

Challenging the mindset in nuclear construction

‘Construction Factory Thinking’

#CE Nuclear Productivity Series
Volume 1





The burning platform

I've been in the nuclear industry since 2008 and observed many comments that the UK shows low levels of productivity compared to other countries. Some statements from various published reports suggest:

- There is an 11% to 30% productivity gap against other countries and nuclear construction productivity is poorer
- Execution plans need to better implement current and best practice with improved quality and planning
- Project controls in the field need to recognise best practice
- Improvement to on-site supervision is required
- Designation of responsibilities needs clarity with responsibility for delivering high productivity that is clearly identified
- Productivity can be improved through site layout, better logistics, reduced walking and travelling
- Productivity can be enabled through improvements in the construction environment
- Trade unions can play a big part in driving productivity in the workforce
- Construction should start later in the design process and address productivity

This is not just a perception of the nuclear sector but of the wider construction sector. It is widely recognised now and being considered by initiatives that include the Nuclear and Construction Sector Strategies recently published by the Government. This along with Project 13 that is a result of the Government and industries engaging through the Nuclear Industry and Construction Leadership Councils.

However considered, it needs to be urgently addressed by all involved at all levels if such perceptions are to be altered and greater value delivered to clients reliably and with confidence given to potential investors. It is a **burning platform issue** which is constraining the development and growth of the sector and therefore the national economy. Changes do need to be led by the major clients and without the creation of an environment where all parties can be successful nothing will change.

Productivity must be a high priority in any delivery model throughout the lifecycle. We also know productivity is an outcome of numerous factors including the environment and structures created by clients and the many inputs and constraints that impact the construction processes. There are views that client capabilities need to be strengthened, delivery models revised, the digital environment embraced and the other factors be improved. We are not seeking to address these aspects in this paper but to highlight the change in thinking required using the proven tools from other sectors could create a **new mind set** where productivity becomes the norm across all parts of the sector. It will require attention to detail and many other elements to succeed as there is no single initiative that will drive the UK to world class productivity.

Prior to 2008 I was involved in manufacturing sectors where productivity was a key driver affecting every aspect of pulling a product out the factory. This included design, supply chain, factory layout and manufacturing techniques all demanding high productivity and the removal of process waste. This thinking can help inform construction projects to greatly enhance productivity given the many similarities combined with ensuring the right productive behaviours come to the forefront.

Productivity is not approached with the same vigour in construction projects and the reasons given are many. But, a key question is '**who is accountable**' for productivity even though it may be more challenging in construction projects and more so in mega-projects as it is affected by multiple organisations, impacted by many constraints such as design, site, seen as one-off, first of a kind with little repeatability etc. However, there is substantial scope where similarities can clearly be drawn.

The purpose of this paper, that is part of a series that will be released, is to describe our view of 'Construction Factory Thinking' and how it can be applied to gain productivity improvements and improve productivity in our sector. All the answers are not known yet, but we must take positive steps and build on the steps we've take so far, but by taking bigger and bolder strides.

I am truly pleased to acknowledge the broad support from the many organisations featured on the cover of this document.

Adrian J Worker
BSc(Hons), MNucl, MAPM
Chair #CENuclear Theme Group



Introduction and purpose

There are conversations currently ongoing between industry and Government through the Nuclear Industry Council (NIC) and Construction Leadership Council (CLC) with the potential to impact the nuclear sector. These are developing and implementing strategies and deals demonstrating a commitment from Government to partner with industry to gain improvement. It includes efforts seeking more highly productive delivery models with Project 13 being one such example. CE contributes and will continue to contribute to this work through various forums.

This is the first paper in the Productivity Series that seeks to support this work and is focused on how highly productive environments can be developed with an aim to stimulate a necessary change in mind set by raising productivity as a priority issue in all nuclear construction and decommissioning projects, including those considered mega projects (all referred to as nuclear projects).

The paper considers the various delivery models being deployed by owners and developers (clients) but primarily seeks to highlight a collection of best practices captured from other sectors used in developing highly productive factories where significant similarity exists. Hence 'Factory Thinking'. It explores what productivity is, why construction factory thinking needs to be considered, how it can be applied to both 'Green Scenario' involving design or a 'Brown Scenario' where design is complete. It highlights proven processes and tools, that will be the subject of additional papers in the Productivity Series, and identifies several areas to be explored recognising high productivity in the construction element is dependent upon design inputs and other constraints by way regulation and site specifics.

Recognising the reputational issues such a change in mindset by the nuclear industry is critical to ensuring clients gain value and investors gain confidence to support nuclear projects and the viability of the nuclear industry.

paper resonates with you, if you are interested in better understanding construction factory further, want to get more involved perhaps and to help use this mindset change into something that has a positive on the construction industry please get in touch and join the #CENuclear group.

