



Global Handbook 2020

Construction trends
and insights

Updated September 2020

linesight.com



Welcome to the **Linesight Global Handbook 2020.**

Each year, we gather the key indices and trends in global construction, giving you the most comprehensive overview of the industry.

For the complete global view,
visit the Linesight Knowledge Center:
linesight.com/knowledge-center

Contents

Global Handbook

Global Market Review 7

01 Macro Indicators

1.1. Level of economic activity	14
1.2. Size of top global construction markets	14
1.3. Investment needs and economic infrastructure	15
1.4. Average global economic infrastructure annual needs, 2017-2035	15
1.5. Share of construction spending by region 2020	17
1.6. Global growth forecasts for 2020 and 2021	17
1.7. Global inflation 2013-2019	18
1.8. Oil production and consumption statistics	18

02 Indices

2. Linesight international construction cost index 2020	21
---	----

03 Contractors and Design Firms

3.1. Top 20 international contractors	23
3.2. Top 20 international design firms	24

Global Insights

The evolution of data centers	30
The impact of COVID-19 on the supply chain	34
Reimagining the post-pandemic workplace	38
Managing bioreactor lead times for success in biologics	42
The true adoption of BIM - adding tangible project value?	46
Keeping it Lean and bringing contractors along for the journey	50
The true cost of NZEB in practice	54
The rise of the smart hotel	58

About Us

What we do	63
Our values	64
Our culture	66
Working with you, wherever you are	70
Acknowledgements	73



Aloft Hotel, Dublin
Architect:
Nikki O'Donnell
Architects
Linesight services:
Cost Management



Global Market Review

In just a matter of months, the global landscape has changed dramatically, with COVID-19 having a profound impact on economies around the world.

In our early March Knowledge Center update, we referred to COVID-19 as a new threat to the global economy, following eighteen months of uncertainty arising from the US-China trade war, which appeared to be coming to an end with the signing of the Phase 1 deal in early 2020. In a matter of mere weeks, the novel coronavirus moved from an impending threat to a confronting reality, and has had an unprecedented impact on both public health and the economy.

Recovery and resurgence in APAC

As the region in which the COVID-19 outbreak originated, many parts of Asia are a number of weeks ahead of the rest of the world in terms of recovery. Indeed, as other parts of the world seek to curb the spread of the novel virus, they can look to countries such as China, to review the efficacy of various policy responses in efforts to soften the economic shock. The pandemic initially caused shutdowns in Asia earlier than elsewhere in the world, with industry grinding to a halt in February and having a significant impact on global supply chains. COVID-19 then brought much of the world's economic activity

to an abrupt standstill, serving a secondary blow to the export-reliant Asian economy. Asia's purchasing managers' indices (PMI) in August show up some mixed results – with Indonesia and Taiwan above the 50 mark, and the latter recording its highest figure in two years at 52.2, and Japan, South Korea, Malaysia, the Philippines and Vietnam all sub-50, indicating contraction. However, some of these sub-50 figures are still indicating gradual improvement and recovery, particularly in the big manufacturing nations. Bloomberg Economics also reported that a private gauge of China's factory activity grew at the fastest pace in August since January 2011, helped by improving exports and continued domestic recovery.

Having seen economic growth of 6.1% in 2019, despite the trade war, the Chinese economy was heavily impacted in Q1 with a 6.8% decline before a return to positive growth of 3.2% in Q2. Although the Phase 1 agreement seemed hopeful with regards to the US-China trade war, tensions have once again intensified, which is having an impact on the Chinese economy and remains a risk factor.

In India, pre-COVID, some important reforms, while expected to benefit the economy in the longer term, such as a unified tax system and demonetisation, have been disruptive in the short term, and India has since been faced with considerable economic challenges due to the pandemic. Q2 was India's worst quarter ever recorded, with a 23.9% contraction and the IMF is projecting a 'historic low' for 2020, with a 4.5% contraction, before a return to growth is expected in 2021.

Although Australia appeared to have a good handle on containing the virus by June, and was beginning to focus on awakening its economy, there has been a recent resurgence in the virus and a recession has hit the nation for the first time in 28 years. A contraction of 6% is expected for 2020 before a prolonged recovery period kicks in over the coming couple of years. The Government introduced a considerable stimulus package, including the AU\$130 billion JobKeeper payment, which aimed to keep Australians in work and support businesses that had been significantly affected by the economic impact of the virus.



**The Museum of Modern Art
(MoMA), New York**

Architect:
Diller Scofidio + Renfro

Linesight services:
Cost Management and

Consultancy

Singapore had an austere reaction to the pandemic, implementing an eight-week circuit breaker to suppress the virus. It entered a recession in Q2 with a 41.2% contraction quarter-on-quarter. To date, the government has announced four support packages worth close to S\$100 billion (nearly 20% of GDP), and has not ruled out announcing another package.

Plummeting activity in Europe

Europe has been particularly hard-hit by the pandemic, between the public health impacts and the strict lockdowns seeing economic activity plummet, and the eurozone recorded an economic contraction of 11.9% in Q2. Although the European Central Bank acted quickly upon the onset of the virus, with significant stimuli put in place to prop up the regional economy, it now appears that even more stimuli will be required from the ECB to tackle the disinflationary impact. Inflation in the eurozone was negative in August for the first time in over four years, with a figure of -0.2% recorded across the 19 countries, well below the ECB's target of 2%. While it is hoped that this is relatively temporary and that a rebound is in the near future, Brexit remains a significant risk, in addition to the pandemic.

Although many European countries looked to be making a recovery in July, as lockdown and restrictions were lifted, a marked slowdown was seen in August as COVID cases rose again in some countries, with the eurozone

PMI dropping from 54.9 to 51.6. Unemployment hit 7.9% in July, up from 7.7% in June, although a Reuters survey of economists had projected a slightly higher figure of 8%.

As Europe's largest economy, Germany, which was already enduring a period of political instability and ongoing economic uncertainty, has reported Q2 as its worst quarterly performance on record, with total output falling by 10.1%. Despite Germany not being as reliant on tourism as other European countries and the public health effects not being as stark, consumer spending has nosedived, and this has been coupled with the steep decline of exports and global trade, which are significant contributors to its economy. While its economy is doing better than initially expected, the aforementioned sluggish demand may prolong the recovery period. Germany's political landscape is in a state of flux, as far-right and the green parties gain popularity, and the once-powerful democratic left has become alienated from the industrial, working-class base.

Meanwhile the French economy, Europe's second largest, saw GDP decline by 13.8% in Q2, although there was moderate improvement in May and June as lockdown measures eased. It was reported that economic activity was down 7% year-on-year in July, albeit an improvement on previous months, as construction activity ramped back up. Spain, however, has recorded its worst recession of modern times, with the economic

shock leading to declines of 5.2% in Q1 worsening to 18.5% in Q2, coming out as the eurozone's worst performer.

The Irish economy is expected to shrink by 8.5% this year, and Government's budget deficit increased to €9.5 billion in August, as VAT receipts reduced and spending on the likes of income supports related to the pandemic soared, compared to a deficit of €625 million this time last year, marking a year-on-year deterioration of €8.8 billion. In addition to contending with COVID-19, Ireland stands to be one of the most impacted countries in the eurozone at the hands of Brexit, with the lack of direction adding to the uncertainty.

Furthermore, as a country that is heavily reliant on FDI, the performance of the US economy is particularly impactful.

As the end of the Brexit transition period fast approaches, and the economic shock of COVID continues to be felt, the UK has entered a recession for the first time since 2009, with a decline of

The eurozone recorded an economic contraction of 11.9% in Q2.

2.2% in Q1 followed by a negative figure of 20.4% in Q2 – the steepest decline on record. The Government has put in place various packages and supports to mitigate the negative impacts and start on the road to recovery, but it is fair to say that economic recovery will be heavily dependent on any recurrence of the virus and whether post-Brexit trade deals are secured.

Israel has posted its worst performance in more than 40 years in Q2, coupled with the CBS (Central Bureau of Statistics) reporting a 28.7% decline. This follows a 10.1% contraction in Q1, after 3.4% growth in the second half of 2019. The country's high-tech landscape has been largely unscathed in comparison to other sectors of the economy. The ripple effect from the pandemic has not been felt so far in the sector, but a slowdown is expected as the pandemic continues.

Record contraction for the US

The US reported its sharpest contraction on record (since 1947) in Q2, at a rate of 32.9%. While it was hoped that recovery would ensue quickly, the second wave of the virus in some locations and resulting measures to

suppress it infer that it may take longer than initially anticipated. As the main driver of the US economy, consumer spending is a particularly important indicator, and declined by 10.7% year-on-year in Q2. Unemployment stood at 10.2% in July, down from 11.1% in June. In addition to the pandemic, rising tensions again between the US and China also pose a significant risk to its recovery.

Continued volatility in the GCC

In addition to COVID, oil prices, geopolitical tensions, global trade wars and macroeconomic performance continue to have a significant impact on growth and make the GCC less predictable than most major global markets. A contraction of 7.3% is expected in the Middle East oil-exporting countries as of July 2020. In addition to the effects of COVID, the GCC remains highly dependent on the oil economy, and the market volatility will undoubtedly have a role to play in terms of the pace of recovery post-pandemic.

The UAE Central Bank has forecast economic contraction of 3.6% for 2020, having put together a comprehensive stimulus package to support the economy, with

increased loan-to-value ratios for first-time home buyers, as well as the range of regulatory changes announced in 2019.

The pandemic is dealing a double blow to Saudi Arabia, with a high volume of COVID cases, as well as energy market turmoil, including cuts in production and an oil price decline to below US\$20 per barrel, saddling the Government with a budget deficit that could rise to around 15% of GDP this year. Officials have been reported to have doubled their borrowing plans and implemented a series of austerity measures, including raising the VAT rate from 5% to 15%.



Kim Hegarty
Director



*Throughout the following sections, the * symbol denotes graphs/data last updated in March, and so the impact of COVID-19 is not accounted for in the marked items.*

Carrying out business throughout the world

Doing business and investing in construction in unfamiliar territories can be a daunting prospect. The World Bank Group publishes a schedule of information on how difficult it is to carry out business across the world in their annual Doing Business Report. The 2020 report has been reproduced in the table below.

Economy	Ease of doing business	Starting a business	Dealing with construction permits	Registering property	Trading across borders	Enforcing contracts	Resolving insolvency
New Zealand	1	1	7	2	63	23	36
Singapore	2	4	7	21	45	1	27
Hong Kong	3	5	1	51	29	31	45
Republic of Korea	5	33	12	40	36	2	11
United States	6	55	24	39	39	17	2
United Kingdom	8	18	23	41	33	34	14
Malaysia	12	126	2	33	49	35	40
Australia	14	7	11	42	106	6	20
United Arab Emirates (UAE)	16	17	3	10	92	9	80
Germany	22	125	30	76	42	13	4
Ireland	24	23	36	60	52	91	19
China	31	27	33	28	56	5	51
France	32	37	52	99	1	16	26
Israel	35	28	35	75	67	85	29
Poland	39	63	60	35	1	38	15
Netherlands	42	24	88	30	1	78	7
Bahrain	43	67	17	17	77	59	60
Kingdom of Saudi Arabia (KSA)	62	38	28	19	86	51	168
India	63	136	27	154	68	163	52
Oman	68	32	47	52	64	69	97
Vietnam	70	115	25	64	104	68	122
Indonesia	73	140	110	106	116	139	38
Qatar	77	108	13	1	101	115	123
Kuwait	83	82	68	45	162	74	115

Source: World Bank Group – Doing Business 2020 Report



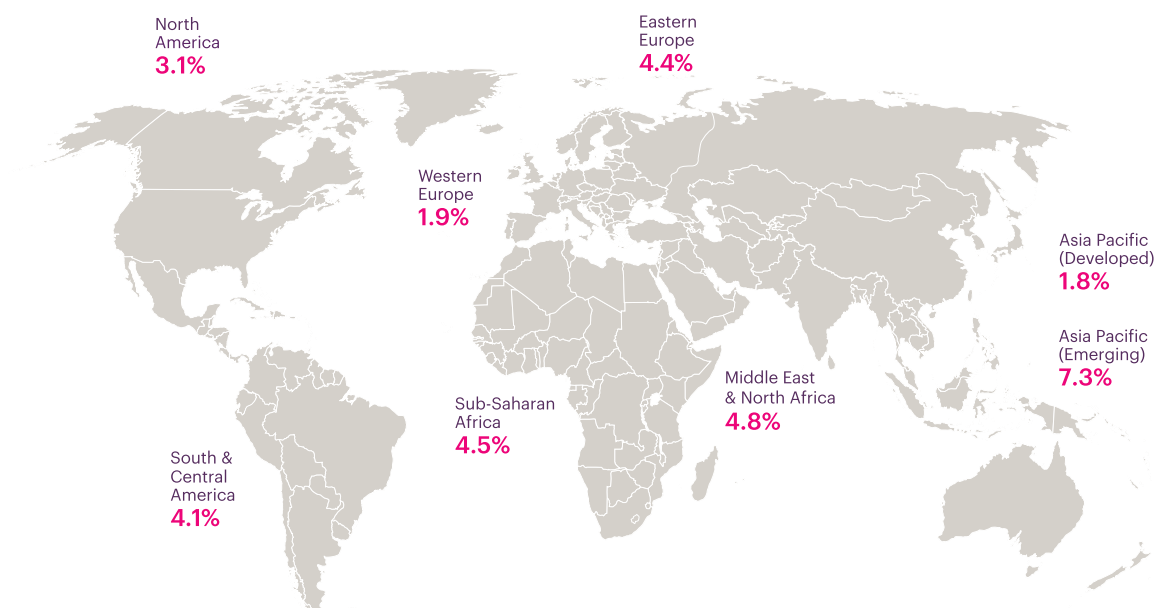
“I joined Linesight in June 2019 on a seven-month internship. The quality of projects that I worked on during that time made me want to pursue full-time employment, and I was subsequently hired in January 2020. Working at Linesight has been a great experience. My colleagues are helpful, the projects are challenging, and I’m constantly given more opportunities to learn and grow my skills. I can’t wait to see where my journey with Linesight will take me.”

