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Interim impact evaluation of the Agri-Tech Catalyst

Extended executive summary

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Introduction

An overview of the Agri-Tech Catalyst

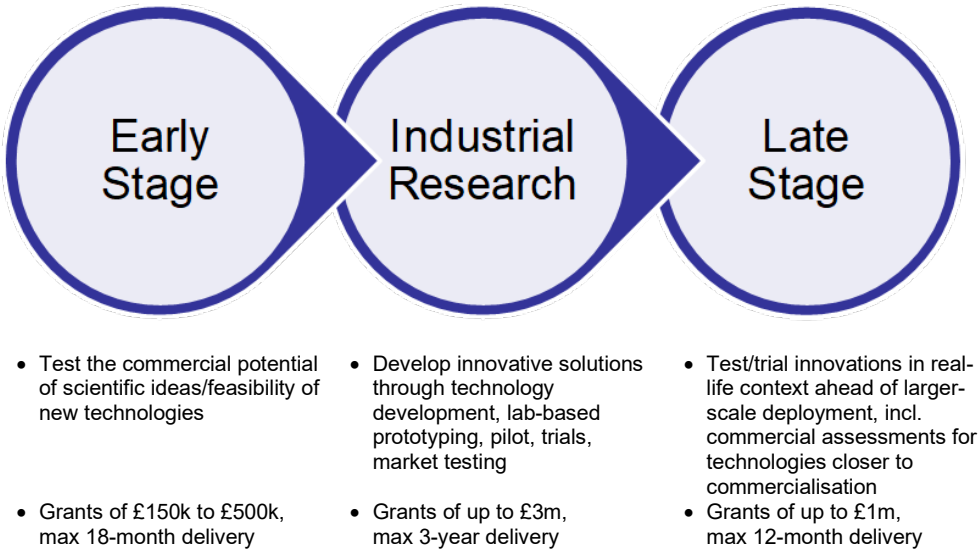
1. The Agri-Tech Catalyst was launched in 2013 as a key programme under the UK Strategy for Agricultural Technologies. The programme secured £60m from the Department for Business, Energy and Industrial Strategy (BEIS), Innovate UK and the Biotechnology and Biological Sciences Research Council (BBSRC) to support UK-based innovation projects in the agri-tech sector. £10m was also provided by the Department for International Development for international projects; these projects are excluded from this evaluation. Throughout this report, 'the programme' refers to the UK-based aspects of the Catalyst.

2. The Catalyst programme aimed to:

   "accelerate translation of research into practical solutions, best practices and applications of new technologies in agriculture – ultimately to contribute to improvements in agricultural output and productivity, whilst reducing the environmental impact of agricultural production".

3. Each competition set out broadly defined sector challenges[1], avoiding prescriptive calls, to facilitate market-led responses. Three grant types were available, reflecting different technological stages (see Figure 1). All projects had to be collaborative in nature – early stage grants could be led by a business or academic, but industrial and late stage grants had to be industry-led. Any sector or discipline could apply, and funders were keen to see spill-in of typically non-agricultural partners to encourage technology convergence.

Figure 1: Overview of Catalyst grant types



Source: SQW, based on the Catalyst programme

[1] Sector challenges were: primary crop and livestock production (including aquaculture), non-food uses of arable crops (for example, for biomass), food security and nutrition challenges in international development, and challenges in downstream food processing, provided the solution lies in primary production.

4. In total, 396 applications were submitted in the five rounds covered by the evaluation[2]. The quality of applications was high, and competitions were significantly over-subscribed, with demand exceeding the funds available: only a third of applications scoring 70 or more out of 100 (a level deemed 'fundable' by Innovate UK) were funded (with funding awarded to those applications that scored highest in each individual funding round).

5. In total, **103 projects were awarded Catalyst funding**[3], of which 36% were early stage projects, 52% were industrial stage, and 12% were late stage. In addition to funding from Innovate UK and BBSRC, the programme has secured nearly £36m in match funding. Projects involved a wide range of organisations:

   - **83 organisations leading projects**, of whom 15 were leading more than one project and 14 were also acting as collaborators on other projects.
   - **229 organisations acting as collaborators on projects**, of whom 44 collaborated on more than one project.

