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July 2021

Evaluation of Rail Innovation Programme

Department for Transport
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PRAGMATEX

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Contents

Figures

Tables

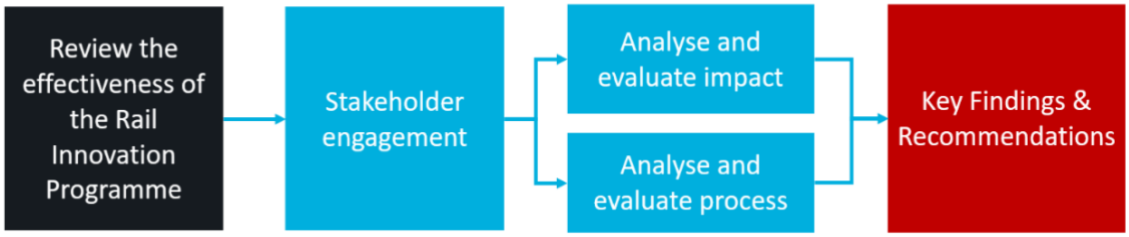
Executive summary

Review of Rail Innovation Programme

The Department for Transport has looked to review the effectiveness of the Rail Innovation Programme, with a view to understanding how best to stimulate innovation within the rail industry in the future.

Between February and April 2021, Steer and Pragmatex conducted an independent review of the 'First of a Kind' (FOAK) competition rounds 1-3, launched between 2017 and 2019, which formed a key part of the Rail Innovation Programme. This was done with a view to assess the effectiveness of processes, outputs and outcomes of FOAK.

An evidence-led approach was followed, based on capturing feedback through an online survey and stakeholder interviews before the analysis of key information and the delivery of findings.



Summary of findings

Throughout this evaluation, it was observed that FOAK does add value and supports participants to overcome some traditional barriers to innovation within rail and help projects advance through Technology Readiness Levels (TRL).

However, Steer and Pragmatex understand that FOAK is designed to support high TRL projects into market quickly and, in the majority of cases (eight out of 15 interviewed), projects are not being delivered to market within 12 months.

The FOAK process is often leaving projects at a point whereby there is no natural process for them to reach market, with additional time and funding normally required. Therefore, the FOAK process, in particular the current adherence to a single-phase Small Business Research Initiative and the link between objectives and selection of projects, may need to be addressed when considering the best way to deliver future objectives.

There are a number of other indirect benefits of FOAK, including helping innovators to develop relationships with key rail stakeholders, potentially making it easier to identify innovative solutions to key challenges and benefiting their companies overall, with some growing following their participation.

These findings are set out in this report.

1 Introduction

Background

1.1 It can be argued that the delivery of innovation within rail is historically challenging. There are numerous barriers which innovators and end users alike have traditionally faced when attempting to introduce innovative products and solutions (such as rail procurement practices, access to trial and testing facilities, acceptance procedures, supplier accreditation schemes and the industry reluctance to invest directly in such innovation).

1.2 Many projects encounter difficulties in the latter stages of Technology Readiness Level (TRL)[1]. This struggle to continue funding development is often termed the 'Valley of Death', or the innovation gap. Many projects flounder at this point, not because the technology or the idea is lacking, but due to the inability of the project team to convince funders of its future potential. Specific to the rail industry, this extends to a 'Second Valley of Death' after demonstration of a technology, where procurement and regulatory requirements mean its value only starts to outweigh risk after its first commercial deployment.

1.3 The Rail Industry Standards and Capability Team funds a Rail Innovation Programme, managed and delivered by Innovate UK. Since 2017 this has consisted of the 'First Of A Kind' (FOAK) series. One of the immediate short term aims of FOAK is to provide funding to address these traditional barriers to innovation, with a view to accelerate innovation in the UK rail sector and to enable technologies to be readily and efficiently integrated into the railway system.

1.4 There have been six rounds of competition, with a seventh launched recently. The first two were carried out under the 'Accelerating Innovation in Rail' (AIIR) banner and were structured as 'collaborative R&D' by Innovate UK. Subsequent competitions were structured using the 'Small Business Research Initiative' (SBRI), aimed at addressing funding and delivery, and formed the FOAK series. Unlike AIIR, FOAK funding is awarded via a fixed price contract rather than a grant. Further detail on these mechanisms can be found in 'Appendix C – Additional detail related to funding mechanism'.

1.5 The Department for Transport (DfT) Rail Industry Standards and Capability team is now considering future activity to be funded or undertaken by DfT, which will be coordinated under the Department's future Science Plan.

[1] Technology Readiness Levels provide a simple way of describing the maturity of innovative solutions. They were first defined by NASA in 1989 as a method of classifying the maturity of a technology during its development. The approach has been developed into a 9-step model and applied to rail. The rail specific stages are: 1) Conception; 2) Opportunity Development; 3) Proof of Concept; 4) Industry Specification; 5) Prototype; 6) Operational Transition; 7) Initial Deployment; 8) Roll out; and 9) Whole Life Management.

Purpose, objectives and scope

Purpose

1.6 DfT has sought to review the effectiveness of the Rail Innovation Programme, to inform decision making related to the future model for stimulating innovation within the rail industry. Given the specific nature of FOAK, this report is intended to evaluate the effectiveness of the first three rounds of the FOAK programme, including the SBRI competition model used and the process for conducting assessments and selecting bids.

Objectives

1.7 The objective of the project reported here is to assess the effectiveness of processes, outputs and outcomes of FOAK competitions 1-3 against a series of indicators agreed with the client[2].

Scope

1.8 The scope of this report is the evaluation of the first three rounds of the FOAK competition, launched between 2017 and 2019.

1.9 AIIR competitions and FOAK 2020 and FOAK 2021 competitions, which have been launched since the completion of FOAK rounds 1-3, do not form part of the scope of this review. While they may be pertinent to Rail Innovation Programme more generally, the report's findings will therefore only be directly applicable to the in-scope competitions.

Report structure

1.10 This report is broken down into six sections:

- **Section 1**: introduces this report and how the study has been conducted;
- **Section 2**: sets out the structure of FOAK 1-3;
- **Section 3**: provides an impact evaluation of programme effectiveness;
- **Section 4**: provides a process evaluation of how the programme is implemented;
- **Section 5**: provides an evaluation of post implementation programme monitoring;
- **Section 6**: details key conclusions.

1.11 These are followed by five appendices:

- **Appendix A**: DfT logic model;
- **Appendix B**: Summary of evidence gathering;
- **Appendix C**: Additional detail related to funding mechanism;
- **Appendix D**: Evaluation and selection material;
- **Appendix E**: Project monitoring material.

Methodology

Overview

1.12 Under instruction from DfT, Steer and Pragmatex have conducted an independent review of FOAK competition rounds 1-3, as part of the Rail Innovation Programme. The approach agreed with the Department to deliver each against each objective is specified below.

[2] These are outlined later in the Chapter and set out in Figure 1-1.

Objective: Assess the effectiveness of processes, outputs and outcomes of FOAK competition 1-3.

- Produce a clear, impartial and evidence-based impact assessment of FOAK competitions 1-3.
- Produce a clear, impartial and evidence-based process evaluation of how FOAK competitions 1-3 were implemented, including the effectiveness of the SBRI model and of monitoring of project success post-delivery.

Evaluation criteria

1.13 It should be noted that access to the original business cases for funding FOAK was not available and therefore it was not possible to use them as a baseline against which to assess effectiveness and understand the quantitative impacts that FOAK was expected to have.

1.14 In the absence of this information, the assessment criteria or hypothesis for effectiveness was based on a logic model agreed with DfT (which can be found in 'Appendix A – DfT logic ') and on other pertinent information, such as the relevant FOAK application material.[3] The components of this analysis process, including a more detailed view of the evaluation criteria which was used to establish overall effectiveness are detailed in Figure 1-1 below. Further detail is also provided in Chapters 3 and 4.

1.15 Therefore, through: i) a process evaluation and; ii) an impact evaluation, we aimed to establish effectiveness based on:

- *Short term outputs* – we examined whether the specified project scope was delivered within the required time and budget and whether the product successfully reached market in a timely fashion. It was also considered whether the project had a positive impact on overcoming traditional barriers to innovation.
- *Medium to long term outcomes* – we examined whether the project was delivering a positive impact against FOAK themes, Rail Technical Strategy (RTS) priorities and DfT R&D priorities[4] (noting that not all medium to long-term outcomes will realistically have been achieved at this stage).
- *FOAK processes* – we examined whether processes enabled the delivery of these outputs and outcomes.

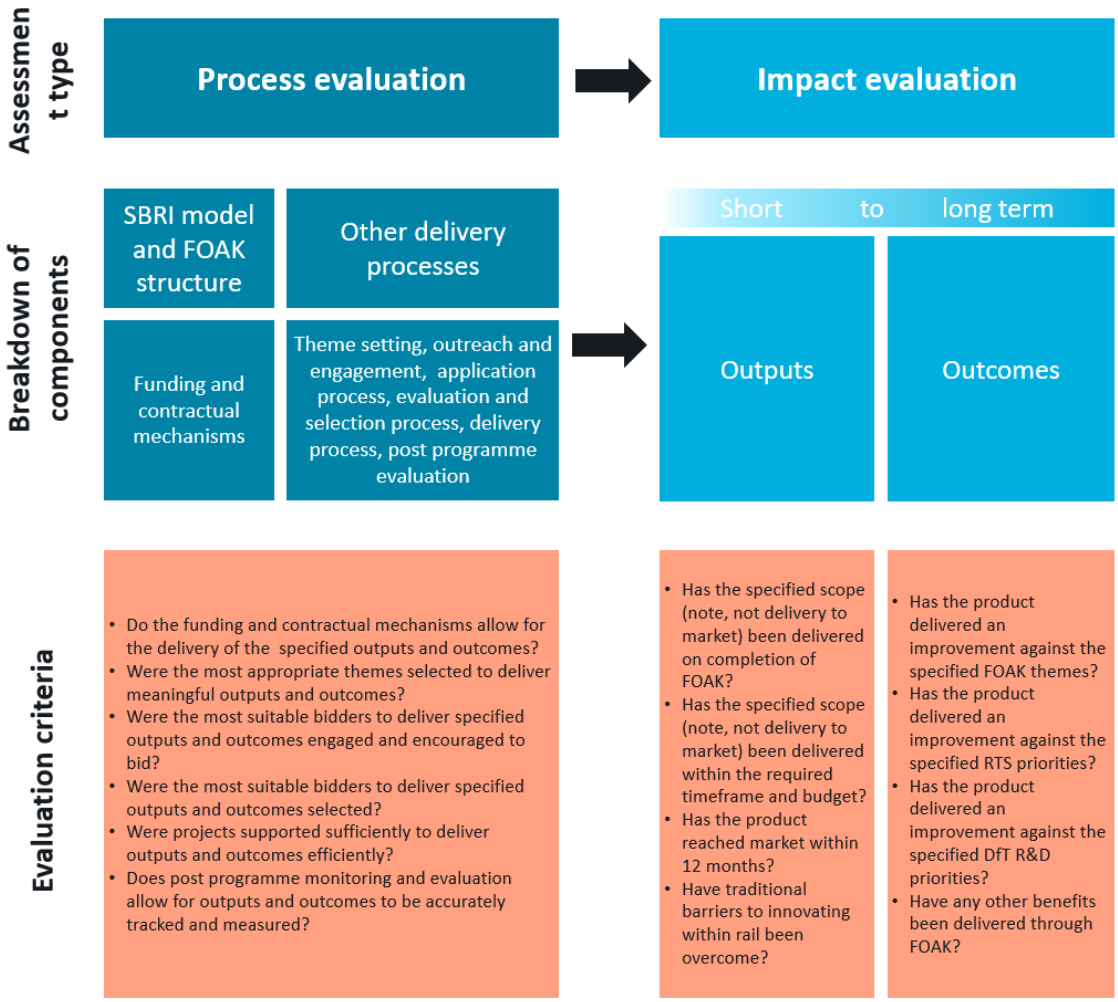
[3] Competition overview - First of a Kind: demonstrating tomorrow's trains today - Innovation Funding Service (apply-for-innovation-funding.service.gov.uk)

Competition overview - SBRI first of a kind round 2: demonstrating tomorrow's stations and a greener railway - Innovation Funding Service (apply-for-innovation-funding.service.gov.uk)

Competition overview - SBRI rail first of a kind round 3: resilience, freight, noise and environment - Innovation Funding Service (apply-for-innovation-funding.service.gov.uk)

[4] These are detailed in 'Appendix A – DfT logic '.

Figure 1-1 Summary of analysis process and evaluation criteria

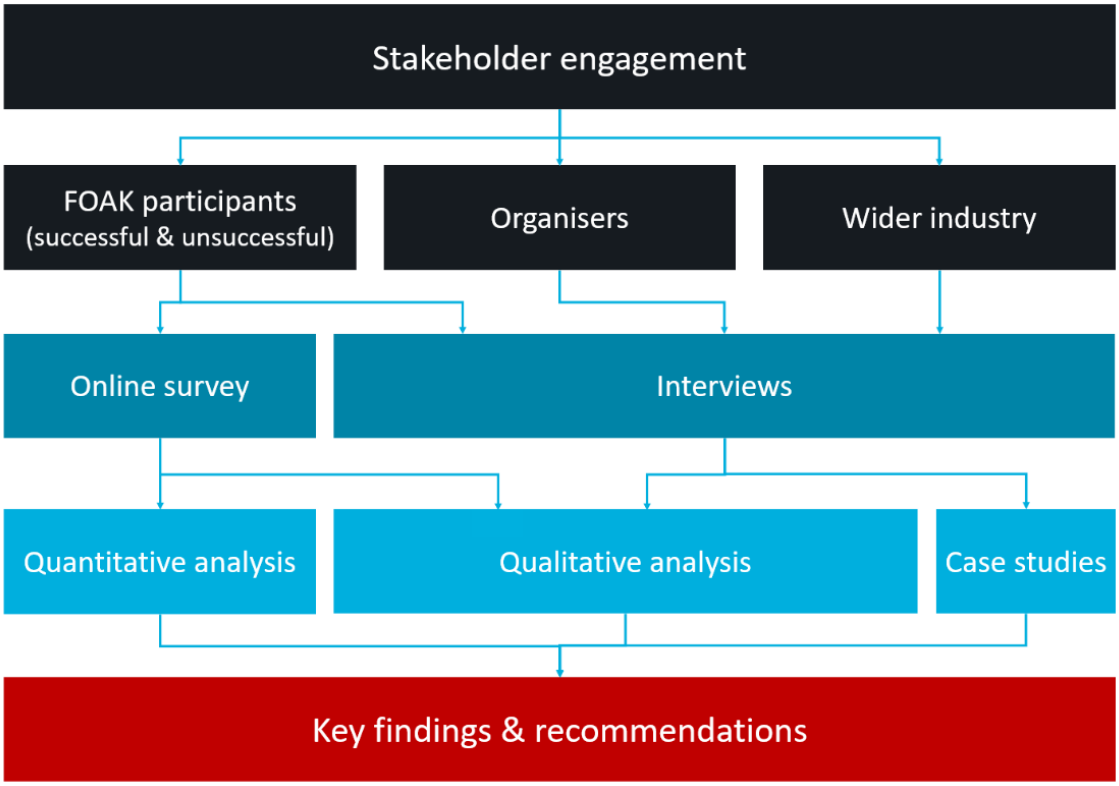


Research methodology

Overview

1.16 An evidence-led approach to delivering key findings has been followed. This is based on extensive stakeholder engagement, capturing evidence via an online survey and bi-lateral interviews, before conducting analysis of feedback provided. An illustration of the process followed is provided in Figure 1-2 below, with a further breakdown of the approach taken for each section also provided.

Figure 1-2: Methodology



Selecting stakeholders

1.17 The process for selecting which stakeholders should be approached to contribute to the evidence gathering process was as follows:

- All applicants (successful and unsuccessful) to FOAK rounds 1-3 were invited to participate in the online survey.
- The initial list of stakeholders to be approached at interview was based on selecting a fair representation of applicants. This involved establishing criteria for selecting a mix of successful and unsuccessful applicants (as well as stakeholders who have applied more than once successfully or unsuccessfully, or a mixture of both) and a spread of FOAK competitions applied to. This list was generated through analysis of the FOAK 1-3 participant data provided by DfT.
- Wider industry stakeholders were also interviewed with a view to gathering further insight on wider FOAK processes.
- Following an initial scheduling of interview sessions, the criteria were revisited and further invitations to interview were extended. We also used the initial responses to the online survey to identify areas of the evaluation where further detail was required as well as where attempts to schedule a session with other stakeholders were unsuccessful.

Online survey

1.18 The online survey was emailed to all applicants of FOAK rounds 1-3. Questions were agreed with DfT and based on achieving the objectives of the report set out above and the evaluation criteria of the process set out in Figure 1-1.

1.19 The survey was left open for 23 days and a number of reminders were sent to applicants. This resulted in the following response rate for the survey, which aligns closely with expectations of

similar survey types. A total of 199 participants were contacted (42 successful, 157 unsuccessful) of whom 57 completed the survey. A breakdown of the number of respondents, by respondent type is set out in Table 1-1. A normal response rate for such a survey is between 25% and 30%, so the response rate of 28.6% for this exercise can be considered healthy. Further detail can be found in 'Appendix B – Summary of evidence gathering'.

Table 1-1 Summary of survey respondents

	Successful respondents	Unsuccessful respondents	Total respondents
TOTAL	**16**	**41**	**57**

Interviews

1.20 Interviews were scheduled as 60-minute sessions and were conducted by a lead interviewer who was assisted by a notetaker. As with the online survey, a structure for the interview was agreed with DfT and based on achieving the objectives of the report set out above and meeting the evaluation criteria set out in Figure 1-1 above. However, it should be noted that the interview process was designed to be flexible to ensure that the interviewer could react to the person being interviewed and focus on the areas which were most closely aligned to the objectives of the study.

1.21 In total, 18 interviews were conducted with both successful and unsuccessful applicants to FOAK 1-3 competitions, members of the Technology Leadership Group (TLG) and with Innovate UK. Further detail can be found in 'Appendix B – Summary of evidence gathering'.

