Ofgem Cover Note

The recent Ofgem Call for Input on the Future of Distributed Flexibility has sparked widespread interest. This report is published as further background work that has contributed to the Call for Input, to ensure the information and analysis is openly available to all.

The work was commissioned by Ofgem as an initial exercise in understanding and developing information on the technical feasibility of digital infrastructure for flexibility markets. The work was put out to open tender via Crown Commercial Services and the competitive tender was won by IBM.

IBM undertook a design and assessment study of possible digital infrastructure for flexibility markets. The IBM report follows a robust digital design methodology, it proposes various options, and evaluates them providing useful information on the functionality and feasibility of the archetypes*. It also recommends one archetype from the assessment as likely to offer a reasonable balance of providing net new functionality while being technically feasible to deliver.

However, it should be made absolutely clear that Ofgem is not proposing *any* archetype as a 'preferred' option. It is expected that there will be many different options and views across industry. The archetypes are just examples on a spectrum of intervention, proposed to facilitate wider debate. Ofgem want to actively use the Call for Input as an open opportunity for all views and information to be gathered to inform ongoing work.

The study and the associated conversations were valuable in informing our early thinking. We extend our thanks to the IBM team for their diligence and challenge.

**Clarification on nomenclature: In the Ofgem Call for Input, the archetypes are called thin "directory", middle "exchange", and thick "central platform". In the IBM report, all archetypes are called a "System-wide Flexibility Exchange Platform" but still cover the full spectrum from directory through exchange to central platform (despite all being called an "exchange").*

Flexibility Markets: Digital Design Study

on behalf of Ofgem

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Structure of the report

The report is structured across five main chapters excluding the appendicies, which can be found in a separate document. The details covered in each section is outlined below.

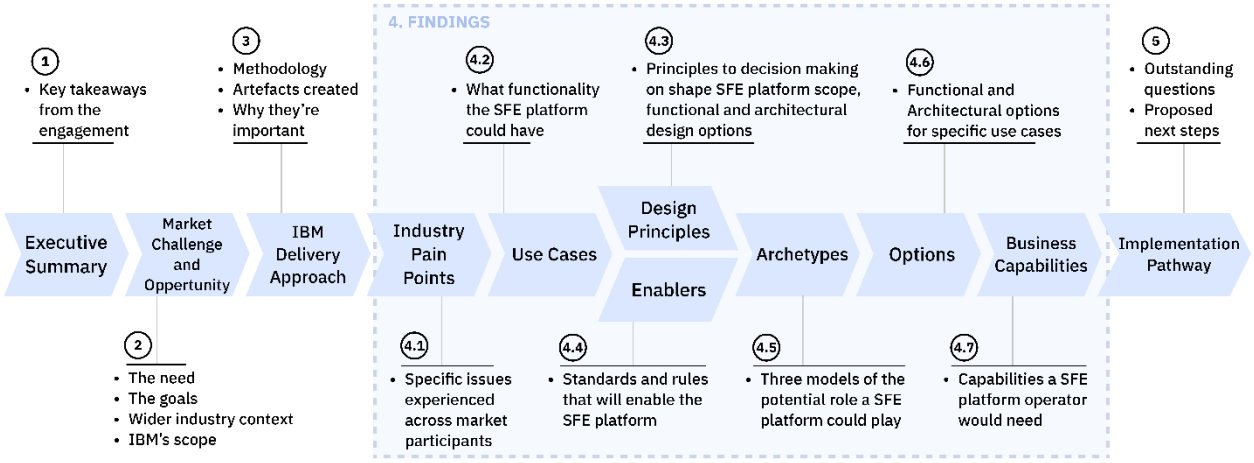
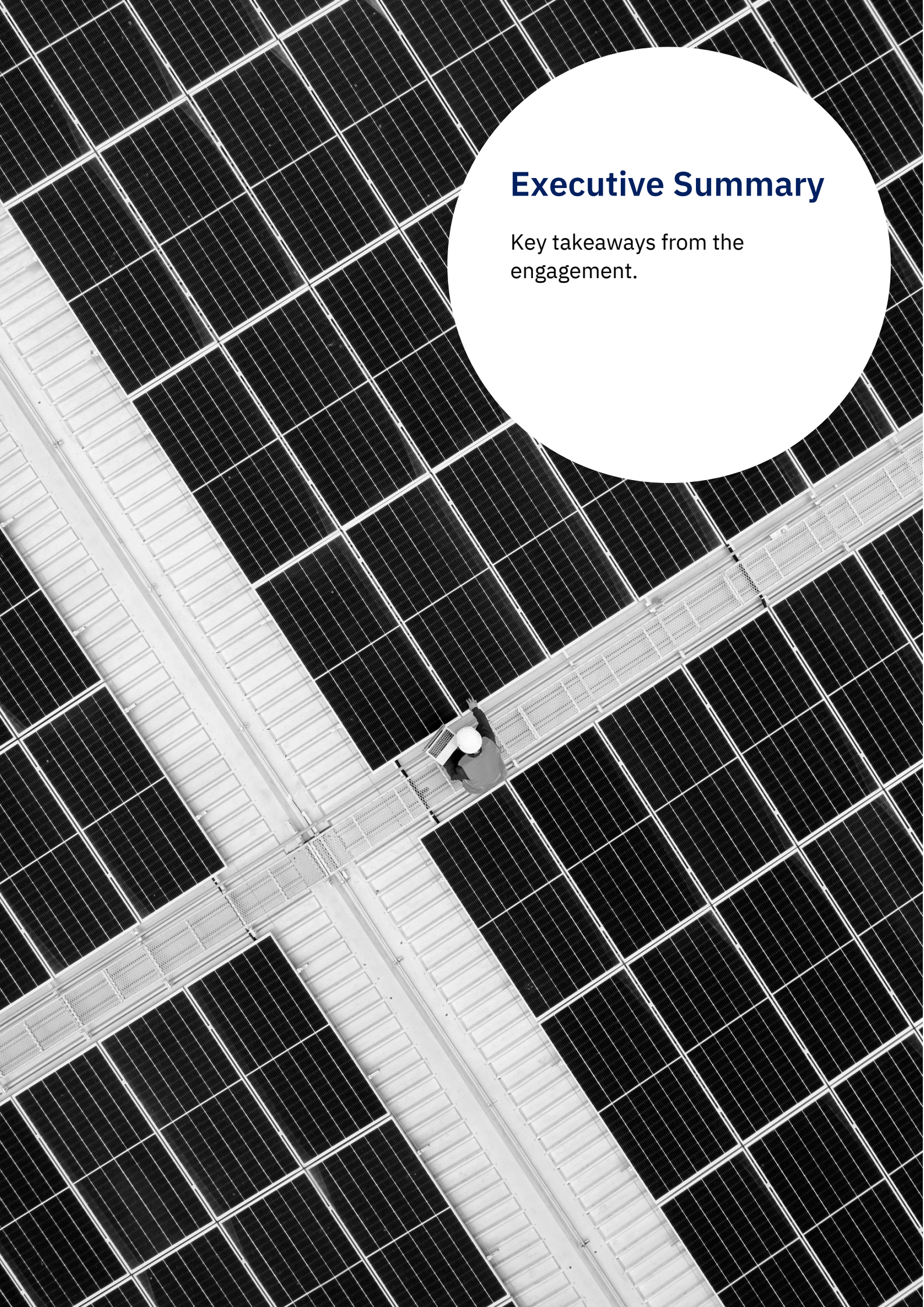


Figure 1. Report structure



Executive Summary

Key takeaways from the engagement.

1 Executive Summary

Despite the significant proliferation of distributed energy resources (DERs), they remain largely absent from flexibility markets. To date, flexibility has not delivered many of its potential benefits because the cost and complexity of providing flexibility are too high, and the benefits and hence compensation are too low.

Ofgem believes there is a requirement for a clear vision of coordination across markets and participants, achieved through new digital infrastructure. They are investigating the potential role for a System-wide Flexibility Exchange (SFE). A SFE platform could facilitate the interaction between flexibility service providers (FSPs) and market operators (MOs) through data exchange. It could make flexibility more commercially viable through easier participation in multiple markets, revenue stacking whilst making it easier for small assets to participate directly.

The SFE platform is a concept. To help evolve that concept into a set of tangible options that could be discussed with industry, Ofgem engaged IBM to answer the questions: "*What does an SFE platform need to do?"* and *"How could that be implemented?"* (Figure 2). Answers to these questions are the starting point to generate debate, and the outputs from this work will be iterated and evolved as work-in-progress, with stakeholder engagement as a key tenet.

IBM delivered this engagement over 9-weeks using its Garage Methodology[1]. Garage is a product-centric and iterative framework proven to take concepts through to tangible designs and is fully aligned to Government Digital Services.

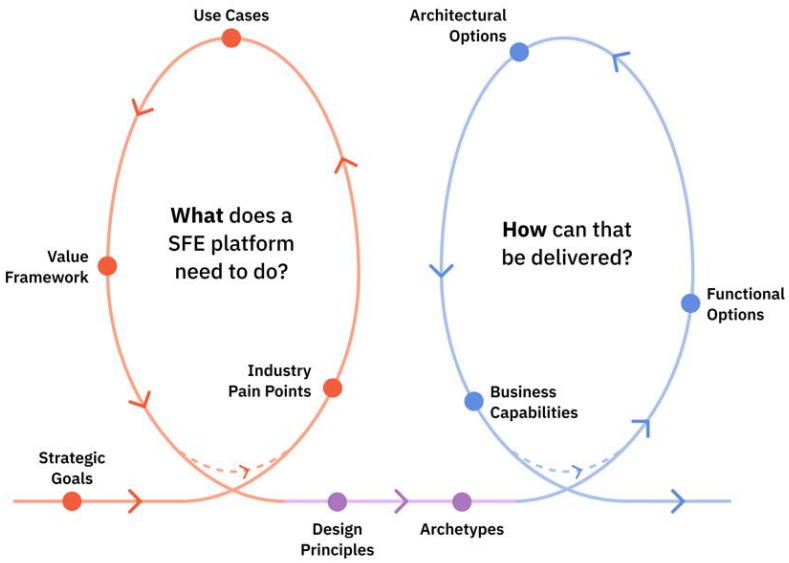


Figure 2. Delivery approach based on IBM Garage methodology

[1] https://www.ibm.com/garage

What does a SFE platform need to do?

Through a series of industry stakeholder interviews, IBM formed a consistent view that DER flexibility is not playing the role it could and should in markets. This is due to a combination of market silos, lack of transparency and data availability. A gap in the market was identified, which the SFE platform could fill.

Based on these stakeholder interviews, thirty-two use cases were developed, describing and explaining the requirements and functionalities of an SFE platform. These use cases formed the core of the analysis on both what the SFE platform should do, and how it should do it.

The use cases were assessed for value (alignment to strategic objectives and industry stakeholder interviews), and the effort to deliver from an IT perspective. Based on this assessment, they were prioritised to drive the following outcomes:

- Enable FSPs (prospective and existing) to better understand the value of their assets, through the availability of historic data on prices, volumes, utilisation, dispatch etc.
- Simplifies and harmonises processes across markets (such as contracting and pre-qualification) to reduce barrier to entry for participants.
- Increases operational efficiency of markets through rule enablement, and conflict identification.
- Increases the ability to revenue stack and better utilise DERs.
- Improved market coordination and visibility.

In the context of the use cases, this engagement considered the role that the SFE platform could play in the market and developed three ‘archetypes’:

1. a **thick** SFE platform archetype that encompasses all market activities e.g. providing a single place to register products and assets, conduct auctions, offer products, dispatch, settle, and process payments;
2. a **thin** SFE platform archetype that solely provides a directory of market participants; and
3. a **medium** SFE platform archetype where some interactions between FSPs and MOs are facilitated by, and flow through the platform. Examples include identifying possible products that an asset could be eligible for, facilitate the pre-qualification process, and collect / provide access to exchange data. Other interactions could happen outside the SFE platform, either bilaterally or via a third-party e.g., auctions, dispatch, settlement, and payment.

We propose the medium SFE platform (see Figure 3). It plays a facilitating role in the marketplace and addresses some of the gaps identified in stakeholder interviews, without replacing the commercial and operational processes already in existence and working well.

The benefits of the medium archetype are:

- **Delivery of net new functionality:** the functionality proposed is net new, addressing gaps identified in existing market structure through the provision of data not previously

available, or through the simplification of processes (depicted by the green box in Figure 3).

- **Feasibility from a technical perspective:** the functionality promotes architectural cohesion and can delivered in a modular fashion meaning it could be delivered in an iterative, agile approach, making the overall delivery more feasible with the added benefit of faster value realisation.
- **Does not replace existing functionality that exists and works well:** it assumes a new role in the marketplace and does not cannibalise existing services (depicted by the grey box in Figure 3).

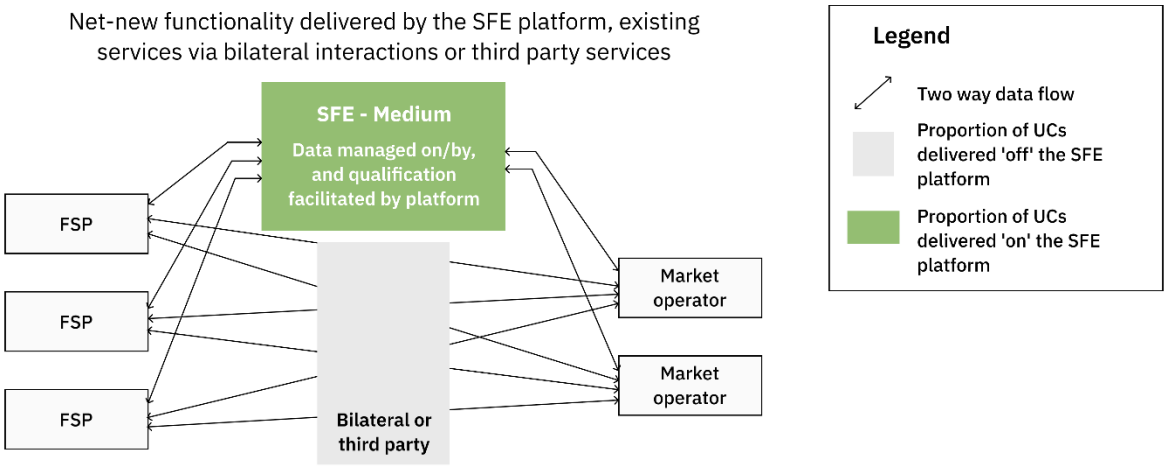


Figure 3. Medium SFE Platform Archetype (enabling coordination across markets)

How could the SFE be implemented?

Regardless of archetype, to achieve any/all of the use cases, the fundamental dependency of the SFE platform is on the standardisation of product and asset data. We have considered this, an underlying foundational layer. Data exchange between market participants is the primary goal of the SFE platform; the technical architectural options of centralised/decentralised is secondary. To successfully deliver the SFE platform, industry will need to agree the market participation data standards and associated market rules. This is the critical enabler for the SFE platform.

The report discusses the advantages and disadvantages of centralised and decentralised data. We have focused analysis on two main areas: 1) product and asset data; and 2) historic data. The appropriate degree of centralisation vs decentralisation is dependent on the level of functionality that is ultimately decided to bring into the SFE platform (details discussed in the report).

Examples of considerations include:

- The argument to centralise data is strengthened by the inclusion of use cases that need to read, analyse, and perform complex computations on data. The performance of these functions is improved if data is more accessible through centralised storage.
- Increasing the number of use cases that include the need to search data, increases the benefits of centralisation of data.

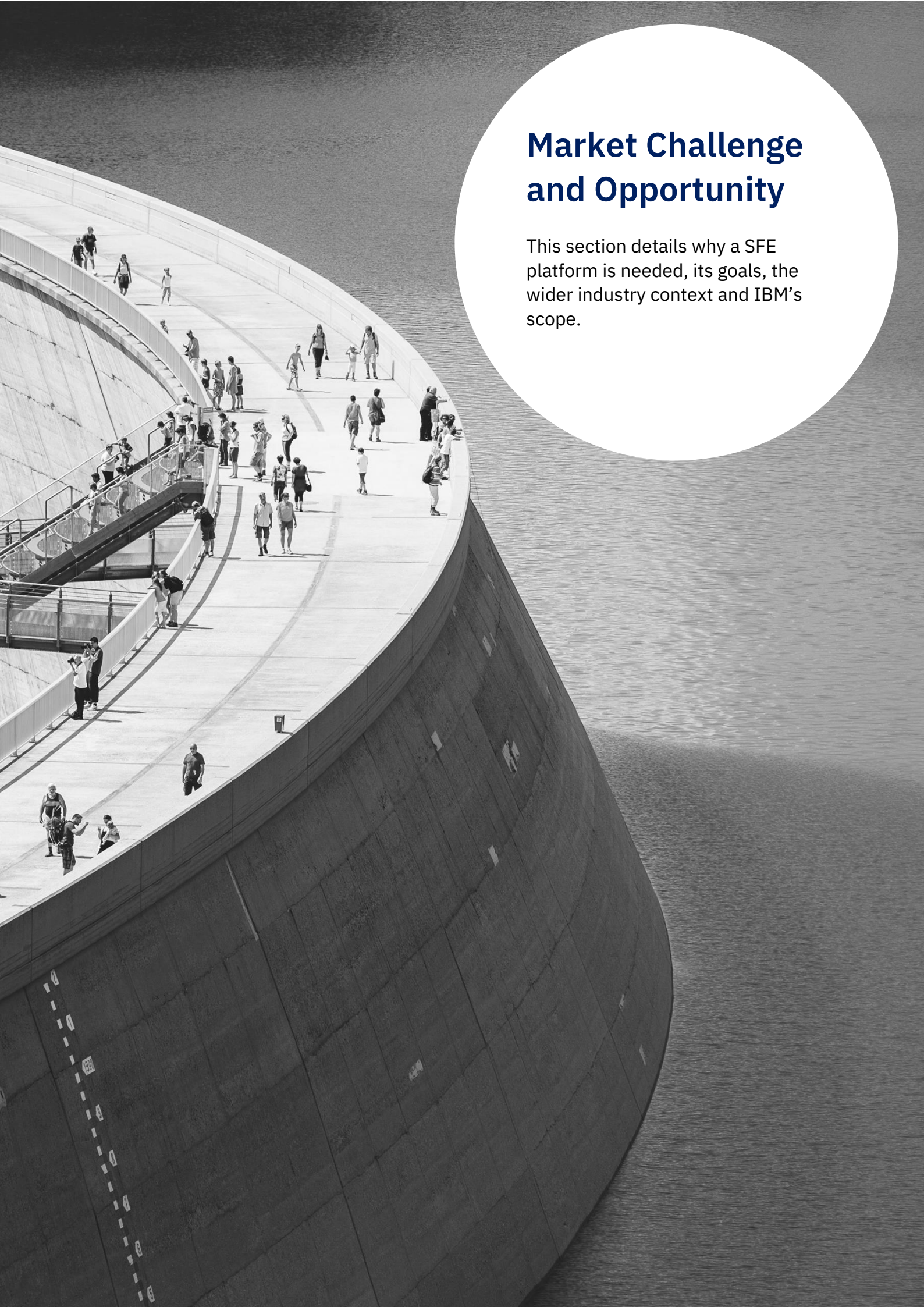
- Dependency on source system availability (i.e. is the system there when you need its data, and when you ask for it do you get it in a reasonable amount of time).

