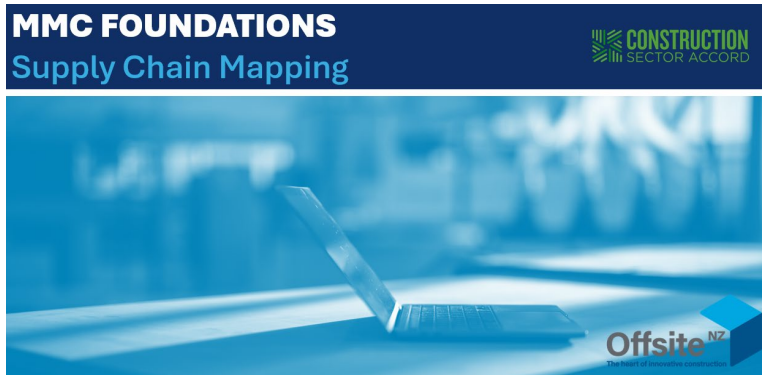
MMC FOUNDATIONS
Defining our Language

CONSTRUCTION SECTOR ACCORD

Offsite NZ
The heart of innovative construction

Comprehensive MMC resources to power the industry.

To increase confidence and certainty across the supply chain



An analysis of the MMC supply Chain in New Zealand, with a focus on Production & Operations, including case studies.

A review of the readiness of the MMC Supply Chain to meet Carbon 2030 requirements, including modelling of exemplar products. Includes case studies.

A proposition for an industry-wide language & process for Clients & the MMC industry, including a product selection matrix.

CONTEXT:

TASK: ESTABLISH A COMMON LANGUAGE FOR OFFSITE MANUFACTURING

- *Agree on a of a standard set of terms for use across industry that clarifies any grey areas & confusion e.g. "What is the difference between Volumetric & Transportable?"*
- *Ensure alignment with language used in Government procurement & government group agrees to proposed language*
- *Publish & promote these definitions through Government, the private sector & industry channels*

WHAT WE DID: WORK WITH EXPERTS & INDUSTRY

- *Collaborate with local & international experts*
- *Review domestic & international literature on language schemas*
- *Develop a draft framework, share with selected industry groups & incorporate feedback*

THE OUTCOME IN A NUTSHELL:

- *Unite under one plain speaking, industry-standard language & definition framework to have* **knowledgeable & confident conversations** –
- *Make Modern Methods of Construction –* **MMC** *– the overall term for the* **Spectrum of better On-site construction & Off-site manufacturing**
- *Make* **Product Development** *& Business Strategy as the framework for how to do* **MMC** *successfully by finding* **Product-Market Fit**
- *Foster the potential of this language for* **better** *design, business development, productivity, procurement and construction* **benefits for clients and the industry**

SCENE SETTING:

BAU

MULTIPLE LABELS

BUT GENERALLY TALKING ABOUT THE SAME THING

OSM = Offsite Manufacturing
MMC = Modern Methods of Construction
IDC = Industrialised Design & Construction
Prefab = Prefabricated buildings
Other = more names coming out all the time

THE LANGUAGE IS CONFUSING

CLIENTS SHOULDN'T NEED TO BE MMC LANGUAGE EXPERTS TO UNLOCK THE BENEFITS

1. **DfMA** = Design for Manufacturing & Assembly - a strategy to facilitate manufacturing by minimising rework through upfront collaboration
2. **Parametric Design =** software & approach to pre-design things using parameters that can be changed to suit
3. **BIM** = Building Information Model/ling - a way of creating & coordinating 3D (digital) design information, often including fabrication information & other data
4. **LEAN** = a process or management strategy focused on reducing production waste
5. **Modular** = Modular construction, a catch-all & basically the same as the other list
6. **Volumetric** = Volumetric construction, basically the same as the other list, but with a focus on **3D** - see below
7. **Part** = A simple part of a building like a beam, door or window
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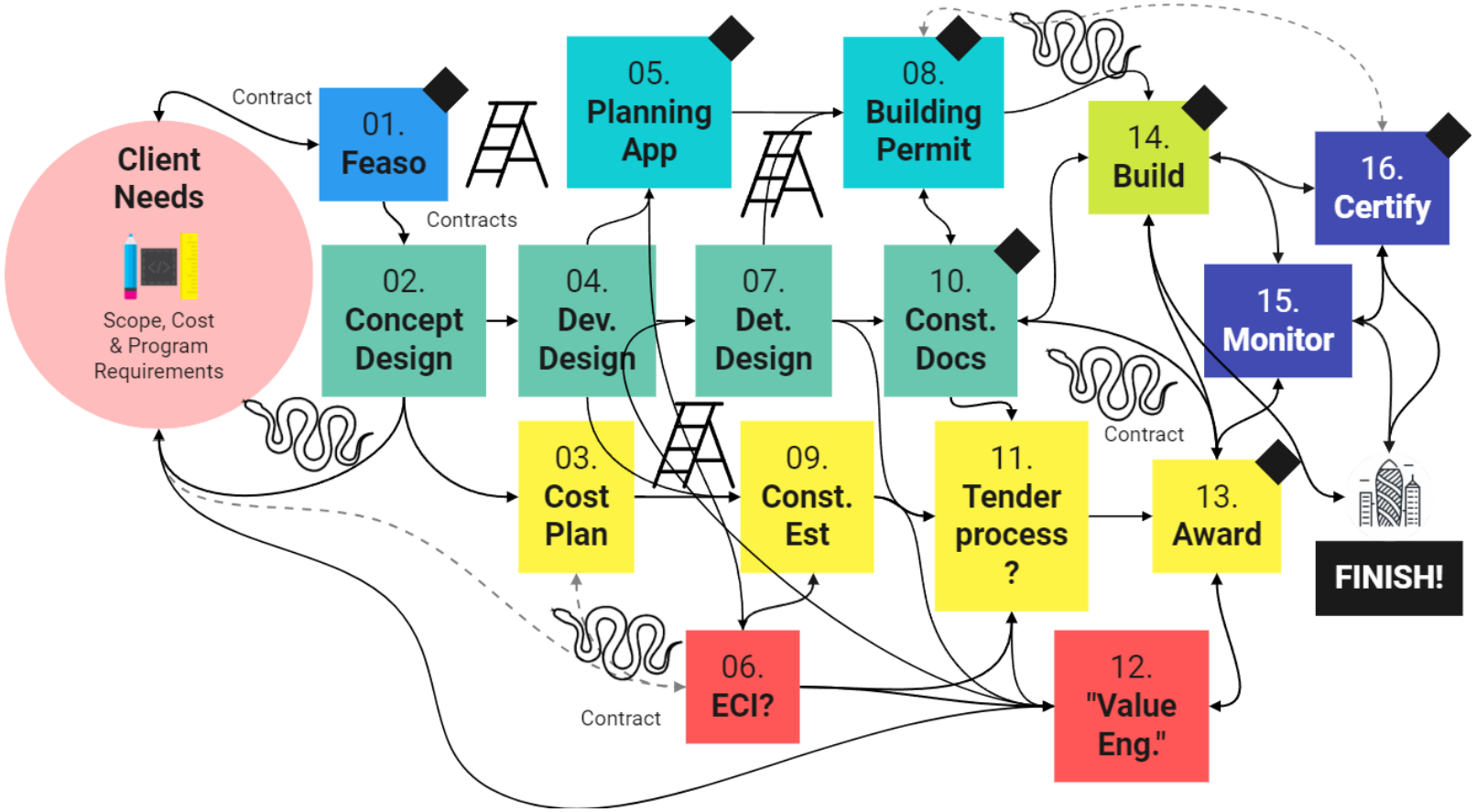
17. **Hybrid** - a combination of some or all of the above (usually), including some onsite work (sometimes)
18. **Kit of Parts** = a combination of any of the above to complete a full building
19. **Platform** = an 'app store' of all of the above with an engagement schema & usage rules

PROCESS IS COMPLEX

NOTORIOUSLY UNCERTAIN

This is what BAU looks like now – a snakes and ladders diagram full of uncertainty for all parties.



AND SO ARE THE RELATIONSHIPS

POTENTIAL: USE LANGUAGE AS A BRIDGE FOR COHESIVE CONVERSATIONS

MMC AS LEADING DEFINITION – THE CASE

GLOBAL SUPPORT FOR THE USE OF MMC AS HOME TERM OF TRANSFORMATION

A range of approaches which spans **off-site, near site and on-site** *pre-manufacturing, process improvements and technology applications.*
Cast - Modern Methods of Construction (MMC)

MMC *covers various diverse aspects of construction including prefabrication,* **off-site manufacturing, and modular or volumetric dwellings**, *as well as new technologies such as 3D printing, robotics, and artificial intelligence (AI).*
NSW State Government

MMC *is a collective term to describe. .. alternative construction practices.* **Off-site,** *factory production of the component parts of properties is a common characteristic of* **MMC**
Zurich Insurance