1.22 It should be noted that many applicants who participated in the evidence gathering process also had experience of FOAK 2020 and FOAK 2021, which are not in scope for this review. Although Steer and Pragmatex reminded participants to base their feedback on FOAK 1-3 applications, it would not be unreasonable to suggest that the processes and outcomes of these latest FOAK competitions may have had an impact on feedback provided.

Interpreting the data

1.23 It is important to note the self-reported nature of the data captured through online surveys and interviews. Applicants are likely to have a vested interest in presenting their projects in a positive light and in highlighting outcomes as being successful.

1.24 Although it is not possible to mitigate this risk entirely, and this should be considered when reviewing the findings of this report, clear and consistent research tools were used to extract as reliable and as robust information as was possible. The interview and survey questions were carefully designed to bring out detail which was measurable and unbiased, and interviewers aimed to probe for detail where possible. Findings that could not be corroborated or were clearly subject to participant bias were either excluded from this report or caveated as such.

1.25 It should also be noted that Steer and Pragmatex are grateful for the support provided by stakeholders in supporting this review of the Rail Innovation Programme. In particular, Innovate UK have been very open and willing to support the process, and has provided a substantial amount of material as well as time.

1.26 It should also be noted that the findings detailed in this report highlight areas which may require further review or improvement. However, the purpose of this report is not to attribute these to a failing in delivery from the perspective of Innovate UK, as many findings are related to areas over which they have no control.

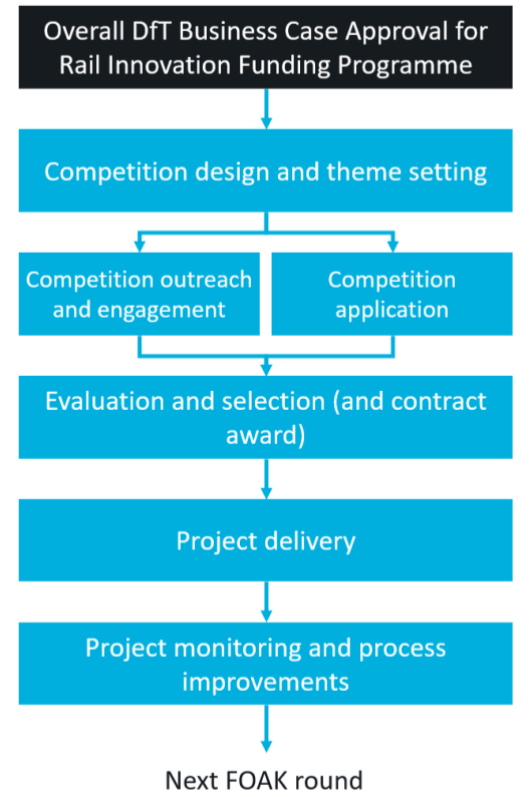
2 FOAK programme structure

2.1 In this chapter we present the structure and processes of FOAK 1-3 which will be evaluated as part of this review.

Overall programme structure

2.2 The overall programme structure for FOAK rounds 1-3 is provided in Figure 2-1. Each stage represents an area that has been evaluated with a view to understanding the effectiveness of competition processes.

Figure 2-1 Summary of overall programme structure for FOAK competition rounds 1-3



Business case

2.3 As detailed in 'Chapter 1 - Introduction', the strategic rationale and detailed business case for initiating the FOAK series of competitions was not available for consideration as part of this report, so the evaluation criteria outlined in Figure 1-1 (and explored further throughout this report) have therefore been developed by DfT, Steer and Pragmatex in the scoping phase of this evaluation.

2.4 However, the original rationale and justification for investment was to accelerate innovation in the UK rail sector and to enable new technology to be readily and efficiently integrated into

the railway system. Specifically, FOAK was intended to support innovation solutions at high TRL in their route to market.

Competition design and approval process

Competition funding

2.5 The maximum funding available for each competition, determined by DfT, was £3.5 million for FOAK 1 and FOAK 2 and £7.5 million for FOAK 3.

2.6 The funding split between FOAK themes (explored later in this chapter) was not published, but anecdotally it is understood that, from FOAK 2 onwards, the split was roughly equal. The maximum funding levels available for individual projects have varied slightly but were usually set between £350k and £400k.

2.7 There are two key structural aspects to the competition design and approval process: the choice of funding mechanism and the theme setting.

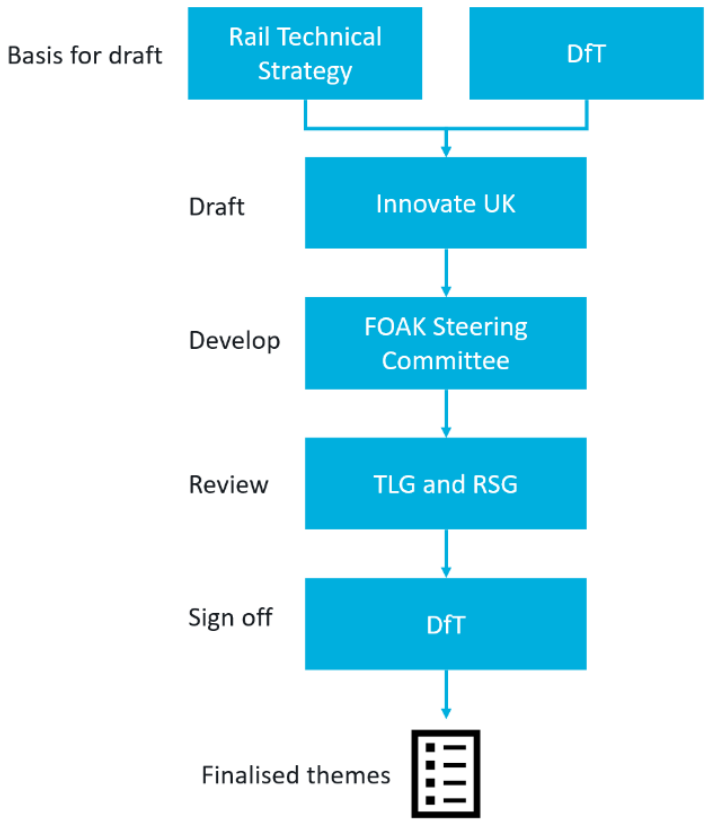
Choice of funding mechanism

2.8 A variety of different mechanisms are available to government when funding research, development and innovation activity. The funding mechanism utilised throughout the FOAK series is SBRI. Further information related to funding mechanisms can be found in 'Appendix C – Additional detail related to funding mechanism'.

Process for selecting themes

2.9 Innovate UK set out the process for selecting FOAK themes, which has been captured below in Figure 2-2.

Figure 2-2 Summary of process for selecting FOAK themes specified by Innovate UK



2.10 Innovate UK indicated that the process, detailed in Figure 2-2, for selecting themes for FOAK was driven through core industry strategies such as the various revisions of the RTS and also DfT R&D (Research & Development) priorities. Industry input was gained through the FOAK Steering Committee (which was formed from the core membership of the original Innovation Leadership Group) with subsequent scrutiny by TLG and Rail Supply Group (RSG) during their committee meetings. The sub-themes (i.e. the additional details provided for each theme) were generally also extracted from the RTS. These raw statements were then reviewed and amended by the Steering Committee and/or DfT until it was agreed that they highlighted the correct priorities.

2.11 The themes for FOAK 1-3 have been broadly reflective of core industry strategies and priorities set out in the RTS, such as the 4C's (customers, carbon, cost and capacity) which have also featured strongly in DfT R&D priorities.

2.12 The key themes selected for the in scope FOAK competition rounds were specified as follows:

- FOAK 1: Demonstrating Tomorrow's Trains Today:
  - more space on trains;
  - personalised customer experience;
  - efficient passenger flow through stations and onto trains;
  - more value from data; and
  - an accessible network.
- FOAK 2: Demonstrating Tomorrow's Stations and a Greener Railway:
  - decarbonisation of the railway; and
  - customer experience in stations.
- FOAK 3: Resilience, Freight, Noise and Environment:
  - operational resilience;
  - infrastructure resilience;
  - freight (non-passenger transport); and
  - noise / environment.

2.13 Although the wording varied slightly for each FOAK competition, a small amount of additional detail relating to each theme was also provided (sub-themes). For example, for FOAK 2, the broad theme 'decarbonisation of the railway' was broken down into more specific areas of interest: 'transferring ideas from other sectors'; 'stations with a zero carbon footprint'; and 'improvements in air quality in stations and throughout the surrounding area'.

2.14 This is in sharp contrast to the detailed requirements of a Network Rail procurement notice, and therefore gives scope for interpretation and creativity. The resulting 'defined' challenge areas for FOAK are characteristically broad. The implications of this approach will be explored in 'Chapter 4 - Process '.

Marketing and engagement

2.15 Marketing for all FOAK competitions was outsourced by Innovate UK to KTN and conducted across multiple channels. This included direct mailing to those registered with KTN, broader announcements made via press releases and use of social media to announce the competition. A briefing event then took place, usually within one week of the announcement.

2.16 The briefing events for the three FOAKs being evaluated were all face-to-face events.

- For FOAK 1, one event was held in London.
- For FOAK 2, three events were held in Cardiff, London and York.

- For FOAK 3, three events were held in Cardiff, London and Manchester.

2.17 All events followed a similar format:

- an introduction from a keynote speaker (usually a Minister);
- provision of details pertaining to the competition and how to apply;
- presentations from key stakeholders relating to the challenges they wished to find solutions for; and
- short 'elevator pitches' from potential entrants in search of partners (these sessions were interspersed with coffee breaks and lunch to allow for networking).

2.18 For each competition one of the briefing events was also provided as a webcast to enable those that could not attend the opportunity to learn more about FOAK. The event was recorded, and a link provided on the competition website.

2.19 It should be noted the FOAK 1 competition, open from 30 October 2017 to 29 November 2017, ran concurrently with the AIIR competition which was open from 18 September 2017 to 15 November 2017. The impact of this has not been assessed directly but could either have diluted the entries or led to consortia submitting entries to both competitions.

Competition application process

2.20 For all three rounds in scope, applicants were required to register for the competition online one week before the submission deadline. Applicants were required to complete an application form and upload the online application onto the gov.uk website by the applicable submission deadline.

2.21 The interval between the competition announcement and the application submission deadline varied for FOAK rounds 1-3, with time available increasing with each round. This information is summarised in Table 2-1 below.

Table 2-1 FOAK 1-3 competition dates

Competition round	Competition dates	Time to prepare and submit bid
FOAK 1	30 October 2017 – 29 November 2017	30 days
FOAK 2	8 October 2018 – 28 November 2018	51 days
FOAK 3	25 February 2019 – 24 April 2019	58 days

2.22 Ten application questions, consistent across FOAK 1-3, were specified. Each question was given a maximum score against which answers were marked. These scores could be weighted differently depending on the value of importance assigned to each question. The assessment criteria published for FOAK 1-3 were identical but the weightings for FOAK 2 and FOAK 3 were adjusted from FOAK 1. Further detail can be found in 'Appendix D – Evaluation and selection material'.

2.23 The space provided in each field on the application form was fixed and applicants were required to restrict their responses to the space provided in each field. Applicants were able to submit project appendices (as PDF documents) to support their application. The FOAK 1-3 application process involved the submission of a word document based on a template provided, but more recent competitions have changed to an online submission system.

Bid evaluation and selection process

2.24 Innovate UK used a standard process for evaluation. It utilised a pool of paid external independent assessors selected according the relevance of their profiles to the subject matter (usually based on technical, business and sector knowledge). Further detail related to this process is explored in 'Chapter 4 - Process '.

Project delivery process

2.25 Once applicants were notified of the funding decision, projects were moved to contract. Unlike collaborative R&D programmes, Innovate UK contracts with a single entity and all other partners are technically a subcontractor to the consortium lead.

2.26 It was the responsibility of the lead party to represent the contractual terms and conditions (T&Cs) of the main contract to any subcontractors who were providing support. It was anticipated that this process takes a month as the T&Cs were generally non-negotiable and acceptance of the T&Cs was implicit in submitting the application unless stated otherwise.

2.27 Innovate UK used a standard approach to monitoring projects. For each project a Monitoring Officer, an external subcontractor to Innovate UK, was appointed. They could monitor more than one project across a competition or across the Innovate UK portfolio of projects. All were experienced in project/programme management and monitoring and where possible Monitoring Officers were appointed with technical knowledge and skills relevant to the specific projects.

2.28 Meetings between the project team and Monitoring Officer took place formally every quarter. These meetings followed a standard format consisting of technical progress update, plans for next period, review of progress against project plan, review of risk register and review of finances. It was the Monitoring Officer's job to approve financial claims and at these meetings they therefore sought evidence that the deliverables and milestones agreed for payment were achieved before payment was released.

2.29 For each project, an Exploitation Plan was developed by the project team. For the project, it outlined the next steps of development, and the proposed route to market once their project was completed. This was a living document and was reviewed during each meeting, with a final version submitted on project completion. It was common practice for an Innovate UK competition sponsor or programme manager (known as an Innovation Lead) to be involved in some of these meetings and to be present for the final project close-out meeting. The Monitoring Officer provided regular updates to the Innovation Lead on individual project progress.

3 Impact evaluation

3.1 In this chapter we present our findings related to the impact of the FOAK 1-3 as part of the Rail Innovation Programme.

Summary of findings

Outputs achieved in short term

3.2 As set out in Figure 1-1 in 'Chapter 1 - Introduction', the overall effectiveness of projects funded through FOAK competitions 1-3 includes consideration of immediate outputs in the short term. To ensure that evaluation is fair and consistent, our findings are considered within the context of the specification originally provided at the start of these competitions.

3.3 This report therefore considers the delivery of outputs against the following criteria:

- *Delivery of product – timescales*: the delivery timescale for the agreed output (at the end of the competition), specified as an eligibility criterion for all in scope competitions, was 9 months.[5]
- *Delivery of product – budget*: the budget specified as an eligibility criterion for all in scope competitions. During the evidence gathering process, each participant's application was considered against the budget specified within their original application.
- *Delivery of product – time to market*: while a deadline for reaching market is not set out as an explicit objective of FOAK, an eligibility criterion for all in scope competitions was that technology should be ready for market within 12 months of project completion. This has formed the basis of the report's consideration of desirable timeframes for reaching market.
- *Delivery of product – barriers overcome*: traditionally there have been a number of challenges and barriers to delivering innovation within rail. The FOAK application process specifies that successful applicants must evidence outputs via an innovative live demonstrator. For the purpose of this review, we have considered whether project outputs have shown that FOAK has supported applicants in overcoming traditional barriers including: i) excessively high risk of investment; ii) lack of access to trial and testing facilities; iii) rail procurement practices; iv) acceptance procedures; v) supplier accreditation schemes; and vi) partnerships between innovators and asset owners and end users.

Delivery of product – timescales (participant feedback)

3.4 In most cases, participants at interview confirmed that the scope of the project, as defined in the bid, was delivered and was delivered within the specified time limit. Quantitative findings corroborate that:

[5] Noting FOAK 1 specified between 6 and 12 months.

- In most cases, the project was delivered as outlined in the project scope.
- In all cases, it was at least partially delivered.

3.5 Similarly, quantitative findings suggest that almost all projects were delivered within the specified timeframe. These findings can be seen in Figure 3-1. It was highlighted during interview, however, that some projects were delivered slightly outside the specified timeframe due to the impact of the COVID-19 pandemic.

3.6 There was some evidence presented by participants at interview, and corroborated in quantitative findings (Figure 3-1), that a small number of projects were not delivered against their original scope. In these cases, there were examples of some 'descoping' activities which meant that the project was not delivered as per the original bid. However, as stated above, evidence generally suggested a timely delivery of the specified scope.

Relationship between scope and timescales (participant and TLG member feedback)

3.7 Despite these findings, there was still significant feedback from participants at interview suggesting that the 9-month timescales were challenging, and additional time would have been beneficial. Specifically, there were comments related to 'leaving the product's feet over the valley of death'. TLG members also suggested that timescales allowed to deliver many of the successful projects fully were unrealistic. Many participants indicated that the navigation of cumbersome regulatory processes within the industry is time-consuming, and engineering projects in particular require additional time to advance through TRLs. Others highlighted that the nature of the competition means that some collaborators may only have met in the preparation of the bid itself – again indicating that mobilisation can be challenging within shorter timescales.

3.8 The delivery timescales and their relationship with the scope of work that can be delivered are explored in more detail in section 'Delivery of product – time to market' and 'Chapter 4 - Process '.

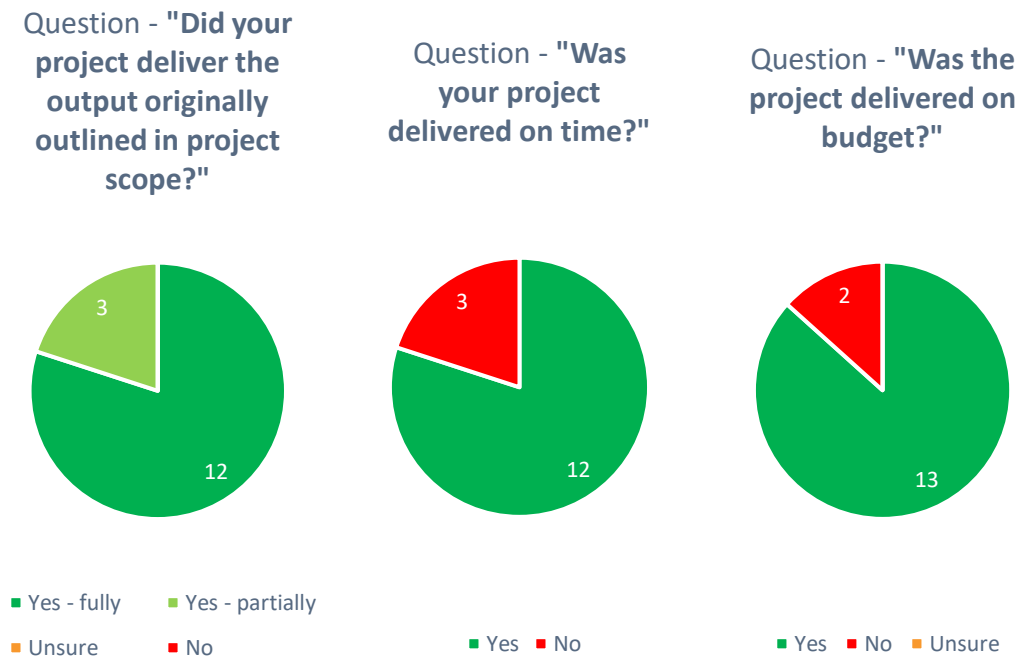
Delivery product – budget (participant feedback)

3.9 In most cases, participants at interview also confirmed that the scope of the project, as defined in the bid, was delivered within the specified budget. Quantitative findings corroborate that, in most cases, projects were delivered on budget[6]. These findings can be seen in Figure 3-1.