6. Overall, academics comprised 13% of project leads, although this is concentrated in early stage grants, as industrial and late stage grants were business led. Over half (54%) of project leads were SMEs, and around one third (32%) were large businesses[4]. Organisations involved in projects were found in all UK regions, with particular concentrations of leads in Scotland, the East Midlands, East of England and South East reflecting the spatial focus of much of the UK's agricultural sector, where key research centres and assets are located, and reflecting the volume of applications received.

The evaluation

7. SQW in partnership with Martin Collison and BMG Research, was commissioned by BEIS in December 2017 to undertake an interim impact evaluation of the Catalyst. The Steering Group included representatives from BEIS, Innovate UK and BBSRC (now both part of UKRI), the Department for International Development (DFID), the Department for Environment, Food and Rural Affairs (Defra), and the Department for International Trade (DIT). The key research questions for the evaluation are summarised in the box below.

Figure 2: Evaluation questions

What has been delivered to date?

- Are projects encouraging new actors/disciplines (including spill-ins) to engage in R&D in the agri-tech sector? Are collaborations new?
- Have the activities been delivered in partnership with other programmes (e.g. Agri-Tech Innovation Centres)? Are any other programmes acting as "feeders" for the Catalyst?

[2] In Rounds 1 and 2 projects could run for up to 5 years
[3] This evaluation excludes the 24 DFID-funded projects under the Catalyst programme
[4] One project was led by a charity (1%)

What outputs, outcomes and impacts have been achieved to date?

- What is the nature, scale and reach of outputs, outcomes and impacts achieved by industry and academic partners, compared to expectations?
- What are the wider indirect outcomes on innovation in the sector more widely?
- What factors have helped or hindered pathways to impact?
- To what extent are outcomes and impacts additional?
- What is the added value of the collaborative approach? Are relationships sustained? Is the Catalyst changing attitudes towards collaborative R&D?
- What is the contribution of the Catalyst relative to other internal/external factors identified?
- What are the anticipated outcomes/impacts of the Catalyst in future (and when)?

How is the Catalyst performing overall?

- To what extent is the Catalyst on track to deliver against original aims/objectives (of the programme and wider Agri-Tech Strategy) and addressing the original rationale?
- What are the remaining barriers to commercialisation?

What are the key lessons from the Catalyst?

- What has worked well (or not) and why in delivering outcomes and impacts?

Source: SQW, drawing on original Specification for the study, SQW's proposal, discussions with the Steering Group, and feedback from the scoping consultations

8. The evaluation is **theory-based**, comparing evidence on what has actually happened as a result of the Catalyst against the original 'Theory of Change' of what was expected to happen. This approach reflects the variation across the three award types, complex and multiple routes to impact, and the very diverse nature of projects supported, combined with relatively small sample sizes (particularly when assessing outcomes for each award type)[5]. As part of our approach, we have drawn on contribution analysis to provide a framework for the assessment of the Catalyst, which involves gathering evidence against three key questions:

    - Is there a reasoned Theory of Change, and have activities been implemented as set out in the Theory of Change?
    - Is there evidence that the expected results have occurred?
    - Was it the Catalyst, rather than other influencing factors that made the difference, or the decisive difference?

[5] The overarching approach aligns with the recommendations for the evaluation of the Catalyst set out in SQW's evaluation framework for the Agri-Tech Strategy in 2016.

9. Following an initial scoping exercise to develop the programme's logic model and Theory of Change, the main evidence gathering has been undertaken in two phases:

   - **Phase 1 focused on early and late stage projects**, the majority of which were expected to be complete by the point of the evaluation fieldwork over February-June 2018.
   - **Phase 2 focused on industrial stage awards**, which were longer in duration and took longer to complete; the research was undertaken over August 2018-May 2019.

10. By phasing the evaluation this way, the Steering Group sought to balance the need to allow sufficient time to pass to observe outcomes against the risk of corporate memory loss.

11. Each phase adopted a **mixed-methods approach**, including a desk-based review of data and documents (including monitoring data and close-out reports), telephone surveys with project leads and collaborators and unsuccessful applicants, and in-depth case studies of 14 projects (seven in each phase). We also consulted with delivery partners, and external stakeholders[6].

