

## REMOVING WASTE FROM CONSTRUCTION

Insights on reducing waste and improving efficiency in construction in the UAE

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# MANAGING WASTE

The construction industry must re-tool to reduce the waste generated across the lifecycle of its projects

aste is one of the biggest challenges facing UAE construction. Poor planning, lack of skills and unfair contracts combine to prevent one of the country's most vital industries from achieving optimum performance. As a consequence, the UAE is wasting billions of dollars every year on badly executed projects.

But while leading industry figures agree that the performance of the construction industry can be significantly improved, no one can say for sure just how much time, money and energy is being wasted on projects.

There is no objective international benchmark against which performance can be measured. And more fundamentally, there is no national system for construction data collection and performance measurement on projects.

The best contractors have internal benchmarking that allows them to monitor their own performance, but this data is not shared. Additional data might come from consultants that have conducted research, or from academic studies by management schools. Most of the evidence however is anecdotal, based on personal experience.

These opinions place construction waste in the UAE at somewhere between 25-33 per cent of the value of projects. With close to \$710bn of construction projects planned or underway, even the lower end of these estimates suggest that about \$175bn will be wasted in the UAE through the life of the projects that we currently know about.

A simple way to measure waste is to compare the prices and deadlines agreed on contract tender bids, with the final costs and time taken to deliver the projects. The variance between the original promise and the final outcome would indicate the level of overruns. This does not allow for artificially low bid prices and unexpected technical challenges. But it provides a starting point against which improvements could be driven.

It is just as important to measure the efficiency of a building through its lifecycle. A poorly designed and poorly built structure requires far higher maintenance and operational costs that one that is well designed. There is also the issue of the energy wasted when construction and demolition material is sent to landfill rather than being recycled.

Over the past five years, lower oil prices and tight budgets have made life very difficult for the UAE construction industry. The disruption caused by Covid-19 is set to make the coming five years more difficult still. Less capital investment will result in fewer projects, and inefficient companies will disappear. It is both a challenge and opportunity for everyone involved in UAE construction to rethink the way projects are designed, built, financed and operated.

*Removing Waste from Construction* is the 10th report from the MEED Mashreq Construction Partnership. It seeks to provide ideas, lessons and inspiration that will help UAE construction move forward into its next phase with a sense of purpose and optimism.

# EXECUTIVE SUMMARY

- The construction industry produces large volumes of physical and material waste, as well as lost time through disputes and unnecessary activities
- Construction accounts for a significant portion of the solid waste generated in the UAE. Studies conducted in 2018 suggest that construction and demolition waste accounts for 70 per cent of the total weight of solid wastes generated in the UAE
- Lowest price bids are a significant contributor to waste generated on construction projects in the UAE
- Construction projects in the region are frequently fast-tracked by owners, which often results in on-site commencing before the detailed designs have been finalised. Incomplete designs can lead to errors and costly changes during construction
- Simpler designs, adoption of digital technologies, and use of off-site prefabrication and modular designs will enable a significant reduction in waste
- Construction companies need to have greater awareness of the various types and volumes of waste being generated on their projects. Quantification of waste will drive time and cost savings, as well as boost productivity
- MEED Mashreq Construction Industry Survey respondents said that building reward incentives into contracts for parties that reduce waste could help the industry reduce waste throughout the lifecycle of its projects and improve the way it manages waste
- Stronger regulation is required in the UAE on dealing with waste generated after the construction phase of a project ie, throughout its operations and maintenance, and also during the decommissioning phase
- The lack of coordination between different authorities is a significant barrier to creating and enforcing effective recycling and waste management regulations
- It is important to have a top-down approach to minimising waste through collaboration across the industry. The government, influential contractors and developers all have an important role to play and must be made more aware of their responsibilities

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## TACKLING WASTE

In order to reduce and eliminate waste generated on construction projects, the industry first needs to be made aware of the various forms of waste

he UAE has one of the highest waste generation rates in the world, with a significant portion of this coming from the construction sector. According to the Abu Dhabi State of Environment Report 2017, one third of the debris produced in the emirate comes from building sites.

This volume of waste being generated by projects may rise, as construction tries to keep up pace with the rising population and industrial growth unless measures are taken to reduce or eliminate waste.

The UAE Vision 2021 identifies six national priorities as key focus areas for government action under the National Agenda 2021.

One of these is sustainable environment. The agenda highlights the importance of infrastructure and aims for the UAE to be among the best in the world in the quality of airports, ports, road infrastructure, and electricity.

#### Ingrained nature

The construction industry is widely viewed as being entirely focused on project delivery and of having little interest in environmental protection. But there is little doubt that its activities have a major impact on the local ecosystem in the immediate vicinity of a project, as well as having a wider impact beyond the local area, not only during the construction phase, but also in the form of waste generated as a result of construction processes and the ultimate demolition of built structures.

"On the environmental side, increment in construction waste quantities depletes landfill spaces requiring to use more space," says Mania Alabadla, lead sustainability engineer, Middle East & Africa, at Atkins.

"Construction waste is harmful to the environment in general and increases pollution potential to the surrounding areas," she says. "Research shows that construction waste increases pollutant emissions and global warming potential. Chemical waste that is not properly disposed can contaminate the soil and underground water.

"From a financial perspective, there is a cost for surplus materials procured and used inefficiently, as well as cost associated with segregating activities on site, waste haulers and landfill." Entrenched attitudes in the industry make it difficult to drive change. Contractors tend to be rewarded for speed rather than their concern for the environmental impact of their work, while various project teams work in silos, with little or no communication.

"It has to start with the client," says Kez Taylor, CEO of Dubai-based contractor Alec. "The client needs to be clear on the scope of the project, before initiating the construction stage."

Taylor highlights that designers tend to work independently, which often results in non-functional designs that work on paper but not in the real world.

"Construction should be a perfect sequence," he says. "It should be almost like a production line, with one client brief, one design, one construction [process], one inspection and handover. If this sequence is disrupted, waste will be generated."

#### Defining waste

Construction projects can generate large amounts of waste, in the form of physical, material waste, costs, as well as in non-tangible forms such as time and effort.