3.10 As with delivery timescales, the specified budget and its relationship with the scope of work that could be delivered is explored in more detail in section 'Delivery of product - time to market' and 'Chapter 4 - Process '.

[6] FOAK projects are unable ineligible for budget increases, and so any additional funding would be sourced or provided by project teams themselves.

Figure 3-1 Summary of successful participant responses to delivery specific survey questions



Base: n = 15

3.11 Table 3-1 displays an anonymised list of successful participant survey responses to the three project delivery focussed questions discussed above.

Table 3-1 Summary of successful participant responses to project delivery specific survey questions

	Did your project deliver the output originally outlined in project scope?	Was your project delivered on time?	Was the project delivered on budget?
Participant 1	✓ (fully)	✓	✓
Participant 2	✓ (fully)	✓	✗
Participant 3	✓ (fully)	✓	✓
Participant 4	✓ (fully)	✓	✓
Participant 5	✓ (fully)	✓	✓
Participant 6	✓ (fully)	✓	✗
Participant 7	✓ (fully)	✗	✓
Participant 8	✓ (fully)	✓	✓
Participant 9	✓ (partially)	✓	✓
Participant 10	✓ (partially)	✓	✓
Participant 11	✓ (fully)	✓	✓
Participant 12	✓ (fully)	✗	✓
Participant 13	Skipped	Skipped	Skipped
Participant 14	✓ (partially)	✗	✓
Participant 15	✓ (fully)	✓	✓
Participant 16	✓ (fully)	✓	✓

Key Finding – The specified scope of project output required at the end of the competition (noting this is not delivery to market), is generally delivered on time and within budget. However, there were examples of final project output including some 'descoping' from what was specified in the original competition bid

3.12 As mentioned above, the overall budget and timescales, and how they relate to delivering the final objectives of FOAK, are also discussed later in the report.

Case study: You Smart Thing (YST) - FOAK scope shift

Background: YST is a West Midlands based SME focused on improving customer experience in the transport sector through innovation, and since FOAK has expanded into other sectors. YST has 11 full-time employees and is based in Birmingham. After securing FOAK 1 funding, YST also bid for a further two rounds of available funding.

Technology: The original concept of the FOAK 1 funded project, 'Smart-Train', was a modular platform, which links customers with destination-based venues and events. The starting point was journey planning and linking customers with different transport providers, to offer them a customised solution specific to their journey. The aim of the project, bid for in partnership with Arriva UK Trains, was to test both the technical and commercial feasibility of real-time passenger counting on board trains to inform passengers of carriage occupancy. This would form a module of the wider Travel Assistant solution being developed by YST.

Market: YST believed that their solution was attractive to train operators as it provided better journey information to customers. Travel Assistant offered passengers real-time occupancy information, which allowed them to select their train based on occupancy and easily find vacant seats once on board.

What happened: The SBRI contracting mechanism required YST (as the lead organisation) to contract Arriva to seek permission to fit the relevant equipment to its vehicles. Due to the increased cost and legal requirements for Arriva to do this in a time-limited Franchise Agreement this was not possible. The project scope was therefore amended. Instead of implementing the system on a sponsored test-vehicle or on Arriva rolling stock on the operational railway, it was fitted to a test vehicle available at Quinton Rail Technology Centre. The system was successfully demonstrated, and potential passenger benefits could be seen, however, with Arriva operators coming to the end of their Franchise Agreement, a commercial model was more complicated. This was partly due to the technical maturity of the ticketing arrangements and yield management model of RDG and the National Reservations System, and also the fact that unless such a solution was specified as a commitment in an operator's Franchise Agreement, there was no compulsion to buy.

Outcome: YST believe FOAK funding for "Smart Train" was valuable as it supported the development of the technology platform that was subsequently used by Travel Assistant system. Whilst the data management solution around the management of seat-counting information has not yet reached the market, the core Travel Assistant system is now commercially available and being utilised at Transport for Wales as part of its 'Boarding Pass' solution introduced during the COVID-19 pandemic. Travel Assistant is also being utilised by West Midlands Metro and Coventry, UK City of Culture.

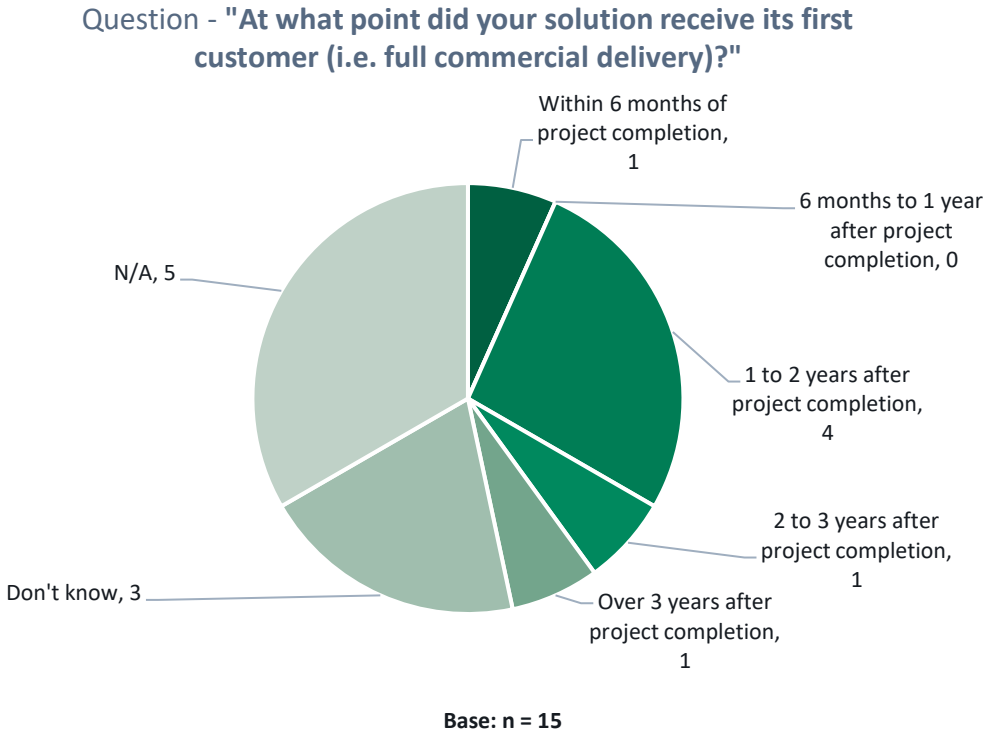
Impression of FOAK: YST believe FOAK is a useful tool as it provides funding for innovation in the railway. However, they believe the timescales and budgets of FOAK make delivering solutions on the operational railway challenging. YST believe that the contractual mechanism of SBRI is challenging, in particular where equipment is being fitted to rail vehicles. They also said that the onerous commercial arrangements required by operators, which can include SMEs being required to take on significant liabilities, indemnities and commercial risks, represent a significant barrier to trialling a new solution and are often too costly for purely innovation-based projects.

Delivery of product – time to market (participant and TLG member feedback)

3.13 As detailed in 'Chapter 2 - FOAK programme structure', FOAK was introduced to support the delivery of products which are close to market and which are high TRL. The aim of FOAK 1-3 applicants has therefore been for a product to reach market in the short term (with assessment for this exercise considering a first commercial customer within 12 months).

3.14 While some successful participants indicated at interview that their solution was delivered to market, for most this was not within the desired 12-month period. Quantitative findings also corroborate that almost all applicants' entrance into the market was over 12 months from the completion of their FOAK project. These findings can be seen in Figure 3-2. It should be noted that only 1 respondent of 15 stated that they had received a first customer within 12 months of project completion, with 5 respondents stating that their solution received its first customer within 12 to 36 months after project completion. 5 respondents indicated "N/A" and 3 "Don't know", suggesting that these are yet to receive a first customer.

Figure 3-2 Summary of successful participant responses to survey question



Base: n = 15

Key Finding – Products that have received FOAK funding have generally not reached market (received their first commercial customer) within 12 months

3.15 The main reasons, provided by successful participants at interview, for the inability to deliver their products to market within 12 months were that additional funding and time were required to develop their product further and to ensure market readiness. Similarly, a significant number of participants, both successful and unsuccessful, indicated at interview that, from a non-project specific perspective, the funding level on offer made it challenging to deliver solutions to market within 12 months.

3.16 Three participants specified that they needed to secure further funding from subsequent FOAK competition rounds. Another respondent also confirmed that they had provided additional funding over and above that provided by Innovate UK to support the project. Another successful applicant secured an additional grant in between successful FOAK entries, while an unsuccessful applicant stated that they wished to propose a larger project than was possible by providing a matching contribution.

3.17 Interviews with industry stakeholders and in particular TLG members raised concern as to whether a small (£300k) project would have any significant impact in major strategic areas such as decarbonisation. There was a danger that a lot of small 'widgets' would be funded, that would have minimal impact without further development, and would have no real mechanism for customer engagement. There was a broadly held perception that certain areas, particularly involving railway infrastructure or major systems, required higher levels of funding and longer projects to make a measurable impact.

3.18 Comments from TLG members indicated that one of the reasons that additional funding was required is that in some instances FOAK is in fact funding projects at a lower TRL than it should be.

Key Finding – Additional funding and time, beyond that specified within FOAK, is often required for a product to reach market

3.19 Many participants and wider industry stakeholders also noted at interview that the money and time required to deliver a solution to market varied according to the application area and stage of development.

3.20 For example, it was noted that technology projects are likely to require different levels of funding (and time) than complex engineering projects. Equally, while a TRL level is specified within the application process, the nature of the market means that each project is different and likely to be at varying stages of the product lifecycle. This is supported, to some extent, by participants who responded via the free form section to the online survey and indicated that they would have welcomed more flexibility regarding project size and the ability to propose larger projects.

3.21 At interview, a TLG member also highlighted issues related to size and curation of funding. The range in project size meant some projects were naturally more brief, and require smaller amounts of money, while the amount of funding could be restrictive for other projects. HydroFLEX, the UK's first hydrogen train, was used as an example of a project that could have benefited from another funding phase.

Key Finding – The different types, size and nature of projects often mean that funding levels and timescales required to deliver a product to market did not fit with a 'one size fits all' approach

3.22 These Key Findings are explored further in 'Chapter 4 - Process Evaluation' and in 'Chapter 6 - Conclusions', alongside the consideration of the funding and contractual mechanisms of FOAK.

Delivery of product – barriers overcome (participant feedback)

3.23 Despite the majority of products not reaching market within 12 months, many participants reported at interview that FOAK did support the advancement in TRL within their product.

3.24 Most successful participants at interview suggested that the FOAK competition did help them overcome some traditional barriers to delivering innovation in rail that might otherwise have been difficult to overcome. Most successful participants interviewed also indicated that without FOAK funding, it is unlikely that they would have been able to continue development. Similarly, a number of unsuccessful applicants at interview also provided information that, following their failure to secure FOAK funding, work related to their submission was discontinued.

3.25 Feedback from successful participants at interview pinpointed the value of FOAK in providing funding for products which may not traditionally receive industry funding and thus helping progress projects which would otherwise stall. [7] Another significant barrier which FOAK helped overcome, again highlighted by many participants at interview, was access to asset owners and end users which enabled the testing and development of solutions in a live railway environment.

3.26 Quantitative findings confirm that, in most cases, successful participants believed that FOAK helped them overcome traditional barriers to innovation. As found during the interview process, two of the main barriers which the FOAK competitions helped participants overcome in the short term were:

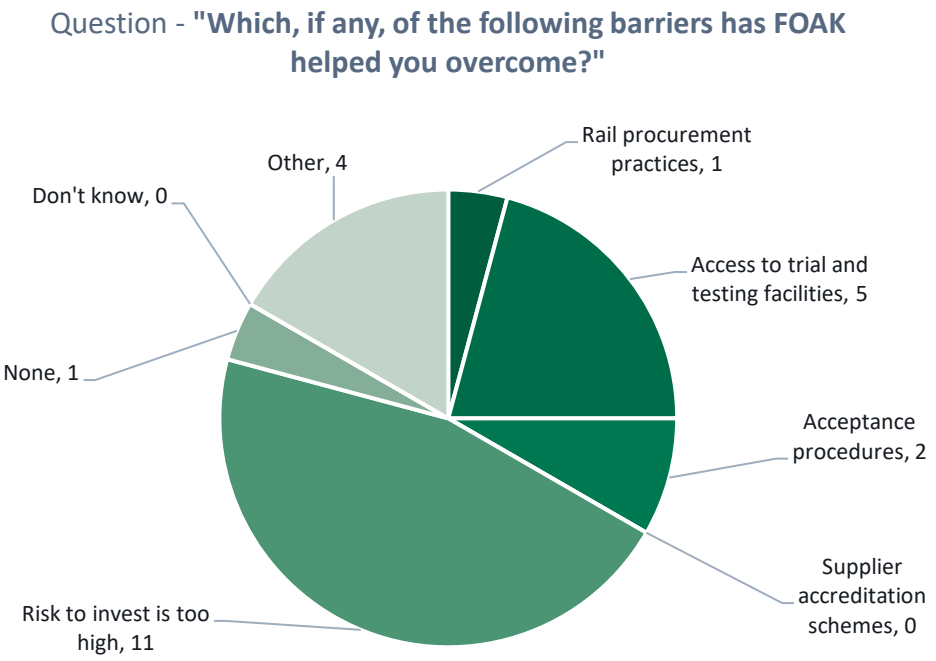
- providing funding when the risk of investment was seen as too high (the primary concern); and
- providing access to trial and testing facilities.[8]

3.27 These findings can be seen in Figure 3-3.

[7] As per the reasons set out in the section 'Outputs achieved in short term' at the start of this chapter.

[8] This finding should be considered within the context that there may be some subjectivity as participants are summarising the success of their own projects.

Figure 3-3 Summary of successful participant responses to survey question



Base: n = 15

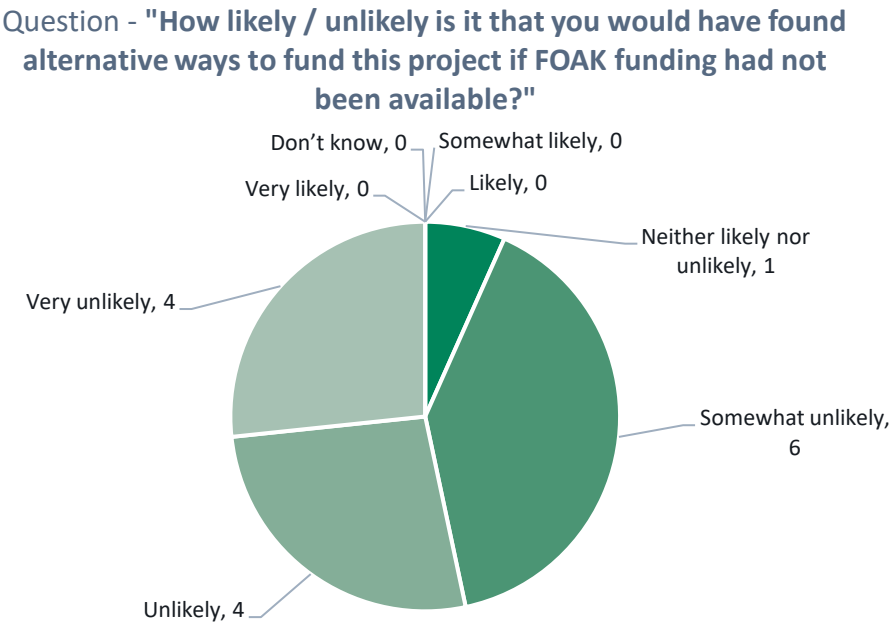
Key Finding – FOAK has supported advancements in TRL

Key Finding – FOAK has supported applicants in overcoming some traditional barriers to innovation, such as the risk of investment being too high and a lack of access to trial and testing facilities

3.28 Quantitative findings also corroborate comments made regarding the positive value of FOAK, expressed by many successful participants at interview. Although somewhat hypothetical, these findings indicate that successful participants felt that, without FOAK funding, they would not have obtained the funds and partnerships required to deliver their project. These findings can be seen in Figure 3-4 and Figure 3-5.

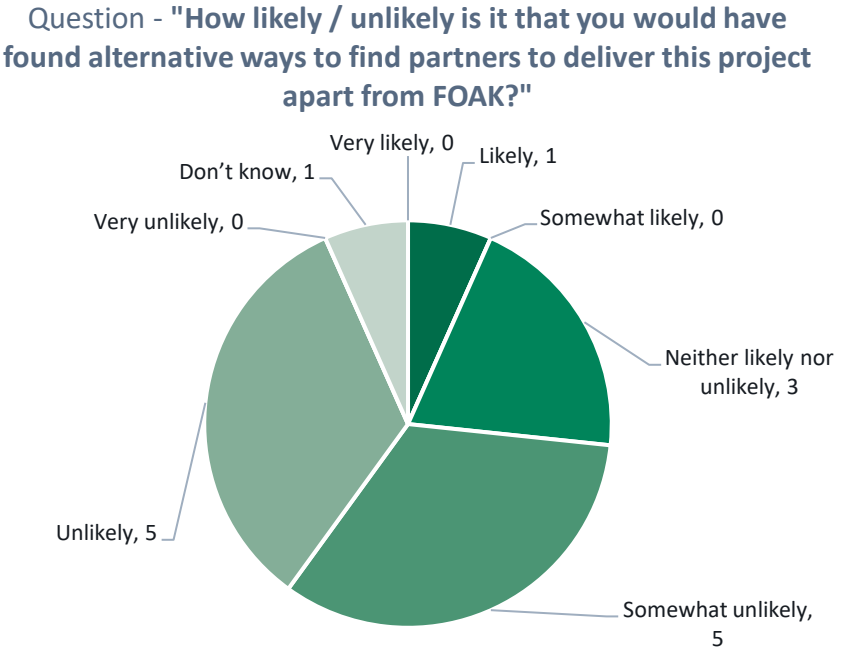
3.29 Feedback from successful participants at interview pinpointed the importance of partnerships formed through the FOAK competition. Numerous participants noted that smaller companies, with limited networks in the industry, benefited from the requirement to form a partnership. It was highlighted that, through networking with those interested in FOAK funding, as well as during the competition process itself, they were able to form partnerships with assets owners and end users which they said had a positive impact on their project and organisation.

