Developing a Product Platform Strategy

Implementing the Product Platform Rulebook

Members of the SNC-Lavalin Group

Contents

1. Purpose of Study

Since the publication of the Product Platform Rulebook (PPR) – and bolstered by both the Construction Playbook and Transforming Infrastructure Performance: Roadmap to 2030 - a number of public and private sector clients have undertaken work to explore the potential for development and deployment of Product Platforms.

In recognition of this, a collaborative team spanning Atkins, Faithful and Gould and Mott Macdonald have been commissioned by the Hub to explore the extent to which the guidance set out in the PPR can currently be implemented by clients and their consultants.

The study is focused on the initial stages of the 'Demand, Develop, Deploy' framework, and more specifically the process steps that would take a client up to an initial Product Platform Strategy, as set out in **Figure 1**.

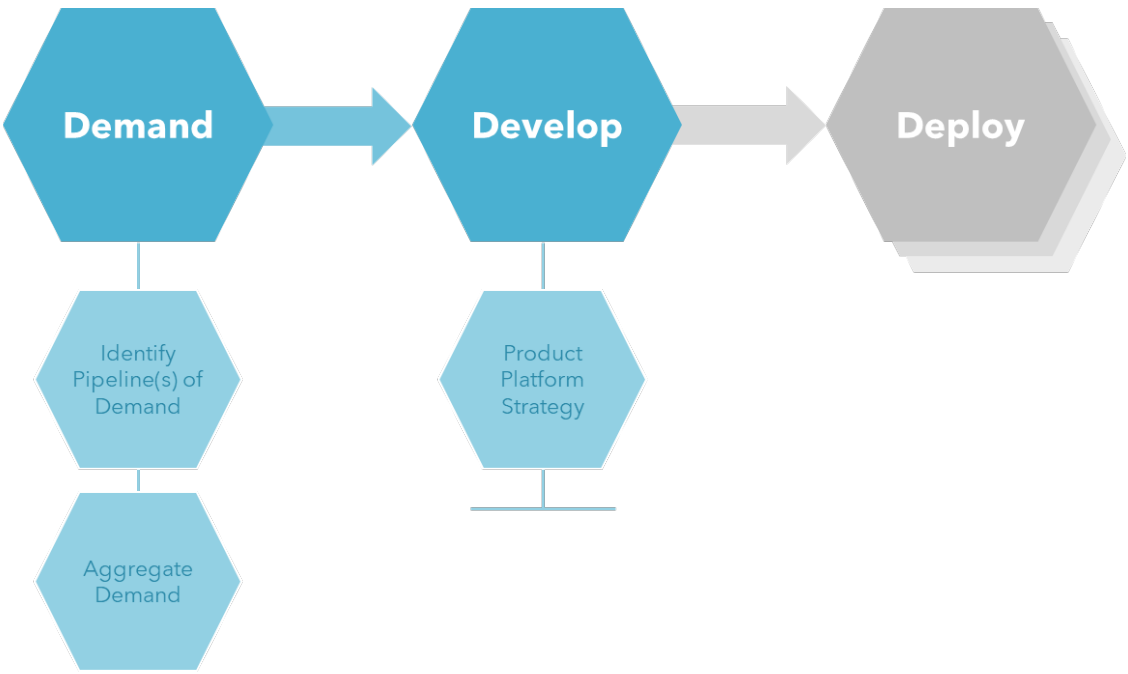


Figure 1. R4 Implementation Study – Scope Boundary

1.1. Defining the 'Product'

The PPR stresses the importance of defining the *'product'* at the start of any Product Platform development process. This point was further reinforced by this study which found that clarity around the 'end' product was critical to understanding and applying the guidance set out in the PPR. Despite this stated importance, the PPR is agnostic when it comes to defining the product in the context of the built environment. In accordance with the definition set out in the PPR, so long as there is evidence of common repeatable elements being utilised across a family of non-identical products (i.e., complete buildings, building systems or individual elements) then this can be classed as a product platform.

The position set out in this study is that there are already high levels of commonality to be found in lower-level building components and systems (e.g., a wall panel system that utilises common light steel studs, gypsum boards and fixings) but that there continues to be little commonality at the building level (e.g., a range of buildings which utilise the same set of wall panels). Accordingly, it was agreed to define the *Product* as a Building, with the *Product Family* being any buildings resulting from deployment of the Product Platform (**Figure 2**). In summary, this work focuses on the early stages of development for Building Product Platform (BPP).

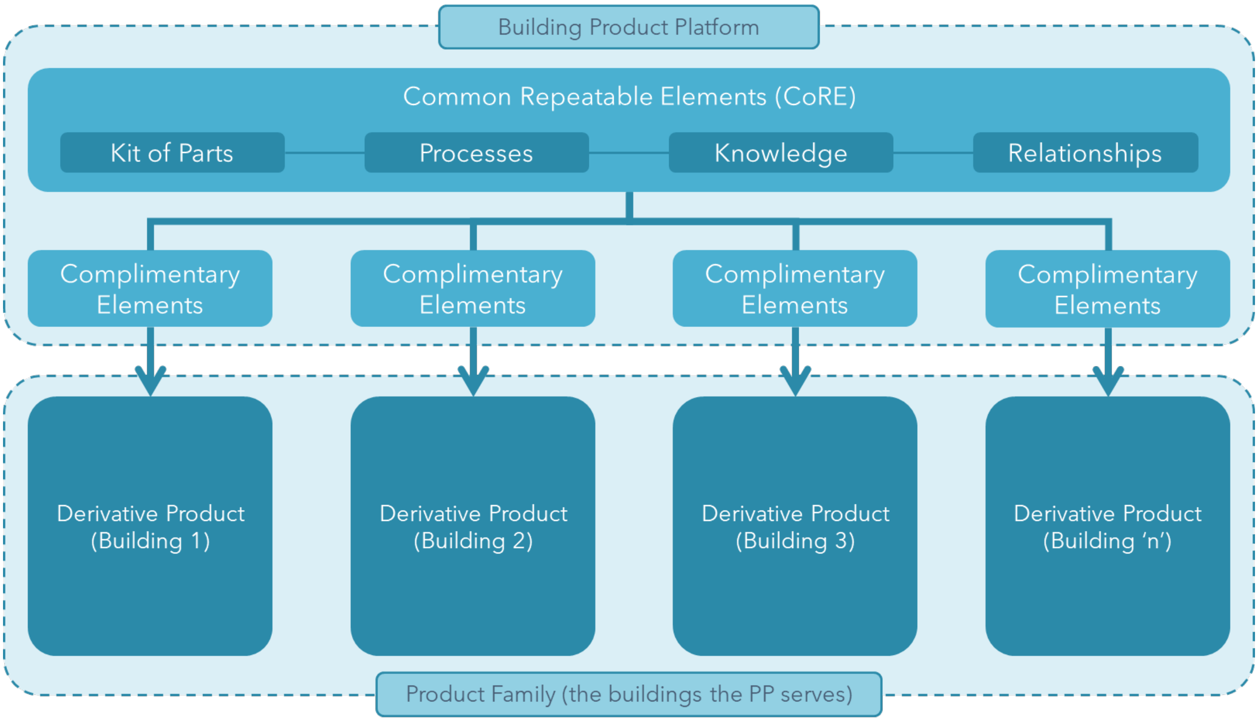


Figure 2. Building Product Platform Definition

1.2. Aim and Objectives

The work described hereafter builds on the PPR to develop a client-focused approach to identifying those building elements that offer highest potential value from increased commonality across a portfolio of buildings.

