of a common technology remains a key issue. Compatibility between multiple platforms will be essential so that information can be shared across different technologies.

Artificial intelligence (AI) is the new 'big thing'. But it is necessary to separate the practicalities from the hype, and advantage from risk. The development of generative AI is outpacing ethics and professional codes of conduct. Results may be inaccurate, biased by training datasets, or even a product of 'hallucination' (as with the fake legal case created by ChatGPT for a New York trial lawyer[9]).

As more and more construction data is captured, there are still stumbling blocks to its use. In a highly fragmented industry, different parties are wedded to different methodologies, software and digital platforms. Data is not structured to be both useable and accessible. Each major project is differentiated by design, topography, team, and local regulations. Aggregation of cleansed data is a challenge, and clients' reticence stands in the way of open sourcing.

Common standards for data are emerging (driven by BIM, as in Australia[10]). And some service providers are already modelling project risks and outcomes using AI tools said to be based on large volumes of historical construction data. By frequently analysing many schedules, the UK's nPlan, for example, is aiming to shave 5% off the cost of Northern Railway's infrastructure programme.[11]

7 2022_AGC_Workforce_Survey_Analysis.pdf
8 McKinsey Technology Trends Outlook 2023 | McKinsey
9 Lawyer cites fake cases generated by ChatGPT in legal brief | Legal Dive
10 Australia adopts International Standard for BIM Data Sharing - Standards Australia
11 nPlan - AI for Construction, Infrastructure and Engineering

## Industry view

The impact of inflation and high interest rates on the construction sector is heavy and ongoing. At a time of slowdown, our industry looks to the public sector and infrastructure projects to sustain activity and stimulate recovery. However, where governments prioritise debt reduction, supply chains will be damaged and jobs lost. Other risks abound, from the technological to environmental, but also opportunities.

Our industry is not renowned for rapid innovation, but it is transforming. Despite technological leaps like building information modelling (BIM), systems to exploit the huge volumes of data generated but siloed on major projects have evolved too slowly and whilst we have made small productivity gains, we have a long way to go. The development of 'plug and play' mission control rooms with the data architecture to allow cross-pollination of data will enable greater collaboration by project stakeholders and better-informed decision-making. The industry is coming to terms with the use and maximising modern methods of construction but must make these cost-effective.

The net-zero transition demands innovation in the design of sustainable infrastructure and buildings and in their delivery. Buildings account for almost a third of the world's energy usage and are key to achieving net zero by mid-century. Targets and commitments on energy usage will be integral to business decision-making. The construction process, meanwhile, needs to embrace alternative fuels in site machinery, data analysis to optimise energy productivity, and more offsite production.

Companies that master these and other challenges have the opportunity to export construction services and partner with developing countries to reduce delays and cost overruns in delivering essential infrastructure for sustainable economic development.

**Mark Reynolds**
Group Chairman & Chief Executive
Mace Group

# Forewarned is Forearmed

It is also hoped that AI could streamline engineering design – by speeding up the response to variations, reducing the need to 'reinvent the wheel' each time on new projects, and increasing productivity.

For construction companies developing AI-powered systems in-house, cost savings are likely to be longer-term, given the upfront costs. Also, like BIM, there will be interface frictions if different tiers of the industry are slower to adopt and apply AI due to affordability or other factors.

In a competitive, litigious market, Project 13 has been in the vanguard, drawing lessons learned for sharing across the industry.[12] Standardisation and sharing of data would also boost the adoption of modern methods of construction.

Off-site manufacture of repeatable component modules is becoming more common as construction gets smarter. This may range from bridge sections to entire structures or installations such as water treatment plants – developed remotely, created as modular sub-structures, and assembled on site. Even in complex, landmark developments, from iconic buildings to rail stations, many elements – from toilets and office suites to signalling systems and ticketing halls – may be modular units.

Housebuilding offers great scope for volume off-site manufacturing. However, quality, planning and financial problems in the UK have forced several big players to quit the market. In Saudi Arabia there is a strong push for prefabrication in the belief that standardisation can help increase volumes and achieve residential construction targets. Efficiency savings may at least partly cushion inflationary impacts on materials costs.

Champions of these technologies (and others, such as digital printing of structures) believe they can help raise construction and engineering productivity, ease skills crises, and reduce the industry's carbon footprint. But what will be the defining event or galvanising force that overcomes deep-seated caution and conservatism to make this seismic shift happen?

## Legal advances and obstacles

Against the backdrop of slower economic growth, we are seeing more legal challenges over cancelled projects and environmental, social and governance (ESG) matters. Governments have pulled contracts for mining and oil and gas developments, in some instances triggering disputes over bilateral investment treaties. Where the defence is based on new decarbonisation policies, plaintiffs are having to rely on environment specialists as well as damages experts.

In addition, the economic context of high inflation and capital costs also has implications for damages in construction and engineering disputes. An assessment of lost profit (both past and future), founded in part on quantum and delay analysis, is required to quantify damages fully.

Another significant environmental development, given their ubiquity in construction worldwide, is the incorporation of net zero obligations in FIDIC forms of contract. The recommended climate clauses in FIDIC engineering, procurement and construction (EPC) contracts oblige contractors and subcontractors to act sustainably in carrying out works.[13] This includes targets to reduce greenhouse gas emissions and reporting requirements.

Meanwhile, state efforts to provide an alternative avenue to resolving claims and disputes are producing mixed results. Having legislated for mandatory adjudication in construction payment disputes, Canadian provinces find the process is not meeting expectations based on decades of UK experience. Cases typically deal only with smaller payment / quantum issues, rather than the complete picture of quantum, engineering and the effect of project delays. While the size of claims has been increasing – since Ontario became the first to make adjudication statutory in 2019 – awards and claimant success rates remain relatively low. Many cases go straight to arbitration or litigation if the parties cannot settle. A negotiated settlement is the strong, perhaps cultural, preference in Canada, as parties make haste to minimise disruption and mounting project costs.

The adoption of a federal scheme for prompt payment in Canada, also in 2019, has eased cash flow for contractors and the supply chain. But this still depends on close adherence to the necessary invoicing procedures.

Saudi Arabia has made further improvements to the regulatory procedures governing arbitration. Codification of local laws is a more significant change, also giving more legal certainty to foreign investors and contractors.

Arbitration processes and litigation are often long and convoluted in South Africa as delivery partners seek to recoup heavy losses on overrunning projects against a background of corruption and state capture. Other countries in Africa are experiencing similar problems, but to a lesser degree. Skyrocketing construction inflation, currency weakness, and supply chain delays are also challenging projects.

Varying in their intensity worldwide, these and other pressures only reinforce the business case for greater rigour in setting up and administering contracts to avoid discord and the high risks and costs of litigation. Will this recognition grow and result in a decline in construction disputes over the medium term? Or will high capital costs and investment U-turns amid the transition to carbon neutrality swell their number as more capital projects are cancelled, postponed or descoped?[14]

12 Project 13 Home - Project 13

13 Net Zero Obligations in FIDIC Engineering, Procurement and Construction (EPC) Contracts | The Chancery Lane Project

14 https://www.pinsentmasons.com/out-law/analysis/construction-disputes-strategic-risk-management-required-recovery-progresses

# Forewarned is Forearmed

## Environmental action lags rhetoric

National and regional economies are at various stages on their transition to carbon net zero, but global progress overall is insufficient to avert grave and potentially irreparable changes in our climate and ocean systems.

Despite progress in decarbonising electricity generation, investment and policy implementation lag behind national pledges. Rhetoric is not matched by action. Nevertheless, more governments are legislating on environmental matters. Also, greater consistency is emerging in ESG legislation, driven by the reporting requirements of the Task-Force on Climate-related Disclosures (TFCD).

In the US, despite the Biden administration's unprecedented green investment, the Supreme Court has rolled back ESG regulations, and federal oversight of environmental controls has been eroded. There is also corporate pushback in the US on the grounds that ESG cannot be justified by cost-benefit analysis.

While corporate ESG policies are generally immature, and a box-ticking exercise for some companies, ESG expectations are becoming a strategic priority in many places from Europe to Asia. Notably in Malaysia, Singapore and Indonesia, more contractors have committed to implementation and close cooperation with government agencies on environmental issues.

Wherever top-tier contractors commit to ESG, they eventually extend the same expectations of governance down the supply chain. The aim is to increase transparency, particularly for clients, and accelerate behavioural change, though the cost implications for second- and third-tier suppliers are not necessarily acknowledged.

Increasingly, ESG risks are being crystallised in courts. Although many actions suffer a failure of evidence, there has been a marked increase in the number of construction-related actions since 2000. The annual total for all ESG cases has doubled since 2015. Many are in the US. Around 20 by American cities and states against the 'carbon majors' are likely to go to trial.[15]

Legal challenges to governments and companies are also rising globally. They range from investment decisions to 'climate-washing' and financial damages for disinformation under consumer protection law. The exposure of investors in developed countries to asset stranding – and the wider risks posed by the transition to carbon net zero – are significant and not fully understood.[16]

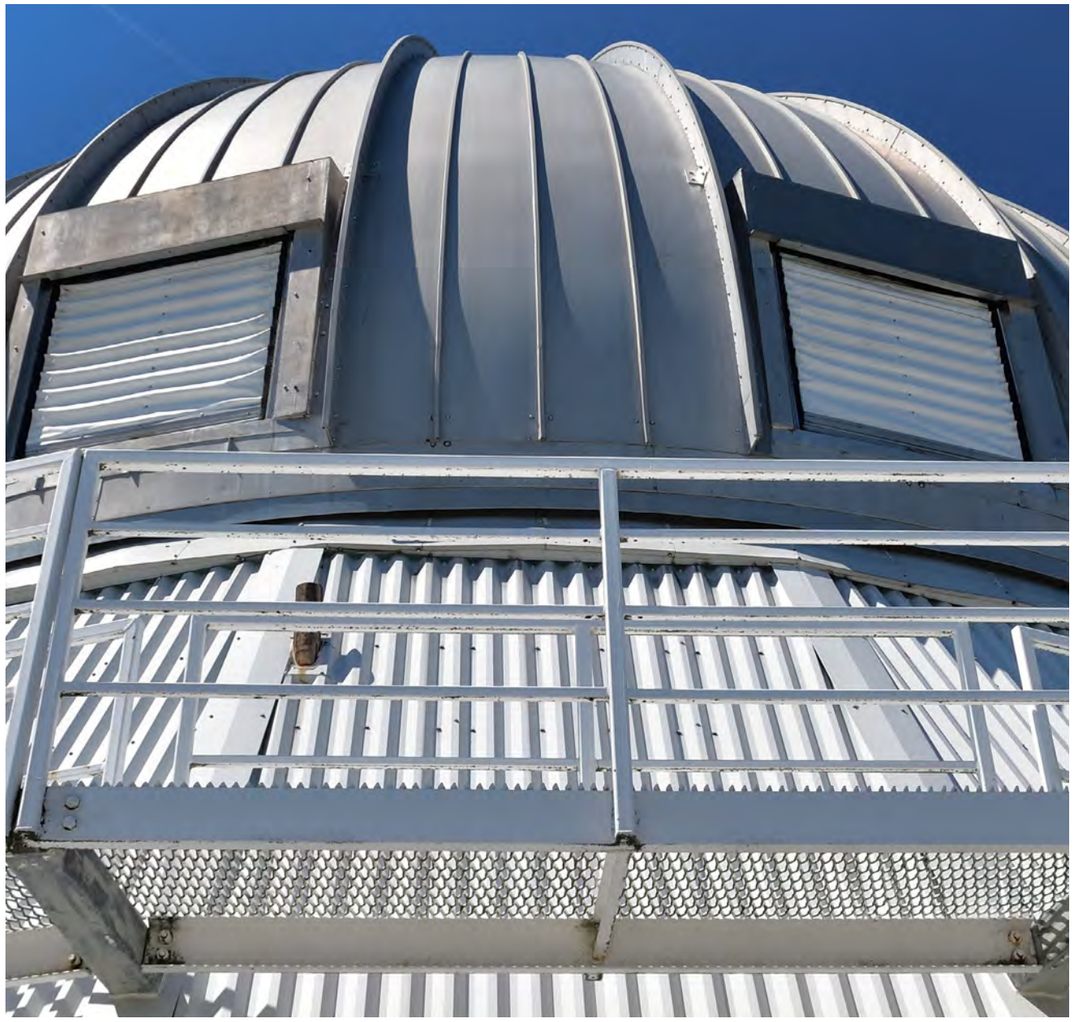
China is set to hit its 2030 targets for wind and solar power five years early (though committed to net zero by 2060, a decade after the EU and US).[17] Taiwan leads the region's offshore wind power revolution. Yet Asia accounts for the bulk of planned investment in coal power stations, (led by China, India, Indonesia, Japan and Vietnam).[18]

Many of Africa's power-hungry economies also depend heavily on coal. North Africa led the way in exploiting wind and solar.[19] Elsewhere, even with mining giants participating in some renewable energy joint ventures, progress is slow. South Africa was promised $8.5 billion at the COP26 climate summit to help end its coal reliance.[20] But with capital to fund investment lacking, governments claim they 'can't afford to be green', locking the continent into fossil fuels for decades.

15 Global trends in climate change litigation: 2023 snapshot - Grantham Research Institute on climate change and the environment (lse.ac.uk)
16 Stranded fossil-fuel assets translate to major losses for investors in advanced economies | Nature Climate Change
17 China is set to shatter its wind and solar target five years early, new report finds | CNN
18 Five Asian countries account for 80% of new coal power investment | Coal | The Guardian
19 This is the state of renewable energy in Africa right now | World Economic Forum (weforum.org) /
20 COP26: South Africa hails deal to end reliance on coal - BBC News

Environmental considerations weigh on all types of capital projects. Companies want to occupy 'environmentally friendly' buildings, so 'green leases' can command premium rents.[21] Upgrades to preserve older buildings' value may be prohibitive and impractical. But, as the focus on the whole lifecycle of buildings includes embodied carbon as well as operating costs, developers will need to justify demolition for new-build on environmental as well as economic grounds.[22]

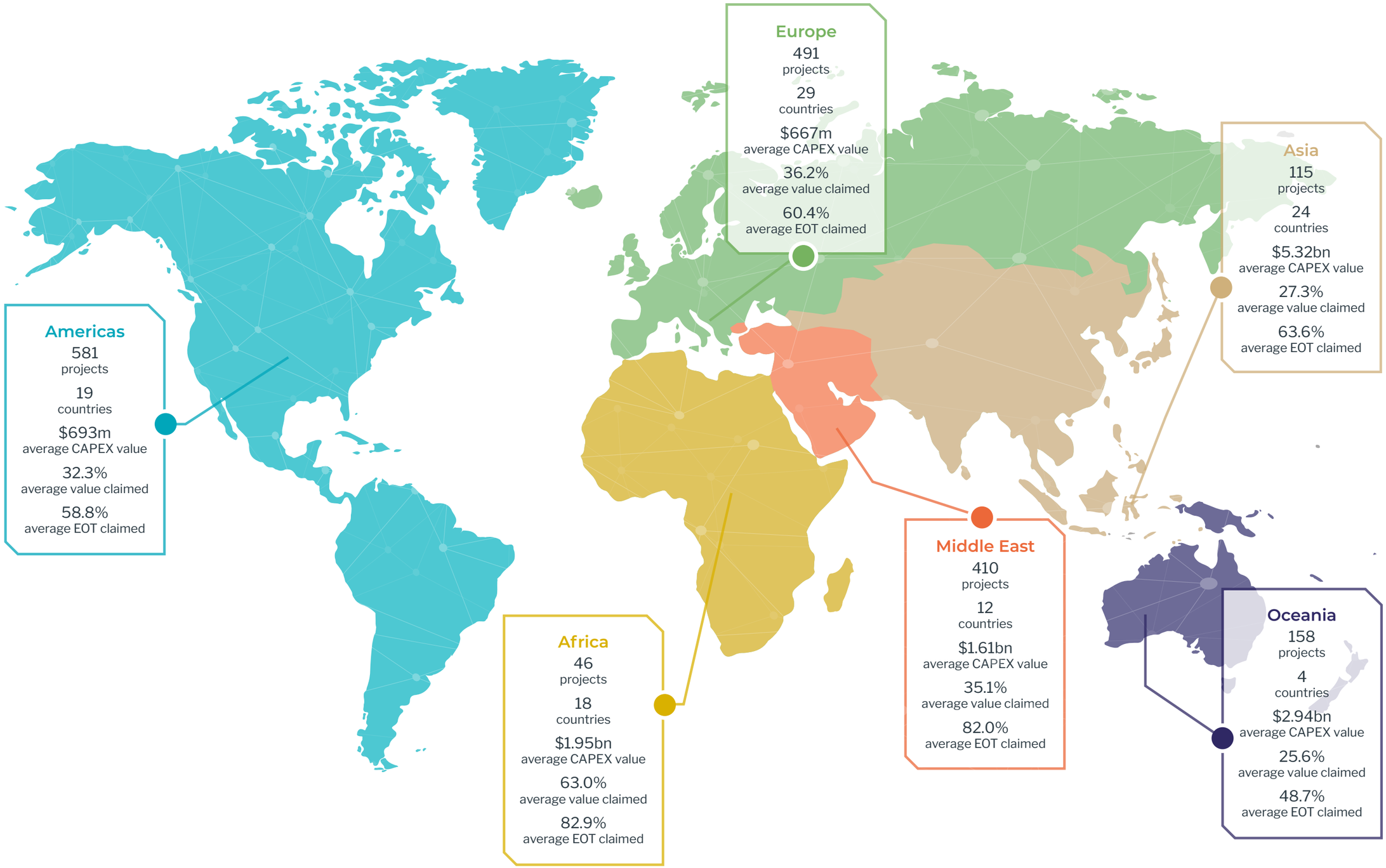
As climate scientists warn of tipping points, extreme weather events risk tilting public opinion heavily against foot-dragging governments and greenwashing companies' licence to operate. At what point will a critical mass of investors withdraw their support for unsustainable projects and business models?