Figure 3-4 Summary of successful participant responses to survey question



Base: n = 15

Figure 3-5 Summary of successful participant responses to survey question



Base: n = 15

Key Finding – Without FOAK funding, it is likely that a large proportion of projects would not have been funded, or received the necessary partnerships, to support further development

3.30 Despite the evidence suggesting that most products were not delivered to market within 12 months of FOAK, some successful participants did suggest at interview that, although in many cases their product had yet to receive its first customer, it had stimulated meaningful dialogue with potential buyers. Examples were provided relating to how developments to products following FOAK funding were the catalyst for discussions with buyers which may, in the future, result in further investment and ultimately in commercial delivery and industry rollout.

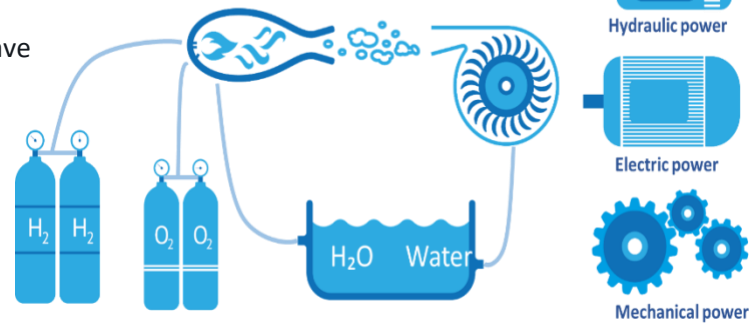
3.31 However, it was noted that this dialogue was normally only at the stage of potential buyers recognising the benefits of a product and signalling that projects were 'well received'. They focused on expressing interest in maintaining contact as the product develops, and in some instances related to future funding opportunities.

Key Finding – According to participants, FOAK has been the catalyst for some positive discussions with potential buyers (without generally reaching market)

Case study: - FOAK success as a platform for growth

Situation: Steamology is a small innovative start-up employing 20 people based in New Forest, Hampshire focussed on delivering zero-emission power solutions. The initial concept came from an attempt at the land world speed record in 2009 before the death of their primary backer. Steamology subsequently struggled to find the development funding necessary to bring their novel technology to market.

Technology: Steamology have designed a "water-to-water" power system, that splits water into hydrogen and oxygen, which is then used to power a highly flexible zero-emission compact steam turbine, capable of delivering power directly, or being used to generate electricity.



Market: Their solution appears to have significant potential. As a genuinely green solution that has the potential to work with existing power trains or as a standalone solution, their potential scope is global and multisector.

What happened: Steamology secured £350k funding from FOAK 2 with a zero-emissions solution entered under the rail decarbonisation theme. Prior to FOAK 2, Steamology had entered into discussions with rolling stock developer Vivarail about how their technology could be used as a zero-emission 100kW range extender for battery powered trains, however, they had all but exhausted potential financing options and were running out of money. Their subsequent success in FOAK 2 ensured the survival of the company and continued refinement of the technology at a critical time in its development.

Outcome: Steamology believe FOAK 2 gave them the credibility and platform from which they secured further funding under the Energy Catalyst initiative and enabled further FOAK success in the 2020 competition with a 600kW steam-electric turbine for class 66 freight engines. They are now attracting interest from private finance and are seeking further funding for a 300kW zero emission diesel engine replacement drive train for passenger fleets.

Impression of FOAK: Steamology are clear in attributing their survival and subsequent growth to FOAK 2. They firmly believe FOAK was critical in ensuring the survival of a key technology from an innovative UK start-up.

Outcomes achieved in medium and long term

3.32 The objectives of FOAK focus on overcoming traditional barriers to innovation and accelerating the introduction of solutions into the market in the short term. However, ultimately this is with the view to deliver outcomes and benefits in the medium to long term.

3.33 Each FOAK competition specifies key themes to which projects should contribute. This is explored in more detail in 'Chapter 4 - Process '. These themes are therefore the most appropriate areas in which outcomes of successful projects should be measured. The key themes for FOAK 1-3 are detailed in 'Chapter 2 - FOAK programme structure'.

3.34 However, the purpose and aim of FOAK is also stated as supporting the rail industry's priorities. Specifically, during the application process links are provided to the RTS, RSSB Solutions catalogue, Network Rail Challenges, Rail Industry Readiness Level definitions, Rail Data Action Plan and 5G Trial.[9]

3.35 As agreed with DfT (and set out in Figure 1-1) RTS core priorities (Easy to use for all, Low emissions, Optimised train operations, Reliable and easy to maintain and Data driven) and DfT R&D priorities (Improving transport for the user, Decarbonisation, Levelling up the economy, Increasing global impact) were specifically considered as part of our assessment of the outcomes of FOAK 1-3.[10] These priorities were summarised to ensure maximum usability during the evidence gathering phase:

- improving customer experience;
- reducing carbon emissions;
- minimising other environmental impacts;
- improving capacity and optimising rail operations;
- improving reliability of assets and reducing costs; and
- better use of industry data.

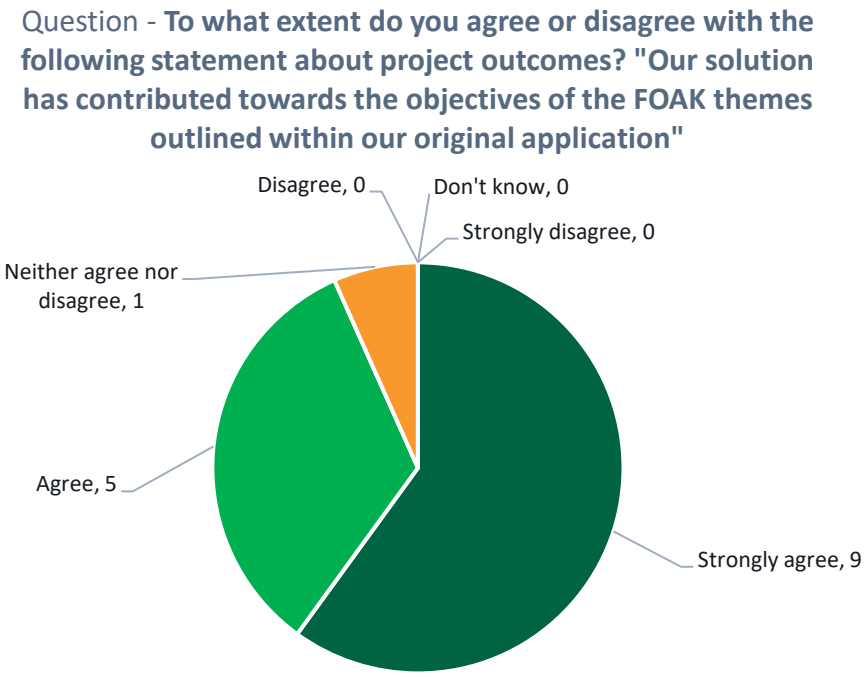
Assessment of outcomes against FOAK objectives, RTS and R&D priorities (participant feedback)

3.36 Most successful participants at interview highlighted the potential for their products to deliver a positive impact against the theme specified in their application, as well as against the wider priorities for rail. This is corroborated by quantitative findings, with most successful applicants reporting that their solution has contributed towards the objectives of the FOAK themes outlined within their original application. These findings can be seen in Figure 3-6, again noting that this is self-reported data.

[9] https://apply-for-innovation-funding.service.gov.uk/competition/315/overview#supporting-information

[10] It should be noted that while these are concerns for rail, the current RTS and DfT R&D priorities were not articulated when the competitions ran and were therefore applied retrospectively.

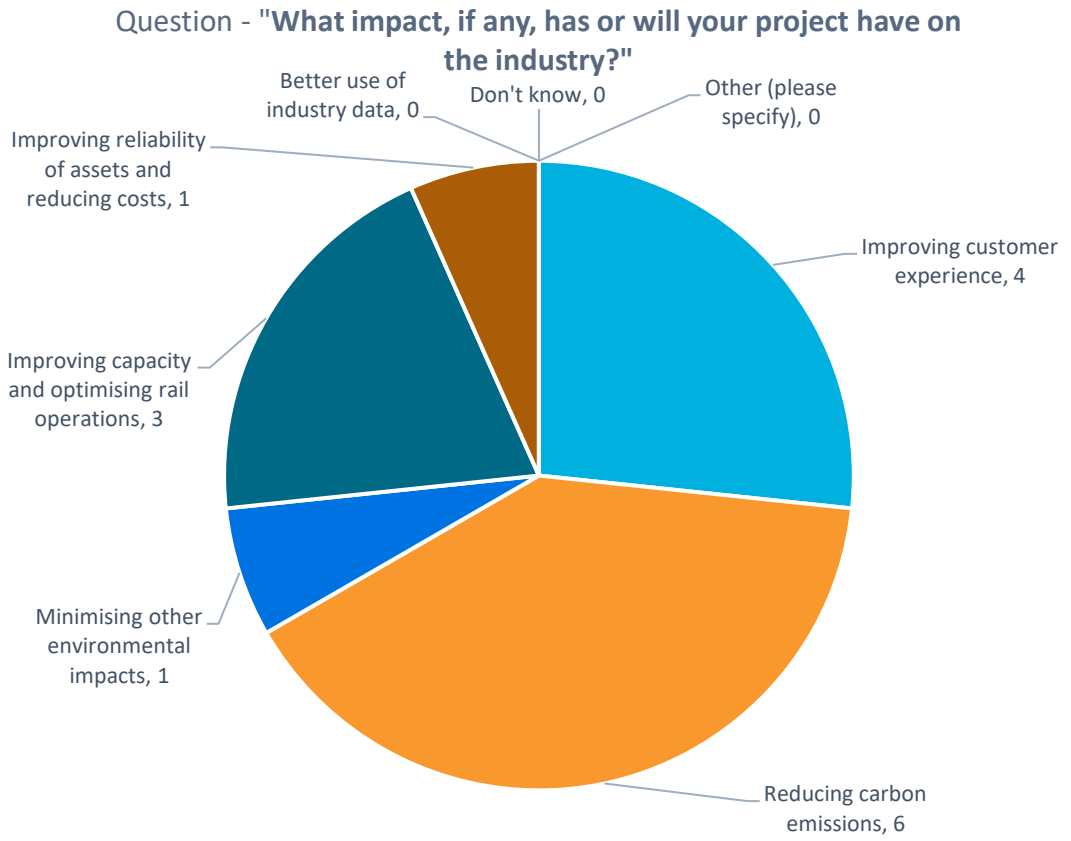
Figure 3-6 Summary of successful participant responses to survey question



Base: n = 15

3.37 It was also noted by participants at interview and highlighted in the quantitative findings that FOAK had assisted in developing solutions which are likely to meet the challenges related to decarbonisation and emission reduction. These findings can be seen in Figure 3-7. However, Innovate UK selects projects on a portfolio basis (i.e. a selection based on a spread of projects across specified themes), so respondents will base their feedback on the theme against which their application was made. Similarly, as noted above, the information related to the specific impact of projects (against decarbonisation targets for example) is self-reported.

Figure 3-7 Summary of successful participant responses to survey question



Base: n = 15

3.38 However, it was found that it was not possible to quantifiably track or measure the delivery of outcomes against the objectives specified in application. As previously mentioned in 'Chapter 1 - Introduction', there was no information provided for this report relating to the original business cases used to justify investment into funding FOAK 1-3, and no measurable data currently being used to track post-implementation progress. See 'Chapter 5 - Post implementation programme monitoring' for more detail related to the process for assessing and evaluating a project post implementation.

3.39 For example, it is possible to obtain hypothetical forecasts related to the potential impact a FOAK funded project may have on 'reducing carbon emissions'. However, no data currently enable the capture of an ongoing actual or future impact against a set of defined targets for delivery of a tangible outcome against a theme (which would allow for forecasts to be considered robust and comparable, such as 'emissions per passenger or tonne kilometre' for the theme of decarbonisation).

Key Finding – According to many participants, there is potential for products funded by FOAK to deliver improvements against themes in the medium to long term, but it is not possible to make a quantitative assessment or prediction with the data available

Assessment of outcomes against FOAK objectives, RTS and R&D priorities (TLG member feedback)

3.40 The outputs and ultimate outcomes of FOAK were discussed with TLG members at interview. Most believe that there is a place for FOAK within the industry and that it has been 'partially successful'. They said that some notable successes will have a positive impact on the industry but, overall, they were not aware of the programme having a significant impact. They said that the industry cannot expect smaller companies, through FOAK, to lead us through the bigger themes and challenges that the Rail Innovation Programme looks to tackle (such as decarbonisation).

3.41 It was commented that there may be missed opportunities as there is a lack of a 'closed loop process' and that more checks and balances (as well as ownership throughout the process) are required to ensure more product take-up. They suggested that some organisations did not know to whom to talk to about their completed product, while in some circumstances the output was very much awaited by the right people, but the potential owner of the product was difficult to locate. It is therefore possible that impacts are diminished by a lack of clients identified.

3.42 TLG members stated that it is not possible to make a definitive judgement as the short period of time since FOAK 1-3 means that the results may not be immediately obvious. However, there was also agreement that they had limited visibility of what happens to projects after FOAK funding. Unless a party issues a press release, there is no mechanism for the industry to be made aware of FOAK outcomes. Therefore, it was not possible for the TLG members interviewed to provide a more detailed commentary on outcomes.

Key Finding – According to TLG members, there are some benefits to FOAK but there have also been some missed opportunities. Ultimately there is no uniform TLG member view as they do not have clear visibility of FOAK outcomes

Other outcomes (participant feedback)

3.43 It was highlighted by participants at interview and via the online survey that there are a number of other indirect benefits of FOAK. These include the collaborative nature of FOAK being likely to stimulate further ideas or developments to solve future industry challenges. Bringing innovators and end users closer together is likely help both parties, making it easier for innovative solutions to key challenges to be more easily identified.

3.44 Most notably, it was highlighted by a number of participants at interview that FOAK enabled companies to expand their network within the rail industry. The partnership model (explored further in 'Chapter 4 - Process ') enabled innovators to develop relationships with key stakeholders which they said will not only have facilitated the delivery of their FOAK project, but also help them as a company moving forwards.

3.45 Some companies who took part in the interview process have grown since they received FOAK funding, which could be seen as a consequence of the FOAK competition. Increasing the size and scope of innovators within the rail industry, and facilitating these companies to flourish, would only make the provision of more innovative solutions more likely.

Key Finding – There are likely to be other indirect benefits of FOAK, such as collaboration stimulating ideas to solve future industry challenges

Case study: 4Silence - Yet to reach market despite FOAK 3 success

Situation:

4Silence is a Dutch company based in Enschede, The Netherlands. Since 2012, 4Silence have been developing and improving traffic noise reduction solutions using the principle of "diffraction". At the time of their successful FOAK 3 application (in 2019), 4Silence were already bringing in some revenue from the concept in the Netherlands. At this time 4Silence had 8 employees, 4-5 of whom were involved in the FOAK product.

Technology and Market:

The solution WHIS®wall combines a low noise barrier with a weathering steel diffractor which essentially deflects sound, thus reducing noise pollution. At only 1 meter in height, WHIS®wall is an alternative solution to taller rail noise barriers.

The noise reducing solution, WHIS®wall, has potential to be rolled out across the UK rail network and globally. Similar products, using the same diffraction technology, aimed at reducing road traffic noise have equally large potential for rollout on the UK's road network.

What happened:

In 2019, 4Silence secured £265k funding from FOAK 3 with their rail noise pollution reduction solution entered under the 'Noise and environment' theme. This was the first funding competition the company had entered in the UK. At the stage of FOAK application, the solution was said to be at the top end of TRL levels but was not yet ready to roll out on the UK network. However, they also received a Horizon SME Phase II Grant worth EUR2.1million for rollout in Belgium, Denmark and Germany.

The company's objective of publishing a measurement report highlighting that the solution works was achieved within the 9-month time period. Initially, 4Silence also aimed to achieve product approval during the FOAK 3 competition cycle but descoped when they realised this was not achievable. FOAK 3 provided 4Silence with the opportunity to build a strong network in the UK with organisations including Network Rail, HS2 and Highways England.

FOAK provided 4Silence the opportunity to test their product and produce/publish a measurement report demonstrating that their solution works. Network Rail is about to issue 4Silence product approval which will allow 4Silence to apply the product in the Network Rail environment. During the competition, 4Silence also spoke with HS2 to seek approval for use in a high-speed environment. These conversations are still on going and also led to an unsuccessful FOAK 2020 bid. Nevertheless, 4Silence is still being considered within HS2.