The primary objectives of the study were:

- To use the guidance contained in the PPR to build a client-facing process for development of a Building Product Platform Strategy
- To use reference data from two major public sector clients to test and refine the process
- To identify current blockers to client-side development of Product Platform Strategies
- To make recommendations for potential remedies to these blockers and, where possible, to assign relevant action owners
- To make recommendations for improvement of the PPR, its core concepts, guidance, and language
- To upskill colleagues within the study teams' respective organisations in the field of Product Platform Strategy.

2. Process Design

It was acknowledged by the original PPR team that the steps outlined in the 'Develop' guidance section were not intended to be sequential. Even so, with increased clarity around 'the product' (see section 1.2) and having taken on a client-perspective, a simple outline process was developed for the study, building on the content set out in the PPR **(figure 3)**.

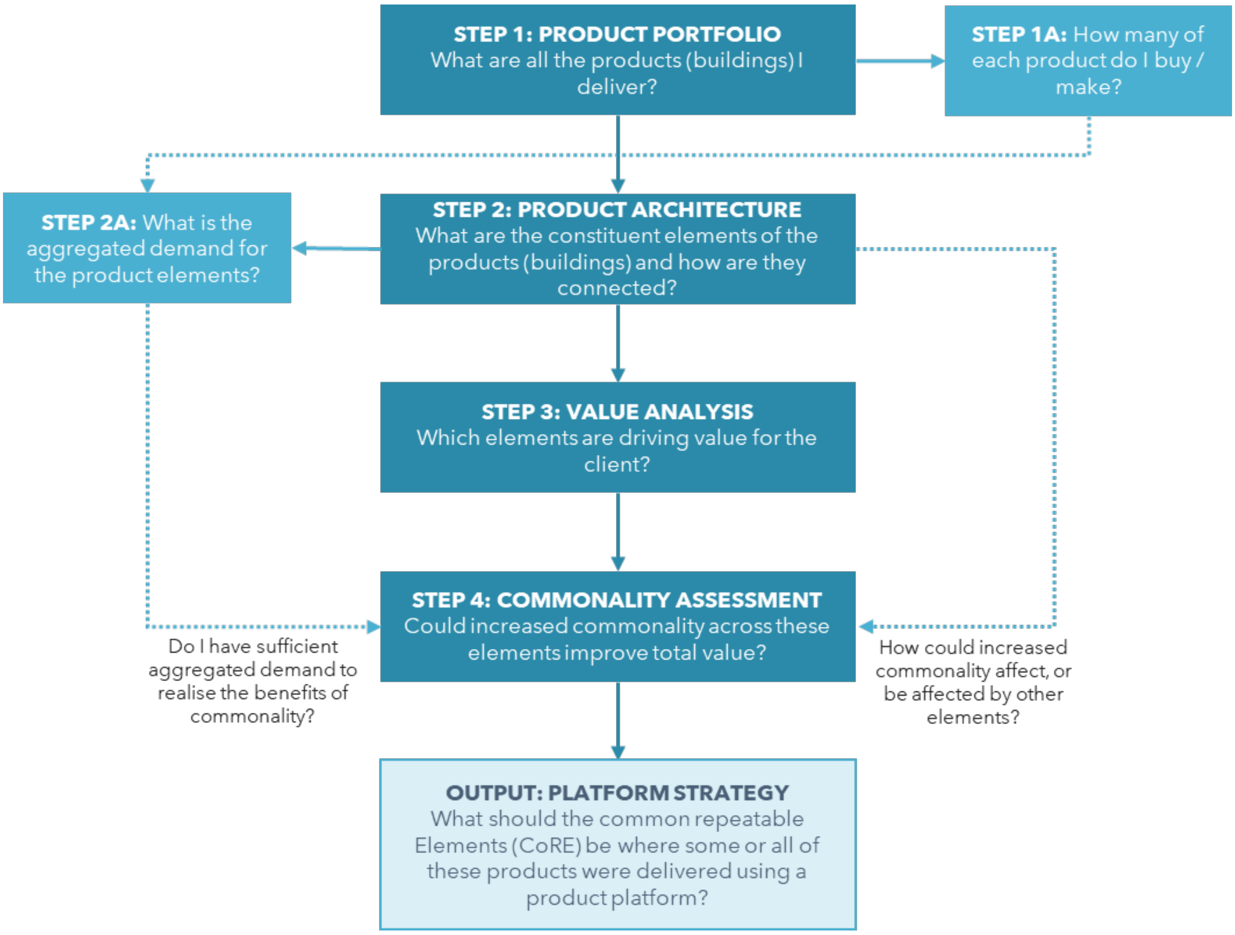


Figure 3. Building Product Platform Strategy Development Process

The process aims to lead a client through an initial evaluation of their [building] product portfolio all the way though through to an initial commonality strategy for a building product platform. It was proposed that by following this process a client should be able to identify the core repeatable elements in which they intended to invest, with confidence that this investment would drive a meaningful benefit.

The core purpose of each step in the process is described below. Section 3 of the report describes how these steps were tested using sample data taken from two major public sector clients.

2.1. Step 1: Product Portfolio

Step one establishes the client's product portfolio; that is, all the buildings ('the products') the client delivers. Some or all of these products may end up being served by the BPP and thus share common repeatable elements. This exercise can be undertaken retrospectively (considering a portfolio of buildings already delivered), speculatively (considering a range of buildings that need to be built going forwards) or from both perspectives, however discontinued products should not be included in the analysis.

2.2. Step 1A: Product Pipeline

Having identified the product portfolio – the range of buildings delivered by the client – an exercise should now be undertaken to understand the likely demand for these products. Where prospective demand for these products is unknown or uncertain, retrospective data can be used to support the assessment, being careful to identify where this data may *not* be representative of the future pipeline (e.g., due to changes in estate strategies and priorities).

At the end of Step 1A, the client should now have a clear picture of the buildings that might be served by a building product platform and the quantities of those buildings that may need to be delivered through it.

2.3. Step 2: Product Architecture

With an understanding of the product portfolio, each product should now be broken down into its constituent components. Product Breakdown Structures should be produced to represent the core components of each product and the relationships between them (as currently designed). Components should be suitably distinguishable as parts of the complete assembly and a consistent naming or referencing convention should be used to allow comparison of elements across products. This exercise directly supports commonality assessment (step 4).

Where a product's architecture is significantly different to other products in the portfolio, these may need to be discounted from the BPP product family. For example, where elements are performing different functions or are highly integrated with elements that do not appear in other products.

2.4. Step 2B: Element Pipeline

Having dissected each product in the product portfolio into its constituent elements, the product pipeline can now be used to quantify the aggregated demand (i.e., across all products in the proposed BPP product family) for different element types. Such aggregation relies upon the use of a consistent methodology for the product breakdown across products.