21 RICS Sustainability Report 2022: Are we making progress?
22 Marks & Spencer refused permission to demolish and rebuild Oxford Street store | Marks & Spencer | The Guardian

# A World View

**CRUX Insight distills expert analysis of actual problems encountered on more than 1,800 projects across more than 105 countries.**



# Africa



**All infrastructure and capital projects must navigate risks specific to their region as well as global forces. If the factors driving claims and disputes in Africa are more distinctive, then the economic and political instabilities can also be said to be more acute.**

As the global economy slows down, government finances have been weakened further by lower capital inflows and significant inflation. And, with more than a dozen elections slated for 2023 – and the impacts of military coups – political uncertainties are inevitably heightened.

Given the natural resources of the continent and severe energy shortages, power generation projects are critical to economic development – and political stability, as load shedding and blackouts cause intense pressure on many national leaders. However, power projects in Africa show a more damaging pattern of claims and disputes than in the rest of the world – even as climate change prolongs drought in the Sahel, and catastrophic storms hit the north of the continent.

Our CRUX analysis covers 46 projects across 18 countries, with an average CAPEX value of $1.95 billion. The toll of claims and disputes both in time and financial impact is heavier than in any other region: disputed costs amounted to 63.0% of committed project expenditure, on average, while claimed extensions of time would prolong a typical schedule by 82.9%.

## Causes and effects

Late or restricted access to sites or workfaces – which tops the ranking as a primary or secondary cause of conflict – affected 37.0% of projects, displacing the world's near-universal prime driver of disputes, change in scope (see Table A).

Multi-disciplinary megaprojects that dominate our analysis, especially in the energy sector, are prone to flow-down delays as contractors overlap. Poor management of subcontractors and interfaces, diagnosed on almost a quarter of projects (23.9%), exacerbated the disruption. Contractors also complained of access delays due to political interference, which can be borne out of corruption (see below).

As design and build is a less common procurement route, in place of which lump sum or EPC procurement is favoured, developing designs in isolation ahead of understanding site-specific and other circumstances may be contributing to scope change.

**Table A - Claims & disputes in Africa & the Rest of the World**

| Top causes of claim or dispute* | Africa | RoW** | Africa | RoW |
|---|---|---|---|---|
| Access to site/workface was restricted and/or late | 1 | 10 | 37.0% | 17.4% |
| Change in scope | 2 | 1 | 39.1% | 38.8% |
| Cash flow and payment issues | 3 | 11 | 30.4% | 14.5% |
| Design was incomplete | 4 | 5 | 30.4% | 21.4% |
| Contract interpretation issues | 5 | 4 | 26.1% | 19.6% |
| Claims were spurious | 6 | 14 | 23.9% | 13.4% |
| Contract management and/or administration failure | 6 | 5 | 26.1% | 19.4% |
| Poor management of subcontractor/supplier and/or their interfaces | 8 | 7 | 23.9% | 19.3% |
| Level of skill and/or experience | 8 | 13 | 23.9% | 13.4% |
| Approvals were late | 10 | 11 | 19.6% | 15.2% |

*Rank is based on both primary and secondary causes of claims and disputes. The percentage represents the proportion of projects on which a cause featured (whether primary and/or secondary).
**Rest of the world.

A high incidence of cash flow and payment issues (on 30.4% of projects) reflects the lack of statutory adjudication regimes in African countries, or prompt payment regulations. The rigid procedures and regulations of state agencies also slow the flow of payments.

More fundamental is the level of development across various functions and the ongoing need to integrate activities and knowledge sharing. From management of projects and human resources to the claims handling process, these systemic weaknesses manifest in multiple drivers of distress. Another by-product was a greater incidence of spurious claims – on 23.9% of projects, as opposed to 13.4% in the rest of the world.

## Power and disruption

Energy supply gaps impede economic development and social progress across the continent. Power generation projects form a significant category within the regional CRUX analysis. The root causes of disputes are shared more with other capital projects in Africa than with energy industries in other regions (see Table B).

Access restrictions loom large again, hampering nearly one-in-three power projects (31.3%) – a higher proportion of power projects than in the rest of the world (17.2%). However, this performance gap with other regions widens to 23 points for the management of interfaces with third parties, which also afflicts close to a third of African projects.

A similar gulf separates the continent's industry when it comes to claims and disputes triggered by cultural and personality differences. These conflicts most likely reflect the increasing role of international contractors in these large projects.

Shortages of skilled and non-skilled workers are more prevalent too – a quarter of projects (25.0%) are affected, compared with one in ten (10.9%) elsewhere. Shortages of key workers and workmanship deficiencies are likely to be exacerbated in a highly cyclical African construction market where knowledge is often lost as teams are demobilised and fragmented. A dearth of major power projects in previous years, the emergence of new technologies, and the draw of higher salaries and benefits beyond the continent risk widening the skills gap.

**Table B – Claims & disputes in power & distribution projects: Africa & the Rest of the World**

| Key causes of claim or dispute* | Africa | RoW |
|---|---|---|
| Poor interface management with a third party | 31.3% | 8.1% |
| Personality and/or cultural differences | 31.3% | 7.2% |
| Access to site/workface was restricted and/or late | 31.3% | 17.2% |
| Shortage of skilled and non-skilled workers | 25.0% | 10.9% |
| Workmanship deficiencies | 18.8% | 15.8% |

*Percentage of projects that had this as a primary and/or secondary cause of claim or dispute.

**46**
projects

**18**
countries

**$1.95bn**
average CAPEX

**63.0%**
average cost claimed

**82.9%**
average EOT claimed

# Africa



## North-south divisions

Deficient skillsets or experience seem to be a bigger problem generally on projects in Sub-Saharan Africa (31.6%) than in the north (18.5%). A similar divide applied to spurious claims, while site and workface restrictions were again dominant in the south (42.1%) compared with one in three North African projects (see Table C).

There was also a divergence between north and south in respect of lost time and money. While southern projects were responsible for inflating Africa's heavy toll of claimed costs, its sorry record on time extensions was skewed by some massive overruns on schedules in the north of the continent.

Here, scope change (40.7%) was the top causal factor, while failures in contract management or administration afflicted a third of projects. A potential complicating issue is language – English may be the lingua franca of international engineering and construction law, but not of most teams delivering projects in the north, putting them at a potential disadvantage.

Until recently, major arbitrations were all seated in Europe, Singapore or other overseas jurisdictions. There is a strong case for a Francophone centre for arbitration on the continent, though South Africa, Kenya and Nigeria are among the countries vying for pre-eminence in this regard.

## Tackling corruption

More distorting – both for project outcomes and the basis for claims and disputes – is the continent's deep-seated corruption. Perhaps reflecting this, analysis of the CRUX dataset over time shows that conflicts over cash flow and payments were at their highest on projects sheduled to be completed by the end of 2016 (affecting over 50%) – a period when unlawful payments were rife.

Disputes over cash flow and payments eased somewhat in the dataset's 2017-19 period. In the wake of the state capture scandal in South Africa, 2019 saw a political commitment to root out corruption and impose systems and procedures to prevent overpayments and bribery. Investigations and arrests have followed, though successful prosecutions resulting in jail sentences may be necessary to deter ongoing fraud and embezzlement.

A Public Procurement Bill before South Africa's parliament aims to correct weaknesses identified by the Zondo Commission of inquiry into state capture. If implemented, it would aim to improve transparency, efficiency and value for money, while addressing problems with previous preferential procurement measures.

**Table C – Claims & disputes in sub-regions: North & Sub-Saharan Africa**

| Top causes of claim or dispute* | North Africa | Sub-Saharan Africa |
|---|---|---|
| Access to site/workface was restricted and/or late | 33.3% | 42.1% |
| Change in scope | 40.7% | 36.8% |
| Cash flow and payment issues | 29.6% | 31.6% |
| Design was incomplete | 29.6% | 31.6% |
| Contract interpretation issues | 29.6% | 21.1% |
| Claims were spurious | 18.5% | 31.6% |
| Contract management and/or administration failure | 33.3% | 15.8% |
| Poor management of subcontractor/supplier and/or their interfaces | 25.9% | 21.1% |
| Level of skill and/or experience | 18.5% | 31.6% |
| Approvals were late | 18.5% | 21.1% |

*Percentage of projects that had this as a primary and/or secondary cause of claim or dispute.

## Ways forward

Various measures could curb the forces bedevilling capital projects, though significant progress would require a more fundamental reset.

Employers determined to secure the lowest price and shortest schedule set up projects to fail. By using engineering, procurement and construction (EPC) contracts, with the burden of risk carried by the contractor, or FIDIC contracts that are heavily amended, again loading the lion's share of risk onto the contractor, or to administration-heavy new engineering contract (NEC) can create its own set of problems. Realism about risk allocation, price and programme is fundamental.

Early contractor involvement and collaboration would help develop designs and enhance their buildability, but employers and well-motivated contractors need to lead this change collectively. In addition, a dynamic project plan and objective project manager, supported by capable staff, are crucial.

Technology, including building information modelling (BIM), can be used to simulate design changes before resources are allocated and costs incurred.

The higher complexity and pace of projects delivered by international contractors demand radical changes in project governance and controls. External expertise may be required to address widespread client-side immaturity and share global best practices, preferably embedded through the training and development of local staff.

Like the global headwinds, other challenges are not abating. National laws and regulations around decarbonisation will have an increasing impact on construction and engineering projects. Increasingly, it is likely that inward investment for Africa's sustainable development will be tied more tightly not only to cost-effectiveness but also to environmental performance and probity.

## Industry view

Disputes continue to impose a heavy burden on infrastructure and capital projects across Africa as inflation, capital costs, and government debts increase the drag on economic development.

CRUX identifies weaknesses in systems and procedures, and gaps in local expertise, that give rise to delays and inefficiencies. These also play into the continent's higher levels of conflict over contract interpretation, spurious claims, and the other top ten causes of disputes. The incidence of 'personality and/or cultural differences' in the power and distribution market, critical to Africa's progress, is another concern.

It would be wrong, however, to overlook cultural changes that are essential for overseas investors' confidence and support. Improvements in governance in the civic sphere are encouraging. Translating these into public procurement and contract governance will be a lengthy process, but South Africa's Public Procurement Bill is encouraging.

Sustained effort is required to promote transparency across the supply chain and enhance contract administration processes. International contractors can exert a positive influence, but more investment is needed in people and client capabilities. Initiatives to strengthen regional centres of excellence in arbitration and spread best practice among legal and construction professionals are growing the maturity needed to make best use of the continent's abundant natural resources and human capital.

**Professor Renato Nazzini**
Director of the Centre of Construction Law and Dispute Resolution
King's College, UK

# Americas



**Amid the global turbulence, the economies of the Americas have shown greater resilience than predicted. A softer landing should see the United States avoid recession this year, with the prospect of a decade of rising public investment in infrastructure and decarbonisation. However, how the economy will fare after the 2024 presidential elections remains unpredictable.**

Canada is also supporting the transition of its resource-intensive economy with green technology incentives as well as through regulation and carbon pricing (employed only by a minority of US states). But similar progress will require higher investment and alignment of national and provincial government priorities.

Labour markets are tight across North America, while inflation and interest rates uncertainty continue to pose risks throughout the continent. Latin America's gloomy growth prospects for 2023 may also have brightened somewhat – bolstered by the strength of Brazil, Chile and Mexico – but weaker public finances and high debt levels portend a widening gap between investment capacity and needs.

The 581 projects in our CRUX analysis extended across 19 countries throughout the region, the majority in North America. Average project value was $693 million in committed CAPEX at the end of our investigations. The disputed costs on projects typically reached almost a third of that value (32.3%), while extra time sought by contractors would prolong schedules by more than half (58.8%) of their planned duration.

## Causes and effects

The top causes of project distress have their roots in changes in scope and under-developed designs. Scope change was the top cause of claims and disputes on 28.3% of projects, while design errors – closely entwined with changing scope – impacted a fifth of projects, as did deficiencies in workmanship – 20.4% and 20.0%, respectively (see Table D).

Late changes by a project owner cause scope change. But more often this cause of conflict arises, as projects evolve, when both owners and design and construction teams discover design gaps and revise their views on specific elements of an asset's operational requirements. It is becoming more common that projects go to tender with incomplete front-end engineering designs (FEED), causing disputes to arise during detailed design development. Not freezing the design can cause changes to keep coming from the client and its design team.

Clients pressure contractors to work faster and shorten schedules. While developers have set goals for completion and financial obligations to meet, contractors may fail to communicate the full extent of the implications for fear of souring relations, schedules and costs escalate.

On design-build contracts for infrastructure projects, we see the common disputes between owners and general contractors expanding as general contractors pursue their designer partners. As subcontractors (or sub-consultants), designers are increasingly exposed commercially. Having failed to recover costs from the client, it is becoming more common for a general contractor to allege design errors and omissions, even though these may result from price restrictions imposed by the contractor that would not apply were the designer working directly for the owner.

Publicly funded projects can also be subject to intervention by a regulatory agency and an enforced change in specifications, which may result in major delays and additional costs.

In the commercial property sector, developers vary widely in terms of experience and understanding of construction. Changing one element, such as headboards in a hotel's bedrooms, for example, may require rework by various trades. The value of a pause to review designs in detail before work starts was illustrated in the pandemic when some clients were able to pre-empt gaps and clashes that would have been costly to rectify during construction.

Pressure on contractors to accelerate progress contributes to workmanship deficiencies, which also trigger more claims and disputes than in other regions (with the exception of Europe). Quality inspections are spread more thinly, but there is a growing recognition that skilled labour is in short supply.

The higher incidence of conflicts arising from unforeseen physical conditions may stem in part from a high proportion of infrastructure and pipeline projects in the US and Canada.

For contractors on projects involving significant excavation and earthworks, unexpected geology or groundwater can be more conducive to a successful claim than other contractual grounds. For linear works, such as highways, roads and pipelines, selective borehole tests can only provide a very limited intelligence on underlying conditions along an entire route.

## Road and rail

Staying with transportation, the CRUX dataset shows that North American rail and transit projects shared a similar hierarchy of causation to roads and highways, with some variations, especially in the frequency of design failures. Incomplete and late rail project designs are more prevalent, most likely due to the mode's higher technological content and need for systems integration (see Table E).

Access can be extremely challenging for both modes, whether links are new or upgraded. Safety controls must be rigorous when works adjoin or cross live highways or rail lines, and permitting requirements may be convoluted. In the US, the rights of way of private rail operators

**Table D – Claims & disputes in the Americas & the Rest of the World**

| Top causes of claim or dispute* | Americas | RoW** | Americas | RoW |
|---|---|---|---|---|
| Change in scope | 1 | 1 | 28.3% | 43.8% |
| Design was incorrect | 2 | 4 | 20.4% | 24.2% |
| Workmanship deficiencies | 3 | 12 | 20.0% | 16.3% |
| Physical conditions were unforeseen | 4 | 10 | 19.7% | 16.8% |
| Design was incomplete | 5 | 6 | 19.3% | 22.8% |
| Poor management of subcontractor/supplier and/or their interfaces | 6 | 7 | 18.8% | 19.7% |
| Design information was issued late | 7 | 3 | 18.8% | 24.2% |
| Contract management and/or administration failure | 8 | 5 | 16.1% | 21.2% |
| Contract interpretation issues | 9 | 2 | 14.7% | 22.2% |
| Access to site/workface was restricted and/or late | 10 | 8 | 16.1% | 18.8% |

*Rank is based on both primary and secondary causes of claims and disputes. The percentage represents the proportion of projects on which a cause featured (whether primary and/or secondary).
**Rest of the world.

**581**
projects

**19**
countries

**$693m**
average CAPEX

**32.3%**
average cost claimed

**58.8%**
average EOT claimed

# Americas



are substantial and sometimes antiquated. In Canada, delays in securing environmental permits and land possessions regularly prove to be costly. While regulatory oversight is essential, excessive bureaucracy is occupying entire teams in recording and reporting duties.

When urban areas are involved, the risk of delays increases due to restricted access to sites, right-of-way conflicts, and unforeseen conditions such as buried utility services, which may not be accurately recorded. Federal, state/provincial, and city regulators and agencies add further levels of complexity.

The data suggests that defective workmanship tended to manifest more on highways (one in five projects) than railways, perhaps due to the rail industry's stricter safety and quality protocols. However, buildings were even more prone to defects in workmanship than civil engineering projects. Poor workmanship was a factor in almost a quarter (24.4%) of claims and disputes over buildings projects in North America, nine points higher than rail and transit and over four points more than roads and highways.

## USA versus Canada

There is a high level of commonality between the US and Canada with regard to the practice of schedule and cost control, government and regulatory oversight, labour market conditions, and some of their leading general contractors. Yet, the CRUX data points to some notable differences in the patterns of dispute causation.

Our analysis shows that design shortcomings generally were a more significant problem in Canada, where close to 42% of projects experienced one or more types of design-centric failure – more than six percentage points higher than in the US. This disparity applied across all three design factors (incomplete, incorrect, and late issuing of design information). Additional analysis reveals that, for transportation infrastructure, the divergence widened beyond 10 percentage points.

In the case of late or restricted access to sites, these claims and disputes were almost twice as common north of the border – 24.5% of Canadian projects, against 12.8% in the US – probably reflecting the Big Country's long-distance pipeline projects, rather than the construction and engineering industry as a whole.