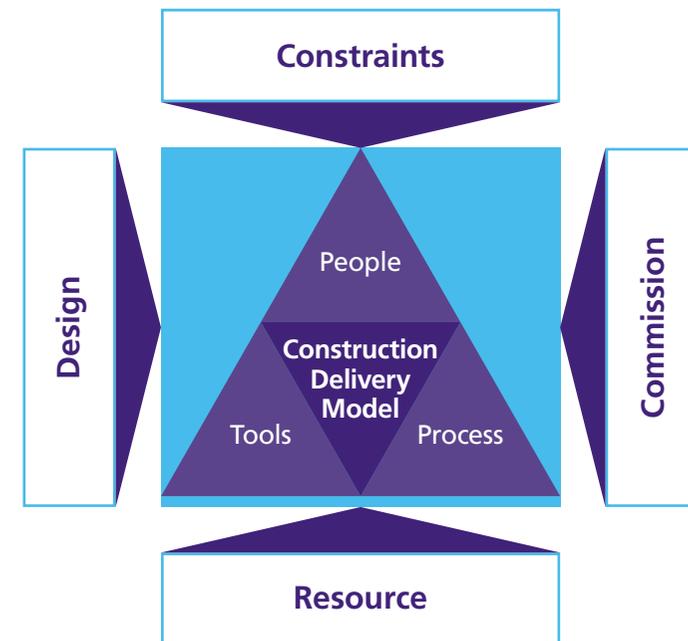
Construction delivery models

Clients pursuing nuclear projects are deploying various versions of Engineering, Procurement and Construction (EPC), ECP(M) where construction is managed and Architect Engineer (AE) that includes build to print through to design and build approaches in various combinations. All seek to engage a complex supply chain to undertake the construction and include Plant Vendors (PV) and Original Equipment Manufacturers (OEMs) along with consultants, technical and design services and, construction companies. All are supported by commercial models which vary considerably.

Applications vary and are driven by client capabilities (existing and desired) including those required by nuclear regulation. They are frequently dictated by the risk clients chose to direct to the supply chain against an environment demanding investment.

In any model, the output is the same: 'a fully constructed ready for commissioning or a fully decommissioned and de-constructed nuclear facility'. The value adding activities required to achieve either is the same. These models are simply an organisational matter that must aim to be efficient and as productive as possible. Therefore, focusing on value adding activities, minimizing non-productive activities and avoiding waste are crucial requiring the right environment that is the responsibility of the client to create. The client must be capable of doing this, be brave enough to do so, and show strong leadership. The supply chain need to be responsive and be focused on achieving client visions and missions. Clients need viable and sustainable supply chains with deep expertise. These are mutual objectives that should be easily recognised and pursued.

Exhibit 1 – Construction delivery model



Critical factors that impact productivity

- Early investment levels
- Design status
- Regulations and legal requirements
- Site layout and logistics
- Quality
- CDM/ Safety
- Nuclear impacts
- Interfaces
- Industrial relations
- Planning
- Contracts

Critical factors that lead to greater productivity

- Client leadership
- Collaborative structures
- Engagement with unions
- Engaging the workforce
- Removal of confrontational relationships
- Use of integrated client teams
- Planning and scheduling
- Design and sequencing
- Use of robust project controls
- Construction start
- Incentives

What is productivity and what does it mean?

Productivity is typically regarded as a measure of an organisation's efficiency and broadly expressed as the ratio of an output to inputs used in a process. These can include 'output per hour', 'output per job', 'output per worker' and 'outcomes to estimates'. Other dimensions include measures of value, health and safety, quality, profitability, customer satisfaction, and corporate social responsibility. It is also a measurement for economic growth and competitiveness and utilised for international comparisons and country performance assessments.

There is a mixture of terms used that Exhibit 2 seeks to clarify. Productivity is a key aspect of delivering value to clients and not being wasteful. Measuring productivity is hard recognising there appears no standardised methodologies as are observed in other industries. In construction, it is generally viewed as expensive if measured at a micro level and misleading if measured at aggregate or macro level. When measured, it is further frustrated by the inability to obtain meaningful benchmarks and thus validate performance.

In the absence of any currently recognised standards, what is important is to define measures from the outset. Measures need to be meaningful and useful at both macro and micro levels where such attention might be merited. Such measures should consider green and brown scenarios with the former being where productivity should be considered in design, addressing the full lifecycle, whereas the latter simply addresses construction of an existing design. Measures should be recognised 'critical success factors' rigorously pursued and driven by the client through the whole supply chain.

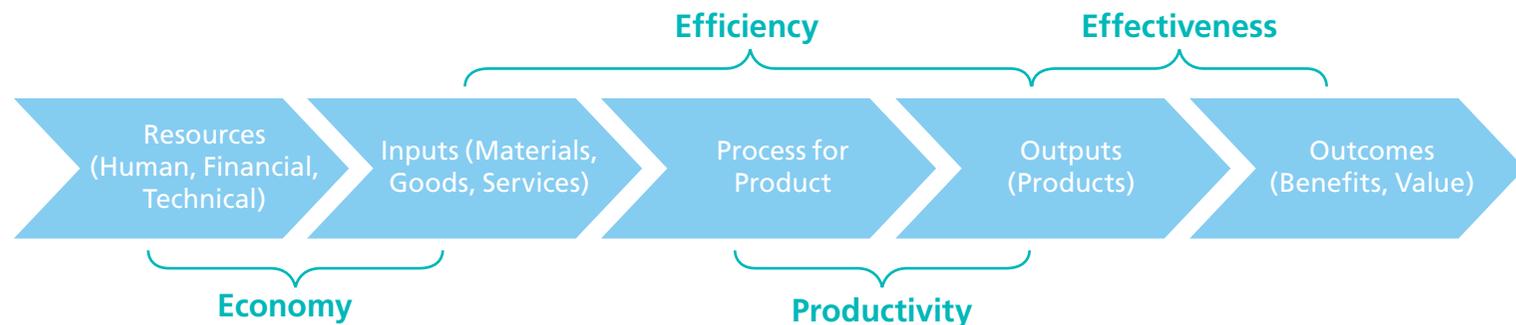
Establish meaningful and useful productivity measures from the onset