At present, historic data and product data have stronger arguments for centralisation, whilst the argument for centralisation of asset data is more finely balanced.

The report identified key use cases with functional optionality: market conflict identification and centralised pre-qualification. Aspects for consideration were noted and some initial options were set out for further thinking and future development.

Recommendations

In conclusion, IBM recommends that the medium SFE platform archetype is put forward for consideration and a Minimum Viable Product (MVP) is developed that enables industry stakeholders to test its use. When formulating the scope of this MVP, consideration should be made regarding the combination of use cases, as it will determine the choice of technical architecture. We further recommend that analysis is undertaken into the wider business capabilities required to deliver the SFE platform and then consideration of “who” could deliver it. As well as considering the involvement required from wider industry to enable the SFE, and any interactions the SFE could have with other ongoing initiatives in the sector.



Market Challenge and Opportunity

This section details why a SFE platform is needed, its goals, the wider industry context and IBM’s scope.

2 Market Challenge and Opportunity

2.1 What is the SFE Concept?

Despite significant proliferation of distributed energy resources (DERs), they remain largely absent from electricity markets. This is because their adoption presents both a challenge and an opportunity in energy market coordination.

DERs present opportunities, through demand shifting and storage, to: 1) reduce or defer network reinforcement; 2) enable greater use of renewable generation capacity (reducing the maximum capacity which needs to be built); and 3) improve system stability and reliability. Challenges are faced by both buyers (market operators) and sellers (flexibility service providers, FSPs). Decentralisation is a new way of working for market and system operators and so there are process, technological and cultural challenges to adopting this new way of working. For sellers, the cost and complexity of disjointed markets outweighs the benefits of participation in those markets. Both lead to the current situation, where the true value of DER flexibility to the system is not being fully realised.

Ofgem believes there is a requirement for a clear vision of coordination, which may be achieved through new digital infrastructure – the System-wide Flexibility Exchange (SFE), a platform to facilitate the interaction of Flexibility Service Providers (FSPs) and Market Operators (MOs) across multiple markets through data exchange.

The goal of the proposed SFE is to increase liquidity in flexibility markets, by achieving five Strategic Goals:

1. Increased cross-market participation and coordination of assets
2. Simplified market access
3. Increased transparency (of market data on assets, products, current market positions and historic market performance)
4. Participant trust in the market ecosystem (e.g. dispute resolution, rule enablement)
5. Increased financial viability of flexible DERs

The SFE platform should avoid duplicating existing functionality but rather strive to integrate existing systems where it is possible and cost effective to do so unless there are significant benefits to providing a parallel function.

The SFE fits in a wider ecosystem of functional processes and emerging digital infrastructure which facilitates them (Figure 4). This ecosystem has a modular structure whereby all the functionality is useful but where exactly the digital infrastructure sits, is modular and flexible. For example, a directory of assets could be useful, however whether it sits internally on the SFE or externally on a Central Asset Register, matters less as long as the functionality is delivered.

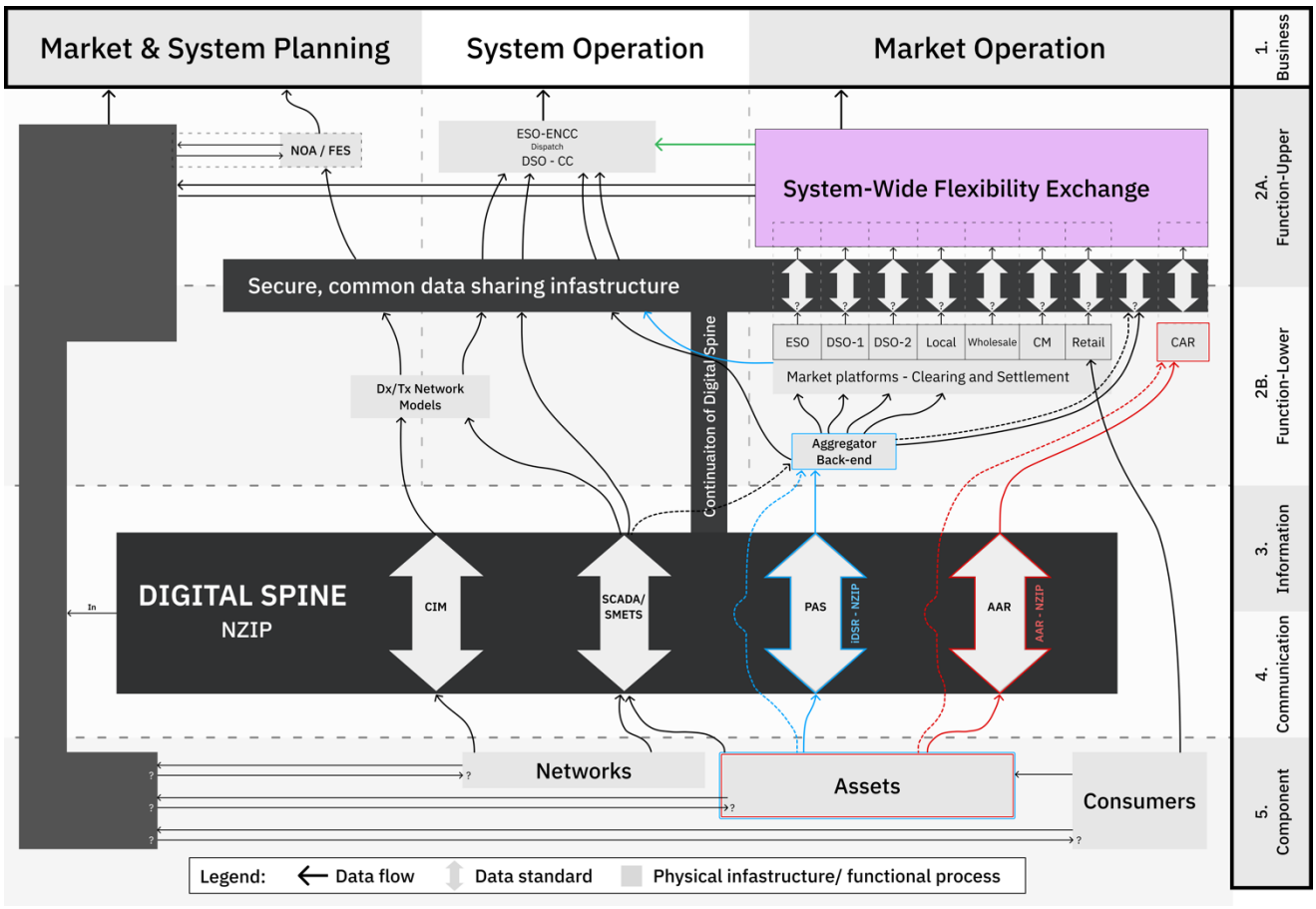


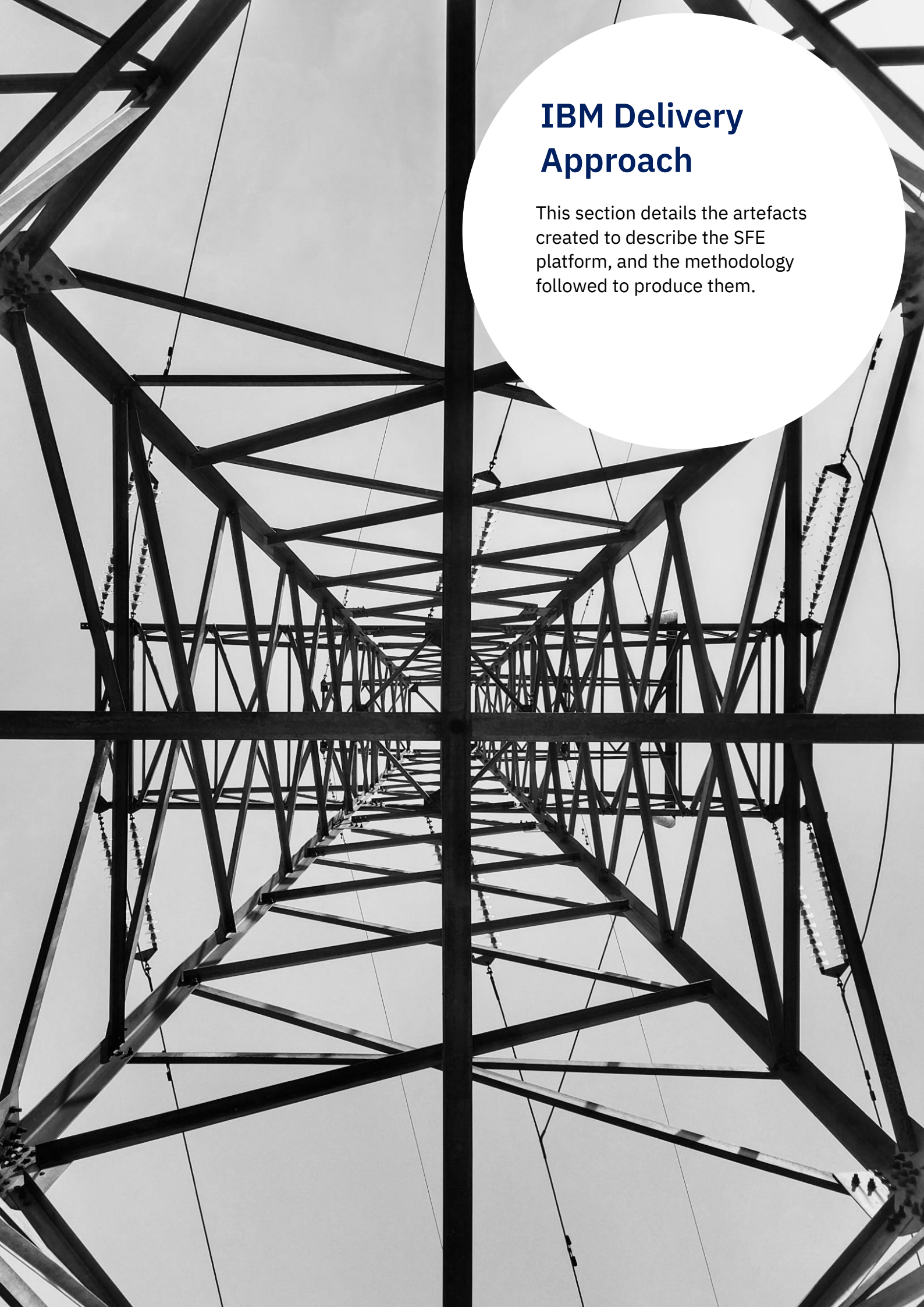
Figure 4: Position of the SFE platform in the context of related platforms and initiatives

2.2 Scope of Work

In preparing its Call for Input, Ofgem sought to answer the following question: *What does a system-wide flexibility exchange require to achieve these strategic goals, and how could that be delivered?* To answer to this question, Ofgem sought to engage an expert and independent third party. Following a public procurement exercise, IBM was appointed.

IBM's goal was to define a set of evidence-based design options for a SFE, through a 9-week consulting engagement. The design options would detail: 1) *what* features and functionality could exist within the SFE; 2) a qualitative assessment of the value and effort associated with delivering that functionality; and 3) *how* these features and functionality could be delivered through an analysis of the technology architecture options.

It is important to note that the SFE is not a final product or foregone conclusion. The Call for Input responses will need to be considered, alongside ongoing wider policy work. Therefore, this work is a starting point for further development and refinement. The design options resulting from this work could be translated into a minimum viable product (MVP), that would enable industry testing and further exploration of how the SFE platform could facilitate increased liquidity in flexibility markets.



IBM Delivery Approach

This section details the artefacts created to describe the SFE platform, and the methodology followed to produce them.

3 IBM Delivery Approach

3.1 Methodology

In delivering this 9-week engagement, IBM defined "*what does an SFE platform need to do?*" and "*how can that be delivered?*" through the creation of several artefacts (Table 1), generated iteratively using its established Garage Methodology[2] (Figure 5).

Garage is IBM's product-centric, agile framework for developing and scaling customer-focused, technology-based solutions, underpinned by human centred design and iterative solution development approach. The Garage methodology – proven to scale vision to digital products at pace for over 3000+ organisations – was chosen as it aligns to Government Digital Services best practice.

Stakeholder engagement was at the heart of this engagement. Over 9 weeks, IBM ran 6 co-creation workshops with Ofgem, and held 24 industry stakeholder interviews.

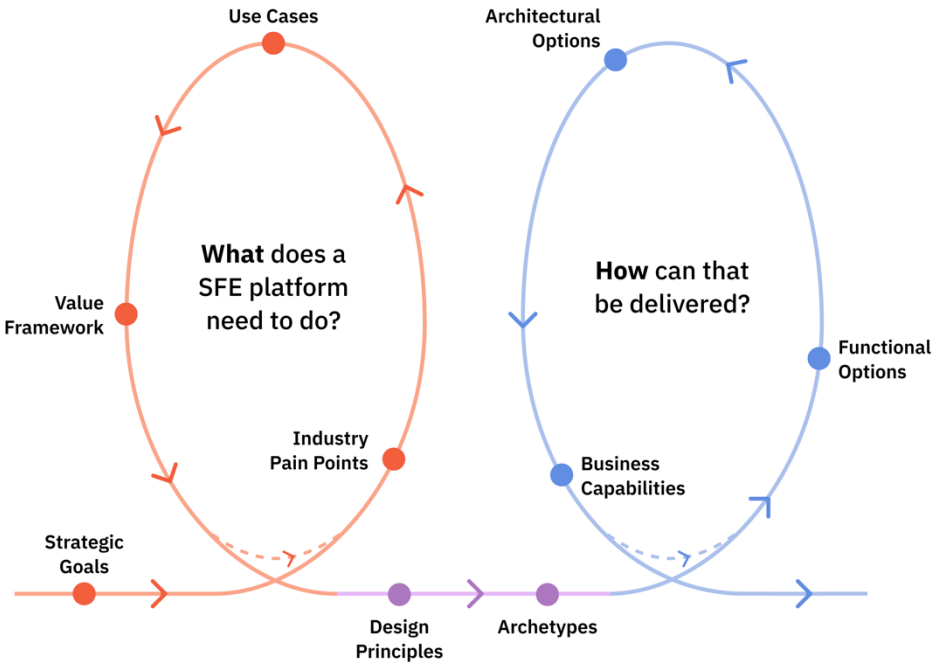


Figure 5. Delivery approach based on IBM Garage methodology

2 https://www.ibm.com/garage

	Questions to address	Artefacts
***What** does an SFE platform need to do?*	What is an SFE platform trying to achieve?	Strategic Goal
	What are the challenges currently faced by market participants?	Industry Pain Points
	What functionality would be beneficial to the marketplace?	Use Cases
	What is the priority of that functionality?	Value Framework
***How** could that be delivered?*	How much of this functionality could be delivered by the SFE platform?	Archetypes
	What are the different ways this functionality could be delivered?	Functional Options & Architectural Options
	What are the dependencies, enablers for this delivery of the SFE?	Design Principles & Enablers
	What are some of the business capabilities needed by an organisation to run the SFE platform?	Component Business Model

Table 1: Core questions for the engagement, and the corresponding artefacts created to address them

3.2 Artefacts

As Figure 5 illustrates, the 'what' and 'how' of the SFE platform are described through various artefacts: Strategic Goals, Industry Pain Points, Use Cases, Archetypes, Functional Options, Architectural Options and Business Capabilities. This section details the methodology followed to develop these artefacts, and the Design Principles and Value Framework used to assess them.

3.2.1 Strategic Goals

The five Strategic Goal articulate the need for a SFE platform and the outcomes it should drive. The goals were drafted collaboratively in early design thinking workshops and were refined as thinking evolved over the course of the engagement. They formed the basis of the value framework, providing a structured set of criteria to assess and prioritise what functionality the SFE platform needed to deliver.

3.2.2 Industry Pain Points

Following a user centric approach, we conducted 24 interviews with stakeholders from across industry, with representation from FSPs (aggregators and asset owners/operators), market operators (system operators and other market operators), platform operators, technology companies and related consultancies. The interviews were one hour in duration and followed a standard script. The objective of the initial round of interviews was to understand and identify the pain points experienced by these market participants.