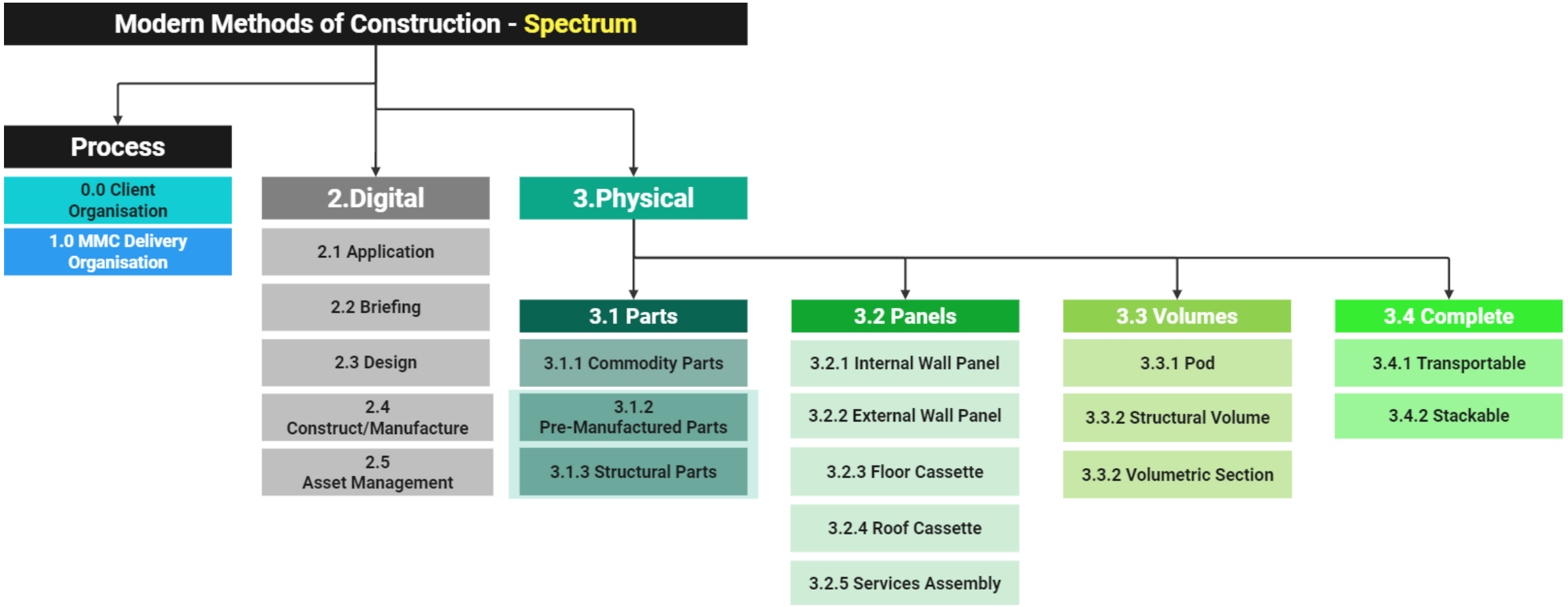
THERE IS A SIMPLE KEY TO SUCCESS

DEVELOP PROCESSES, UTILISE DIGITAL TOOLS, THEN MAKE PHYSICAL PRODUCTS

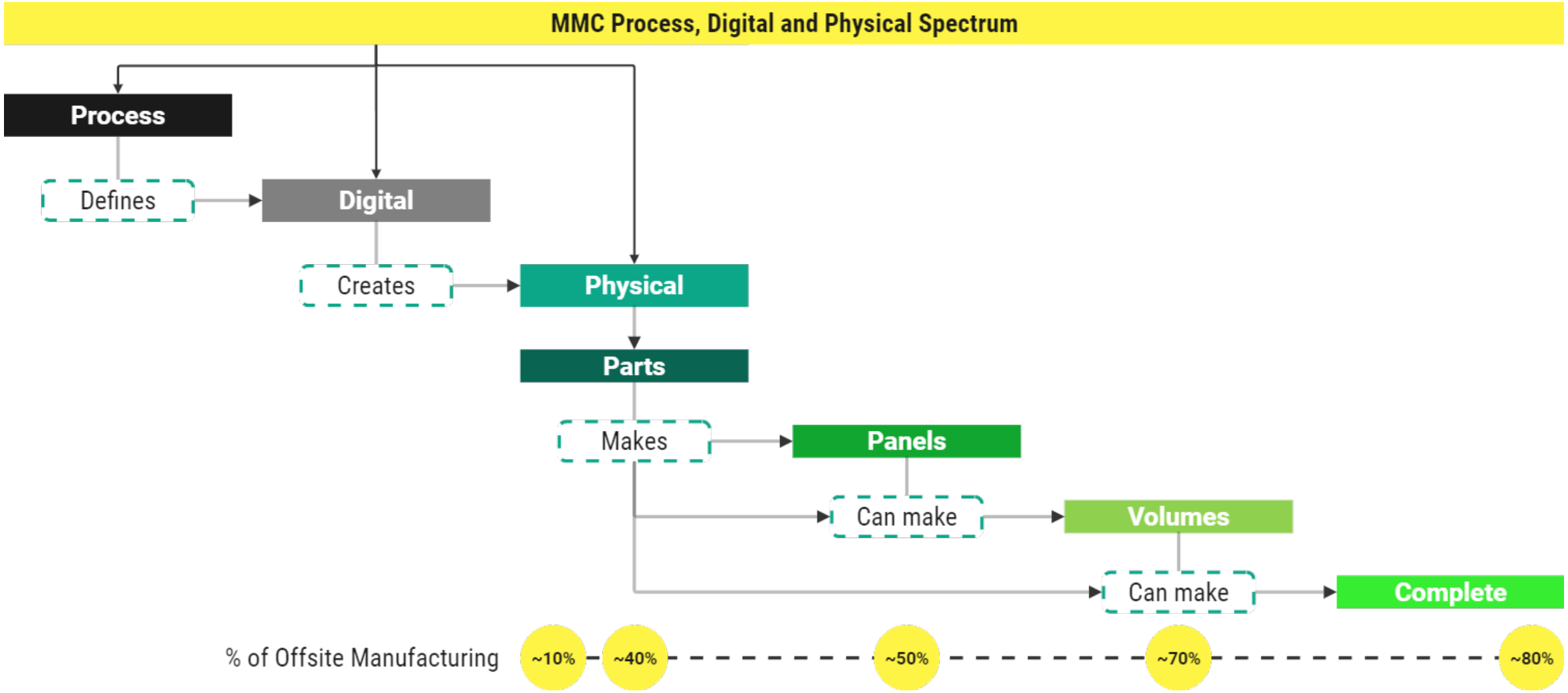
WHAT THIS LOOKS LIKE IN PRACTICE

MMC LAUNGUAGE FRAMEWORK

FLEXIBLE, DESCRIPTIVE, STANDARDISED.



THE MMC LANGUAGE FRAMEWORK LOGIC



PHYSICAL PRODUCTS - EXAMPLE

Modern Methods of Construction

Physical

Parts

Commodity Parts

Parts that anyone can buy from a merchant.

Claddings, linings, insulation, membranes, panels, wraps, tapes, surfaces, cabling, lighting, fixings, paints, sealers, fixtures & fittings etc.

Pre-manufactured Parts

Parts that are supplied by 3rd party specialists.

Pre-manufactured Products -
Truss, windows, doors, stairs, balustrades, connectors, custom steel work, custom kitchen/bathroom joinery, custom flashings

Complex Parts supplied by 3rd party specialists needing commissioning & maintenance.

Proprietary Systems -
Lifts, access, safety systems, HVAC systems, switchboards, appliances, balconies, bike racks, acoustic products, shower & drainage systems, ducting, passive/active fire products, extracts etc.

Structural Parts

Parts that are needed to meet NZBC B1.

Mass Timber -
beams, columns, slabs (CLT, LVL, GLT, Other)

Timber -
Frames, trusses, plywood, strandboard, MDF, studs, plates, beams, piles joists, etc.

Steel -
beams, columns, braces, secondary steel, plates, reinforcing, piles etc.

Light Gauge Steel -
studs, plates, beams, joists, etc.

Concrete -
beams, columns, slabs, piles, precast panels

Masonry -
bricks, blocks, stone etc.

Note: these shaded categories already have a high amount of Pre-Manufactured Value that contribute significantly to MMC

SELECT THE RIGHT MMC PRODUCTS

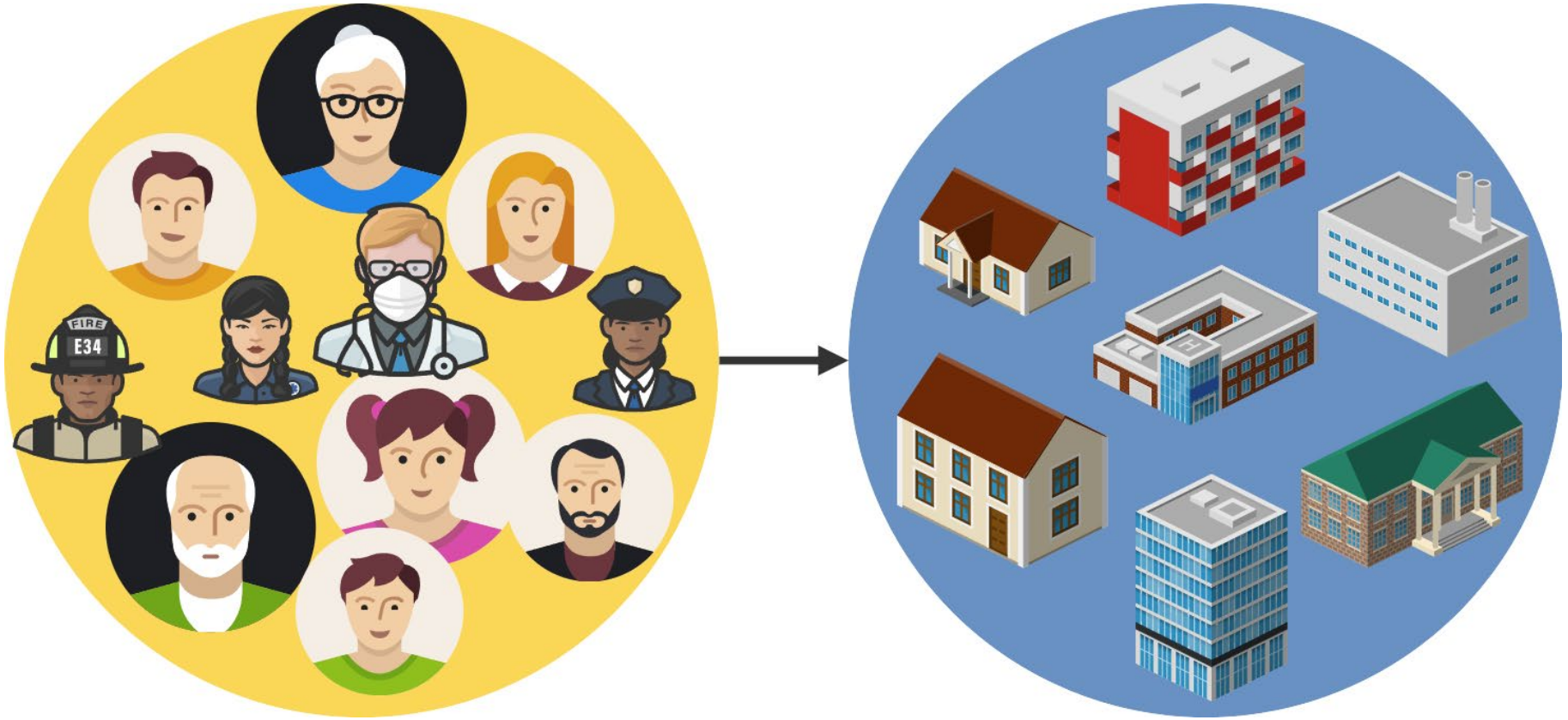
Client - Process | MMC - Process

Digital Tools

Physical Products	3.1 Parts			3.2 Panels					3.3 Volumes			3.4 Complete	
	3.1.1 Commodity Parts	3.1.2 Pre-Manufactured Parts	3.1.3 Structural Parts	3.2.1 Internal Wall Panel	3.2.2 External Wall Panel	3.2.3 Floor Cassette	3.2.4 Roof Cassette	3.2.5 Services Assembly	3.3.1 Pods	3.3.2 Structural Volume	3.3.2 Volumetric Section	3.4.1 Transportable	3.4.2 Stackable
Off-Site Manufacturing Portion	10%	30%	40%	50%	50%	50%	50%	60%	70%	40%	60%	90%	80%
Limited Build Window Schedule-driven solution required	○	○	○	○	○	○	○	○	○	○	○	●	○
Constrained Site Tight urban sites & logistics	○	○	○	○	○	○	○	○	●	●	●	○	●
Programme Rollout Kit of Parts for at-scale rollout	○	○	○	●	●	●	●	●	●	○	○	○	●
Temporary Use On-demand occupancy	○	○	○	○	○	○	○	○	○	○	○	●	●
Carbon Targets ESG-driven goals for Green Finance	○	○	○	●	●	●	●	●	●	○	○	○	●
Accomodation Small Scale spaces for traveler use	○	○	○	○	○	○	○	○	●	○	●	○	●
Remote Site Difficult/remote access	○	○	○	○	○	○	○	○	●	●	●	●	●