2.5. Step 3: Value Analysis

With a clear picture of the constituent elements of a product and how they interact, this step seeks to identify those elements which have a substantial impact on value. In this context, value is defined as the outcomes the client seeks to realise through introduction of a BPP. For example, where the client is seeking to reduce product (building) cost, this exercise should be used to identify those elements that have the most substantial impact on cost. Similarly, where the client seeks to use a BPP to drive down embodied carbon, this exercise should identify the most carbon-intensive elements.

2.6. Step 4: Commonality Assessment

Starting with those having highest impact on value, a high-level commonality assessment is now undertaken for each element. The earlier steps of the process should have refined the product portfolio down to those which share element types (i.e., share a similar product architecture). This allows an assessment of the extent to which requirements for those elements vary across the products in the portfolio. For those element types with low levels of commonality across products, a further assessment should be undertaken to establish whether it is both practical and advantageous to increase this. This should take account of how, and the extent to which, elements are connected to others, the likely benefits that can be realised through increased commonality and the scale of aggregation that might be required to deleverage these benefits – linked back to the core value drivers for the BPP.

2.7. Building Product Platform Strategy

Having followed the steps outlined above, the client should now understand:

1. The different buildings that could be served by a building product platform
2. The number of buildings that might be delivered through that platform
3. The constituent elements of each product and the relationships between them
4. The elements with significant impact on value
5. The elements which offer the biggest potential benefit from increased commonality
6. The potential aggregated demand for those elements and associated benefits.

3. Process Testing

In line with the guidance outlined in section 2, two sub-teams were formed, each gathering sample data from a major public sector client as means to test the proposed BPP Strategy Development Process. The sample clients selected were the Ministry of Justice (MoJ) and the Defence Infrastructure Organisation (DIO) who have annual capital spend budgets of £1.8bn and £2.3bn respectively.

3.1. Step 1: Product Portfolio

To identify the products that may be served by a BPP for each respective client it was necessary for the groups to review buildings both previously delivered and those planned. Data was extracted from multiple sources including internal client data, Tussell, the National Infrastructure and Construction Pipeline as well as data sitting within the study team's own organisations.

As is normal in the construction industry, demand for each client was primarily articulated in terms of 'projects' which often delivered multiple buildings. As such, the data had to be further interrogated to identify the specific buildings that had been or would be delivered. This was not always immediately clear without access to more detailed information (e.g., site plans).

Figure 4 and **Figure 5** show the process through which the MoJ product portfolio was determined, starting with the different facilities delivered and operated across the estate followed by the types of buildings contained within these facilities.

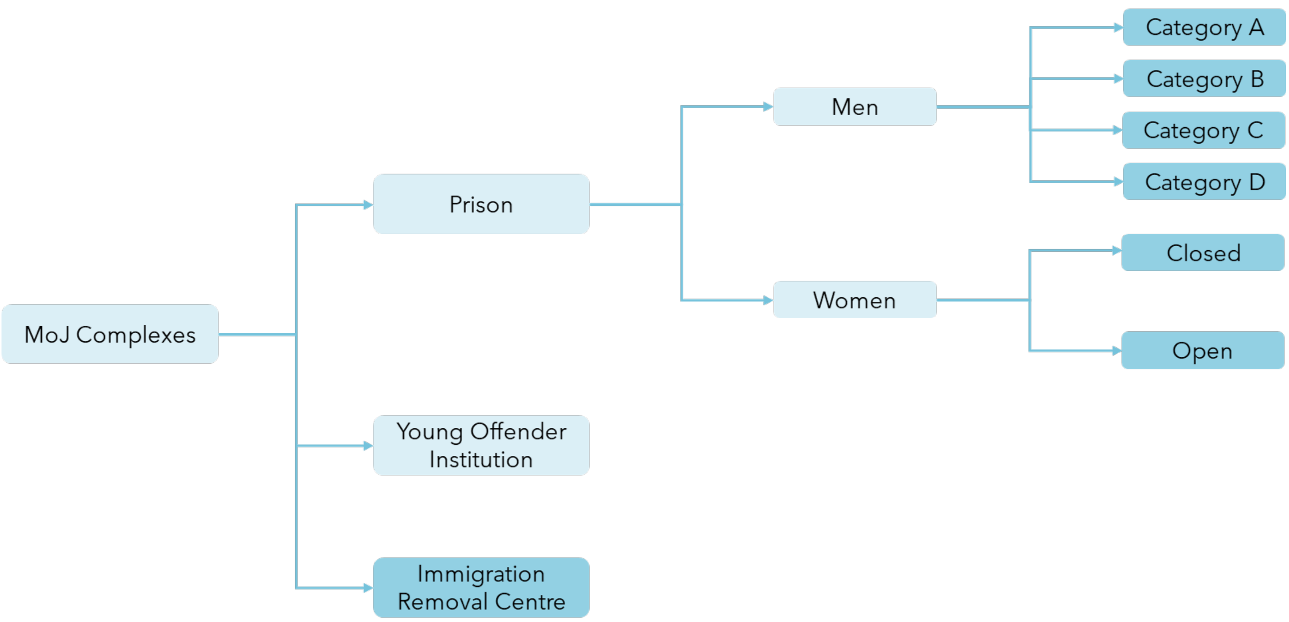


Figure 4. MoJ Facility Types and Classifications (non-exhaustive)

MoJ Facilities / Complexes		Buildings (Products)							
		Care and Separation Unit	Central Services Hub	Entrance Resource Hub	Houseblock	Workshop	Kitchen	Education	Support
	Men's Category A	X	X	X	X	X	X		X
	Men's Category B	X	X	X	X	X	X		X
	Men's Category C	X	X	X	X	X	X		X
	Men's Category D	X	X	X	X	X	X		X
	Women's Restrictive	X	X	X	X	X	X		X
	Women's Closed	X	X	X	X	X	X		X
	Women's Open	X	X	X	X	X	X		X
	Youth Offender Institution		X		X			X	
	Immigration Removal Centre	X	X	X	X	X	X		X
								Removed from further analysis	

Figure 5. MoJ Buildings by Facility Type (new facilities and expansion projects)

3.2. Step 1A: Product Pipeline

With each client's product portfolio established, each group moved onto assessing how many of each product had been delivered in prior years and how many were planned to be delivered within the current capital investment period. With reference to the exercise undertaken in Step 1, planned projects were converted into their respective buildings by looking at those buildings that had been delivered as part of similar projects previously.

	Product Pipeline		
	Retrospective Projects (2010-2021)	Forecast Projects (2022-2027)	Total (2010-2027)
Care and Separation Unit	13	4	17
Central Services Hub	7	4	11
Entrance Resource Hub	6	4	10
Houseblock	43	51	94
Workshop	14	4	18
Kitchen	8	4	12
Support	7	4	11

Figure 6: MoJ Buildings delivered and planned (projection only – sample data)

While construction pipeline data is notoriously vulnerable to change (e.g., as a result of changing policy or investment or due to planning complications), both clients *are* able to express 'true' demand in terms of the additional capacity that needed to be added to their respective estates over time. In the case of the MoJ, the current capital expansion programme is specifically focused on delivering an additional 20,000 prison places. Accordingly, both teams explored a 'functional unit' approach to more clearly and accurately articulate future demand.