"Actions and processes that do not contribute to end result of a project in the most efficient manner to me constitutes as waste," says Saeed al-Abbar, managing director of Dubai-based consultancy AESG. "From materials and resources, to time and costs. These can all be classified as waste."

A survey was conducted by MEED to identify the different types of waste that the construction industry

## What is the biggest type of waste in the UAE construction sector?

33%
Solid and material waste
33%
Delays in project completion and delivery
15%
Waste human energy and productivity
6%
Fuel used to power a project and CO2 generated
6%
Cost overruns
3%
Disputes and court cases
3%
Other
Missing out on skilled workers
Source: MEED Mashreg Construction Industry survey

generates. Seven areas were broadly recognised, of which solid or material waste, and delays caused in project completion and delivery were identified as the biggest cause of waste in UAE construction sector.

"I think people recognise when there is material waste, because there's a cost aspect to that," says Ghassan Ziadat, vice president – major projects at McKinsey & Company. "However, when it comes to wastage in terms of productivity, and by that, I mean by productivity in terms of how much value you generate per hour on labour expense on project, then people are not very conscious of it."

The tangible nature of solid construction waste makes it easier to keep track of how much and where this waste ends up. Studies conducted in 2018 by Ecomena, a non-profit environmental organisation, show that out of total solid wastes generated in the UAE, construction and demolition (C&D) wastes account for 70 per cent of the total weight of solid wastes. Dubai alone produces nearly 5,000 tonnes of C&D waste every day, which is about 70 per cent of the total solid waste generated every day.

However, wastage in the form of time overruns, preventable disputes and lost human effort are much tougher to account for.

"Disputes represent one of the largest value leakages from a project," says Andrew Mackenzie, partner and head of international arbitration at Dubai-based law firm Baker McKenzie Habib al-Mulla. He adds that there may be situations where disputes could be necessary for a party to claim what is rightfully theirs.

But in many instances, disputes are badly handled or ignored from the beginning and allowed to build up. Such cases cause large sums of money and time that could otherwise be spent on a project, to go down the drain.

"These disputes can consume all different types of resources within a company, from head office overhead to the time and effort spent by the management, claims teams, etc," says Mackenzie. "All that resource does not get accounted for. Even where a party does win, it is very seldom able to recover the management time spent to run the case."

Another area of waste on projects is securing regulatory approvals and issuing permits, which can often take longer than the time taken to construct a project. Dubai has implemented steps that speed up the process of obtaining building permits to provide a 'one stop shop' for all stages. Such streamlining can help improve project delivery and generate savings that can be used for other purposes such as mitigating environmental effects.

15 per cent of the respondents of the MEED Mashreq Construction Industry survey said that human energy and

#### Overview

productivity wastage on projects is also a critical issue in UAE construction.

McKinsey Global Institute's (MGI) 2017 report 'Reinventing Construction' focuses on labour productivity in its analysis, stating that "construction is a labour-intensive industry where labour costs account for between 30 and 50 per cent of the total cost of a construction project".

In the UAE, where the value of projects planned in the construction and transport sector is nearly \$592bn, labour costs would account for between \$178bn-\$296bn.

MGI's report further observes enormous cost and time overruns of construction projects, with their recent analysis finding average cost and time overruns relative to original budget and schedule at 70 percent and 61 percent, respectively.

Another area of waste, though still up and coming, is data. A project's lifecycle generates valuable data at every stage. But the fragmented nature of the industry makes it difficult to centralise and streamline it. Moreover, data captured through BIM models in the design or construction stage of a project is often not utilised in the operational or demolition stage of a project, rendering hours of data inputting and storage to waste.

"I would say 99 per cent of buildings, around the world and in the UAE, don't have proper records of what was built or what equipment is in it," says Al-Abbar. "They might have the data but it might be in a box somewhere in a basement.

"And the challenge it presents is that in this current real-estate climate, flexibility of space is essential. You need to constantly adapt to what's happening in the market, which is not possible without knowing what is in your building."

#### Quantifying waste

Conversations with industry players suggest that quantification of waste generated on a project could provide a starting point for change.

"Waste quantification is all about good practice of site accounting and record-keeping," says Ali al-Jassim, chairman of Emirates Green Building Council. "By estimating the quantity of construction waste generated, an entity can assess the potential for waste reduction."

However, necessary information on the amount and type of waste generated on construction sites has been limited and fragmented

If adequate decisions are to be made on how construction wastes should be managed on and off the construction site, how they should be used, recycled or deposited, hard data on the amount, type, time and place of their generation is essential.

#### What is your company's policy towards waste management on construction projects?

58%
Redu <mark>ce</mark> was <mark>te</mark>
42%
Recycle materials and resources
39%
Reuse materials and resources
30%
Eliminate waste
9%
No policy / I don't know
6%
Direct all waste to landfill

Source: MEED Mashreq Construction Industry survey

"[Quantification] is quite difficult," says Al-Abbar, stating that "the industry is not there yet".

"The perception of how much something should cost and how long it should take are somewhat flawed because it shouldn't three years to build a tower," he justifies. "That's how long it used to take in the 60s. We need to rethink this approach.

"You should have a benchmark of where you as a company need to be. Once you know how long a project should take and how much it should cost, then anything over and above that constitutes waste."

The quantification of waste on construction sites needs to start at the outset of a project. This requires a thorough analysis of the project, resources required and the risks involved if the project is not delivered on time.

"One way to quantify waste generated is by measuring productivity against initially set key performance indicators (KPIs)," says Ahmed el-Wakil, MEP project director at Dubai-based contracting firm ASGC. These KPIs can include performance, employee satisfaction and quality in terms of reworks, defects and number of inspections.

"Additionally, you need to compare the percentage and types of materials used at every stage, to the specifications provided in the initial tender," says El-Wakil. "This helps you understand how inefficient the process is. Equipment usage should also be calculated similarly, per square metre of work done, to see how much more operational time and cost was required."

There ultimately needs to be greater transparency and communication among project parties, as well as the greater industry. Becoming aware of the waste on a project is a critical step, but reducing and eliminating this will require joint effort.

Planning better



# **PLANNING TO MINIMISE**

To cut down on the amount of time and materials wasted, the industry must engage in better planning from stage one of a project

he fundamentals of the GCC construction industry have changed dramatically in recent years. Contractors and consultants in the region are under increasing pressure not only to deliver projects with less waste at the end of it, but to design structures that continue to give good value to clients and end-users through their full life cycle.