3.2.3 Use Cases

A use case describes the way a system can be used to achieve a particular goal and have been used to describe 'what' the SFE could bring to the sector. They were formulated as a proxy for requirements.

Use cases were identified and developed iteratively and evolved through cycles of industry stakeholder feedback. This resulted in a set of evidence-based use cases. Please note, the numbers associated with use cases are for unique identification only, and it not related to value or priority.

Subsequent rounds of interviews were used to market test ideas and use cases developed to address those pain points.

3.2.4 Value Framework

The value framework provided a set of structured criteria to assess the use cases and prioritise them. This was critical to shaping the thinking about, and assessing what, type of role the SFE could play in the market (i.e. archetypes), and what a potential minimum viable product (MVP) could look like.

Use cases were qualitatively assessed against the dimensions below:

- Value (assessed by Ofgem):
  - A combination of their alignment to the Strategic Goals, and their ability to deliver against the industry pain points (see section 4.1 Industry Stakeholder Pain Points).

- Effort (assessed by IBM):
  - An evaluation of the effort and complexity involved in the IT implementation only.

It is important to note, that the assessment of relative value was based on current understanding of the market and will be part of the debate for the Call for Input.

3.2.5 Design Principles

Design Principles, derived from the strategic goals, guided the decision making for the proposed scope of the SFE platform, and how it could be implemented from a functional and architectural perspective.

3.2.6 Archetypes

Archetypes were identified to model how market participants interact with the flexibility market, and how much or how little a role the SFE should play in that interaction. The archetypes present options for the scope of SFE platform, detailing how those use cases should/could be delivered 'on' the SFE, or 'off' the SFE, shaped by the design principles. They were assessed against the strategic goals and design principles.

3.2.7 Functional Options

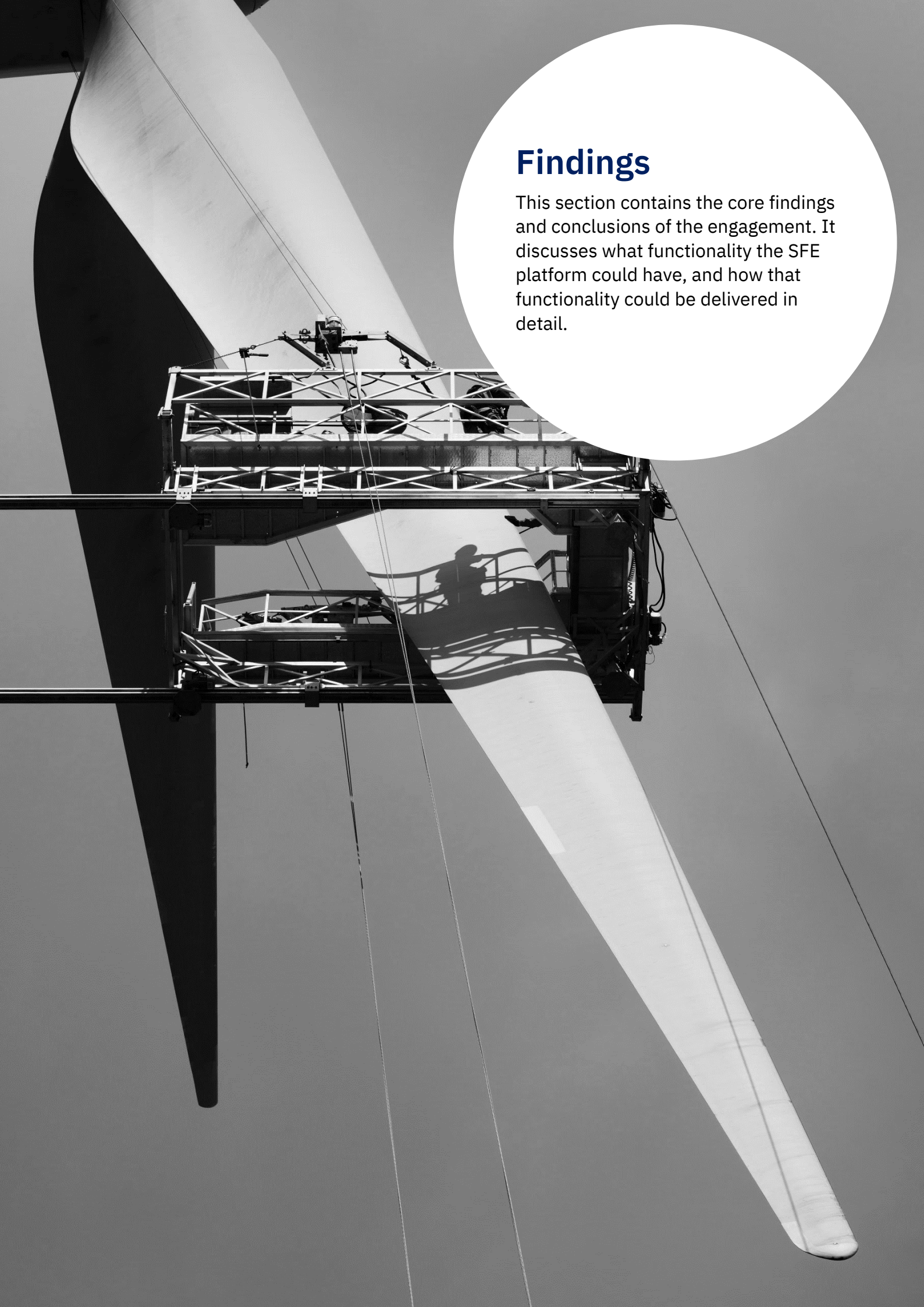
For a specific use case, the functional options describe different interactions a market participant could have with the SFE platform, to achieve the same goal.

3.2.8 Architectural Options

Architectural options detail key variations in the architecture underpinning specific use cases, a discussion of the advantages and disadvantages, and a final recommendation guided by the strategic goals and design principles. These options were designed using IBM architectural best practice combined with learnings from energy markets in other geographies and adjacent industries.

3.2.9 Business Capabilities

Business capabilities are key components of business architecture and denotes “what” an organisation can do. We used IBM’s patented Component Business Model (CBM) analysis to propose the capabilities which will be critical for organisation operating the SFE platform, based on a utility market standard capability model.



Findings

This section contains the core findings and conclusions of the engagement. It discusses what functionality the SFE platform could have, and how that functionality could be delivered in detail.

4 Findings

This section details what the platform could do, through use case, and how that could be achieved, through archetypes, architectural and functional options, and business capabilities.

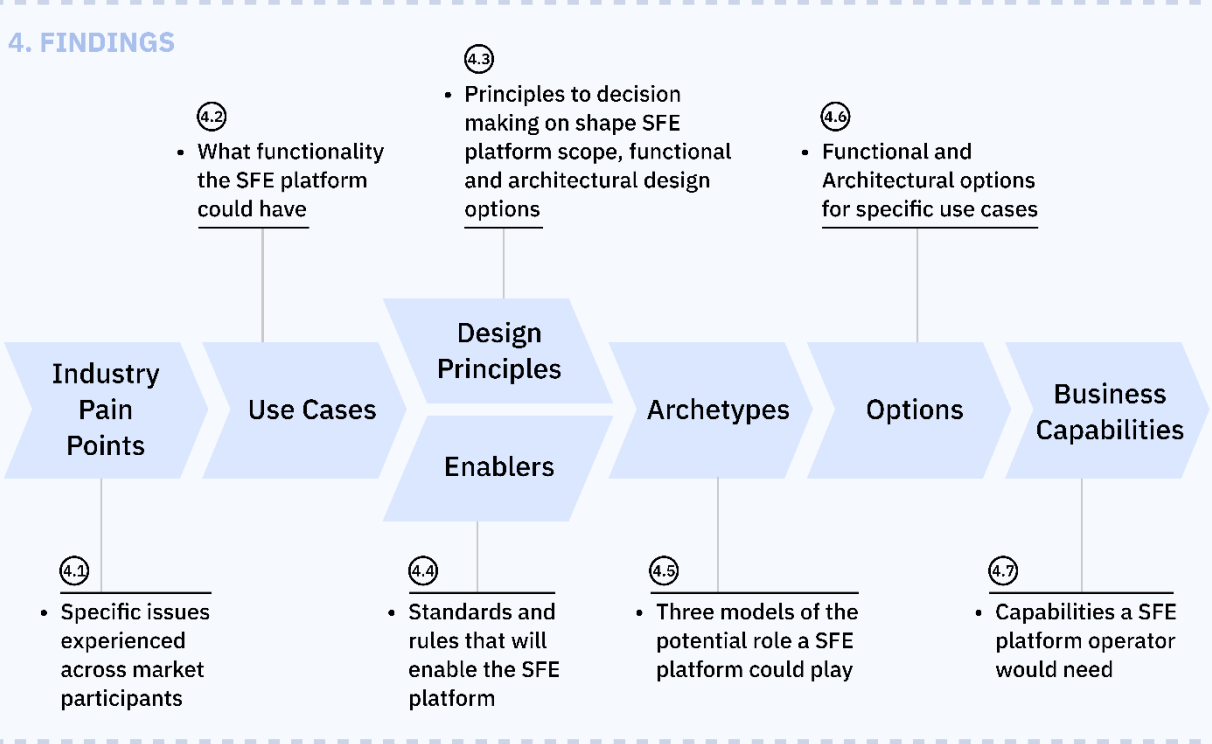


Figure 6: Structure of section 4 Findings

4.1 Industry Stakeholder Pain Points

The interviews identified several pain points, which were grouped into eight categories (listed below with key examples and supporting evidence). This stakeholder feedback was instrumental in developing and prioritising the use cases for the SFE platform.

1. Disparate market processes and data standards/definitions are a high barrier to entry for new participants

- Unanimous agreement on the need for common and harmonised data on assets, products, and participants across markets, but differing opinions on how best to achieve that harmonisation.
- Prequalification processes vary across multiple markets and products, the same information needs to be provided every time but in slightly different format.
- Each DNO has a different market platform, a different bidding process and different products, which means that aggregators need to invest a lot of time and resource to understand each market.
- Inconsistent baselining methodologies.
- Inconsistent metering standards.
- Changing metering requirements make it hard for manufacturers to know what to design for.
- It's very hard to generate a business case and understand the value of entering flex, because process and volumes are volatile and there is a lack of transparency.

2. Product requirements are often designed for traditional, large scale generating assets

- Many domestic assets are not registered for half-hourly settlement, as that could lead to increased cost for the supplier. But that excludes them from the balancing market and the ancillary service market, where most money could be earned.
- Need for shorter term products as long-term forecasts are often not realistically possible for small scale assets.
- Minimum bid size for most products is way too high for most FSPs.
- Often areas with a lot of available flex don't overlap with areas that are constrained.
- Domestic portfolios are subject to change, which presents a huge admin burden to manage the asset changes and the implications on the prequalification status.

3. Low DNO maturity with respect to flexibility, causing low confidence and subsequent lack of liquidity in local markets

- Stakeholders lack confidence that the DNOs/DSOs pursue the growth of their flex markets with sufficient rigor.
- Many DNOs do not have short term products.
- DNOs/DSOs need to model their network flows and constraints to identify flex demand.

4. Difficulty in understanding the markets, regulation, and market rules

- The rules and regulation are written for mature and sophisticated users and vary from product to product.
- Creating an initial business case for flex assets takes extremely long. The data on prices and volumes is dispersed and not in an easily understandable format.
- There is insufficient transparency around performance of flex assets.
- Market rules and regulations are spread across multiple sources.
- Investors, aggregators, and investors lack visibility of how much and where flexibility is needed in the mid and long term.

5. Revenue stacking is prohibited by product design and market rules

- Assets aren't utilised as best as they could.
- Eligibility for stacking unclear across markets.

6. Pre-qualification presents a high barrier to entry

- Pre-qualification processes are highly complex for many products. Aggregators and FSPs described pre-qualification as "*incredibly slow and time consuming*".
- Flexibility buyers often want the same data, just in slightly different formats which creates a huge admin burden.

7. Lack of transparency of asset utilisation

- All assets under Active Network Management (ANM) are excluded from participating in various flex markets.
- Market operators need confidence that the assets are doing what they claim to do, which creates strict metering requirements, which some asset types struggle to provide.

8. Inability to dispatch small assets 'skip rates'

- There is a lot of frustration about the fact that small assets are at times skipped in the merit order as the market operators can't handle bulk dispatch.

4.2 Use Cases

A use case describes the way a system can be used to achieve a particular goal and have been used to describe 'what' the SFE platform could bring to the sector.

The thirty-two[3] use cases defined in this work define potential functions that the SFE platform **could** provide. This section discusses the alignment of the use cases to the strategic goals (2.1 What is the SFE Concept?) and the industry stakeholder pain points (4.1 Industry Stakeholder Pain Points), to derive relative value of the use cases.

4.2.1 Description of Use Cases

This section provides an overview of the use cases, grouped by the outcomes they drive. A full list with individual write ups, can be found in Appendix A – Use Case Catalogue.

Use case groupings:

- Group A: Enable new FSPs and FSPs looking to scale to understand the value of their assets
- Group B: Simplified and harmonised processes to reduce barriers to market entry
- Group C: Increase operational efficiency of markets for MOs and FSPs
- Group D: Optimise decision making when operating in markets
- Group E: Increase trust and governance
- Group F: Consistent description of assets and products through definition and harmonisation of data standards

4.2.1.i Group A: Enable new FSPs and FSPs looking to scale to understand the value of their assets

- Group A is a collection of use cases that enable FSPs to assess the financial viability of their assets, and answer questions like: '*Is it financially viable to partake in flexibility markets?*', '*Which products/markets should I participate in?*' and '*Am I potentially eligible for those products/markets?*'
- This is achieved through a mix of functionality, including the provision of historic data on price, volume, utilisation, dispatch and current and forecasts on flex needs from MOs, and third-party services to predict future asset value.

[3] 32 is the resulting number of use cases. 38 use cases were initially identified, and six were de-scoped. This was due to limited endorsement from stakeholder interviews suggesting limited requirement and because some use cases were deemed not to fall within the technical scope of the functionality of an SFE.

Group A: Enable new FSPs and FSPs looking to scale understand the value of their assets	
Use Case title & ID	Description
Reporting on prices and volumes (UC6)	Provision of information around prices and volumes that were sold, broken down by product and asset type, to support analysts and investors in understanding market trends.
Asset value based on historic data (UC8)	Enable sellers of flexibility to develop a high-level understanding of asset value per asset type, to develop a business case.
Understand eligibility for pre-qualification (UC9)	Enables asset owners and aggregators to easily understand which products their asset(s) could get prequalified for.
Reporting on trade, dispatch, settlement, and performance (UC10)	Provide certainty and evidence that trade, dispatch, and settlement has completed.
Visibility of current & future flexibility needs for all networks (UC16)	Enable FSPs and Aggregators to find or build assets in the right locations. Enable retailers/suppliers to identify which of their customers are particularly attractive for provision of flex.
Asset value prediction (UC28)	Help FSPs to understand the best deal for their assets at any point in time.

Table 2: Group A use cases

4.2.1.ii Group B: Simplified and harmonised processes to reduce barriers to market entry

- A collection of use cases that simplify and harmonise processes across MOs. Once an FSP has decided to partake in a particular market/product, the processes to enter the market are simplified and friction is reduced.
- Achieved through a streamlining of contracts between MOs, and centralised pre-qualification:

Group B: Simplified and harmonised processes to reduce barriers to market entry	
Use Case title & ID	Description
Streamlining contracts across markets and products (UC14)	Combining contracts across multiple markets into ‘fewer docs’.
Centralised pre-qualification (UC15)	Enable aggregators and FSPs to enter data that is common to the pre-qualification processes for many products in one place, reducing admin burden and repetition.

Table 3: Group B use cases

4.2.1.iii Group C: Increase operational efficiency of markets for MOs and FSPs

- A collection of use cases that increase the operational efficiency of markets for all market participants. The scenario is, now the participants are qualified into and actively participating in the market, the goals of these use cases are to enable those operations to run more efficiently, reducing the barrier to ongoing market participation.
- Achieved through use cases enabling multiple market participation through rule enablement and conflict identification, the provision of information on market rules, and other core operational processes of auction, dispatch, and settlement:

Group C: Increase operational efficiency of markets for MOs and FSPs	
Use Case title & ID	Descriptions
Rule enablement (UC5)	A rules engine, ensuring adherence to the rules around participation in multiple markets (especially so regarding market coupling).
External information provision (market rules) (UC7)	Provision of information around policy changes, SO market rules and current regulation in a single, easy to access location.
Market conflict identification (UC11)	If one asset is participating in two markets (and is operating within the defined market rules), and there is a conflict, users are alerted to it.
Settlement (UC32)	The determination and settlement of amounts payable in respect of Trading Charges (including Reconciliation Charges) in accordance with the Code (including where the context admits Volume Allocation).
Dispatch (UC33)	Send instruction signal to assets to confirm set point, start and end time.
Auctions (UC35)	Introduce a process of buying and selling flexibility.
Simple market participant search (UC36)	Identification and accreditation of users via a central list of all users (directory). This provides information on who the different market participants are.