For example, the team working with MoJ attempted to establish how the number of additional prison places required relates to the numbers and types of different buildings required to support them. Past project data was used to establish ratios between prison cells, the houseblocks that contain them and the other ancillary buildings that were required as a result.

Both teams agreed that a functional unit approach was worthy of further investigation, primarily to understand what the functional unit should be for different client organisations. Such an approach would provide the supply chain with a more useful product-focused view of the pipeline, though it should be noted that, even where this were achievable, there may remain a gap between true demand and that deliverable in practice.

3.3. Step 2: Product Architecture

While the concepts of product architecture and product breakdown structures are well established in many sectors from consumer electronics to software development, their application to buildings is not. When considering the elements of a building, the team considered two different approaches: to map the *spaces* contained within that building (dictated by the activities the building supports), and to map the physical elements that create those spaces.

As the requirements of and relationships between spaces typically *define* the physical elements that are used to create them (e.g., walls, floors, services), a spatial product breakdown structure was developed first.

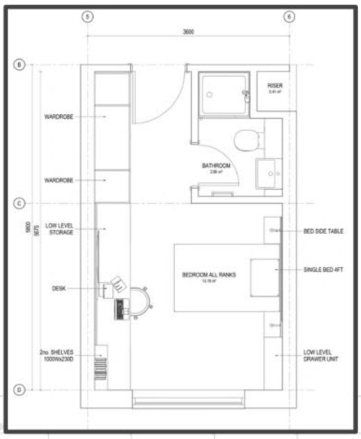
3.3.1. Spatial Product Breakdown Structure

Building on and validating work conducted by the Hub as part of the 'Define the Need' report, the spaces contained within each building type were identified and mapped to Uniclass space definitions for consistency. While the spaces identified generally aligned with Uniclass at the 'group' level, there remained multiple, client-specific variants within these classifications **(Figures 7 and 8)**.

Space Type (Uniclass)	Code	Space Variant (MoJ)
Common Spaces	SL_90_20	Association Area - Main
		Association Area - Wing A
		Association Area - Wing B
		Association Area - Wing C
Detention Cells	SL_20_75_22	Bedroom
		Bedroom - Accessible
		Bedroom - Double
		Bedroom - Gated
		Bedroom - LM
Fitness Rooms	SL_42_40_30	Cardio Room
Corridors	SL_90_10_15	Circulation
Cleaners' Store	SL_90_50_16	Cleaners' Store
Pharmaceutical Stores	SL_90_50_65	Dispensing Booth
		Drug Dispensary
Lobbies	SL_90_10_51	Entrance Lobby
		Lift Lobby
		Lobby
		Staff Lobby

Space Type (Uniclass)	Code	Space Variant (MoJ)
Servery Spaces	SL_35_60_78	Floor Servery
		Servery Washdown
-	-	Functional Area
Interview Rooms	SL_20_65_42	Interview
Kitchenettes	SL_35_60_45	Kitchenette
Laundries	SL_30_60_47	Laundry
Switch Rooms	SL_90_90_85	Electrical Switchroom
Water Supply Spaces	SL_55_70	Water Tank Room
Work Booths	SL_90_20_98	Private Booth
Offices	SL_20_15_59	Staff Office
General Store Rooms	SL_90_50_35	Staff Store
		Store
Escape Stairs	SL_20_90_25	Stair - Fire
Stairways	SL_90_10_87	Stair - C&R
		Stair - Main
		Stair - Plant
Medical Treatment Rooms	SL_35_10_53	Triage Nurse
Accessible Toilets	SL_35_80_03	WC Acc. Staff

Figure 7: Aligning Space Types and Variants to Uniclass – MoJ Houseblock Example



Product Type	Space Type	Spaces	Space Code (Uniclass)	Area (m2)	Quantity / Building	Total Area (m2)
B111 All Ranks	Living Space	Bedroom	SL_45_10_09	15.19	92	1397.48
B111 All Ranks	Living Space	Bathroom (En-Suite)	SL_35_80_08	2.86	92	263.12
B111 All Ranks	Living Space	Communal Space (GF)	SL_45_10_49	43.52	1	43.52
B111 All Ranks	Living Space	Communal Space (L1)	SL_45_10_49	20.16	1	20.16
B111 All Ranks	Support Space	Kitchenette	SL_35_60_45	18.53	4	74.12
B111 All Ranks	Support Space	Utility Area	SL_45_10_93	14.33	4	57.32
B111 All Ranks	Support Space	Risers (Bedrooms)	SL_90_90_78	0.82	50	41
B111 All Ranks	Support Space	Risers (Mechanical)	SL_90_90_78	2.03	8	16.24
B111 All Ranks	Support Space	Risers (Electrical)	SL_90_90_78	0.75	8	6
B111 All Ranks	Support Space	Cleaners Room	SL_90_50_16	4	4	16
B111 All Ranks	Support Space	Drying Room	SL_90_50_84	10.02	4	40.08
B111 All Ranks	Circulation Space	Corridors	SL_90_10_15	74.28	4.0	297.12
B111 All Ranks	Circulation Space	Lift	SL_90_10_47	2.98	4.0	11.92
B111 All Ranks	Circulation Space	Stairs	SL_90_10_87	6.63	4.0	26.52
B111 All Ranks	Circulation Space	Entrance Hall	SL_90_10_27	14.27	4.0	57.08

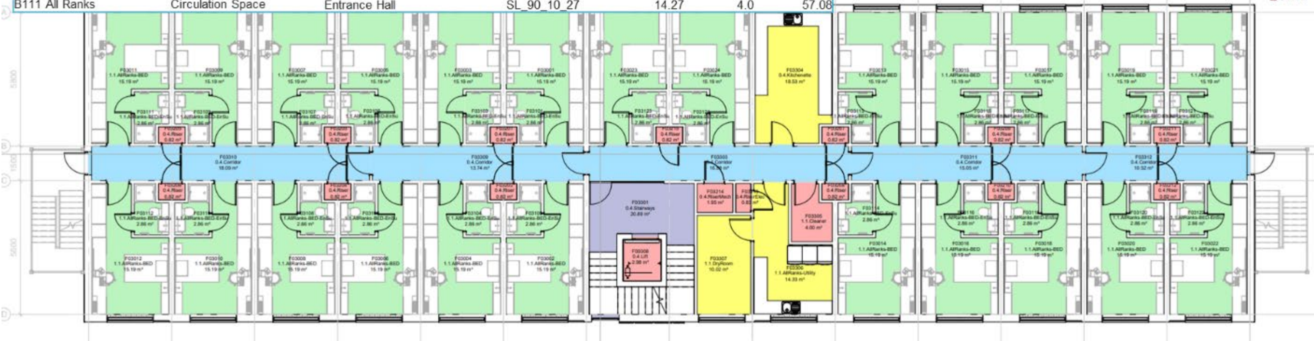


Figure 8: Aligning Space Types and Variants to Uniclass – MoJ Houseblock Example

The spatial breakdowns for both reference clients were found to be relatively rational. That is, there were only a few instances of similar or identical spaces with non-identical names though it was not clear at this point, the extent to which spaces with the same name shared requirements (e.g., standard dimensions). It does however seem logical that, as departments increasingly standardise their reference designs and associated spaces that Uniclass should be updated accordingly.