But poor design has been cited as the major cause of construction waste, with an estimated 33 per cent resulting from architectural decisions made at the outset of a project. In addition, late changes to project scope along with document errors have been highlighted by contractors as major causes of time and cost overruns.

Early consideration of waste reduction during the design stage of a project development, along with meticulous planning, is essential to enabling resource-efficient construction in the long-term. Many projects in the region are fast-tracked so developers can start generating income from their investments as quickly as possible. This means construction often commences before the plans are finalised.

Incomplete, poorly specified designs lead to errors and costly changes during construction. Estimates for the cost of rework on projects range from 6 to 15 per cent of the total budget. In addition, post-contract design variations are cited as a major cause of lost time on a project, along with delays caused by obtaining the requisite government permits and approvals.

"Absence of, or non-compliance with, regional building regulations, codes, and standards that govern the adequacy of design creates waste," says Akram Ogaily, executive consultant at the US' Hill International. "It is also necessary to provide an adequate design review, audit or assessment to avoid waste [at a later stage]."

#### Better contracts

Bad design choices and poor communication between the teams can lead to changes and errors that could have been avoided by early collaboration. The appointment of a construction manager or design-and-build contractor during the planning stage will result in better integration of design and construction.

"[They] could help to select the proper [procurement] method tailored to the project type, development objectives and the type of procurement contract awards," says Ogaily. "The project manager or construction manager, through well-defined and planned procedures, could achieve better control of construction processes including site, logistics, quality of materials and waste control."

A more detailed understanding of technical constraints during the building process would enable better design decisions from the outset.

"Waste comes from construction documentation produced by engineering consultants [without an understanding of the] technical capacity of [the] design consultants and services engineering practices," says Ogaily.

An early agreement on the use of compatible systems and standards such as building information modelling (BIM), document management systems and a common data environment will help avoid misunderstanding and duplication, and will improve efficiency as the project progresses.

#### Less is more

"Waste can be attributed to poor or [excessive] design of structural, civil, mechanical and electrical works; overdone architectural design images; or incomplete detail design information," says Ogaily. Overcomplicated designs coupled with a lack of awareness of the standard dimensions of raw materials in the market leads to over-ordering and excessive cutting and trimming on site. As well as generating a large amount of solid waste through offcuts, custom sizing increases the scope for error and is slow and labour-intensive.

A simplified design adhering to industry-standard sizing will reduce this waste, but taking it one step further, modular construction methods offer the industry dramatic reductions in both time and labour.

#### Going modular

Prefabricated modules made offsite in factory conditions provide advantages such as predictability and efficiency, which are normally associated with the manufacturing industry. Accurately-produced components are quick to install, typically bringing a 30-50 per cent reduction in man hours according to the Modular Buildings Institute. And because production can be done in parallel with site activities, the overall project timeline can be significantly reduced.

Prefabrication carries the benefits of scale: repeatable, optimised processes, centralised procurement and a concentration of specialist staff can deliver higher quality with less waste.

#### Circular thinking

Simple design decisions such as stipulating durable, recyclable materials, using bolts rather than adhesives, and minimising composites, coatings and finishes can make the difference between a component being reused after building demolition or being sent to landfill.

As well as re-using single components, flexible build-



#### Which project life cycle stage is most critical to reduce the overall amount of waste generated?

Source: MEED Mashreq Construction Industry survey

Can better management of waste on a construction project reduce its construction and lifecycle costs?



Source: MEED Mashreq Construction Industry survey

ings that can be adapted to suit different requirements to increase the lifespan of the structure are gaining popularity in the region.

A mixed-use tower in Dubai called Opus by Omniyat was set up for spaces to have different uses with only minor modifications, ensuring the building would be able to meet the needs of the end-user for as long as possible.

Optimising planning and encouraging ongoing feedback throughout the lifecycle of a building will give stakeholders the opportunity to reflect and learn.

"The best-laid plans can be laid to waste if monitoring and feedback are not effective," says Manosh De, Middle East urban planning lead at US consultancy Jacobs.

"Many regional projects still suffer from a siloed delivery approach," says De. "Knowledge gained from the operations, maintenance and how people use the infrastructure should feed into how [other projects] are planned and designed in the future. This is essential to help prevent both design and material wastage and to improve the development of sustainable, adaptable infrastructure that meets the needs of its users."

#### Information modelling

For many years, proponents of innovation in construction have talked about the potential for BIM systems to transform the building industry.

"It stands to reason that the best way to minimise material waste is not to use it in the first place," says Waseem al-Azeh, senior manager for sustainability at Lebanon's Khatib & Alami.

"I would say that a 33 per cent reduction of waste at the design stage is a conservative figure, and that 50 per cent



should be achievable for most projects," says Al-Azeh. "This is especially the case where projects are designed in BIM, because we can fully visualise what is being built well before construction work starts. So it should be perfectly possible to avoid purchasing excess materials, while rework due to misunderstandings can be reduced."

Utilised fully, the technology provides a central design platform that can be accessed by stakeholders throughout the lifecycle of a project to improve communication and collaboration, minimise clashes, highlight errors at an early stage and streamline scheduling and procurement.

BIM also introduces the potential to track a development after completion to provide data for maintenance and future designs.

The adoption of BIM in the region has been patchy however, and the technology is rarely employed to its full capability. The UAE government has mandated its use on certain projects, but there are various interpretations of what constitutes BIM, and sometimes it does not go far beyond the use of a straightforward computer-aided design (CAD) model.

Collaborative approaches and compatible platforms, along with clear legislation and standards will open the door to all of the advantages that BIM modelling can bring to the construction industry.

"Digitalisation is starting to play a bigger role in waste reduction through the use of BIM and other technologies," says Al-Azeh. "These are enabling even sophisticated buildings to be developed using modular construction, which [makes] 'zero waste' a realistic target within the next decade."