Table 4: Group C use cases

4.2.1.iv Group D: Optimise decision making when operating in markets

- A collection of use cases the enable market participants to optimise their decision making when participating in markets, for all market participants.
- Achieved through use cases providing functionality to enable FSPs to decide which are the most profitable products to bid for at any given point in time, and functionality to enable MOs to improve decision making when accepting bids, increase the ability to revenue stack and to enable better utilisation of DERs:

Group D: Optimise decision making when operating in markets	
Use Case title & ID	Description
Market testing of products (UC13)	The ability for flexibility buyers to suggest new products, then allow flex providers to declare interest and provide feedback on that product.
Transparency of DER positions & actions (UC18)	Enable market coupling by creating transparency of asset position and action benefitting ESO/TSO and DNOs/DSOs
Facilitate small asset participation (UC21)	Help MOs see how many more assets could enter their market if they lowered a specific market entry rule, e.g. through 'what if' analysis.
Probabilistic dispatch of small assets (UC20)	Remove the barrier of dispatching many small assets.
Secondary market (UC25)	Aggregators/FSPs who have won a bid, but no longer want provide the flexibility anymore have access to a marketplace, where they can log their position. Other FSPs/Aggregators can then buy that position and all the responsibilities that go with it.
Bid strategy support (UC27)	Help Flex sellers to understand the best products to bid their assets for at any point in time.
Risk calculation (UC31)	Calculation of how likely it is that an asset won't perform (based on historic performance and participation in multiple markets). This should be both an asset level and aggregated to flag areas where the SO or wider market might have an issue.
Optimisation across all markets and voltage levels (UC34)	Optimising demand and supply (constraints etc) across all markets could lead to an optimal solution based on a set of criteria (e.g. cost, carbon, risk).

Table 5: Group D use cases

4.2.1.v Group E: Increase trust and governance

- A collection of use cases that enable transparency in decision making and governance, fostering trust in the marketplace.
- This is achieved through use cases providing functionality to ensure clear change management processes, monitoring and user accreditation and rating:

Group E: Increase trust & governance	
Use Case title & ID	Description
SO disclosure of rational behind asset dispatch (UC22)	Enable flex providers to understand if assets have been dispatched based on the merit order, and if not, why not?
Change management (UC29)	Business process implementation around market, standards, taxonomy, and rule changes where Regulators/ MOs must follow a defined process within SFE platform to implement market changes. Allow market participants to engage in the change management process.
Streamline user rating (UC30)	Streamlined process for rating the performance of that user (e.g. like Airbnb), so that buyers/sellers can see past performances of the users' assets and comments from people who they previously traded with.
Market monitoring (UC37)	Enable continuous observation of market activities to enable identification of regulatory issues, market faults and security issues via analytics processes.
Impartial route to recourse in case of dispute (UC38)	Create a process to manage disputes around SFE platform processes.

Table 6: Group E use case

4.2.1.vi Group F: Consistent description of assets and products through definition and harmonisation of data standards.

- A collection of use cases that provide the necessary harmonisation of data standards for products and assets to underpin all the use cases discussed so far in this section.
- Achieved through use cases providing common standards for product, asset, and user data:

Group F: Consistent description of assets and products through definition and harmonisation of data standards.	
Use Case title & ID	Description
Maintain taxonomy (UC1)	Maintain the taxonomy that underpins asset, product, and market participant definitions that are used to categorise, describe, and harmonise them across multiple markets thereby helping participants to find each other and comparing products and assets.
User registration (UC2)	Registration of users onto the exchange facilitating access to multiple markets through a unified experience.
Asset registration (UC3)	FSP register assets 'once', by providing detailed information (such as asset type, location, asset size, connection point) common to all products/markets.
Product registration (UC4)	Most register products that are searchable (in one place) and comparable due to common taxonomy. Asset can be linked to products.
Collect historic data and rules (Feature 1)	A functional component that underpins the collection of data on prices, volumes, dispatch, trades, metering and settlement.

Table 7: Group F use cases

4.2.2 Prioritisation of Use Cases

Prioritisation of use cases is critical to shape the thinking about the (broad) role that the SFE could play in the market (i.e. archetypes), and what a potential minimum viable product (MVP) could look like.

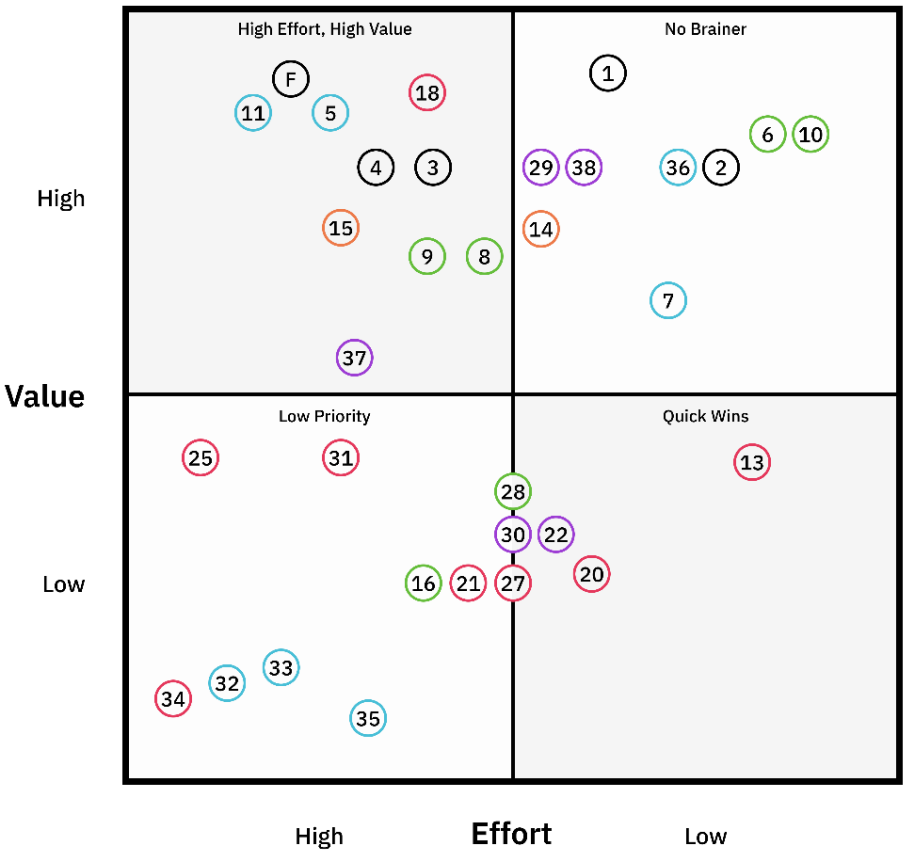
Each use case was qualitatively assessed on 1) alignment to the Strategic Goals of the SFE platform and the degree to which the use case was core to implementing the SFE; 2) the degree to which they address the pain points (4.1.Industry Stakeholder Pain Points) surfaced from stakeholder interviews; and 3) on the effort and complexity of the IT implementation (the effort to define cross-industry standards has been excluded from this effort assignment). This resulted in relative value and effort assignments, which is included in more detail in Appendix A.3 Prioritisation Rationale. The assessment of relative value was based on current understanding of the market and will be part of the debate for the Call for Input.

These relative rankings are shown in Figure 7.

Use cases providing (or underpinning) net new functionality to the sector have been assigned the highest priority. This is because they have the potential to bring a significant step change in the market and has the potential to increase liquidity through increased cross-market coordination (Strategic Goal Strategic Goal1) and improved financial viability of DERs (Strategic Goal 5), hence are deemed of highest value. These use cases:

- Enable FSPs to better understand the value of their assets (group A) by making data widely available that is not at present.
- Increase operational efficiency of markets and ability to revenue stack (group C) through greater clarity and adherence to market rules.
- Provide a consistent description of assets and products through definition and harmonisation of data standards (group F)

The next tier of use cases broadly provides centralised and simplified processes (e.g. pre-qualification in one place), with a priority for processes relating to market entry (Strategic Goal 2). These use cases are not bringing new functionality to the sector but improving efficiency and simplifying existing processes (group B).



Use Case Legend:

Group A: Enable new FSPs/FSPs looking to scale to understand the value of their assets

- 6 Reporting on prices and volumes for market trends
- 8 Asset value based on historic data
- 9 Understand eligibility for pre-qualification
- 10 Reporting on trade, dispatch and settlement for asset performance
- 16 Visibility of current & future flexibility needs for all networks
- 28 Asset value prediction - third party

Group B: Simplified and harmonised processes to reduce barriers to market entry

- 14 Steamlining contracts across markets and products
- 15 Centralised pre-qualification

Group C: Increase operational efficiency of marketsfor MOs and FSPs

- 5 Rule enablement
- 7 Existing information provision (market rules)
- 11 Market conflict identification
- 32 Settlement
- 33 Dispatch
- 35 Auctions
- 36 Simple market participant search

Group D: Optimise decision marking when operating in markets

- 13 Market testing of products
- 18 Transparency of DER positions & actions
- 20 Probabilistic products enabling small assets
- 21 Faciliate small asset participation
- 25 Secondary market
- 27 Bid strategy support - third party
- 31 Risk calculation
- 34 Optimisation across all markets and voltage levels

Group E: Increase trust and governance

- 22 SO disclosure of rationale behind asset dispatch
- 29 Change management
- 30 Streamlining user rating
- 37 Market monitoring
- 38 Impartial route to recourse in case of dispute

Group F: Consistent description of assets and products through definition and harmonisation of data standards

- 1 Maintain the taxonomy
- 2 User registration
- 3 Asset registration
- 4 Product registration
- F Feature - collect data on prices, volumes, dispatch, trades, metering and settlement

Figure 7. UCs plotted by qualitative assessment of value and effort

Optimisation across all markets and voltage levels (UC 34) has the potential to revolutionise the sector, however the significant number of dependencies and potential monopoly this would require offsets the initially perceived high impact, hence has been designated a low value.

4.2.3 Technical interdependencies of Use Cases

The technical interdependencies of the use cases dictates the order and combination in which they can be implemented.

The use case prioritisation discussed in the previous section describes the desirable order in which they could be implemented, the use case interdependency map (see Figure 8) dictates the feasible order in which they could be implemented. In conclusion, the technical dependencies detailed in Figure 8, must be taken into account when implementing.

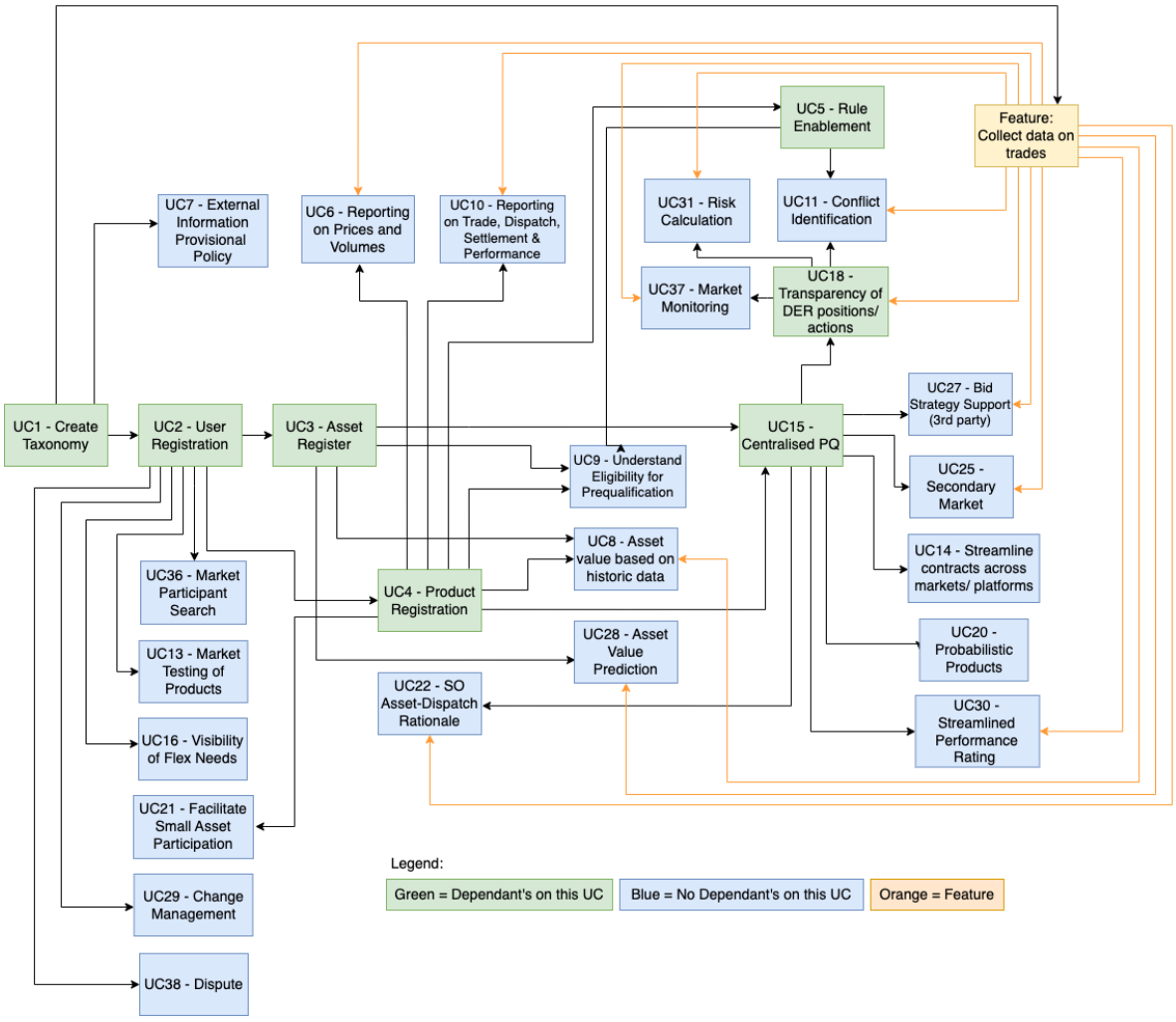


Figure 8: Dependency map depicting interdependencies between use cases

4.3 Design Principles

The design principles provide a set of decision making criteria to help decide the scope of the platform (discussed in 4.5 Archetypes), and assess the architectural and functional design options (discussed in 4.6 Options).

They are derived from the strategic goals, and adherence to these principles ensures decision making was consistent throughout the process and always aligned to the strategic goals.

Design Principles:

1. **Favour services that have significant benefits from having only one provider** (i.e. a deliberate monopoly) for implementation on the SFE platform, and provides equal access to the market for small/large and mature/less mature participants. Or it provide access to third-party services for those services that are best served by a competitive market.
2. **Make use of existing market services and systems** where they perform adequately.
3. **Reduce friction for all participants**; trade-offs should favour FSPs over MOs e.g. easier mechanics to trade.
4. The platform should **improve market efficiency** through better cross silo system visibility – ensuring trades optimise system operation.
5. The SFE platform should be **cohesive**; use cases and features that depend on the core function or technology of the platform take precedence. For example, secondary market trading could be considered a central function, but requires different technology (content management) and is not related to any of the core functions, therefore it is not a priority for inclusion.

4.4 Enablers of the SFE Platform

4.4.1 Standard Interface Model

Data needed for market participation (i.e. asset and product definition data) should be available in a standard form, underpinned by a consistent taxonomy of asset and product features and attributes.

The standard interface model establishes the structure of data elements (i.e. asset and product definition data), relationships among them and specifies the interactions by building on the conceptual organisation of data (i.e. a taxonomy) and adding more information to them.

This provides the following benefits:

- Consistent description of assets, market participants and products.
- Enables better data quality control as Application Programming Interfaces (APIs) and validation functions know what to expect and are more likely to be able to differentiate between valid values and incorrect data.

- Allows better and faster searching.
- Can form the basis for standard contracts.
- Visibility of contracted positions to enable commercial deconflicting.

These benefits are central to the value that the SFE platform can add to the flexibility market, the exact implementation is somewhat secondary to agreeing this standardised model.

Allowing FSPs and MOs to provide data in proprietary formats would require the platform to transform the data to a standard format. This is not considered feasible given the number of market participants.

It should be noted that the specification of such a standard model is non-trivial. There are some standards, such as the Common Information Model (CIM), that can serve as a baseline. Other standards used in market platforms include ibex[4] and OpenADR[5]. Further review of these will be required once the scope of the SFE platform has been agreed, it is however likely that they will not be complete for our purpose, including the UK market design, and will have to be extended.

4.4.2 Market Rules

To unlock the revenue potential of DERs, greater cross-market participation is necessary. Through the rule enablement and market conflict identification functionality, the SFE platform has the potential to be the enabler of this transition.

Market rules that govern product dependency rules (used by the rules engine on the SFE platform) need to be defined. This will require significant collaboration between all MOs and a deep understanding of each other's products to agree dependencies.

[4] https://www.ebix.org/
[5] https://www.openadr.org/

4.5 Archetypes

We have identified three archetypes that model how data will be exchanged with other market participants within the flexibility market, and how much or how little a role the SFE plays in that interaction. They are underpinned by the design principles in 4.3 Design Principles.

The market archetypes for the SFE platform are introduced below:

- **Thick SFE Platform Archetype (enabling end-to-end delivery of market activities)**
  All flexibility trade related interaction is managed by the SFE platform, providing a single place to register products and assets, conduct auctions, offer products, dispatch, settle, and process payments.

- **Thin SFE Platform Archetype (enabling bilateral interactions between parties)**
  This archetype provides directory and governance services only. This includes helping FSOs find potential MOs and ensuring that there is a standard way of interfacing between them. All other communication is bilateral, and the SFE platform plays no active role other than facilitating market participants to identify each other.

- **Medium SFE Platform Archetype (enabling coordination across markets)**
  In the medium archetype some interactions between FSPs and MOs are facilitated by, and flow through the SFE platform, examples are: identify possible products that an asset is eligible for; facilitate the pre-qualification process; and collect and provide access to exchange data. Other interactions happen outside the SFE platform, either bilaterally or via a third party, examples are auctions, dispatch, settlement, and payment.

The key distinction between archetypes is the proportion of use cases delivered **'on' the SFE platform** compared to the proportion delivered **'off' the SFE platform**, defined as:

- **'On' the SFE platform** means a user would achieve their goal (as described by the use case) by interacting with the SFE platform.
- **'Off' the SFE platform** means a user would achieve their goal (as described by the use case) by interacting bilaterally with another market actor, or via a third-party.