To convert the spatial product breakdowns into spatial product breakdown *structures* (SPBS), matrices were used to indicate how the spaces in each building related to one another (**Figures 9 and 10**). This exercise was only completed for a single building product and was limited to horizontal adjacencies on one floor only. In practice, the exercise would need to be completed for horizontal and vertical adjacencies across all floors and repeated for each building in the product portfolio. This would require a significant time investment and was therefore deemed to be beyond the scope of this study. Where this exercise *was* fully completed, the team would not only be able to identify spaces and groups of spaces (clusters) that were already common – or could be made common – across building types.

	Association Area - Main	Association Area - Wing A	Association Area - Wing B	Association Area - Wing C	Bedroom	Bedroom - Accessible	Bedroom - Double	Bedroom - Gated	Bedroom - LM	Circulation	Cleaners' Store	Corridor Shared	Dispensary Booth	Dispensing Booth	Drug Dispensary	Plant - Electrical Switchroom	Entrance Lobby	Cardio Room	Floor Servery	Functional Area	Houseblock Washdown	Interview	Kitchenette	Laundry	Lift Lobby	Lobby	Plant - Plant Area	Private Booth	Staff Lobby	Staff Office	Staff Store	Stair - Fire	Stair - Main	Stair - C&R	Stair - Plant	Store	Triage Nurse	Plant - Water Tank Room	WC - Staff
Association Area - Main					X				X	X								X	X	X		X		X															
Association Area - Wing A					X	X	X		X													X																	
Association Area - Wing B					X	X	X		X													X																	
Association Area - Wing C					X	X	X		X													X																	
Bedroom	X	X	X	X	X	X	X	X				X										X																	
Bedroom - Accessible		X	X	X	X	X						X																											
Bedroom - Double		X	X	X	X							X																											
Bedroom - Gated					X							X																				X							
Bedroom - LM	X	X	X	X																																			
Circulation	X																									X													
Cleaners' Store																														X									
Corridor Shared					X	X	X	X																								X							
Dispensary Booth																																							
Dispensing Booth																																				X			
Drug Dispensary																										X		X						X			X		
Plant - Electrical Switchroom																									X													X	
Entrance Lobby																														X			X						
Cardio Room	X																			X																			
Floor Servery	X																					X		X															
Functional Area	X																	X																					
Houseblock Washdown																																							
Interview	X	X	X	X	X														X																				
Kitchenette																																							
Laundry	X																		X																				
Lift Lobby																X																		X					
Lobby										X				X																				X					
Plant - Plant Area																																							
Private Booth														X																									
Staff Lobby																																							
Staff Office											X						X																						
Staff Store																																							
Stair - Fire								X				X																											
Stair - Main																	X																						
Stair - C&R															X										X	X												X	
Stair - Plant																																							
Store														X																							X		
Triage Nurse															X																					X			
Plant - Water Tank Room																X																		X					
WC - Staff																																							

Figure 9: Horizontal Spatial Adjacencies (MoJ T60 Houseblock EXAMPLE ONLY)

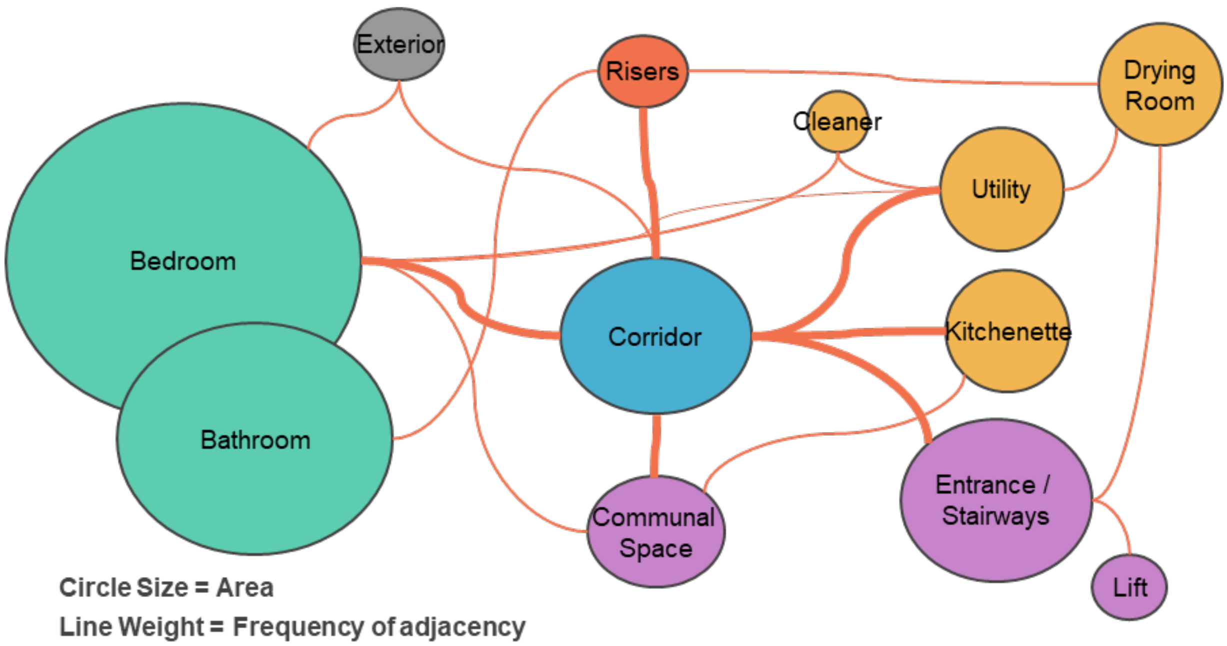


Figure 10: Spatial Product Breakdown Structure - DIO SLA Example

3.3.2. Elemental Product Breakdown Structure

Both groups were faced with the same challenges when trying to produce elemental product breakdown structures (EPBS). The product architecture (i.e., what the elements are and how they relate to each other) is dictated by the construction methodology selected, yet this could not be ascertained from the general arrangement drawings available. Furthermore, were the team to assume a construction methodology – and thus the relevant element types – a more detailed and granular view of these elements and variants of them would be required for later steps. This raises questions around the level of detail required for an EPBS to be useful.

Attempts to *assume* a product architecture also led to another important observation; that while there are thought to be a relatively small and finite number of 'product architectures' for buildings, no established templates currently exist to articulate these. Where Uniclass lists many of the elements, systems and products that might be contained within a building, it does not assign these to specific product architectures or give any indication of the relationships between them.

In attempting to use cost data to establish the proposed construction methodology, another issue was identified. The use of the NRM methodology to produce cost breakdowns, does not align with an elemental, product-focused view, instead being trade-based and unrelated to the product architecture. For example, where the cost data listed steel frame components, it was not clear what function these elements were performing, where they were located or how they were related to other components. This also highlights – perhaps unsurprisingly – an incongruence between traditional craft-based construction and the more modular, systems approach required for the development of product platforms. It was concluded that, should the team have been able to access designs which had already been suitably modularised for delivery using manufactured solutions (i.e., category 1, 2, and 3 MMC), they would have had a much clearer view of the constituent elements and subsequently, the level of commonality in those components across the different building products.