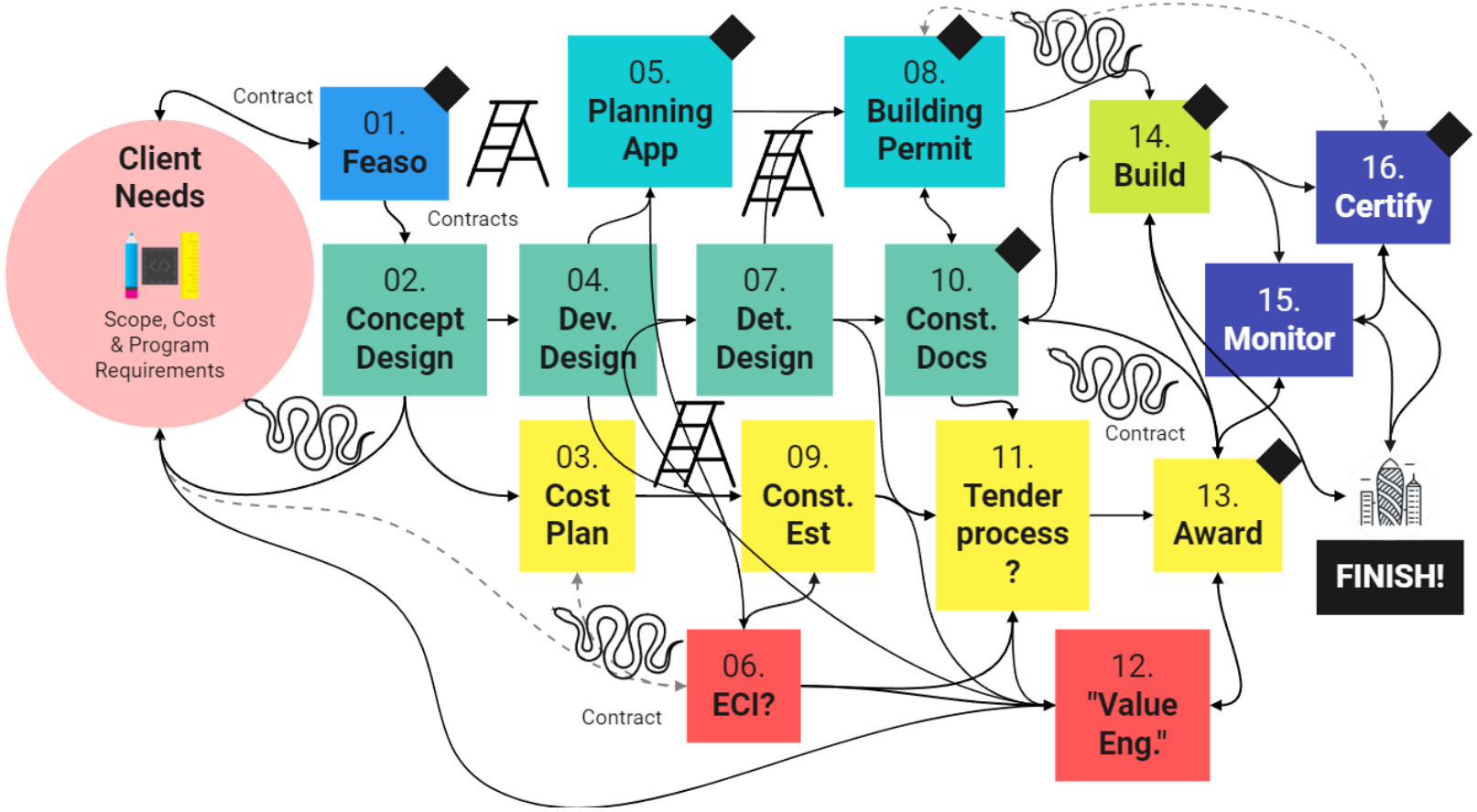

GOVERNMENT
INDUSTRY

The Story of Modern Methods of Construction



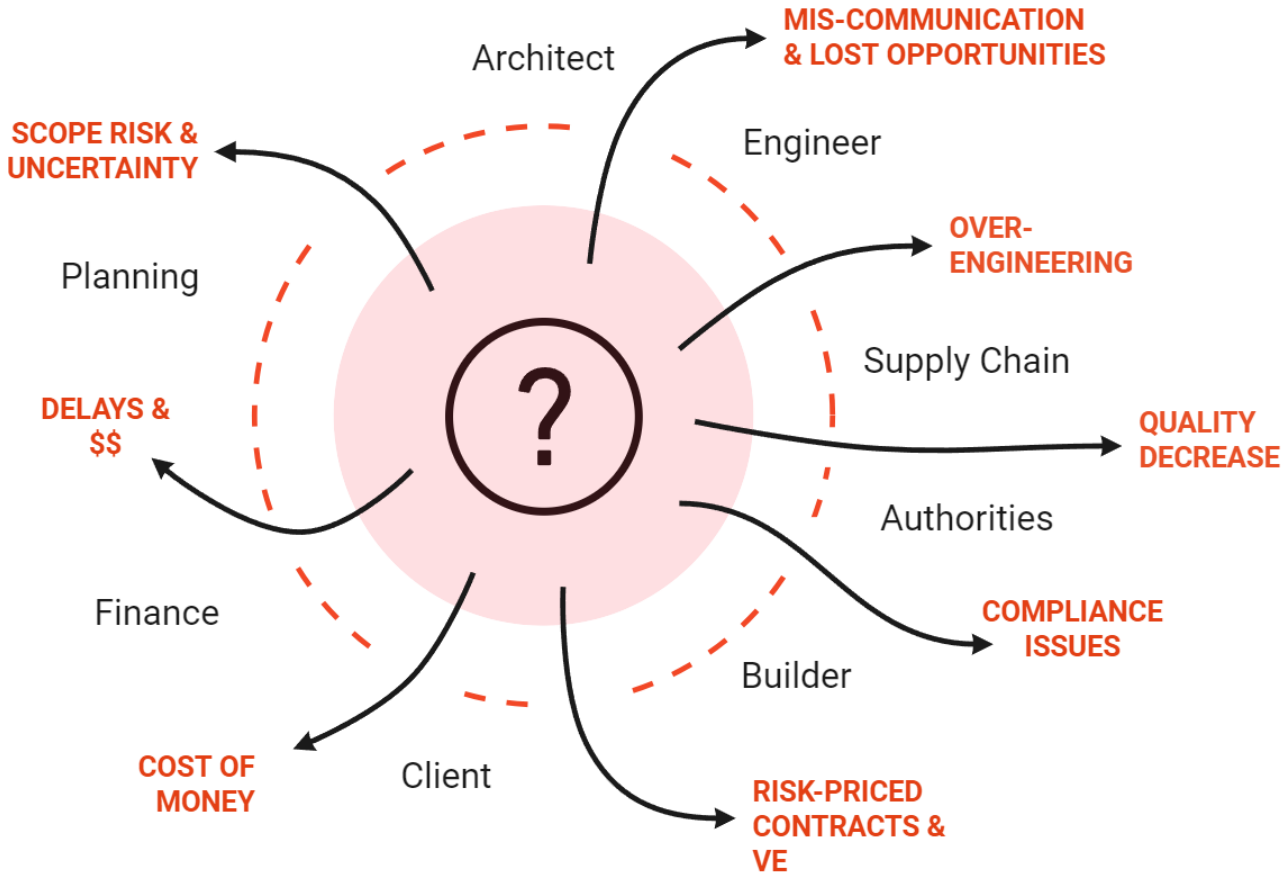
These people need these buildings.

But sometimes, they have trouble getting the buildings they want & need....

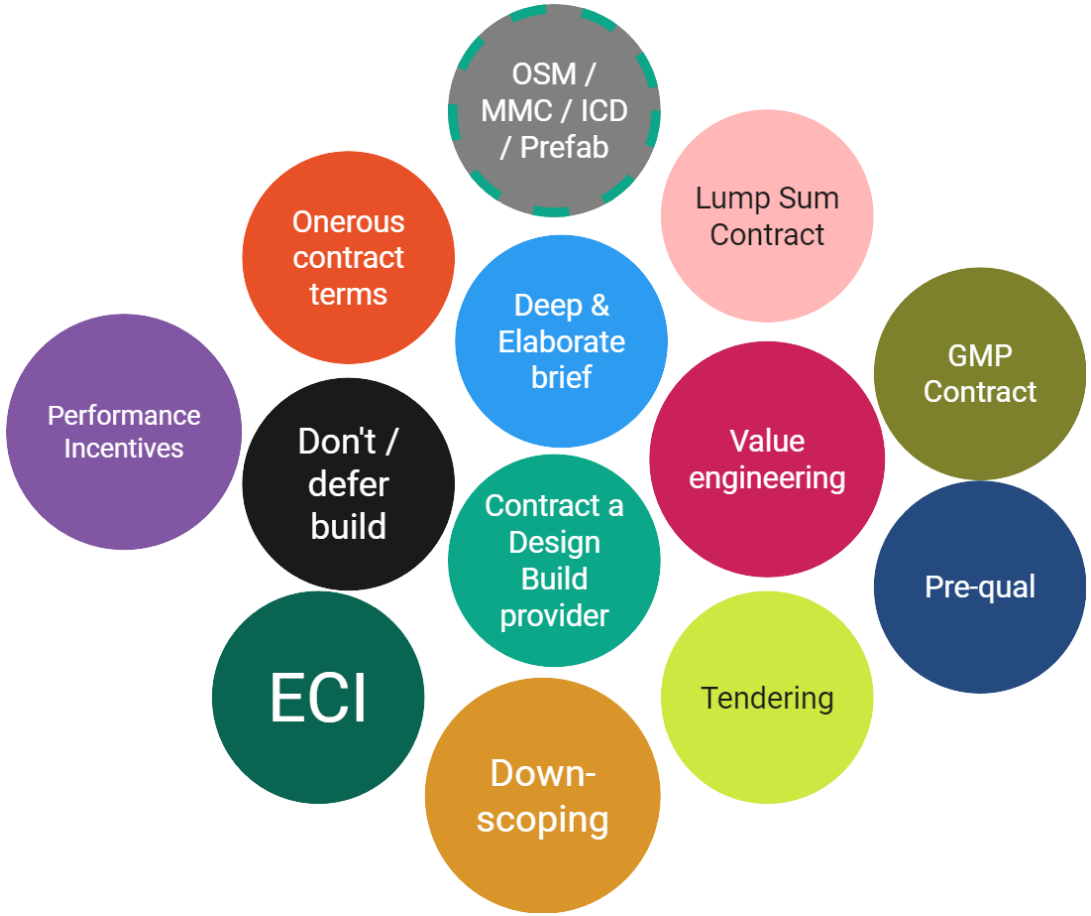


.... because this is the way buildings are delivered.

Every snake, ladder & box represents a chance for waste to happen which in turn, increases uncertainty, cost, time & reduces quality.



And the people involved to run this process can be misaligned, badly incentivised, inadvertently or deliberately hamstrung in providing the best value to meet client requirements. It's a credit to the people involved that buildings get done.



There are lots of common alternatives & strategies to improve the chances of project success, but they rarely work reliably.

One of these has a lot of potential to deliver what people need, but again, its not often successful. Let's look at some reasons why.

OSM = Offsite Manufacturing
MMC = Modern Methods of Construction
IDC = Industrialised Design & Construction
Prefab = Prefabricated buildings
Other = more names coming out all the time

Firstly, it has a lot of names & labels that make it confusing. Some people have been known to argue over these names. Let's refer to this as MMC for now (because it doesn't really matter too much).

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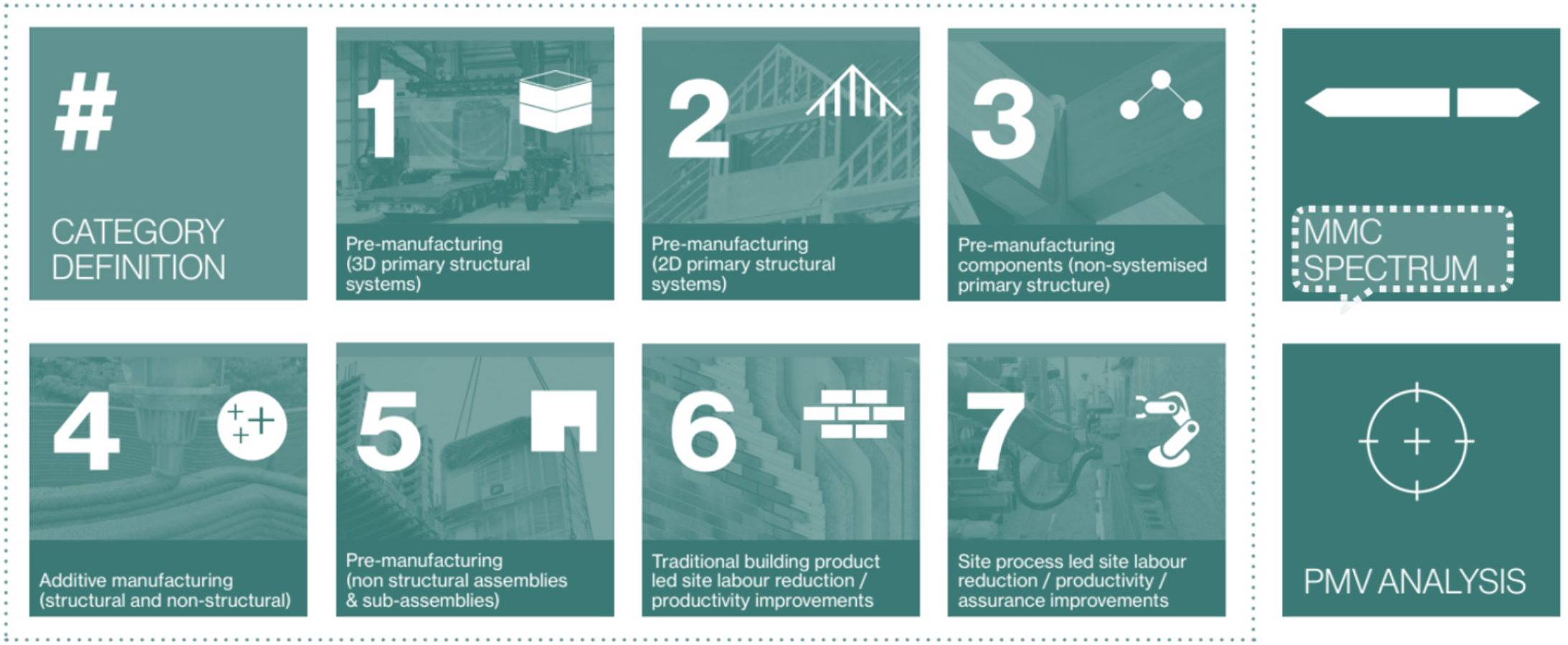
But it gets worse, because there are also other terms that get used, often interchangeably with others without further explanation, and again, more terms added all the time.