Ronak Shah,
*Scheduling and
Project Controls Graduate*

1. Macro indicators

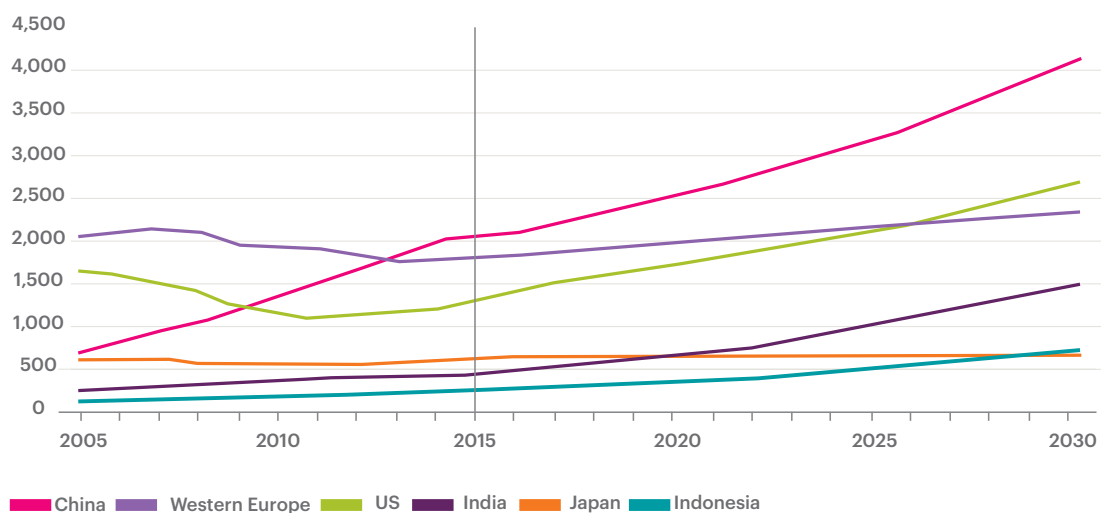
1.1. Level of economic activity *

Average % pa Rates of Change in real GDP 2010-2020



Source: Global Construction Perspectives and Oxford

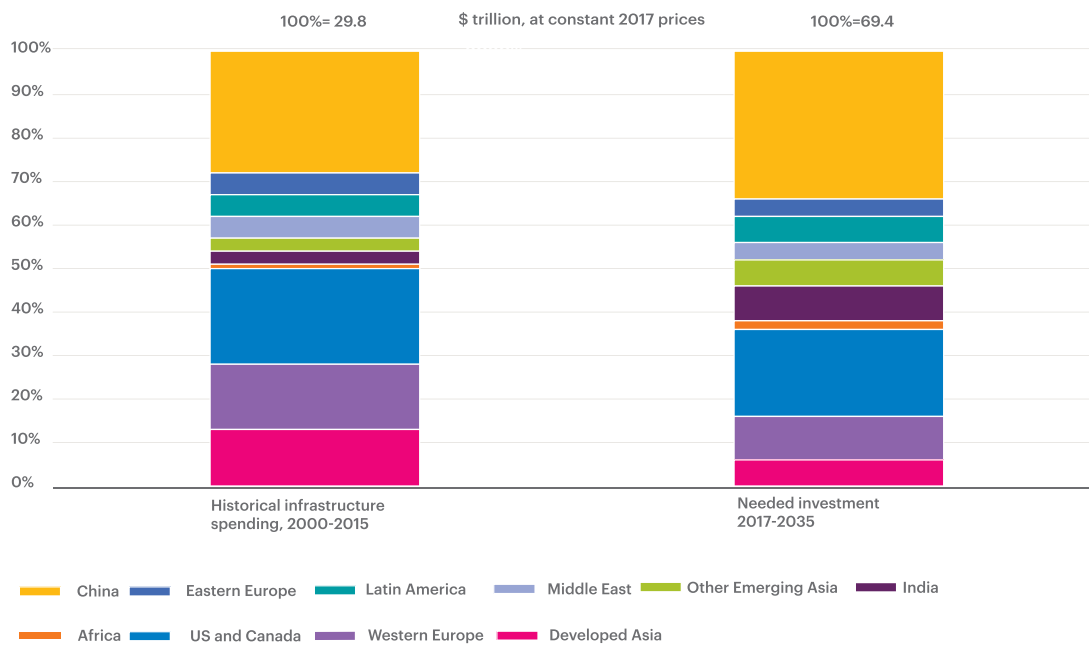
1.2. Size of top global construction markets *



Note: \$bn, 2014 prices

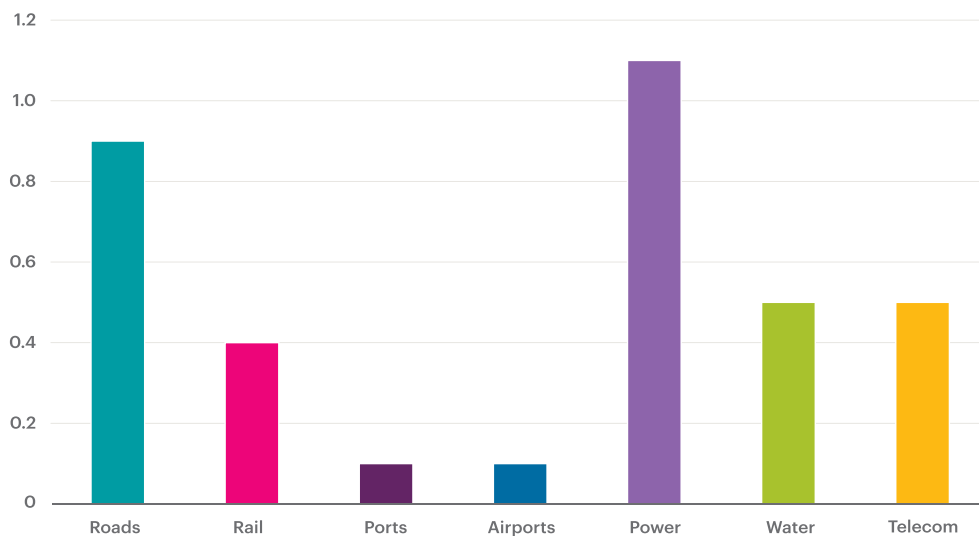
Source: Global Construction Perspectives and Oxford

1.3. Investment needs and economic infrastructure *



Source: GWI/IHS Global Insight/ITF/nationalstatistics/McKinsey Global Institute analysis

1.4. Average global economic infrastructure annual needs, 2017-2035 *



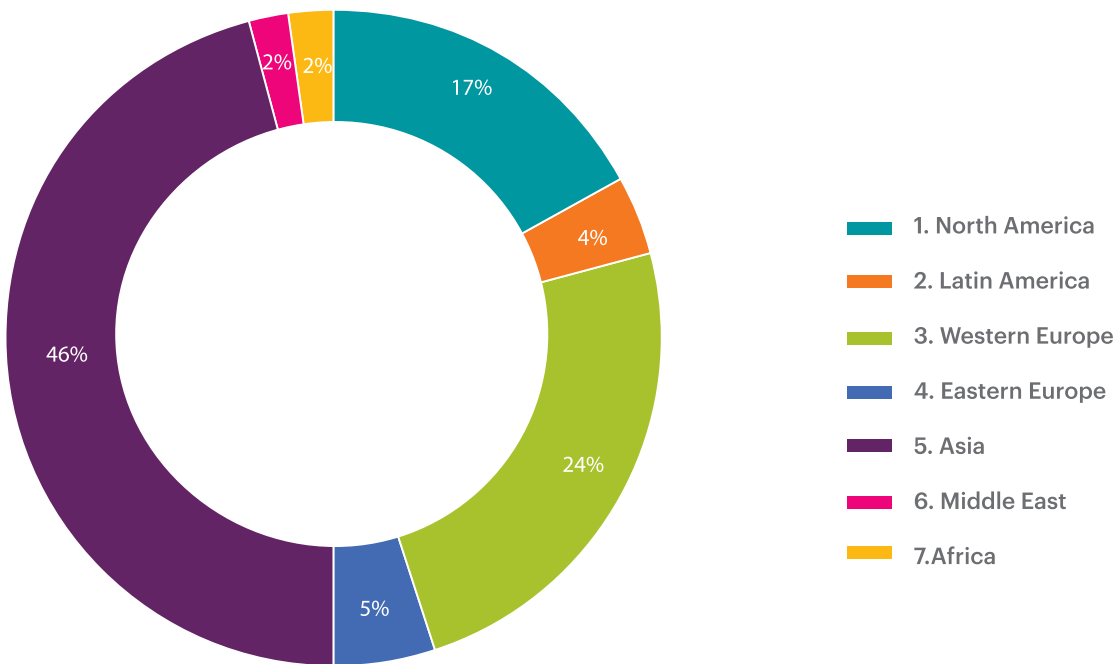
Source: GWI/IHS Global Insight/ITF/nationalstatistics/McKinsey Global Institute analysis



“Although I studied general quantity surveying in college, Linesight has given me the chance to focus on MEP by joining our dedicated team. The scale of projects that we work on really appeals to me – I’m getting the chance to work on large-scale, complex projects for world-leading clients, with the opportunity to gain experience abroad as well.”