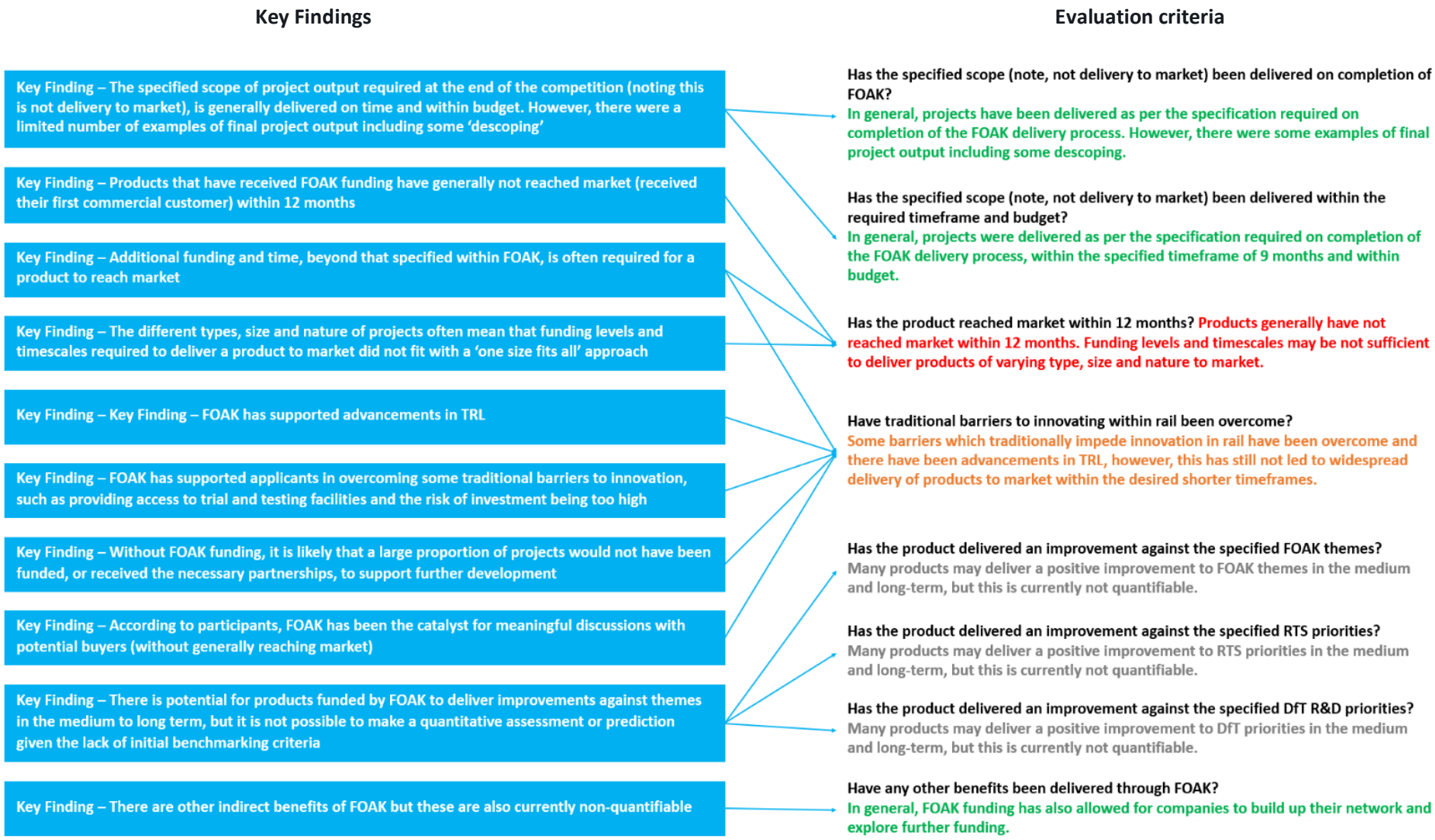
Their involvement in FOAK has helped stimulate buyer interest (conversations but no bid at this stage) from Network Rail, HS2 and Highways England. 4Silence hope to begin roll out of their project in 2022.

Impression of FOAK:

4Silence attribute their success in the UK to FOAK. They believe the competition allowed them to build relationships with potential buyers, helped them overcome internal procedures and to 'get things moving' with the big organisations. For example, FOAK gave 4Silence license to put pressure on TfL to ensure the testing of the pilot solution would happen within the 9-month period, accelerating their testing. They suggest that without FOAK, 4Silence would be two years behind where they are now in the UK market.

Overview

3.46 A summary of how the Key Findings relate to the core evaluation criteria for the impact evaluation (detailed in Figure 1-1) can be seen below.



4 Process evaluation

4.1 In this chapter we present our findings related to the process required to implement FOAK rounds 1-3 and whether this has been done so effectively. This evaluation covers the following processes:

- funding and contractual mechanisms;[11]
- theme setting;
- project selection;
  - outreach and engagement
  - competition application process
  - bid evaluation and selection
- project delivery; and
- overall process improvements.

Summary of findings

Funding and contractual mechanisms

4.2 Although many participants were familiar with both the SBRI and collaborative R&D approaches that Innovate UK use, they were not directly asked through survey or interview to comment on the funding mechanism choice. However, interviews with wider industry stakeholders, in particular TLG, specifically addressed the FOAK funding mechanism.

4.3 This section builds on findings related to timing, budget and output of projects initially set out in 'Chapter 3 - Impact evaluation'.

Phasing of funding (participant and TLG member feedback)

4.4 The current single-phase SBRI model used as part of FOAK differs to other UK SBRI models and those used in other countries which provide a more traditional multi-phase model of breaking funding into several segments. A TLG member cited the example of COMPASS, a project funded through the SBRI mechanism, that had followed a three-phase structured approach, with the best solutions being taken forward at each stage. From an initial selection of five, it was narrowed to two for the second phase and a single supplier for the final demonstration.

4.5 It is set out in section 'Delivery of product – time to market' in 'Chapter 3 - Impact evaluation' that, despite supporting tangible advancements in TRL, products that have received FOAK funding have generally not reached market within 12 months and that additional time and budget were required to ensure market readiness. At interview, many participants also

[11] We understand that Innovate UK are currently undertaking a wider evaluation of the SBRI model (of which the FOAK programme will be a part) and it would be advisable for DfT to seek a copy of the output report to help inform decisions regarding the funding mechanism and its application.

highlighted that a model which included additional phases or stage gates, where further funding could be unlocked, would be beneficial.

4.6 Several participants noted at interview that the timeframes and resources are unrealistic for ensuring the solutions are both: i) rail ready (certified safe and effective, which is always prioritised); and also ii) market ready. This is particularly challenging, as there are numerous facets to ensuring that these two conditions are met. These include ensuring that:

- the potential customer is fully engaged;
- any concerns have been addressed;
- the proposition is fully integrated with customer need (including technical integration requirements);
- the market entry strategy is validated; and
- the business model is sustainable.

4.7 Similarly, TLG members commented that it is 'almost impossible' to deliver some of the previous project to market within 12 months, and that FOAK should be funding projects in the 'valley of death' (TRL 7/8) but instead it is funding projects at TRL 5/6. It was commented that a multi-phase competitive approach may allow these critical elements time to develop, while at the same time letting less commercially viable propositions find alternative development paths or to close down.

4.8 What represents "enough" time also appears to differ according to the nature of the deliverable product or service. It has been observed that where innovators face additional certification, commercial warranties or requirements for conformity with safety standards (such as when integrating items into the operational railway), control of the timeline moves beyond the innovator's ability to manage, influence or control. Moreover, the burden for designing a project that can be developed and delivered in a short timeframe must be taken by the innovator in a 4 to 6-week window that the competition is open. In several cases (as seen in YST case study at the end of 'Chapter 3 - Impact evaluation') either the initial knowledge of these aspects was insufficient, or, for reasons beyond the innovators' control, (e.g. external certification) the timeline extends beyond the 12 months required by the SBRI contract.

Key Finding – According to many stakeholders, the opportunity to develop products by allowing participants to apply for further funding rounds may increase the chance of inducing a meaningful impact

100% funding (participant feedback)

4.9 Participants commented at interview that 100% funding was crucial for smaller companies and start-up propositions, as many would have been unable to attract industry funding to prove new concepts or to get the proposition to an investable level. The subsequent success factor of having accrued government funding often resulted in a halo effect resulting from this perceived external endorsement, allowing companies to secure further funding on the back of FOAK success.

4.10 Other studies have cited failure to validate market need as the top reason for start-up failure.[12] Supposedly 'near to market' propositions (TRL 7-8) would probably be able to secure private sector investment in many markets. Many participants said that this is not the case for rail, which may support the case for 100% funding, but may also support the case that the post-FOAK route to market is not short or easy – evidenced by the low level of uptake and implementation of FOAK project outputs.

Key Finding – Participants suggested that 100% funding may support participation from innovative start-ups with little access to development capital, but positive feedback regarding 100% may also suggest the post-FOAK route to market is not short or easy

Contracted partnership model (participant feedback)

4.11 Successful participants noted at interview that the emphasis on delivery consortia was a highly desirable aspect of FOAK. The complex requirements of the railway sector mean that many companies lack the full skillset required to deliver innovative products and services. As noted in 'Chapter 3 - Impact evaluation' and in Figure 3-5, quantitative findings also indicated that successful participants said they would be unlikely to find alternative ways to find the necessary partnerships if it were not specified as part of the FOAK model.

4.12 However, as part of the contractualisation process for SBRI, the lead organisations applied for and contracted directly with Innovate UK and consortium members became subcontractors to the lead. This is very different to the collaborative R&D approach, where all consortium members sign up to T&Cs upon application and when the grant is approved by Innovate UK. The current approach was generally well received by participants at interview, with an appreciation that this pragmatic approach probably ensured a swift turnaround on project initiation.

4.13 The risk of the SBRI approach is that a lead organisation may secure funding largely on the capabilities and reputation of its 'partners' (which due to the nature of SBRI are listed as 'suppliers', who have no direct contract with Innovate UK), but then unilaterally decide to change its delivery approach and either change or exclude 'partners' named within the application. However, only one successful participant stated that they were aware of several cases where this had occurred. It is also likely that if original partners did drop out for other reasons, such as a change of strategic direction, retaining the flexibility to rapidly adjust the consortium make-up would be highly valued. Innovate UK are required to agree any such changes, and the loss of an essential 'partner' without adequate replacement would likely result in termination of the project.

Key Finding – The contractualised emphasis on consortia was on the whole seen by participants as highly desirable

[12] https://www.cbinsights.com/research/startup-failure-reasons-top/

https://www.startups.com/library/expert-advice/why-do-startups-fail

https://www.bbva.com/en/why-do-startups-fail/

Themes

Themes setting process (TLG member feedback)

4.14 TLG members indicated at interview that they were unclear regarding the process for theme setting and the link between the final themes and sub-themes and wider industry strategies, such as the RTS.[13]

4.15 TLG members noted that the role of the TLG was limited in regard to FOAK theme setting and that opportunities to provide further input would be welcomed. A number of TLG members interviewed indicated that their apparent role was to review and sign off a set of themes/areas for funding rather than help to identify, shape or define what might be needed. (However, as noted in Chapter 2, industry input into theme setting is received through the FOAK Steering Committee.)

4.16 A TLG member noted that the TLG were involved when the themes were already quite developed. They noted that clear themes are identified but how projects make a difference under those themes is not articulated. It was mentioned that earlier TLG involvement would ensure that there is further industry insight during the theme setting process. Having this additional exercise would allow for the TLG, who have significant amounts of industry experience, to support the development of themes which deliver against what they perceive as the key priorities for the industry. TLG members commented that the TLG, as owner of technical strategy, should have a greater role in understanding where such investment is. The need for this additional level of TLG 'critique' was noted as being very important by TLG members during the interview process.

4.17 At interview, one TLG member said that the organisers had changed the proposed themes 'quite significantly', despite recommendations made by the TLG. They said that the organisers had identified other areas which were felt to be of greater importance than those highlighted by the TLG. Following the finalisation of themes and subsequent project awards, it was also said that there was no direct discussion between the organisers and the TLG, and that the process was 'not a closed loop'.

Key Finding – According to TLG members, the role that the TLG play in FOAK is limited. TLG members are open to being more involved

Themes chosen (participant feedback)

4.18 Most participants at interview highlighted that broader FOAK themes were appropriate. In general, both successful and unsuccessful participants said that the breadth of the theme available kept FOAK competitions open to a wide array of applicants. Unlike the more focused nature of Network Rail R&D schemes, the broader FOAK themes allowed for companies from outside the sector (such as Over-C, a security company with little knowledge of rail), or alternative approaches to traditional problems (such as University of Sheffield - track treatment with dry ice instead of water) to apply to the competition.

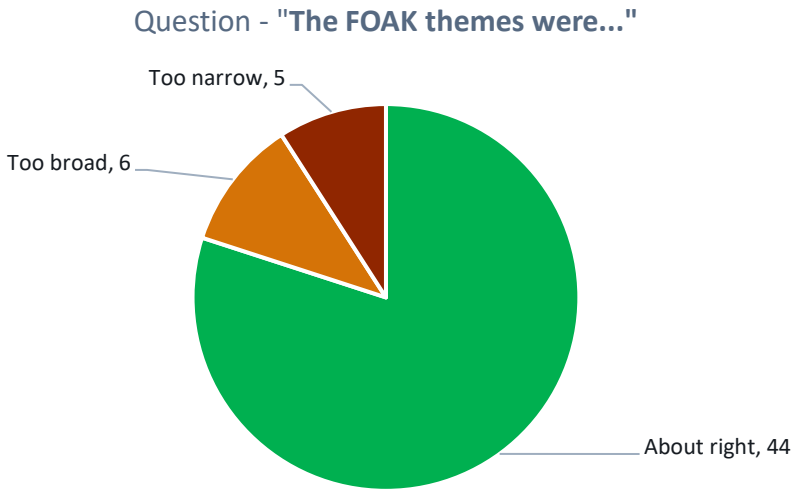
In most cases, participants at interview said that the FOAK themes also reflected the needs of their company. There were very few objections to the FOAK themes and there was a consensus that they allowed applicants to propose innovative solutions to meet industry

[13] Note - Innovate UK provided detailed related to the theory of this process (set out in Chapter 2).

challenges. However, these broad themes could mean the competition is too generic and not allow for a focus on any specific and targeted needs required by the industry.

4.19 Quantitative findings confirm that, in most cases, participants said that the breadth of FOAK themes were appropriate, with a significant majority of both successful and unsuccessful applicants stating that they were 'about right'. However, it should be noted that only participants who chose to apply to FOAK (and by definition register for a theme) were surveyed. These findings can be seen in Figure 4-1.

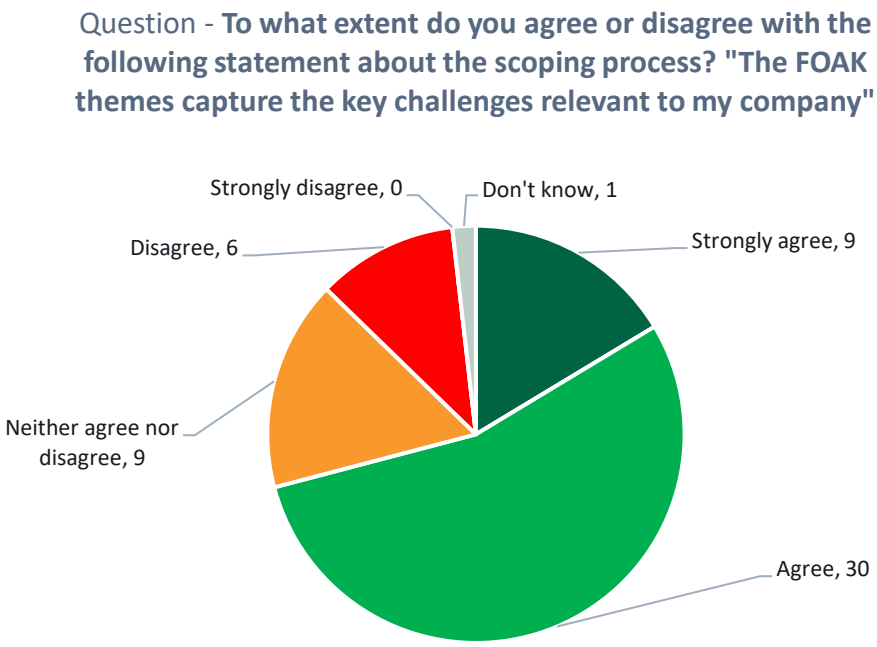
Figure 4-1 Summary of successful and unsuccessful (combined) participant responses to survey question



Base: n = 55

4.20 Quantitative findings also suggest that the majority of participants, both successful and unsuccessful, agreed that the FOAK themes captured the key challenges relevant to their company. These findings can be seen in Figure 4-2.

Figure 4-2 Summary of successful and unsuccessful (combined) participant responses to survey question



Base: n = 55

Key Finding – From an applicant perspective, the breadth of FOAK theme provides an opportunity for them to apply for competition funding and, again from their perspective, allow the priority industry challenges to be addressed

Themes chosen (TLG member feedback)

4.21 TLG members raised some concerns about FOAK themes. One TLG member was unsure how themes were linked from year to year. Others were unsure how the themes fit with the wider technical strategy and whether they might be too broad. One member commented that, within any competition, there is a vast divergence of project types, and recommended more focused themes to allow gaps in strategy to be addressed. Another suggested that there could be a more 'specific focus' within themes.

4.22 However, another TLG member felt that the current 'broader' themes provided innovators with an opportunity to offer solutions and narrowing themes could restrict innovation. It was also commented that regular changes in the 'future vision of the industry' from government also make theme setting very challenging, as it can impact upon priorities and core long term goals.

Key Finding – Some, but not all, TLG members suggested that FOAK themes were too broad

Project selection process

Outreach and engagement (desktop research and participant feedback)

4.23 Innovate UK contracted KTN to undertake outreach and engagement activities for FOAK. It is difficult to assess to what extent the key outreach and engagement messages attracted or diverted the intended target audience, but programme data shows that the industry engagement has been rising steadily over time, see Table 4-1. This trend has continued in FOAK 2020 and 2021. This suggests that industry awareness is at a high level and that FOAK is appealing to potential applicants.

4.24 It is difficult to decouple to what extent this is a result of the direct engagement carried out via the KTN, or the 'word of mouth' effect that multiplies over time. The launch events are well attended, which suggests that, at the very least, the KTN messaging regarding the competition is effective.[14]

4.25 At interview, a number of participants indicated that these events were key networking opportunities, and several respondents indicated that they secured an application partner at a FOAK event. The annual increase in entrants, shown below, and participant perception of events, suggests that there is a year on year rise in the general awareness of FOAK.