**Table E – Claims & disputes: Transportation infrastructure projects**

| Top causes of claim or dispute* | Rail & Transit | Roads & Highways |
|---|---|---|
| Design was incomplete | 53.8% | 33.3% |
| Design was incorrect | 38.5% | 26.7% |
| Physical conditions were unforeseen | 28.2% | 23.3% |
| Change in scope | 38.5% | 23.3% |
| Workmanship deficiencies | 15.4% | 20.0% |
| Design information was issued late | 38.5% | 16.7% |
| Access to site/workface was restricted and/or late | 23.1% | 20.0% |
| Contract management and/or administration failure | 15.4% | 23.3% |
| Poor management of subcontractor/supplier and/or their interfaces | 20.5% | 23.3% |
| Contract interpretation issues | 20.5% | 6.7% |

*Percentage of projects that had this as a primary and/or secondary cause of claim or dispute.

Despite these commonalities and disparities, the outcomes were in Canada's favour when the toll of claims and disputes in costs and time is calculated. Sums in dispute averaged 22.0% of project CAPEX compared with 34.4% for US projects. In terms of schedules, the additional time sought by contractors averaged 60.3% of planned programmes in the US, against Canada's 53.4%. Cultural differences may be in play, along with a more contractor-driven environment in the US, and a less litigious one in Canada.

Adjudication has become a statutory remedy in several provinces, and there also is a greater tendency to settle promptly. In the US, mediation tends to provide an effective path to settlement for public agencies, which tend to be risk-averse. However, this year has seen an uptick in the number of cases overall going to arbitration or court as the legal system caught up with its post-pandemic backlog.

General contractors, squeezed by inflation and higher borrowing costs, are less inclined to settle and seek to maximise their recovery through litigation; (despite the risk of incurring costly delays where projects are ongoing). Prohibitively high insurance premiums are also forcing these contractors to self-insure.

While smaller building developers are more inclined to make a pragmatic business decision to settle cases, other parties are pressing ahead with actions from a weak position – whether in mediation, arbitration or litigation – unless they are convinced that they stand to lose. Team members embedded in projects often struggle to be objective about the merits of their case.

## Risks and opportunities

US infrastructure has suffered from years of under-investment and the country has lagged behind other regions in the transition to clean energy. However, the bureaucracy and funding rules associated with the Infrastructure and Jobs Act and the Inflation Reduction Act pose risks.

## Industry view

The CRUX Insight Report provides some intriguing insights into the performance of major projects, and much that is concerning. In the Americas, the impacts of disputes on schedules and costs may be somewhat lower than the global average according to the CRUX analysis, but are still severe.

Only more proactive management of the risks highlighted here can achieve the goals of clients. It must be sustained for all project phases from feasibility studies, basic design and FEED, through detailed engineering, procurement, and construction, to commissioning and handover.

Managing interfaces is a major challenge, as the CRUX data shows. Notably, these challenges occur where contractors' scopes overlap and where assignment gaps exist. Every project stakeholder depends on successful management of these interfaces. Close collaboration amongst project management and contractor's teams and the client's representatives is essential.

Inflation adds further complexity with its varying effects on different continents, products, services, and points in the supply chain and project lifecycle. Long-term relationships with suppliers based on mutual respect and trust are the key to mitigating risks and aligning interests.

Enabling the transition to sustainable energy and infrastructure is exciting but will continue to challenge our industry and everyone involved in managing and delivering major capital projects.

**Poornima Sharma**
VP Operations Europe & Americas
Technip Energies

# Americas



In the past, 'shovel-ready' projects have been awarded federal funds on the basis of conceptual designs alone, increasing the likelihood of budget and schedule overruns due to design failures and scope change. Skills under-capacity in the market, newly formed contractors and consortia, and firms diversifying into unfamiliar fields also increase the risk to these public projects.

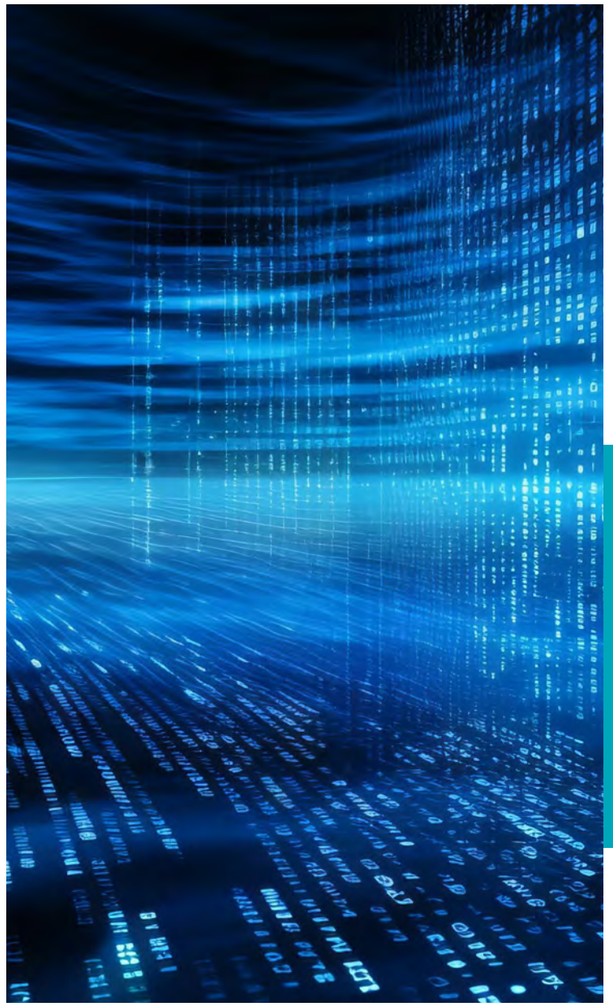
Labour markets will remain tight for the foreseeable future. Shortages in skilled and unskilled workers will worsen, unless concerted efforts are made to attract more people, earlier in their careers, into construction – which is unattractive to younger generations and female candidates.

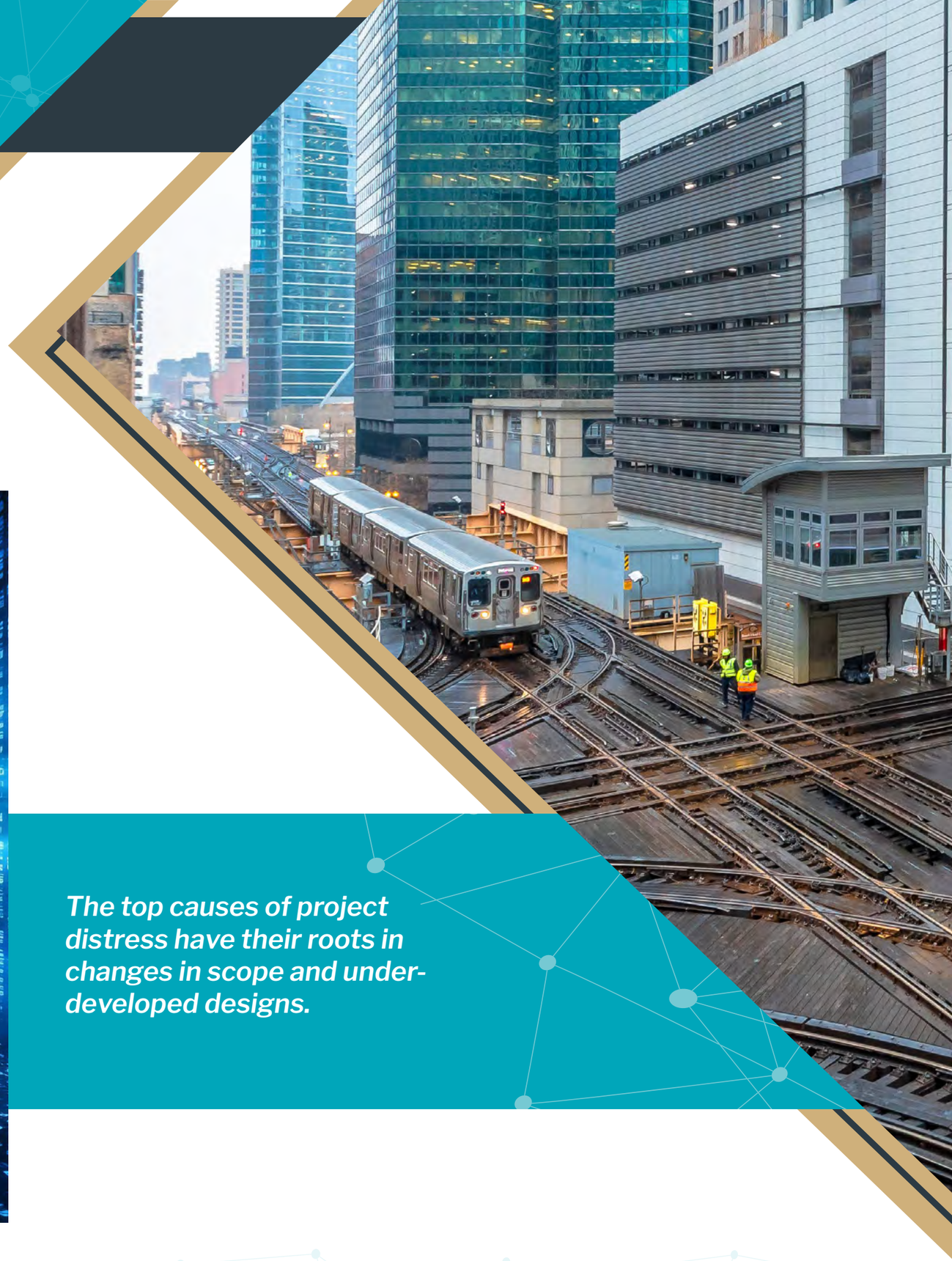
Traditional engineering and other technical university classes are shrinking as high school leavers are attracted to computer science and other studies that promise more appealing careers in tech companies, finance, retail, and online services. However, some US community colleges are promoting trade skills by offering shorter programmes and associate degrees that are more affordable than conventional degrees.

While the steady attrition of an ageing workforce cannot be halted, additional efforts are needed to hand down skills and 'know-how'. These need to be formalised to improve succession planning and organisational learning. The industry must also invest more in skills training and in quality control and assurance inspections. In the meantime, some of the causes of workmanship quality problems could be assuaged through labour agreements on projects and phase planning in collaboration with specialist trades.

Technology can boost the industry's productivity and its appeal to a new generation of workers. New, more advanced document management systems are being adopted on projects, along with building information modelling (BIM). The challenge is to ensure that all on the project team, including senior staff, adapt and understand how to make the best use of these systems. That may involve ramping up quality control and assurance to ensure that what is being built on site accords with the latest design documents. Again, training – including refresher training as the technology evolves – is imperative.

Software harnessing artificial intelligence (AI) is beginning to make inroads. Applications, including aids for scheduling and risk management, will need to prove their value. We are also seeing greater use of automation, tracking of materials, and use of prefabricated modules. Given the many constraints on an industry that has generally been slow to adopt new techniques and technologies, the upside for stakeholders is potentially significant.





***The top causes of project distress have their roots in changes in scope and under-developed designs.***

# Asia



**The wide diversity of Asia – and the 24 countries with projects in our regional analysis – spans underdeveloped, emerging and highly advanced economies.**

Aside from the global slowdown and the decelerating engine economy of China, some of its sub-regions face particular challenges due to shortcomings in governmental administration, project governance or procurement practice. Environmental risks are also an increasingly critical concern. Meanwhile, the region is still reeling from the effects of the COVID-19 outbreak and may still have lessons from the pandemic to apply.

The latest CRUX analysis takes in a total of 115 projects, their massive scale giving an average CAPEX of more than $5.32 billion, the highest of any region. Extensions of time sought by contractors were at the upper end of the global scale also – veering towards two-thirds of planned schedules (63.6%, on average).

The monetary impact of claims was less damaging. Sums in dispute on projects in Asia averaged 27.3% of a project's CAPEX – only bettered in Oceania (25.6%).

## Causes and effects

Asian projects are little different from their counterparts worldwide in terms of vulnerability to change in scope. Perhaps reflecting their scale, almost half (49.6%) suffered claims and disputes due to this cause (see Table F). But there are other factors contributing to scope change, including the fact that most major projects are instigated by governments. Their requirements are often less clear than those of private enterprises, tightly defined within strict budgets.

With some exceptions, procurement strategies tend to be less advanced than in other regions such as Europe and the Americas. Other causation factors are linked, such as the absence of early contractor involvement, which can give rise to design immaturity (in turn leading to later changes in scope), design information that is issued late, and weak mutual agreements over clauses for materials and contractor labour cost increases.

From a project governance perspective, restrictions to site access were a prime cause of claims and disputes during the pandemic. Significant delays can still arise from an unclear understanding of land ownership and failures to complete purchases of land in time for handover. In some cases, especially remote areas, assumptions that territory is not inhabited or will be secured quickly, can prove unreliable.

Lack of clarity in legislation and bureaucratic processes and procedures at national and/or regional levels contributes to these delays and disruptions. Governments often prefer to be agile in how they apply regulatory requirements to suit their requirements, causing uncertainty in project execution.

Other challenges include infrastructure limitations so that, for example, access roads are inadequate or lacking. Local communities dispute land ownership or may protest the impact or purpose of projects, blockading sites. Environmental risks are rising. Unpredictable events, such as excessive rainfall, leading to floods or exceedances of pollution limits, also give rise to programme delays.

The level of skill and experience of the teams delivering projects is another increasingly prevalent cause of claims and disputes. On long-term projects, knowledge is often lost as works progress; a project manager (PM) may average little more than a year at the helm, or having steered works for several years, an experienced PM moves on, leaving a large gap in the team's knowledge.

We have also observed critical gaps in commercial management, not helped by a lack of quantity surveying expertise, which if honed through commercial and contract manager experience, helps ensure that team members are well-versed in notification and other processes.

With a less litigious culture than some other regions, contractors are generally more focused on getting the job done. However, this can have unintended consequences when an early start is made on site to demonstrate project progress, but designs are incomplete. Contract interpretation ranked more highly as a trigger for claims and disputes in regions outside Asia. However, the CRUX data and post-pandemic developments (see below) point to a cultural shift, as contractors question the efficacy of contract provisions amid rising input costs and supply chain uncertainties.

## Power and resources projects

Some dispute causes are amplified, others less pervasive, on resources and power projects, which are heavily represented in our regional analysis.

Change in scope is a far greater challenge in the resources industry, triggering claims and disputes on 61.8% of projects, compared with 22.7% for power and utilities (see Table G). It is our experience that the nature of extractive operations, and unpredictable subterranean conditions, mean that works are less likely to be replicated on other sites and thus less repeatable than power station construction projects.

However, maturity of design and preconstruction planning are often found wanting. Ground condition surveys and site investigations by third parties for the employer may not be rigorous. Inadequate feasibility studies fail to capture the full complexity of conditions for tenderers. Designs are not sufficiently mature before breaking ground. Contractors do not help themselves if they are overly anxious to win work and get started on site. This haste is often incentivised by

**Table F – Claims & disputes: Asia & the Rest of the World**

| Top causes of claim or dispute* | Asia | RoW** | Asia | RoW |
|---|---|---|---|---|
| Change in scope | 1 | 1 | 49.6% | 38.1% |
| Design information was issued late | 2 | 4 | 23.5% | 22.4% |
| Access to site/workface was restricted and/or late | 2 | 10 | 23.5% | 17.5% |
| Poor management of subcontractor/supplier and/or their interfaces | 4 | 7 | 20.9% | 19.3% |
| Contract management and/or administration failure | 4 | 6 | 21.7% | 19.4% |
| Approvals were late | 6 | 12 | 21.7% | 14.9% |
| Level of skill and/or experience | 7 | 13 | 17.4% | 13.4% |
| Contract interpretation issues | 8 | 3 | 16.5% | 20.0% |
| Design was incomplete | 8 | 5 | 15.7% | 22.1% |
| Cash flow and payment issues | 10 | 11 | 14.8% | 14.9% |

*Rank is based on both primary and secondary causes of claims and disputes. The percentage represents the proportion of projects on which a cause featured (whether primary and/or secondary).
**Rest of the world.

**115**
projects

**24**
countries

**$5.32bn**
average CAPEX

**27.3%**
average cost claimed

**63.6%**
average EOT claimed

# Asia



advance payment terms. In addition, employers are also all too willing to hand over design responsibility. Both factors independently impact on project delivery downstream.

When the consequences are felt later on in the programme, the delays and disruption are often significant. On one Asian mining contract, for example, when a 200m-long tunnel boring machine unexpectedly hit granite, recovering the unit and changing the drill head resulted in a two-month delay.

Greater attention and investment at the front end of projects would save time and money over their full lifecycle.

More projects in the power and utilities industry (27.3%) struggle due to the limited experience or skills of their teams. Renewable energy schemes are also competing for specialist skills in a sector where capacity and available expertise appear to lag its growth.

## Sub-regional differences

The diversity of culture, language and economic status across Asia also exists within sub-regions, which show some sharp differences in the pattern of claims. A high-level comparison of dispute causation indicates that Central Asia is the weakest performer. Almost all the top ten drivers of claims and disputes affect a greater proportion of projects in this sub-region than in East, South or Southeast Asia.[23]

Central Asia also saw by far the worst outcomes in terms of schedule overruns, opening up a gap of around 40% with the rest of Asia (where claimed extensions of time averaged in the 57-63% range). However, sums in dispute for Central Asia were more than 10 points below the average for the rest of the region, with only South Asia having a lower sub-regional average (13.7%) for costs claimed as a proportion of project CAPEX.

Central Asia aside, comparing the causes of claims and disputes in the other sub-regions – East, South and Southeast Asia – projects in South Asia (India, Pakistan and Bangladesh) were more likely to be disrupted by change in scope, restricted access to sites or workfaces, and contract interpretation issues. Indian contracts can be complicated and overly detailed, and often bar recovery of costs, allowing only time extensions rather than money for delay, regardless of responsibility.