# WASTE MANAGEMENT

Various stages in an asset's lifecycle present the potential for a waste generation and need to be minimised from the outset

#### DESIGN

- Lowest-price-wins model
- Non-functional designs
- Incomplete design
- Detail design errors
- Frequent changes
- No awareness of standards for raw materials
- Bespoke design
- Lack of consideration for complete lifecycle
- Inflexible structures
- Poor logistical planning leading to delays for orders, permits, inspections, instructions
- No re-usable metallic frame
- No energy efficiency considerations and monitoring systems

#### CONTRACTUAL

- Document errors
- Unclear specifications
- Frequent changes
- Unclear risk allocation leading to dispute
- Government approvals not in place \_\_\_\_\_
- Unrealistic schedules
- Poor cost estimation
- Delayed decisionmaking process
- Payment delays
- Lack of communication between project parties

#### PROCUREMENT

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- Inappropriate procurement method
- Poor communication
- Not sourcing reclaimed materials
- Over-ordering to avoid shortage
- Ordering errors (non-compliant materials)
- Minimum order requirements
- Supplier errors
- Transport and
- storage damage
- Poor stock control

- No plans in place for the lifecycle of the asset. All focus on design through to delivery
- Lack of standards and mandates to account for waste through asset lifecycle



#### **ONSITE**

Poor site

### management

- Communication issues caused by multi-nationalities
- Errors and re-work caused by unskilled, badly-supervised staff
- Broken equipment causing delays
- Poor waste management plan
- Bad site layout
- Delayed decisions and communications
- Initiating construction without proper/finished design
- Carbon emissions
- Excessive fuel usage
- Lost human effort and energy
- Adversarial attitudes

#### HANDOVER

- No set standards for waste management
- No plans for disposal of excessive materials and other resources
- Direct-to-landfill approach for excess and refuse
- Inept or biased inspection processes

## OPERATIONS AND MAINTENANCE

- BIM models generated throughout construction left unused and treated as records
- Waste generated by asset not segregated for recycling
- Lack of energy efficiency, building optimi-

#### DECOMMISSIONING AND DEMOLITION

- Little thought for re-use of components during planning
- Use of glue, not bolts, excessive finishes and coating, non-durable components
- Poor waste management plan
- Lack of market for monetised waste disposal and recycling
- Direct-to-landfill approach

Complete lifecycle monitoring and feedback is required from all stakeholders to inform and improve future project development



# MANAGING LIFECYCLE COSTS

Stakeholders must prioritise lifecycle costing from the inception stage of a project to reduce wastage and reap future cost efficiencies

Il project owners start out with the intention to achieve cost efficiency on their projects, not just at the time of development but across the project's lifecycle. In some cases, however, efforts to estimate lifecycle costs are minimal and other targets are prioritised.

In the construction sector, lifecycle costing involves the assessment of a building's assets and components in order to estimate the capital expenditure requirements over the course of its useful life.

Two main factors play a significant role in the decision to lower lifecycle costs: the overall costs involved in the various stages to achieve the best results; and the level of knowledge or desire on the developer's part to ensure the longevity of the asset in the absence of a defined mandate to do so. Initial costs are bound to increase in the short term if the decision is made to deploy high-quality equipment or materials to achieve efficiency and limit future costs. This may cause the project to overshoot the initial budget. So naturally, future cost efficiency assumes lower priority over current expenses for clients.

It is imperative to ask: who is the targeted end-user? Let us say a developer has sold a building off plan to a purchaser. The transaction is completed and the developer does not stand to gain any advantage from future cost savings.

Therefore, there is little incentive for the developer to take on early-stage costs and shrink potential profit margins for no real payback in the future.

One also needs to assess the viability of creating longterm lifecycle cost plans at the initial stages of a project.



In the case of a new building at the design stage, several assumptions need to be made for a lifecycle plan to run like clockwork, but seldom do all stakeholders follow through as planned.

For example, a piece of equipment may have a life expectancy of 15 years. However, this can increase or decrease depending on the level of maintenance, spares available and overall usage.

In that case, it is preferred to produce lifecycle cost reports after the building has been in operation for some time as surveyors can then assess determining factors such as the level of usage and maintenance.

While tricky, lifecycle costing is possible prior to construction, but the assumptions must be close to reality. For example, if the equipment listed is a substitute with specifications other than the one to be used, the study will prove to be futile.

#### **Better results**

Notwithstanding the challenges, the benefits of undertaking this exercise are tangible. Building owners conducting the analysis are better positioned to understand their capital expenditure obligations over a set period of time.

This enables the owner to budget for replacement or refurbishment of major assets, potentially avoiding expensive, reactive repairs. By scheduling replacements, the

"In a capital-intensive sector such as construction, an accurate lifecycle cost estimation with prolonged relevance can result in long-term cost savings by reducing the lifecycle budget of the asset" chances of critical equipment failing are reduced, which helps avoid further losses.

If completed at the design stage itself, lifecycle costing enables the developer to assess options for construction materials, finishes and so on, allowing the team to make recommendations of substitute materials to achieve greater efficiencies. This can also lead to the use of more sustainable materials, which is increasingly becoming a trend.

This practice could then achieve the often elusive goal of waste reduction, more so during the demolition stage at the end of a building's useful service life, if not the construction stage itself.

#### Driving change

Despite the benefits, we have yet to see widespread endorsement of lifecycle costing. Similar to the UK and Asia Pacific, in the UAE lifecycle costing studies are seldom conducted at the ideation stage.

A financial budget for a project would account for costs including design, construction and consultants, and each specialist would have to play their part to ensure the most feasible option is being chosen to achieve long-term sustainability while considering budget constraints.

The process would ideally start with the designers. This ensures at the design stage itself that quality equipment suited to the budget is being deployed, setting in motion the wheels that will successfully drive the project through its lifetime.

The analysis, however, is only as good as the data. For the plan to be truly successful, accurate details of all installed assets would need to be programmed into a de-

tailed assessment tool. The data can then be used to analyse estimated service life, predict replacement timelines, and thereby costs, taking into consideration inflation and other regional factors.