Table 8 compares the proportion of use cases delivered 'on' the SFE, and the associated technical feasibility for each archetype (the analysis rationale for each archetype is discussed in the subsequent sections). We propose the medium SFE platform archetype, the use cases it delivers 'on' the SFE address gaps identified in stakeholder interviews, without taking over the commercial and operation processes already in existence and working well (these are the use cases delivered 'off' the SFE). It provides an optimum balance of value and feasibility.

The interactions market participants could have with the medium SFE platform are presented as an infographic in Appendices D – User Journeys.

Archetype	UCs delivered 'on' the SFE platform	Feasibility of Technical Implementation
Thick		
Thin		
Medium		

Table 8. Depicts proportion of UCs the SFE platform delivers for each archetype, and technical feasibility
*Estimate is approximate, highly dependent on the UCs Ofgem decide to implement

4.5.1 Thick SFE Platform (enabling end-to-end delivery of market activities)

This archetype describes a single, central platform for all flexibility markets. The defining feature of this archetype is that the platform is the hub that manages all flexibility exchange activities.

Figure 9 shows a central platform that can be used to find, optimise, exchange, settle, pay, and govern all markets.

In this archetype all thirty-two use cases that have been identified, are implemented on the SFE platform (Table 9).

Title	UC ID
Asset Register	3
Asset value based on historic data	8
Asset value prediction	28
Auctions	35
Bid strategy support	27
Centralised pre-qualification	15
Change management	29
Dispatch	33
External information provision (market rules)	7
Facilitate small asset participation	21
Feature – collect data on prices, volumes, dispatch, trades, metering, and settlement	F1
Impartial route to recourse in case of dispute	38
Maintain taxonomy	1
Market conflict identification	11
Market monitoring	37
Market testing of products	13
Optimisation across all markets and voltage levels	34
Probabilistic products enabling small assets	20
Product registration	4
Reporting on prices and volumes for market trends	6
Reporting on trade, dispatch, and settlement for asset performance	10
Risk calculation	31
Rule enablement	5
Secondary Market	25
Settlement	32
Simple market participant search	36
SO Disclosure of rational behind asset dispatch	22
Streamlining contracts across markets and products	14
Streamlining user rating	30
Transparency of DER positions & actions	18
Understand eligibility for prequalification	9
User registration	2
Visibility of current & future flexibility needs for all Networks	16

Table 9. Use cases delivered 'on' the SFE platform in the **thick** archetype

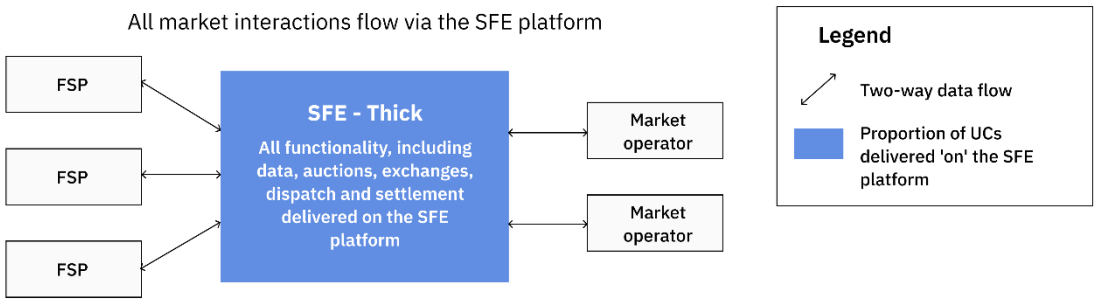


Figure 9. **Thick** archetype depicts market centralisation, through the delivery of all thirty-two use cases on the SFE platform

4.5.1.i Benefits

This archetype addresses all five strategic goals.

Strategic Goals	Alignment
Increase cross-market participation and coordination of assets	High
Simplify market access	High
Increase transparency (of market data on assets, products, current market positions and historic market performance)	High
Participants trust the market ecosystem (e.g. dispute resolution, rule enablement)	High
Increase financial viability of flexible DERs	High

Table 10. Alignment of **thick** SFE platform to strategic goals

One additional benefit that such a complete platform could provide, is optimising the whole market across all voltage levels via a central algorithm (UC 34). Such an approach has the following challenges:

- Very high mathematical and computational complexity
- Bias – which objective(s) should be optimised for and how should they be weighed?
- Governance – who decides on the objectives and constraints to be included?
- Would invariably influence the market due to the issues listed above.

A single platform, that does everything, would reduce duplication of function in the energy system and thus has the potential to reduce over-all cost through economies of scale.

4.5.1.ii Downsides

The downside of the thick SFE platform is that it would replace functionality that already exists elsewhere, thereby significantly reducing the economies of scale benefit. This does not comply with our Design Principles.

It will be complex to develop and would itself need stringent governance to ensure fair market operation and mitigate the risk of unintended market interference. (Please note, this estimation excludes the effort to define the Standard Interface Model.)

Such a platform would take a significant amount of time and effort to develop and require buy in from existing service providers in the flexibility market that are likely to be threatened, both commercially and by the technical risk of such an approach.

Examples such as the NHS Digital Spine, CLS and Smart DCC, while not directly comparable to the SFE, demonstrate how difficult it is to implement ecosystem wide systems that must engage with a wide range of stakeholders and depend on their active participation for successful delivery.

These projects all required many participants to make significant changes to their business processes and IT systems to participate in a new service that replaced some already functioning process significantly modified them.

4.5.1.iii Recommendation

This archetype has been discounted as the likely cost, development timescales and risk, both technical and market support are deemed to outweigh the benefits of economies of scale and cross market optimisation. It is included in this section for completeness to show that the full range of options has been considered.

4.5.2 Thin SFE Platform (enabling bilateral interactions between parties)

In the thin SFE platform archetype, the platform itself would only act as a directory that enables market participants to search for and identify each other, achieved through the delivery of two of thirty-two use cases (Table 11):

- Registering and Identifying Users (UC 2)
- Searching for other market participants (UC 36).

All other use cases would be handled 'off' the SFE platform; either bilaterally or via third-party services (depicted by the grey box in Figure 10).

Title	Use Case ID
User registration	2
Simple market participant search	36
Asset Register	3
Asset value based on historic data	8
Asset value prediction	28
Auctions	35
Bid strategy support	27
Centralised pre-qualification	15
Change management	29
Dispatch	33
External information provision (market rules)	7
Facilitate small asset participation	21
Feature – collect data on prices, volumes, dispatch, trades, metering, and settlement	F1
Impartial route to recourse in case of dispute	38
Maintain taxonomy	1
Market conflict identification	11
Market monitoring	37
Market testing of products	13
Optimisation across all markets and voltage levels	34
Probabilistic products enabling small assets	20
Product registration	4
Reporting on prices and volumes for market trends	6
Reporting on trade, dispatch and settlement for asset performance	10
Risk calculation	31
Rule enablement	5
Secondary Market	25
Settlement	32
SO Disclosure of rational behind asset dispatch	22
Streamlining contracts across markets and products	14
Streamlining user rating	30
Transparency of DER positions & actions	18
Understand eligibility for prequalification	9
Visibility of current & future flexibility needs for all Networks	16

Legend	
	On the SFE platform
	Off the SFE platform

Table 11. **Thin** archetype; **white** UCs delivered '**on**' the SFE platform, **grey** UCs delivered '**off**' the SFE platform

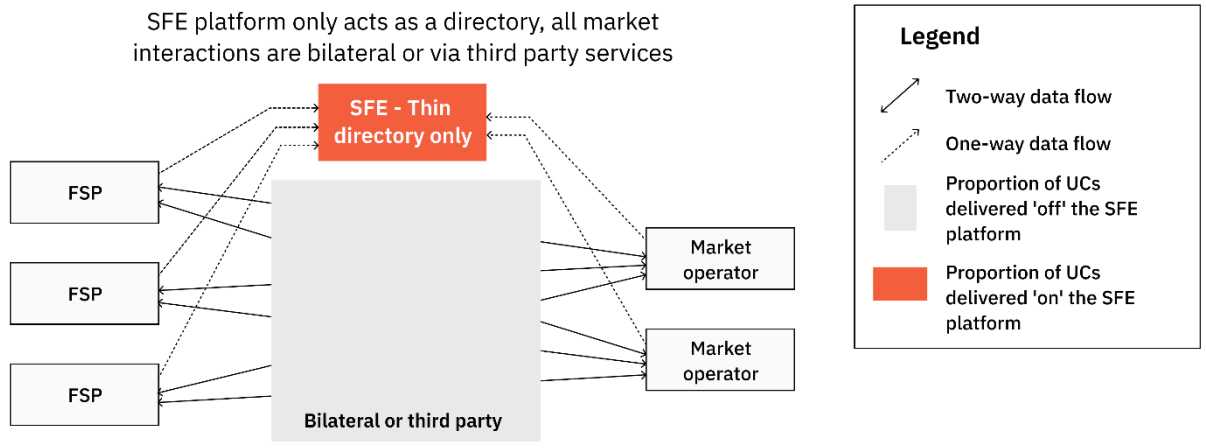


Figure 10. Thin SFE platform archetype, majority of services delivered 'off' the SFE platform, by bilateral or third-party services

4.5.2.i Benefits

This archetype would be fast to develop, low cost and present a low risk. Please note, this estimation excludes the effort to define the Standard Interface Model.

4.5.2.ii Downsides

This archetype does not satisfy many of the strategic goals:

Strategic Goals	Alignment
Increase cross-market participation and coordination of assets	None
Simplify market access	Very Low
Increase transparency (of market data on assets, products, current market positions and historic market performance)	Low
Participants trust the market ecosystem (e.g. dispute resolution, rule enablement)	None
Increase financial viability of flexible DERs	Very Low

Table 12. Alignment of **thin** SFE platform to strategic goals

4.5.2.iii Recommendation

This archetype, whilst easy and quick to implement, addresses too few of the strategic goals of the SFE and has therefore been discounted. It is included in this report for completeness to show that the full range of options has been considered.

4.5.3 Medium SFE Platform (enabling coordination across markets)

The medium SFE platform archetype does not replace existing functionality that has been deemed to work effectively in today's marketplace (i.e. auction, settlement). Its objective is to coordinate the more disparate market activities in today's world (e.g. pre-qualification) and enable greater visibility on market and asset performance (e.g. reporting on pricing, volumes). It adheres to Design Principles 1 & 2.

Table 13 lists the use cases that could be delivered 'on' the SFE (white table rows), and use cases that should be delivered 'off' the SFE (grey table rows). The use cases that could be delivered 'on' the SFE (white table rows), are further broken down into categories which describes the nuance of how they could be delivered.

Title	Use Case ID
Maintain taxonomy	1
User Registration	2
Asset Register	3
Product Registration	4
Simple market participant search	36
Feature – collect historic data and rules	F1
Rule enablement	5
Reporting on prices and volumes for market trends	6
Asset value based on historic data	8
Understand eligibility for pre-qualification	9
Reporting on trade, dispatch and settlement for asset performance	10
Market conflict identification	11
Market testing of products	13
Centralised pre-qualification	15
Transparency of DER positions & actions	18
Facilitate small asset participation	21
Streamlining user rating	30
Risk calculation	31
External information provision (policy changes)	7
Streamlining contracts across markets and products	14
Probabilistic products enabling small assets	20
SO Dispatch of rationale behind asset dispatch	22
Secondary market	25
Change management	29
Market monitoring	37
Impartial route to recourse in case of dispute	38
Visibility of current & future flexibility needs for all networks	16
Bid strategy support	27
Asset value prediction	28
Settlement	32
Dispatch	33
Auctions	35

Legend

	On the SFE platform
	Off the SFE platform

Table 13. Medium archetype; white UCs delivered 'on' the SFE platform, grey UCs delivered 'off' the SFE platform

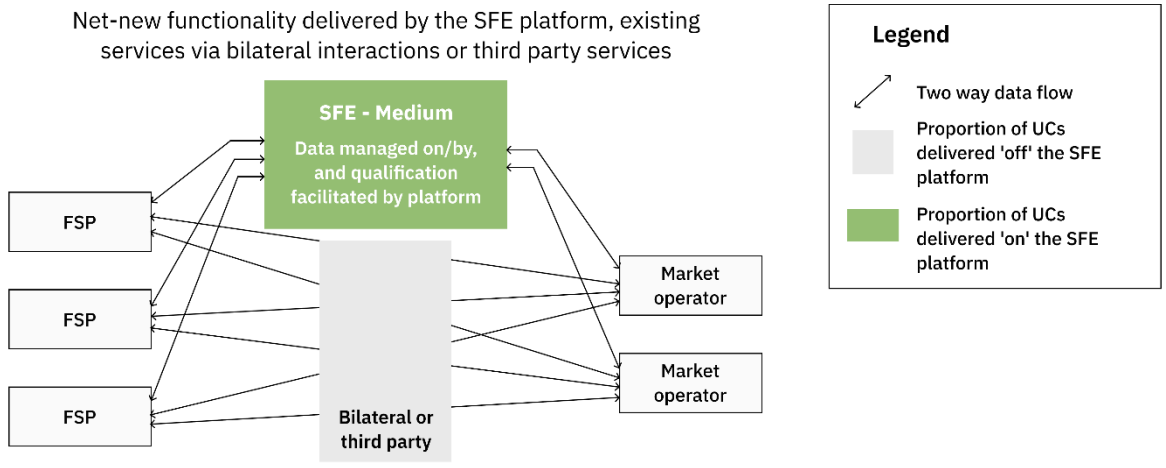


Figure 11. Medium SFE platform, new functionality delivered by SFE, existing operational services continue to be delivered bilaterally or via third party services

4.5.3.i Scope

The scope of the SFE platform in the medium archetype is described through use cases, organised into four nuanced categories detailing how those use cases should/could be delivered 'on' the SFE, or 'off' the SFE, see Table 14.

It is important to note that the use cases in categories 1, 2, 3 & 4 can be delivered in any combination of releases of the SFE (see Implementation Pathway, section 5), if they adhere to the use case technical dependency map.

Title	Use Case ID	
Maintain taxonomy	1	**Category 1** **Use Cases** that **must** be done **on** the SFE
User Registration	2	
Asset Register	3	
Product Registration	4	
Simple market participant search	36	
Feature – collect historic data and rules	F1	
Rule enablement	5	**Category 2** **Use Cases** that **if selected**, **should** be implemented **on** the SFE platform
Reporting on prices and volumes for market trends	6	
Asset value based on historic data	8	
Understand eligibility for pre-qualification	9	
Reporting on trade, dispatch and settlement for asset performance	10	
Market conflict identification	11	
Market testing of products	13	
Centralised pre-qualification	15	
Transparency of DER positions & actions	18	
Facilitate small asset participation	21	
Streamlining user rating	30	
Risk calculation	31	
External information provision (policy changes)	7	**Category 3** **Use Cases** that **if selected, could** be delivered **on or off** the SFE platform (bilateral or via a third party)
Streamlining contracts across markets and products	14	
Probabilistic products enabling small assets	20	
SO Dispatch of rationale behind asset dispatch	22	
Secondary market	25	
Change management	29	
Market monitoring	37	
Impartial route to recourse in case of dispute	38	
Visibility of current & future flexibility needs for all networks	16	
Bid strategy support	27	**Category 4** **Use Cases** that should be implemented **off** the SFE platform (bilateral or via a third party)
Asset value prediction	28	
Settlement	32	
Dispatch	33	
Auctions	35	

Table 14. Medium archetype use cases, categorised by how they could/should be delivered 'on' of 'off' the SFE platform

Category 1: Use cases that **must** be **implemented** and **must** be delivered **on the SFE platform**.

This is because these use cases:

- Provide the minimum functionality required to facilitate the interaction of FSPs and market operators through data exchange.

Category 2: Use cases that, **if selected**, **should** be implemented **on the SFE platform**. This is because these use cases:

- Reduces friction. Having the use case on the SFE platform provides easier and more equal access (Design principle 3, and Strategic Goal 2)
- Promotes cohesion. The use cases use functions and technologies that align with the core uses cases in category one (adhering to Design Principle 2), hence delivering this functionality on the SFE platform is the most logical from an architectural perspective.
- The use cases as a collective benefit from having only one provider (deliberate monopolies) (Design Principle 1).

Category 3: Use cases that, **if selected**, **could** be delivered **on the SFE platform or off SFE platform** (i.e. bilaterally or via a third party).

This is because these use cases:

- Are not particularly cohesive with the SFE as defined in category 2&3, hence can be easily delivered by other central platforms (other than the SFE platform) or done bilaterally.
- Benefit from having only one provider (deliberate monopolies) (design principle 1)
- Where having the use case on a platform provides more equal access and reduces friction (design principle 3).

For example, providing a secondary flex market (UC 25) turns the SFE from a single sided to a double-sided platform where asset owners become both buyers and sellers. This adds substantial additional functionality to the platform, so falls into category 3.

Category 4: Use cases that should be delivered **off the SFE platform**, (i.e. either bilaterally or via a third party).

This is because these use cases:

- Replace existing services (Design Principle 2), the use cases describe functionality that is currently delivered through existing bilateral or third-party mechanisms (Auction, Dispatch and Settlement),
- Make the platform less cohesive, e.g., require new architectural components that are not used by many other use cases.
- Or, describes new functionality but for reasons of culpability and impartiality it is recommended they are delivered externally to the SFE, to maintain impartiality of the

SFE.

Note that this list excludes use case 34, *Optimisation across all markets and voltage levels*, as this use case can only be implemented on a central platform (category 2) but is dependent use cases in category 4. It therefore does not belong to either category 2 or 4 as defined for the medium archetype.