**Table G – Claims & disputes: Resources & Power & Utility projects**

| Top causes of claim or dispute* | Resources | Power & Utilities |
|---|---|---|
| Change in scope | 61.8% | 22.7% |
| Design information was issued late | 23.5% | 18.2% |
| Access to site/workface was restricted and/or late | 17.6% | 22.7% |
| Poor management of subcontractor/supplier and/or their interfaces | 20.6% | 18.2% |
| Contract management and/or administration failure | 17.6% | 22.7% |
| Approvals were late | 14.7% | 18.2% |
| Level of skill and/or experience | 8.8% | 27.3% |
| Contract interpretation issues | 17.6% | 22.7% |
| Design was incomplete | 17.6% | 4.5% |
| Cash flow and payment issues | 11.8% | 9.1% |

*Percentage of projects that had this as a primary and/or secondary cause of claim or dispute.

23 General maps | Geospatial, location data for a better world (un.org)

An inter-regional comparison, meanwhile, shows a closer alignment between Asia and the Middle East compared to other territories. A common factor is the high proportion of projects in both these regions promoted by governments rather than private developers.

## Lessons from COVID-19

The after-effects of COVID-19 are still being felt in Asia through strained supply chains. Our analysis of the claims and disputes occurring on projects scheduled to finish before or after the pandemic reveals some sharp differences (see Table H, which categorises inter-related causes under ten summary headings).

In contrast with the more economically stable and predictable era pre COVID-19, clients/employers have not been making timely decisions, which manifested in an increase in management failures (on 43.3% of projects). Contractors' ability to manage projects improved (33.3% compared with 50.0% pre COVID-19), which may reflect breaks in operations and reduced pressure on interface management and reporting duties during and after the pandemic.

It is evident that during the hiatus, contracting parties – and perhaps particularly contractors, desperate not to lose ground with contracts – took the time to study their wording closely. Much of the focus was on clauses relating to force majeure and change of law, with contractors often citing both in claims for delay with a view to securing both time and money.

The spike in contract-related claims and disputes – from 9.4% to 26.7% – was sharp. It has become increasingly clear that contracts were often unfit for purpose, not only for pandemic scenarios, but also the escalating prices post COVID-19 and the economic shocks from the Ukraine war. The inflexibility of relations between employers and contractors across the Asia Pacific region has been laid bare.

Though not as pronounced, the reduction in design failures (from 39.1% to 30.0%) is consistent with more time being available to develop design maturity before commencing works on site.

Our CRUX analysis also shows that incompatibility issues – from breakdowns in cooperation and personal or cultural clashes to socio-political frictions – apparently melted away in the post COVID-19 era.

The corollary of these findings should be an overhaul of contracts to make them more agile and a greater willingness to put the principles of partnering models, which are widely discussed, into action. As for designs, their development and maturity are within the control of one or both parties.

Although first to be engulfed by the coronavirus, Asia was cushioned from some of its worst financial effects. Large Chinese contractors, who deliver around a quarter of the region's contracts, were able, as state-owned enterprises, to absorb much of the impact.

**Table H – Claims & disputes with project finish dates pre and post-COVID**

| Top causes of claim or dispute* | Pre COVID | Post COVID |
|---|---|---|
| Change in scope | 51.6% | 40.0% |
| Management failure (contractor) | 50.0% | 33.3% |
| Design | 39.1% | 30.0% |
| Management failure (client) | 29.7% | 43.3% |
| Skills/workmanship issues | 18.8% | 16.7% |
| Access | 23.4% | 16.7% |
| Physical conditions | 18.8% | 20.0% |
| Contract | 9.4% | 26.7% |
| Cash/payment | 14.1% | 10.0% |
| Human incompatibility | 15.6% | 3.3% |

*Percentage of projects that had this as a primary and/or secondary cause of claim or dispute.

# Asia



## Industry View

A greater understanding of the factors that give rise to claims and disputes on major projects can benefit all stakeholders in the construction and engineering industry.

The CRUX Insight report's finding that projects in Asia, on average, faced claims to extend completion time by 63.3% is a cause for concern. The additional costs claimed on these projects – although lower than in other regions – were still significant, amounting to 27.3% of CAPEX.

We note the report's analysis that there is a need for greater maturity in procurement processes and design development before construction. It is also notable that the level of skill and experience of the teams delivering projects across Asia is a more prevalent cause of claims and disputes than in other territories.

CRUX correctly identifies the risks from inflation, the cost of capital and supply chain constraints as well as labour shortages. In our highly competitive markets, the scale of these challenges is great. There are also big opportunities for the companies that change and adapt.

Along with other regions of the world, we are going through a triple transformation involving working methods in the construction industry, digital technology, and sustainability. Our industry is only at the development stage in its use of data, digital technologies, and automation. These and other developments have the potential to boost productivity and accelerate decision-making as we embrace open innovation and become sustainable enterprises.

The CRUX research can help inform the industry as a whole and our clients so we are better prepared for these challenges and deliver better outcomes for society.

**Ahmed El Ghayesh**
Project Director
Taisei Corporation

## A hostile environment

Lashed by an unusually ferocious typhoon season beginning in May, Asian countries increasingly consider themselves on the front line of the climate crisis. Investment in clean energy and sustainability is increasing, though more slowly than risks from extreme weather and other environmental events. Short-term political cycles and affordability, in the region's less wealthy countries, are the main barriers to investment in enhancing resilience and energy transition.

Progress by the region's biggest emitters, China and India (see Forewarned is Forearmed, page 7), remains mixed with growth currently taking priority over sustainability. This is also true of other countries. Indonesia, for example, developed a large hydropower facility in Sumatra, while continuing to build coal-fired power plants elsewhere. Singapore is constrained by the lack of land for solar farms and busy shipping lanes offshore. Malaysia has pledged to reduce its reliance on coal, invest in large-scale solar installation, and embrace the circular economy. But access to private capital will be crucial to sustain momentum. In Asia, and worldwide, it will be lenders and investors that make the most decisive changes to the pattern and purpose of capital project investment.

In the meantime, environmental regulations are evolving. More complex to navigate, they demand greater attention and expertise from developers and contractors, who will also come under increasing pressure over their energy use. Effective government policies are needed to constrain burgeoning demand, which is driving fossil fuel use despite the growth of renewable supplies.

More time and money must be invested in ensuring designs take account of local ecosystems and biodiversity, as part of the industry's wider upskilling. In this changing environment, the heightened risk of project delays and liquidated damages spell further distress for clients.

***Critical gaps in commercial management are not helped by a lack of quantity surveying expertise.***

# Energy

## A turbulent transition

**The energy transition was always going to be challenging, and – many in the construction and engineering industry believe – potentially unachievable on a 2050 carbon net zero timescale. War in Ukraine, with Russia's weaponisation of oil and gas, sweeping trade sanctions and global economic turbulence, may have delivered the coup de grâce.**

The spike in energy prices should only reinforce the momentum behind cleaner and cheaper renewable alternatives to fossil fuels, and many governments remain committed to decarbonisation policies. However, energy insecurity and global inflation have altered political and market dynamics, at least in the short to medium term.

As the global oil and gas industry generates record profits, reinvestment is rising into extraction, refining and processing, if not exploration (though recently the UK government controversially issued hundreds of new North Sea licences).[24]

Net zero poses a socio-political dilemma, especially for democracies. Radical, sweeping change inevitably involves trade-offs and sacrifices. As voters begin to balk at inconvenience in their daily lives or extra expense (with living standards already squeezed), the populist course may be to soft-pedal the green agenda, polarising rather than leading public opinion.

Rising global temperatures, extreme weather events and alarming scientific evidence are ratcheting the tensions between short-term energy security and the existential imperative of transition. Pressure to decarbonise all sectors, including power, will continue to grow. Carbon pricing, for example, as with the EU Emissions Trading System (ETS) – the world's largest carbon trading scheme – is pushing up the costs of energy-intensive industries like cement production.

Designed to reinforce the competitive economic advantage of renewable wind and solar power over fossil fuels, the ETS also helps fuel construction inflation. All types of capital projects are impacted. We are seeing many falling into distress, especially in the energy transition space.

What factors are impeding energy projects?

### Technology – a question of maturity

Risk profiles are very different for solar and wind power. Issues over steel, grouting and composite materials in blades have generally been resolved for on- and offshore turbines, notwithstanding recent and well-publicised quality problems at the leading German-Spanish turbine manufacturer Siemens Gamesa.[25] As wind farm scale increases, the main challenges revolve around logistics and installation capacity stretching supply chains, as the base technology – and the market, at least in Europe and Asia – is now mature. The risks are well understood, and specialised manufacturers, designers and contractors should know how to manage them, including change in scope (see below). The appetite for investment is strong and growth projections bullish. However, even in this mature market, distinct challenges remain with tight commercial models and struggling supply chains, resulting in a cooling of interest in the latest development bidding rounds for the Gulf of Mexico and the UK.

With solar, the incidence of claims and disputes reflects conditions in the wind power market a decade ago. The technology continues to evolve. Components are becoming more compact. While some are cheaper to produce, others have been hit harder by inflation. The larger number of smaller players in the market and their diversity – from investors and landowners to designers, manufacturers and installers – means more variability in expertise, quality and outcomes. Solar farms may be easier to build, but intrinsic risks remain as the industry accumulates knowledge and experience.

A similar cycle has begun in the US as it embraces offshore wind power. Developers must initially import contracting expertise proven in Europe (China's being off-limits). Claims and disputes are already emerging, largely driven by regulatory and cultural factors. European installation vessels have to be retrofitted to meet federal specifications for seabed monopiles. US clients push back against foreign partners' approaches to contract management or risk allocation; the sector will inevitably suffer some growing pains. Teething problems recur, and lessons have to be learnt anew even when proven technology is transplanted to new markets and jurisdictions with their own codes and mores.

Hydrogen power promises another, steeper learning curve. Transferable knowledge from gas and oil, where hydrogen is a byproduct, will be severely limited. The standards for pipes, metallurgy and welding bear little relation to those for natural gas, given hydrogen's far higher volatility. The hydrogen rainbow – from black and brown to blue and green, depending on the production method – also demands discrete engineering skillsets.

Natural gas network operators and energy companies across Europe are collaborating on the innovation needed for the safe and efficient production, storage and distribution of hydrogen. After the extensive research and development phase, the technology's promoters would be prudent to apply the lessons from past process plant projects. Stresses often stem from the tendency of investors and owners to offload risk via lump-sum engineering, procurement and construction (EPC) contracts. But a single contractor may be expert only in some facets of a complex project, such as boiler and turbine systems, while ill-equipped to manage the risks of civils and other works.

### Regulation – mind the contractual gaps

Hydrogen and other emerging alternative sources of clean energy will galvanise governments to set up new regulatory bodies and safety inspectorates, as with nuclear.

Contracting parties need to recognise the potential ramifications of these non-contractual entities on their projects.

Offshore wind farm developers, for example, require an independent marine warranty surveyor (MWS) to mitigate risk on behalf of the insurer by verifying that installations are designed and executed to accepted standards. Marine contracts, often ambiguous or lacking clarity in this respect, may fail to provide for the impacts, in time or cost, if such MWS approvals are not forthcoming.

Contractors tend not to appreciate their exposure to these significant risks. Claims can therefore result with little or no route to establish entitlement. Lack of clarity in contracts and unknown risks will only harm supply chains and the growing alternative energy industry. Risks must be identified before they can be effectively allocated and priced. There are moves to address this in the sector, but work remains to be done. Parties involved in the energy transition should also bear in mind that the addition of tailored clauses will tend to lag the creation and growing influence of new non-contractual bodies.

### What CRUX tells us

Change in scope is the primary driver of claims and disputes on capital projects, and it is both perennial and universal. Compared with power projects exploiting fossil fuels, however, other energy contracts are more likely to be affected (see Table I). This is understandable over the longer construction programmes required for nuclear stations, extending to 15 years or more. Far more difficult to justify is the failure to fix clients' contractual requirements on offshore

24 Hundreds of new North Sea oil and gas licences to boost British energy independence and grow the economy - GOV.UK (www.gov.uk)

25 Blade break hits giant brand-new wind turbine as Siemens Gamesa woes mount | Recharge (rechargenews.com)

# Energy

## A turbulent transition

wind projects. Scope change here gave rise to conflict in 45.0% of projects, more than for any other capital and infrastructure project category. The contrast with onshore wind projects (15.0%) was also notable, whereas one in five solar schemes (21.4%) were affected.

While not as significant a factor as in other sub-sectors, change in scope may be hidden amongst other causes for onshore wind projects. Their claims and disputes tend to revolve around foundation and access route design which may be due to insufficient ground or route investigation, or changed turbine parameters. These and other aspects can be planned, priced and managed out through more effective project planning prior to procurement. The early investment will reduce such claims and disputes later.

Poor management of subcontractors, suppliers and their interfaces also challenged a high proportion of energy projects generally. This can be attributed to gaps in skills and experience and the need for training and staff development. This lack of expertise is prevalent across all industries, but the CRUX data also bears out anecdotal observations that young engineers and other construction professionals are gravitating to clean energy sectors. More than a fifth (22.4%) of non-renewable energy projects ran into difficulties due to deficits in skill and experience, while 15.3% reported worker shortages (this cause ranked 13th on the list and so is not seen in the table). This capability gap is set to widen as oil and gas contractors struggle to replace retirees from the industry's ageing workforce, impacting the delivery of upcoming projects.

However, there is a more fundamental root cause for the avoidable failings in how subcontractors are managed. Contractors, pushed on price, tailor their human resources for a winning tender rather than a successful project. It is not unusual to see a single planner allocated part-time to a complex energy project where two full-time planners were needed to cater for its multiple interfaces and critical milestones.

It may be short-sighted for a contractor to trim its team to budget rather than need, but employers bear ultimate responsibility for these false economies. Tender evaluations must then identify under-staffing of project management teams and other essential posts, even if that means further negotiation on price.

### The risk-responsibility mismatch

A large part of the problem – as with many of the other high-ranking causal factors revealed by CRUX – stems from the allocation of risk. Parties do not enter the majority of contracts with a true appreciation of the project's risk profile. Experience reviewing distressed projects confirms time and again that pricing and programming are unrealistic. Risk is still misunderstood on both sides.

The shift toward the all-risk EPC model driven by funders in the energy transition market is compounding this intrinsic mismatch. Effectively, almost all risks sit with the contractor who, in theory, has priced and factored these into the programme. At the end of the project, the extent and value of claims for costs and extended time should be very low.

In practice, and as expected, CRUX shows that on power projects, EPC contracts do indeed return better outcomes than other types of contract. However, the margin of improvement tends not to reach the level procuring parties would be aiming for. The average extension of time claimed on EPC contracts remained significant, equivalent to 41.6% of scheduled duration, compared to 58.7% on non-EPC contracts. The differential was more favourable for claimed costs. These amounted to 22.4% of committed CAPEX for the EPC model, compared with 47.6% for other forms of contract.

These comparisons demonstrate that EPC projects can and should be procured more effectively, with the aim of reducing the overruns on energy projects. Further, the party procuring using an EPC model must still expect and budget for a significant proportion of claims. If risks were properly understood and priced, EPC contracts would be set up to achieve far superior outcomes, easing some of the challenges facing the world's energy transition.

**Table I – Claims & disputes on Energy projects**

| Top causes of claim or dispute* | Non-renewable Energy | Nuclear Power Generation | Onshore wind Generation | Offshore wind Generation | Solar |
|---|---|---|---|---|---|
| Change in scope | 28.2% | 37.0% | 15.0% | 45.0% | 21.4% |
| Contract interpretation issues | 20.0% | 29.6% | 15.0% | 35.0% | 14.3% |
| Contract management and/or administration failure | 23.5% | 25.9% | 5.0% | 25.0% | 14.3% |
| Poor management of subcontractor/supplier and/or their interfaces | 25.9% | 22.2% | 10.0% | 35.0% | 0.0% |
| Design information was issued late | 23.5% | 22.2% | 5.0% | 30.0% | 21.4% |
| Level of skill and/or experience | 22.4% | 18.5% | 5.0% | 10.0% | 7.1% |
| Claims were spurious | 25.9% | 18.5% | 5.0% | 10.0% | 7.1% |
| Physical conditions were unforeseen | 16.5% | 14.8% | 30.0% | 30.0% | 28.6% |
| Materials and/or products were delivered late | 16.5% | 22.2% | 25.0% | 25.0% | 28.6% |
| Access to site/workface was restricted and/or late | 21.2% | 3.7% | 25.0% | 20.0% | 14.3% |

*Percentage of projects that had this as a primary and/or secondary cause of claim or dispute.

# Resources

## Cost pressures escalate

**Economic turbulence following the global pandemic and Ukraine invasion has created winners and losers in the resources sector, spawning many disputes.**

### Disputes take off

Amid sharp fluctuations in market prices, off-take contracts are being breached. Producers able to secure higher spot prices decide not to supply under contracts agreed when markets were more stable. Conversely, when commodity prices have fallen back, buyers seek to terminate agreements tying them into unfavourable terms; these might be double the going rate, if not more (for example, in 2022, weak Chinese demand pushed iron ore prices down from $150 a tonne to a low of $80).

As in other industries, capital projects are under tremendous pressure from cost escalation. Construction and engineering contractors make the case that employers should absorb cost increases, given the inflated value of resources extracted through their newly built assets. Despite higher operating costs over the life of these assets and continuing volatility in commodity markets, many owners are reaping far greater rates of return.