In a capital-intensive sector such as construction, an accurate lifecycle cost estimation with prolonged relevance can result in long-term cost savings by reducing the lifecycle budget of the asset. Therefore, project owners, end-users and consultants should all have an inherent interest in lifecycle costs. To encourage this, the government can play a major role in incentivising stakeholders to accept long-term gain for short-term pain. ABOUT THE AUTHOR



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#### Occurence



## WHY DOES WASTE OCCUR?

One of the main problems plaguing the regional construction industry is that most professionals do not know when they are being wasteful

he UAE's construction sector has lived in a constant state of struggle for nearly a decade, fighting to recover after the global financial crisis in 2008, which led to a collapse in property markets and destroyed liquidity. The crude price plunge in late 2014 further distressed recovery efforts as challenging macroeconomic conditions in oil-dependent Gulf states brought contracting giants in the industry to the brink of insolvency. Several firms are still working to restructure debt while others have fled the country or exited operations in the region.

But while the downturn has driven improvements in efficiency across the oil and gas sector, veterans of the construction industry say operations in their line of work continue to follow wasteful patterns.

#### Legacy problem

"The construction industry has been facing a continuing productivity problem, with its average growth rate over

the past few decades being lower than that of other sectors," says Robert Jackson, managing director for Europe, Middle East and Africa at the UK-based Royal Institution of Chartered Surveyors.

Jackson notes that project delays, budget overruns, disputes and a lack of skilled professionals are some of the biggest challenges faced by the industry that can be considered 'waste'.

"Our sector is wasting time on 'fighting fires' rather than focusing on innovation, sustainability and the future," says Jackson.

However, a UAE-based contractor says the constant fire-fighting mode of operations simply underlines the root cause of waste – a "blame culture" that is commonplace across the region's construction industry.

"In a toxic blame culture, everyone lives in a constant state of insecurity and low productivity," says the contractor. "I have also seen two extremes where there is [either] a complete breakdown of communication

#### What is the biggest contributor to waste?

18%
15%
15%
15%
12%
9%
Lowest price bids

Attitude towards recycling

Opting for short-term costs over long-term goals

Lack of education and awareness

Fast tracking projects

Lack of regular monitoring and project tracking

Adversarial relationships among project parties

Source: MEED Mashreq Construction Industry survey

or inefficient over-monitoring where everyone is more focused on assigning blame rather than addressing how to improve execution."

The contractor adds that businesses continue to operate the same way they have for years. The only difference now is that previously, companies could "afford waste" because there was more work and money to go around.

A UAE-based consultant says waste, which he broadly defines as "anything that isn't productive", represents more than 20 per cent of contracting output globally, but in the Middle East this can be "as high as 50 per cent".

#### Human challenge

In the end, waste primarily boils down to human resource challenges, the contractor insists. Hiring unsuitable candidates and then setting unrealistic goals across teams leads to a waste of time, money and manpower, he says.

"After more than 25 years in the industry, I have yet to

see rational human resources management in our industry. Instead of addressing challenging times by working to improve our operational efficiency and productivity, the answer is always rash cost-cutting for balance sheet purposes and then either hiring cheaper or expecting one person to do the job of three."

Another issue, the contractor says, is that various roles only hire candidates with qualifications from certain countries that companies believe merit "disproportionately higher salaries" along with perks such as vehicles and housing.

"Meeting this requirement does not mean you necessarily add more value to operations," he says. "On site, you have to deal with human emotions. You must be able to [communicate with] everyone from labourers to foremen, procurement and finance, in a way that drives productivity. Many highly qualified candidates cannot do this and [are thus] of no use on a site."

The contractor adds that such hiring policies have goaded industry professionals far too long. "Discord, poor communication – which often leads to issues being discovered too late – and mistrust are the most common scenarios that cause direct and indirect losses," he says.

Factoring workplace cultural fit is especially crucial in the construction sector, where projects can last years, says a headhunter.

"Most hiring managers do not want to listen to our recommendations. They often insist on a profile that is nationality-centred typically because it is the C-level directive. But a mismatch in cultural fit for the company, especially in mid-to-senior management, proves to be a huge loss for the project. This is less about just nationality and more about how people will mesh."

The recruiter adds that while companies no longer offer the same expatriate benefits as before the 2014 oil price plunge, candidates are willing to accept the updated packages in current market conditions. Many employers opt to "pay as per passport", she acknowledges, with plans to offset the higher salaries by hiring cheaper for other roles.

#### Zero profit

Lowest-priced bids and consequently battered margins have made waste an "extremely serious" concern, industry players admit, even on projects worth billions of dollars.

"Most of our projects are making zero profit," the contractor confesses. "We've gone from 8-12 per cent profit margins to barely 4-6 per cent, but then projects almost always go beyond the estimated budget."

Cyrus Engineer, managing director of India's Shapoorji Properties, says lowest-priced bids and executing projects

#### Occurences



"Lowest-priced bids and consequently battered margins have made waste an "extremely serious" concern, industry players admit, even on projects worth billions of dollars"

in the absence of completed designs and approvals are among the biggest challenges.

"In the current environment, with a lot of challenges on cost and profitability for organisations and individual projects, [organisations resort to] a sub-optimal approach [in aspects such as] vendor selection [and] specifications to reach lower costs, which affect delivery and quality," he says.

"Likewise, organisations with inadequate project management capability, in order to meet project delivery timelines or interim milestones, resort to an unplanned execution approach, consequently resulting in waste and inefficiency."

He adds that time and cost – in that sequence – are the "most critical slippages". "[These] then have a ripple effect on the under-utilisation [and] wastage of all other factors such as resources, quality and customer satisfaction."

Ultimately, the consultant adds, the correlation between the right team, cost and delivery remains the biggest challenge. But a more pressing concern, he adds, is the lack of awareness among individuals of when they are being wasteful.

#### Running out of landfill space

Dealing with physical construction waste is one of the many challenges faced in the construction industry, says Cyrus Engineer, managing director of India's Shapoorji Properties.

"Disposal costs are high, resources are being wasted, and we are running out of landfill space. Construction waste increases the burden on landfill sites, which are becoming scarce. In addition, if the waste is not managed properly, materials such as solvents and chemically treated woods can cause pollution.

"Hence it is critical, since waste adds to inefficiency in the system and, with the construction trade being interlinked with several stakeholders, waste or inefficiency at any point in the stakeholder chain ends up affecting the entire system in terms of time, money, effort and energy."