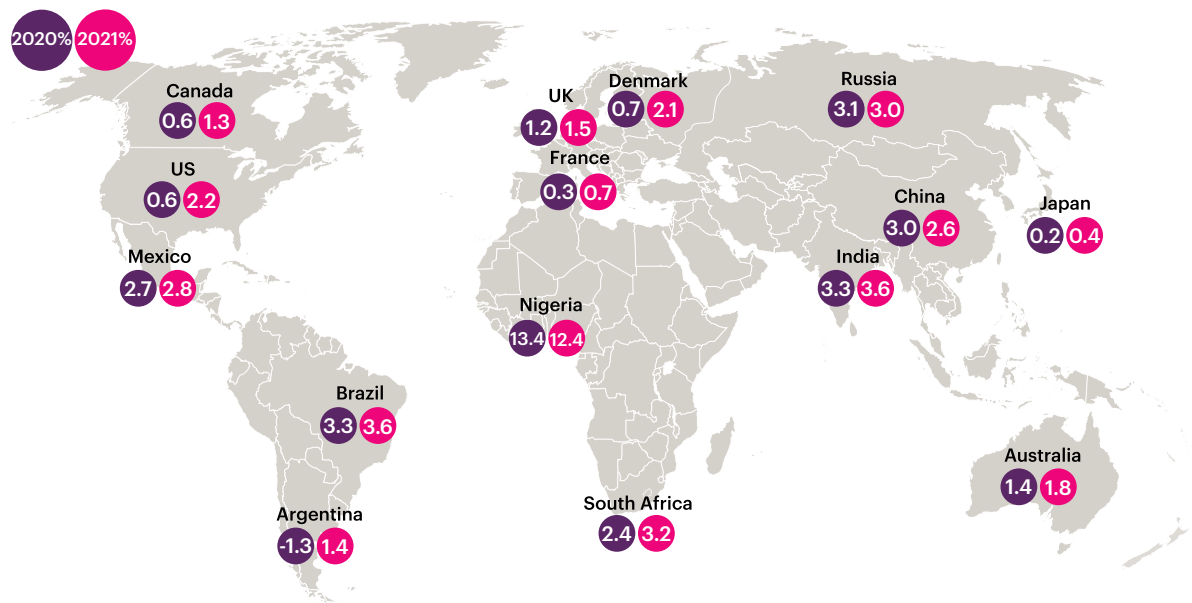
Manli Hu,
Cost Manager

1.5. Share of construction spending by region 2020 *



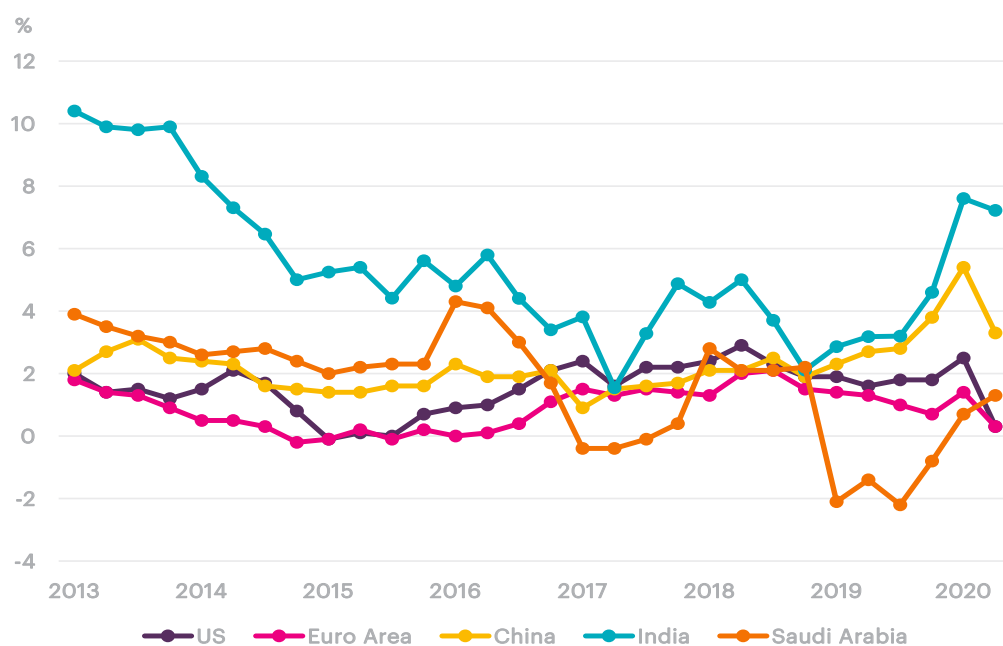
Source: IHS Global Insight

1.6. Global growth forecasts for 2020 and 2021



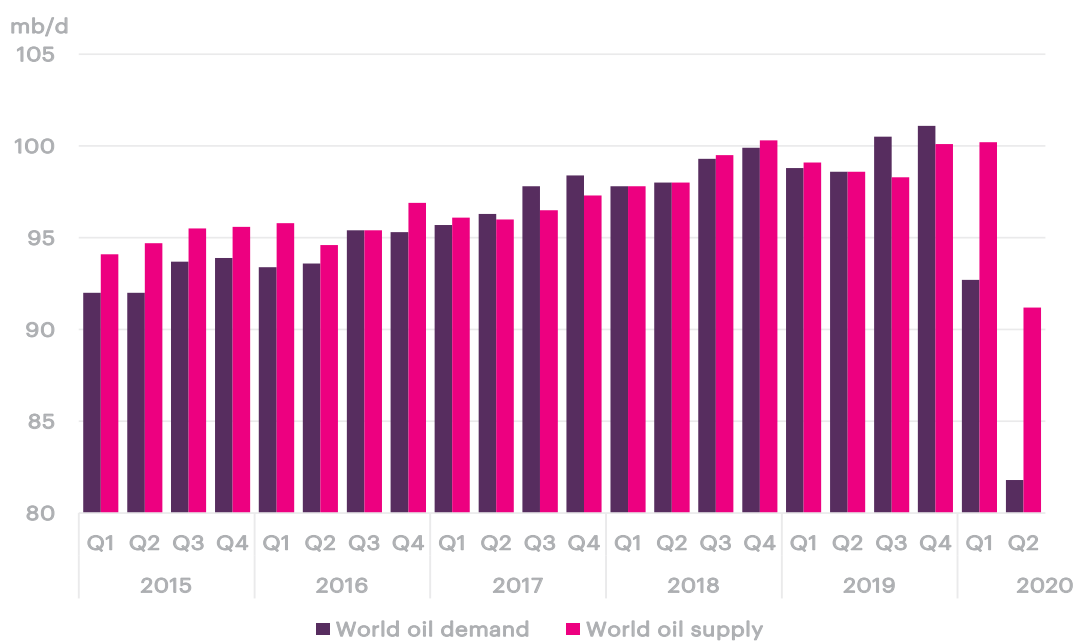
Source: International Monetary Fund

1.7. Global inflation 2013-2020



Source: IMF

1.8. Oil production and consumption statistics




Source: International Energy Agency



“Having spent the past eight years in the Middle East, I was ready for a change of pace in a new environment and market. I was drawn to Linesight, as it was constantly named as one of the leading companies. Working with top clients on prestigious projects cemented my desire to join the company. Since starting at Linesight, everyone has been extremely welcoming and professional, helping me adjust to a vastly different market.”

Caoimhe Britton,
Senior Cost Manager

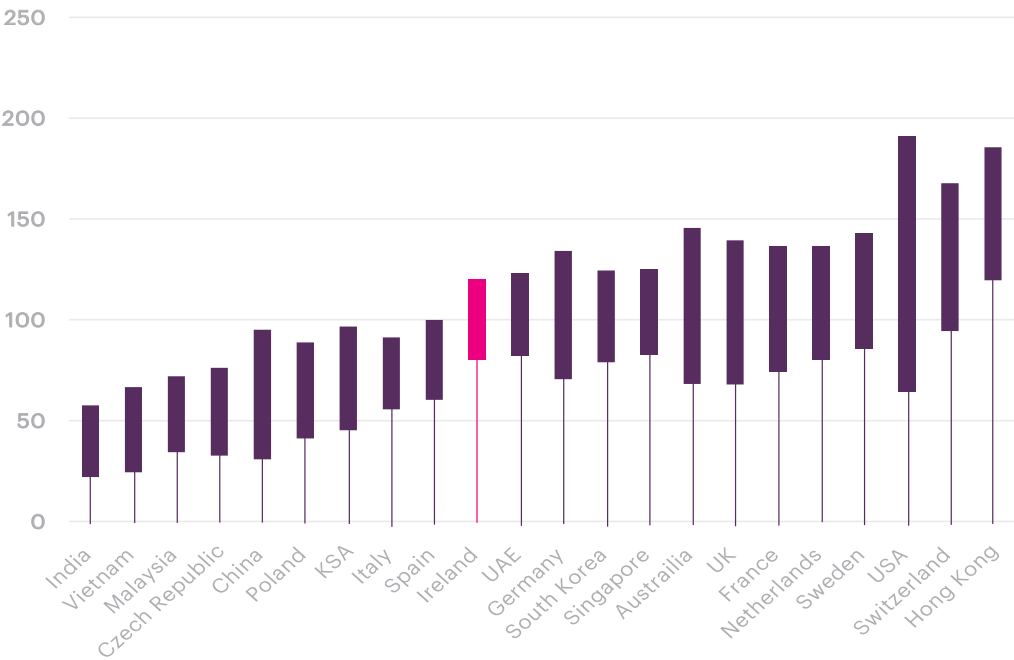
A portrait of Jason Tse, a man with dark hair, smiling, wearing a dark suit, white shirt, and a patterned tie. The background is a light purple gradient.

"The comradery amongst the team is fantastic, and facilitated by our forward-thinking, dynamic and approachable leadership team. There is a keen focus on supporting each individual's development, and I am being actively encouraged to further develop my skillset and the attributes needed to progress to a more senior role."

Jason Tse
Cost Manager

2. Indices

2.1. Linesight international construction cost index 2020 *



Source: Linesight



“There’s an open-door policy with management, and always someone you can turn to for advice and support. I really enjoy working with so many passionate and knowledgeable professionals in an open environment, in which communication and productivity are vibrant.”

Grace McConnell,
Senior Quantity Surveyor

3. Top international contractors and design firms

3.1. Top 20 international contractors *

Based on total firm contracting revenue

2019 rank	2018 rank	Firm	Revenue \$ bn
1	1	China State Construction Engineering Corp. Ltd.	170.43
2	2	China Railway Group Ltd., China	140.09
3	3	China Railway Construction Corp. Ltd., China	111.65
4	4	China Communications Construction Group Ltd., China	83.27
5	6	Power Construction Corp. Of China, China	52.98
6	5	Vinci, France	52.13
7	7	ACS, Spain	44.18
8	10	China Metallurgical Group Corp., China	37.23
9	9	Shanghai Construction Group Co. Ltd., China	34.24
10	8	Bouygues, France	32.02
11	11	Hochtief Aktiengesellschaft, Germany	29.12
12	12	China Energy Engineering Corp. Ltd., China	26.86
13	14	Strabag Se, Vienna, Austria	18.68
14	24	Larsen & Toubro Ltd., India	17.63
15	15	Obayashi Corp., Japan	17.52
16	16	Skanska Ab, Sweden	17.12
17	13	Bechtel, Reston, U.s.a.	16.83
18	20	Eiffage, France	16.04
19	18	Kajima Corp., Japan	15.98
20	19	Hyundai Engineering & Construction Co. Ltd., South Korea	15.73

Based on contracting revenue from projects outside home country

2019 rank	2018 rank	Firm	Revenue \$ bn
1	1	ACS, Spain	38.04
2	2	Hochtief Aktiengesellschaft, Germany	27.79
3	3	China Communications Construction Group Ltd., China	22.72
4	4	Vinci, France	22.20
5	5	Strabag SE, Austria	15.77
6	7	Bouygues, France	15.58
7	10	Power Construction Corp. of China, China	13.75
8	9	Skanska AB, Sweden	13.58
9	8	China State Construction Engineering Corp. Ltd. , China	12.81
10	11	Ferrovial, Spain	11.89
11	6	TechnipFMC, UK	11.14
12	13	Fluor Corp. U.S.A	8.84
13	12	Bechtel, U.S.A	7.20
14	14	China Railway Construction Corp.Ltd., China	6.95
15	16	Hyundai Engineering & Construction Co.Ltd., S.Korea	6.63
16	15	Salini Imregilo S.P.A, Italy	6.46
17	18	Consolidated Contractors Group, Greece	6.20
18	17	China Railway Group Ltd., China	6.18
19	25	China national machinery industry corp., China	5.44
20	18	Royal BAM Group nv, Bunnik, The Netherlands	5.30

Note: 2019 ranking is based on contracting revenue for services provided in 2018.

Source: Engineering News Record

3.2. Top 20 international design firms *

Based on total firm revenue

2019 rank	2018 rank	Type of firm	Firm	Revenue \$ bn
1	1	EAC	Jacobs, U.S.A	10.85
2	2	EC	Power Construction Corp. of China, China	8.82
3	3	EAC	Aecom, U.S.A.	7.93
4	**	EC	WOOD, UK	7.27
5	4	EC	China Energy Corp. Ltd., China	6.72
6	6	E	WSP, Canada	5.16
7	5	EC	China Communications Construction Group Ltd., China	4.82
8	8	E	Arcadis NV, The Netherlands	3.81
9	7	EC	SNC- Lavalin, Canada	3.79
10	10	EAL	Stantec Inc., Canada	3.15
11	9	EC	Fluor Corp., U.S.A.	3.11
12	13	EC	KBR, U.S.A.	3.09
13	11	E	Tetra Tech INC. U.S.A	2.89
14	14	EC	Worleyparsons, Australia	2.58
15	12	EC	China Railway Group Ltd., China	2.52
16	25	A	AF POYRY, Sweden	2.30
17	18	EA	HDR, U.S.A.	2.19
18	15	EA	Dar Group, Dubai	2.15
19	19	EA	Sweco Ab, Sweden	2.15
20		EC	China Railway Group Ltd., China	2.13

Based on contracting revenue from projects outside home country

2019 rank	2018 rank	Type of firm	Firm	International revenue \$ bn
1	**	EC	WOOD, U.K.	5.99
2	4	E	WSP, Canada	4.32
3	1	EAC	Jacobs, U.S.A.	4.24
4	2	EAC	Aecom, U.S.A.	3.59
5	5	E	Arcadis NV, Amsterdam, The Netherlands	3.45
6	3	EC	SNC-lavalin INC., Canada	3.36
7	9	EC	Worleyparsons (trading as worley), Australia	2.25
8	8	EAL	Stantec inc., Canada	2.24
9	7	EA	Dar group, U.A.E.	2.15
10	6	EC	Fluor Corp., U.S.A.	2.13
11	12	EC	KBR INC., U.S.A.	1.83
12	16	EA	Ramboll group A/S, DENMARK	1.59
13	14	E	Arup, , U.K.	1.36
14	15	AE	SWECO, Stockholm, Sweden	1.36
15	11	EC	Tecnicas reunidas, Spain	1.35
16	17	EA	Power construction corp. Of china, China	1.25
17	13	E	Mott Macdonald, U.K.	1.22
18	18	EC	China Energy Corp. Ltd., China	1.20
19	10	GE	Fugro NV, The Netherlands	1.19
20	40	A	AF POYRY, Sweden	1.02

Key to type of firm: A - architect; E - engineer; C - contractor; P - planner; L - landscape architect

Note: 2019 ranking is based on revenue for design services performed in 2018.

Source: Engineering News Record



“There is complete meritocracy at Linesight – there are no barriers to progression as we continue to expand and grow. It's an ambitious business with a distinct culture that encourages and supports the building of meaningful relationships, both inside and outside the organisation.”