Amid what now seems an economic perma-crisis, the number of contracts with no provision for price escalation is startling. In Africa, for example, Asian contractors have taken on fixed-price contracts amid fierce competition. Many projects in Saudi Arabia also lack formal escalation clauses. However, a 2019 Royal Decree in the Kingdom does offer the prospect of some entitlement to claim for inflated costs in contracts with government entities.[26] Under certain circumstances, contract values can be increased by up to 10%, or decreased by up to 20%, to allow for variations in costs. The safety net should encourage contractors to continue bidding, but there has been a reluctance so far to exercise this option, perhaps for fear of jeopardising future bids.

### Non-renewable resources

The global transition to renewable energy sources is fuelling further uncertainty. In the shorter term, the position of fossil fuels has been bolstered by hard economic and industrial realities.

Many economies depend on exploiting reserves of coal for fuel or export, and not only developing countries. Australia, though signed up to net zero by 2050, relies on resources (including coal) for two-thirds of its exports. Iron ore and coal together were worth more than A$200 billion a year, but their value is falling sharply. The stakes for the national finances are high, with the economy of China, its biggest market, faltering and political relations strained.

The race to net zero and renewable sources of energy has also slowed as governments recognised their market constraints. Countries lack the skillsets and capacity in engineering and design, and in construction, to deliver the sheer number of projects envisaged at the pace required.

Oil and gas are benefiting from this softening of commitment to decarbonisation. The investment boost will be mainly in technologies and projects that prolong the life and maximise extraction from existing assets, rather than new ventures and exploration.

Some fresh developments have been enabled by the energy crunch unleashed with the Ukraine war, such as Shell's Jackdaw gas field in the North Sea.[27] But as the world counts down towards carbon neutrality, hydrocarbon projects will no longer meet their minimum payback period of 25 years. Funds for investment will run dry before the last wells.

The supply of human resources to the resources industry, and oil and gas in particular, is also drying up as young talent diverts to cleaner and greener pastures.

26 https://www.reuters.com/article/saudi-arabia-procurement-lawmaking-idUSL8N24H5ZN
27 Shell's Jackdaw Project | About Shell UK

### Industry Insight

"Investment decisions and project planning are being shaped by geopolitical and other forces beyond the normal swings in commodity prices.

By fuelling cost escalation, high oil prices add to the pressures on capital projects and supply chains, even as they finance reinvestment to sweat existing assets. Meanwhile, metals mining is boosted by the scramble to secure lithium, cobalt and other minerals essential for the low-carbon transition.

Change in scope and design-related issues are the main drivers of disputes and claims on resource extraction projects. Further CRUX analysis reveals how resultant costs surpass other industries: sums in dispute averaged 41.0% of project CAPEX, versus the 33.6% global average. Within the sector there are significant cost differences also – the 29.5% average for mining and metals rose to 45.3% for offshore oil and gas. Design-related disputes are more evident in mining than oil and gas, which is most often disrupted by scope change. The remedies for mitigating these risks are well rehearsed in this and previous CRUX reports.

**Ben Highfield**
Partner, Regional CEO, Asia-Pacific
HKA"

### Causes of conflict

Although claims and disputes are not generally attributed to lack of experience or skills shortages, these are almost certainly contributory factors. Scope change, for example, is exacerbated by a lack of experienced project managers and engineers on both contractor and client sides. This causation factor is more prevalent in resources than other industries (see Table J). Overall, less than half of projects (47.6%) experience conflicts arising from scope change – but more than half in oil and gas (51.1%) – notably more than in all other sectors (37.2%).

Similarly, shortages of key staff disrupt the design process, giving rise to delays. Lateness of design was the industry's second-ranked cause of claims and disputes, affecting more than a quarter (26.7%) of resources projects – and more than one in three (36.1%) involving mining and metals. As in the energy transition sector, employers' unrealistic expectations of EPC contracts and contractors breaking new ground are distorting the risk profiles of projects. With many top-tier contractors experienced in the sector working at capacity, firms previously focused on construction and engineering in other sectors are exploring opportunities in new markets, including resources. However, even when such a project team has co-opted members with relevant experience, a plethora of unfamiliar specifications, technical standards, health and safety and other requirements, and ways of working can lead to significant overruns and losses for a contractor on strange ground.

Another complicating factor, especially on oil and gas contracts, is the requirement for local content. Contractors typically increase their prices to cover the need for additional management and oversight, training and, where necessary, stepping in to complete indigenous contractors' works themselves. Countries in regions such as the Middle East have now developed local capabilities. African and other states who define their local requirements more broadly will allow the contractor to match the needs of the project to the domestic market without charging such a premium.

**Table J – Claims & disputes on Resources projects**

| Top causes of claim or dispute* | Resources | Mining & Metals | Oil & Gas | Other Sectors |
|---|---|---|---|---|
| Change in scope | 47.6% | 38.9% | 51.1% | 37.2% |
| Contract interpretation issues | 22.7% | 13.9% | 23.7% | 19.2% |
| Design information was issued late | 26.7% | 36.1% | 26.7% | 21.7% |
| Access to site/workface was restricted and/or late | 24.5% | 27.8% | 19.3% | 16.7% |
| Contract management and/or administration failure | 19.0% | 22.2% | 20.0% | 19.6% |
| Approvals were late | 19.4% | 11.1% | 16.3% | 14.6% |
| Design was incomplete | 20.9% | 30.6% | 19.3% | 21.8% |
| Physical conditions were unforeseen | 18.3% | 13.9% | 12.6% | 17.7% |
| Materials and/or products were delivered late | 16.8% | 25.0% | 13.3% | 8.9% |
| Poor management of subcontractor/supplier and/or their interfaces | 17.2% | 25.0% | 14.8% | 19.8% |

*Percentage of projects that had this as a primary and/or secondary cause of claim or dispute.

# Transportation Infrastructure

## Fast track to disruption

**With the end of super-low interest rates, governments are less inclined to take on heavy debts to fund major transportation infrastructure.**

COVID-19 too has cast a longer shadow in this market with potentially far-reaching effects. Travel patterns have changed, perhaps permanently, in countries worldwide. Combined with the high cost of capital, the business case and even viability of transport schemes serving city centres is weaker.

Digitally connected, well-planned '15-minute cities' should reduce the need for mass or long-distance mobility. Nevertheless, growing urbanisation, especially in developing countries, will require transportation projects which, in turn, can have catalysing effects on economic development.

Infrastructure deficits exist not only in less developed countries. Since the 1960s, public investment in US infrastructure as a share of GDP fell by around 40%.[28] In 2021, the $1 trillion bi-partisan Infrastructure Bill allocated $240 billion to rebuilding roads, bridges, public transport, airports and railways.[29]

As Australia also found during its more recent construction boom, surges in investment tend to overwhelm national capacity and capability to deliver. The risk is that public funds are not spent to best effect. American projects must compete for material resources and international contracting expertise with gigaprojects in the Middle East. As well as the vast futuristic city of NEOM, Saudi Arabia's $7 trillion Vision 2030 programme includes several new airports plus tram and highway networks serving regional tourism developments.[30]

Sustained development supported the growth of Asia's megacontractors. Stop-start infrastructure investment elsewhere hollowed out market capacity. Expert teams dissolve and skills lose their currency during long gaps between projects. Fewer contractors have the heft to take on massive projects. Major design consultancies have switched their focus to growth markets, such as green energy and defence.

Ever-bigger and more complex transport infrastructure projects also expose a vast critical competency gap through their need for integration. Rail projects, in particular, involve multiple main contractors and interfaces between tunnels, stations, tracks, electrification, rolling stock, signalling, and traffic control and management systems. A holistic view of this system of systems is required.

### Tracking disputes

Deficient planning and coordination largely explain the uptick we have seen in rail disputes. Delivery of road and rail projects is also complicated when design responsibility is fragmented and public-private partnerships (PPPs) involve contractors, financiers, concessionaires and other parties, some with shorter-term agendas.

On the face of it, claims and disputes on transportation projects are driven by much the same factors as other capital schemes. Change in scope not only ranks highest, but it is also a primary or secondary cause of conflict on 57.1% of rail and transit projects; and even 41.3% of road schemes. Design failures are also to the fore, again more so with rail and transit than other transportation infrastructure projects, as can be seen in Table K below.

However, these and other high-ranking causes of conflict are often symptoms of a more fundamental issue. Delivery of any capital project suffers when preconstruction activities are concertinaed to fast-track construction. Transport infrastructure is a case in point. Governments are inclined to announce new rail schemes – with start and completion dates, and price tags – before detailed planning and analysis have been completed. From the outset, projects are racing to meet unrealistic commitments.

28 Modernizing U.S. Infrastructure: the Bipartisan Infrastructure Law | CEA | The White House
29 How will America spend its $1 trillion infrastructure bill? | World Economic Forum (weforum.org)
30 https://www.arabnews.com/node/1947546/saudi-arabia

### Industry Insight

"Transportation infrastructure is a proven catalyst for economic growth and development.

The World Economic Forum estimated that the global gap in infrastructure will stretch to $15 trillion by 2040*. However, economic uncertainty, high capital costs and construction inflation are slowing the flow of investment even as it needs to be ramped up for the low-carbon transition and futureproofing of infrastructure.

Notwithstanding the changes in travel demand in cities post-COVID-19, rapid urbanisation also continues to drive demand, which in turn, calls for vision and ambition.

* https://www.weforum.org/agenda/2019/04/infrastructure-gap-heres-how-to-solve-it/

Visible pipelines of strategically programmed projects give financiers and the industry more confidence to invest. But robust preconstruction planning and mature designs are essential to achieve successful outcomes and meet the needs of owners and society. All too often transportation projects are compromised in the rush to start work.

Innovation, sustainability goals, smarter regulation, and new technologies have important roles to play, but contracting parties who learn the lessons of past disruption hold the levers to transform infrastructure delivery."

**Amanda Clack**
Partner, Regional CEO, EMEA HKA

Linear rail and road schemes are also a special case when it comes to ground conditions and access. Ground investigations rely on sample borehole tests along a route, with interpolated estimates in between. When rock is harder or higher than anticipated, for example, excavation time and cost increase. If tunnelling, softer rock may require a redesign and lining. In urban areas, uncharted underground services compound diversionary works. Transportation assets are also unusual in that they must be operated as they are rebuilt or expanded. Working alongside a live railway or highway is inherently difficult as well as dangerous.

### Futureproofing infrastructure

All capital assets need to be futureproofed as far as possible to protect their value and serviceability. The challenge is immense, given the long design life of transport infrastructure and the risks coming down the track, particularly with the increasing frequency of extreme weather events due to climate change. Rails, road pavements and bridge structures must withstand higher temperatures and flash floods, and in some coastal areas rising water levels. Building in resilience against extreme weather events and a wider range of stresses requires new thinking and innovation in all parts of the world as the climate emergency intensifies.

Despite its advanced signalling and traffic management systems, the transport industry has, by and large, been slower than others to embrace new technologies. The conservatism of the rail industry is reinforced by regulatory frameworks imposing multiple layers of approval. Retrofitting rail systems is also fiendishly complex. Road users navigate using GPS, yet the infrastructure relies on analogue systems for dynamic lane allocation based on traffic movement, while the driverless future is still some way off.

Approval frameworks also require re-thinking to allow other innovations without compromising safety. Structures are built with extra steel and concrete to meet archaic requirements and ensure approval. This unnecessarily high embedded carbon may offset other measures that enhance sustainability.

At the same time, redundant capacity must be built into transportation infrastructure to cater for future demand. Scale is another matter raising philosophical questions about purpose, aesthetics and social impact. Sydney's Harbour Bridge, built with a 100-year design life, is able to carry today's 12 traffic lanes within an iconic structure. Riyadh's King Abdullah metro station, designed by starchitect Zaha Hadid, makes its own statement about Saudi Arabia's modernisation and global ambitions and will serve a projected population of 8.5 million.

While striking a balance with buildability, transport megaprojects can be transformative, providing a socio-economic legacy as well as long-running service to the public. Upheaval and disruption are unavoidable during construction in cities. Meticulous planning is also imperative in rural areas, putting a greater onus on project teams to work collaboratively with environmental watchdogs and special interest groups.

The ultimate challenge is not only to mitigate the risks that drive transportation projects off track, but to engineer such a step change in the quality of infrastructure that the dislocation is justified and forgotten.

**Table K – Design related causes of claims & disputes on Transportation Infrastructure**

| Design causes of claim or dispute* | Rail & Transit | Other Transport |
|---|---|---|
| Design information was issued late | 37.0% | 18.0% |
| Design was incomplete | 40.3% | 21.2% |
| Design was incorrect | 26.1% | 24.9% |
| All design issues | 60.5% | 45.2% |

*Percentage of projects that had these issues.

# Europe



**Europe's economies were shown to be resilient, but failed to regain the momentum lost to the shocks reverberating from the Russia-Ukraine war, hard on the heels of the pandemic. The European Union's modest growth forecasts have been downgraded (to just 0.8% and 1.4% for 2023 and 2024, respectively).[31] The UK faces more stubborn inflation and the prospect of a sharp recession in construction this year.[32]**

Private capital still favours the continent's more mature and stable markets, bolstered by EU commitments to green investment, emulating the industrial ambitions of the US and China, on top of recovery funding for member states. Amid the many significant investment opportunities across Europe, there are also serious risks, amplified in the UK by the long-term impacts of Brexit now manifesting particularly in skills shortages.

Our CRUX analysis encompasses 491 projects spread across 29 countries, throughout Europe. The average project CAPEX was $667 million, while the values of disputed time and money fell toward the middle of the global spectrum. Extensions of time sought by contractors were, on average, equivalent to 60.4% of scheduled programmes. The cost of claims typically amounted to 36.2% of a project's CAPEX.

## Causes and effects

The global CRUX dataset shows that design-centric failures sit near the top of most rankings of the causes of claims and disputes, though change in scope (to which they contribute) perennially takes the top slot. But not in Europe, where incorrect design has that dubious distinction, disrupting the delivery of nearly one in three projects (32.3%, see Table L).

There is no question that the design market in this region is under a lot of pressure. Design teams are squeezed on budgets and programmes. Design costs – reflecting professional pay rates – tend to be higher. More universal is the haste of employers to start construction (for understandable but risk-laden reasons), undervaluing planning and preparation. It is not so much that the preconstruction phases of major infrastructure and capital projects are rapid, more that the critical importance of this upfront focus is not fully recognised, or the consequences of neglect are not sufficiently understood.

And this design dilemma is not just a European problem. While design errors across the board rank highest, the incompleteness and lateness of designs are comparatively lower in its top ten, but second and third for the rest of the world. Collectively, this design triple whammy is the dominant driver of project distress worldwide, even eclipsing change in scope (with which design is inextricably entwined).

Moreover, scope change may be distorting the diagnosis of projects' performance problems, and the remedies. Some degree of change is inevitable, especially on megaprojects, as employers redefine their requirements, or unexpected ground conditions necessitate scope and design changes. By now, the industry should be more adept at managing this process and build in greater financial risk contingency to account for it.

However, the process of producing a complete design for construction should be the most controllable aspect of project delivery. Such a recurrent project-critical failure demands to be addressed wherever practicable. The fault lies less with the competitive nature of design consultants competing on meagre margins; and more with the failure to fund better designs. If projects were properly planned and priced, then flawed, late or partial designs would be avoided.

Employers need to accept that the 'long road is the short road'. Getting spades in the ground as early as possible may denote progress for senior leaders and project financiers eager to reap returns on their completed asset, but a premature start may impede delivery later.

Deficiencies in workmanship and the levels of skill or experience also loom larger in Europe than other regions as causes of claims and disputes. Poor workmanship, cited on more than a quarter (25.4%) of projects, tends to be attributed to the quality of training and calibre of recruits to the workforce. However, the correlation with the high prevalence of lump-sum contracts awarded to the lowest bidder is probably stronger. As contractors rush to complete jobs quickly and move on to the next site, quality inevitably suffers.

Strains on supply chains in Europe, with strong inflation and the after-effects of the COVID-19 pandemic, are no less acute than elsewhere. Poor management of interfaces with suppliers and subcontractors ranks fifth (based on both primary and secondary causes), perhaps reflecting the region's greater reliance on subcontractors as well as its intense cost pressures.

## Building types and disputes

The largest category of projects within the CRUX dataset for Europe were buildings (residential, retail, commercial, and other types – from government, healthcare and education to leisure and tourism). Analysis reveals some notable differences between market segments (see Table M).

Again, workmanship deficiencies are a prominent cause of conflicts, more so on residential schemes (38.3%) than other buildings. Compared with retail and commercial projects, volume housebuilding and low-rise residential development tend to employ a lower-

**Table L – Claims & disputes in Europe & the Rest of the World**

| Top causes of claim or dispute* | Europe | RoW** | Europe | RoW |
|---|---|---|---|---|
| Design was incorrect | 1 | 7 | 32.3% | 19.5% |
| Change in scope | 2 | 1 | 28.4% | 42.7% |
| Workmanship deficiencies | 3 | 12 | 25.4% | 14.5% |
| Contract interpretation issues | 4 | 4 | 18.2% | 20.4% |
| Poor management of subcontractor/supplier and/or their interfaces | 5 | 8 | 20.4% | 19.1% |
| Contract management and/or administration failure | 6 | 5 | 17.0% | 20.5% |
| Design was incomplete | 7 | 3 | 18.8% | 22.7% |
| Design information was issued late | 8 | 2 | 17.2% | 24.5% |
| Level of skill and/or experience | 9 | 14 | 15.3% | 13.1% |
| Physical conditions were unforeseen | 10 | 9 | 15.3% | 18.7% |

*Rank is based on both primary and secondary causes of claims and disputes. The percentage represents the proportion of projects on which a cause featured (whether primary and/or secondary).
**Rest of the world.