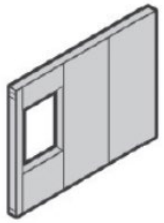
As the adage goes, 'explaining is losing'.



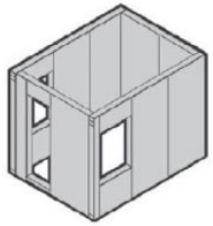
There have been attempts to standardise this language over time. This one is from the UK and produced by the MHCLG Working Group for MMC.

Note the word ‘spectrum’.

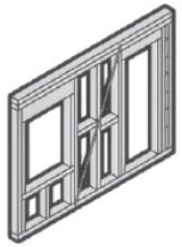
Kāinga Ora is helping drive consistent definitions to support interoperability. Our focus is the full spectrum of OSM elements and we have been testing different OSM solutions in a range of settings and sites for several years. The results are enabling us to define and recommend the best solutions for particular situations.



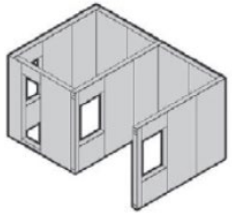
Panel
Wall and floor panels assembled on site



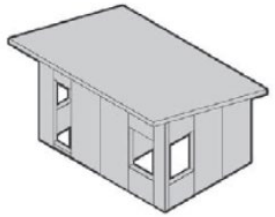
Volumetric
Modular parts (floors or rooms – for example bathroom pods) assembled to form the whole building



Component
Components such as windows, facades, stairs, and other fittings and joinery that is manufactured offsite for onsite assembly



Hybrid
A combination of different offsite manufacturing solutions in one building, including cross laminated timber – a strong, renewable and lightweight building product. Hybrid also refers to how offsite is combined with traditional onsite construction.



Transportable
An entire building transported to site.

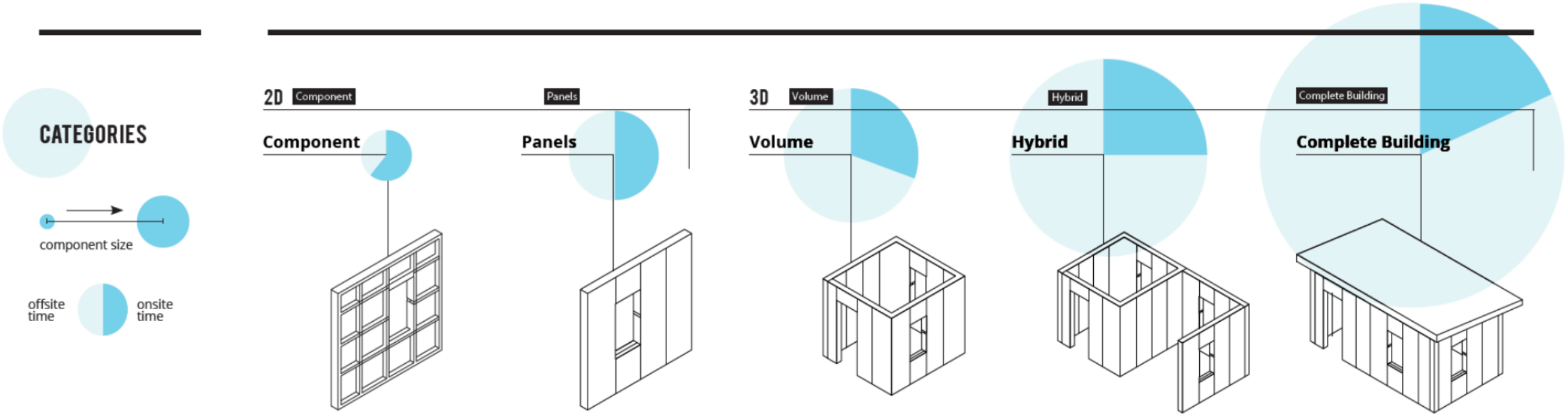
OSM consenting

Consentium (the Kāinga Ora building consent authority) is developing a consenting pathway for Kāinga Ora-retained offsite manufactured homes and increasing industry knowledge of what is required to comply with the Building Act 2004 and Building Code regulations. This will enable suppliers to demonstrate compliance before applying for building consent.

consentium.co.nz

This one is from Kainga Ora as part of their Building Momentum OSM Plan 2021. You can see OSM, elements & ‘spectrum’ again.

This is based on the Offsite NZ categorisation which we will review next.



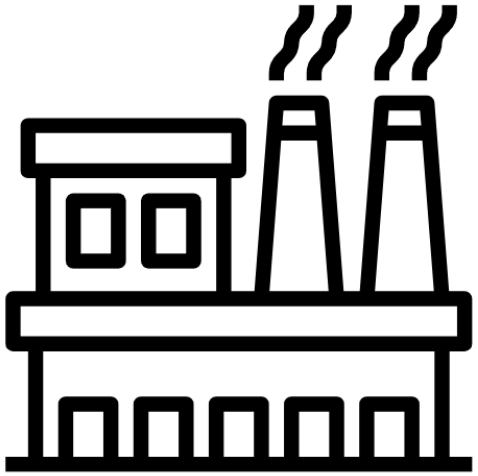
And this one is from Offsite NZ. This infographic handily organises the spectrum into % of offsite and onsite as well as physical size.

OSM Types	OffSite NZ	KO Equivalent	%OSM Expected theoretical	Qualitative OSM	Description
Traditional Construction (Custom building)			Up to 40%	Low	Can involve pre-nail systems and floor cassettes – considered to be 'the norm' for most residential, commercial and industrial schemes. These systems do contribute to faster frame assembly – but limited other benefits
Building product led systems Component approach	Component		40% to 50%	Medium	Part of DfM options where design dimensions are linked to manufactured 2D module sizing. Faster installation time on site; increases factory utilisation and efficiencies. Harder to identify and measure across projects
Closed Panelisation / Flat pack (MMC Cat type 2)	**Panel**	**Panel**	**50% to 60%**	**Medium**	**More of a 2D premanufactured panel system incorporating linings, pre-wiring and windows / doors assembled at factory. Reduced site time for installation and fitting out of enclosures. Standardisation of panel sizes and apertures allows reduced factory time.**
Volumised (MMC Cat type 5)	**Volumetric**	**Volumetric**	**50% to 70%**	**Medium**	**Parts of the building non-structural parts are assembled as 3D pods in the factory and delivered to site as completed modules / pods. Large reduction in site labour and time.**
Modular 3D Hybrid (MMC Cat type 1 / 5)	Hybrid		70% to 80%+	High	Linked 3D pre-assembled modules that create rooms or sections of buildings. It is a combination of volume (pod) and panel units – standardised sizing allows greater speed or assembly and less wastage (requires on-site completion)
Volumetric complete buildings (MMC Cat type 1)	**Transportable**	**Transportable**	**80%+**	**High**	**Complete 3D transportable building manufactured in factory. Requires limited site connection trades – primarily sub-structure trades, services connections etc. The least amount of on site work required**

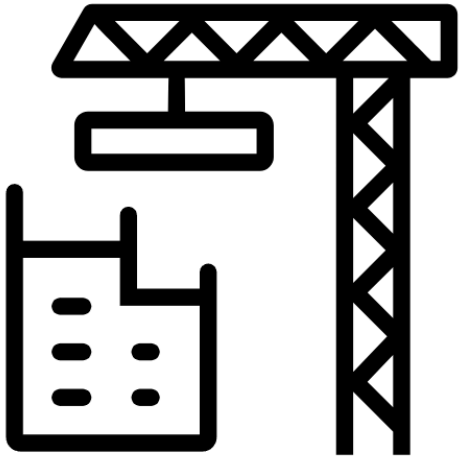
Movement towards

This table summarises the different approaches by each organisation - lots of consistency in names here. It is organised into a spectrum of % of off-site manufacturing.

So, if the industry can't work out definitions, then what chance does a client have? Perhaps the reason why there are so many names is because people focus on the 'what', but have forgotten about the 'why', and this leads to confusion. But first, let's look at off-site vs. on-site.



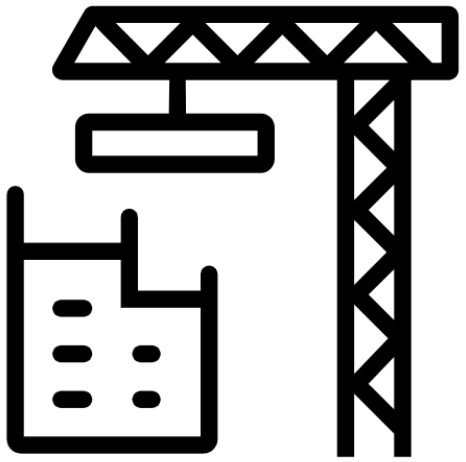
Off-site



On-site

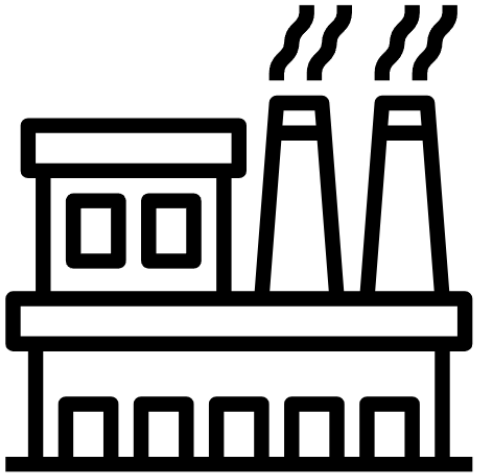
The reason why names are so important in the MMC industry is because they want to set themselves apart from traditional construction.

This is off-site vs. on-site.



On-site

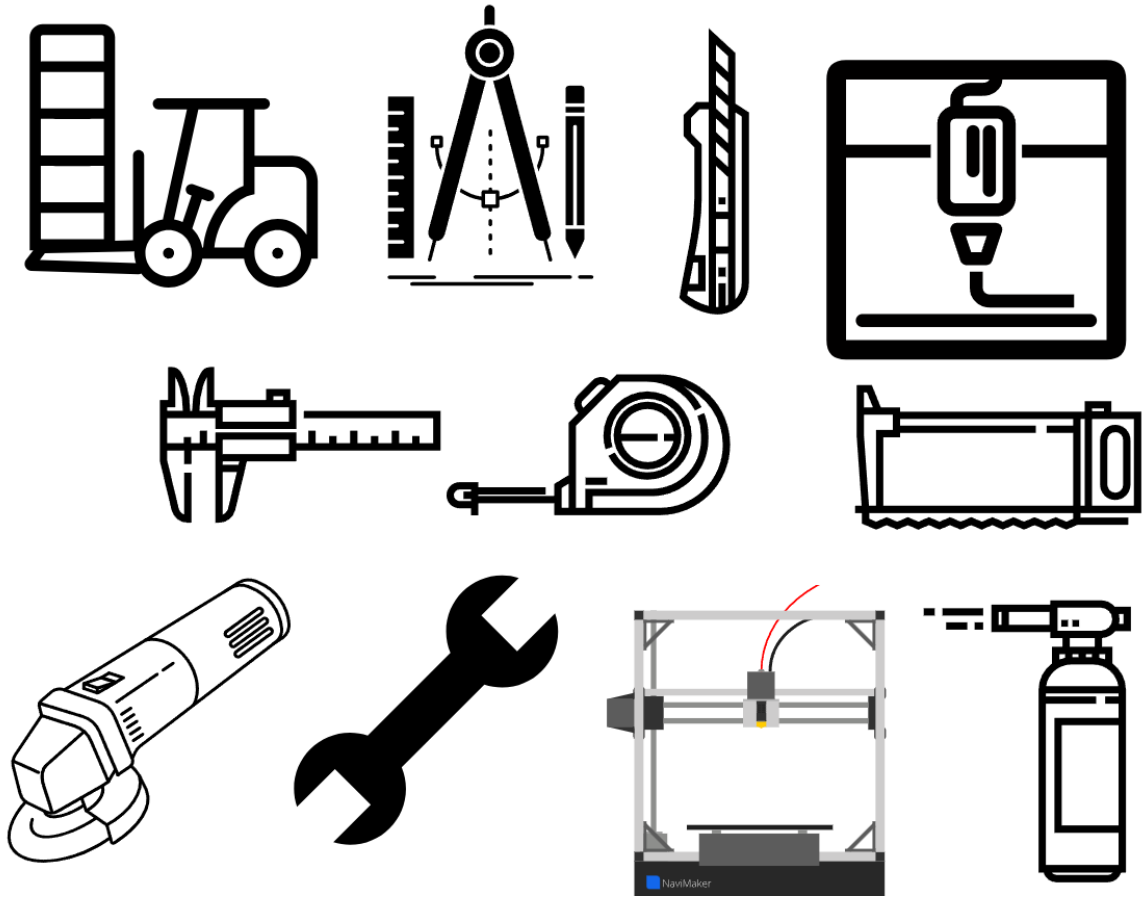
On-site means turning the site into a factory with all inputs coming in. It is a ‘free’ production space, and is subject to weather, site constraints, logistics, traffic & other matters,
& increasingly, for waste, poor quality, budget & schedule overruns.