4.5.3.ii Benefits

This archetype addresses all the five strategic goals of the SFE:

Strategic Goals	Alignment
Increase cross-market participation and coordination of assets	High
Simplify market access	High
Increase transparency (of market data on assets, products, current market positions and historic market performance)	High
Participants trust the market ecosystem (e.g. dispute resolution, rule enablement)	Potentially high, depends on use cases included
Increase financial viability of flexible DERs	Very Low

Figure 12. Alignment of medium SFE platform to strategic goals

This archetype is modular and flexible, individual use-cases/functions can be included on a case-by-case-basis (given the constraints of the UC dependency map) and with some there is optionality as to whether they can be delivered on or off the SFE. Hence this archetype is more adaptable to different needs/approaches.

This archetype does not replace the existing auction, dispatch, and settlement mechanisms (use cases 32-35) thereby reducing the cost, timescales, and risk of implementing the platform. Please note, this estimation excludes the effort to define the Standard Interface Model.

4.5.3.iii Downside

Given the objectives of the SFE platform, only one downside has been identified. This archetype does not support the delivery of a central cross market algorithmic optimisation mechanism (use case 34) as this is dependent on use cases in category 4.

4.5.3.iv Recommendation

This archetype can deliver the strategic goals of the SFE and is well aligned with the Design Principles. It addresses gaps in the current market without replacing services and mechanisms that exist and functional well. The potential additional benefit of the thick

archetype - the cross-market optimisation - is outweighed by its significant delivery complexity and is seen as a non-realistic option at in the medium term. Therefore, the medium archetype is the recommended option.

It should be noted that additional functionality could be added to the platform later without impacting the functionality provided in the medium archetype to deliver the currently identified use cases; this can therefore be seen as a low-regret option should a more complete platform be pursued in future.

4.6 Options

For some use cases we have identified optionality. This section considers the noteworthy functional and architectural options.

Two use cases have been identified where **different functional options** (of note) exist:

- Market conflict identification (UC 11)
- Centralised pre-qualification (UC 15)

Six use cases have been identified where there are **different architectural options** (of note) listed below. The details and considerations of those architectural options are discussed the Architectural Options section 4.6.2.

- Asset registration (UC 3)
- Product registration (UC 4)
- Reporting on prices and volumes for market trends (UC 6)
- Reporting on trade, dispatch and settlement for asset performance (UC 10)
- Asset value based on historic data (UC 8)
- Optimisation across all markets and voltage levels (UC 34)

4.6.1 Functional Options

4.6.1.i Market Conflict Identification (UC11)

The objective of the market conflict functionality is to identify operational conflicts (e.g. bids and dispatch), in a close to real-time basis. This would require the implementation of a rules engine to process complex rules.

Conflicts in pre-qualification are not discussed in this section, as they are a different, simpler type of conflict with a non-real-time requirement.

Market conflict identification requires rules to be defined that link products to each other, these could for example include:

- If an asset has been **bid** for product A, then it cannot also bid for product B for the same (or an overlapping) time.
- If an asset has been **dispatched** to service product X, then it cannot be dispatched to service product Y at the same time.

These rules can be implemented to identify the conflict before proactively (before the event), or reactively (after the event):

- **Proactive**: Alerting participants to a potential conflict **before** it happens so participants can prevent it occurring.
- **Reactive:** Alerting participants to a conflict that is identified **after** the bid has been accepted or the dispatch signal has been sent.

The interaction diagrams below show the market participants as vertical lines and the interactions between them as arrows that flow from the initiating party to the party that receives a request, data, or some other event. Sometimes interactions are **direct or indirect**, depending on the scenario.

Bold vertical line show that there is some processing that happens because of receiving an event that directly results in triggering another.

Bid Conflicts

We have outlined three options for identifying **bid** conflicts. The underlying premise is that all bids are sent to the platform and each one is checked against the bids that are already registered.

In ***proactive (direct to platform***) (Figure 13) the bid is sent by the FSP to the SFE platform, where it is validated. The validation result is sent to the Market Operator, who in turn informs the FSP whether the bid has been accepted or not. Note there could be reasons, other than a conflict, why a bid is not accepted.

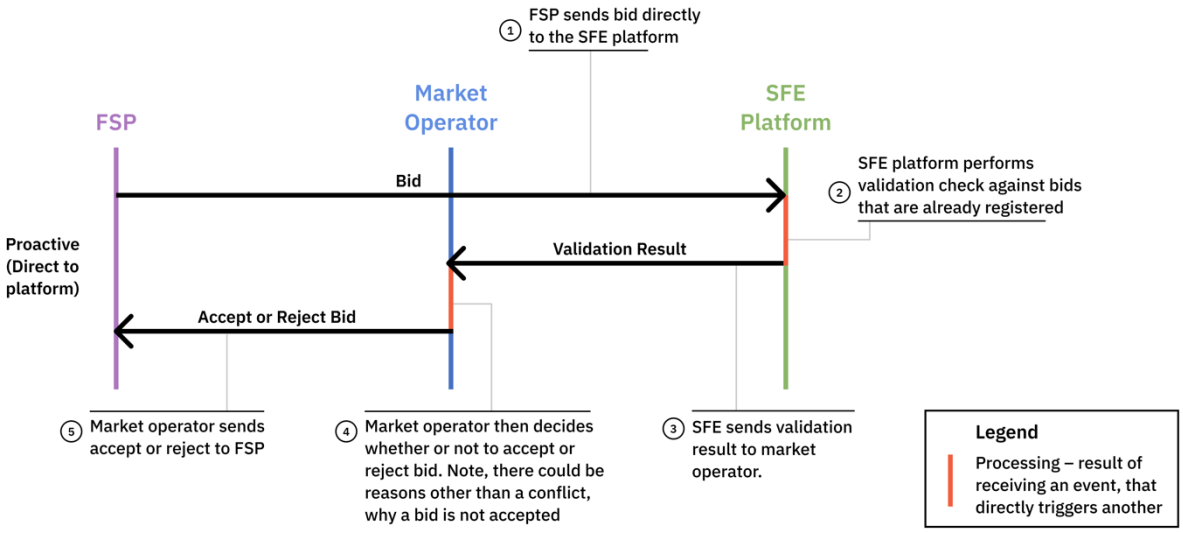


Figure 13: Bid conflict – proactive (direct to platform)

In ***proactive (indirect via Market Operator)*** (Figure 14) the bid is sent by the FSP to the Market Operator, who then sends a validation request to the SFE platform and responds to the FSP (with optional processing to check for other reasons for rejection).

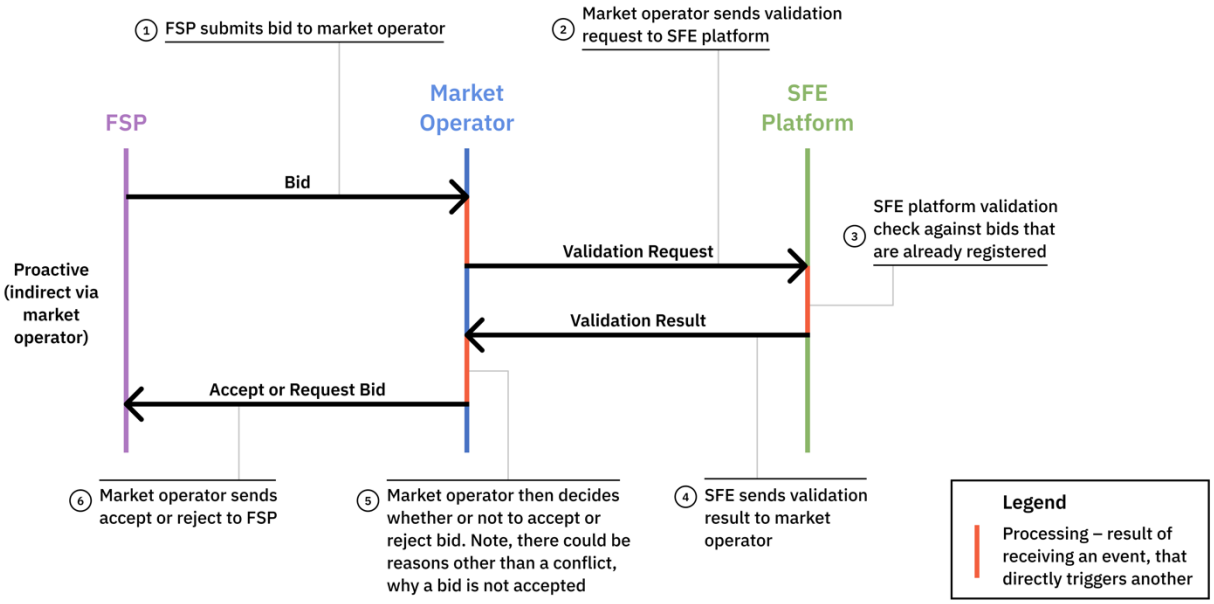


Figure 14: Bid conflict – proactive (indirect via market operator)

Please note: Both of these options have potential variants (e.g. the validation result could be sent directly or in parallel to the asset owner)

In the **reactive** scenario (Figure 15) the bid and a copy of it are sent to the Market Operator and the Platform in parallel. The platform performs checks for conflicts and alerts both parties in parallel when one is identified. They can then resolve the matter bilaterally.

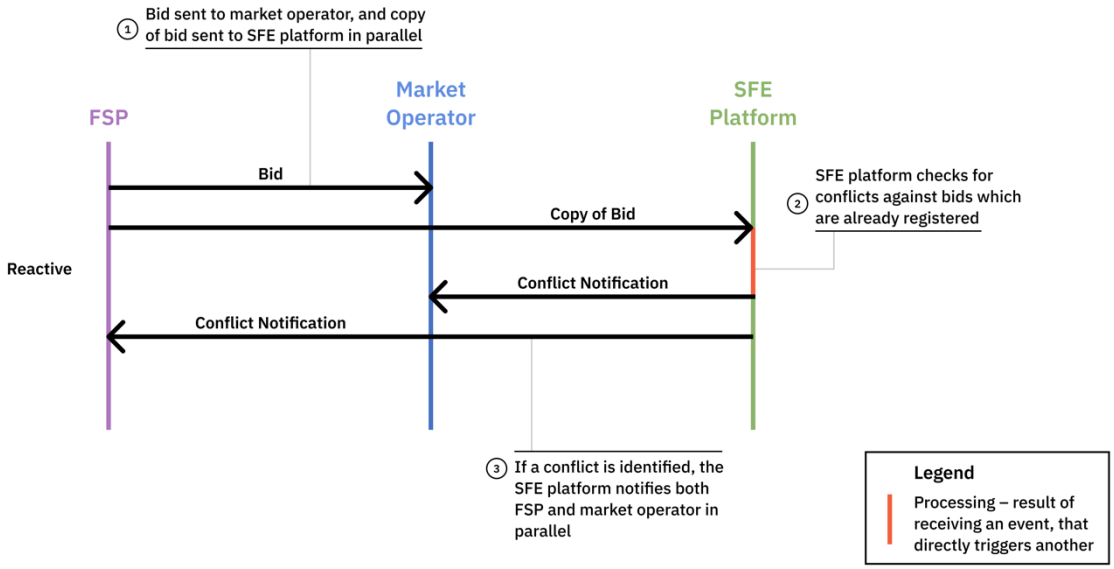


Figure 15: Bid conflict – reactive

Both ‘Proactive’ scenarios can increase liquidity as the FSP has direct feedback and has time to consider other options.

Dispatch Conflicts

The diagrams below outline two options for **dispatch** conflict identification.

In **proactive** (Figure 16), the FSP sends a dispatch validation request to the platform. Only once this has come back positive the market operator can issue the dispatch issued to the FSP.

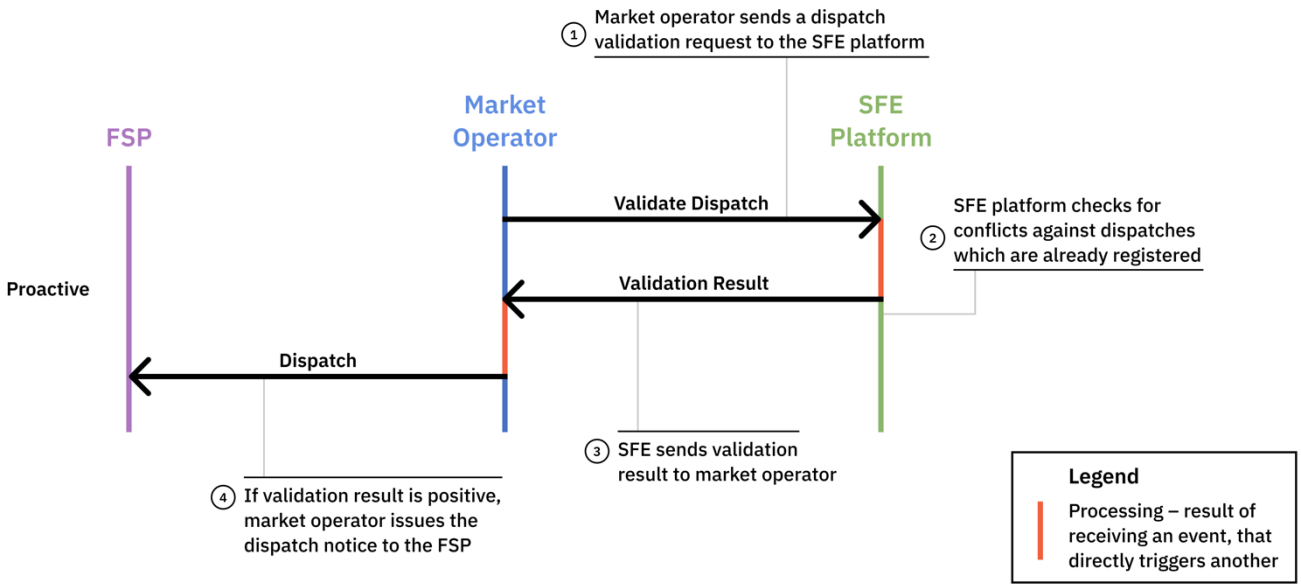


Figure 16: Dispatch conflict - proactive

In **reactive** (Figure 17), the market operator sends a dispatch notification directly to the FSP and a copy to the SFE platform. The platform performs checks and notifies Market Operators of a conflict which would be resolved bilaterally.

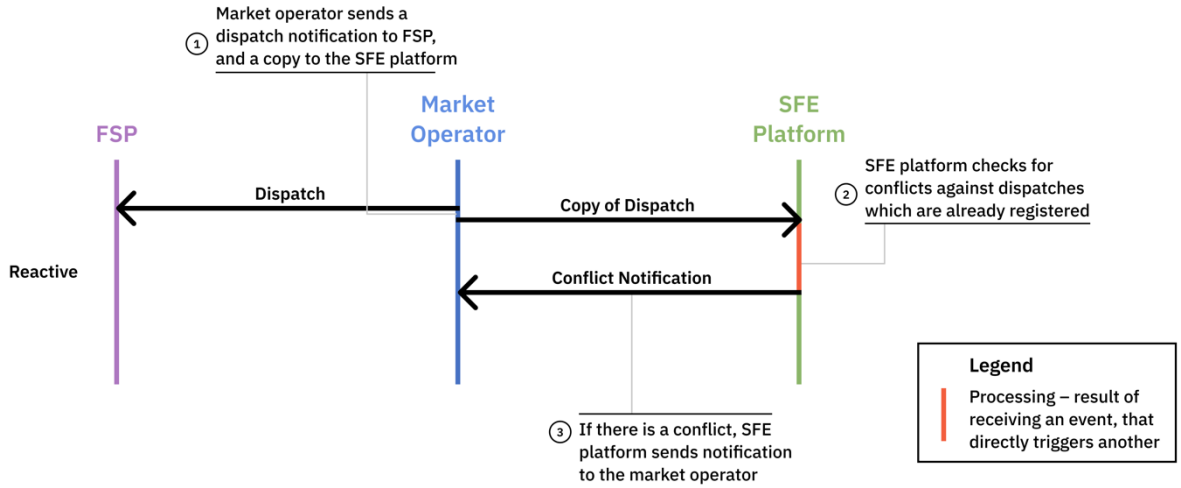


Figure 17: Dispatch conflict - reactive

Event driven vs schedule driven triggers

In all five scenarios outlined above the validation process could be triggered:

a. By an event (e.g. a bid or dispatch was received) or
b. Based on a predefined schedule.

Event-triggered validation would allow more timely responses of the SFE platform and enable a more dynamic market, but it would increase the cost as it uses more processing power and IT Resources.

Schedule based validation is more efficient, as it bundles up similar action into a batch process, which creates less cost. However, it does introduce a time delay. Both create different market dynamics and offer different analytics use cases.

Market conflict identification requires the SFE platform to alert parties to conflicts in a timely fashion. Therefore, we propose to use an event driven architecture for this using event streaming technology. Event-streaming services like Apache Kafka and Confluent publish streams of events to a broker. Consumers of event-streaming platforms can access each stream and consume their preferred events, and those events are then retained by the broker. This blog[6] discusses event driven architecture and event streaming in more detail.

Considerations

Challenges and opportunities of 'proactive' scenarios

In all "proactive" scenarios the bids/dispatch orders would be processed by the SFE platform in the order in which they were received (first in first out). If a submitted bid/dispatch order creates a conflict with a previously registered one, the market operators would be informed of the clash so the product owners could decide what to do based on market rules, then notify any FSPs as necessary.

Because the first bid/dispatch originally got a positive validation back (as there was no conflict at the time) the market operator might already have accepted the bid/sent the dispatch signal. Changing the acceptance status might not be possible and could create costs for the market operator.

Timing risk

For either dispatch or bids, the "Proactive" scenario options suffer from a timing risk when two validations are performed roughly at the same time (Figure 18). This would require careful transaction management form an IT service perspective.