31 Summer 2023 Economic Forecast: Easing growth momentum amid declining inflation and robust labour market (europa.eu)
32 CPA Forecasts Recession in Construction for 2023 (constructionproducts.org.uk)

**491**
projects

**29**
countries

**$667m**
average CAPEX

**36.2%**
average cost claimed

**60.4%**
average EOT claimed

# Europe



**Table M – Claims & disputes on Buildings projects**

| Top causes of claim or dispute* | Residential | Retail & Commercial | Other Buildings |
|---|---|---|---|
| Design was incorrect | 29.0% | 36.8% | 37.3% |
| Workmanship deficiencies | 38.3% | 23.7% | 27.7% |
| Change in scope | 15.0% | 22.4% | 25.3% |
| Contract management and/or administration failure | 12.1% | 11.8% | 20.5% |
| Poor management of subcontractor/supplier and/or their interfaces | 12.1% | 22.4% | 15.7% |
| Design was incomplete | 13.1% | 14.5% | 22.9% |
| Contract interpretation issues | 7.5% | 13.2% | 15.7% |
| Design information was issued late | 7.5% | 14.5% | 20.5% |
| Installation failure | 11.2% | 13.2% | 16.9% |
| Physical conditions were unforeseen | 8.4% | 11.8% | 12.0% |

*Percentage of projects that had this as a primary and/or secondary cause of claim or dispute.

**Table N – Claims and disputes in UK & the Rest of Europe**

| Top causes of claim or dispute* | UK | Rest of Europe |
|---|---|---|
| Design was incorrect | 32.8% | 29.9% |
| Change in scope | 25.4% | 42.5% |
| Workmanship deficiencies | 27.4% | 16.1% |
| Contract interpretation issues | 14.9% | 33.3% |
| Poor management of subcontractor/supplier and/or their interfaces | 18.4% | 29.9% |
| Contract management and/or administration failure | 16.4% | 19.5% |
| Design was incomplete | 18.7% | 19.5% |
| Design information was issued late | 15.4% | 25.3% |
| Level of skill and/or experience | 12.2% | 29.9% |
| Physical conditions were unforeseen | 13.7% | 23.0% |

*Percentage of projects that had this as a primary and/or secondary cause of claim or dispute.

skilled workforce, working at pace and often on lower margins. Meanwhile, retrofit as well as new-build residential schemes were represented in the dataset, including high-rise external cladding works.

> *Incorrect design tops the ranking, disrupting the delivery of nearly one in three projects.*

Developers, owners and lessees demand higher quality control in the construction of their commercial buildings, which are usually more complex, with sophisticated services and technology. This accounts for the higher incidence on retail/commercial and other (non-residential) building types: of design errors (where the gap is around 7-8% higher than residential projects); scope change (7-10% higher); and poor management of interfaces (3-10%).

Further analysis also reveals that claimed costs on retail and commercial schemes (at 18.9%) were typically less than half the proportion seen in other building categories. The gap was smaller for extensions of time (averaging 53.6% of planned schedules for retail and commercial, 64.8% for residential, and 61.1% for all other buildings).

Notwithstanding this sub-par performance in residential, other segments of the market could potentially learn some lessons from housebuilders' tighter management of the supply chain. Even in bespoke structures, there is scope to standardise some repeatable core elements.

## UK after Brexit

With the UK now operating firmly outside of the EU bloc, divergence from the practices and economic cycle of the continental construction and engineering industry may widen over time. CRUX data on the comparative patterns of dispute causation within the UK and the rest of Europe (see Table N) more likely reflects historical trends – and the impact of the pandemic and economic aftershocks – rather than emergent Brexit effects.

Workmanship deficiencies are cited more often on UK projects (27.4% versus 16.1%), and incorrect design to a lesser extent. Other factors in project distress are less prevalent. Counter-intuitively, given the 'Brexodus' of EU nationals and media reports of job vacancies, even levels of skill and experience were associated with a lower level of claims in the UK (12.2%) compared with continental Europe (29.9%). There is evidence from CRUX that – where skills gaps have given rise to disputes – claimed extensions of time have lengthened considerably for projects scheduled to complete post-Brexit compared with those on pre-2020 timescales. The prolongation was significant, but it is not yet possible to separate the effects of workforce pressures from the pandemic and other factors.

Given the impacts on trade – estimated to cost the UK economy £100 billion a year[33] – the construction and engineering industry is bound to suffer direct and indirect impacts on construction products manufacturing as well as overall activity. At more than five thousand, construction company insolvencies are 16.5% up on 2022.[34]

After intense lobbying by the construction industry, immigration rules have been relaxed for some workers. The UK has a traditionally strong skills base in quantity surveying, planning and commercial management (which may partly explain the comparatively low incidence of many CRUX causal factors). But the international advantage conferred by English language and law may be a double-edged sword for domestic employers if gigaprojects overseas lure professional talent away with career-high opportunities and rewards.

## Opportunities and risks

Aside from the huge challenges posed by the inflated and unstable costs of materials and resources (especially energy), capacity is an immediate and serious concern for the pan-European construction and engineering industry.

33 https://www.bloomberg.com/news/articles/2023-01-31/brexit-is-costing-the-uk-100-billion-a-year-in-lost-output

34 Construction insolvencies up one third on last year | News | Building

# Europe



## Industry view

This year's CRUX Insight Report highlights the importance of the delivery and assurance of a 'right first time' design service and the significant impact design flaws can have on increasingly complex infrastructure programmes. Fundamentally, clients seek two things from their investment; value creation and predictability.

The emergence of claims and disputes for additional costs and delay – from any source not just design shortcomings – are a direct threat to those aspirations. As with previous editions, the CRUX report provides credible analysis of the key causes of dispute and highlights the impact of workmanship and interface management shortcomings.

In addition, commentary on the prevalence of lump-sum/fixed price contracting in mainland Europe is worthy of debate, and in many ways counter-intuitive to the collaborative approaches being taken in the UK. Whilst lump-sum contracting has its place, it can be a 'blunt tool' with regards the pursuit of predictability. UK infrastructure clients are seeking predictability and value creation through enterprise models and progressive forms of contract such as the NEC4.

Our challenge in the UK, as in Europe, is to achieve net zero whilst building greater asset resilience and transforming delivery capability in a way that is safe, efficient, adds value and is predictable. And to be predictable, you need to avoid the inefficient and corrosive effects of claims and disputes and to do that, you need to understand the genesis of dispute.

Stakeholders, clients and key suppliers would do well to consider the extent to which these aspects are described and analysed in this year's CRUX report.

**Stephen Blakey**
**FRICS,FCInstCES, FICW**
Strategic Commercial Director
North West & Central, Network Rail

From materials and the supply chain through to workforce planning, such shortages risk becoming acute, and in the medium term, chronic.

School leavers and graduates are not being attracted in sufficient numbers to renew an ageing workforce. There are more women in consultancy roles, but little progress in addressing the gender imbalance overall. A 'shout first, ask later' culture on site reflects a wider resistance to change. While the pay gap with other industries may be bridged, perceptions persist that careers in IT, high-tech fields, finance and services are more comfortable and fulfilling. Yet those same digital and tech-savvy skills will be crucial in solving the productivity, capacity and sustainability challenges facing construction, as well as transforming its image.

There are huge opportunities in the transition to carbon net zero, requiring investment in renewable energy, grid connectivity, hydrogen storage and distribution, as well as retrofitting existing buildings. The supply-side risk is that other markets, particularly the Middle East, bid up the prices of materials and suck up resources, exacerbating construction inflation and supply chain strains.

Other obstacles range from bureaucratic planning controls to new regulations on embedded carbon in the built environment. Though essential, innovations must avoid repeating past mistakes such as asbestos, combustible cladding and reinforced autoclave aerated concrete (RAAC).

To overcome these challenges, proactive leadership is needed not just in the construction and engineering industry, but also from government, regulatory authorities, and investors.

***Deficiencies in workmanship and levels of skill or experience also loom larger in Europe.***

# Middle East



**Fuelled by buoyant energy prices and sovereign funds, oil-rich states in the Middle East are enjoying an expansive phase, projecting their culture and influence as they diversify their economies. With investment swelling a formidable pipeline of infrastructure and capital projects, there are clear risks of over-heating in the regional market, with potentially far wider repercussions.**

As well as intra-regional differences in wealth and development, there is also divergence in how states approach contracting and associated project outcomes. Amid encouraging signs of a cultural shift to a less rigid strategy, this tentative trend's significance will become more apparent as the region's hugely ambitious and somewhat daunting gigaprojects come to fruition.

The CRUX dataset includes 410 projects involving 12 countries across the region. Their average value was $1.61 billion in CAPEX committed by the time of our analysis. Programmes in the Middle East continue to suffer some of the most significant overruns. The extended time sought by contractors was typically 82.0% of planned schedules; only marginally less than the worst prolongation in any region (Africa's 82.9%). Claimed costs averaged out at more than a third (35.1%) of CAPEX per project.

## Causes and effects

Change in scope and failures to complete designs in a timely manner – driven by employers' desire to get works underway on site – form a nexus of causation for conflict on Middle Eastern projects (see Table O). More than half of projects (57.3%) suffered from scope changes, while designs that were late (34.9%) or incomplete (30.5%) also afflicted a disproportionate number of projects (in many cases, the same ones).

Many of the projects analysed are first-of-a-kind and complex, often located in challenging locations, which can make it more difficult to attract and retain experienced staff. But the top-ranking causes of claims and disputes in the region tend to stem from timescales that are unrealistic, compounding the inherent obstacles to successful delivery.

Projects often go out to tender before the employer's requirements are fully defined, or when designs are not adequately developed. Lack of clarity on what the contractor is to deliver inevitably leads to disputes over whether something is a change or not.

Claims arising in the early stages of fast-tracked projects are not resolved expeditiously, with negative ongoing effects on the project programme and costs as a whole. More than one in four projects (26.6%) are embroiled in cash flow and payment issues, which rank twice as high (seventh) as a causation factor than in the rest of the world. Faster mobilisation increases the pressure on cash flow, but contractors are generally in a weak position when negotiating payment terms and seeking remedies for late payments.

Overly bureaucratic systems slow the necessary approvals, compounding this problem and also resolution of contract interpretation issues. Late approvals (ranked sixth, in contrast with 15th outside the region) were cited as triggers for conflict on 27.1% of projects. Where multiple projects are underway and planned, there may be additional delays due to the volume of applications and because the authorities must take account of future projects, which are not themselves fully defined.

However, we are seeing some evidence of changes in the approach to contracting, including the introduction of Dispute Adjudication Boards, which could help work to progress while disagreements are resolved in parallel.

## Alternative approaches

Contractors may have limited options, apart from following the many international contractors who have turned their back on certain markets and their high risks. Many are exposed to price fluctuations. Some niche contractors have bolstered their positions by building stronger relationships with clients over time.

However, many employers – not least in oil and gas – are exploring alternative procurement models to lump-sum contracts with a view to managing risk more effectively. Options include cost-plus or target price, still novel in the region.

Saudi employers are experimenting with early contractor involvement; the suitability of the UK's Construction Playbook for the region is being studied by a construction industry

**410**
projects

**12**
countries

**$1.61bn**
average CAPEX

**35.1%**
average cost claimed

**82.0%**
average EOT claimed

**Table O – Claims & disputes in the Middle East & Rest of the World**

| Top causes of claim or dispute* | Middle East | RoW** | Middle East | RoW |
|---|---|---|---|---|
| Change in scope | 1 | 1 | 57.3% | 33.3% |
| Design information was issued late | 2 | 8 | 34.9% | 18.8% |
| Contract interpretation issues | 3 | 4 | 28.8% | 17.1% |
| Design was incomplete | 4 | 7 | 30.5% | 19.0% |
| Contract management and/or administration failure | 5 | 6 | 25.6% | 17.7% |
| Approvals were late | 6 | 15 | 27.1% | 11.8% |
| Cash flow and payment issues | 7 | 14 | 26.6% | 11.5% |
| Access to site/workface was restricted and/or late | 8 | 10 | 25.4% | 15.7% |
| Poor management of subcontractor/supplier and/or their interfaces | 9 | 5 | 20.0% | 19.3% |
| Design was incorrect | 10 | 2 | 20.0% | 23.9% |

*Rank is based on both primary and secondary causes of claims and disputes. The percentage represents the proportion of projects on which a cause featured (whether primary and/or secondary).
**Rest of the world.

**Table P – Claims & disputes on Oil & Gas projects: Pre and post-COVID**

| Top causes of claim or dispute* | Pre-COVID | Post-COVID |
|---|---|---|
| Change in scope | 51.3% | 33.3% |
| Design information was issued late | 23.1% | 6.7% |
| Contract interpretation issues | 10.3% | 33.3% |
| Design was incomplete | 17.9% | 13.3% |
| Contract management and/or administration failure | 15.4% | 6.7% |
| Approvals were late | 23.1% | 20.0% |
| Cash flow and payment issues | 20.5% | 6.7% |
| Access to site/workface was restricted and/or late | 33.3% | 6.7% |
| Poor management of subcontractor/supplier and/or their interfaces | 10.3% | 6.7% |
| Design was incorrect | 17.9% | 13.3% |

*Percentage of projects that had this as a primary and/or secondary cause of claim or dispute.

# Middle East



working group in Dubai; while in Abu Dhabi, there are moves to restrict the degree to which FIDIC contracts are amended for public sector works, in line with the standard form's 'golden principles'. The rate at which these initiatives are being adopted in practice is less clear, however.

The Middle East remains behind the curve amid a global shift to more collaborative contracting models. Employers pay a price for transferring risks onto contractors, who may not be best placed to deal with factors such as cash flow pressures or price fluctuations. More need to consider whether they really get value from engineering, procurement and construction (EPC) arrangements. Also, in hot economies such as Saudi Arabia, they must bear in mind that the balance of power is likely to shift back to contractors, as before the 2007 financial crash.

For now, it is still unclear whether these signals are merely a correctional trend, reflecting the economic cycle, or the first stages of wholesale change away from a procurement model seen to be fundamentally flawed.

> *Saudi Arabia and UAE are more closely aligned than Qatar, where project performance appears to be lagging.*

## Post-pandemic fallout

The cycle in world oil prices will also play out in the construction market over time, but the influence of the pandemic is more evident in the CRUX dataset (see Table P).

Analysis of projects by scheduled completion period confirms the benign by-product – also seen in other regions – of downtime applied to design development. Claims and disputes were far less likely to be triggered by the lateness of design information (down to 6.7% of projects from 2020 onwards, compared with 23.1% in the period before) or incomplete or incorrect designs which both fell (from 17.9% to 13.3%) after the pandemic.

Scope management may also have benefitted, though descoping of oil projects after the price slump of 2015 will have inflated this cause of claims and disputes over several years.

Conflicts over contract interpretation have, unsurprisingly, spiked in the period since COVID-19, centred on claims for extra time and/or money under force majeure or change of law clauses. The data also shows that the region generally managed to find commercial solutions during the pandemic: the percentage of projects affected by cash flow and payment issues fell from 20.5% in the years before COVID-19 to just 6.7% afterwards.

## Energy market dynamics

The timeliness of design information is also a distinguishing factor when comparing oil and gas projects with works in the power market – both important categories in the Middle East analysis.

National oil companies have well-established CAPEX programmes and development experience. In such a mature market employing tried and tested techniques, designs tend to show similar maturity.

Power generation projects are more likely (43.5% compared with 22.4%) to be thrown off course by delayed designs. More project-specific challenges tend to add to project complexity. The specifications of high-tech elements in electricity generation infrastructure are also evolving rapidly, even as projects progress.

Despite the fossil fuel market's maturity, changing performance specifications on oil and gas projects – usually to upgrade capacity – still contribute to a higher level of scope change (53.4% are affected, versus 34.8% for power contracts). This is contributing to poorer outcomes in terms of claims for delay and, even more so, quantum, quadrupling the level of claimed costs seen on other (non-fossil) power projects. The average sum in dispute amounted to 46.2% of oil and gas projects' CAPEX, against just 13.7% for other energy schemes. For extensions of time, the differential was still significant – averaging 65.7% of planned oil and gas programmes, compared with 45.4% for other power projects.

## Intra-regional divergence

Within the Middle East, and even among the Gulf states, there are some notable differences in how projects are procured and managed, and variations in the incidence of claims and disputes that result (see Table Q).

In the United Arab Emirates (UAE), for example, we have observed a gradual improvement in contracting strategies; and a lower proportion of its projects experienced failures in contract management or administration. Meanwhile, Saudi Arabia, having been one of the least attractive markets for contractors, has overtaken its neighbours over the last five or six years in this respect. Such is the scale of the Kingdom's capital programme that these more progressive approaches have had to be embraced.

The two territories are more closely aligned with each other than Qatar, where project performance appears to be lagging. All of the top causes of claims and disputes are more prevalent on the peninsula than in one, if not both, of the bordering states. Whereas there are multiple employers elsewhere, the Qatari state effectively controls all major projects, imposing strict terms and conditions. Hierarchical management structures limit flexibility and hamper changes in procedures and practice to reflect lessons from past projects.

As host for the 2022 FIFA World Cup, the state had to deliver a significant construction programme involving complex football stadia and other developments by an immovable deadline and under the spotlight of world's media. Repurposing this infrastructure presents a fresh challenge for the country and its construction industry.

## Risk landscape

While the economic risks are greater for countries that lack oil and gas resources, there are other technological, environmental and social factors to consider in the region.

More legislation is in the offing to promote the sustainability of new build. Apart from regulatory compliance, infrastructure and capital projects will

**Table Q– Claims & disputes in Qatar, UAE & Saudi Arabia**

| Top causes of claim or dispute* | Qatar | UAE | Saudi Arabia |
|---|---|---|---|
| Change in scope | 71.1% | 59.4% | 54.0% |
| Design information was issued late | 53.9% | 30.8% | 34.5% |
| Contract interpretation issues | 34.2% | 28.0% | 26.5% |
| Design was incomplete | 43.4% | 31.5% | 30.1% |
| Contract management and/or administration failure | 38.2% | 19.6% | 23.0% |
| Approvals were late | 36.8% | 23.8% | 31.9% |
| Cash flow and payment issues | 23.7% | 26.6% | 33.6% |
| Access to site/workface was restricted and/or late | 32.9% | 15.4% | 34.5% |
| Poor management of subcontractor/supplier and/or their interfaces | 22.4% | 17.5% | 23.0% |
| Design was incorrect | 28.9% | 12.6% | 21.2% |

*Percentage of projects that had this as a primary and/or secondary cause of claim or dispute.