Productivity measures should feature within construction-related enterprises and address all aspects of a project including design, construction, logistics and supply chain to search ways to remove cost, improve outputs and deliver more value. Clients should also set standards and expectations with incentivise mechanisms based on value and outcomes.

Measure to improve – provide incentives based on client value mechanisms

In time, it is hoped a common set of productivity measures, benchmarks and standards will evolve to enable a drive towards enhanced productivity. Constructing Excellence will continue to develop this area with clients, industry and other bodies through the development of a productivity series of papers to come.

Exhibit 2 – Definitions



So why use factory thinking?

Highly productive factories are designed from every conceivable aspect, starting with design of the product, layout of the factory, the use of technology, human interaction and establishing a highlight productive supply chain removing process waste and unproductive time. Processes are driven to be repetitive and repeatable, driving out cost and adding value introducing technology where possible. Highly productive projects should adopt and apply these techniques in a similar manner that is appropriate to the specific nuclear construction project that is seeking to gain similar benefits and value for clients.



Overview of 'the productive construction factory' model – value thinking

Exhibit 3 presents our model of 'Construction Factory Thinking' in the form of an Input/Output diagram. It describes and highlights inputs and desired outputs with activities needed to undertake a construction project, recognising typical constraints and tools to hand. Most importantly, it seeks to define specific productivity targets that should be considered as potential Critical Success Factors, and thereafter measures the efficiency of achieving those targets.

Clients are always responsible for initiating projects and determine the environment in which the project is undertaken. In one form or another they already have defined strategies and have:

- A design at a stage of development that is either progressed by the constructor as in Design and Build (D&B) approach or simply constructed as in Build to Print approach
- Specific levels of skills and capabilities to manage and oversee the construction project
- Access to a supply chain to undertake the construction, whether that be through single source as in Design & Build (D&B) or Engineer, Procure and Construct (EPC) or multi-contracting approach with deep supply chains

The outputs are clear and that is a completed construction, ready for commissioning, whether infrastructure, facilities, plants, buildings or any combination. Key to 'Construction Factory Thinking' is the focus on 'value stream, integration, decision making, repeatability and measurability' in the construction processes that will support enhanced productivity.

Planned – to be productive a productivity plan needs to exist and acted upon within a construction strategy. The plan should also be simulated to remove conflicts, address sequencing issues, define critical points which can be managed, efficiently use resource etc. and be based on best practices.

Value stream – If it's not directly adding value to the construction process then it is process waste, this should not be acceptable and therefore removed where possible.

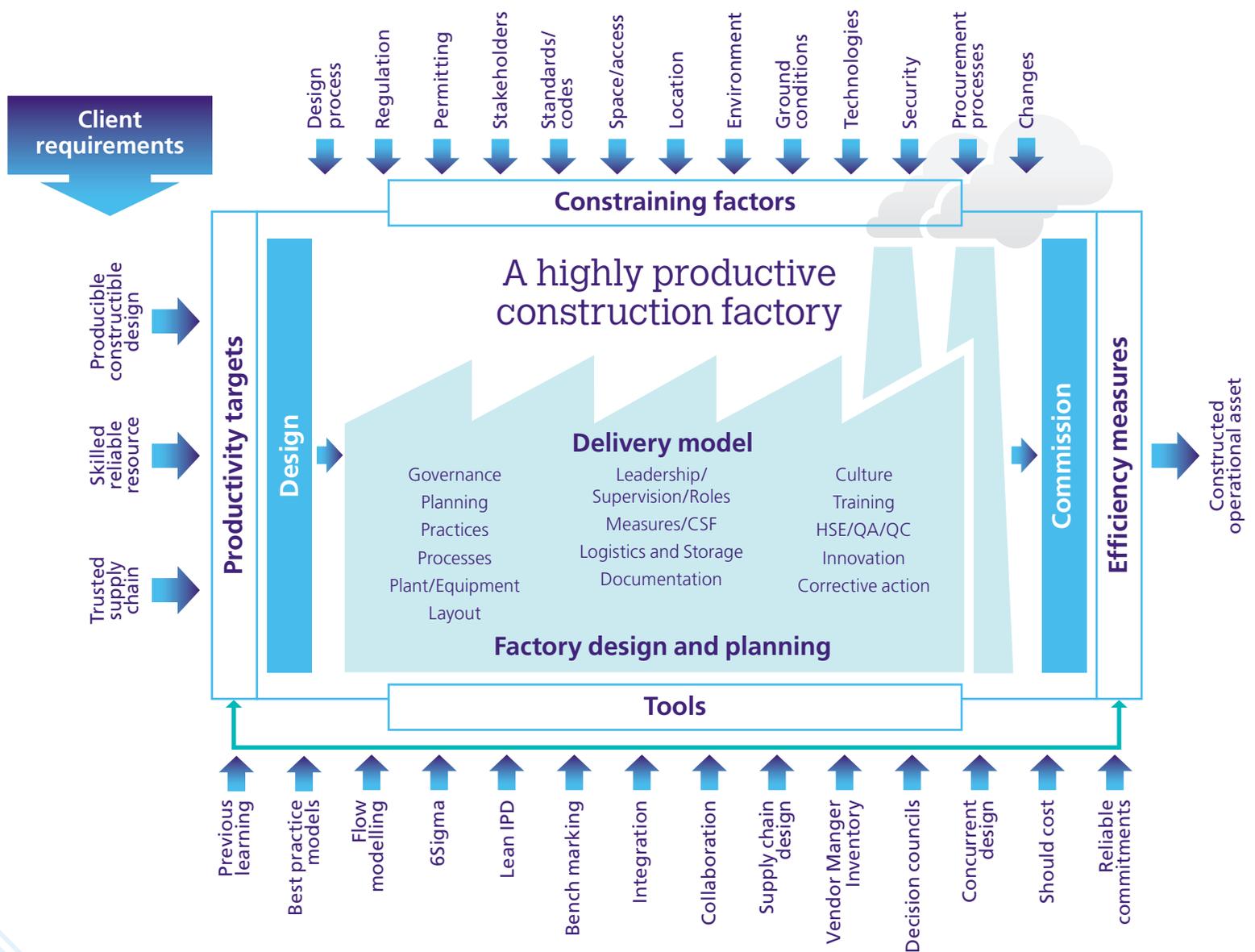
Integrated – There are many transfer points presenting barriers between organisations, skills, phases and handovers. With trusted processes and systems, integrated designs, broader skilled workforce etc, process waste can be removed.