The developer adds that while the industry's efforts are geared towards minimising physical construction waste and recycling guidelines, "very few attempts" are made by stakeholders to address the use of building information modelling (BIM) for waste elimination during various phases of development.

"Developers should also take the initiative in minimising waste during project development by implementing BIM," says Engineer. "For instance, at our Downtown Dubai project Imperial Avenue, we are taking this approach toward BIM right from 2D design development stage until 6D lifecycle management."

#### Legislation



## LEGISLATING WASTE AWAY

Strong government intervention is essential if the UAE is to become a regional leader in recycling and solid waste management

he UAE's ambition to divert 75 per cent of solid waste from landfill by 2021 as part of its Vision 2021, echoes growing global interest in improving waste management.

To move the emirate closer to its target, the UAE's Ministry of Climate Change & Environment issued a resolution in February 2019, addressing the use of recycled aggregates from construction and demolition (C&D) waste for road construction and other infrastructure projects carried out by the public and private sectors in the UAE.

The resolution outlines environmental prerequisites for recycling cement, concrete, steel, bricks, gravel, sand, asphalt, timber, and gypsum waste into new high-value materials. It also mandates local departments to ensure contractors collect and sort the waste that they generate.

But while it may be possible to separate construction waste on site, the region does not have the infrastructure, or indeed the market, to effectively deal with the materials generated.

"If there was a value to that waste and you could obtain financial benefit from it, that would incentivise people to segregate properly," says Christian Millar, director of the sustainability and environment division of Kuwait-based KEO International Consultants. "But...where the virgin aggregate is cheaper than C&D waste in this part of the UAE, they have failed."

The global market for waste management is projected to grow about six per cent a year, and will be worth an estimated \$530bn by 2025, according to US-based Allied Market Research. But the UAE is underperforming in terms of waste management and recycling in comparison to the leading markets, and needs to develop the infrastructure to tap into this value.

"The market [in the region] in terms of waste is very young," says Eoin Sheridan, regional manager of KEO's sustainability and environmental division. "It is very one-sided and falls very heavily on the government. Without that market, it is very difficult to incentivise investment."

Sheridan says government mandates and legislation are critical for attracting investors.

"If you structure the legislation, you can incentivise a market that will bring in public-private partnerships to build your infrastructure, and that will offset the costs."

#### **Guaranteed prices**

A reliable return on investment is a deciding factor for investors. Regulating prices for products from a recycling facility for a set period of time would help make invest-

#### Legislation

ment in waste infrastructure an attractive proposition.

In Scotland, the government considered a brokerage system to balance the cost of recycled plastic for a 10year period.

"This presented the opportunity for people to invest in that 10-year window," says Millar. "It could guarantee a return on investment before, say, year two. So, it is not rocket science to say [that] if you can fix the import cost of virgin plastic higher than the purchase cost of recycled plastic for 10 years, you have created an investable window."

Adopting a similar approach to fixing the cost of recycled construction materials is one way to enable investment in crucial waste infrastructure in the region.

#### **Recycling mandate**

It is difficult to find definitive rules for the use of recycled construction materials in the UAE. Abu Dhabi has mandated recycling of construction materials, stipulating the inclusion of 10 per cent recycled aggregate on government projects. Meanwhile, Ras al-Khaimah requires 20 per cent of the fuel for cement kilns to come from renewable sources "if available".

Without legislation in place, construction clients and contractors are unlikely to go to great lengths to use recycled components and materials on a development.

"If there is no enforcement of the mandate, then people won't do it," says Sheridan. "We are working throughout the region reviewing legislation and they often fall at the same point with the enforcement."

Establishing an overarching ministry to create legislation and empowering municipalities to enforce it would require substantial budget allocation at a time when government finances are coming under increasing pressure.

#### **Ministry coordination**

The lack of coordination between different authorities in the UAE and across the region is a significant barrier to creating and enforcing effective recycling and waste management regulations.

In the UAE, a no objection certification (NOC) is required to transport waste between emirates and there are travel limitations on certain types of waste.

Moreover, the capacity to handle and recycle waste material varies widely across the country. "If the barriers were removed today," says Millar, "you could quite quickly see everybody was going to go to [dispose of waste in] the cheapest emirate. So how do you balance that?"

Despite the lack of legislation however, KEO has seen a growing interest in entities in the region wanting to invest in waste infrastructure.

#### Who is responsible for improving waste management in the UAE construction industry?



#### Will quantifying waste in the UAE construction industry help the industry and regulators?



Source: MEED Mashreq Construction Industry survey

"Suppliers are saying in a year and a half it will pay for itself," says Millar. "You have to maintain it, but it will operate for 20 years. So, you are going to get 18.5 years of money rolling in off the back of this. And it will work. But it needs to work in a semi-mature environment."

Led by government-backed entities Sharjah-based Bee'ah and Abu Dhabi-owned Masdar, the UAE is increasing its focus on recycling and solid waste management as part of its drive to reduce its carbon footprint and achieve the sustainable growth ambitions of Vision 2021. And, with appropriate government action, there are set to be some lucrative opportunities for investors.

"I think it is a really exciting time in the Middle East for the progression of waste," says Millar. "We're just waiting for it all to happen, and it will happen very soon."



O Bee'ah's construction and demolition waste recycling facility

#### Bee'ah leads by example

Every day, more than 6,000 tonnes of construction waste made up of concrete, bricks, wood, insulation and asphalt is processed at Bee'ah's construction and demolition waste recycling facility in Sharjah. The facility has a recovery rate of 95-97 per cent, and 100 per cent of construction waste is diverted from landfills.

Concrete and debris are broken down and processed in about 15 minutes. The by-products are five grades of aggregate that are used for roads, pavements, walkways and landscaping.

From recovered construction waste, Bee'ah produces concrete eco-curbstones, aggregates for road-base construction, recycled concrete eco-interlock, recycled concrete eco-blocks. Other recovered materials include stainless steel, rebar steel, aluminium and copper.

"The past decade has seen sustainability fast become a priority for governments, industries and communities, as everyone recognises that the way we are going will drain our resources," says Bee'ah group CEO Khaled al-Huraimel. "At Bee'ah, we take an integrated and sustainable approach to waste management, from waste collection to material recovery and waste-to-energy solutions," says Al-Huraimel.