# Middle East



## Industry view

Inflation and high interest rates are curbing economic growth, but the Middle East is better resourced than other regions to sustain capital investment.

Compared to the global average, the cost of claims and disputes on projects is only slightly less punitive, however. The Sixth Annual CRUX Insight Report reaffirms the startling scale of conflict, delays and lost value that could be avoided.

From upfront planning and greater investment in design to more balanced risk allocation and collaborative approaches to contracting, this report also identifies sensible steps that can be taken to improve project outcomes.

Developing dispute resolution solutions is another, and the Middle East is paving the way. Governments, institutions, construction and engineering companies, and dispute resolution practitioners are together advancing alternatives to the high costs and risks of litigation. RICS continues to work with them to promote more cost-effective ways of avoiding and settling disputes.

CRUX also highlights the introduction of Dispute Adjudication Boards and improvements to Saudi Arabia's regulatory procedures governing arbitration, along with experimentation in forms of contract. As the Kingdom and other Gulf states embark on an ambitious new era of development and diversification, dispute provisions in contracts can be instrumental in ensuring fair and sustainable returns on that investment.

**Dr John Fletcher**
Director of Dispute Resolution
RICS

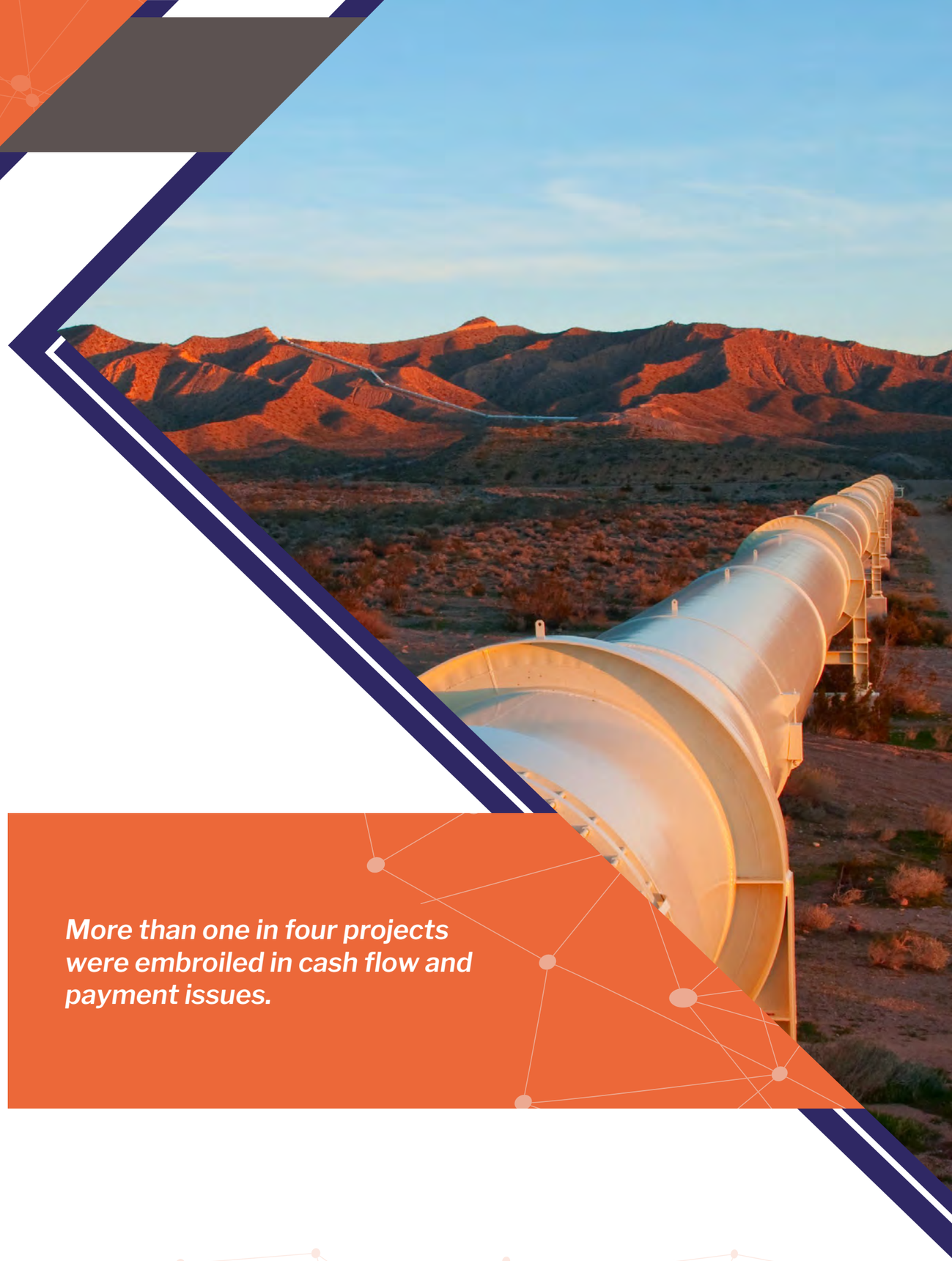
need to incorporate technologies that improve the energy performance of buildings and other assets.

The capability to harness digital technology requires a sea change across the industry – that goes beyond treating building information modelling (BIM) as a mere bolt-on contractual requirement.

Other pressures are country-specific, such as the reduction in working hours in UAE, and the spike in living costs there, prompted by an influx of money since the Russian-Ukraine war.

Supply chain strains will be more general and intense, given the scale of construction activity in the region and the ambitions of Saudi Arabia Vision 2030. The unprecedented challenges in terms of material and human resources, and integration of different developments, seem to be understood. As are concerns that contractors will top up tender sums to allow for the maximum liquidated damages that could be levied against them, or once again desert the market if the risks outweigh the potential returns.

A hard-headed review of strategies for procuring project partners, materials and equipment is imperative as gigaprojects compete for resources in regional and global markets. Commercial management post-COVID-19 and steps so far toward greater collaboration and risk-sharing are encouraging though not yet commensurate with the scale of the challenge.



***More than one in four projects were embroiled in cash flow and payment issues.***

# Oceania



**Changing political priorities – prompted by general elections and increased pressure on public finances – are impacting the outlook for infrastructure and capital projects in Oceania. As global forces drive inflation and interest rates in this, as in other regions, weak economic growth or stagnation in New Zealand and Australia will extend into 2024.**

The flow of new projects currently coming to market may be slowing, but the Australian market will continue to run hot on the back of its multi-year construction boom. Despite the dampening of new activity, under-capacity in construction and supply chain constraints will impede the delivery of major projects already underway and planned. Timescales and costs (including salaries and wages) will be impacted.

Extreme weather events are also shifting priorities. Homes, highways and other infrastructure in New Zealand's North Island were severely damaged by the worst cyclone in a century in February 2023, diverting public funds from other projects to clean-up activities. Australia, which has also suffered severely from global overheating, must strive to make up for lost time in the transition to renewable energy.

There are 158 projects from four countries in our analysis of the oceanic region of Australasia and the Pacific Islands. Many were large in scale, giving an average CAPEX value of $2.94 billion. Although the overall impact of disputes in lost time and money is significant, average claimed time extensions and costs were the lowest of the regions – at 48.7% of planned schedules and 25.6% of committed CAPEX, respectively.

## Causes and effects

Change in scope is the primary driver of claims and disputes in the region, as it is globally, but its prevalence is even more pronounced (see Table R). This number-one factor was cited on more than half of projects (53.5%), notably higher than in the rest of the world (37.4%).

Some underlying reasons are universal. Projects may go to market without first being scoped properly (both in terms of detailed objectives and design) – a tendency likely to be accentuated by the high proportion of government-funded transportation infrastructure projects in the latest CRUX analysis. Given the high political capital invested in landmark schemes, they tend to be backed and announced before detailed scoping, design and costings are fully conceived. Three-year federal election cycles make both Australia and New Zealand more vulnerable to these political risks, including cancellation. Combined with high technical complexity and long project gestations, such factors increase the likelihood of significant scope change.

Restricted or late access to sites is also elevated in the Oceania ranking (to second) compared with the rest of the world (tenth). One in four projects (25.5%) experienced claims and disputes for this reason. Again, this at least partly reflects heavy public investment in transportation projects requiring extensive tunnelling, often in urban areas where the challenges are amplified by complex interfaces with adjacent roads, rail tracks, buildings and underground utility services. Access difficulties can also be aggravated by challenging topography or ground conditions, especially over a long-distance road or rail scheme.

Although design-related causes rank lower than elsewhere, each of the three factors – inaccurate, late and incomplete design – affected around a fifth of projects. When looking at all three factors combined this rose to two-fifths of projects affected.

## Shifting priorities

Government priorities are shifting in response to various pressures – political, social, and environmental. In the case of Australia, Sydney's road network and its metro extension are seeing significant investment, as will the city's West Harbour Tunnel, whereas other future public investment is expected to favour energy, resources and building projects.

In New Zealand, the shift is likely to be from resilience and climate change projects back to road investment. These changes could give rise to new or different sources of claims. The pattern of dispute causation on past projects in each segment is shown overleaf (see Table S).

Can project management skills honed in one area of infrastructure development be brought to bear in other sectors? It is notable that well over a third of energy, oil and gas projects (36.4%) are affected by contract administration failures, whereas this is less of a problem for buildings (26.1%) and transportation infrastructure (9.1%). Meanwhile, the advent of alternative energy projects with more fragmented supply chains and contractual interfaces will be a challenge to this sector's stronger record in this area of project management, where it outperforms both transportation and, to an even greater extent, the buildings sector.

Following its leftward tilt at federal and state levels, Australia's governments will need to reign in capital expenditure amid deteriorating economic conditions and public finances. The goalposts have also moved following the pandemic, as changes in commuting patterns and inward migration projections call into question the business case and viability of investments in public transport and airport expansion.

High-profile blow-outs on big-ticket projects, such as the New South Wales-funded metro and the second federal-backed Snowy Hydro pumped storage scheme, add to the pressures on budgets and political leaders. With public and market confidence at stake, governments have chosen to settle rather than escalate disputes,

**Table R – Claims & disputes in Oceania & the Rest of the World**

| Top causes of claim or dispute* | Oceania | RoW** | Oceania | RoW |
|---|---|---|---|---|
| Change in scope | 1 | 1 | 53.5% | 37.4% |
| Access to site/workface was restricted and/or late | 2 | 10 | 25.5% | 17.2% |
| Contract interpretation issues | 3 | 4 | 20.4% | 19.7% |
| Contract management and/or administration failure | 4 | 6 | 21.0% | 19.4% |
| Design information was issued late | 5 | 3 | 21.7% | 22.6% |
| Design was incorrect | 6 | 2 | 20.4% | 23.2% |
| Claims were spurious | 7 | 14 | 17.8% | 13.2% |
| Physical conditions were unforeseen | 7 | 9 | 17.8% | 17.8% |
| Design was incomplete | 7 | 5 | 17.8% | 22.0% |
| Poor management of subcontractor/supplier and/or their interfaces | 10 | 7 | 14.6% | 19.9% |

*Rank is based on both primary and secondary causes of claims and disputes. The percentage represents the proportion of projects on which a cause featured (whether primary and/or secondary).
**Rest of the world.

**158**
projects

**4**
countries

**$2.94bn**
average CAPEX

**25.6%**
average cost claimed

**48.7%**
average EOT claimed

# Oceania



**Table S – Claims & disputes by sector: Transportation, Energy & Buildings**

| Top causes of claim or dispute* | Transportation Infrastructure | Energy/ Oil & Gas | Buildings |
|---|---|---|---|
| Change in scope | 52.3% | 45.5% | 60.9% |
| Access to site/workface was restricted and/or late | 25.0% | 13.6% | 21.7% |
| Contract interpretation issues | 20.5% | 27.3% | 28.3% |
| Contract management and/or administration failure | 9.1% | 36.4% | 26.1% |
| Design information was issued late | 18.2% | 13.6% | 19.6% |
| Design was incorrect | 18.2% | 22.7% | 15.2% |
| Claims were spurious | 18.2% | 22.7% | 17.4% |
| Physical conditions were unforeseen | 15.9% | 13.6% | 19.6% |
| Design was incomplete | 13.6% | 9.1% | 13.0% |
| Poor management of subcontractor/supplier and/or their interfaces | 6.8% | 4.5% | 21.7% |

*Percentage of projects that had this as a primary and/or secondary cause of claim or dispute.

dampening the apparent impact on costs captured by CRUX. Claims are likely to mount as contractors' opportunities shrink in a downturn.

By contrast, the rightward shift expected in New Zealand should see an increased focus on privately financed investment and greater appetite for risk in the push to deliver major capital schemes, despite market constraints.

In both countries, there are also systemic funding and planning obstacles in the way of successful project outcomes.

Under Australia's federal structure, both national and state funds feed the capital project pipeline. There is a need to improve strategic coordination, especially as states often promote the same kind of projects and compete for the same supply chain resources, while aiming to deliver projects ahead of their neighbours.

In New Zealand, central and local government agencies must compete for limited public funds and for the best contractors in a smaller market. Contract size has to be tailored too to capacity for two principal reasons: limitations on the quantity and quality of available contractor and supply chain resources; and the cash flow availability of the Crown or council client. As in Australia, where projects approved by the previous federal administration face deferral or cancellation, an agreed long-term strategic pipeline of projects remains an elusive goal, making it difficult for the supply chain to plan with confidence. These shared characteristics result in higher tender costs and, in some cases, greater reliance on smaller or lower-tier contractors with less relevant experience, further increasing potential risk.

As investment is re-directed towards energy projects with different risk profiles due to their substantial hi-tech elements, clients' contracting strategies also increase the risk of certain conflicts. Already, publicly funded projects are often delivered by several contractors, with insufficient central coordination of their works. Follow-on contractors are delayed, resulting in claims for restricted access, re-worked designs, and other causes.

The integration risk rises when energy megaprojects are broken down into various packages for civils, building construction, blades or other plant, generation, and distribution. In place of an engineering, procurement, and construction (EPC) contractor, the employer tends to assume the burden of interface management under public contracts. Yet the client side may lack the skillset required of an integrator, bringing with it the potential for huge risk both in terms of project schedule adherence and cost.

Tighter public finances are also reinforcing the trend of weighting contract awards towards the cheapest bidder. It is not unusual in the buildings sector for contractors to 'buy' work and beef up their commercial management teams from the outset with a view to recouping costs through variations and claims. Claims and disputes increase in number and scale as a result. A compounding effect occurs when international contractors out-compete local firms but under-estimate the adversarial nature of government contracts. Joint ventures with local contractors limit cultural conflicts. Yet, contrary to their experience in Asia, for example, foreign operators may find that contractual processes have to be exhausted before a settlement is finally reached.

## After COVID-19

Employers generally managed the COVID-19 lockdowns well, limiting the volume of subsequent claims and disputes.

Deserted city centres allowed far more transport movements, asset maintenance, and the acceleration of some works. Recognising construction's critical contribution to employment and the state's economy, New South Wales eased the flow of cash down the supply chain, while keeping sites open.

Good practices tend to fade away in the aftermath as supply chain disruption and increasing costs have more enduring and negative impacts. Many contracts signed years before – when materials, shipping and energy prices were cheaper – have left contractors with few contractual remedies to recover massive additional costs. Some have gone outside their contracts to plead hardship under laws of equity.

## Industry view

In the constantly changing economic and political landscape, adaptability is rapidly emerging as the key to the successful delivery of infrastructure in Oceania.

This report provides some timely lessons on how projects are vulnerable to leaking both time and costs through claims and disputes at all stages, from planning and design through to delivery. While the specific challenges may vary between sectors, in general the regional operating environment is trending towards greater complexity and less predictability. Insights from data such as this are powerful tools in guiding projects through the uncertainty.

We are seeing a growing need to strike a balance between different objectives, including serving the needs of a growing population, urbanisation, decarbonisation and improving resilience in the face of sea-level rise, climate change, seismic events and extreme weather events.

Aotearoa, New Zealand is putting all hands to the pump to help the recovery of the East Coast from Cyclone Giselle. With decades' worth of capital works already in the pipeline, this may drive a conversation on how as a nation NZ can and should prioritise its many infrastructure needs present, future and responsive.

Finally, this report also shows the need for us to consider our supply chain management as tough economic conditions are increasing risks of instability. Clients have opportunities to improve their supply chain resilience but need to do so by engaging early and earnestly with delivery partners, and try to co-develop shared benefits.

**Nick Leggett**
CEO of Infrastructure New Zealand
& Chair of Wellington Water

# Oceania



## Challenges and lessons

Despite the global slowdown and its impact on national economies, the region's two leading markets have long lists of infrastructure and other capital projects to deliver in the coming years. The energy transition alone will demand massive investment over the next ten years and beyond.