Decision making – Attention to decision making processes from a tactical (construction face) to strategic level (executive level) can enhance productivity by removing holding or waiting time bringing clear focus etc.

Repeatable – Many see construction as single unique events, where in fact there are often many repeatable processes and activities that exist or could be made to exist. Repeatable processes should where possible be digitised.

Visibly measurable – Like factories, productivity indicators and measures should be used that are visible and can be immediately acted upon to correct any drift from established targets.

Exhibit 3 – Construction factory thinking – A highly productive construction factory conceptual model



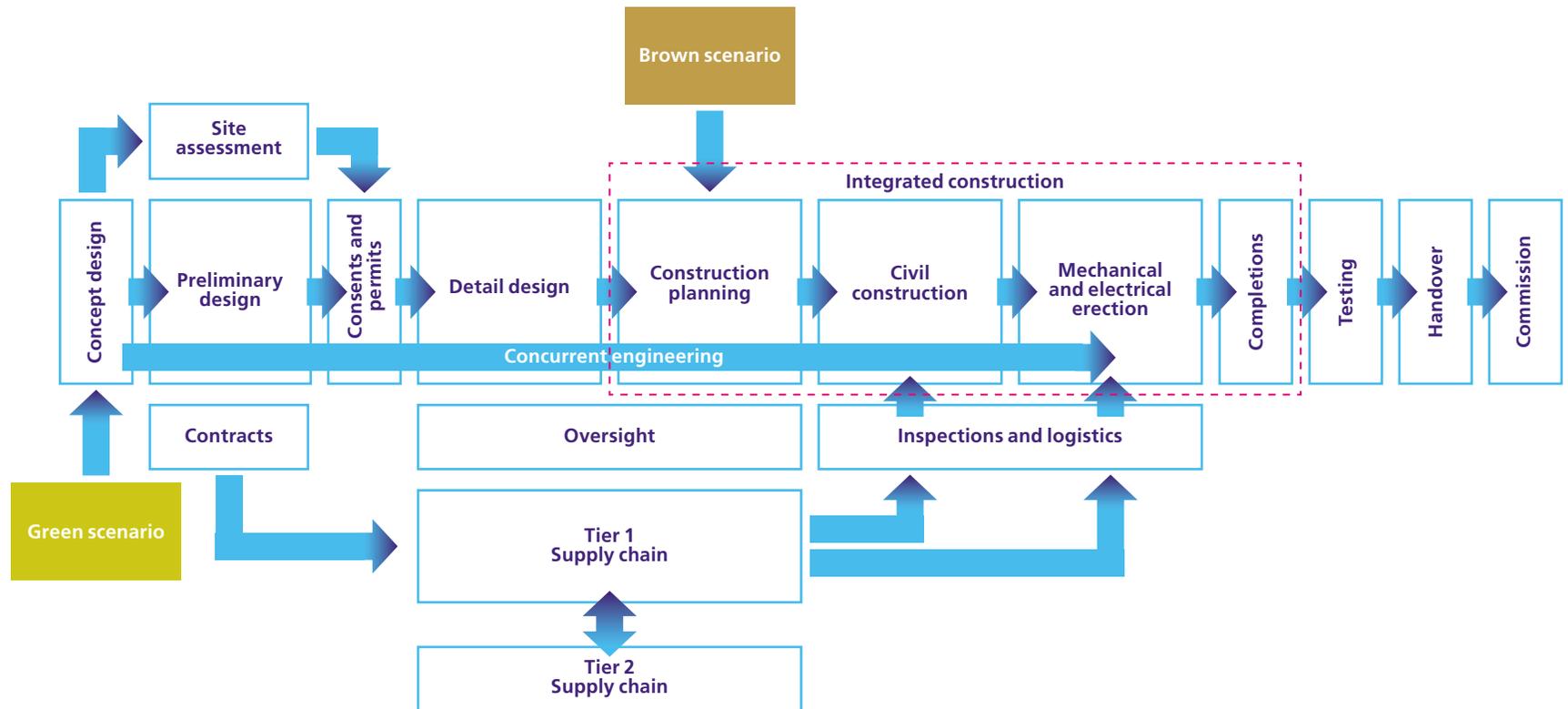


Application of 'the productive construction factory thinking' model

In considering the potential to apply 'construction factory thinking' it would mean designing the design and the construction process to be productive from the onset. When manufacturers design their factories, they look to be productive and use tools and methods to achieve this including the use of technology. Therefore, when we start designing infrastructure, facilities, plants or buildings in the context of nuclear projects we need to think and take the same approach at the design

stage or as soon as possible that is described as the 'Green Scenario' in Exhibit 4. In many cases constructors may be faced with a 'Brown Scenario' in which case approaches can be taken to drive more productivity even recognising there are many more constraints to consider. Thinking and driving productivity at the earliest stage will deliver enhanced productivity and benefits.

Exhibit 4 – Construction focused process





The primary difference between these scenarios is the level of the productivity improvement opportunity available. In a Green Scenario, with the design process still to be completed, productivity can potentially be driven into the process using tools and techniques such as:

- Simplification of design and driving for repeatable elements and standardisation of process, components and equipment
- Integration of design elements to remove interfaces during construction
- Introduction of safety and construction challenge reviews by experts
- Right to left thinking around constructability reflecting commissioning/ construction in design
- Pre-manufacturing enabled designs to integrate and factory build to gain higher productivity, improved quality and cost surety
- Developing construction strategies before the design process, embedding how you build into the design philosophy
- Condition based maintenance for improving whole life capability
- Embracing 5D+ modelling for accurate construction planning and improvements to a range of disciplines such as logistical management
- Utilising the visual support of BIM, Virtual and Augmented Reality

There are many design tools that can contribute in developing highly productive designs. The critical outcome from design is setting the basis for high construction productivity along with establishing targets for construction, sympathetic to the inevitable constraints.

'Brown Scenarios' are where the constructor is essentially given a design simply to construct. This constrains opportunities for productivity gains, however there remain many areas that could be considered during the construction planning processes of both scenarios. These include:

- Governance, assurance and decision-making processes