12. For the surveys, *all* project leads and collaborators were contacted, with a response rate of 46% in Phase 1 and 59% in Phase 2. This enabled us to gather primary evidence from well over half (62 of 103) supported projects, although owing to issues in accessing contact data for industrial stage projects[7] there is a bias towards projects in later rounds, with implications for the potential impacts captured by the evaluation. To inform an understanding of the counterfactual, leads of unsuccessful applications deemed fundable but which scored lower than supported projects in each funding round and therefore not supported were also surveyed[8] (expanded to include all unsuccessful applicants for industrial stage projects given the small sample size).[9] In total, 43 unsuccessful applicants were surveyed (29 in Phase 1, 14 in Phase 2), a third of relevant contacts.

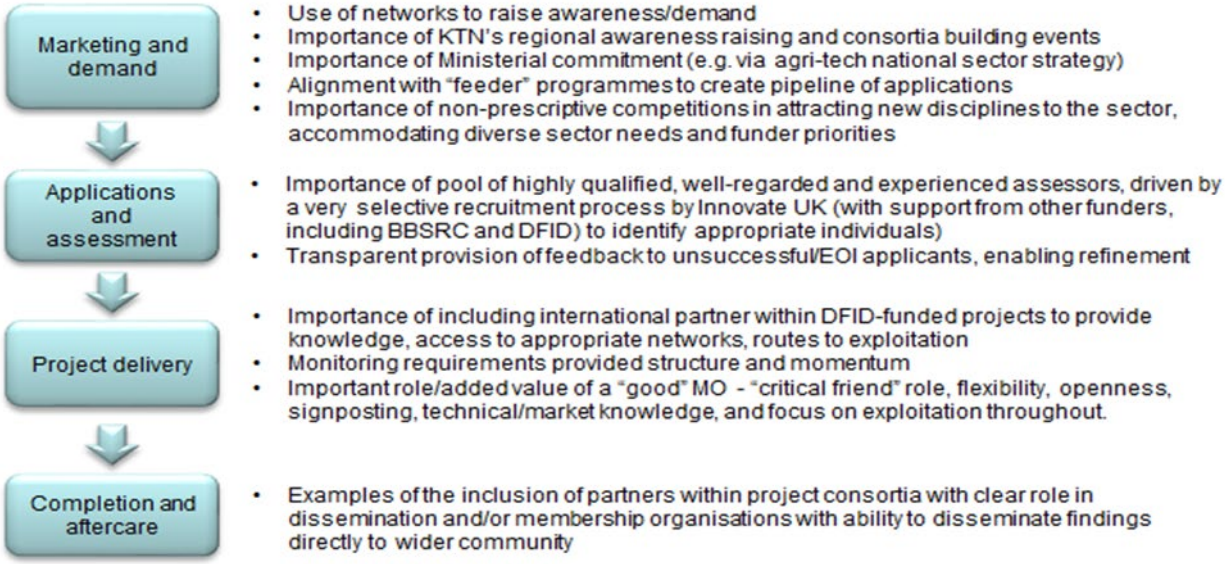
13. This is an extended Executive Summary of the findings. Two detailed reports – one for each of the two phases of research – underpin this Executive Summary and are available separately.

Wider evaluation activity

14. Prior to this interim impact evaluation, a process evaluation was completed of three Catalyst programmes (Agri-Tech, Industrial Biotechnology and Energy) exploring how effectively they had been delivered and the extent to which processes supported or inhibited routes to impact. For context, key findings in relation to the Agri-Tech Catalyst are summarised below.

[6] External stakeholders had an interest in the agri-tech sector, but were not directly involved in the delivery of the Catalyst.
[7] They had to opt into the survey.
[8] i.e. those who met Innovate UK's funding threshold but did not rank highly enough to receive funding
[9] i.e. those who met Innovate UK's funding threshold but did not rank highly enough to receive funding

The Catalysts were seen as a pioneering way for funding bodies to work together to support multi-disciplinary research at different stages of commercialisation. The evaluation focused on three of Innovate UK's Catalysts: Agri-Tech, Energy and Industrial biotechnology. The study found that the programmes were delivered effectively on the whole: strong partnership working was evident in the marketing and promotion of the programmes, where Knowledge Transfer Network (KTN) helped to stimulate strong and consistent demand; the core application, contracting and monitoring processes worked effectively and were in line with Innovate UK's and the Research Councils' approaches; and decision-making process and management structures varied across the three Catalysts but each was generally perceived to have achieved a balanced portfolio, reflecting broad-ranging demand from a breadth of sectors. Good practice was identified throughout the customer journey, highlighting processes that worked well in the delivery and governance of the Agri-Tech Catalyst (and in some cases other Catalysts); key findings are set out in the Figure below.