"Sharjah has committed to a 100 per cent waste diversion rate by next year with the completion of the country's first waste-to-energy facility, built by Bee'ah and Masdar."

On 31 January 2020, Bee'ah signed an agreement with the Egyptian government to manage the waste from the country's new administrative capital, which is currently under construction. It is the biggest waste management deal ever signed in the Middle East.

"Through Bee'ah, Sharjah is leading the way in waste management and the environmental capital of the Middle East," says Al-Huraimel.

# BETTER TOGETHER

Employers must capitalise on opportunities to drive efficiency if wastage of resources is to be eradicated

ith project growth slowing in the UAE, the schemes that ultimately progress past the design stage will have to be executed in a way that drives cost efficiency for owners. For some project teams, however, this is easier said than done.

UK consultancy Capital Economics has cut its GDP growth expectations for the Middle East and North Africa region by 0.5-2 per cent. The largest drop is the UAE's 2 per cent decline, and Capital Economics says the country's economy would "do no more than stagnate this year".

"The trend of starting construction before design works have been fully completed is viewed as a major hindrance to effective collaboration" As the cash crunch intensifies, it is likely fewer projects will come online in the UAE over the next 12 months. Regional projects tracker MEED Projects shows the country has 1,483 projects worth a total of \$474.4bn in the execution phase, with 305 developments totalling \$90.1bn under design or study.

Some market experts believe owners must start projects with more clarity than is currently the case with local construction schemes.

The trend of starting construction before design works have been fully completed is viewed as a major hindrance to effective collaboration.

Project owners will argue design updates during construction are not only a non-issue, but also necessary to ensure their development is optimised based on changing site conditions. However, design revisions mean the project team has fewer chances and less time to find collaboration opportunities that can drive efficiency gains.



How can the construction industry reduce waste generated across the lifecycle of its projects and improve the way it manages waste?

#### 42%

Build incentive schemes into contracts to reward project parties that reduce wastage

#### 27%

Promote best practices and report instances that counter sustainability

#### 12%

Use different forms of contract than those usually chosen

#### 9%

Finance joint initiatives such as training institutes, educational materials and training manuals

#### 9%

Share performance data to improve processes

Source: MEED Mashreq Construction Industry survey

It is also important to have a top-down approach to minimising waste through collaboration, not just internally but across the industry. Influential contractors and developers can play a pivotal role here.

#### Paperless strategy

UAE-based contractor Alec's work on the Dubai Hills mall project involved driving a paperless strategy for the development team.

CEO Kez Taylor told local media in June 2018 that Alec implemented a plan to cut down paper wastage during the mall's construction. He explained how a platform was formed to facilitate documentation and communication within the project team, and all project stakeholders were encouraged to buy into the plan.

Similarly, Alec also advised on the solar panels that were installed to power the mall.

Alec's inputs helped cut down material wastage on the project. It also capitalised on an opportunity that led to savings for the team.

Such a change requires that contractors have the pull to influence client decisions and enough time to execute efficiency measures. Most builders instead find themselves weighed down by the risk of late payments, contractual disputes and clients wary of experimentation.

The situation is only made more challenging by the problems related to hiring in the local industry.

Mismanaged appointments are also perceived by some industry professionals as being a roadblock to collaboration. A Dubai-based contractor says some clients have, in the past few years, filled procurement department roles with under-skilled professionals who tend to prioritise cost savings over greater returns.

For example, the contractor explained, some procurement professionals prefer to award packages to contractors that quote the lowest price, even if their technical bid and track record were of poor quality.

This practice is largely driven by employer pressure to show savings, regardless of whether it would benefit the project in the long term.

As the job market becomes more challenging due to slow project activity, procurement executives choose to appease their employer with pre-construction savings instead of picking qualified contractors that may quote a higher bid but offer better quality products and services.

In such conditions, it is extremely unrealistic for construction contractors to offer suggestions that can cut waste through material specifications, work schedules or engineering plans.

#### Crucial skills

Equally problematic, as one international consultant explained, is the practice of maintaining an in-house project management office (PMO) instead of outsourcing the role. A senior consultant based in Dubai says employers often build their PMOs up with engineers that do not have the requisite qualification to efficiently deliver projects.

This results in some specialised project management functions, such as goal-setting, being inadequately delivered. Meanwhile, other tasks that should be shouldered by PMOs, such as project training, tend to get ignored almost entirely.

The senior consultant says hiring the right PMO is essential to reduce time wastage, which remains a critical challenge on most megaprojects in the GCC and also causes significant budgetary overruns.

A project schedule established and managed by a specialised PMO may be more exacting for the employer and contractor in some ways, but is also likely to be more realistic and deliver better results than a timeline set by engineers that have been moved into project management roles, the consultant argues.

There is no dearth of collaboration software or strategies in the UAE's construction industry. Top-tier clients, consultants and contractors agree working together can help deliver more efficient projects.

It is now a question of finding the most financially viable way of doing so.

# **REDUCING MATERIAL WASTE**

Cloud solution provides real time visibility to improve cost-effectiveness

teelPac Cloud is an online platform and a collection of mobile applications that integrates all steel reinforcement activities for the entire supply chain. The technology was developed by a Du-

bai-based company called Constructive Technologies, with the aim to help control and reduce wastage within the steel reinforcement supply chain.

CEO Andrew Woolnough says that many construction projects across the world continue to be designed even as they are being built, resulting in constant variations and changes in material requirement. Nevertheless, it is critical that the project is still delivered on time and wastage is kept to a minimum.

SteelPac Cloud provides visibility of real time changes in design and delivered material, which means design changes can be implemented cost effectively. Moreover, any redundant material that has been created through last minute changes in design or construction sequence can then be re-used in other parts of the project rather than sold as scrap.

There is an average of three to five per cent scrap and waste on traditionally managed projects. However, the software can reduce this to around 0.2 per cent.

The technology is able to exact steel bar schedules for all 2D and 3D technology platforms. It provides a live overview to ensure complete transparency and visibility of the steel reinforcement detailing, site management and production processes, including GPS tracking and location of steel bundles.

The technology also manages design changes and re-use of any redundant material, while tracking all site activities relating to steel orders, deliveries and installation.