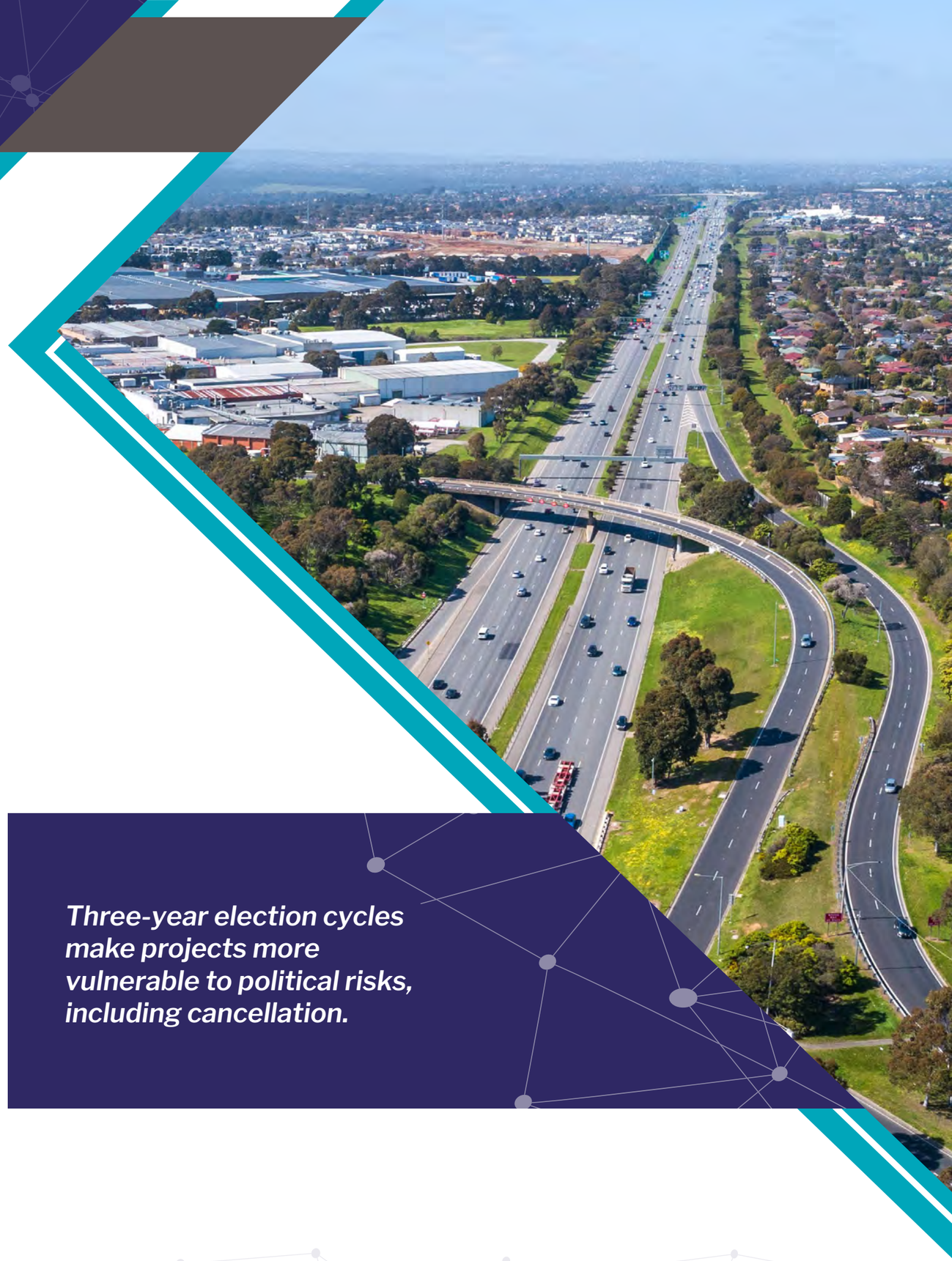
One high-profile project secure in Australia's pipeline is the Brisbane 2032 Olympics. Planned largely around existing infrastructure, rather than new build, the aims are to keep costs and risks down while minimising environmental impacts. The market will increasingly need to adopt this mindset, recognising the necessity of building climate resilience into new and existing infrastructure and buildings.

There are major obstacles to effective delivery. Local markets lack the expertise to take on complex energy projects, further reducing competition and/or the capability to deliver successful outcomes. Under-capacity in the supply chain and lack of competition will worsen as consolidation continues and Australian contractors amalgamate. Local engineering and construction industries will continue to depend on inward migration even as existing talent is lost to more buoyant markets like the US and the Middle East – themselves under huge pressure to find and retain talent.

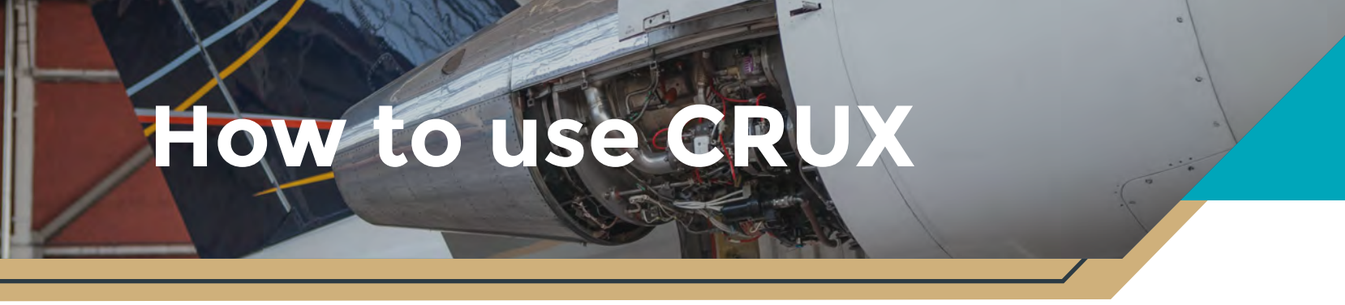
The squeeze on capital funds combined with political imperatives to accelerate delivery increases the risk of poor decision-making. Better strategic planning of public investment and the sequencing, or 'staggering', of major projects would help balance supply and demand. Client capabilities will also need bolstering to strengthen procurement strategy and structure.

Affordability is now the great barrier to planned federal and state projects. Victoria's A$30-50 billion Suburban Rail Loop is likely to be among the first to be formally deferred by an incoming state administration. As its seven-year boom ends, Australia and its construction industry may be reaching an inflexion point. Great strides were made in collaborative contracting and market engagement, but massive investment has not engineered a transformation in national capacity, capabilities and contracting culture. The danger is that the sector reverts to the status quo ante.

Following later in its economic cycle, New Zealand – an innovator in other policy areas and public projects – could learn lessons from its bigger neighbour's actions and omissions.



***Three-year election cycles make projects more vulnerable to political risks, including cancellation.***



# How to use CRUX

**CRUX, HKA's integrated research programme, captures data on the proven causes of claims and disputes on major global capital projects. This CRUX Insight report aims to share insights from this data – and from our consultants working in the field – to help improve project outcomes.**

We hope that as many industry stakeholders as possible, not just our clients, derive value from this unique and growing data bank. Previous CRUX Insight reports have been referenced in panel discussions, webinars, speaking engagements, interviews, and articles published around the world, as well as by a UK parliamentary inquiry into the management of major state projects.[35]

Industry, professional bodies and universities are encouraged to disseminate CRUX's lessons widely. They can be used by governments to inform legislation, policy, and practice. Many types of company can gain from further analysis at the project and enterprise level, including employers, contractors, insurance providers, designers, suppliers, financiers and lawyers.

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. Industry stakeholders can delve deeper into the CRUX dataset with the help of the CRUX Interactive Dashboard.

The dashboard allows you to explore data on more than 1800 projects, and to shed light on a multitude of issues, such as: the most prevalent causes of claims and disputes in your industry; the proportion of projects affected by a specific cause in particular jurisdictions; or the extension of time typically claimed on different types of say, energy or transportation projects, whether in a region or globally. These are just a few examples of the many questions the dashboard can answer.

New insights also emerge from tailored analysis by HKA's data specialists, helping clients shape strategy and set priorities for planning, procurement, and project controls and governance. This intelligence can be used 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.

HKA is committed to our ongoing integrated research programme, and to sharing the fruits of our analysis with clients and the wider industry in all regions. To learn more about the scope of the CRUX data and the methodology behind the report, see overleaf.

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

# Our Interactive Dashboard


**Scan the QR code or visit:**

**https://www.hka.com/crux-interactive-dashboard**

# Methodology

**The Sixth Annual CRUX Insight report presents the high-level findings from our analysis of the causes of claims and disputes on 1,801 projects in 106 countries worldwide.**

## How we define the causes of claims and disputes

When we originally set out to define the CRUX causation factors, we compared causation taxonomy across 57 peer-reviewed academic publications, industry reports, and other sources worldwide. This produced a list of 1,750 causes of construction and engineering claims and disputes.

Through detailed analysis and mapping of trends and variations in terminology, we were able to condense these causes into 50 coherent, individual definitions. This list of theoretical factors was then assessed by a HKA Expert Review Panel against their practical experience on live projects.

The panel's refined list of most salient, frequent causes was then reviewed by another group of HKA experts drawn from all our regions. They ensured that the causation factors to be used in our internal questionnaire would be comprehensive and representative of the disputes occurring on projects across the global industry. Subsequent reviews led to further refinements, including the addition of causes to cover claims and disputes relating to the COVID-19 pandemic. The updated list of factors in the current questionnaire comprises 38 causes of claims and disputes.

We remain committed to reviewing and refining the causation factors used in the CRUX analysis to reduce subjectivity and improve reliability.

## CRUX criteria and scope

The CRUX report examines construction and engineering projects on which HKA has provided services involving the investigation of claims and/or disputes. All data is derived from these real-world assignments carried out by our expert consultants. The analysis therefore reflects the pattern of HKA workload in our operating regions, the mix of project types, and the quantum, delay and/or forensic analytical services provided.

CRUX is a cumulative dataset – not a snapshot survey – to which we add continuously, updating previously captured information where appropriate. The intelligence covers commissions on projects from 2016 up to August 2023.

## Process of producing the report

When an HKA team has been involved with such a project for over 30 hours it becomes eligible for inclusion in the CRUX analysis. Our colleagues complete a digital questionnaire to provide data and insights for CRUX. This information is analysed to produce our initial CRUX results. We share the findings with HKA staff from around the globe who, in a series of regional panel discussions, appraise and contextualise the results, adding further value; (CRUX Interviewees are listed on page 67).

Data and expert insights are then summarised for the annual CRUX report, which is peer-reviewed before publication. Additional data is included in the CRUX Interactive Dashboard.

## CRUX rankings

When filling out a questionnaire, our experts identify one or more causes of claims or disputes that occurred on their project. For each cause they select, they determine if it was a primary or secondary cause, depending on whether the factor was a direct or indirect cause (or both). For our ranking, these primary and secondary contributions are combined to give an overall score. Where we also calculate the proportion of projects affected by a particular causal factor, this is a percentage of the projects where that cause was diagnosed (whether primary or secondary). Rankings and the percentages figures may not always align for this reason.

If you would like to know more about the methodology of our reports, please contact:

**CRUX@hka.com**

# Who We Are

**HKA is a leading global consultancy in risk mitigation, dispute resolution, expert witness and litigation support services.**

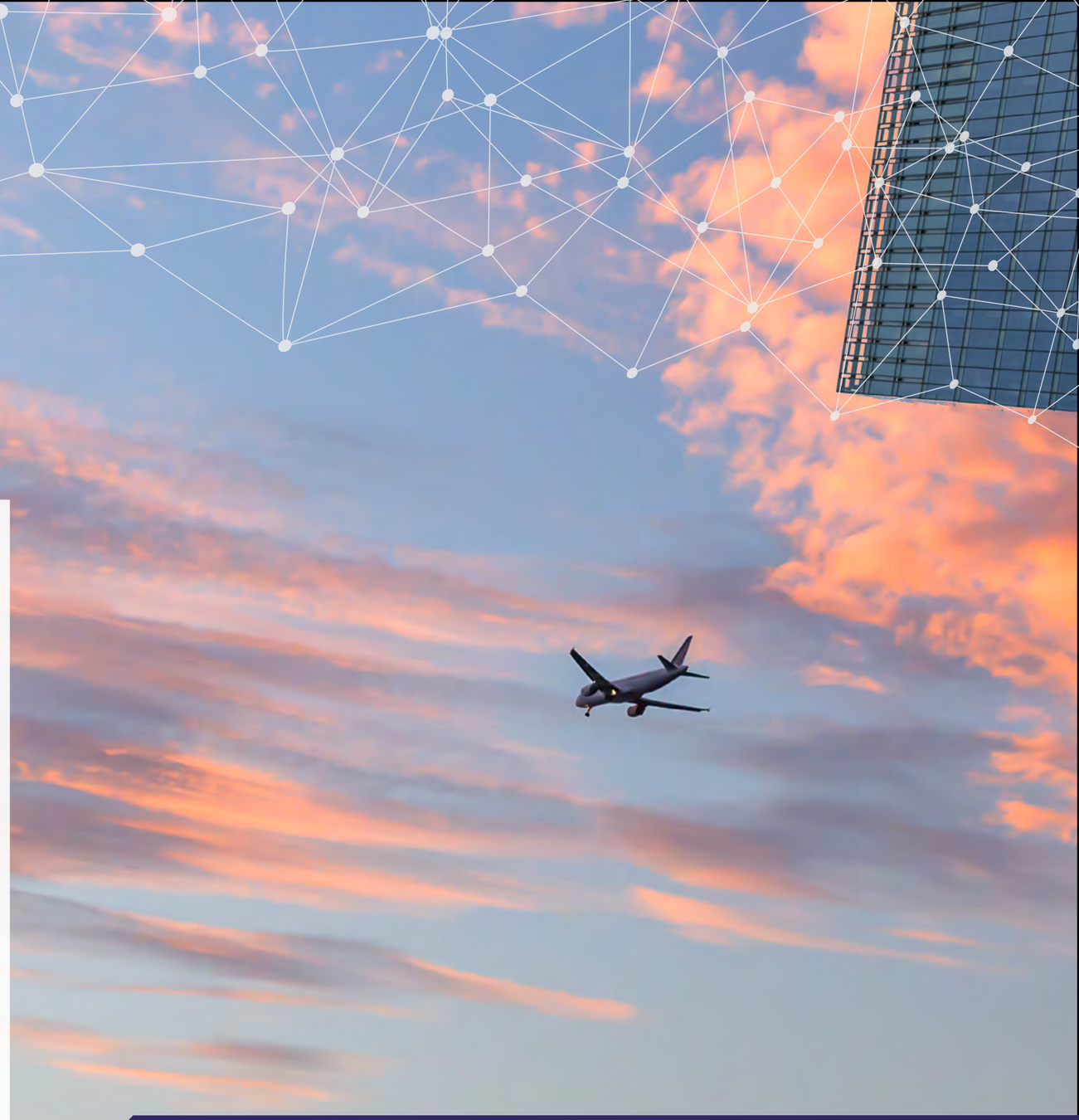
HKA brings a proud record of excellent service and high achievement to bear on today's challenges. As trusted independent consultants, experts and advisers, we help clients manage disputes, risk and uncertainty on complex contracts and challenging projects. Our advice is impartial, incisive and authoritative.

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.

HKA's global portfolio includes some of the world's largest and most prestigious commissions across a wide range of industries, including aerospace and defence, buildings, energy and natural resources, environment and climate change, financial services, healthcare and life sciences, industrial and manufacturing, marine and shipping, mining and metals, oil and gas, power and utilities, real estate and tourism, sports and entertainment, technology, media and telecomms and transportation infrastructure.

HKA has in excess of 1,000 experts, consultants and advisors across 45+ offices in 17 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.

For more information about HKA, visit hka.com and connect with us on LinkedIn, X (formerly Twitter) @HKAGlobal and Facebook.



> ***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.***

# CRUX Interviewees

**Jon Bird**
Technical Director

**Paul Cacchioli**
Partner

**Julia Humpidge**
Partner, Forensic Technical Services Lead, EMEA

**Toby Hunt**
Partner, Business Development Lead, EMEA

**Stefan Brill**
Partner

**Tim Harwin**
Partner

**Hilton Karnovsky**
Associate Director

**Claudia O'Brien**
Partner, Head of Africa Operations

**Colin Johnson**
Partner, FACD Lead, EMEA

**Alex Lee**
Principal

**Michelle Metz**
Partner

**Charles Wilsoncroft**
Partner

**Johanlene Venter**
Senior Consultant

**Maged Abdelsayed**
Partner, Construction Claims & Expert Services Lead, Americas

**Tracy Doyle**
Partner

**Dan Feinblum**
Partner

**Dafydd Wyn Owen**
Partner, Advisory Lead, EMEA

**Nicola Caley**
Partner

**Mark Castell**
Partner

**Alastair Gray**
Partner

**Caryn Fuller**
Partner

**Kim Reome**
Partner

**Maximilian Benz**
Director

**Ben Highfield**
Partner, Regional CEO, Asia Pacific

**Haroon Niazi**
Partner, Construction, Claims and Expert Services Lead, EMEA

**Michael Tonkin**
Partner

**Amelia East**
Partner, Advisory Lead, APAC

**Jonathan Humphrey**
Partner, FACD Lead, APAC

**Pirodja Lawyer**
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**Shamila Neelakandan**
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**Andrei Soltan**
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**Kourosh Kayvani**
Partner, Forensic Technical Services Lead, APAC

**Phil Kienstra**
Partner, Lead Advisory, Asia Pacific

**Mike Pitt**
Partner, Lead Advisory, Asia Pacific

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**Eugene Silke**
Silke & Co Editorial Consultancy

HKA would like to thank **Renny Borhan** (Partner, Chief Executive Officer), **Toby Hunt** (Partner, CRUX sponsor), **Jeffrey Badman** (Partner, Construction, Claims and Expert services lead, Europe), **Dafydd Wyn Owen** (Partner, Advisory Lead, EMEA) and the CRUX interviewees for their review and guidance throughout the production of Sixth Annual CRUX Insight report.

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# DECODING COMPLEXITY

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