Off-site

Off-site seeks to complete as much of the building in a controlled environment prior to getting to site. The degree to which this is done depends on the company & its capabilities. It's fair to say so far results are mixed but there are evidence-backed reasons for why this is a good idea if done right!!

By taking construction activities off-site, several benefits accrue - some of them are listed above. The key thing is the choice about what to do off-site & onsite which needs a deep understanding of all parts of the construction process. This is often poorly understood - again, the 'why' is often forgotten.

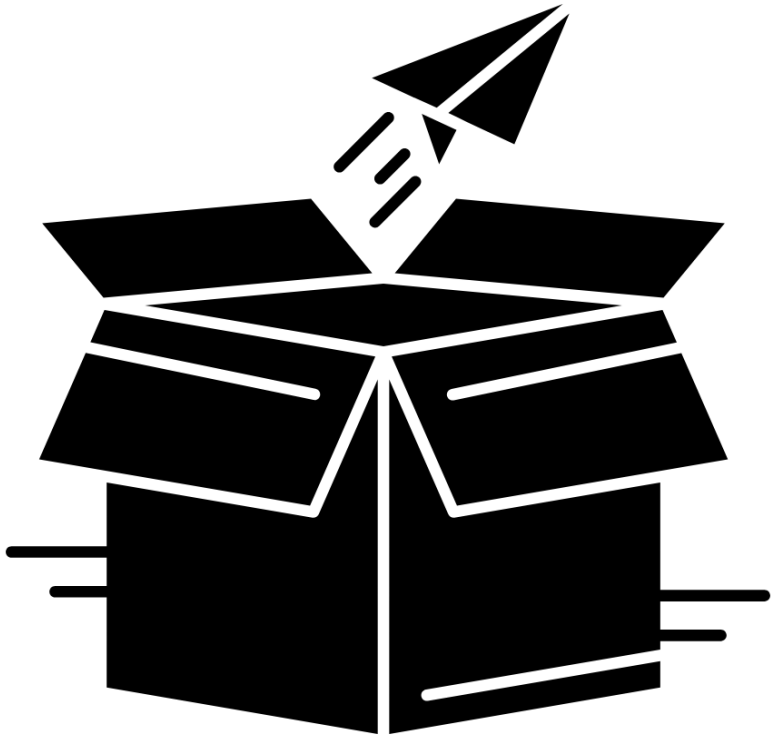


And, if the off-site facility is filled with expensive equipment, it can be very costly & therefore existential to the business. There are many examples of failure in the MMC space that can trace origins back to this problem - adopting expensive technology without fully considering client requirements.

So, Off-site wants to set itself apart from On-site by:

- moving portions of construction into a controlled environment
  – avoid weather, waste, traffic etc.
- build-in the benefits of Off-site into these portions to avoid typical on-site issues
  – higher quality
- take more responsibility for these portions by in-housing design, trades, logistics & QA
  – reduce onsite work & complexity
- using all the above, remove waste from the system to achieve a positive cost & time delta than On-site construction alone

Next, we investigate the idea of Product-Market Fit.



"Product-market fit," writes startup coach & investor Marc Andreessen, "means being in a good market with a product that can satisfy that market". When a company identifies a need in the market & builds a solution that customers want to buy, that's product-market fit. This approach has propelled tech for 40+ years.

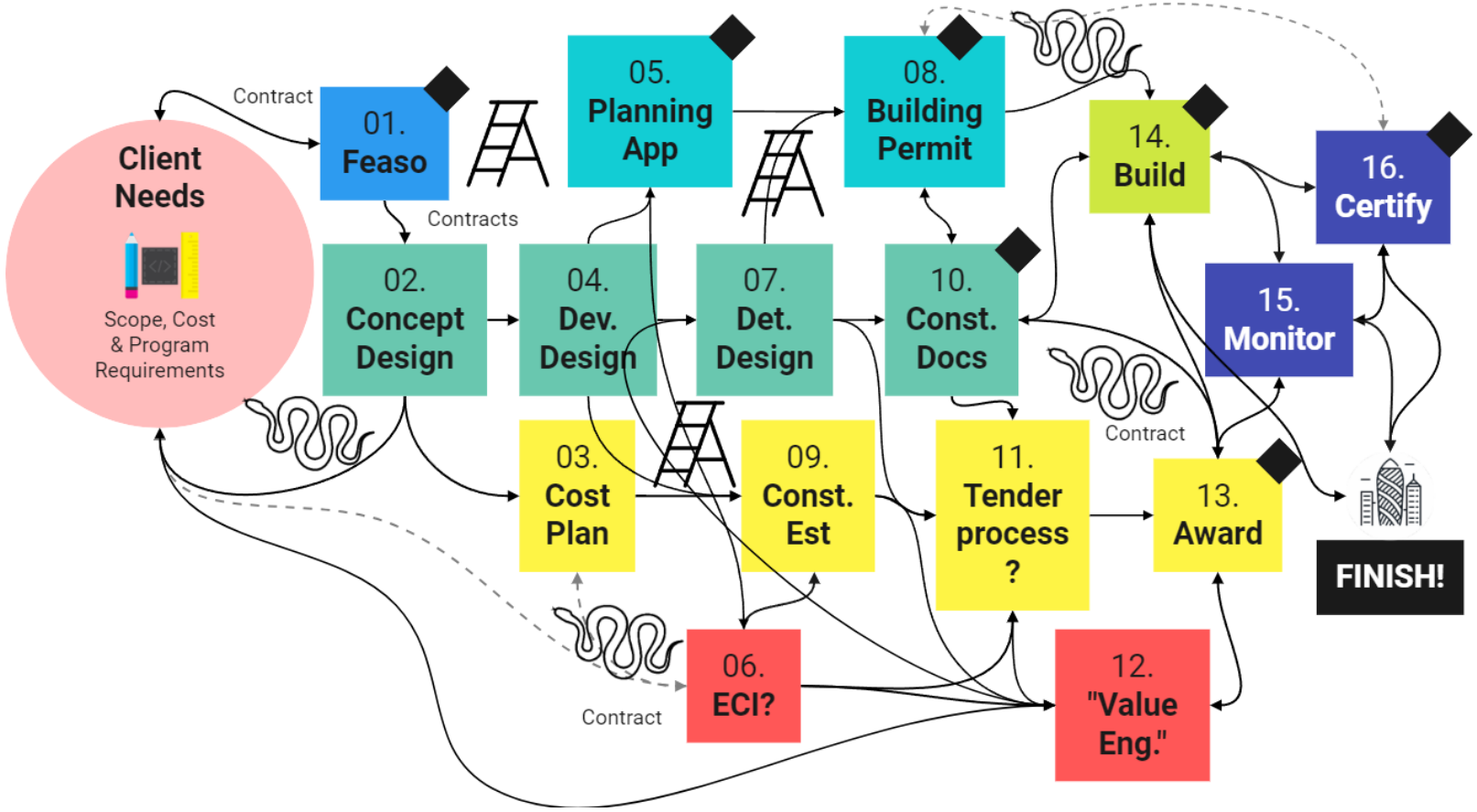
Arguably, on-site construction has product-market fit apart from one factor: the deep dissatisfaction of the typical on-site process in meeting client demands. In fact, the pain is so high, that even Off-site companies without demonstrated product-market fit will find enthusiastic clients.

Let’s recap.

In review:

- We have an incumbent way of getting buildings done called On-site, but it's got problems & clients are looking for alternatives.
- Off-site has a lot of proven potential, but suffers from a lack of definition, cohesion & can be highly fragile under certain conditions.
- Finding Product-Market Fit could be a strategy to harness the potential of both On-site & Off-site to meet client pain points

Let's look at the previous diagram on workflow.

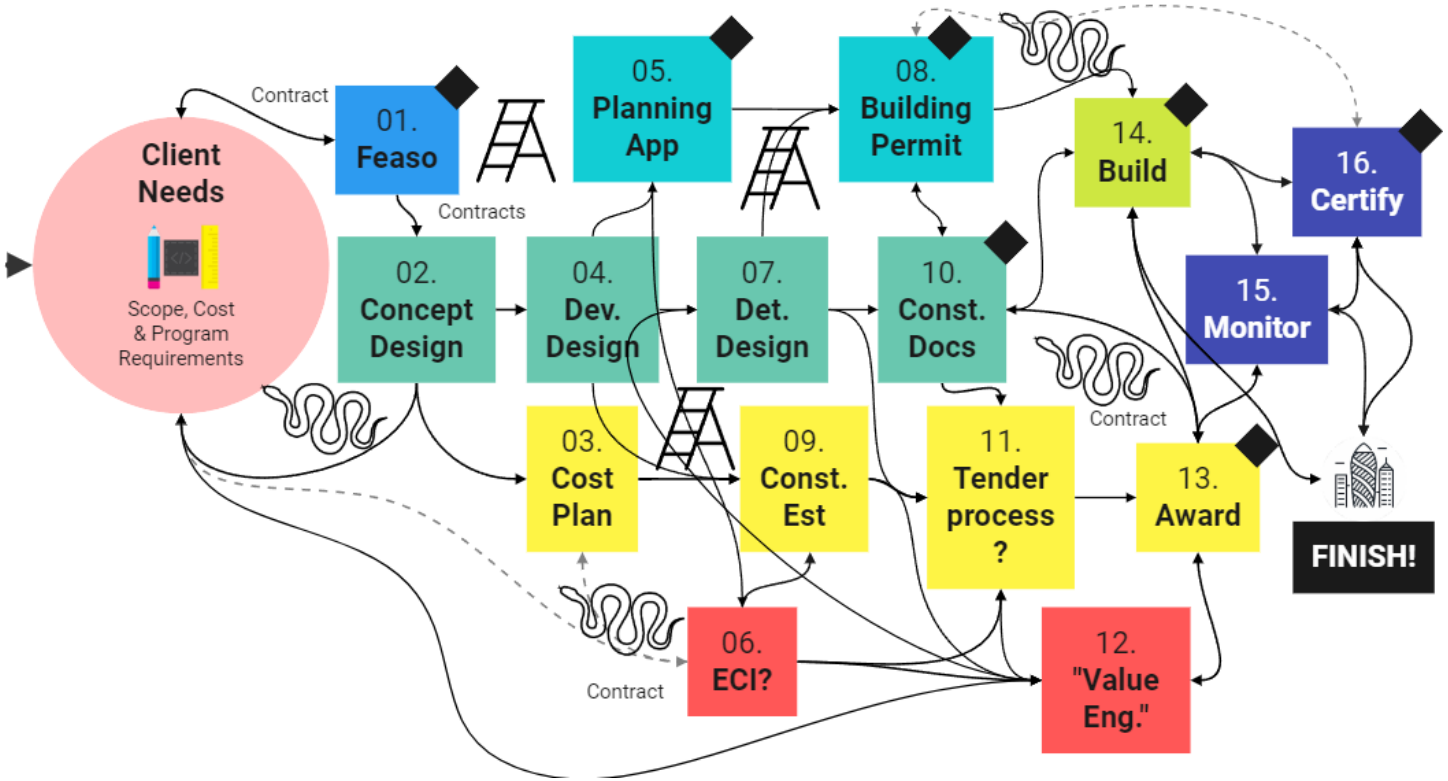


Arguably, this workflow is organised well. The client has requirements that need to be verified through a process prior to the actual build. It's just more aligned with On-site - designed to mitigate risk & increase certainty over time. This is the existing context which Off-site has to understand.