All data is securely stored on the SteelPac Cloud platform and is accessible from anywhere in the world via a web browser on mobile, tablet or computer.

The software has been designed and written to enable it to manage other critical construction materials and Woolnough says that there are plans to launch a digital construction cloud later in 2020 which will be able to manage all construction site materials.









O SteelPac Cloud's online platform on mobile and desktop



## LEARNING FROM THE PROBLEM

The construction industry needs to stop treating waste as a problem and instead needs to focus on the opportunities for change

s one of the biggest generators of waste, the efficiency of the construction sector impacts both the industry as well as the country's reputation. Moreover, it results in loss time, capital and critical resources which could be injected into other ventures.

"The key challenge of an economically developing country is to decouple economic and population growth with waste generation," says Ali al-Jassim, chairman of Emirates Green Building Council. "Not to forget that any fast-developing country like the UAE would naturally have considerable construction waste."

Andrew Mackenzie, partner and head of international arbitration at law firm Baker McKenzie Habib al-Mulla says that the reason construction is contentious, especially with megaprojects, is the wide number of parties operating at any given time.

"Take for instance, the Midfield Terminal project in Abu Dhabi," he says. "Hundreds of packages were contracted separately. There is usually a party responsible for managing all the other players on such projects. But if any one party is facing cashflow issues, it will have a domino effect across the chain regardless."

Saeed al-Abbar, managing director at AESG, notes that the challenge of fragmentation is one that faces not just UAE construction but the global construction industry.

"There is a fragmentation between development teams and the operations or real estate teams," he says. "However, developers that have integrated models where they retain their assets and manage them are waking up to this and are making sure there is proper handover from construction through to operation."

### Facing the challenge

"In the next 10 years, the big players in the construction sector will not be the same ones that exist today," says Al-Abbar. "You're already seeing that, with some of the big construction PLCs going into liquidation. The root cause of that is inefficiency in delivery. Unfortunately, it will continue to happen. We will continue to lose construction behemoths that do not adapt."

Construction industry players are gradually coming to recognise the need to think about the entire lifecycle of an asset and not just an isolated phase.

#### Driving change

"To get the best value in terms of cost and environmental sustainability, you need to look at the whole lifecycle," says Ghassan Ziadat, vice president – major projects at McKinsey & Company. "There is no point skimping on the capital expenditure, because then will be problems further down the line when you are in the construction stage, or in the operations and maintenance stage. You need to strike the right balance."

If the construction industry is to tackle waste effectively, it needs to look at the entire building cycle rather than isolated elements of the project. This is where BIM can come in handy, streamlining the lifecycle.

"By using BIM 3 or BIM 4, you can have accurate measurement of the quantity on a project or building directly from the 3D model," says Ziadat. "And with BIM 5 or BIM 6, you can assign cost and project lifecycle information. By having better estimates, you can reduce the wastage in terms of the material that you ordered, design clashes, reworks and so forth."

Public projects can be benchmarked and model waste management plans can be implemented to drive change across the industry. Moreover, government clients can require its project parties to limit the amount of waste generated through their activities.

#### Is it too late?

"It doesn't matter what stage the building, construction or facility is," says Al-Jassim, stating that it is never too late to start thinking about limiting waste on the asset.

"However, the amount of waste generated from each stage is different. Each stage should have its own independent process and regulation for recycling and reusing process. It is not as simple as putting one common regulation for all facilities."

Al-Jassim adds that the best method of reducing waste is to not produce any waste in the first place.

"Given that the UAE aims to become one of the most sustainable countries in the world, we should be looking to move away from the linear model to a circular model," he says. "Materials, products and components are held in repetitive loops, maintaining them at their highest possible intrinsic value."

However, to reach a circular and zero waste economy, coordinated efforts is required from all stakeholders within the industry.

"The major responsibility of everyone within the industry should be to raise awareness and educate all their business supply chains, contractors, sub-contractors, consultants, suppliers, developers and people within their circles in the society," says Al-Jassim. "The overall level of ambition can be raised when everyone is committed to

#### Last Planner System

The Last Planner System, introduced by the Lean Construction Institute, is a collaborative process that helps managers with production control on complex projects with a lot of task dependencies and strict deadlines. It improves communication, helps in identifying and overcoming bottlenecks, allows everyone on board to be on top of details, and introduces commitment-based planning.

In the design phase, last planners are typically architectural and engineering project managers. And in the construction phase, last planners are usually foremen and superintendents for the trade contractor crews.

## Has your company tried to quantify the waste produced by your construction projects?



No

Source: MEED Mashreq Construction Industry survey

responsibly sourcing materials and managing waste."

By making most of opportunities to reduce waste, contractors can also differentiate themselves from competition and increase their chances to win tender bids.

"There will be a radical change, rather than just traditional parties slowly resolving the issue," says Al-Abbar. "It will be almost a shock therapy in the next 10 years. I don't think we'll be doing things the same way in the next 10 years – at least I hope we're not. Otherwise we're in big trouble."

### ABOUT MEED

MEED has been integral to delivering business information, news, intelligence and analysis on the Middle East economies and activities for over 60 years. Attracting a key senior management audience through its content and activities, MEED is a media brand, publication and data business that covers a spectrum of services which inform, engage, connect and ultimately support our subscribers and partners in their business development and strategic growth.

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### **ABOUT MASHREQ**

Established in 1967, Mashreq is the oldest bank in the UAE, with awardwinning financial solutions and services. Throughout its 50 years' history, Mashreq has differentiated itself through innovative financial solutions, making it possible for its customers to achieve their aspirations.

Today, Mashreq has a significant presence in 11 countries outside the UAE, with 21 overseas branches and offices across Europe, the US, Asia and Africa.

Mashreg launched its new Vision and Mission recently, outlining its commitment towards its clients, colleagues and the community. In line with its vision to be the region's most progressive bank, Mashreq leverages its leadership position in the banking industry to enable innovative possibilities and solutions for its customers across corporate, retail, international, treasury and Islamic banking.

Mashreq is proud to be the first financial institution in the UAE to be awarded the Gallup Great Workplace Award for four consecutive years from 2014-17. Mashreq also continues to invest in recruiting, training and developing future generations of UAE national bankers. www.meedmashreqindustryinsight.com