Giles Heather
Associate Director

**The Eight Building,
Dublin**

Architect:
Reddy Architecture +
Urbanism

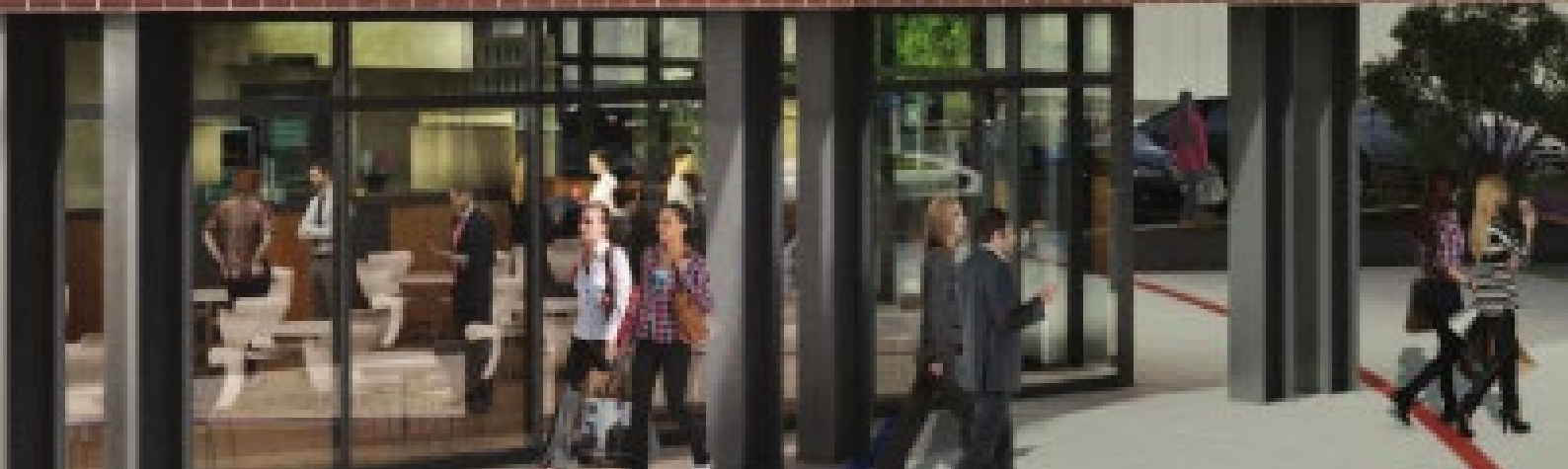
Linesight services:
Cost Management





Review and Outlook

Global Insights





**Lidl Ballymun - Student
Accommodation, Dublin**

Architect:

MCA

Linesight services:

Cost Management

The evolution of data centers

By 2025, the International Data Corporation (IDC) projects that the global need for data will skyrocket to 163 zettabytes, and COVID-19 has further increased our reliance in the interim. But how is this dependency on data in our day-to-day lives affecting the data center sector?



Gavin Flynn,
Program Director



Eoin Byrne,
Associate Director

Today's world is dependent on data, and that dependency has been exacerbated by the COVID-19 pandemic. By 2025, the International Data Corporation (IDC) projects that the global need for data will skyrocket to 163 zettabytes. From our banking infrastructure to our smart homes, technology and information play an increasingly crucial role in every aspect of our daily lives. This demand will continue to propel the data center market, which has changed dramatically since the 1940s, when large computer rooms like the Electronic Numerical Integrator and Computer (ENIAC) became the predecessors of modern data centers. From 2019 to 2023, the global data center market size is expected to grow by US\$284 billion, at a compound annual growth rate (CAGR) of more than 17%. But with the accelerated pace of innovation calling for facilities that are built faster, on tighter budgets and to evolving specifications, the construction industry must first understand the new challenges impacting the market. By bringing improved construction management methods like cost management, procurement and supply chain management, the industry can address the new challenges related to cost and time to market.

The impact of cloud and edge computing

The adoption of cloud infrastructure has heavily influenced the requirements of modern data centers. With the

advent of cloud-based software platforms, the organisation of resources has shifted to hybrid cloud systems, which pools off-premises and on-premises resources to optimize digital processes.

Another shift in workflows that affects the market is the rise of edge computing. More Internet of Things (IoT) devices, and the increased need for real-time data analytics and interactions, have pushed the demand for applications to have their computing processes closer to end users, which is usually at the edge of a network. By 2025, it is projected that 75% of enterprise-generated data will originate and be processed outside of traditional data centers or clouds.

This restructuring of digital resources has caused many enterprises to begin shifting from owning or operating their own data centers to incorporating colocation and managed hosting services. Businesses are now spending more on cloud infrastructure services than on data center hardware and software: from 2009 to 2019, spending on cloud infrastructure services has grown by 56% annually to nearly US\$100 billion, while annual enterprise spending on data center hardware and software grew by only 4% on average.

Hyperscale and colocation

This substantial change in how digital resources and

infrastructures are managed has boosted the hyperscale market, but also shortened project timelines. More than half of data center hardware and software spending now comes from cloud providers' hyperscale facilities. This massive demand for more capacity means that previously acceptable project durations are no longer sustainable. Providers must explore other options to reduce their construction schedules, which can include changing designs, land banking, developing cold shells and applying pressure to the construction market to match the speed of data center growth. The added demand has a domino effect. If hyperscale facilities and their supply chains cannot meet the need for more capacity, enterprises can lease more space from colocation providers to handle changing workload requirements.

Modular construction

Another way in which data center demands can be met is by adopting a modular construction approach. By applying modular techniques, speed to market can be addressed with an efficient supply chain. Modules can be manufactured offsite and tested for compliance, while the shell and core are built on location. Once the modules are ready, they can be shipped to the site and installed quickly. The simultaneous progress of all elements of the build shortens schedules significantly, with a 25-30% reduction in the time needed to build and commission a modular project.

There is also the added benefit of cost efficiency when adopting a modular approach. This is achieved by standardising certain building materials and designs. The modular method also employs economies of scale, where building materials that are mass-produced can be made at a lower cost.

Supply chain and procurement management

While modular construction methods may help in preventing delays and cost overruns, supply chain and procurement management processes are also extremely important tools that can be used to drive down costs and control project schedules. With market growth comes stress on the pool of available equipment manufacturers and suppliers, and if there are delays to equipment deliveries, then there will be interruptions in the overall project schedule. Equipment is a critical part of the project and can have a direct impact on a provider's ability to complete builds on time. By having an established supply chain with robust contracts, providers can take proactive steps to protect themselves.

Vendor Managed Inventory (VMI) is another key element. With the market moving towards more cost effective and consistent oversight of large equipment, VMI provides suppliers or the supply chain with more certainty around the construction project pipeline. This in turn helps them to be more economical

and flexible to align with their customers' demands. VMI also enables owners and data center providers to reduce their overall lead time. Collaboration and information sharing between clients and suppliers are essential to drive these results. By implementing supply chain and procurement management processes, and working closely with suppliers, project costs can be reduced and delays can be minimized.

The next step in data center construction

The changing requirements of data center builds and the growing demand for capacity highlights the need for a solution that can bring projects to market quickly and within a reasonable budget. Providers must now look beyond traditional construction techniques to meet market demands by employing a developed approach to procurement and supply chain management in navigating the new age of data center construction.





The impact of COVID on the supply chain

The supply chain has been one of the key casualties of the pandemic, with significant disruptions to delivery schedules and material supply remaining a core challenge.



Neil L Doyle,
Director

From the very early stages of the COVID-19 pandemic, with its outbreak in China and its proliferation around the world, and the subsequent and ongoing lockdown periods, the impact on the supply chain has been one of the key considerations and vulnerabilities for the construction industry. Significant disruptions to delivery schedules and material supply remain a key challenge, with diversification and strength within the supply chain now a fundamental objective. With the risk of financial instability, the strain on resources, and reduced efficiencies, lower working capacities and increased sanitation checks leading to longer lead times to contend with, there are three core pillars to focus on with regards to securing the supply chain, as discussed below; investment, diversity and resilience.

Investment

Construction is an essential component in the recovery of the global economy, constituting a key contributor to GDP for most countries and a vital source of demand for raw materials. As the industry continues to recover and restart, investment in the supply chain is a fundamental requirement across all levels.

Private investment and financial support from clients and Tier 1 suppliers should be provided to the lower levels of the supply chain to protect and secure it, and avoid further casualties of COVID-19. These lower levels are key to a successful recovery of

the construction industry, and with numerous suppliers affected by the pandemic, the focus should be to return to pre-COVID levels. Equity investments and acquisitions are crucial to the re-emergence of the supply chain. It is also imperative that government stimulus packages are used to restart the economy and provide a boost to the lower levels of the supply chain to return to operations. The current shortage of materials will continue in effect if government support is not provided.

Lastly, with the delays caused by COVID-19, the sharing of business forecasting and planning is imperative to securing a supply chain. Many businesses are now employing the use of advanced purchasing and increasing inventory levels to provide short-term security in the supply chain. While this will provide encouragement to the suppliers, the onus must be on the supplier to maintain pricing levels and not pass the costs of inventory storage to the consumer.

Diversity

With the considerable disruptions to the supply chain, which are well documented at this stage, there has been an increased focus on sourcing more local suppliers, who have manufacturing capacity and materials available to circumvent the overseas shipping delays. This includes Tier 1 suppliers looking into local suppliers, with an overall shift away from dependency on cheaper produce available

from other regions. If COVID has highlighted anything to the wider industry, it has been the overreliance on China as the factory of the world, and there is now a marked effort to look at other low labor cost locations as alternatives.

The pandemic has undoubtedly spurred on key improvements across the industry and the supply chain, including innovation to maintain agility in the sources of supply and to mitigate the risk of issues in the supply chain. The ability to move quickly to activate secondary supplier relationships, and secure additional critical inventory and capacity is key. It may also be prudent to identify suppliers with shared resource pools for raw materials inventory, where it applies. Overall, the adaptability of suppliers is coming to the fore.

Furthermore, COVID-19 has impelled the digitalization of supply chain management, innovation and the advancement of technology. This extends across resource planning, supporting increased communication without the need for complex travel arrangements and enhanced supplier relations.

The severe impact we have all witnessed within supply chains around the world has led to a rethink around different supplier resources, and mapping those out to reduce the impact in the supply chain when 2nd and 3rd tier suppliers can't meet demand. While it can be expensive as it requires time to build up a good





risk-mitigation strategy and an updated list of companies in the market, it is ultimately worth it to avoid disruption at times like this. Lastly, the importance of better due diligence checks and increased awareness across the supply chain cannot be underestimated. It is imperative to know all of the supplier base below level 1, and where the supply comes from to secure business continuity. There is also, of course, a need to now tighten up supplier selection protocols. updated list of companies in the market, it is ultimately worth it to avoid disruption at times like this.

Lastly, the importance of better due diligence checks and increased awareness across the supply chain cannot be underestimated. It is imperative to know all of the supplier base below level 1, and where the supply comes from (geographical location) to secure business continuity. There is also, of course, a need to now tighten up supplier selection protocols.

Resilience

Needless to say, resilience within the supply chain has become all the more important in light of the current pandemic. The impact of COVID is reverberating down the chain, through Tier 2, 3 and

4, given the unavailability of raw materials and components to feed up through. With the reduced efficiencies and loss of revenue as a result of less purchasing during the pandemic, financial instability within the supply chain is a risk, and the increased strain on resources may drive some suppliers out of business.

Conversely, some businesses and supply chains have demonstrated their adaptability and changed their approach, and may have excelled during the pandemic due to demand, e.g. PPE, delivery services. We have seen collaboration across the supply chain in some instances, with suppliers working together with a common end goal in sight. Some have even seized opportunities presented by the crisis for growth, with new businesses emerging, although the long-term stability and viability of these companies could be considered somewhat precarious.

Ultimately, companies are quite susceptible to experience disruption in the challenging times we find ourselves in, with potential factory closures at play, whereby manufacturing can grind to a halt very quickly. Supply lead times are being prolonged by the extra security and sanitation

checks required, with packaging, loading and shipping taking longer than previously, and scheduling becoming more difficult.

Summary

Undoubtedly, the impact of COVID-19 on the supply chain has been a huge issue since the early stages of the outbreak and has been felt around the world. It has proved to be a significant challenge and vulnerability for the construction industry, and the need to protect and secure the supply chain has never been more apparent. There are three core pillars that we view to be fundamental in this regard, as discussed above – investment, diversity and resilience.

Reimagining the post-pandemic workplace

COVID-19 is redefining how we live and work, as well as altering our perceptions of place, and challenging us to rethink the design and functionality of our spaces.



Adrian Farren,
Associate Director



Des O'Broin,
Director

COVID-19 is redefining how we live and work, as well as altering our perceptions of place, and challenging us to rethink the design and functionality of our spaces. The built environment will face new demands post-pandemic, and how we use spaces will change, from repositioning and adapting existing assets to building new ones.

Real estate has undergone quite a bit of change in recent years as is, with the proliferation of concepts such as coworking, flexible working and hot desking, providing new solutions that account for the evolving ways in which we work. However, COVID has certainly served as a catalyst for transformation with the commercial and corporate interiors space. In this piece, we put forward some of the key considerations in this sector for the near future, as we look towards a return to offices.

The role of remote working

Prior to the pandemic, the proportion of individuals working remotely was low, with figures from various labor force surveys indicating that just 5% of the workforce in the EU27 worked from home in 2019 – a proportion that had remained relatively constant since 2009. In the US, this figure was 7% according to the 2019 National Compensation Survey from the Bureau of Labor Statistics. Despite years of predictions about remote working being the upcoming trend and advocacy for its merits,

a marked shift never really happened. And yet, suddenly in March 2020, working from home was thrust upon us as the new norm.

While productivity has been relatively unscathed – a recent Stanford report notes a 13% gain in employee performance related to remote working – it is clear that social and collaborative workplace engagement have been casualties of full-time working from home, and that employees may not feel as connected to the company culture as they do when immersed in it physically in an office. It is more challenging to maintain the more personable, human aspect of an organization remotely.

Going forward, it is likely that there will be a happy medium in terms of remote working, and that corporate workspaces will serve as environments for collaborative working and connectivity, rather than a place where employees come to work on individual projects or tasks.

Density and space utilization

Pre-COVID, soaring real estate costs were driving higher density and greater utilisation of space. Many large companies were forming global standards of office spaces, that were essentially a kit of parts to be adapted to different locations, such as tech hubs, easily configured offices, open-bench workstation neighbourhoods, and open network team areas. In

terms of average square feet per employee, the norm in the 1980s was 200 to 300, according to Moody's Analytics, but by 2019, that average had fallen to 126.5.