Table 4-1 Number of applications and successful projects broken down for FOAK 1-3

	FOAK 1	FOAK 2	FOAK 3
Entered	20	56	124
Won	10	9	24

Key Finding – Awareness of FOAK is growing and engagement processes appear to be operating well

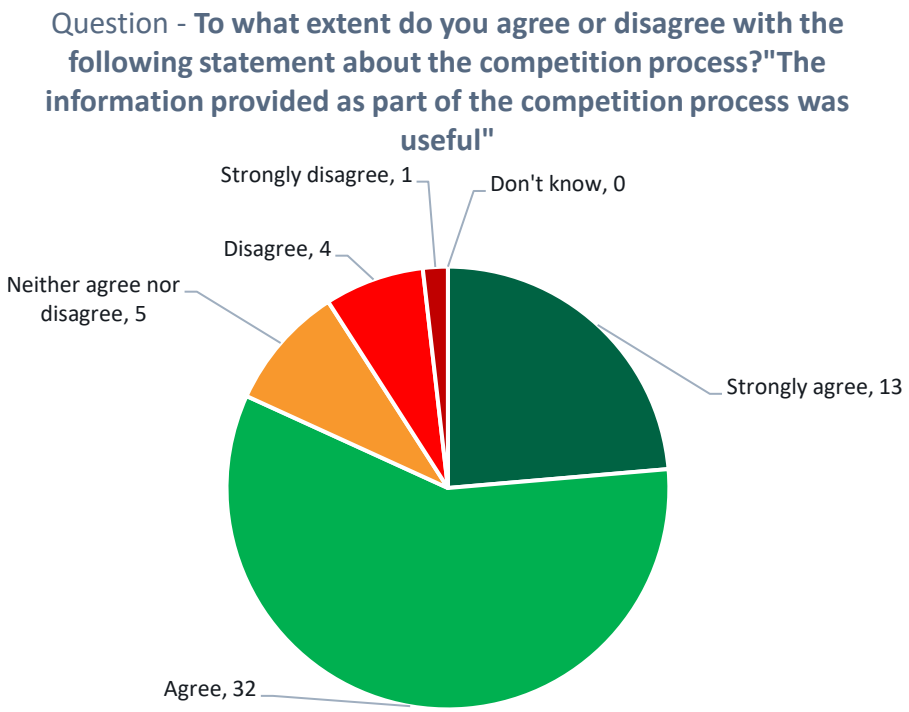
Competition application process (participant feedback)

4.26 Feedback from participant interviews suggests that the information provided by Innovate UK as part of the application process is sufficient. Quantitative feedback also indicates that most applicants felt that the information provided was useful. All successful applicants agreed with the statement "The information provided as part of the competition process was useful" along with many unsuccessful applicants. These findings can be seen in Figure **4-3**.

4.27 Several participants also noted that they had the opportunity to raise questions/seek further clarification from Innovate UK during the application process. However, one survey respondent said that responses to queries during the application process were slow.

[14] Innovate UK believe the response rates were comparable to launch events from other sectors, but there was little evidence of a detailed analysis or a targeted approach in this area.

Figure 4-3 Summary of successful and unsuccessful (combined) participant responses to survey question

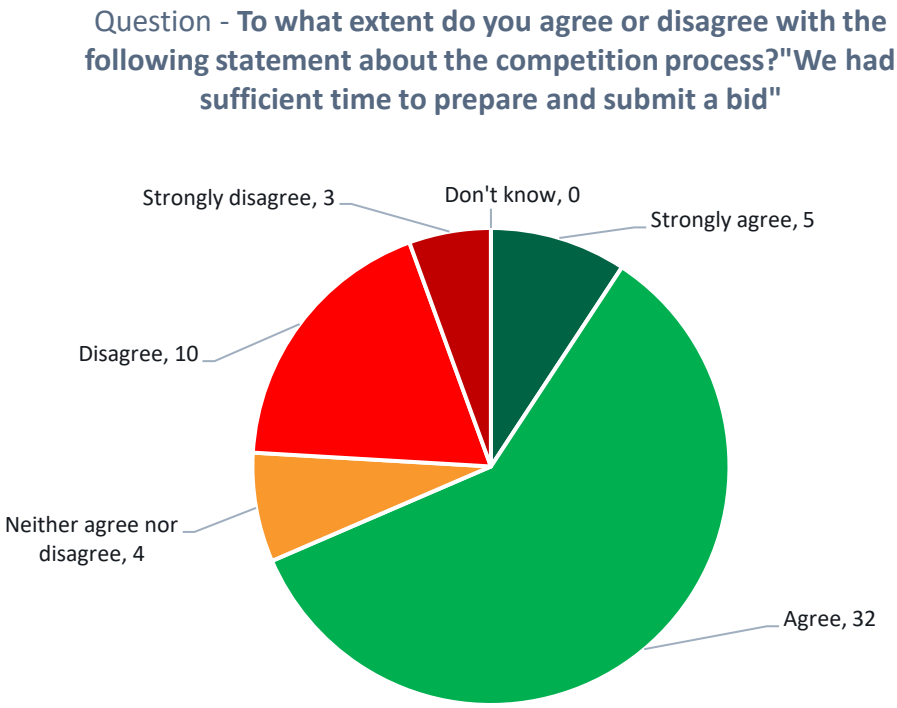


Base: n = 55

4.28 At interview, most participants said that the competition timescales were adequate, particularly for those with an existing project/idea within the scope of one of the competition themes. However, a limited number said that the time available between competition opening and application submission was too short to prepare the bid and secure partners.

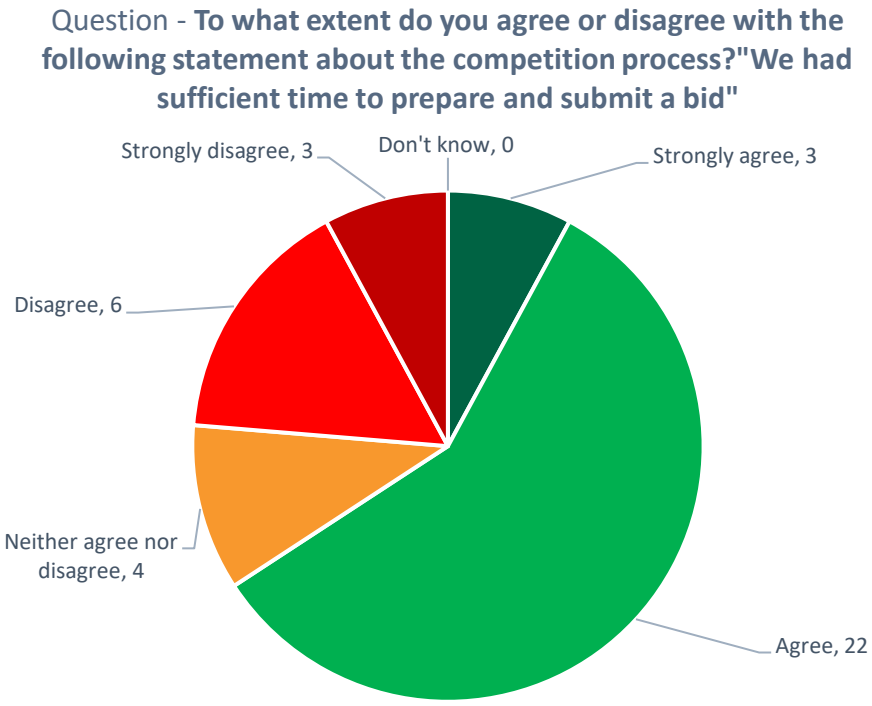
4.29 Quantitative findings confirm that most participants agreed that the FOAK 1-3 competition application process allowed sufficient time to prepare and submit a bid, although successful participants were more likely to agree than unsuccessful participants. These findings can be seen in Figure **4-4** and Figure **4-5**.

Figure 4-4 Summary of successful and unsuccessful (combined) participant responses to survey question



Base: n = 54

Figure 4-5 Detailed breakdown summary of unsuccessful only participant responses to survey question

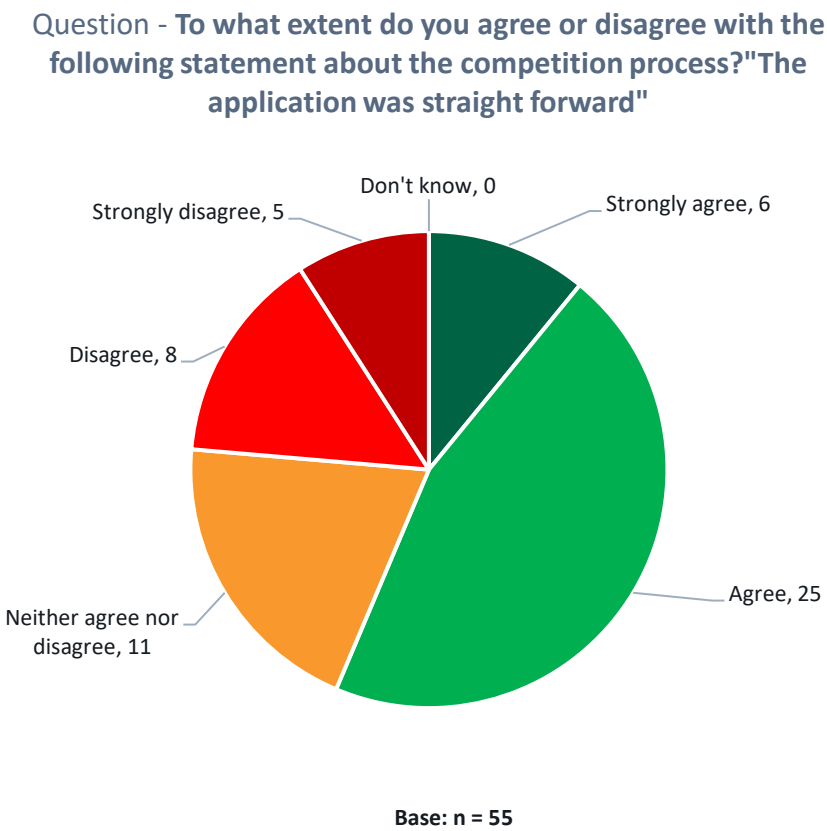


Base: n = 38

4.30 Most participants at interview also indicated that the application process was relatively straightforward but there were some minor issues with the forms provided, formatting and the time taken to submit an application. However, applicants have noted that many issues have been addressed from round to round and these will likely have been largely overcome with a new online submission system that has been implemented by Innovate UK for FOAK 2020 and FOAK 2021.

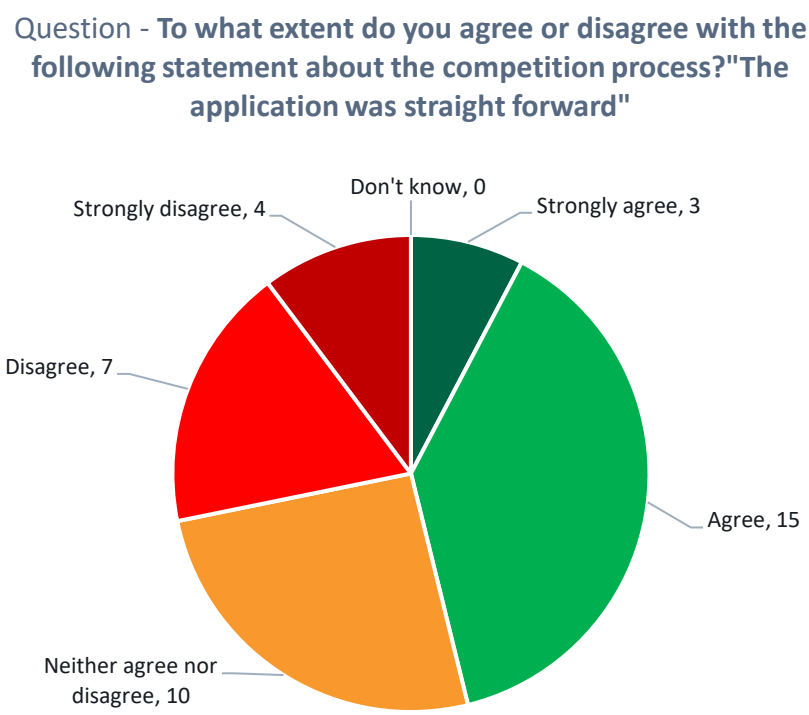
4.31 Quantitative findings corroborate that a large majority of both successful and unsuccessful applicants found the application process straightforward. Unsuccessful applicants were less likely to agree that the application process was straightforward with 10% strongly disagreeing with the statement "The application was straight forward". These findings can be seen in Figure **4-6** and Figure **4-7**.

Figure 4-6 Summary of successful and unsuccessful (combined) participant responses to survey question



Base: n = 55

Figure 4-7 Detailed breakdown summary of unsuccessful only participant responses to survey question



Base: n = 39

4.32 Interview feedback from participants did highlight that certain organisations may be better suited to submitting an application, particularly those with experience of applying for funding (such as universities) and that those organisations less experienced (such as small SMEs and micro-organisations) may struggle to submit a successful bid. There were a number of comments made at interview and via the free text section of the online survey that the process appeared to favour professional bid writers.

4.33 Several participants mentioned employing funding application specialists/consultants to support them to write/prepare a bid. There were also references to a lack of prescription within the application questions themselves and mixed feedback after submission, leading to applicants being uncertain if they had responded correctly. One unsuccessful applicant suggested that the process is heavily biased towards organisations that can devote large amounts of administrative staff time to bidding for relatively modest funds, rather than SMEs that focus effort on day-to-day operations[15].

Key Finding – While the application process may be better suited to those with specialist funding application and writing skills, the process is generally well received and is seen as straightforward, with sufficient time and information to submit an application

[15] While not mentioned by participants, we understand from Innovate UK that the Knowledge Transfer Network offer to review bids once completed.

Bid evaluation and selection process (desktop research)

4.34 The key headline aims specified on the application sites for FOAK 1-3 were:

- FOAK 1 - *accelerate innovation in the UK rail sector and enable new technology to be readily and efficiently integrated into the railway system; and*
- FOAK 2 - 3 - *demonstrate how proven technologies can be integrated into a railway environment for the first time ('first of a kind' demonstrations).*[16]

4.35 The timescales required to deliver these aims, and the various supplementary materials on the application site, suggest that projects should be one of:

- high TRL (probably at least TRL 6) with technology demonstrated in a relevant environment;
- ready for demonstration in an operational environment (TRL 7);
- already have strong end-user buy-in and engagement; or
- depending on the specific technology, TRL 5, if progressing through TRL 6 and 7 can be achieved in a 12 to 18-month timeframe. This is likely to be truer of customer experience type solutions than solutions that require either infrastructure or rolling stock fitment.

4.36 As such we would expect the application guidance and evaluation criteria to reflect this project specification and guide applicants and assessors accordingly, and ensure that projects selected meet these aims of FOAK.

4.37 Following a desktop review, it is noted that the application guidance gives a strong indication that this is the intent of the guidance, with the 'Eligibility' section specifically stating 'we will not fund projects that: are not within a year of being ready for market'; and 'are not high TRL or do not have low technical risk'.

4.38 However, there is also some ambiguity and possible contradiction due to other guidance provided on the application site, specifically 'we will not fund projects that do not create a significant change in the level of innovation available in the rail industry' and 'Applications must have at least 50% of the contract value attributed directly and exclusively for research and development (R&D) services'. The terms 'innovation' and 'R&D' can mean very different things to different people and are open to a very wide interpretation and integration of existing systems to form a new solution is often not widely considered a 'high-level of innovation'.

4.39 Similarly, on the FOAK 1 application page, there is a reference to a suitable project being 'close to market (within one year)'. Although the purpose of FOAK is undeniably linked to delivery of products to end users within a short timeframe, this term is relatively vague, could be interpreted in different ways and is arguably challenging to track effectively. Similarly, the term 'within a year of being ready for market' used for FOAK 2 and 3 could also be open to interpretation.

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[16] **Competition overview - First of a Kind: demonstrating tomorrow's trains today - Innovation Funding Service (apply-for-innovation-funding.service.gov.uk)**

Competition overview - SBRI first of a kind round 2: demonstrating tomorrow's stations and a greener railway - Innovation Funding Service (apply-for-innovation-funding.service.gov.uk)

Competition overview - SBRI rail first of a kind round 3: resilience, freight, noise and environment - Innovation Funding Service (apply-for-innovation-funding.service.gov.uk)

Key Finding – Eligibility guidance provided is focused on delivering against the aims of FOAK. However, the language is subject to being interpreted in multiple ways

4.40 The application questions and evaluation criteria are provided in 'Appendix D - Evaluation and selection material' and we understand that applicants were assessed on the whole application (rather than these criteria being applied to specific questions).

4.41 While we noted nothing specifically wrong with the criteria themselves (also noting we have not reviewed the specific guidance given to assessors) no specific criteria relate to time to market or high TRL. These may therefore have to be covered under the specific scope question (requiring a determination by the assessor as to whether the project fitted within the scope within the competition briefing document) or the final question which is again at the assessor's discretion and justification. The weighting of criteria (as referred to in 'Chapter 3 - Impact evaluation') may also suggest that the weighting of the criteria places less emphasis on speed than is required to deliver FOAK aims. Further analysis can also be seen in 'Appendix D – Evaluation and selection material'.

4.42 Criterion 3 ('making a good case for the application') is the most heavily weighted criteria for FOAK 2 and FOAK 3, and the assessors are guided towards questions 8 and 9 ('Application to the rail Industry: practicality' and 'Application to the rail industry: benefits') within the application. The guidance provided to applicants for both these questions focuses on understanding the impact of the solution on end-users. It also considers attracting potential customers and whether the project will provide 'operational evidence to help accelerate the commercialisation of this innovation in the rail industry'. There is no explicit reference to timescales.

4.43 Criterion 8 ('commercial potential') is the next most heavily weighted question. However, we believe that the focus of criterion 8 could also be interpreted as favouring the potential of the product and its advantage over competitors and the plan to bring it to market, rather than the specific timescale for delivery.

Key Finding – Evaluation criteria and the application of weightings appear to emphasise project benefits, however, the criteria and weightings may not be specific enough to focus on selecting projects that are 12 months from market

Additional feedback from participants and TLG member

4.44 Some participants also suggested at interview that they were uncertain about the overall objectives and aims of FOAK and what 'success' means.

4.45 Similarly, a TLG member commented at interview that there was a 'lack of understanding' of the starting place of projects. They stated that they were unsure of the starting TRL of FOAK projects – for example, they could be TRL 1 or in fact much higher TRL (such as 3 or 4).