[6] https://www.ibm.com/cloud/blog/event-driven-architecture-vs-event-streaming

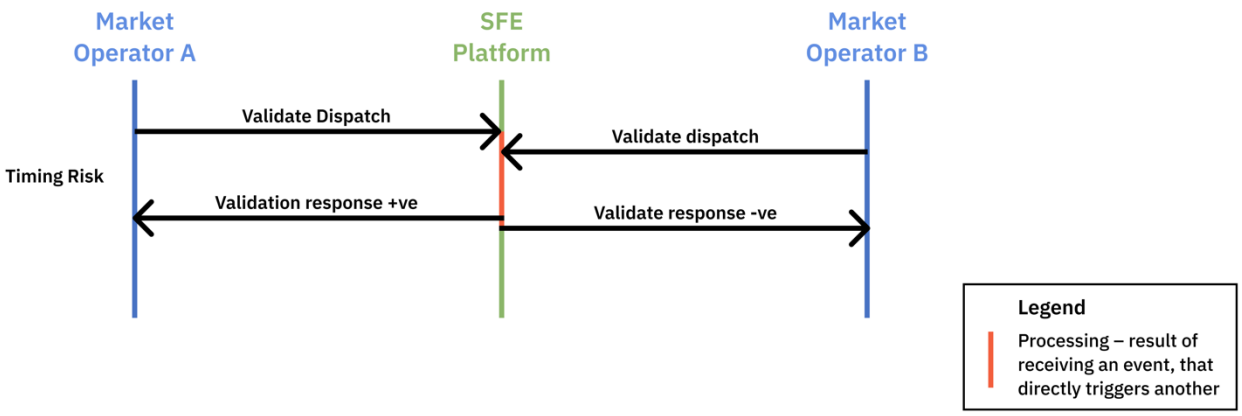


Figure 18: Timing risk in proactive conflict identification scenarios

Defining market rules

Market conflict identification will also require access to a rules engine to evaluate bids and dispatch notifications. Rules engines are considered mature technology but the inclusion thereof in the platform will add complexity, this should be considered when prioritising this use case.

Note: It is not clear who will identify and define the rules that govern these product dependencies rules (used by the rules engine) as they are likely to require multiple Market Operators to understand each other's products and agree the dependencies.

4.6.1.ii Centralised Pre-Qualification (UC 15)

The goal of the pre-qualification (UC 15) is to enable FSPs to enter data that is common to the pre-qualification processes for many products in one place.

The benefits include:

- Reducing admin burden and repetition. Achieved by enabling a FSP to pre-qualify an asset for a different product (if it is already qualified for at least one other product)
- Increasing market liquidity. By providing easier access to markets by enabling users to see if qualified for this product, notifying them of which other potential products they could also be eligible for, increasing market liquidity.
- Transparency of conflicting products.

Optionality exists around the extent of which pre-qualification is done on the SFE. Pre-qualification is often a multi-step process, including data submission on asset specification, IT requirements, testing requirements and metering requirements. It is unlikely that the complete pre-qualification process for all products can be completed on a platform that is outside of the MOs control (e.g. testing). The degree to which this use case is delivered on the SFE platform requires further investigation.

4.6.2 Architectural Options

4.6.2.i Product/Asset Data Exchange and Storage

The sections below describe the pros and cons for a set asset and product related data exchange patterns (relating to UCs 3 & 4, respectively).

Note: all options assume that users themselves are, where necessary, registered on the platform and that registered user data is securely maintained centrally on the platform.

As stated in the Design Principles Section, the underlying assumption behind asset and product data exchange is that this is done in a standard format, the benefits of standardisation are central to the value that the SFE platform can add to the flexibility market, the exact implementation options, described below, are somewhat secondary to agreeing this standardised model.

Table 15 and Figure 19 below show different storage and access options for product and asset data:

Option	Product Data	Asset Data
1	**Centralised - Store data in platform** in a standard form via: a. A web UI (done manually) b. an API (this requires the product owner to have a standard model) c. Store data in platform in a standard the product owner could have a real time transformation mechanism that replicates any changes made to asset data via an API to a central store (seems unlikely).	**Centralised - Store data in platform** in a standard form via: a. A web UI (done manually) b. an API (this requires the product owner to have a standard model) c. Store data in platform in a standard the product owner could have a real time transformation mechanism that replicates any changes made to asset data via an API to a central store (seems unlikely).
2	**Decentralised** - Access data **via an API** on an **as-needed** basis, requiring the product owner to have: a. data in a standard form (which could be translated by humans or machines) b. a real time translation facility.	**Decentralised** - Access data **via an API** on an **as-needed** basis, requiring the product owner to have: a. data in a standard form (which could be translated by humans or machines) b. a real time translation facility.
3	**Decentralised** - Access data **via distributed data access mechanism** that uses remote data access technology, rather than APIs, that needs to be implemented by all participants.	**Decentralised** - Access data **via distributed data access mechanism** that uses remote data access technology, rather than APIs, that needs to be implemented by all participants.
4	**Quasi-Centralised** - Retrieve product data from an **external (central) repository**. We are not aware of any initiative to develop a central flex product repository and have thus not considered this further.	**Quasi-Centralised -** Retrieve asset data from an **external (central) repository** such as the Central Asset Register (CAR) initiative. This could replicate the patterns of options 1, 2 & 3, only one option is shown.

Table 15: Data exchange and storage options for product and asset data.

The following options have identified but not considered in detail:

- Automated transformation to a standard format on the SFE side of the interface. This would allow each data provider to submit data in the format that they prefer, using a provider specific API, and then transform the data centrally. This was discounted as it would significantly increase the cost of the platform and would provide data providers with only limited savings as they would have to work closely with the platform provider to specify the API and transformation.

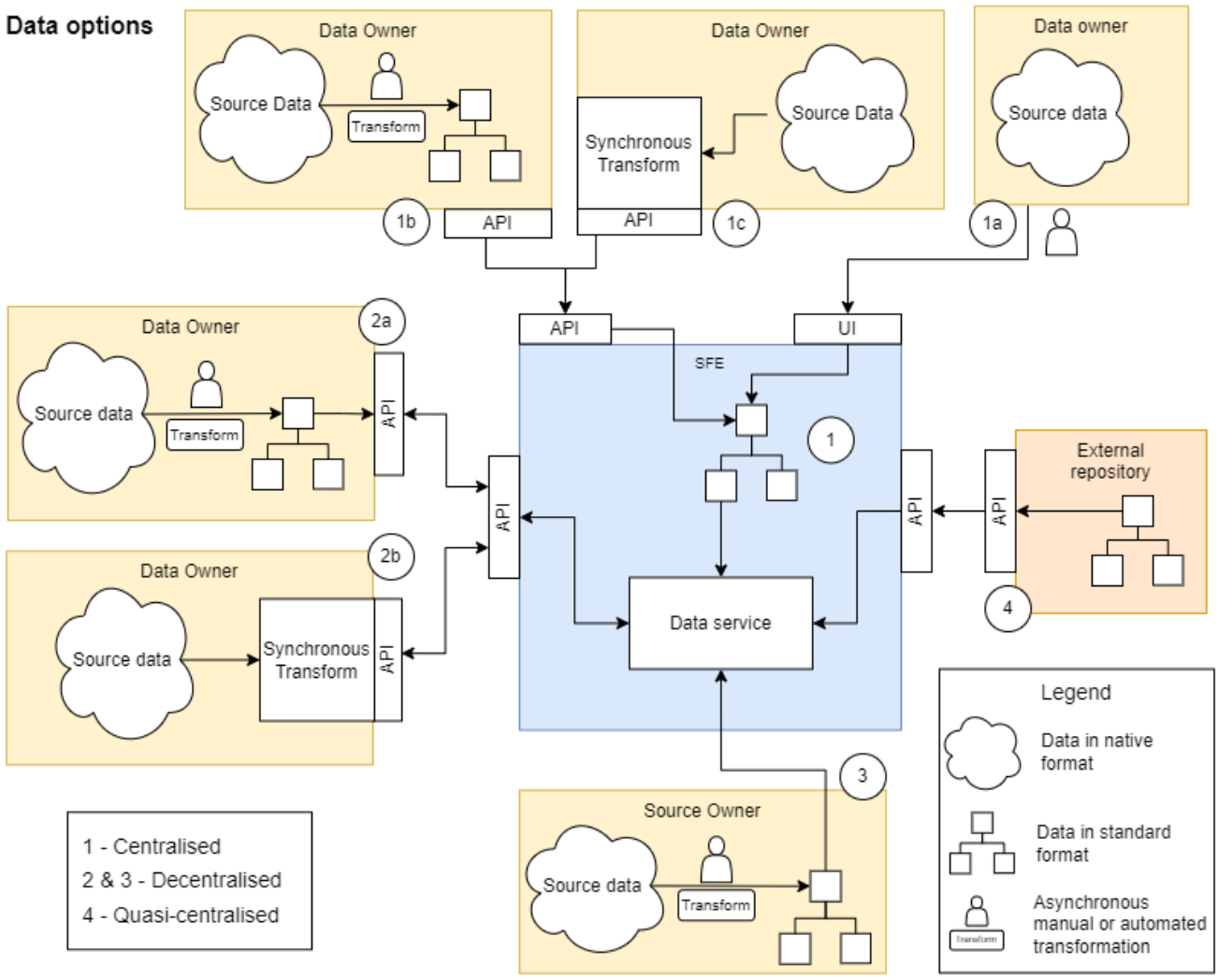


Figure 19: Data exchange and storage options for product and asset data

Option Considerations

This section discusses common considerations for the options outlined above. It includes consideration of the CIA principles, Confidentiality, Integrity, and Availability.

Option 1 – Data stored on the platform

Storing data centrally has the following **benefits**:

- It allows data to be entered manually (1a); this may lower the entry barrier to smaller flexibility providers.
- It makes the data easy to search.
- It does not rely on external systems and networks to be available when the data needs to be accessed.

The **downsides** are that:

- A copy of the data is stored and needs to be maintained. This could lead to data integrity issues if there is a time gap between updating the source and the replica.
- Increase in storage requirements for the platform but is unlikely to be material, especially for products. Even for assets, the storage requirements are not likely to become substantial proportion of the over-all cost of operating the SFE platform.
- Please note that all options would require protection of data confidentiality. This can be done effectively in all the options, though data providers may have to be convinced that they can trust the central platform's security controls if data is to be stored centrally.

Sub-options 1a, 1b and 1c could potentially co-exist without too much additional expense as the UI could be built on top of the API.

Option 2 – Data accesses via distributed access mechanism (decentralised)

Providing data on an as-needed basis by an API relies on data being accessed on the owning system via an API call and has the following **benefits**:

- Data does not have to be stored centrally, reducing the need for data storage technology (e.g. database).
- Duplication can be avoided, saving on storage volumes, and avoiding possibly integrity issues are there is only a single source of truth.

Downsides are:

- Unless data providers either store data locally in the standard format or the provider has an automated transformation capability, the data owner will have to maintain a separate copy of the data, which negates some of the benefits of this option over Option 1 and just moves the problem from the platform to the data providers and increases the

entry barrier. This can be mitigated by providing and open-source data maintenance app that provide a standard format compliant API.
- Data owners that do not have their data in a structured format will need to invest in a system to capture and store their data in a structured format.
- Data access is dependant data owner system availability; this option requires all participating systems to be available and connected when the data is required.

Option 3 – Data accesses via distributed access mechanism

There are federated data technologies (GaianDB[7] or remote SQL that could be used to access data remotely as needed.
This would require data providers to store data in a compatible technology in the standard format and the remote systems need to have acceptable availability and performance characteristics.
This option is not recommended as the above constraint is unreasonable in a heterogenous ecosystem such as the flexibility market and it provides fewer options for validating data and thus poses a data quality risk.

Option 4 – External repositories (quasi-centralised)

Accessing data in external repositories provides an attractive alternative where these exist or are likely to be created in a similar timeframe to the SFE platform.

The key **benefit** is:

- It would reduce duplication and would give the platform a head-start by accessing data that has already been collected.

This option has the following challenges and **downsides**:
- All the attributes required by the SFE platform need to be stored in the external register (or augmented via additional mechanisms)
- Data will have to be in an agreed standard format in the external repository.
- Data quality enforced by the external register will need to meet the SFE platform requirements or the SFE platform will need to perform secondary data quality check and validations.
- The external register will need to meet the SFE platform's availability and performance requirements.
- The external repositories may not be available in time (or at all), their development roadmap could constrain that of the SFE platform. The Automatic Asset Registration (AAR) Programme[8] is currently in early stage.

[7] https://github.com/gaiandb/gaiandb
[8] https://www.gov.uk/government/publications/automatic-asset-registration-aar-programme

Please note that all options would require protection of data confidentiality. This can be done effectively in all the options, though data providers may have to be convinced that they can trust the external repository's security controls if data is to be stored externally.

Recommendations

Product Data

For product data, there is stronger argument for central storage in a standard form (Option 1). The expectation is that this would be delivered through an API (Option 1b).

The core objective of the SFE platform is to increase liquidity, by making it easier for FSPs to engage and find the right products and quantify the value that they can generate for them. Hence there is a clear advantage for having a central product repository and a standard format to enable fast and easy searching for prospective and existing FSPs to find and compare products, access product dependencies, and calculate the value that they can deliver. The case is strengthened by the asymmetry of the flexibility market – i.e. there are many more potential FSPs (thousands) than there are product owners (seven - ESO plus six DSOs, and potentially some other MOs).

Furthermore, providing a secondary flex market (UC25) on the platform would strengthen the argument for storing product related data on the platform along with a minimum of asset related data that would ensure that only qualified assets are offered to take on secondary flexibility commitments.

A secondary flexibility market would require trades that are offered to be accessible on the platform. This is a new, time critical data service that requires search functionality so that asset owners can quickly find and respond to secondary trade offers. This makes on platform storage of secondary trades the preferable solution, strengthening the argument for centralisation.

In conclusion, if any use cases making use of product data (e.g. UC5, 9, 11, 20, 25) are delivered, it strengthens the argument for centralisation of product data.

Asset Data

For asset data, there is no significant differentiator between centralised (options 1&4) or decentralised (options 2&3) models. The case for storing asset data centrally is weaker than it is for product data, as we assume that it will be predominantly asset owners and operators or their proxies (typically aggregators) that will search for matching products, rather than market operators searching for assets. Should the latter become a requirement then a central asset data repository (either internal or external to the SFE platform) will become more important.

Asset owners may be reticent to have their asset data stored on an external or central platform, this would have to be mitigated by building sufficient trust in the platform, both from an IT security and a platform governance perspective.

The inclusion of any use cases that make use of asset data (e.g. UC 13, 18, 21, 25, 30), it strengthens the argument to store asset data centrally.

The SFE platform could implement a combination of these mechanisms, some data can be stored centrally and some decentralised, though this would increase the cost and complexity of the platform.

4.6.2.ii Historical Data

This option is related to the following use cases and features:

- Historical Data Collection (UC6, 10, Feature 1)
- Asset Value based on Historic Data (UC 8)

One of the key features of the SFE platform is to provide access to historical trade data that is currently spread amongst Market Operators and settlement service providers (such as Elexon and Piclo). This option analysis differs from that covered *Data exchange and storage* section in that this is a one-way flow of data from the data providers to the platform and that there are relatively few data providers (when compared to the number of flexibility providers).

Format Options

This historic data can be consolidated into a single data warehouse or data lake on the platform or accessed via API calls to the data holders. The trade-offs for this option are similar to those of asset and product data storage. Furthermore, the data can be provided in source format or in a standardised format:

- **Standard format**: An agreed format for all historic data that is common across all data providers and uses a common structure and glossary.
- **Source format**: Data is provided in a format defined by the data provider (typically the format that the store the data in or in a format of existing data sharing mechanisms), There is still an expectation that the metadata, which describes the published data, is also published.

The following tables contrast these options, the first one identifies key differences between the standard format and source format options.

	Data Format Options	
	Standard Format	**Source Format**
Transformation	Done once, either by platform or data provider	Specific to requirement done by data scientist or report author
Purpose of data use	Predetermined to some extent	Determined at point of use
Users	Must understand standard format	Must understand format from all providers

Table 16: Data format options for historic data

Storage Options

The following table identifies key differences between storage options:

- **Local in platform (centralised):** means a copy of the data is stored in the platform. It can get there by several mechanisms including APIs and file transfer; the data can be in standard or source format. This is like option 1b in the *Data Exchange and Storage* section.
- **Data provider (decentralised):** Data is provided by the data provider via an API and is accessed on an as-needed basis. This is like option 2 in the *Data Exchange and Storage* section.

	Storage Options	
	Local in platform (centralised)	**Data provider (decentralised)**
Access	Data base access	APIs or distributed data base access. Latter requires all providers to implement compatible distributed technology
Speed of data access	Determined by platform design and capacity	Determined by data provider's systems and network connection
Data availability	Determined by availability characteristics of the platform	Determined by availability of the data provider's platform, that of all required systems and the network connecting them.
Storage	Data is duplicated	Data stored only once (though provider may make a copy to isolate their systems from performance impact and / or security considerations)

Table 17: Data storage options for historical data

Recommendations

We are currently leaning towards **storing the historic data in the platform** for the following reasons:

- Having direct access to a data store increases the number of tools that can be selected from to deliver data reporting and analysis.
- Does not require reporting and analytics tools to access multiple APIs or the provision of a data service that provides a virtualised single view of multiple APIs.
- Is not dependent on data provider system availability at the time of running report or analysis.

These benefits look likely to outweigh the additional storage costs that the 'in platform storage' option would incur, though this cost has not been estimated and needs further investigation.

We are also leaning towards presenting data in a **standard format**. This will provide better transparency across market silos, reduce the effort to create reports and analytics (thereby improving 'data democracy') and decouple analytics availability and performance from that provided by the systems of data providers.