However, with the social distancing measures in place for the foreseeable future, and the abovementioned role of remote working going forward, space capacity and functionality will change, meaning that traditional high-density configurations of rows of desks will have to be reconsidered. With offices expected to cater more towards collaborative and social functions, there will need to be a shift towards smarter spaces that are conducive to interaction and conversation.

HVAC

The role of adequate ventilation and indoor air quality in office spaces is obviously important, but it should be noted that not all heating, ventilation and air conditioning (HVAC) systems are up to the task for current requirements. Now more than ever, it is vital that systems are reviewed with fresh air intake in mind and relative humidity, and potential improvements, such as filter upgrades, pre-filtration options and purification solutions, considered. The opportunity for smart technology to optimize the systems should also be explored, in terms of monitoring CO2 levels as a fundamental air quality indicator (and of the performance of the ventilation system), and controlling the operation of the system.

A strong focus on well-being

In recent years, there has been increased focus on the role of health and well-being in the workplace. Given that the average American spends 93% of their life indoors, according to the Environmental Protection Agency (EPA), it makes sense that now more than ever, organisations want to explore how they can optimize their

workplace from a health and wellness perspective.

While certifications such as the Well Building Standard and Fitwel have been more and more popular in recent years, both have developed new standards in response to COVID. WELL has introduced the Health-Safety rating, which builds upon the existing pillars within the Standard, focusing on five key themes:

cleaning and sanitization; emergency preparedness, which incorporates business continuity planning, building re-entry, and supporting resilience during emergencies; health-related services for occupiers; air and water quality management; and stakeholder engagement and communications. It is not confined to a particular type of facility and is customizable across 38 different criteria.



Meanwhile, Fitwel has launched a Viral Response Module as of the end of August, as an addition to its standard building certification. It provides annual, third-party certification of policies and practices, informed by the latest public health research on mitigating the spread of contagious diseases and incorporates turnkey policies that can be adapted to specific requirements. There are five chapters involved: leveraging

buildings to migrate viral transmission; building trust in the workplace; addressing mental health within residential settings; optimizing density for people; and addressing health disparities in the built environment.

While developers and tenants are reviewing their space requirements and looking to adapt their office space for flexible and remote working, the reality is that the need for

connectivity and collaboration will ensure that the office market remains somewhat resilient during these uncertain times.



Managing bioreactor lead times for success in biologics

Because of their long lead times, bioreactors can greatly influence a biotech project's critical path and affect the overall project timeline. Linesight has conducted in-depth market research to better understand the current conditions, drivers and future trends of the bioreactor industry.



Jeff Peragallo,
Director and Vice President
of Operations



Nigel Barnes,
Director of Life Sciences



Ronak Shah,
Scheduling and Project Controls
Graduate

With the global healthcare spend continuing to increase dramatically and projected to reach in excess of US\$10 trillion by 2022, pharmaceutical companies are making significant investments in the research, development, and manufacturing of biologics, which are drugs that are derived in living organisms. Biologics projects consist of many elements, including the overall design, construction, and start-up of the entire facility, but one of the most important pieces of equipment involved in the manufacturing process is the bioreactor. Because of their long lead times, these reactors can greatly influence a biotech project's critical path and affect the overall project timeline. By focusing early on a bioreactor's design and development, clients can control one key aspect in ensuring the successful and timely delivery of biologics projects.

Key considerations

- Preparing for a project's success begins with understanding critical equipment lead times
- Bioreactors are major components in biologics facilities
- Developed by rigorously distilling project and market data, Linesight's diagnostic reveals vital insight into the impact of bioreactor lead times on the overall project timeline.

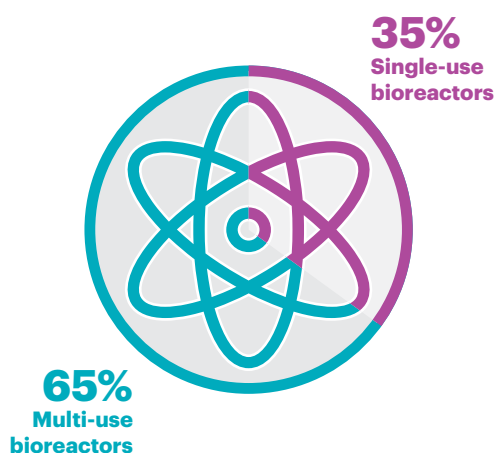
Investments in biologics are driven in large part by the global increase in life expectancy, improved access to medicines and the growth of non-communicable diseases, most prominently cancer, heart disease and diabetes. Spending on new cancer drugs alone is expected to grow by more than 50% over the next few years, with particular focus on the production of biologics. These biologics have revolutionized the treatment

of many cancers and chronic conditions, such as multiple sclerosis, arthritis and rheumatoid arthritis, Crohn's disease and other autoimmune diseases.

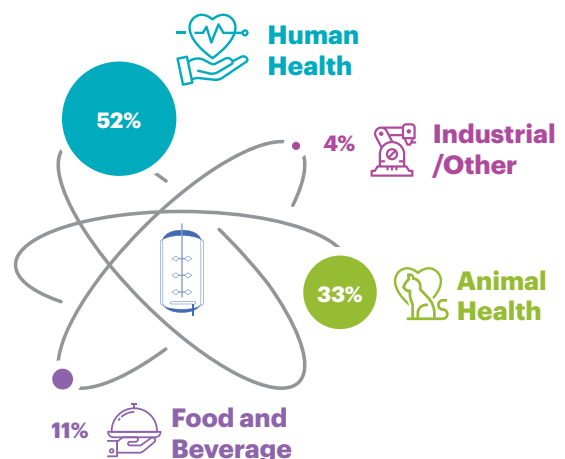
Additionally, established life science companies are upgrading their existing facilities to keep track with the latest regulations and technology. Start-ups are also joining the fray, as funding has become available based on the anticipated high return-on-investments. Thus, biologics manufacturing is expected to skyrocket over the coming years.

The manufacturing of biologics relies heavily on the use of bioreactors. A bioreactor is simply a vessel in which a chemical process, usually involving organisms or biochemically active substances derived from such organisms, is carried out. There are two types of reactors: multi-use and single-use.

TYPES OF BIOREACTORS BEING BOUGHT



WHO IS BUYING?





A single-use bioreactor, or disposable bioreactor, is a bioreactor that is lined with a disposable bag. A multi-use reactor is a vessel made typically of stainless steel or glass. With the full-on press of the pharma industry into biotech, the bioreactor market is red hot.

As such, with any significant investment, understanding the critical equipment and the lead times help our clients to better plan and prepare their projects for success. Our clients depend on us, as the market intelligence leader, to bring this insight to their projects.

To this end, Linesight created a diagnostic that was based on real-time data that was gathered through a survey administered

to a cross-section of bioreactor manufacturers located across the globe. The respondents were business owners, operations managers, and sales managers with current project experience. The objective of the survey was to understand the current conditions, drivers, and future trends of the bioreactor industry.

Insights and market forecast

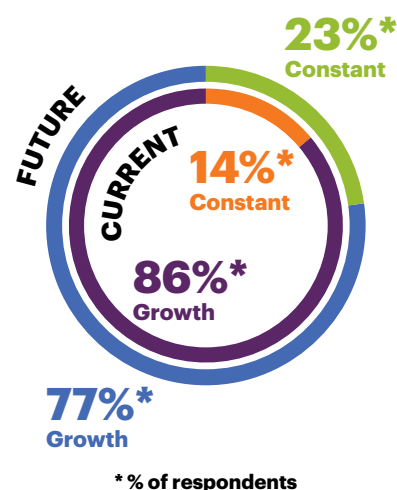
Historically, the US and Europe have been the major consumers of bioreactors and continue to be in a strong position with robust demand. The US biologics market could, however, face possible threats to its vitality, depending on the US Presidential election and any incoming changes to policies regarding healthcare

and drug pricing. The market in Asia, on the other hand, is having a major effect on the purchasing of bioreactors and is expected to see growth, with many of the bioreactor suppliers moving to the region to meet the demand. 80% of the reactor suppliers see the market increasing in activity, thus adding more pressure to lead times. The factors that are driving biologics are not expected to change if a global recession were to occur.

Conclusion

With their long lead times, bioreactors are driving the critical path of biotech projects. Though lead times are primarily influenced by reactor size and the manufacturers' supply chain, there are specific actions that clients can take to help minimize

MARKET CONDITIONS



IMPACT TO MARKETPLACE IF GLOBAL RECESSION OCCURS





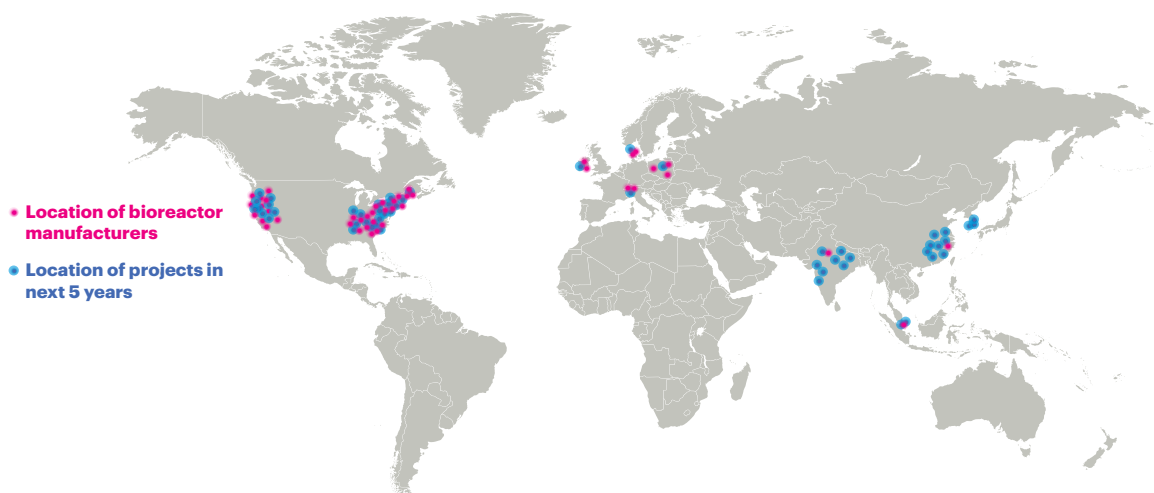
delays by **locking in their process design early**, providing **focused show drawing reviews** and **streamlining approvals**. Linesight has seen success with clients that have a strategic focus on sourcing. These sophisticated clients have engaged Linesight to bring industry and marketplace expertise to help implement and execute sourcing strategies that are aimed to deliver value across their programme of work. These clients have successfully

leveraged their buying power and have strategically aligned with some of these reactor manufacturers to improve costs and lead times. The work does not stop at the sourcing stage; order management is equally important, where focus must be on maintaining regular contact with the manufacturer and visiting the fabrication facilities to ensure processes are on track. Understanding bioreactor lead times and working with

construction consultancies that have experience in reducing delays on this critical equipment are proactive steps to ensuring overall success on biotech projects.

Please note that this study was conducted pre-COVID, so bear in mind that supply chains are disrupted and as a result, lead times may vary at this juncture.

WHERE THEY ARE VS WHERE THEY ARE NEEDED



The true adoption of BIM - adding tangible project value?

Despite improved quality of information, as well as more accurate and speedier cashflow analyses being obvious advantages in the built environment, these benefits of BIM are often not realized to their full potential, due to implementation or adoption issues.



Diarmaid Connolly,
Associate Director

It is fair to say that BIM has been a topic of great interest within the construction industry over the last number of years, hailed as one of the core ways that we as an industry are embracing technological evolution, tackling inefficiencies, improving information quality and increasing design team collaboration. It is true that it offers a number of distinct advantages, and yet, as noted by John Hainsworth of Aurecon in his article, 'The promise of 'digital' won't be achieved by doing things the way we've always done things', with an array of definitions and a lack of clarity surrounding BIM, its full benefits are yet to be realized. John points to the fact that its implementation is often carried out in a file-based, transactional manner, with a truly collaborative approach absent and ways of working essentially the same as they have been traditionally – just using the technology to do the same things and missing out on the potential benefits.

At Linesight, the lack of willingness to fully adopt is something that we see on a global basis, although the extent does vary somewhat from region to region. We have adopted BIM on a global basis and invested heavily in its implementation, both in hardware and software, and in continuous staff training, to ensure that we are up to date with the latest developments and at the forefront in terms of its effective utilisation. Below is a summary of the key benefits

that we see in the effectual use of BIM.

Speed and agility

The pace at which estimations can be produced increases considerably with the use of BIM, and this is one of the key advantages of its effective implementation. It enables the creation of option costs with greater speed, as well as the potential for live cost planning and modelling – introducing a level of agility with cost planning and estimating that has not traditionally been possible. Ultimately, this leads to faster decision-making and thus, a faster speed to market.

Accuracy and quality

Information accuracy and quality has been a particular challenge for the industry in recent years, with the UK's 'Get It Right' initiative finding that information errors cost the industry an estimated 5% of project value globally. In addition to the abovementioned speed and agility benefits, effective BIM implementation increases the accuracy with which cost estimating, planning and modelling can be carried out, by minimising the risk of human error, as well as supporting a higher quality of information. This in turn leads to a more cooperative project, as tenderers are much less likely to recover costs incurred due to poor or inconsistent information.