- Planning and deployed practices including processes and equipment
- Site layout, information and documentation
- Culture, leadership, supervision and roles

- Staff training, hoteling and welfare
- Technology and innovation deployment
- Logistics and storage
- Health Safety and Environment (HSE)/ Quality Assurance and Control
- Supply chain integration including just in time (JIT) delivery and vendor managed inventory (VMI) techniques
- Trade Union engagement and aligned reward packages
- Quality control approaches to avoid work or re-work consider wasteful
- Actively manage interfaces of all kinds

Each can make substantial impacts on productivity and should be considered as early as possible in the planning process and within the regulatory requirements, utilising the tools and resources identified with the model. Some key areas worthy of special mention are:

- Clients determine the environment of the project – if done well, outcomes are always better
- Engage and facilitate the best to do what they know
- Understanding the requirements from the onset to avoid wasted work
- Have efficient decision-making processes throughout the project – poor or tardy decision processes harms productivity
- Use contracting approaches that encourage productivity aligning commercial drivers of all organisations engaged in the construction process
- Reduce interfaces between phases and contributors, whilst sometimes necessary, can add considerable waste and are usually based on mistrust
- Design a supply chain to have a robustness that accommodates market capabilities, recognise it will fail sometimes – know before they do using trend analysis and support them overcoming the challenges when needed
- Have a construction strategy that enables and focuses on productivity
- Consider pre-engineered solutions, maximising the impact of off-site construction
- Measure the right things and undertake active corrective measures
- Plan for the worst and hope for the best

Setting productivity targets, benchmarking and driving efficiency factors

A potential output from the design process, regardless of whom conducts the design, could be a set of challenging but attainable productivity targets. These should be considered as Critical Success Factors and be benchmarked against current observed best practices and outcomes from similar projects, recognising specific constraints. If used, these should be expressed in the construction strategy and methodologies developed during the design phase, and reflect the design to be constructed to aid construction planning.

Specifically, Productivity Leads should be appointed early in any project and be accountable across all phases, with contributors bringing joined-up thinking in driving enhanced productivity.

Appoint Productivity Leads as early as possible

Constraining factors

Every project benefits or suffers from constraining factors in addition to the client's requirements. It is important that such constraints are examined and challenged to confirm that value is gained through their inclusion. Some will be unavoidable and some a physical reality. Many required by law and regulation. However, often they are not challenged and simply accepted reducing productivity and adding wasteful cost. The nuclear industry is full of this, and fear often prevents proper consideration and therefore productivity is impacted. Clients need to consider this if productivity is to be a key driver in nuclear construction. In all cases you should implement strategies to facilitate and minimise disruption.