The transformation into the standard format can be done by the data provider or in the platform.

- The benefits of the data provider implementing the transformation is that they understand their own data and are therefore better placed to define the transformation rules that will govern the process. This also protects the platform from changes that data providers make to their data formats.
- Implementing the transformation in the platform has the benefit of economies-of-scale, a single transformation engine and team can define, implement, and manage the transformations.

This is a finely balanced argument; we are currently leaning towards the former option.

There is the option of presenting the data both in its source format and in a standard format, this increases storage requirements but provides experienced data scientists the option of using the original, pre-transformation, data that may suit their needs better. The structured nature of the market suggests the translation from source to standard data is likely to be smaller changes which should not substantially limit a data scientist's ability to undertake bespoke analysis. Therefore, our current view is that this limited benefit, of additionally presenting the source data, is outweighed by the costs and complexity of providing two options.

4.6.2.iii Whole Market Optimisation

Whole market optimisation across all voltage levels via a central algorithm (UC 34) is special case in that if implemented it would be done on the SFE platform but is dependent on use cases in category 4 (auction, UC 35 and dispatch, UC 33).

This use case has the following challenges:

- Very high mathematical and computational complexity
- Too time intensive and would therefore not actually achieve the best result
- Bias – which objective(s) should be optimised for and how should they be weighed?
- Governance – who decides on the objectives and limitations to be included?
- Would invariably influence the market due to the issues listed above.

We have therefore not assessed this further.

4.6.2.iv Distributed Ledger Technology

Distributed Ledger Technology (DLT), usually implemented as a blockchain, is a model that overlaps with some of the challenges the SFE is addressing. The key problems that DLT solves are distributing data amongst a range of participants, providing each with a copy of data relevant to them and addressing a lack of trust between participants.

This is useful for tracking *things* through their lifecycle (say food[9] or containers & freight[10]) as well as managing transactions (e.g. equigy[11]). The latter would be a potential solution for handling the auction / bidding / proof of fulfilment / payment cycle.

As we are recommending the medium archetype, where services which are most applicable to DLT (such as auctions, settlement etc) will be delivered 'off' the SFE platform, and the role the SFE will play is a central trusted one, the most important benefits of DLT are negated.

In summary, DLT is a good solution for providing data visibility and transactional integrity in the absence of a central trusted entity. Given the SFE platform's central role, DLT has been discounted. Our focus is to couple the markets and provide transparency of DER positions and actions across multiple markets to enable revenue stacking, hence gravitating towards a centralised register.

[9] https://www.ibm.com/uk-en/blockchain/solutions/food-trust
[10] https://www.tradelens.com/
[11] https://equigy.com/the-platform/

4.7 Business Capabilities

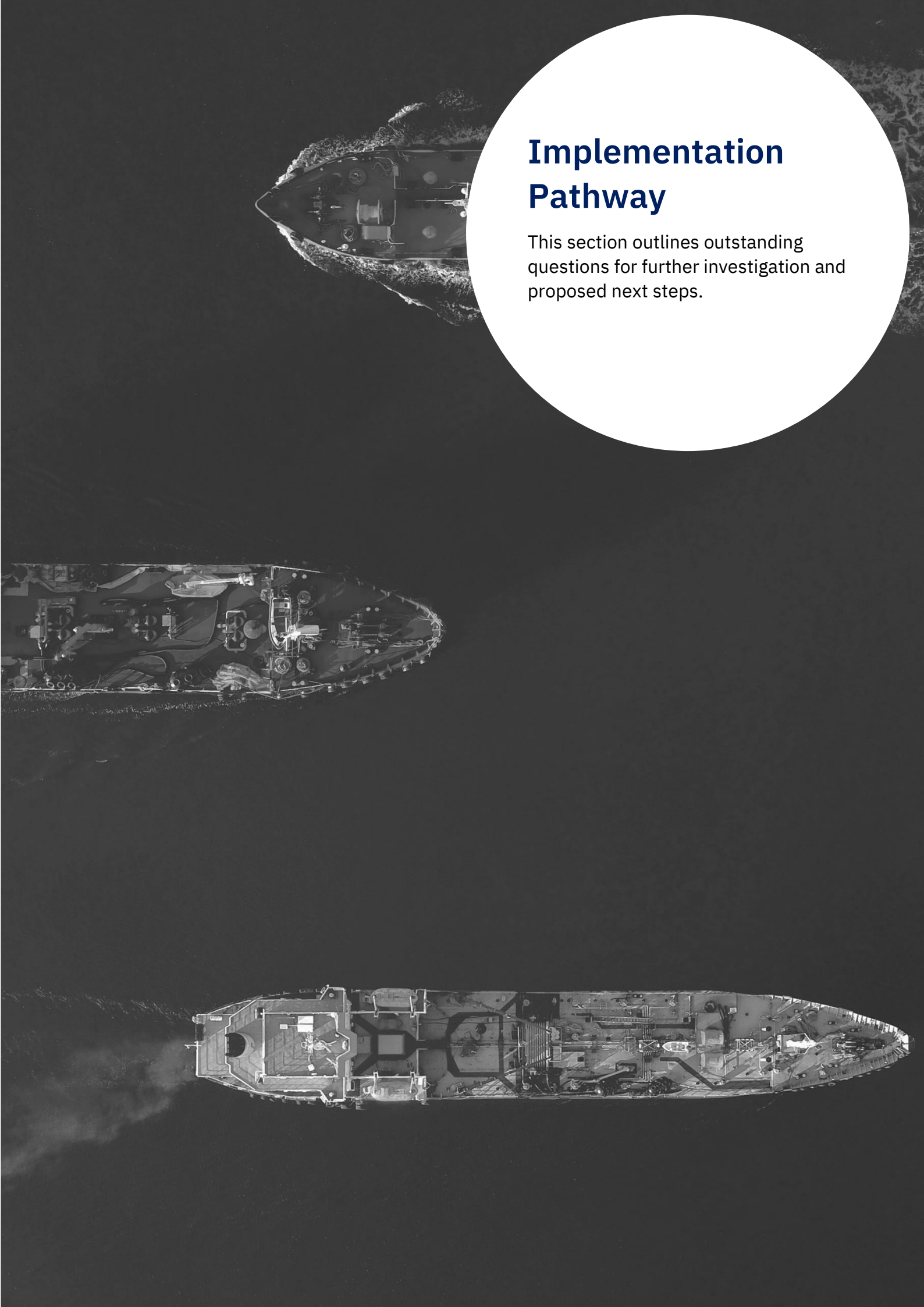
When implementing complex digital infrastructure (like the SFE), it is essential to consider both the wider business capabilities required to deliver it, as the actual technology. IBM's component business model (CBM) offers a way to view all business components of an organisation in one place. CBMs can be used to get an overview and can serve as the basis for heat maps or to redefine a competitive position in the face of the sweeping changes in the industry.

The purpose of this CBM (Figure 20) is to describe the business functions and capabilities required to operate the SFE. IBM used existing utility market standard capability model templates as a reference (predominantly columns 3, 4, 5 and 6) and then both added (predominantly columns 1 and 2) and amended it to address the SFE specific requirements. A description of each business component is provided in Appendix C – Business Model Component Descriptions.

Similarly, there are key typical technical components that will be required to deliver the SFE, a diagram of these components can be found in Appendix B – Logical Architecture.

	Flex Market Operations	Market Administration	Strategy & Regulation	Business Services	Finance, HR, and Administration	Digital & Technology Services
A. Strategy & Direct	Flex Market Policies and Procedures	Consultation Standards, Policies and Procedures	Regulatory Strategy	Business Support Services Planning	Corporate Governance	IT Architecture
		Market Administration Standards, Policies and Procedures	Business Strategy		Policies and Procedures	IT Strategy
		Marketing Strategy	Operational Strategy and Planning			Management of Data & Information
B. Manage & Monitor	Market Governance Arrangements	Market Monitoring	Market Compliance	Risk Management	HR Services	IT Project Management
	Secondary Market Administration	Market Administration Performance Management	Risk Management	Business Performance Management	Management Accounting	IT Architecture Review
		Customer Registration Management	Regulatory Compliance	Business Change	Facilities Management and Maintenance	Digital Risk & Security
		Dispute Resolution		Business Resilience	Revenue Forecasting	Systems Support
		Marketing Campaigns		Audit & Assurance		Data Standards
						Vendor & Commercial Management
						Data and Information Governance
						Analytics and Reporting
C. Execute & Deliver	Market Compliance	Market Consultation	Strategy Development	Business Support Execution	Procurement	IT Production Support
	Secondary Market Operation	Market Participant Registration	Regulatory Interaction		Workforce Administration	IT Project Delivery
		Market Participant Invoicing/Payment	Regulatory Reporting		Business Administration	Data Ownership & Control
		Market Promotion			Financial Accounting	Data Collection, Processing and Validation
						Data Science
						Reporting and Publishing

Figure 20: Component Business Model (CBM) analysis



Implementation Pathway

This section outlines outstanding questions for further investigation and proposed next steps.

5 Implementation Pathway

5.1 Potential Delivery Approach

When moving into the delivery of the SFE, IBM recommends continuing a scaled-agile methodology as defined by the IBM Garage methodology, with implementation delivered through a series of releases.

The minimum viable product (MVP) would need to include at a minimum all the use cases assigned to Category 1, as these use cases provide the minimum functionality required deliver a SFE platform that makes a significant stride towards achieving the SFE objectives:

- Maintain taxonomy (UC 1)
- User registration (UC 2)
- Asset registration (UC 3)
- Product registration (UC 4)
- Simple market participant search (UC 36)

In addition, any use cases from categories 2 and 3 could also be included in a MVP. When determining any additional MVP scope, this needs to be a decision based on qualitative assessments of **value** (i.e. to what extent do then UCs deliver the strategic goals), the **effort** to deliver (i.e. how much business analysis, architecture build, delivery), see section Use Cases, then through the lens view of the enablers, and the technical dependency on other use cases.

Subsequent releases would contain use cases from categories 2&3, driven by the same decision-making processes just described, i.e. their value.

Once an initial decision of MVP scope has been decided, the next activities could be:

a. Identify which assets / products to introduce first

b. Evolving the use cases with feedback from the Call for Input

c. Creating user stories and UI wireframes to explore key functionality in more detail

d. Small technical Proof of Concept around data collection from MOs. Our architectural recommendations lean towards centralisation of product data; hence MOs were selected for the PoC.

5.2 Areas for Further Investigation

IBM has identified the following areas for further investigation, which have been posed as follow-on questions to this work.

1. What involvement and effort (time and cost) required from wider industry to make the SFE successful? What is required to develop the enablers?

Involvement would specifically be required for:

- Definition of the standard interface model for data (for products and assets) and the underlying taxonomy
- Identification and definition of rules that govern product dependencies rules to enable increase cross-market participation of DERs.
- For both examples:
  - Where does the underlying responsibility sit for the governance?
  - What is the requirement for IT infrastructure and data transformation processes?

2. What other industry wide initiatives could have an impact on the SFE platform?

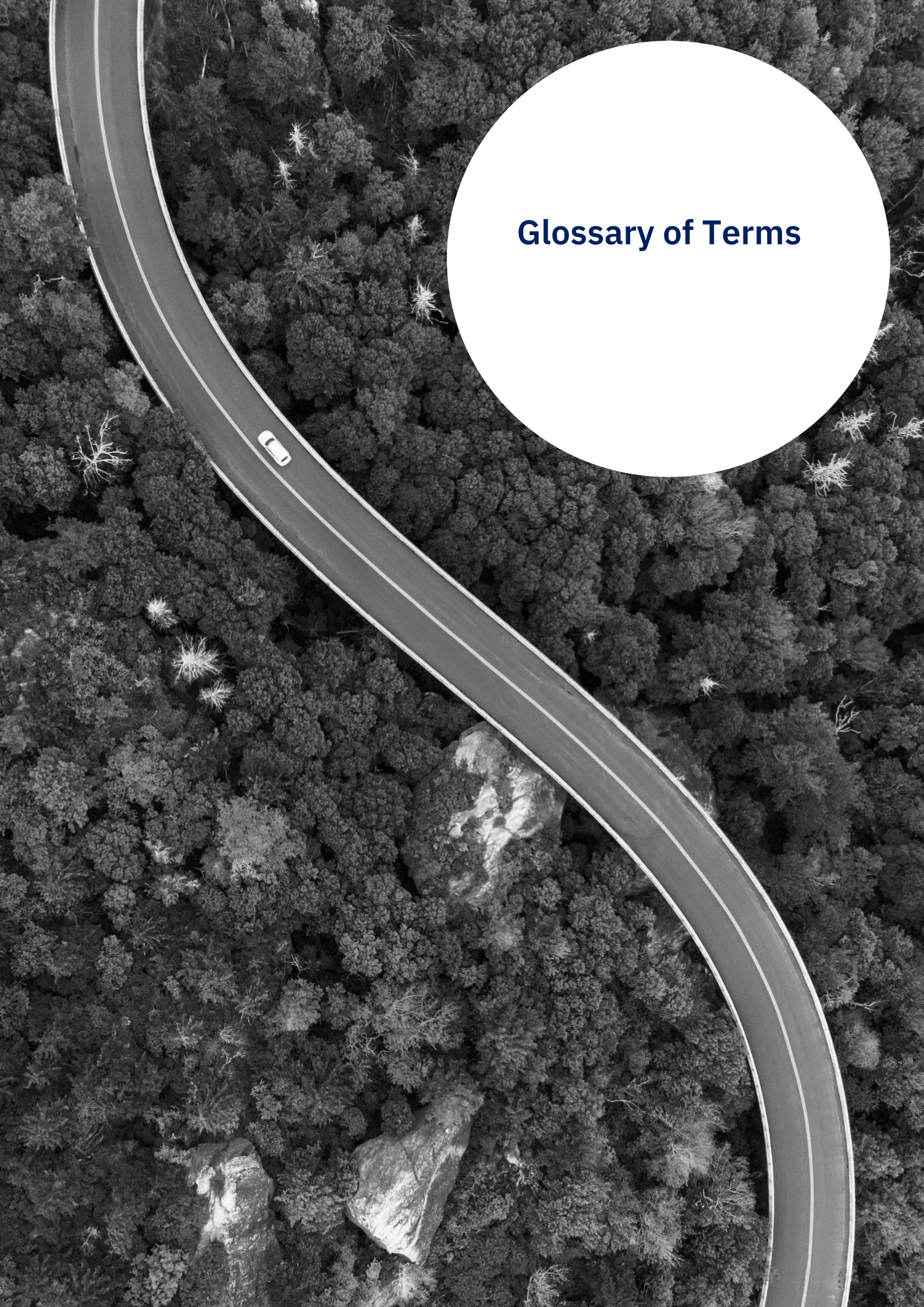
How can duplication be avoided, enabling linkages formed and collaboration be cultivated where appropriate?

3. What are the implications on cyber security?

Cyber security considerations were out of scope for this engagement, and a full examination of security implications and subsequent requirements of the SFE platform will need to be investigated fully.

4. What are the business capabilities required for an organisation to manage the SFE platform?

As part of this engagement, IBM has proposed some initial business capabilities necessary for the organisation that would set up and manage the SFE platform (based on industry standard templates and frameworks). A deeper analysis of the types of capabilities is needed.



Glossary of Terms

6 Glossary of Terms

Term	Definition
AOD	Architecture Overview Diagram - This artifact provides an overview of the main conceptual elements and relationships of an architecture, which might include candidate subsystems, components, nodes, connections, data stores, users, and external systems. As such, it represents the governing ideas and candidate building blocks of the architecture.
CBM	Component Business Model – an IBM proprietary business modelling technique.
Data lake	A data lake is a centralised repository for managing extremely large data volumes. It serves as a foundation for collecting and analysing structured, semi-structured, and unstructured data in its native format to drive new insights, better predictions, and improved optimisation. Unlike traditional data warehouses, data lakes can process video, audio, logs, texts, social media, sensor data and documents to power apps, analytics, and AI.
Data warehouse	A data warehouse, or enterprise data warehouse (EDW), is a system that aggregates data from different sources into a single, central, consistent data store to support data analysis, data mining, artificial intelligence (AI), and machine learning. A data warehouse system enables an organisation to run powerful analytics on huge volumes (petabytes and petabytes) of historical data in ways that a standard database cannot.
FSP	Flexibility Service Provider is an umbrella term to cover entities that provide flexibility such as the asset owners, asset operators and aggregators.
Market Participants	Systems, users that all interact with each other in the flexibility market and will thus interact with the SFE platform.
MO	Market Operator is a collective term for system operators, product owners, buyers of flex.
Pain Point	Pain points are specific problems faced by market participants.
Platform Operator	The Platform Operator is the organisation or entity that will operate the SFE platform.
Standard Interface Model	Establishes the structure of data elements (i.e. asset and product definition data), relationships among them and specifies the interactions. It takes the elements of conceptual data modelling (i.e. a taxonomy) a step further by adding more information to them.
System Context	The System Context work product represents the entire system as a single object or process and identifies the interfaces between the system and external entities.
Technical Architecture	The Technical Architecture is a description of the technical solution. It provides an overview of the anticipated software and hardware platform(s) required to run the proposed business solution, as well as a consolidated view of the requirements focused on these technical elements.
Use Case	This artifact captures the system behaviour to yield an observable result of value to those who interact with the system.

Table 18: Glossary of terms

7 Appendices

The appendices document contains the following:

Appendix A – Use Case Catalogue
- A.1 Use Case List
- A.2 Use Case Details
- A.3 Prioritisation Rationale

Appendix B – Logical Architecture
- B.1 System Context Diagram
- B.2 Information Flows
- B.3 Architecture Overview Diagrams

Appendix C – Component Business Model Descriptions

Appendix D – User Journeys