3.3.3. Relating Spaces to Elements

As part of the EPBS exercise, both groups considered how the SPBS could be used to identify physical elements and associated variants before coming together to develop a suggested methodology for relating building elements to spaces. Firstly, elements were classified into three types according to the relationship they have with spaces:

- **Captive Elements:** Elements that are contained within, and have their requirements determined by, a single space (e.g., packaged MEP cassette, ensuite bathroom pod). The requirements for captive elements are not affected by the location of the space or their interaction with other spaces
- **Boundary Elements:** Elements that define, or contribute to, the boundaries between spaces and which have their requirements determined by two or more sets of space requirements (e.g., internal walls, floors, envelope). The requirements for – and thus the specification of - 'boundary' elements can only be determined when the relationships between spaces is known.
- **System Elements:** Elements which interact within multiple captive and boundary elements, and which have their requirements determined by the collective requirements and configuration of those elements (e.g., services distribution). The requirements for system elements can only be determined when all space requirements and layouts are known.

What is immediately obvious from this classification system is that, where different buildings share common spaces, common 'captive elements' could also be developed that were relatively agnostic of where the spaces were or what they were connected to. Similarly, where spatial clusters are shared, certain boundary elements and, depending on the size of the cluster, system elements could also be developed. However, where space types and associated adjacencies vary significantly between products served by a building product platform, increasing commonality between and reducing variants in boundary elements is likely to be more challenging.

This approach offers some value for spatial platform approaches. Spatial platforms are defined here as a 'kit' of standard spaces and variants that can be reconfigured to produce different building designs. Critically, with such an approach, each space would be assigned requirements which reflect the activities the space supports covering performance (e.g., acoustic performance), interfaces (e.g., adjacencies) and geometry (space dimensions). As a result, the spatial platform becomes a powerful tool for quickly generating requirements for all three element types described above.

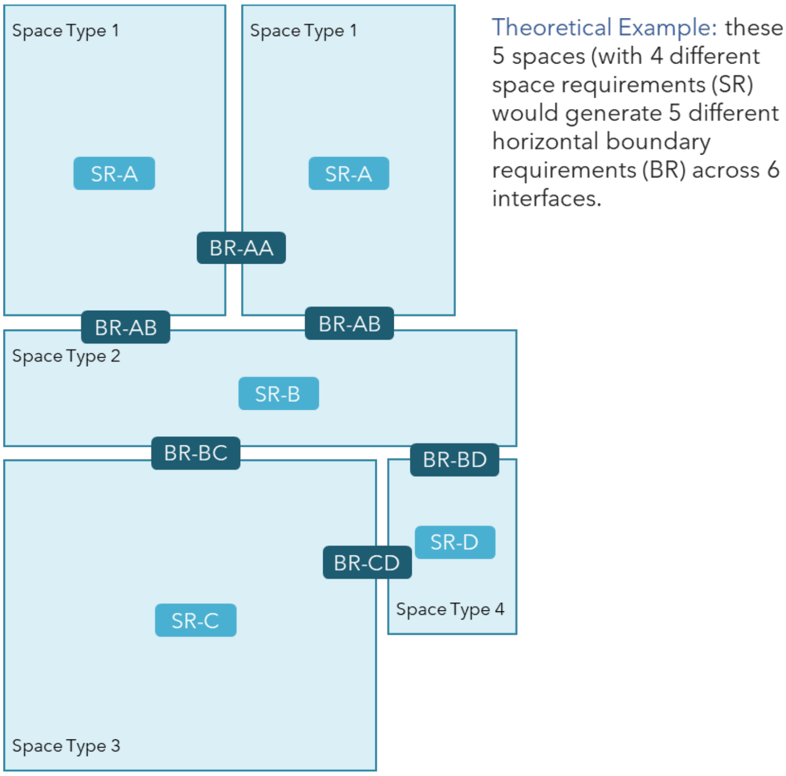


Figure 12: Use of spatial requirements to derive element variants (vertical planes example)

While the above spatial approach could not be used to define specific physical components (in the absence of a selected construction methodology), where applied to all buildings in the product family, it could be used to provide an insight into the number of potential element variants as far as requirements go (**Figure 12**).

3.4. Step 2B: Space and Element Pipeline

Building on the findings of the product architecture exercises, the generation of a pipeline for building elements can also take two forms: spatial or elemental. In both cases, the objective would be to aggregate demand for the constituent element of each product in the portfolio. Where the product breakdown structures are consistently structured (with the help of Uniclass) this could also yield aggregated demand for any elements that are common across all products.

As a result of the difficulties in developing elemental product breakdown structures for the reference buildings, this exercise was limited to generation of spatial pipelines (**Figure 13**). In theory, the product pipeline could be passed through the spatial platform methodology described above to establish aggregated quantities for various element requirement sets. As this is a highly time- and data-intensive exercise - and is unlikely to yield an accurate picture of the final physical components - this was not pursued as part of this study.

Spaces	Total Spaces in Pipeline (Ranked)
Bathroom (En-Suite)	15272
Bedroom	15272
Risers (Bedrooms)	8300
Risers (Electrical)	1328
Risers (Mechanical)	1328
Cleaners Room	664
Corridors	664
Drying Room	664
Entrance Hall	664
Kitchenette	664
Lift	664
Stairs	664
Utility Area	664
Communal Space (GF)	166
Communal Space (L1)	115
Office	51

Figure 13: Space Pipeline – DIO SLA Example (sample data only)

3.5. Step 3: Value Analysis

For this study, both groups assumed the core objectives of BPP development to be reduced capital cost and reduced time in delivery. The true value profile for each client is likely to be significantly more complex, and an additional exercise should be undertaken to identify those client value drivers that can be influenced through development of a BPP (e.g., carbon reduction).

The aim of the value analysis exercise conducted was therefore to understand which items on the Product Breakdown Structures have the most significant impact on cost and time - recognising that cost and time are heavily linked.

3.5.1. Spatial Value Analysis

It was not possible to quantitatively identify those building spaces which most significantly drive cost and time. Where time and productivity data were unavailable in any form, the cost data available was not assigned to spaces, instead using average m2 costing for each building.

An interim solution to this issue could be to develop cost density weightings for the primary space types (e.g., office, classroom, lab, circulation). However, no such weightings were found to be available, and this was not deemed to be a desirable solution given the number of assumptions that would underpin them.

3.5.2. Elemental Value Analysis

In the absence of an EPBS for each building (see section 3.3.2), it would not have been possible to identify those specific building elements driving cost and/or time for each building. It was also acknowledged that there is not currently alignment between NRM cost data and Uniclass element codes which would make this exercise difficult to complete consistently.