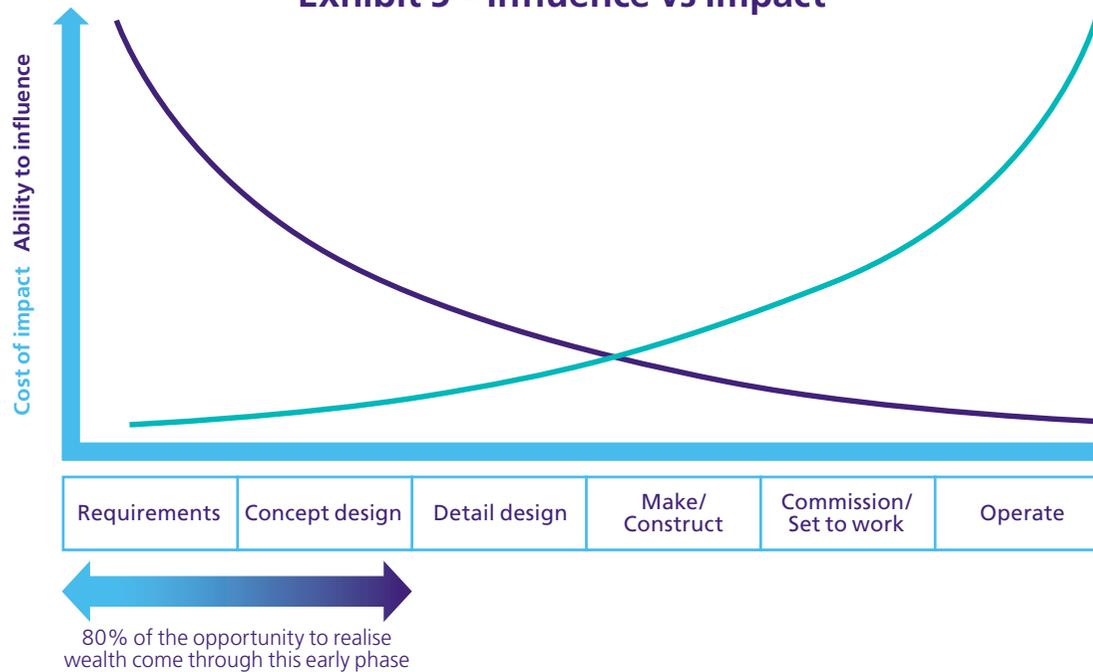
Constraint	Potential impacts
Regulation, consenting and permitting:	Have strategies to avoid adding design new requirements and construction processes. If not sufficiently addressed can add inspection steps impact timescales causing potential delays, demand rework and require may more expensive solutions.
Stakeholders:	There are many stakeholders of all sorts in any project. Develop strategies to avoid unmerited changes and hamper progress if not addressed adequately at the appropriate times.
Standards/ codes:	Identify and recognise from onset and implement early in designs and approaches. If not considered or addressed in the area concerned change will be likely adding waste.
Space, access and location:	Can add inefficient processes and require specific facilities adding potentially constrained work processes and waste and require special measures in some instances. Consider from onset large items and storage space required in the construction process.
Environment and ground conditions:	Make sure well understood before commencing work as can add additional and surprising demands resulting in interruptions particularly when unknown or inadequately accounted for. Plan for weather, holiday seasons etc.
Technologies:	Some technologies may require special measures of which to take account in either installation or operation. Do use technologies in the construction and management process.
Safety and security:	Critical to everything done on a construction site but should support productivity and be conducted efficiently.
Commercial policies:	Sometimes required by law or corporate policy, but should seek to engage the best and facilitate high productivity, rather than all too often frustrating selection of the best and hampering productivity through inappropriate mechanisms.

Construction factory design and planning

Construction planning is a well-practised process and often curtailed in the earlier stages of a project for many reasons. Some driven by the need to be seen making progress, some by regulation, some by procurement processes. Sometimes construction can also get ahead of design, causing further waste.

The fact is that influence is greater at the start of a project with impacts being greater towards the end as Exhibit 5 below illustrates. If enhanced productivity is desired, it needs to be driven from the start and a focus throughout.

Exhibit 5 – Influence vs Impact



Construction planning

Despite the stage of the design there are many opportunities to improve productivity during construction planning. It is here that construction strategies will have been determined and confirmed that the design can be constructed safely. During the planning phase in construction, factory thinking would seek to optimise operations by considering:

- Repeatability and standardisation
- Site layout and movements including laydown
- Construction sequencing
- Safety and quality of processes and operations
- Workforce planning, movements and welfare
- Application of technology and implementation of innovation
- Logistics and storage
- Data and information flows
- Process simulation and optimisation
- Quality control on construction site and supply chain
- Right first time avoiding rework, temporary structures and facilities
- Ensuring mindfulness in recognising areas that could go wrong
- Never compromising on safety or quality related issues

Some key areas are discussed on the next page.