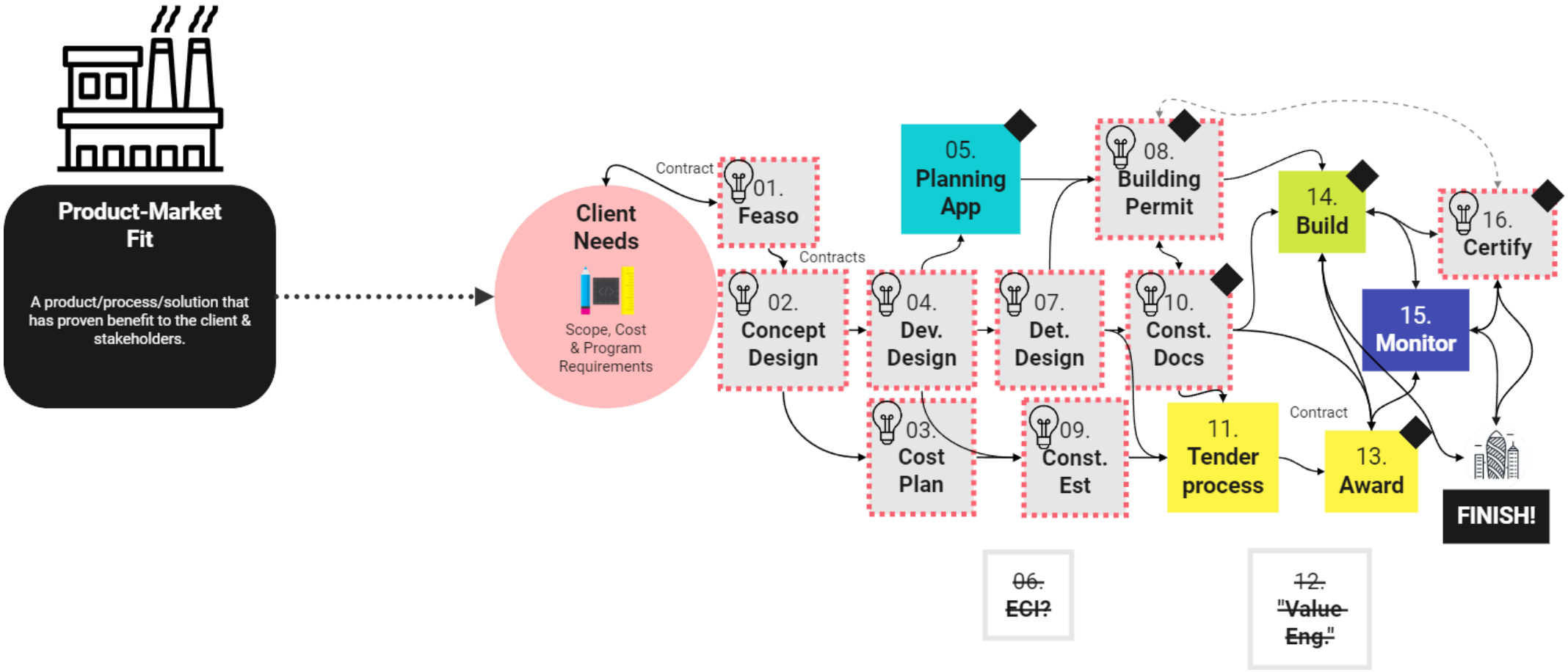
Product Development Strategy

A structured process to understand client pain points from first principles - prior to design, manufacture or build - and then design solutions backed with evidence.

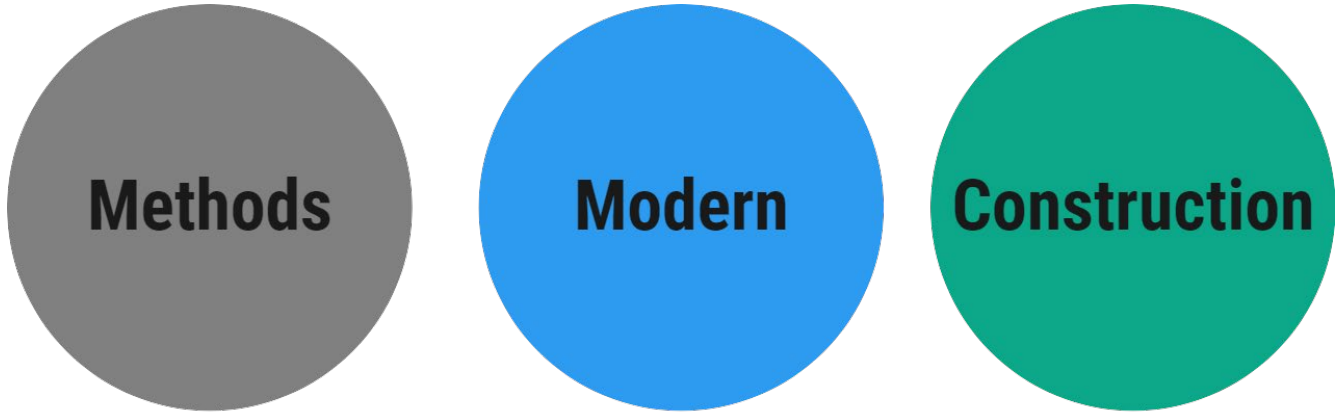
- Select Client/market
- Establish business case i.e. there is sufficient opportunity
- Engage to understand pain points, requirements, pipeline, opportunities and relationships
- Develop solutions to pain using expertise & experience
- size up the capital demand
- create marketing strategy & price model
- execute



Off-site distinguishes itself through innovative thinking. What has driven innovation in the tech industry has been taking a product development approach to solving client pain points. This has been the case for Apple, Tesla, NASA, Uber, Air BNB & many other companies. MMC needs to understand Product-Market Fit.



This is what MMC Product-Market Fit could do - simplifying process, increasing certainty for stakeholders & collaborators, removing roadblocks, increasing project speed & most importantly, providing the client with what they need. So how could MMC companies start to think about what they do as products?



1. Planning
2. People
3. Technology
4. Governance
5. Markets
6. Engagement
7. Contract
8. Delivery
9. etc.

1. Design software
2. Fabrication software
3. Design Automation
4. QA
5. GIS
6. LIDAR
7. Digital Twins
8. etc.

1. Part
2. Panel
3. Volume
4. Complete
5. etc.

In MMC, we can think about Digital, Process & Physical. Usually, the physical product is foremost - this is the pod, the transportable home etc. But these physical parts are first made digitally with software etc., & most importantly through a process - this is the way things get done or setup.

1. Planning
2. People
3. Technology
4. Governance
5. Markets
6. Engagement
7. Contract
8. Delivery
9. etc.

1. Design software
2. Fabrication software
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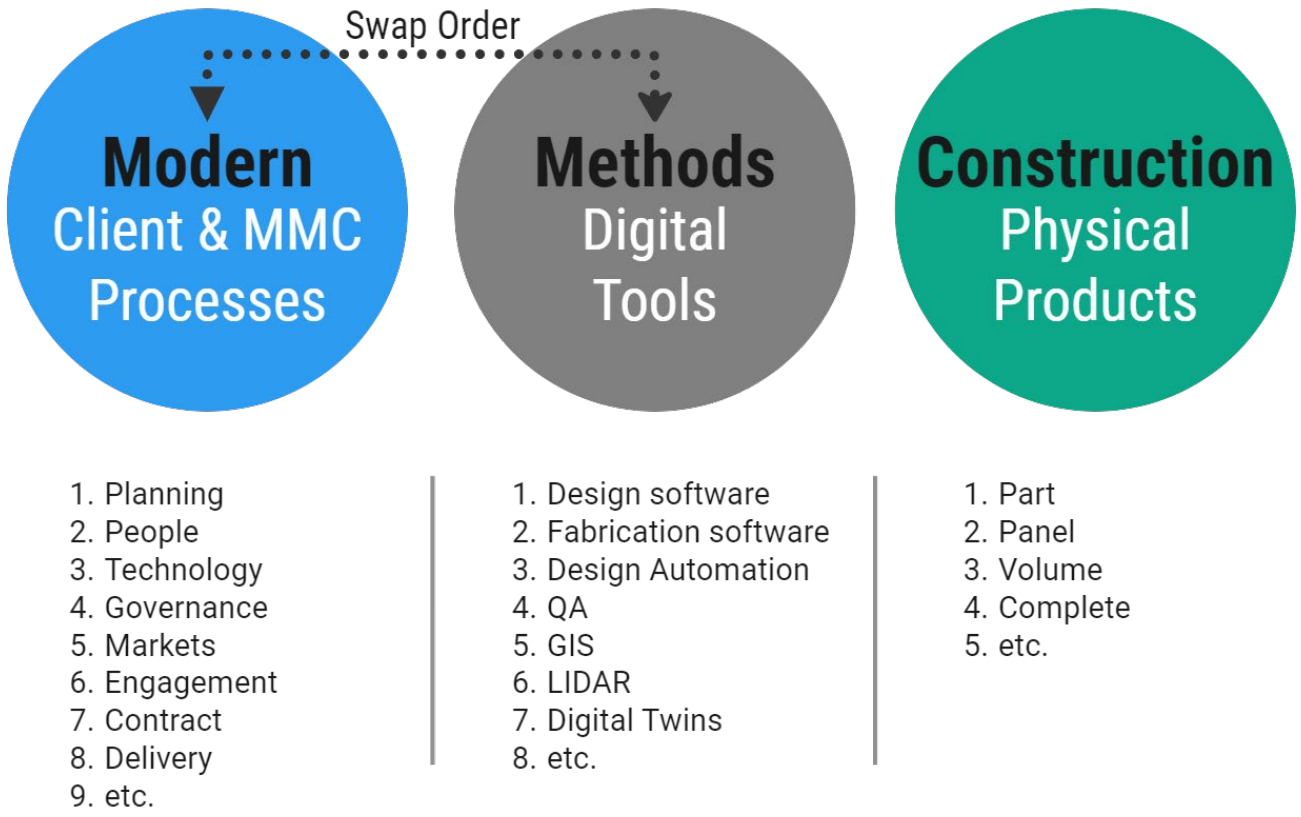
7. Digital Twins
8. etc.

1. Part
2. Panel
3. Volume
4. Complete
5. etc.

When we map MMC back on to the different categories, it maps nicely.
As innovators, we need to take the potential of digital tools & develop a modern process or method to create construction or physical products.



One more thing, we are going to change the order slightly to preference PROCESS first. There is a good reason for this which we will get to later, but it's still called Modern Methods of Construction or MMC.

MMC = Modern Methods of Construction

OSM = Offsite Manufacturing

IDC = Industrialised Design & Construction

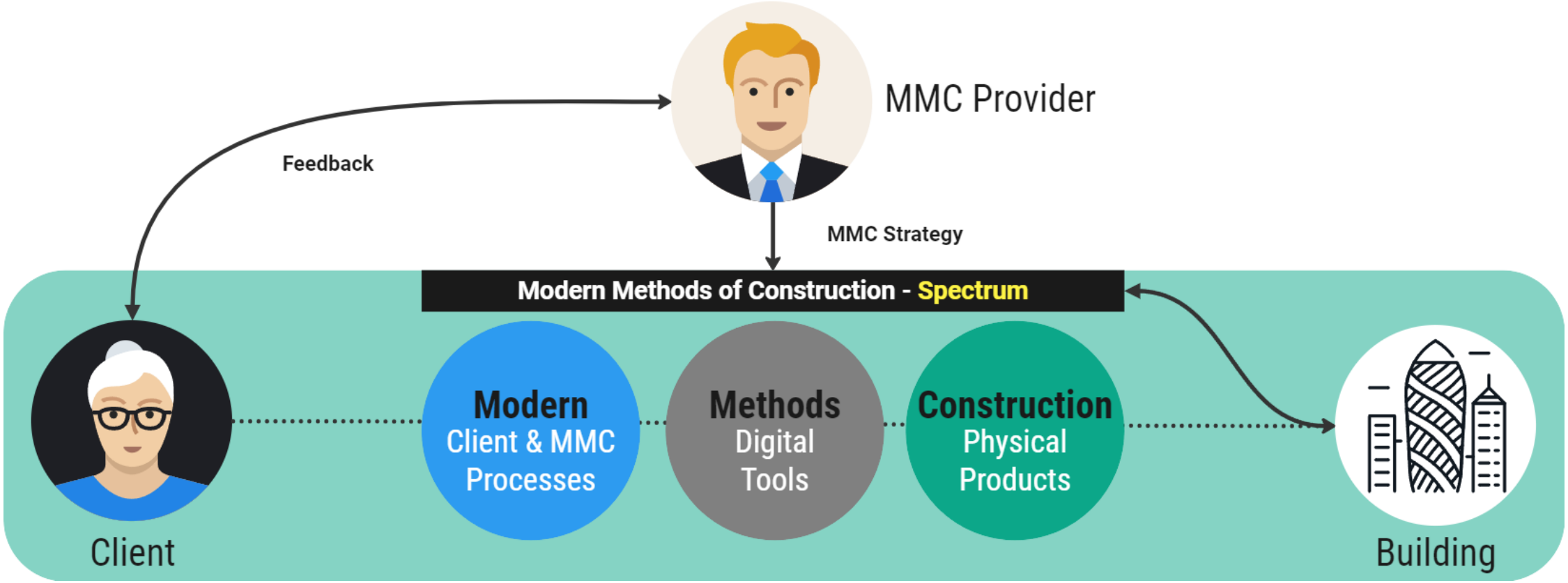
Prefab = Prefabricated buildings

Other = more names coming out all the time

This is why we think that landing on MMC is the best overall name - this is the same as in Australia & the UK.