Uniclass Code	Uniclass Title
EF_15	Earthworks and remediation
EF_20_05	Substructure
EF_20_05_30	Foundations
EF_20_10	Superstructure
EF_25_10	Walls
EF_25_10_25	External walls
EF_25_10_40	Internal walls
EF_25_30_25	Doors
EF_30	Roofs, floor and paving elements
EF_30_10	Roofs
EF_30_20	Floors
EF_35	Stairs and ramps
EF_35_10	Stairs
EF_35_10_30	External stairs
EF_35_10_40	Internal stairs
EF_35_20	Ramps
EF_35_20_30	External ramps
EF_35_20_40	Internal ramps
EF_40	Signage, fittings, furnishings and equipment
EF_40_40	Equipment
EF_50	Waste disposal functions
EF_50_30	Above-ground drainage collection
EF_50_35	Below-ground drainage collection
EF_55_20	Gas supply
EF_55_30	Fire-extinguishing supply
EF_55_70	Water supply
EF_60	Heating, cooling and refrigeration functions
EF_60_40	Space heating and cooling
EF_65	Ventilation and air conditioning functions
EF_65_40	Ventilation
EF_70	Electrical power and lighting functions
EF_75	Communications, security, safety and protection functions
EF_80	Transport functions
EF_80_50	Lifts

NRM Group	NRM Element
0 Facilitating Works	
1 Substructure	
1 Substructure	1.1 Substructure
2 Superstructure	2.1 Frame
2 Superstructure	
2 Superstructure	2.5 External Walls
2 Superstructure	2.7 Internal Walls and Partitions
2 Superstructure	2.6 Windows and External doors; 2.8 Internal Doors
2 Superstructure	
2 Superstructure	2.3 Roofs
2 Superstructure	2.2 Upper Floors
2 Superstructure	2.4 Stairs and Ramps
2 Superstructure	2.4 Stairs and Ramps
2 Superstructure	2.4 Stairs and Ramps
2 Superstructure	2.4 Stairs and Ramps
2 Superstructure	2.4 Stairs and Ramps
2 Superstructure	2.4 Stairs and Ramps
2 Superstructure	2.4 Stairs and Ramps
4 FF&E	4 FF&E
5 Services	5.2 Services Equipment
5 Services	5.1 Sanitary Installations; 5.3 Disposal Installations
5 Services	5.1 Sanitary Installations; 5.3 Disposal Installations
5 Services	5.1 Sanitary Installations; 5.3 Disposal Installations
5 Services	5.9 Fuel installations
5 Services	5.11 Fire and lignthing protection
5 Services	5.4 Water installations
5 Services	5.5 Heat source
5 Services	5.6 Space heating and air conditioning
5 Services	
5 Services	5.7 Ventilation
5 Services	5.8 Electrical Installations
5 Services	5.12 Communication, security and control systems
5 Services	
5 Services	5.10 Lift and conveyor installations

Figure 14: Uniclass and NRM Alignment - SLA Example

As an interim solution, the teams used NRM data for each building type to identify the element types (construction packages) generally driving cost. For the MoJ example below, it is important to factor in the product pipeline data (section 3.2) which indicates that electrical installations represent the single biggest cost to the client across all planned projects (on account of houseblocks representing the majority of the pipeline).

	Houseblock	Office	Multi-Faith	Workshop	Property Store
Leading Cost 1	Electrical Installations	Frame	Fabricated Structural Steel Frame	Fabricated Structural Steel Frame	Roof
Leading Cost 2	Ventilation	Roof	Ventilation	Electrical Installations	Raft Foundations
Leading Cost 3	Roof	Ventilation	External Walls	Windows and External Doors	General Fittings, Furnishings and Equipment

Figure 15: Leading cost by building and element type (MoJ example - sample data only)

As for the spatial value analysis, very little data was available to help the team to build a picture of which elements drive delivery time. The use of proportional cost data was explored as an interim solution (design, material, and construction costs) but no established reference data was identified. Where such data was available, it is likely this would reflect traditional trade-based construction methodologies and therefore being of limited value.

3.6. Step 4: Commonality Assessment

As the commonality assessment relies directly on the prior development of clear product breakdown structures, the extent to which the team could test this element of the process was severely limited. Even so, discussions between the groups helped to refine the approach that might be taken were the required data available:

Firstly, there is a need to determine the appropriate level of detail for this exercise. Where the PPR provides guidance for development of a detailed Commonality Strategy in the later stages of the 'develop' phase, the aim of this exercise is to build an *initial* picture of where commonality will add most value and, by extension, where investment will be required and the likely benefits of that investment.

Were a full EPBS available - providing a list of discrete building elements and their associated requirements in a consistent [harmonised, digitised] format - the team would quickly be able to identify current levels of commonality across different buildings, shortlisting those with high potential for increased commonality and with a significant impact on cost and time. With reference to the elemental relationships contained within the EPBS the team could also identify whether the proposed approach was achievable and desirable.

While the above approach appears to be focused primarily on identifying physical candidates for commonality, it could equally be applied to spaces. Building on the 'spatial platform' concept explored in section 3.3, this exercise could easily be used to rationalise space types and associated requirements across a portfolio of assets – an approach already advocated by the Hub's define the need report.

4. Reflections

Building on guidance set out in the PPR, this study set out to develop a process which could be implemented by building clients (both public and private) and their consultants for the purpose of developing an initial Building Product Platform Strategy.

While the process developed was deemed to be highly logical, the study team faced significant barriers in implementing it. The following sections outline some of the primary findings and recommendations extracted from the study, providing a robust taking off point for further work in the field of platform approaches in construction.

4.1. Embracing Product Architecture

One of the most fundamental barriers the team faced in executing the platform strategy development process was their inability to describe buildings in terms of their constituent components and to understand the relationships between those components.

The concept of product architecture (also referred to as *system architecture* or *system logic*) is not well understood in the construction sector and, therefore, while it is generally held that there are only a finite number of product architectures applied in building construction, there exist no established templates and associated data structures for these. Where Uniclass was used throughout the study to structure the analysis, it does not appear to recognise these different architectures and the impact they have on the constituent element and their functions.

MMC categories 1 (3D volumetric), 2 (2D panelised) and 3 (1D elements) are considered to provide a good basis for developing the primary product architecture templates and data structures for buildings though these would need to be considered alongside other fundamental design philosophies such as the need for a structural core or the choice of servicing strategy. The existence of such templates would make the task of developing elemental product breakdown structures significantly quicker and support cross examination of EPBS's across multiple clients.

4.2. Modern Methods of Costing

To fully embrace and exploit the concept of product architecture, we must also reflect this product-focus in way we measure performance. Where a manufacturing organisation can reasonably be expected to know exactly which elements of their products drive material cost, production time or, increasingly, embodied carbon it was found to be near impossible to achieve the same resolution in a buildings context. This does of course also reflect the current lack of repeatability in the products delivered in contrast with most manufacturing organisations.

Current pricing methodologies adopt a trade-based approach, reflecting the way traditional construction operations are *packaged* rather than the specific elements that are delivered. This is already reflected in the identified misalignment between NRM and Uniclass. In their current state, cost data also do not allow a full understanding of how those cost are accrued (e.g. design, materials, labour). It was generally considered by the organisations undertaking the study that, where available, such data is likely to be hidden in the lower tiers of the supply chain, reflecting the extent of subcontracting commonplace in construction projects.

Attempts to access and use data from MMC-led projects further highlighted the lack of alignment between method of construction and method of costing – something which is widely cited as a barrier to widespread uptake of manufactured solutions. It is recommended that the MMC sector should work with RICS to increase alignment between modular approaches and methods of measurement.