However, there were also some sub-optimal processes that risked inhibiting pathways to impact, including inconsistent and in some cases limited approach to aftercare, and limited data collection to evidence impact and share learning. The evaluation also noted that the curtailment of Catalyst funding has meant that relatively few projects have been able to progress through the different grant stages.

The study made a number of recommendations to improve the Catalyst process in order to maximise impact, some of which were Catalyst-specific and others were generally applicable to wider research and innovation programmes. These included: ensuring the programme design includes plans for knowledge dissemination (from and between projects); formal and comprehensive inclusion of signposting; and improved programme-level monitoring.

Source: SQW. See full report.

15. In addition, 24 DFID-funded projects under the Catalyst programme (excluded from this evaluation) are subject to a separate evaluation, summarised below.

In early-2019, DFID commissioned a separate performance evaluation of the DFID-funded Catalyst projects through to 2021 to assess the effectiveness of the Catalyst as a funding mechanism in stimulating agricultural innovation in and for developing countries. The evaluation will review implementation and assess initial impacts achieved to date and potential future impacts, including on the end users of innovation in developing countries.

The evaluation will be conducted in two main phases: 2018/9 and 2021, with a modest interim phase in 2020. The first phase will comprise a process evaluation and a first assessment of outcomes, early impacts and sustainability. The second phase will then involve a more thorough assessment of impacts and sustainability. A mixed-method approach will be adopted, including desk-based research, interviews with stakeholders in the UK and overseas and farmers/end users of technology, field visits to developing countries, an applicant survey and case studies.

Source: DFID

Conclusions on the effectiveness of the Catalyst

Key messages

- There is strong evidence to support the underlying rationale, particularly in terms of risk, uncertainty and time-lag to impact, and co-ordination failures that inhibit collaborative R&D on high-risk projects.
- Demand for the programme was strong, and it stimulated new collaborations, the convergence of technologies, and new project ideas.
- Some aspects of the programme have been sub-optimal: projects have not been able to progress through the Catalyst grant types; a potential missed opportunity to share learning/encourage synergies across the project portfolio; and dissemination activities have been limited.
- There is strong evidence to demonstrate how the Catalyst's intended intermediate outcomes have been achieved to date, particularly in terms of innovation behaviours, capacity and partnerships.
- At this interim evaluation stage, commercialisation, employment and turnover outcomes for those involved and wider impacts on the agricultural sector are modest (as expected with many of the projects funded given their stage of technological development).
- The programme has achieved high levels of (self-reported) outcome additionality. The Catalyst is one of a number of interdependent and reinforcing factors that have been important in realising outcomes – and was the decisive factor for many beneficiaries.
- Overall, the programme is delivering against the Agri-Tech Strategy's ambitions for the Catalyst and has addressed many aspects of the original rationale.

Is there a reasoned Theory of Change, and have activities been implemented as anticipated?

16. Overall, there is **strong evidence to support the underlying rationale**, particularly in terms of (often mutually reinforcing) factors such as risk, uncertainty and time-lag to impact, and co-ordination failures that can inhibit collaborative R&D on high-risk projects. For industrial projects in particular – that accounted for the majority of funding – scale was a key factor underpinning the rationale for public intervention. The inputs have focused on the intended audience and activities have broadly been implemented as set out in the Theory of Change. **Demand for the programme was strong**, and the quality of projects supported was high. The programme has encouraged spill-ins, of partners who were new to agri-tech and in some cases those who were new to R&D (especially public sector R&D). It has also **stimulated new collaborations and the convergence of technologies, and stimulated new ideas** for new products, services and processes. There is a high level of 'activity' additionality, and technological progress has been made more quickly that would have been the case without Catalyst support.