Increased productivity

While increased collaboration is often touted as a key benefit associated with BIM, this is not something that comes to fruition as often as one may think. The technology facilitates clarity, transparency and real-time sharing of information across the project team, coordinating information from various disciplines and eliminating version control issues, as well as keeping the lines of communication open. However, a proactive approach is needed across the team to actually realize these benefits, which is quite often lacking.

Cashflow

Managing and forecasting cashflow throughout a project is fundamental to its success, and traditionally, cashflow analysis is a lengthy and tedious process. From Linesight's perspective, this is one of the biggest advantages associated with BIM – its effective adoption facilitates more accurate speed forecasting by linking cost-loaded models and programmes, with more detailed models producing more accurate cashflow analyses. Ultimately, our early involvement in a project means that cashflow investment can often be deferred, which is particularly beneficial for projects with a large capital spend.

Cost intelligence

While benchmarking is not a new methodology, BIM facilitates it at a more accurate level as costs are broken down in more detail in the models, so by splitting the model, it allows us to benchmark

specifics. However, by using BIM to its full potential, it pushes this further, to what we refer to as cost intelligence. With a deluge of complex data associated with projects nowadays, utilising the latest data visualisation tools brings this data to life in a meaningful way – illustrating trends and concepts in a quick and easy-to-digest format, allowing project teams and clients to draw conclusions from large volumes of data and inform effective decision-making.

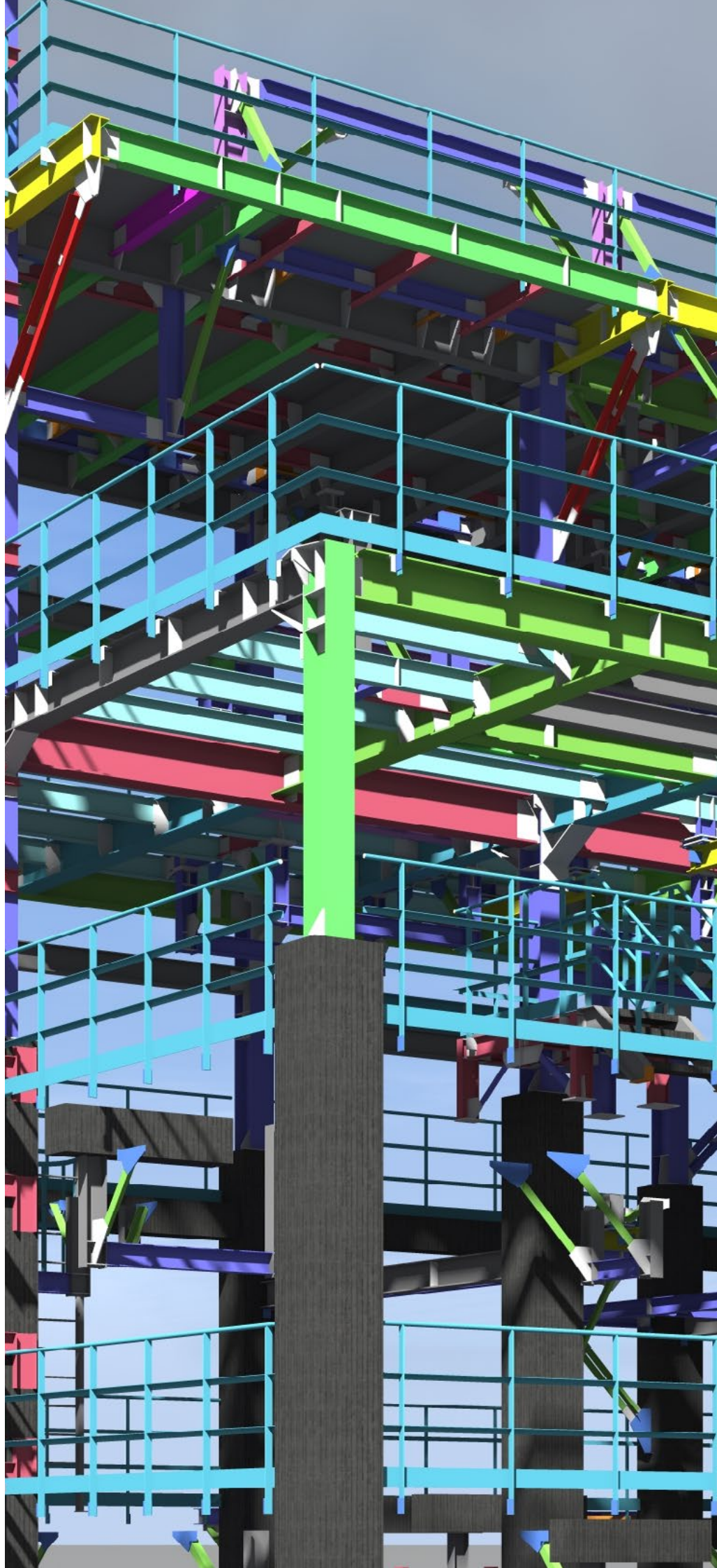
In summary

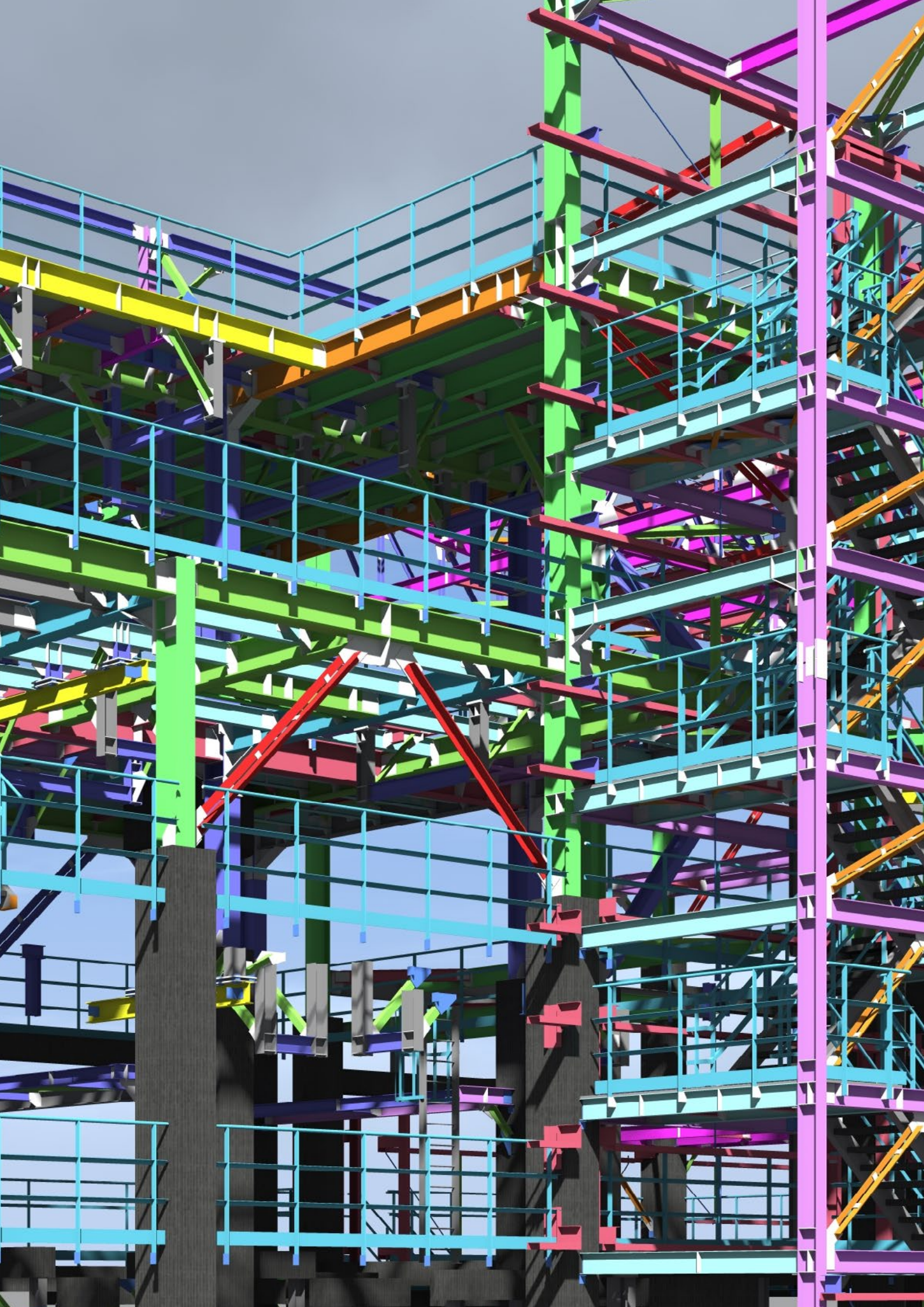
While the benefits of BIM are often well-covered, these are not often realized to their full potential due to implementation or adoption issues. Ultimately, the technology is there, but not the willingness to take the leap of faith to truly adopt and trust the use of BIM. At Linesight, we believe that clients and design teams should consider this sooner rather than later, as the rewards are rich. We've made the jump and seen significant benefits in the built environment for our clients – are you ready for the leap?

**Information
errors
cost the industry
an estimated**

5% of
project value
globally.

—





Keeping it Lean and bringing contractors along for the journey

Lean concepts have been applied with much success in many industries and service provider organisations around the world. But how can it positively impact the built environment and why has its adoption amongst contractors been relatively slow to date?



Jeff Peragallo,
Director and Vice President
of Operations



Pat Unger,
Associate Director

The landscape for the construction industry has changed immeasurably in the face of the current global pandemic, similar to almost all other industries. It would seem now more than ever, that Lean principles would be beneficial to help the industry navigate into the post-COVID world. Furthermore, with the ever-growing demands and complexities associated with the built environment, and the well-publicized productivity challenge within construction (more than 70% of all construction projects are completed late and over budget), it is evident that the industry requires some level of disruption to enable it to keep apace of the progress other industries are making in terms of efficiency. So, why is Lean Construction still not fully embraced by contractors, and what do you as an end-user need to be aware of that can lead to this reticence to adopt?

What is value, and how is it driven by Lean?

Value is defined as what the customer perceives as important and is willing to pay for. It comprises anything that moves the project closer to completion and that cannot be reworked. True value is the 'why' behind a project being undertaken and the desired outcome or objectives, and this typically extends beyond budgets and schedules. Lean focuses on the prioritisation of the operational needs and values of the users, while delivering on budget and schedule, promoting innovation that optimizes value

and eliminates waste.

Eliminating waste and inefficiency

Construction industry studies have shown that in excess of 50% of the effort required to deliver a project is typically non-value-added effort, or waste from the perspective of the client. By focusing on non-value-added activities, processes are constantly reviewed for any waste or inefficiency, and what the client-led value objectives are, to achieve true alignment. Ultimately, it leads to productivity gains, optimal ways of working and the optimisation of project outcomes.

Nurturing a collaborative culture

Traditionally, construction is a combative industry – teams work in silos, the built environment is increasingly challenging, and as referenced above, productivity is stagnant. A combative culture will derail Lean, and will often have tangible impacts on a project, both in terms of cost and schedule. The Lean concept turns this on its head, championing collaboration, trust and open communication between all members of the project team, streamlining the efficiency of the project team and giving the highest chance of collective project success.

Streamlining the workflow and project delivery

Not only does Lean remove waste and inefficiency, while facilitating early engagement, consistent collaboration and constant communication, but these

factors intuitively streamline the workflow. Furthermore, the use of methodologies, such as modular and prefabrication, support fast-tracked delivery, as well as optimising the capital spend.

Why are contractors slow to adopt Lean?

Contractors play a key role in the adoption of Lean, as they are responsible for the key facets of a project, including cost, schedule, safety and quality. And yet for the most part, general contractors have been somewhat slow to embrace it. Why is this the case?

A fundamental, organisational change

Lean is a significant change for any business, and can be perceived as a somewhat abstract methodology for those from a traditional construction background. It essentially changes the contractor's organisational approach at its core, and so it must be fully bought into and believed to be achievable to facilitate such a fundamental change.

Tight profit margins versus perceived cost

Construction contractors typically operate on a relatively tight net profit margin before tax, sitting around the 3% of revenue mark. Inevitably, the perceived costs associated with the necessary training and implementation of Lean will be a particularly important factor in this case, and may play a hand in its slow adoption as a result. Any potential adopter will need a good understanding of what level



of productivity loss they should expect during the learning and implementation phase.

An elemental approach

Lean's main allure for the construction industry comes in the use of elemental and relatively inexpensive tools, which again taps into its inherent value. Breaking activities and tools down will be cost-efficient but effective. A platform like Last Planner is an example of one of these tools.

What is the value to the contractor?

Similar to the client, Lean offers a distinct value proposition to

the contractor, and again, the value relates to productivity. In an industry in which productivity is poor and wages account for a substantial proportion of total revenue, a marginal increase in productivity arising from a methodology such as Lean will have a significant impact on profit. For example, a 10% uplift in productivity in a business, with 3% average profit where wages amount to 35% of total revenue, will double the profit.

Furthermore, achieving improved productivity helps to mitigate against risk in a business that is inherently risky and competitive, and so it is hard to understand

why the adoption rate is still remarkably low. However, the general consensus is that these distinct benefits have been lost in translation along the way, and that hard facts and statistics are needed to address this in terms of which contractors will be receptive.

What Lean techniques and practices are particularly relevant in a post-COVID world?