Key Finding – The overall aim and objectives of FOAK may not be clearly defined or widely understood

Bid evaluation and selection process (participant feedback)

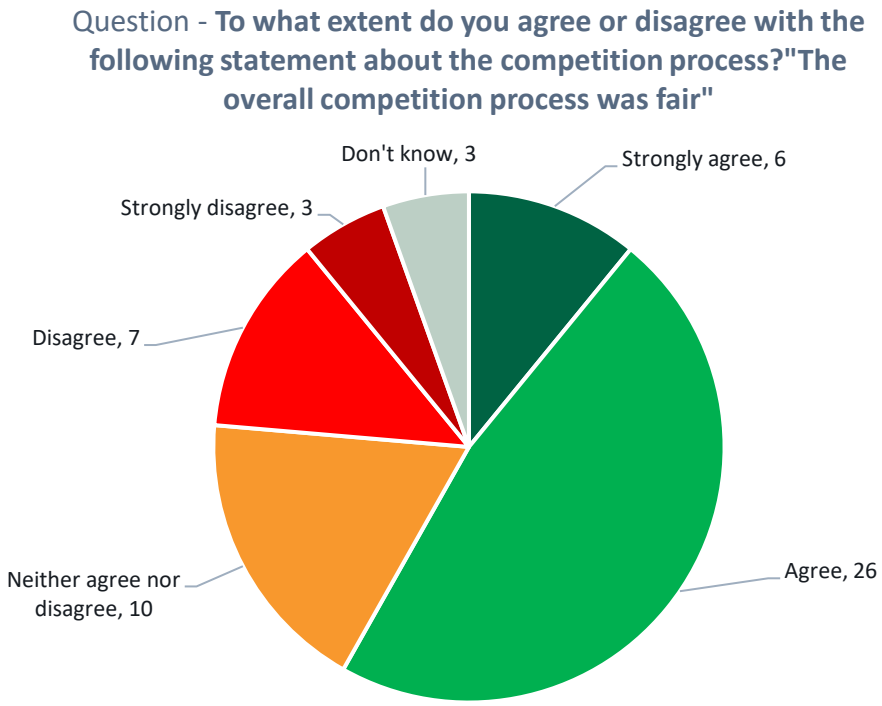
4.46 Overall feedback from participants on the bid evaluation and selection process was positive. Unsuccessful applicants' concerns appeared to be based on the perception that FOAK projects are not reaching market within the indicated shorter timescales, as detailed in 'Chapter 3 - Impact evaluation'. This led some respondents to question the technical rigour of the assessment process, as well as the associated operational understanding and identification of risks.

4.47 There were specific concerns raised at interview that not enough evidence is required to support claims within the application and that not enough due diligence is conducted during the evaluation of bids (to confirm that projects have the ability to achieve the outcomes made in the bid). One participant said the application form was straightforward but, compared to the equivalent for other competitions such as Shift2Rail, was insufficiently prescriptive to enable the validation of applicant claims.

4.48 Some responses at interview, from both successful and unsuccessful participants, suggested that feedback from the assessors may have varied, with one participant saying that they were aware of conflicting opinions of assessors. Some interviewees suggested that the feedback received was not objective. Another suggested providing the opportunity for a face-to-face session with assessors during the evaluation process to enable teams to validate/substantiate claims within their bid.

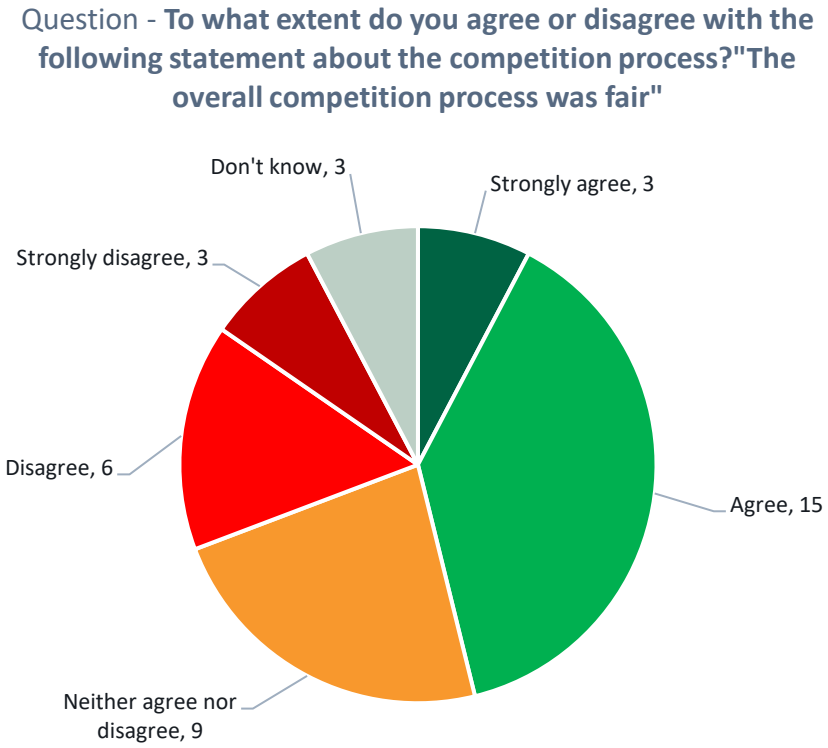
4.49 However, despite the comments raised above, feedback was still generally positive and suggests that on balance, the majority of participants did view the competition process as fair. The quantitative survey feedback corroborates this, with the majority of both successful and unsuccessful applicants suggesting they found the overall competition process fair. However, correlating with the concerns that were raised by unsuccessful participants at interview and in the free text form of the survey, 8% of unsuccessful applicants strongly disagreed with the statement "The overall competition process was fair". These findings can be seen in Figure **4-8** and Figure **4-9**.

Figure 4-8 Summary of successful and unsuccessful (combined) participant responses to survey question



Base: n = 55

Figure 4-9 Detailed breakdown summary of unsuccessful only participant responses to survey question



Base: n = 39

Bid evaluation and selection process (TLG member feedback)

4.50 At interview, one TLG member commented that they would like to see more due diligence regarding the scalability of the project in the future. They commented on an example of a project which they felt was clearly not set up to succeed within the specified budget and timeframe of FOAK but was still successful in receiving funding. They argued that some improvements may be required to ensure that the project selection process is robust enough to select projects that can meet intended FOAK objectives.

4.51 Another TLG member commented that they did not believe evaluators were being asked to assess applications in the way that the TLG/rail industry might want projects to be assessed – although we understand from Innovate UK that the evaluators are rail specialists.

4.52 As detailed earlier in this chapter, it was also noted at interview that industry groups, although involved in the specification of FOAK themes, were not involved in the project selection process. This was again noted by one TLG member as a missed opportunity to validate whether selected projects were likely to deliver key industry objectives within the specified timescales and budget. However, since FOAK 3, RSSB have had input into project selection.

Key Finding – The approach to bid evaluation and selection is seen as broadly fair, however, there were some concerns about the consistency and robustness of the process raised by several stakeholders

Case study: Vivarail - Moving away from FOAK

Situation and Technology: Vivarail Ltd. is a UK company incorporated in 2013. The company specialises in green traction systems based on battery technology to deliver emission-free trains. It worked from its D78 platform to build Class 230 and Class 484 stock. It has the UK's only fully approved battery and battery hybrid trains as well as the associated charging systems. It has sold trains to West Midlands Railway, Transport for Wales, Southwestern Railway and Railroad Development Corporation. Vivarail began investigating the potential for battery technology in 2016 and invested time and money to develop its first proof of concept train. The company realised that, to make battery trains feasible, a system able to recharge the batteries extremely quickly was needed – so they developed 'Fast Charge'.

What happened: Vivarail were successful in securing a pre-FOAK grant of 75% (£640k) from Innovate UK to develop the prototype charging system which was delivered successfully. Thereafter, Vivarail invested its own money into the subsequent development of 'Fast Charge' with the result that it is in its final stage of Network Rail approvals. To continue their work into providing emission-free, clean technology, Vivarail applied for FOAK 2 and FOAK 3 funding – for support in delivering a hydrogen fuel cell train and a Silent Train respectively. Neither of these bids were successful.

Outcome: Vivarail's edge in hydrogen traction technology has now been lost to competitors who did receive grant funding. The subsequent failure of their FOAK 3 submission has made the company reassess the value of Innovate UK funding. As a small company with limited resources, Vivarail noted that their submissions took people away from their actual roles which was ultimately unsustainable. Vivarail has received no subsequent public funding or Government assistance other than making use of the furlough scheme.

Impression of FOAK:

Vivarail's experiences have led them to believe that the FOAK process favours professional bid writers and academics. They believe smaller companies should be given extra support where they are shown to have limited resources and a small team, otherwise they believe some excellent technology from innovative young companies will fall through the cracks of the funding system.

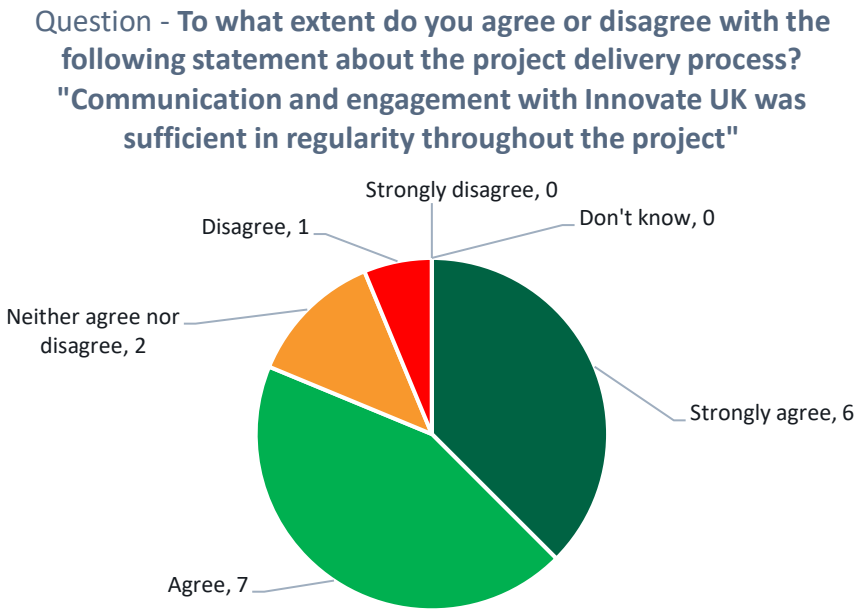
Vivarail's primary recommendation is that there is a face-to-face session after submission, so companies can explain about their project and answer questions. Although feedback was received post-award, Vivarail is still unclear as to why its applications failed and what it should have done differently. They do not believe they were ever given the chance to explain or clarify their bid before the decision was made, with their view being that FOAK seems to be a 'one-way' process.

Project delivery process

Participant feedback

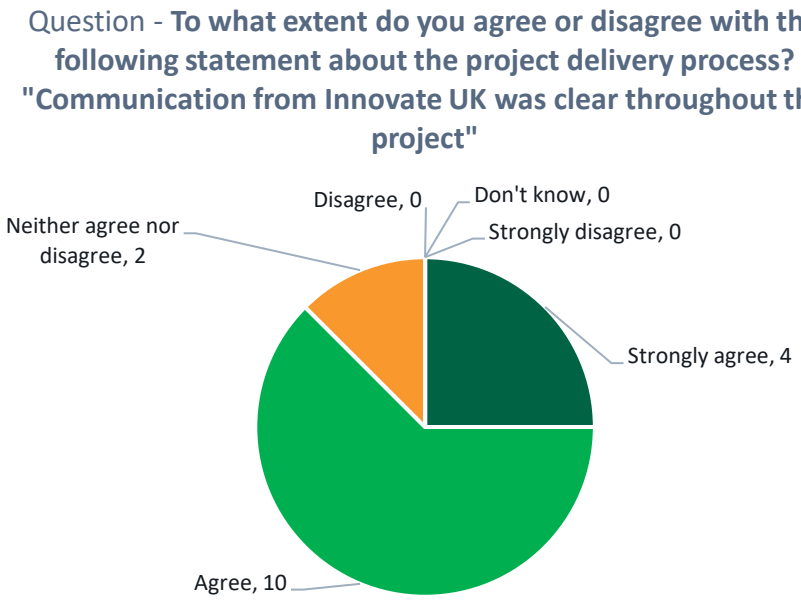
4.53 For all three in scope FOAK competition rounds, quarterly contact was maintained with successful participants via a Monitoring Officer, as highlighted in 'Chapter 2 - FOAK programme structure'. Quantitative findings indicate that successful participants were satisfied with the level of engagement and communication from Innovate UK. Findings also indicate that participants were satisfied with the clarity of communication from Innovate UK. These findings can be seen in Figure 4-10 and Figure 4-11.

Figure 4-10 Summary of successful participant responses to survey question



Base: n = 16

Figure 4-11 Summary of successful participant responses to survey question



Base: n = 16

4.54 Qualitative feedback also highlighted a good working relationship between project teams and their associated Monitoring Officers. Interviewees generally felt supported by their Monitoring Officers and were comfortable with the project delivery process. The few problems highlighted (for example late payment of funding and slow responses from help desk) were generally considered minor and not raised as significant issues by participants during the interview process.

4.55 However, it is noted that through a risk register review, issues and risks are highlighted and it is the Monitoring Officer's job either to try to help resolve these issues or to escalate to Innovate UK if required.

Key Finding – The process of delivery (i.e. contractualised delivery requirements and in-project support) is well received by applicants

Process improvements

Desktop research

4.56 It was also found that changes were made, with a view to improving processes, between each FOAK round. This includes changes introduced in FOAK 2020 and FOAK 2021.

4.57 Innovate UK hold process reviews which have led to improvements being incorporated within each new iteration of FOAK. This has included a streamlining of the application form as well as a development in the requirement for rail sector expertise in the team and the link to a customer organisation.

4.58 There was less of a requirement for an applicant to involve an owner of railway assets in FOAK 1. However, teaming requirements were developed and in FOAK 2 the owner of the railway assets were required to be part of the team. In FOAK 3, the request for a letter of support

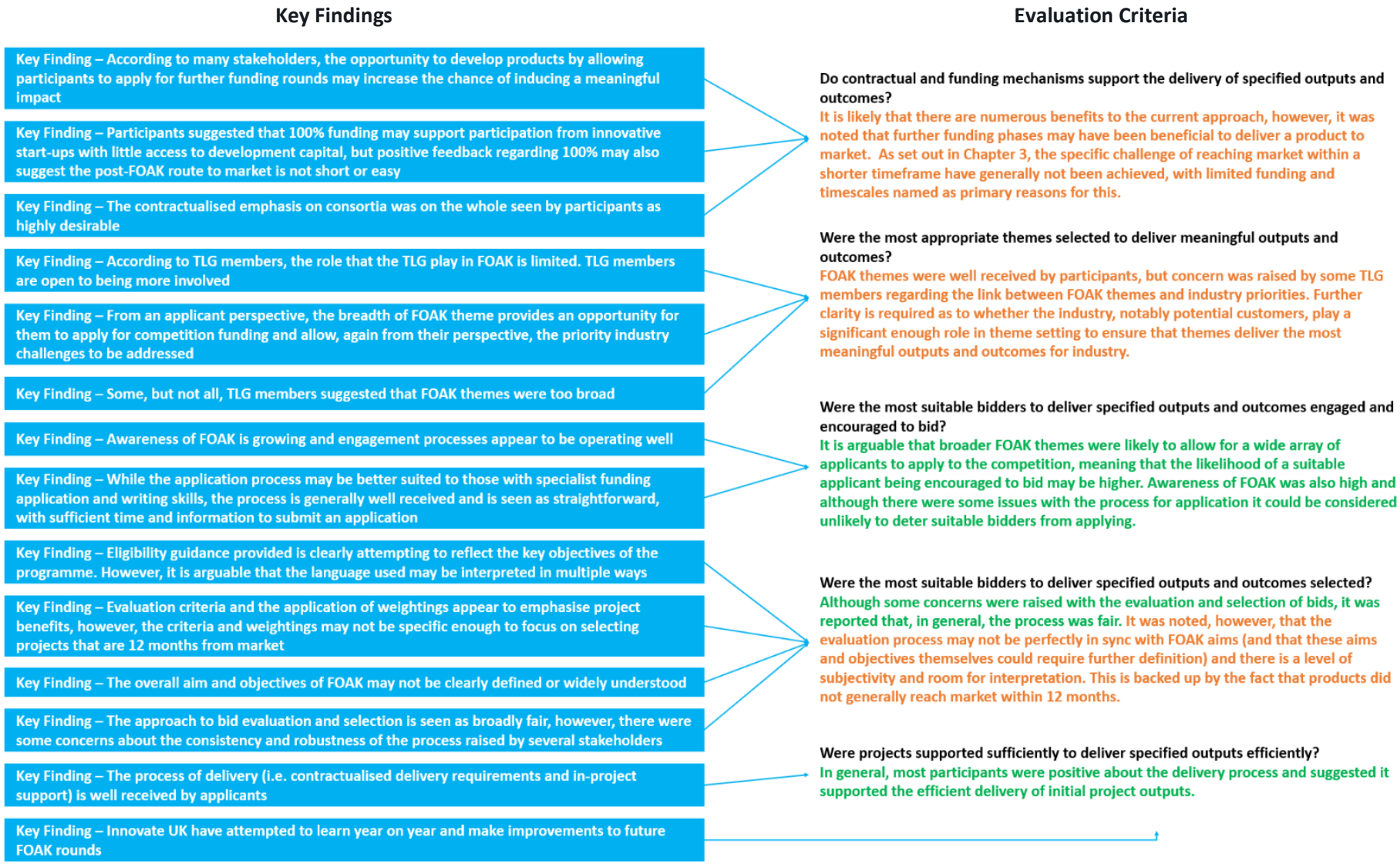
from potential customer organisation was also introduced and would positively impact on the scoring of the application (this became mandatory in competitions after FOAK 1-3).

4.59 Another improvement to FOAK 2020 and FOAK 2021, following a recommendation from TLG after earlier FOAK rounds, was a specification that there should be no duplicate applications (e.g. submitted simultaneously to two competitions).

Key Finding – Innovate UK have attempted to learn year on year and make improvements to future FOAK rounds

Overview

4.60 A summary of how the Key Findings presented relate to the core evaluation criteria for the process evaluation (detailed in Figure 1-1) can be seen below.



5 Post implementation programme monitoring

5.1 In this chapter we present our findings related to the effectiveness of monitoring and evaluating projects post completion of the FOAK competition.