4.3. From Products to Portfolios

Where manufacturing approaches require a shift from *project*-thinking to *product*-thinking, the development of viable product platforms requires a further shift from products to *portfolios*. The case study examples raised some interesting challenges relating to the size and shape of portfolio needed to warrant development of BPPs.

Sample data from both clients demonstrated considerable maturity with regard to Design for Manufacture and Assembly (DfMA) - whether in terms of space rationalisation, development of standard building layouts or the optimisation of building designs for modularity and repeatability. However, as stated in the PPR, product platforms add value by leveraging commonality across a family of non-identical products and, as such, clients should be careful to distinguish between these two approaches.

For clients with large pipelines of similar but non-identical buildings a product platform approach is likely to be valuable. However, for clients with large pipelines but a very limited number of products (or where those products are significantly different in their product architecture) a product specific DfMA approach is recommended. Alternatively, such clients could work in collaboration with those delivering similar products to develop shared building product platforms.

4.4. Established and Emergent Product Families

With reference to examples from other sectors, the starting point for development of any product platform appears to relate to one of the following two perspectives:

- *Established Product Family:* All the products that could be served by the platform are known and can be interrogated to support development of an outline commonality strategy. In this case, the development of a PP will help to improve what an organisation already does

- *Emergent Product Family:* There is an existing portfolio of products that can be interrogated to support development of a commonality strategy, but the product platform is being designed to support the development of new products at lower cost

The perspective taken has a direct impact on the activities undertaken to develop a BPP strategy. While a product platform developed to facilitate an evolving product portfolio will consider what *might* vary across a range of future products, a product platform developed for an established portfolio will likely dictate what *can* vary in any subsequent products, being less flexible in that regard.

4.5. Spatial Platforms: A Logical Starting Point?

Perhaps the most interesting of the findings emerging from the study was the obvious potential of spatial platforms as an enabler for the development of effective product platforms.

The spatial platform concept seems the most logical approach to increasing commonality across building types while remaining relatively agnostic to the technical solution. Increasing commonality in building spaces will drive commonality in captive elements and provide a structured approach to increased commonality in boundary and system elements.

For many clients, this is likely to be a sensible starting point on the path to increased uptake of manufactured solutions and their associated benefits. As a result, it is the primary recommendation of this report that proposals for a government-led spatial platform for social infrastructure assets should be explored as a logical next step. **Appendix 1** sets out a roadmap for building product platforms, with the development of a *Spatial Platform for Public Sector Buildings* as the core enabler.

5. Conclusion

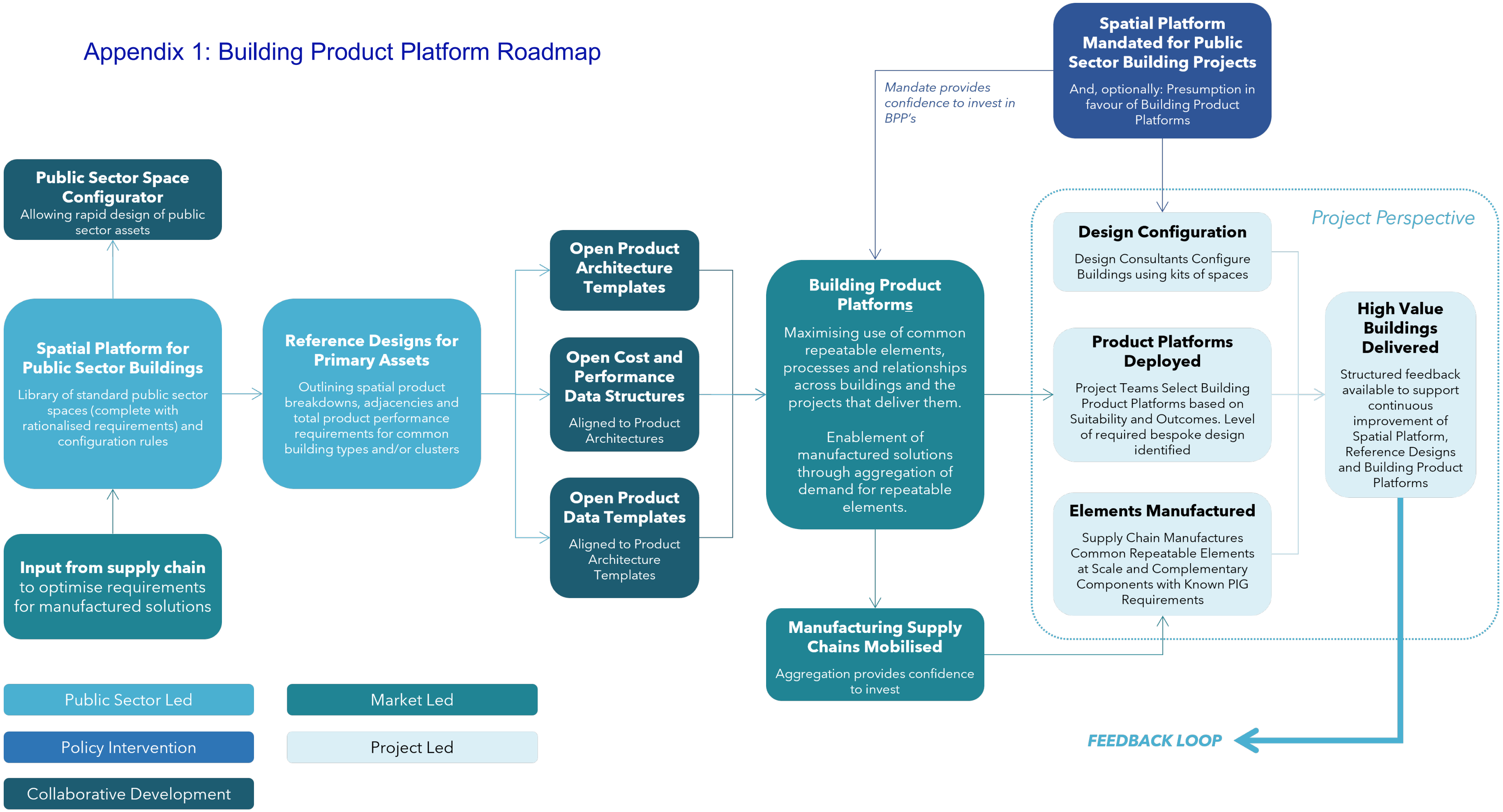
The launch of the Product Platform Rulebook marked the start of a journey towards greater uptake of product platforms in the built environment. This study sought to test and refine the early stages of the demand, develop, deploy framework set out in the Rulebook with a specific focus on clients looking to develop initial platform strategies.

The study sets out a practical, client-focused platform strategy development process, and in doing so refines some of the core concepts and terminology set out in the Rulebook to aid its implementation.

With reference to case study data from two major government clients, the study highlights the current barriers to the development of a building product platform strategy, reflecting on these findings to provide a sound basis for further work in this field.

Finally, the study sets out a roadmap for building product platforms, establishing the development of a public sector spatial platform as a logical starting point (**appendix 1**).

Appendix 1: Building Product Platform Roadmap



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