While the benefits that off-site methodologies can offer is relatively well-known, the potential for OSM to counteract some of the productivity challenges arising from COVID



measures (for example, reduced capacity on-site due to social distancing) is significant. Another system worth referencing in this regard is Last Planner, with its capabilities to produce a predictable and efficient work flow all the more pertinent with the current challenges being faced in the industry.

Conclusion

While we see Lean being readily adopted in some sectors, it is typically more widely accepted in manufacturing and industrial-type verticals. This is because the Lean concept is ingrained in their background, and as a result, it is second

nature. For contractors, Lean can represent a daunting and costly investment, but it is evident that the derived benefits of adoption are worthwhile. There are many examples of contractors embracing the methodology to its full effect, and perhaps part of the solution lies in learning from peers and allies, exploring case studies of what has worked well in the adoption approach.

While overall, challenges to its widespread adoption remain, the benefits of Lean to projects and the construction industry as a whole are clear. It promotes the elimination of waste and inefficiency, nurtures

a collaborative culture and streamlines the workflow and project delivery. In bringing the concept to the forefront, Lean becomes a client-led objective, with a clear statement of the intention to embrace the Lean approach to all members of the project team at an early stage. It must be implemented through a systematic, process-driven and program-based approach. Ultimately, there's a great deal to gain by innovating project delivery. The Lean methodology has a lot to offer, which begs the all-important question: where are you and your organisation on the Lean journey?

The true cost of NZEB in practice

With NZEB now in practice, we are seeing the true cost and impact of it manifesting itself on Grade A commercial space and large-scale residential apartments. But in addition to the increased construction costs, we are also seeing the positive implications it is having for the developer.



Stephen O'Grady,
Senior M&E Surveyor

The background to NZEB

The EU Energy Performance of Buildings Directive which affirmed that all new building constructed in member states will be near zero energy buildings (NZEB) by December 31, 2020, and all new buildings owned and occupied by public authorities must be NZEB-compliant after December 31, 2018 has now been incorporated into Part L Building Regulations.

The key parameters for measuring NZEB compliance are the maximum permitted energy performance coefficient (MPEPC), renewable energy ratio (RER) and maximum carbon performance coefficient (MPCPC). Each method within the NEAP framework will calculate the EPC and CPC of the building being assessed, and clearly indicate whether compliance with regulations has been achieved:

- Where the MPEPC of 1.0 and MPCPC of 1.15 is achieved, an RER of 0.2 or 20% represents a very significant level of energy provision from renewable energy technologies
- Where the MPEPC of 0.9 and MPCPC of 1.04 is achieved, an RER of 0.1 or 10% represents a very significant level of energy provision from renewable energy technologies

Meeting NZEB

Commercial schemes

Since the revised Part L regulations have been introduced,

Linesight has been involved in numerous commercial and residential projects, and the uplift to M&E installations is circa. 7-10% when benchmarked against historical projects. Ultimately, these new regulations are adding capital costs to developers.

In commercial office buildings in Ireland, there are numerous items to be undertaken to ensure compliance is achieved:

- Use of renewable sources – photovoltaics (PVs), air source heat pumps (ASHP) etc.
- Fabric insulation and reducing thermal bridging
- Enhanced building controls
- Limiting air infiltration
- Enhanced commissioning
- Specific fan power reduced for various systems

At Linesight, we are seeing the above having impacts across the mechanical installation in a standard four-pipe FCU CAT A development, and these include the following:

- Upsizing of FCUs to enable lower temperatures from ASHP
- Upsizing of pipework to enable lower temperatures
- Costs associated with specific fan power across all plant items
- Ductwork leakage testing mandatory on high-pressure ductwork
- Increase in costs of BMS to cater for additional building controls
- Increase in commissioning requirements to meet minimum standards

In most commercial office projects in city center locations, it may be difficult to meet the RER 0.2 by changes to the above systems due to site constraints, so it is also advised to make the façade as efficient as possible, as this reduces the energy loss of the building. There is no one way to gain compliance with regulations, however. Whichever approach is taken, the M&E systems are affected and generally, when our benchmarks are looked at, the M&E element is increasing in cost by circa. 7-10%, as referenced earlier.

Residential projects:

Linesight is also involved in numerous large-scale apartment schemes, whereby various technologies are being used in order to meet the new NZEB requirements.

Where a building contains more than one dwelling, like a block of apartments, it has to be shown that every individual dwelling has an EPC and CPC no greater than the MPEPC and MPCPC respectively. Alternatively, it must be shown that the average EPC and CPC for all dwellings in the building is no greater than the MPEPC and MPCPC respectively.

The Part L regulation standards must be achieved for both apartment and landlord areas. The key client decision to make is the mechanical system to be installed, which can be summarized as follows:

1. EAHP (exhaust air heat pump) in each apartment for water heating, MVHR unit for

- ventilation requirements, electric heaters for space heating, PV required on roof
2. EAHP for space, water heating and ventilation requirements, minimal PV panels required
 3. District heating (ASHP) to HIU in each apartment for space and water heating, MVHR unit in each apartment, PV required on roof

Currently in the Irish market, the most common solution is the EAHP as a one-stop solution in each apartment for space, water heating and ventilation requirements. However, the most cost-effective solution to meet NZEB requirements is option 1 above, utilising electrical heaters, around which there remains a stigma, meaning that developers and agents are slow to commit to them.

Conclusion

In summary, the new NZEB regulations have a distinct impact on the clients developing Grade A commercial space and large-scale residential apartments, as it increases the cost of construction projects, so the developer may feel that they are not seeing a sufficient yield to warrant this additional cost. However, the flip side of the coin is that the developer is getting a higher quality building with a reduction in running costs, and also a higher specification of building services. This is down to the increased commissioning requirements, as well as the quality increase in monitoring and building management systems.





The rise of the smart hotel

Intelligent buildings are not a new concept, but the level of advancement is gathering pace and the increasing adoption of smart technology is spreading across multiple sectors.



Andrew Callaghan,
Director



Des O'Broin,
Director



Hugh McElvaney,
Senior Quantity Surveyor

Intelligent buildings are not a new concept, but the level of advancement is gathering pace and the increasing adoption of smart technology is spreading across multiple sectors. While these core drivers impact every sector, the influence of technology and shifting demands is particularly significant within the hospitality sector, as it shows a marked shift towards integrating these technologies into the latest developments. This boils down to a few key factors, as discussed below. It is important to bear in mind that while the sector is currently struggling with the impact of COVID, it will recover in the coming years as the world adjusts to the 'new normal', and smart technology will play an even more important role in its recovery and success.

The hyperconnected guest

One of the most fundamental drivers behind the trend for smarter hotels comes in the form of the rise of experience consumption, which is a key catalyst in a sector wherein consumer needs are front and center. As noted by Alex Witkoff, Executive Vice President of Witkoff Development, at Bisnow's Hospitality Investment, Development and Management Summit in New York earlier this year, "Spending on the experience economy is expected to reach \$8 trillion by 2028". The experience is becoming even more important to the guest and optimising this can make all the difference against an increasingly

competitive landscape. Recent reports actually suggest that 2020 will be the year that customer experience overtakes price and product as the key brand differentiator.

There is a plethora of ways in which intelligent technologies can be leveraged in order to optimize the guest experience, but the crucial aspect is its ability to tailor and personalize their stay. Indeed, 86% of consumers say personalisation plays a role in their purchase decisions, according to recent Kahuna survey, and brands that incorporate personalisation by integrating data and advanced technologies report revenue increases of 6-10% (Qubit). Ultimately, Millennials or Generation Y form a very significant proportion of the target market, influencing the design of new hotels, from incorporating new technologies to the inclusion of co-working areas.

Customer expectations are evolving in line with their adoption of technology in their day-to-day lives. Guests are using technologies, from streaming services and smart assistants to remote climate control in their homes, so the expectation that hotels will have the infrastructure to support and match these technologies is taking hold. They expect the ability to tailor their experience to some extent, and to have the autonomy to control their space and hotel experience, including:

- Climate and temperature control
- Temperature for showers
- Curtain/drapes/blinds
- Entertainment systems
- Hands-free, voice-control
- smart assistants
- SmartBed™ technology
- Smart self-check-in/check-out kiosks

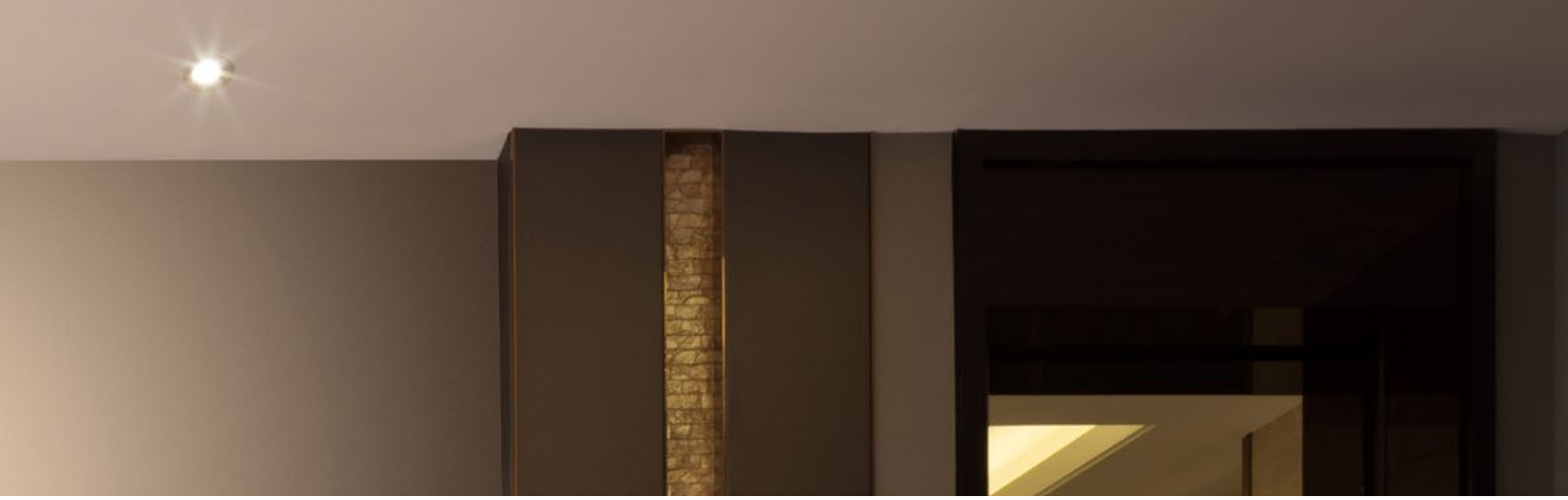
Needless to say, it is now the norm to interact with multiple devices at any given time.

Furthermore, hotels are now in a position to collect and analyse insightful data, and to anticipate, manage and understand guest preferences, in order to enhance the guest experience. Data-driven insights will help to personalize the experience and guide service provision.

Guiding operational efficiency

The second key driver lies in operational efficiency. Integrating smart technologies, from the simple occupancy detection systems to the more complex smart phones operating the lights and electricity within a room, keyless access and mobile check-in — these measures are proving to offer tangible benefits to the running costs of a hotel. We are moving towards the concept of a truly connected hotel, by leveraging Internet of Things (IoT) technology to ensure systems work together and communicate to deliver efficiencies in all areas. This extends from robot butlers delivering your room service to digital door signage functionality, to allow housekeeping staff to





remotely see the rooms to be cleaned and devise an efficient workplan around that live data.

Smarter hotels in practice

Yotel, Citizen M, Best Western and Wynn Resorts are just some of the names adopting and promoting these new technologies. Marriott International is often perceived to be leading the charge in this regard across its 30 brands in 126 countries, from integrating keyless access on a widespread basis, to continuing to work on its connectivity and adoption of smart technologies via its IoT Guestroom Lab within its Innovation Lab. An example of how it is implementing this technology in practical terms lies in the Aloft Hotel chain, which sits under the Marriott umbrella. Linesight was a part of the team that delivered its Dublin City branch last year, with some interesting and forward-thinking technologies delivered as part of the project:

- Mobile check-in
- Keyless access via an app
- Wireless printing facility in reception
- Large video walls to reception and bar area
- USB charging sockets
- Integrated international adaptors in guestrooms
- A fully-integrated VRF AC system, controlling the room

temperature and power supply to the room

- An integrated door sensor for room access. Once the room is activated by the guest's smartphone, the power is automatically supplied to the guestroom and the VRF system comes online and goes offline automatically when the room is unoccupied for any length of time
- An automated minibar system - once an item is removed, if it is not returned within a certain time period (can be set by the operator), a charge will be applied to the room for that item
- 43" smart TVs in all bedrooms with a casting system for the whole hotel, to allow guests to watch content from their own devices
- A room service robot named 'Lofty' or 'Botlr'. Once an order is made and placed, the robot travels to the lift, which it calls wirelessly on its way to the room. Once it arrives, the room phone will ring and inform the guest that the order has arrived

Costs

There are reasonably significant costs associated with upfront investment in these technologies and systems, including

high-speed WiFi everywhere and boosters for the latest 5G mobile coverage, but the pace of demand for smart hotels and the latest technology is on the increase.

In summary, the hyperconnected guest, and their needs, evolving habits and expectations are driving the shift towards smart hotels. In their 'home away from home', they expect an integrated experience that aligns with the technology that they have become accustomed to in their day-to-day lives. Hotels should leverage the data that they can now readily collect to glean meaningful guest insights, and to anticipate and better manage guest preferences. Room presets based on loyalty scheme guest accounts can have the room set-up for guest preferences, including temperature, lighting and even minibar contents.