Repeatability and standardisation

If design options remain open, pragmatically seek areas for standardisation of components, material and construction processes to gain commonality and procurement leverage without impacting qualification processes. Moving into construction planning, repeatable processes in manufacturing are sought and optimized, with continuous improvement driving up productivity. There are many processes that could and should be considered candidates. Also many post-construction benefits can also be found through realising standardisation.

Site and construction layout

In the manufacturing process, consider the flow of material and resource using modelling techniques to optimise movement, remove non-process time, use skills mixing, add automation and process workstations. Consideration is given to creating 'kits of parts', JIT presentation, visible status reporting, and corrective processes to respond to unacceptable variation or stoppages.

Construction sequencing

Construction sequencing is critical to enable access, resource use efficiency, remove waiting time and simplify process. In manufacturing, full simulations are conducted looking for efficiency, removal of pinch points and avoidance of queuing scenarios. Additionally, simulate, practice and rehearse critical processes prior to implementing into wider site processes to avoid unnecessary and costly delays on site.

Trusted supply chains

In manufacturing processes, supply chains are now designed from a process perspective engaging trusted supply chains with rewards aligned to process performance. There is a desire to remove wasteful inspection processes by ensuring the appropriate control of quality and suppliers that can be trusted.

Commercial instruments and mechanisms to drive productivity in the supply chain, need to be utilised to achieve enhanced productivity and put a clear focus on achieving recognised desired project outcomes.



Logistics (On and offsite)

Organising the arrival of the right material or equipment of the right quality at the right time to the point required within the construction sequence has significant impact on improving productivity. Dependable and reliable logistics lines to the construction site need to exist in many forms with custom barriers to be overcome. Attention here is important in avoiding delays to site and corrupting construction processes. The potential for damage needs consideration with appropriate measures taken on critical components.

Focus on integrated logistics – resource, material and equipment, information and access

Logistics within site are important with the need to align material, equipment, information, access and skilled resources to proceed unimpeded. Movements become important ensuring materials and equipment are available, and quality control systems become a significant contributor.

Storage on site including significant laydown areas, should be available but minimised by ensuring the supply chain functions appropriately. Special measures may also be necessary in some environments.

Data and information flows (Digitalisation)

Data and information is now being enabled by the new digital information age and this opens opportunities to have accurate, up to date information from the start of a construction project, through to its completion that can thereafter be used during the operational phase offering great benefits.

Work planning tools, progress measuring all exist and can be deployed to provide a high productive environment used appropriately. Stores accounting and material logistics systems are widely available that can support productivity with demand forecasting potentially leading to JIT and VMI solutions known to support productivity and reduces storage requirements.

Productivity design processes and tools

There are many tools available to support construction productivity improvements and design a construction factory. Some of these are illustrated in Figure 5. Some are considered in more detail in additional papers by the #CENuclear Group in the Productivity Series being developed.



Summary and conclusions

Achieving highly productive projects and delivery will be challenging improvement that the construction industry needs to embrace in all sectors.

It is hoped that some of this 'Construction Factory Thinking' will inform, allow you to think differently and show a path, tools and techniques to delivering productivity enhancements, critically leading to delighted clients and recognised world-class productivity.

Key points to take away:

- Establish meaningful and useful productivity measures from the outset
- Measure and improve – provide incentives based on client value mechanisms
- Appoint Productivity Leads as early as possible
- Focus on integrated logistics – resource, material and equipment, information and access
- Make full use of digitalisation during planning, construction and into the facility's operation