Summary of findings from desktop review, participant and TLG member feedback

5.2 Innovate UK retains the right to contact projects for a period of time after project completion to conduct assessment and evaluation activities. Innovate UK noted that this process is under review, however, they specified that successful recipients of funding are contacted:

- on a periodic basis (coordinated centrally within Innovate UK); and
- at DfT's request, with a target frequency of every quarter (noting this is not always achieved).

5.3 Innovate UK also tried to contact participants directly via telephone but said that this is an exceptionally time-consuming process (e.g. changes in phone numbers, unanswered calls) and it is only conducted sporadically.

5.4 Innovate UK stated that the response rate for the Rail Innovation Programme specific request is between 50% - 75%. The data is reported back to DfT and summarised to provide a status of commercial status as one of: i) in progress; ii) prospect of a commercial relationship; iii) strong prospect of a commercial relationship; or iv) finalised commercial relationship (i.e. under contract).

5.5 Many applicants that received funding as part of FOAK 1-3 have not yet introduced their product to market. Therefore, our findings related to the ongoing monitoring and evaluation of projects, and consequently the Rail Innovation Programme, are not based on practical examples of assessing how project outcomes and benefits are being tracked. Instead, findings are predominantly based on proposed methods for tracking and evaluation outcomes in the future.

5.6 No notable concerns were raised by participants at interview regarding the process of feeding information back to Innovate UK. In most cases, participants at interview were happy with communication from Innovate UK post-project completion and, as with the communication during the project delivery process, the relationship between organiser and funding recipient was generally seen as very good. Many participants did, however, note that the process was relatively high level and did not stipulate the provision of in-depth feedback. It is therefore inevitable that companies who do provide feedback offer a differing level of insight based on their own interpretation of what is required, and this is supported by feedback from participants at interview.

5.7 Following a review of post-project communication sent to applicants who received FOAK 1-3 funding (see 'Appendix E – Project monitoring material'), we found that the information requested by Innovate UK is quite limited and predominantly qualitative. The commercial status of the product is requested, but this information is unlikely to provide sufficient structure for information to be used to track progress in a measurable and quantifiable way. The current method of data gathering does not include tracking information against pre-defined outputs or outcomes, which means it would be difficult to use the current process to effectively assess whether medium to long term objectives specified in the application phase are being met.

5.8 Feedback from Innovate UK indicated the reason for approaching data capture and assessment post-project completion from a more high-level (or 'brief') perspective was poor response rates from relevant organisations, and therefore a requirement to keep the request for data process simple and straightforward to encourage a higher level of engagement and provision of feedback.

Key Finding – The ongoing data capture and monitoring of projects post implementation of FOAK delivery process is well received by funding recipients, however, it is high level and does not provide quantitative measures to track ongoing success against an agreed pre-project baseline or metric

5.9

Key Finding – Gaining meaningful responses from successful applicants' post-project completion is challenging and results in an incomplete data set (not all applicants provide responses)

5.10 There was significant feedback from participants and industry stakeholders during interview, and noted from qualitative section of the online survey, that only limited information related to the evaluation of projects funded through FOAK is publicly available. Unless a press release was issued in relation to a success story, the wider industry could not follow the progress of FOAK competitions and the impact that projects may have on the rail industry. It was commented that this restricted the industry's ability to learn lessons from FOAK funded projects, including the potential opportunities or pitfalls related to certain technologies or solutions to wider industry challenges.

Key Finding – The wider industry has limited opportunity to be made aware of the progress (including successes and failures) of FOAK funded projects

6 Conclusions

Summary of evaluation

Impact evaluation

1. FOAK 1-3 projects are generally being delivered within the specified timeframe and budget and this is resulting in advances in TRL and ensuring that some traditional barriers within rail, such as the risk of investment being too high and lack of access to trial and testing facilities, are being overcome.

2. According to successful participants, this is also leading to discussions with potential customers regarding adopting their solution in the future, however, the desired aim of products reaching market in the short term (within 12 months) is generally not being achieved.

3. It is therefore clear that some barriers remain, as additional time and funding is often required to deliver a product to market. Given the high TRL level requirement for FOAK selection, this implies that some, or a combination of the below, may be true:
   a) There is misalignment between this desired aim of reaching market within 12 months and the projects being selected (overestimating the actual TRL of the FOAK project).
   b) The difficulties being encountered in this critical area (such as long safety certification timeframes, failure to overcome business switching costs, lack of scalability, procurement) are underestimated and therefore more time and budget is required to deliver projects to market.
   c) Products delivered are not fully aligned with customer need or that customers are not for some reason able to exploit the product (e.g. franchise term precluding investment).
   d) The risk of not reaching market within 12 months is inadequately addressed during the project delivery phase.

It should be noted that not all of these challenges are within the scope of FOAK to resolve. For example, the lengthy process of safety certification is an industry problem and requires a coordinated industry wide approach to address it.

4. There is a perception that FOAK projects may deliver some medium to long term objectives of FOAK, delivering against FOAK themes, RTS priorities and DfT R&D priorities, however, it is not currently possible to measure or quantify this impact.

Process evaluation

5. In general, the FOAK processes receive positive feedback, and are viewed as well implemented. In particular, the theme selection, competition process and project delivery process were, despite some issues highlighted in this report, likely to support the delivery of outputs and outcomes as intended.

6. FOAK 1-3 projects are generally being delivered within the specified timeframe and budget, which implies Innovate UK delivery processes are working well. There was significant praise of the role of Innovate UK in supporting projects through the process from application through to project delivery.

7. However, as set out in point 3 above, products are generally not reaching market in the short term (within 12 months) which suggests some disconnect or gaps in the underpinning assumptions or the processes in place to deliver the competition aims. From a process perspective, this suggests that:
   a) There may be an issue with the definition of objectives and ensuring these are clearly understood and align with realistic aims that can be achieved within the required budget and timeframes.
   b) Although evaluation criteria and the application of weightings to specific criteria appear to be used to select better projects, the criteria and weightings may not be specific enough to select projects that are likely to reach market within 12 months. Following a review of application and evaluation material by Steer and Pragmatex, as well as through the consideration of comments from participants regarding the perception of TRL and what is required through the delivery process, there is some ambiguity regarding the way in which objectives and guidance material could be interpreted. This again could cause some confusion across the selection and evaluation of bid process and makes it challenging to track outcomes.
   c) There are indications that the current SBRI structure of FOAK may not align with the desired post-FOAK goal of achieving rollout to market within 12 months nor with the broader outcomes of making improvements to broad challenges and strategic rail priorities. Specifically, the constraints that were noted were:
      - structure (single phase);
      - timescales (nine-month delivery); and
      - budget allocations (insufficient for major innovations).
   d) It could be argued that the project delivery process, and associated risk management, is also at fault. There are examples of project 'descoping' and, while most projects' scopes were generally delivered within the 9-month FOAK delivery process, there may need to be more onus on participants and Innovate UK to address the wider risk of not reaching market soon after project delivery during the initial project delivery phase.

8. However, it should be noted that various other elements of the current model, such as the emphasis on consortia, are seen as beneficial.

Overview

Following this evaluation, it is clear that FOAK does add value and supports participants to overcome some traditional barriers to innovation within rail and help projects advance through TRLs. However, our understanding is that FOAK is designed to support high TRL projects into market, and in most cases, projects are not being delivered to market within 12 months. The FOAK process is therefore often dropping projects at a point whereby there is no natural process for them to reach market, with additional time and funding normally required to further develop the product to be market ready. Therefore, processes of FOAK, in particular the current adherence to a single-phase SBRI and the link between objectives and selection of projects, may need to be addressed when considering the best way to deliver these quite specific and challenging targets in the future.

Appendix A – DfT logic model for assessing FOAK 1-3

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PRAGMATEX

Inputs & activities	Outputs	Short-term outcomes	Mid-term outcomes	Longer-term impacts
<u>Inputs:</u> £36m of overall programme funding to Innovate UK, FOAK 1-3 total: 14.55m (FOAK1: 3.5m, FOAK2: 3.5m, FOAK3: 7.55m) From the above budget, funding of £250,000 to £350,000 provided for each project <u>Activities:</u> Innovate UK design the overall funding competition in consultation with DfT Key R&D themes for the rail sector are outlined in the scope and at launch events Potential innovators receive access to networking with industry stakeholders and	For each project, demonstration of the technology in a live railway environment Projects successfully delivered on budget Projects successfully delivered within the set timeframe *(secondary)*	Barriers to the potential uptake of new technologies are overcome, e.g. • Rail procurement practices; • Access to trial and testing facilities; • Acceptance procedures; • Supplier accreditation schemes; • Risk to invest is too high. More technologies are ready for commercialisation Improved industry perceptions of the potential use of the technologies funded	Adoption of the technologies funded by the programme in the rail sector ↓ *Increasing awareness and interest in the rail market among small to medium size innovative companies* *More willingness to invest in new technology in the rail industry*	Funded new technologies contribute towards themes from FOAK 1-3: **FOAK 1: Demonstrating Tomorrow's Trains Today** Themes: More space on trains, Personalised customer experience, Efficient passenger flow through stations and onto trains, More value from data, An accessible network **FOAK 2: Demonstrating Tomorrow's Stations and a Greener Railway** Themes: Decarbonisation of the railway, Customer experience in stations **FOAK 3: Resilience, Freight, Noise and Environment** Themes: Operational Resilience, Infrastructure Resilience, Freight (non-

potential collaborators at launch events Funding is applied for and awarded via Innovate UK, using SBRI competition model (100% funding for project; contractual approach to funding arrangements)				passenger transport), Noise / Environment  **Rail Technical Strategy (RTS) core priorities:** • Easy to use for all • Low emissions • Optimised train operations • Reliable and easy to maintain • Data driven  *DfT R&D priorities:* • ***Improving transport for the user*** • ***Decarbonisation*** • *Levelling up the economy* • *Increasing global impact*

Appendix B – Summary of evidence gathering

Breakdown of online survey respondents

The online survey was sent on 01 March 2021 and closed on 23 March 2021. Three email reminders were sent.

Number of respondents per FOAK competition and theme:

	No. of successful respondents	No. of unsuccessful respondents	Total respondents
FOAK 1 - 2017: Demonstrating Tomorrow's Trains Today			
• More space on trains	**2**	**1**	**3**
• Personalised customer experience	**1**	**3**	**4**
• Efficient passenger flow through stations and onto trains	**0**	**2**	**2**
• More value from data	**0**	**1**	**1**
• An accessible network	**0**	**1**	**1**
FOAK 2 - 2018: Demonstrating Tomorrow's Stations and a Greener Railway			
• Decarbonisation of the railway	**4**	**3**	**7**
• Customer experience in stations	**2**	**5**	**7**
FOAK 3 - 2019: Resilience, Freight, Noise and Environment			
• Operational Resilience	**3**	**12**	**15**
• Infrastructure Resilience	**1**	**9**	**10**
• Freight (non-passenger transport)	**2**	**0**	**2**
• Noise / Environment	**3**	**5**	**8**
• Skipped survey question	**1**	**4**	**5**
TOTAL	**16**	**41**	**57**

Breakdown of interview schedule

Competition participants by FOAK 1-3 round:

	Successful applications	Unsuccessful applications	Interview Date
Participant 1	**FOAK 1, FOAK 3**	**FOAK 2, *FOAK 2020***	10 March 2021
Participant 2	**FOAK 2**	**FOAK 3**	18 March 2021
Participant 3	**FOAK 2**		12 March 2021
Participant 4	**FOAK 2**		17 March 2021
Participant 5	**FOAK 3**	***FOAK 2020***	15 March 2021
Participant 6	**FOAK 3**	***FOAK 2020***	19 March 2021
Participant 7	**FOAK 3**	***FOAK 2020***	22 March 2021
Participant 8	**FOAK 3**		30 March 2021
Participant 9		**FOAK 2, FOAK 3**	17 March 2021
Participant 10		**FOAK 1**	15 March 2021

Other interviewees by stakeholder category:

Category	Interview Date
TLG	17 March 2021
TLG	17 March 2021
TLG	26 March 2021
TLG/Network Rail	19 March 2021
Innovate UK	9 March 2021, 29 March 2021
KTN-UK	19 March 2021
TOC	29 March 2021

Appendix C – Additional detail related to funding mechanism

A key consideration in how innovation investment activity is funded is state aid. At the time, this funding was available as the UK remained part of the European Union and as such state-aid considerations were aligned to the General Block Exemption Regulation (GBER).

The most commonly used mechanism for funding projects of this size and scale is **Article 25**[17], which sets out a co-funded approach with funding amounts dependent upon organisation size and the stage of development of technology. Smaller companies receive larger aid percentages than larger companies and the earlier in the technology development cycle, the larger the aid percentage. The funding provided is administered through a grant arrangement rather than a contract.

An alternative funding mechanism available to government and other bodies or agencies, subject to public or EU procurement regulations, is a mechanism referred to as **pre-commercial-procurement (PCP)**. PCP challenges industry from the demand side to develop innovative solutions for public sector needs and it provides a first customer reference that enables companies to create competitive advantage on the market.

PCP enables public procurers to compare alternative potential solution approaches and filter out the best possible solutions that the market can deliver to address the public need[18]. However, a key aspect of the approach is that it enables the public sector to fund competing suppliers in parallel to compare different solutions to a problem through a series of R&D phases in each phase the number of solutions reduces. The number of phases is determined at the outset in the procurement documents and can be a single phase or multiple phases.

In the UK, **SBRI** is the UK government version of PCP and is utilised by multiple government agencies (usually administered by Innovate UK) but the mechanism is free for use by any public sector body.

Key aspects of SBRI are:

- The provision of '100% funding'. Proposals are evaluated against 'fair market value' and 100% of the funding requested by the suppliers is provided against deliverable and milestones achieved.
- A fixed price contract rather than a grant; and if the supplier fails to meet agreed milestones or deliverables in the timescales indicated within the contract, the procurer is

[17] https://www.gov.uk/government/publications/innovate-uk-state-aid-funding-policy/innovate-uk-state-aid-funding-policy

[18] https://ec.europa.eu/digital-single-market/en/pre-commercial-procurement

not required to pay in full (unless the agreements are amended and similar changes are available to other funded suppliers within the programme).

- No limit on the amount of money put toward a PCP programme or individual project sizes.
- The market may not currently offer a solution or there may be a need to improve on the cost and effectiveness of current products and services that are available.

Appendix D – Evaluation and selection material

Evaluation Criteria and Questions – FOAK 2 and 3

Application questions

- 1: description of proposed idea or technology
- 2: technical project summary
- 3: current state of the art and intellectual property
- 4: project plan and methodology and continued project management
- 5: technical team and expertise
- 6: application finances and justification of continued costs
- 7: commercial potential
- 8: application to the rail industry: practicality
- 9: application to the rail industry: benefits
- 10: declaration.

Evaluation criteria

Evaluation Criteria	Weighting
Does the proposal meet the scope as detailed in the brief?	Y/N
1. How well does the proposed idea, solution or technology meet the challenge as detailed in the brief?	10
2. How valid is the technical approach that will be adopted?	10
3. Have the applicants made a good case for application of this idea, solution or technology to the rail industry? (See particularly questions 8 and 9 on the application form)	40
4. How innovative is this project? To what extent does the project develop or employ novel concepts, approaches, methodologies, tools or technologies for this area?	10
5. To what extent does the proposal show a clear plan for establishing technical and commercial feasibility and the development of a working prototype? How does the proposal demonstrate that there is a clear management plan What are the risks (technical, commercial and environmental) to project success? How effectively will these be managed? How appropriate are the milestones and evaluation procedures?	10
6. To what extent does the applicant appear to have the right skills, capabilities and experience to deliver the intended benefits?	10
7. How appropriate is the proposal financially? Is the overall budget realistic and justified in terms of the aims and methods proposed? Are the costs appropriate and justified?	10

8. Is there a clear commercial potential to lead to a marketable product, process or service and a clear plan to deliver that and route to market? How significant is the competitive advantage which this technology affords over existing or alternate technologies that can meet the market needs?	20
Would you fund this project	Y/N

The assessment criteria published for FOAK 1- 3 are identical; however, the weightings for FOAK 2 and 3 are adjusted from FOAK 1 in that criteria 3 is weighted at 40 and criteria 8 is weighted at 20, compared to FOAK 1 where these were both weighted at 10.

Appendix E – Project monitoring material

Innovate UK quarterly monitoring email to successful FOAK participants

Dear «Main_Contact_First_Name»

We hope you are having as good a summer as possible in these challenging times.

We are emailing in relation to your DfT/InnovateUK-funded project "«Project_Title»" from the competition "«Competition_Name»". As you may know, on a quarterly cycle, DfT requires InnovateUK to collect information on the commercial developments and successes of projects from the Accelerating Innovation in Rail and First of a Kind Programmes. This is critical to reporting back to DfT and we would appreciate it if you could make answering this email a priority.

If your project has been a great success and become commercial that's excellent, and please let us know. If you are heading in this direction, but not yet there, please take time to tell us the encouraging news. Or if your project demonstrated a great capability that you are still working to commercialise, that's also fine, but please let us know so we can get as accurate a representation of the programme as possible.

Please answer the two brief questions below before 14th August if possible and return to InnovateUK at this email address (please do not change the email subject title).

Thank you in advance for your help.

Number	**Project**	**Please summarise any formal commercial relationships you have in place as a result of your project activities, or steps in this direction.** If you can cite figures (£) please do – your information will be treated in confidence.	**Additional Comments (if required)**
«TSB_Project_Number»	«Project_Title»	<please insert Text Here>	<please insert text here>

We very much appreciate your support,

Regards

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Quality Assurance Level

Level 3 (please see table below for reference)

Level	QA/review	Context
0	None	Typically this would be email and/or informal correspondence. The PM/PD would be aware of the correspondence and information exchange but the project requirements are likely to have prevented review.
1	Reviewed by Workstream Lead	Working notes to support discussions with DfT peers, e.g. Draft Scoping Notes.
2	As per #1 plus reviewed by Project Manager or Project Director	Interim milestones used to inform progressive decision making on the project such as prioritisation of tasks. Final Scoping Notes. Working Draft Reports for Discussion.
3	As per 1 plus reviewed by Project Manager and Project Director	Draft reports and analyses that underpin policy decisions.
4	As per #3 plus independent review by QA Lead or their nominee	Final reports and analyses that underpin policy decisions.

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