It encompasses Off-site, On-site and everything in between.

But if people still really want to call it by other names, that's OK too.



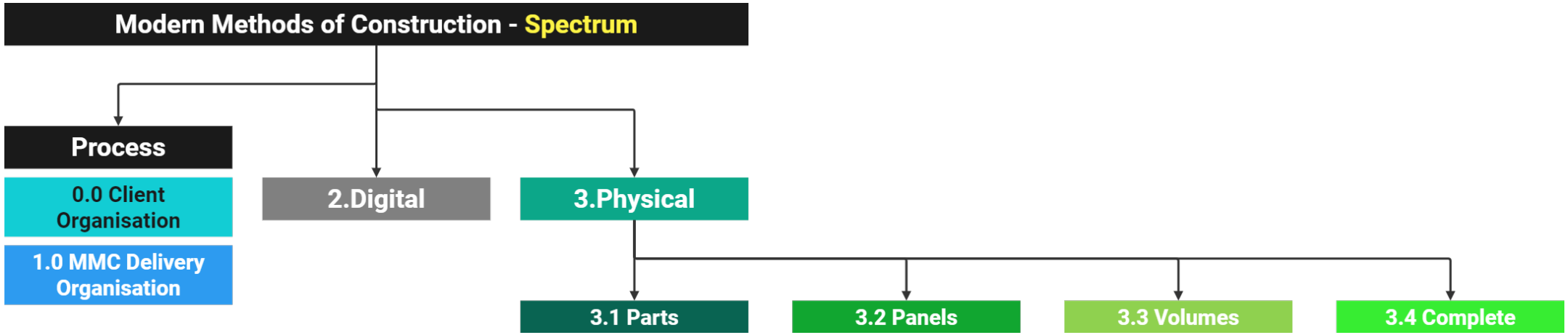
This is MMC in a nutshell – a client needs a building, the MMC provider engages with the client to understand pain points & then selects from the 3 spectrum categories to create a solution.

Let’s recap, again.

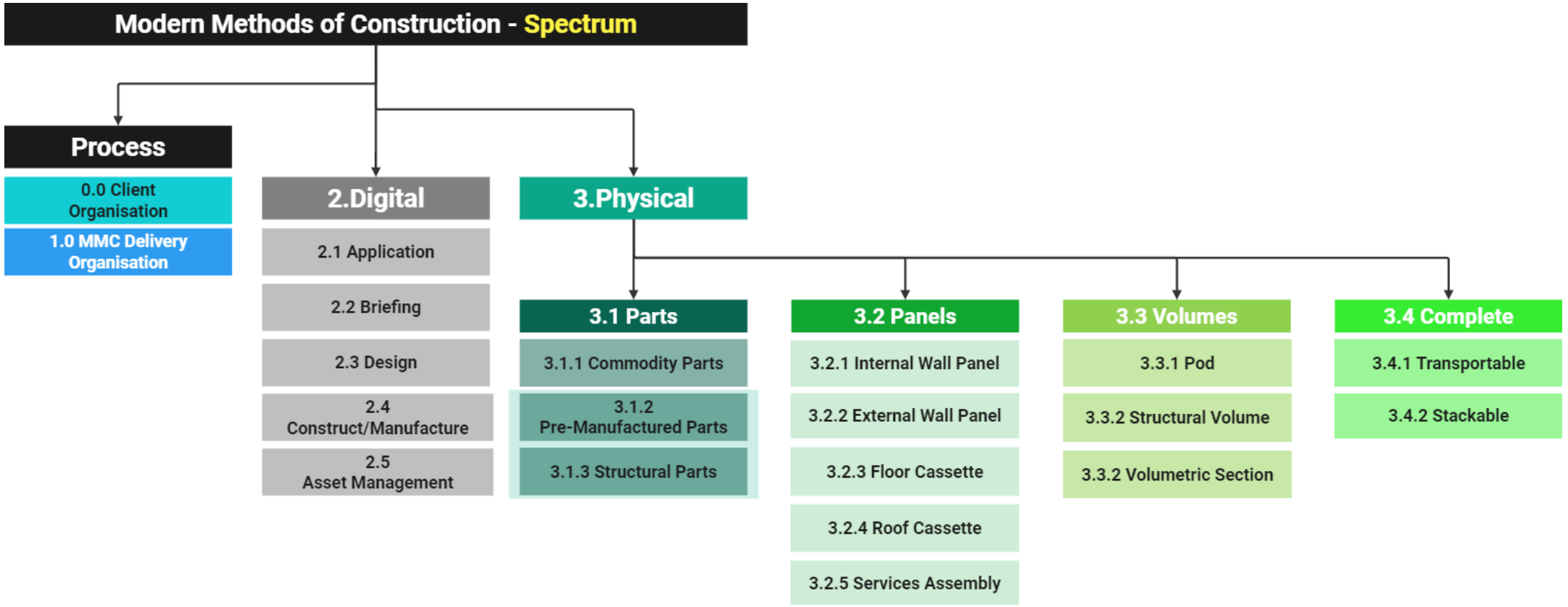
Off-site can set itself apart from On-site by:

- Deeply understanding client pain points
  – adopt a Product Development Strategy
- Utilise Process, Digital & Physical to create solutions
  – creating a process to satisfy client pain points will lead to the right solution
- Unite behind MMC as the principal industry label
- Using all the above, create a solution that has Product-Market Fit for successful buildings & businesses

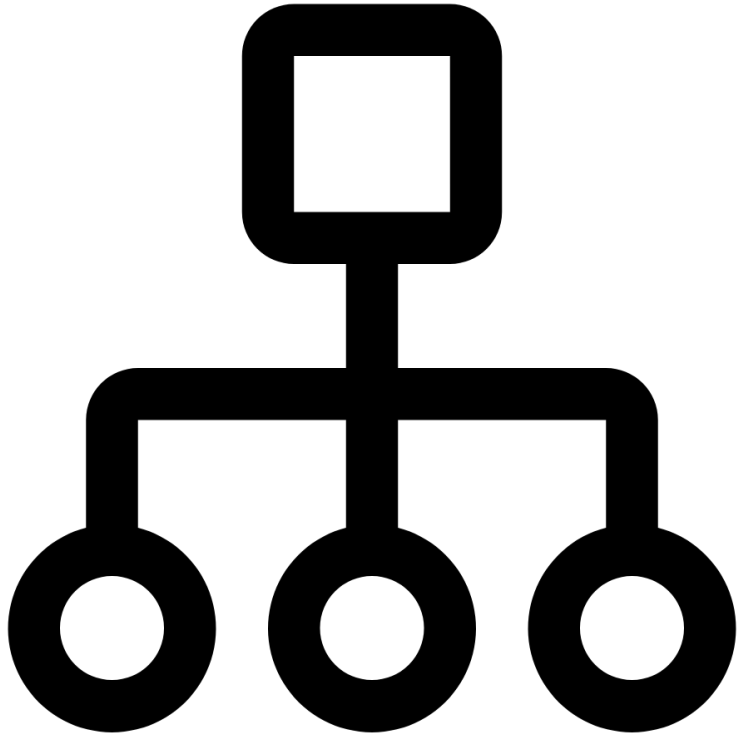
Next, we establish a deeper, standardised schema to unite MMC.



When we extrapolate the three categories – process, digital & physical - we can then categorize the spectrum quite simply.



MMC providers can talk about what they physically provide in their own way – parts, panels, volumes & complete. And because we know that the MMC space is wide & deep, MMC providers can also talk about their process & their digital products too.



Let's break these down further.

Modern Methods of Construction

Client - Process	Internal - Organisation	External - Market	Business Model
	Planning Process development & improvement for org alignment, repetition, standardisation & integration of systems across design, delivery, procurement, investment planning & monitoring, asset management, digital **People** Skills, experience, capability & gaps, organisational goals **Technology and Systems** Technology databases, SLA's, common data environments, LEAN, Level of Standardisation **Governance & Decision-Making** DLA's, responsibilities, budgets, stage gates, committees **Procurement** Contract type and stage-gates, scope & sequence of lifecycle works **Finance** Drivers & ROI expectations, budget, time-frames, portfolio vs. project, debt, equity, instruments, bank, bonds, PPP	**Market Scoping** Understanding capability & capacity of options, trade-offs, options, alignment with goals. Following assessment, explore options for delivery solutions - local and international. **Early Market Engagement** Identifying aligned delivery partners and options **Delivery Options** Workflow, warranties, responsibility of delivery i.e. full turn-key, installation, supply, manufacture **Skills** level of experience, competence & maturity of supply chain.	**Problem Definition** What are the challenges, constraints & opportunities? Why MMC? **Contracting Approach** ECI, Design-Build, Alliance, PPP, Super-subs **Risk** Macro, labour, supply chain & environmental risk, program **Budget** Timing, Size, Scope, net present Value metrics, decisions, feasibility modelling & assessment, pricing in benefits (shorter build time etc.) **Measuring Success** Whole of Life Costings, broader outcomes, Programme Certainty

The single most important activity in getting the benefits of MMC is establishing your process.

For Clients, this means understanding your internal operations, the market, and your business model to make your programme of works or project successful.

Modern Methods of Construction

MMC Delivery - Process

Internal - Organisation	External - Market	Business Model
Planning Process development & improvement for org alignment, repetition, standardisation & integration of systems across design, delivery, procurement, investment planning & monitoring, asset management, digital	**Target Client** Identification, engagement & understanding of pain points. clearly state with evidence benefits to the Client & planned outcomes.	**Product-Market Fit** The unique solutions a company offers to its target customers with evidence of benefits
People & Resources Skills, experience, capability & gaps, facilities & equipment	**Competition** Identification, evaluation of businesses offering similar products or services.	**Product Set** What the company provides & generates its income from - mixture of offerings & services to diversify income streams.
Technology and Innovation Automation, machinery, tools, DfMA, Intellectual Property, Methods, design & management software	**Policy & Compliance** Laws, regulations, and government policies that affect or support business operations.	**Delivery Model** Revenue model, Internal & external contracting of activities, methods & physical products to deliver solution, contract, innovation
Quality Assurance Accreditation, operations, process, insurance, compliance, monitoring, LEAN, ESD	**Supply Chain** Identification of collaborators & providers of materials, process, activities and assurance.	**Marketing & Demonstration -** Create opportunities for pilot/proof of products to demonstrate solutions & use to market.
Finance Drivers & ROI expectations, budget, time-frames, funding, investment, debt.	**Future Impacts & Risks** Labour, automation, carbon, resources	

For those delivering MMC, this means understanding your internal operations, the market, and your business model.

This focus here is to develop a strong solution to meet your client requirements, which will then inform your digital & physical assets.