Exhibit 6 – Productivity design tools

<p>Previous Learning</p> <p>Previous learning can lead to the implementation of approaches that avoid previously discovered pitfalls improving productivity. Knowledge management processes should be deployed and gather information in a consistent and useful manner including productivity measures.</p>	<p>6 Sigma</p> <p>6 Sigma is a methodology used in measuring manufacturing output and enabling corrective action to retain process performance. This can be applied to any definable process and is a technique to be appropriately applied to repeatable process on a construction project.</p>	<p>Integration</p> <p>As used here integration refers to a more holistic view, that can enable the integration of different groups, trades and skills in the design and construction processes or develop blended organisations with no organisational barriers all focused on the achievement of the client determined objectives.</p>
<p>Best Practice Models</p> <p>There are many best practice models available from many sources covering a wide range of subject matters relating to construction projects and construction methods. These can be assessed and applied in construction projects in an appropriate manner to the benefit of the construction project.</p>	<p>Lean Integrated Project Delivery (IPD)</p> <p>Lean IPD is a respect and relationship-orientated approach to project delivery leveraging early collaboration and alignment and follows five basic principles: [1] Respect for People [2] Focus on customer-defined value [3] Delivering value and eliminating productivity waste [4] Continuous improvement of processes [5] Shift thinking and behavior, supported with Lean tools to optimise the whole.</p>	<p>Collaboration</p> <p>Collaboration is the art of people working together to a common purpose that can lead to the removal of working practice barriers, alignment to mission, focus on value delivery and better understandings. This can include across organisation, cross function and much more including openness.</p>
<p>Flow Modelling</p> <p>Flow modelling is used to track movements of resource and material in a process or series of processes within a space. The objective 'minimise movement and queuing' (waiting time) by laying out spaces better reducing needs for tools/ machinery. Can plan access, material delivery, resource and information to the work face at strategic and tactical levels.</p>	<p>Bench Marking</p> <p>Benchmarking can be used to determine success of construction processes design and challenge the norm driving to achieve greater efficiencies and productivities and avoid diminishing returns.</p>	<p>Supply Chain Design</p> <p>Many supply chains determined by procurement practices demanding competition. This approach has many concerns if addressed inappropriately. More modern approaches design supply chains to align to the market capabilities and look to bring in reliable and secure supplies doing what they do best. Design a supply chain that supports a construction project.</p>
<p>Reliable Commitments – Planned Percent Complete (PPC)</p> <p>Building reliability into planning and production during construction has the largest impact on traditional metrics. PPC is a basic measure of how well the planning system is working. Research has shown that there is a positive correlation between reliability (PPC) and project profit, early completion, safety, and client satisfaction.</p>	<p>Value Engineering/ Should Costs</p> <p>Value engineering is a technique that explores a design to reduce costs, weights and other matters by focusing on the function of the design and removing redundant components, simplifying components and improving manufacturing and constructability. Should costs are benchmarked estimates with that are highly efficient removing non-value, management and corrective costs.</p>	<p>Standardisation</p> <p>Is where standard components and equipment's are used in a design to increase purchasing leverage and provide in the long term easier maintenance and spares requirements. Standardisation can reach across material, components, equipment (small and large) and processes.</p>
<p>Vendor Managed Inventory (VMI)</p> <p>Vendor managed inventory is usually applied to consumable materials where a vender is required to maintain certain levels of stocks to support processes. This can include materials to support processes such as tools, oils, welding rods, clothes, HSE and much more. It reduces the burden of self-managed material and aligns to experts.</p>	<p>Decision Councils</p> <p>Potentially one of the most impactful approaches that drives positive decision making avoiding delays. Decision councils are conducted when critical decisions are required and demands all critical staff attend a meeting and continue together until a decision is reached. If further data required its called for and the council continues until conclusion is reached.</p>	<p>Concurrent Engineering</p> <p>This is where the engineering design is completed just ahead of the need of the construction process. This does add other risks but if implemented correctly can accelerate the construction and enable design modifications to be more easily accommodated including the use of new technology.</p>

Endorsements



The HPC Project is working hard to capture, understand and apply international Lessons Learned and Operating Experience in every aspect of our business. This Constructing Excellence document and the approach to Construction Factory Thinking that it proposes is a good way to identify innovative new ways of working from the nuclear industry and beyond.

Melanie Sachar,
HPC Project Delivery
Model Lead



"Constructing Excellence and the NIA have been worked together since 2011 to support the adoption of internationally recognised best practice in construction of nuclear projects. This report is a timely contribution to meeting the productivity challenge in nuclear construction. It emphasises that productivity does not depend on just one thing but requires actions on various fronts and through collaboration of all parties in their shared interest"

Tom Greatrex,
Chief Executive



"This report addresses the challenges facing large nuclear power construction projects. It complements the World Nuclear Association's work on lessons learned from recent projects in Asia, the Americas and Europe and on good international practice in supply chain oversight."

Greg Kaser,
Senior Project
Manager



NUCLEAR AMRC

"We agree that the nuclear construction industry could achieve significant improvements in productivity by adopting practices from the advanced manufacturing sector. This paper is a valuable introduction to many of the key tools and techniques that are now widely used in high-value manufacturing, and will be of interest to many in the construction industry."

Andrew Storer,
Chief Executive
Officer



"Construction is entering an exciting and disruptive phase, in which best practice and a digitally enabled built environment will be key to unlocking productivity gains and seizing new opportunities. This paper captures the essence of what we believe are the key requirements to enable this to happen and how this thinking can be embedded across our membership and the industry."

Ben Pritchard,
G4C co-chair of
#CEnuclear



"There is a lot of research out there that comes to similar conclusions. The nuclear sector has its own peculiarities but the basic challenges apply to all forms of major industrial and infrastructure projects. There are not that many nuclear plants constructed around the world, so if the problems are similar we should broaden our view to learn with other sectors. Joint exploration of these issues affecting industry at large and the possible solutions is of benefit to all."

John Fotherby,
Chairman, ECI



"Productivity and cost are key challenges in making nuclear construction both affordable and time efficient. This document neatly sets out some of the key data and information flows required in the digitalisation of the industry and why the adoption of this approach is a fundamental requirement for the future. It is mirrored in how the Nuclear Institute's Digital Special Interest Group has attempted to link Engineering, Manufacturing, Construction and Operations to achieve accurate, up to date information from project start to completion. The end result is greater benefits through the whole life-cycle to decommissioning and eventual disposal."

Philip Isgar,
Nuclear Institute
Chair Digital
Community Special
Interest Group



Get involved

Constructing Excellence welcomes all organisations that share our values and mission. Get in touch to find out how your organisation can become part of the UK's leading movement for change devoted to delivering excellence in the built environment.

www.constructingexcellence.org.uk

Telephone +44 (0)3330 430643

helpdesk@constructingexcellence.org.uk



[@constructingexc](https://twitter.com/constructingexc)

Constructing Excellence, BRE,
Bucknalls Lane, Watford, Herts, WD25 9XX

Constructing Excellence is committed to reducing its carbon impact.