From an operational perspective, there are a multitude of benefits that arise from integrating smart technologies, from streamlining running costs and optimising operational efficiency, to reducing power consumption, and playing its part in making the hotel a more sustainable facility.



“I was initially attracted to Linesight by the project portfolio, in particular its diversity in both sector and region. It’s a dynamic team of great people, with a positive work environment, a proactive approach to achieving optimum outcomes for clients, and plenty of opportunities to work on world-class projects.”

John O'Sullivan
Associate Director

What we do

Our services are tailored for your project, delivering maximum efficiency from inception to completion. We specialize in key areas, to provide faster project delivery, greater cost efficiency and maximum value.



Project Management

Delivering project success through strategic planning and stringent controls.



Supply Chain Management

Providing efficient logistic strategies to streamline the delivery of equipment and services.



Cost Management

Driving better value for money at every stage of the construction process.



Health and Safety

Securing compliance, and providing design teams and clients with expert advice and independent review.



Program Management

Managing a network of projects simultaneously in order to deliver program success.



Consultancy

Providing professional, hands-on advice and guidance throughout every stage of your project.



Project Controls

Controlling every aspect of a project to deliver maximum performance and long-term success.



Planning and Scheduling

Providing an initial project overview, developing a detailed structure and identifying schedule controls.



Procurement

Adopting the most appropriate strategy to suit both public and private sectors.



Monitoring and Due Diligence

Examining project information independently, identifying issues, and ongoing project monitoring.



Our values

Over the years, we have developed a way of working that delivers quality and consistency in how we operate. Our five core values inform what we do and how we do it:



Partnership

We are focused on our clients' goals and work closely with them to achieve the best possible results. We believe in collaboration. When we share our experiences and combine our expertise, we can achieve great things.



Progress

We believe in always moving things forward and finding better ways of working. We're not just focused on what we do, but also on what we can achieve. We are driven by success – for our clients, our partners and each other.



Integrity

We are fair, open and ethical in everything we do. We challenge things we believe to be wrong and are open to being challenged by others. We take pride in the quality, accuracy and independence of our work.



Resourcefulness

We work around the world, in diverse sectors and for clients with distinct ambitions. This requires us to act effectively and creatively in new and complicated situations. We rely on our individual and collective abilities to resolve any challenges we may face.




Long-term view

We believe in working sustainably, and so we build enduring relationships with our clients and partners. We work together in a way that is respectful and considerate of each other and the wider society in which we live.

A man and a woman are seated at a wooden table, engaged in a conversation. The man, on the left, is wearing a dark suit and is seen from the side, looking towards the woman. The woman, on the right, has long blonde hair and is wearing a red long-sleeved top with a ruffled collar. She is smiling warmly at the man. The background is a bright, out-of-focus indoor space with large windows.

Our
culture



Our **bold ambition, honesty** and **confidence to deliver**, together with our commitment to cultivating **meaningful relationships** is what sets us apart.



Our distinctive culture has always played a key role in our success. As a business we want to be intentional in maintaining and working within the principles of our distinctive culture.

Own and empower

We have a highly developed sense of responsibility for identifying problems, finding solutions and executing with excellence.

As individuals and teams, we are free (and encouraged) to exercise our judgement to reach our goals.



Connect for good

We are team players, collaborating globally and locally to deliver exceptional results. We encourage and nurture relational rather than transactional business relationships, continuously building a totally inclusive working environment.



Embrace clarity

Our emphasis is on direct communication - our preference is always face-to-face, or to pick up the phone. We express ourselves clearly, honestly and effectively in our communication. We are proactive in inviting and providing actionable feedback.



Lead by example

We believe in mentoring as a way to strengthen and develop ourselves and provide the resources, environment and flexibility required. We practice 'reverse mentoring' between junior and senior employees - every single person in Linesight has something to teach.



Bold ambition

We continuously develop our global team, with a shared drive and ambition to deliver exceptional results. We believe success is winning unreserved recommendations for exceptional work and impact. We always work with an eye on the future, whilst delivering on our commitments and objectives.



**76 Sir John Rogerson's
Quay, Dublin**

Architect:

RKD

Linesight services:

Cost Management,
Project Management and
PSDP



Working with you, wherever you are

With staff located across Europe, MENA, Asia Pacific and the USA, our reach is truly global. We are delivering projects in over 40 countries and are always exploring new areas of opportunity. We offer first-class consultancy on major projects across 13 specialist sectors, and we have developed a broad portfolio of innovative projects in every region.

Commercial Development

Commercial Fit-Out

Data Centers

Education

Food and Beverage

Healthcare

High-Tech Industrial

Hospitality

Life Sciences

Residential

Retail

Student Accommodation

Transportation and Infrastructure

Europe

London

2nd Floor
27-29 Cursitor Street
London EC4A 1LT
T: +44 20 7784 7330

Dublin

Hoban House
Haddington Road
Dublin 4
T: +353 1 661 4711

Manchester

Peter House
Oxford Street
Manchester M1 5AN
T: +44 161 618 1811

Cork

VHI House
70 South Mall
Cork
T: +353 21 4274 474

Paris

Linesight SAS
23 Rue d'Anjou
75008 Paris
T: +33 1 70 92 37 91

Limerick

Linesight House
6 Hartstonge Street
Limerick
T: +353 61 493 515

Dusseldorf

4th Floor
Königsallee 92A
40212 Dusseldorf
T: +49 211 5403 9615

Galway

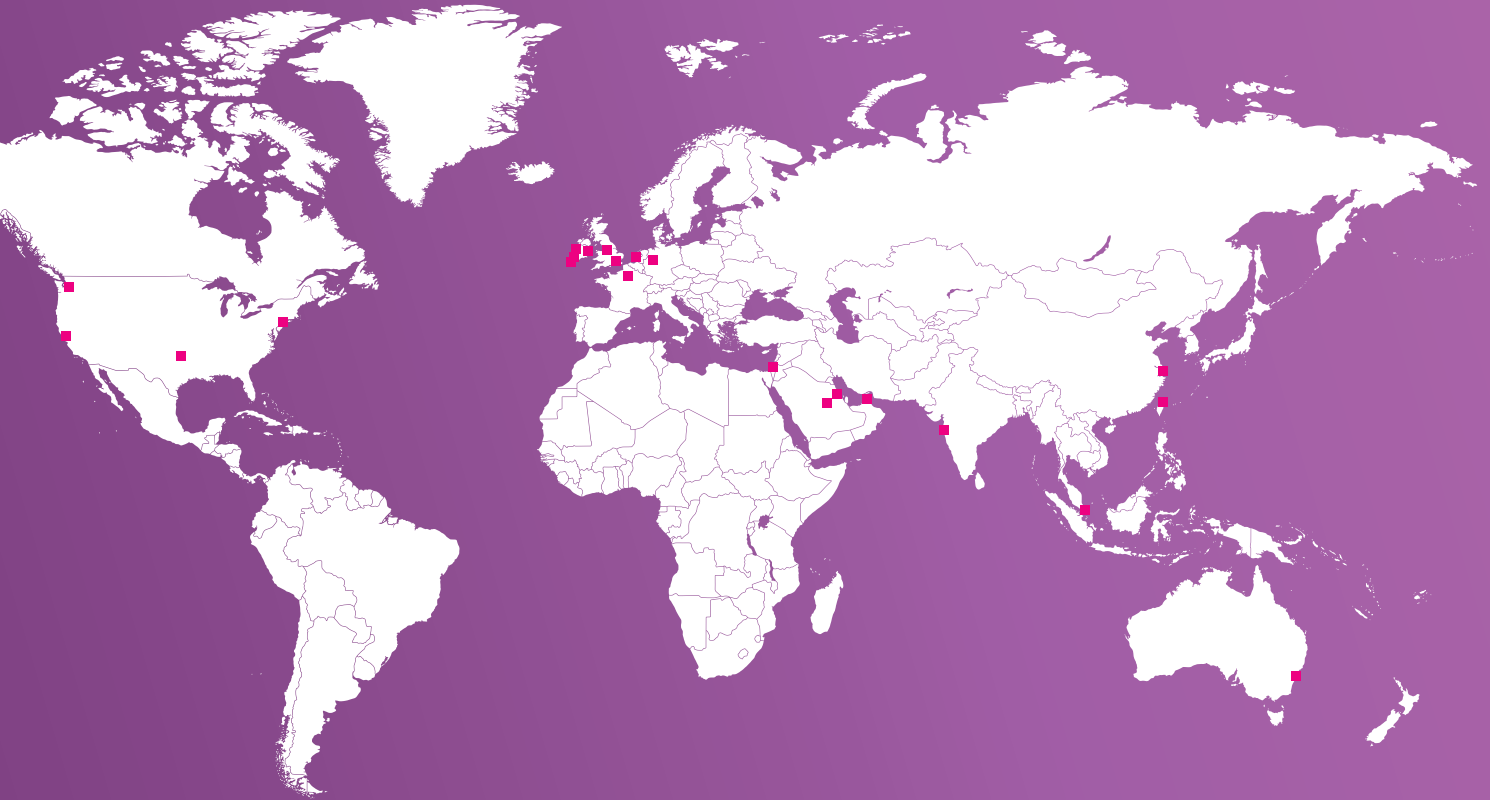
TaraRock 7
Galway Technology
Park
Parkmore, Galway
T: +353 91 734 005

The Hague

11th Floor
Koningin Julianaplein 10
2595 AA The Hague
T: +317 08 918 467

Tel Aviv

Ramat Gan Atrium
18 Jabotinsky 2nd
Floor
5250501
T: +972 3 754 1289



Asia Pacific

Singapore

150 Cecil Street
#05-01
Singapore 069543
T: +65 6801 4540

Shanghai

Unit 819 8F Building 2
No 1196 Century Avenue
Shanghai 200120 PRC
T: +86 21 6043 3695

Taipei

10F-2 No 162 Sec 4
Zhongxiao E Rd Da'an Dist
Taipei City
106 Taiwan (ROC)
T: +886 906 179382

Sydney

Level 5
131 Macquarie Street
Sydney NSW 2000
T: +61 2 8278 9500

Mumbai

Unit No 902
Maithili Signet
Sector 30A Vashi
Navi Mumbai 400705
T: +91 22 49766744

The Americas

New York

286 Madison Avenue
Suite 602
NY 10017
T: +1 646 802 9900

San Francisco

582 Market Street
Hobart Building
San Francisco CA 94104
T: +1 415 343 2434

Seattle

2018, 156th Ave NE
Suite 310, Bellevue
WA 98007
T: +1 425 748 5147

Dallas

350 North Ervay Street
Suite 3105
Dallas
Texas 75201
T: +1 469 513 4113

MENA

Bahrain

Building No 655
Road 3614
Al Seef Area
T: +973 17 746 892

Dubai

24th Floor - Office
2403
1 Lake Plaza Tower
PO Box 11497 Dubai
T: +971 4 432 3831

Riyadh

Office 503 5th Floor
Al Akariyah 1
Olaya Street
Riyadh 14023
T: +971 55 615 6846

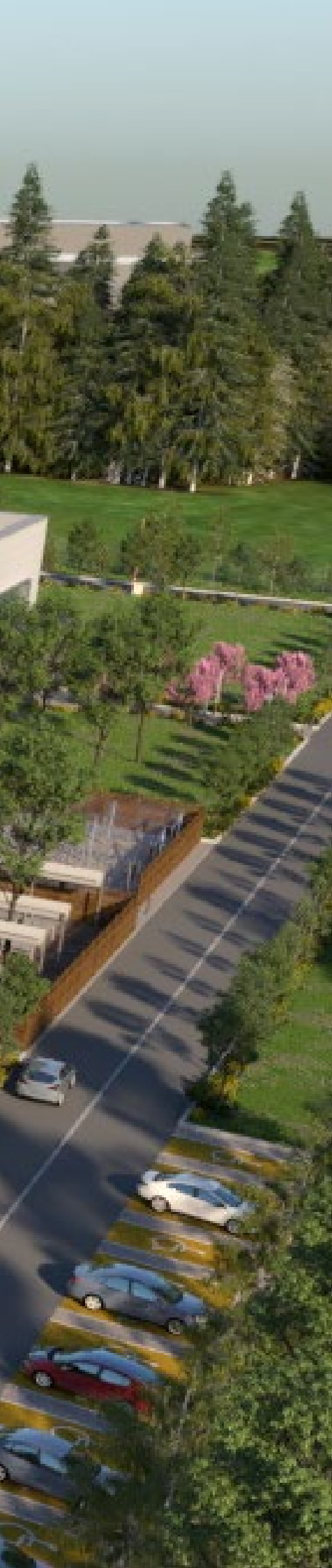
22
offices

**Edwards Lifesciences,
Castletroy, Limerick**

Architect:
Jacobs

Linesight services:
Cost Management,
Project Management and
Health and Safety review





Acknowledgements

A special thank you to all those involved in this year's publication.

Editorial team:

Derry Scully, Alan Dunphy, Claire O'Broin, Hazel O'Donnell, Kim Hegarty, Niamh Moore and Vinod Jain.

Contributors:

- Adrian Farren
- Andrew Callaghan
- Christopher Lynch
- Des O'Broin
- Diarmaid Connolly
- Eoin Byrne
- Gavin Flynn
- Hugh McElvaney
- Jeff Peragallo
- Neil L. Doyle
- Nigel Barnes
- Pat Unger
- Stephen O'Grady