Modern Methods of Construction

Digital

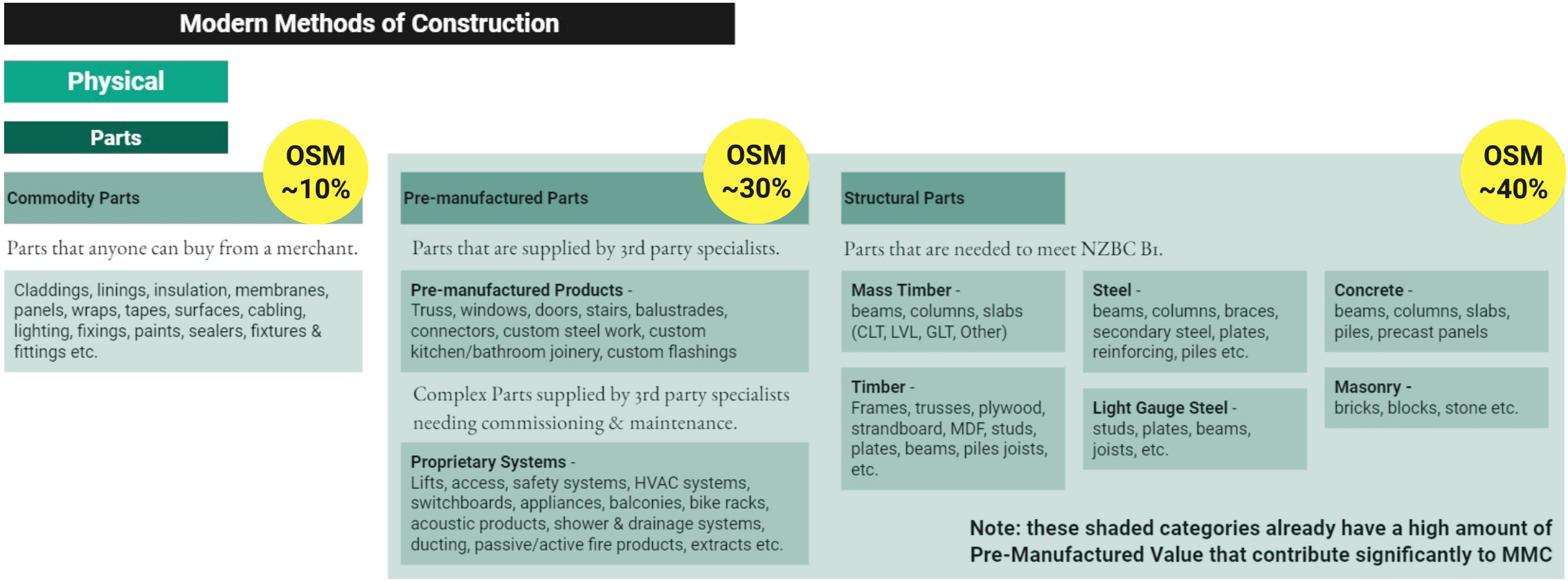
Programme or **Project**

A **Programme** consists of Multiple projects across an asset owner organisation, city or country. owner organisation, city etc. A **Project** is an individual or one-off project in one location.

Briefing	Design	Construction/Manufacturing	Asset Management
Digital Kit of Parts Catalogue - a set of products drawn from the MMC Product spectrum in digital format, reusable across projects & sourced from widely available, robust & reliable supply chain and/or within MMC provider capability.		**Fab Automation & Analytics** Optimise production process.	**Maintenance Analytics** Predictive maint. & ops monitoring
Configurators Tools for Kit of Parts to be used.	**Digital Construction Model** Sharing data through digital formats (e.g. BIM, CAD, IFC etc.) & developed in CDE.	**Digital Manufacturing Model** Link fabrication to manuf. workflow.	**Asset Information Database** Linked CapEx and OpEx databases.
Product Lifecycle Management (PLM) Strategic approach to managing the entire lifecycle of kit of parts components from inception to decommissioning. This process enables more stringent change management & decision-making processes.			
Logistics Database Optimise flow of physical parts.	**Carbon Lifecycle Calculations** Embedded parameters in the digital components for accurate projections.	**Digital Assembly Manual** Interactive detailed assembly instr.	**Digital Twin** Optimised 3D analytics to demonstrate asset performance.
Process Automation Improvement processes (e.g. procurement, design, construction, operational) at a programme level.	**Generative Masterplan Tools** Algorithms to rapidly explore a variety of design options.	**4D Programming (Sequencing)** Timeline Simulations to demonstrate logistics and construction/assembly methodologies and sequencing.	
Supply Chain Database Inventory of suppliers for each MMC Physical product category.	**Geospatial (GIS)** Database of geospatial and locational information to inform design.	**5D Cost Information/Bill of Materials** Embedded cost parameters in the digital components for accurate projections and real-time cost analysis.	
	LiDAR & Survey Advance photogrammetry techniques to attain 3D measurement of asset or site to be altered.	**Simulation/ AI** Analysis of structural, environ- mental and other aspects.	**Fabrication Software** Transfer of models to manufacturing standards

Interfaces crucial to efficiency and priority for automation and flow.

These are a selection of the digital tools & processes that can be used across the project or programme of works.



Parts can be further categorized into these groups. Parts are best understood as the basic physical ingredients of MMC - they get combined into Panels, Volumes and Complete Buildings.

They are also the basic & main ingredients of traditional On-Site construction – part of the MMC Spectrum.

Modern Methods of Construction

Physical

Panels

Wall Panel — OSM ~50%

Vertical panels combining structure with value-add parts like linings, cladding, insulation & services.

Internal Wall Panel -
Structural Part systems with commodity & pre-manufactured parts to meet functional & regulatory requirements, including: insulation, linings, acoustic & fire layers, openings, connections, outlets, channels etc.
Examples include: partitions, intertenancy walls, corridor walls

External Wall Panel -
Structural Part systems with commodity & pre-manufactured parts to meet functional & regulatory requirements, including: insulation, linings, acoustic & fire layers, windows, balustrading, flashings, connections, outlets, etc.

Cassettes — OSM ~50%

Horizontal panels combining structure with value-add parts like sheeting, insulation & services.

Floor Cassette -
Structural Part systems with commodity & pre-manufactured parts to meet functional & regulatory requirements, including: insulation, sheeting, acoustic & fire layers, connections, outlets, etc. Examples include: LTF floor cassettes, composite floors

Roof Cassette -
Similar to Floor cassette but with different loading, weathertightness & geometry requirements.
Examples include: SIPS, insulation panels, LTF, CLT, Box beams

Specialist Assemblies — OSM ~60%

Horizontal and vertical panels, cassettes & assemblies typically with a single function.

Services Assembly -
Panel or assemblies with commodity, pre-manufactured, proprietary & structural products with a services function.

Examples include: pre-plumbed wall, wet-area floor panel, services shaft box, horizontal ducting assembly, electrical switchboard & distribution assembly, HVAC cassette etc.

Parts can be combined into Panels.

Panels are not occupiable like volumes but have added-value through combination. Panels are best made off-site and require DfMA to be successful - especially in interfaces, fabrication and installation.

Modern Methods of Construction

Physical

Volumes

Pods

OSM ~70%

Volumetric units comprising panels & assemblies to make an occupiable, functional space.

Bathroom Pod -
A complete volumetric unit with all of the aesthetic, functional & regulatory requirements of a bathroom i.e. plumbing, drainage, extracts, ducting, regulatory surfaces, geometry, fixtures & fittings, doors. Can be structural for the purposes of transportation, or part of a larger structural system

Specialist Pod -
Similar to Bathroom Pod but for a different purpose/s: Examples include: Kitchen/Bathroom/Laundry Pod, Specialised Pod i.e. large scale HVAC units, plumbing, power supply or other.

Structural Volume

OSM ~40%

A structural volume that is then used as the basis for more construction.

Structural Frame -
A volume created from a frame that will be the basis for further construction.
Examples include: heavy steel or metal box frames for occupation, vertical circulation, bracing, and CLT volumes or other structural systems that are then the basis for more complete buildings.

Volumetric Section

OSM ~60%

A strategy where larger buildings are split into smaller off-site pieces, then combined on-site.

Volumetric Section -
Various, with various levels of physical products and levels of completion. Typically stems from the need for more efficient building practices, production space or opening limitations, logistics, transportation, lifting or installation. This also includes approached to create multi-level buildings i.e. stacking volumes.

These volumetric solutions are then combined onsite to make a complete building. The term '**hybrid**' references where the combination of off-site and on-site construction meet to complete the volumetric section.

Parts & Panels can be combined into Volumes.

Volumes can be stood inside, may have a door, walls or other products that make it feel more complete. But it's not yet a complete building.

Modern Methods of Construction

Physical

Complete

Complete

A complete building typically built to maximum production space and/or transportable (trucking) dimensions, with minimal onsite construction & commissioning works.

Transportable -
Transportable's are typically governed by transportation limitations, but small & large buildings can be manufactured and delivered this way. Common examples include homes, tiny homes, classrooms and others.

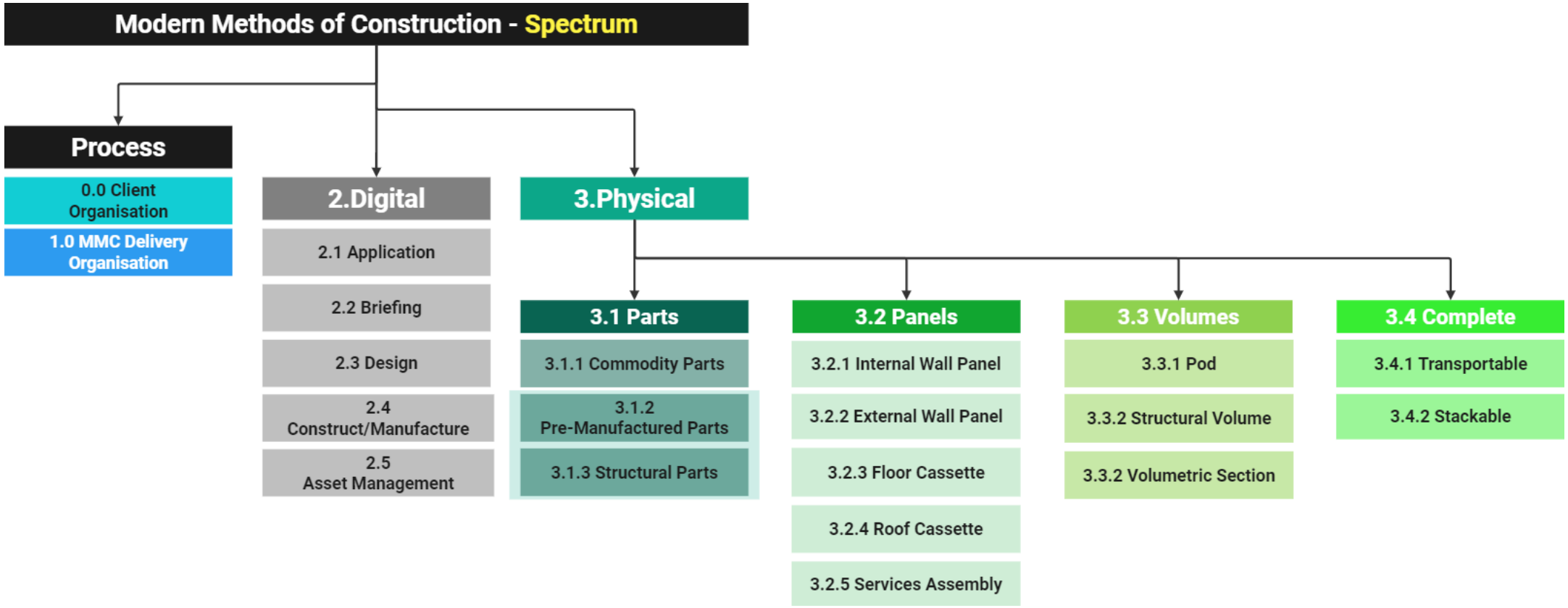
OSM ~90%

Stackable -
These are complete units designed to be stacked together to make complete buildings. Can be based on other products like shipping containers or bespoke. Used for hotels, student accomodation, apartments or other uses.

OSM ~80%

Parts, Panels and Volumes can combine to create Complete buildings - the full physical spectrum.

Basically, the only thing that needs to be done to be as if it was like an onsite building, is to secure it to ground and infrastructure and hand over the keys.



MMC Providers can now talk with clients about their approach to MMC that they offer – Process, Digital and Physical – singular, or in combination or collaboration with others – to meet client pain points & find Product-Market Fit.