That said, many of those taking projects forward after the Catalyst have required further investment (either via collaborator/customer funding or public sector grants) to do so.

17. However, there are **some aspects of the Theory of Change that have not been realised as expected**, which may have implications for impact. Specifically:

- projects have not been able to progress through the Catalyst grant types (risking a funding gap post-Catalyst) nor link-up consistently with the Centres for Agricultural Innovation as anticipated (due to the timing of the programme)
- there has been limited knowledge sharing across the Catalyst portfolio, with a potential missed opportunity to deliver more than the sum of its parts (although Innovate UK has more recently allocated funding to address this issue, as projects come to a close)
- dissemination activities have been sub-optimal, raising concerns that wider impacts/spillovers will not be fully realised.

Is there evidence that the expected results have occurred?

18. The evaluation indicates that **intermediate outcomes set out in the original logic model have been achieved to date**, particularly in terms of innovation behaviours, capacity and partnerships. Benefits in terms of improved staff skills/knowledge, new or improved collaborations established with the research base, enhanced R&D/commercialisation capabilities, and perceptions of an improved profile/reputation/credibility were particularly common amongst the beneficiaries surveyed for the evaluation. The programme has also made beneficiaries more likely to invest internal funds in other R&D, and bid for Government funding for R&D, in the future, according to the survey evidence.

19. **At this interim evaluation stage, commercialisation, employment and turnover outcomes are modest**. While the survey evidence indicated a high level of confidence that new/significantly improved products/services will be introduced to the market, in most cases this has not yet been realised, with market introductions of new technologies expected generally within the next three years. New/significantly improved processes were also largely expected rather than achieved. Participants regularly expect to experience both product/service and process outcomes, demonstrating the integrated and multi-faceted nature of Catalyst project activity.

20. These findings are not unexpected given most of Catalyst projects were early and industrial stage awards, designed to take ideas to TRL 4 and 7 respectively (i.e. not full commercialisation), and the timing of the interim evaluation. However, further investment will be required in most cases to realise these outcomes, highlighting the importance of pathways to follow-on funding from the Catalyst, including public funding where the proposition has not been de-risked sufficiently to ensure the private sector will meet funding needs.

21. There appears to have been **limited impact on the wider agricultural sector to date** – as we would expect from R&D projects of this nature, and given the timing of the evaluation, with many projects still in the R&D stage and/or early in their commercial roll-out. However, there is confidence amongst participants that projects will deliver positive impacts on agri-tech productivity, produce quality and environmental

sustainability in the future (fewer projects are expected to impact on animal health and welfare, reflecting the portfolio mix[10]). Many projects are reliant on project leads (and in some cases collaborators) to generate the wider sector impacts that the Catalyst is seeking to achieve, and so it is essential these businesses have the necessary skills, expertise and finance to reach and effectively market their new products/process in UK and (in some instances) global markets.

Was it the Catalyst, rather than other influencing factors that made the difference, or the decisive difference?

22. The self-reported evidence suggests the programme has **achieved high levels of outcome additionality**. For most surveyed beneficiaries, outcomes would not have been achieved at all, or at a lower quality, smaller scale and/or over a longer time period, in the absence of the Catalyst. Collaboration was consistently identified as the critical factor in enabling pathways to impact – projects benefited from the technology convergence and synergies associated with complementary expertise, skills and experience, research could be undertaken at sufficient scale to validate results, industry provided commercial pull and expertise in commercialisation processes, and businesses/membership bodies provided routes to market.

23. However, the Catalyst is in most cases one of several factors that have influenced the outcomes achieved. In many cases, other internal factors – especially other R&D activities, new equipment, new innovation partnerships or collaborations and new business plans – were regarded as more or equally as important as the Catalyst in realising outcomes. This said, the relative contribution is complex and context specific, and Catalyst support was commonly responsible for – directly or indirectly – these other internal factors being introduced.

24. Overall, the **Catalyst is one of a number of interdependent and reinforcing factors that have been important in realising the project-based outcomes observed, but it was the decisive factor for many beneficiaries, particularly in terms of intermediate outcomes**.

Overall programme performance against objectives and rationale

25. The evidence gathered for this evaluation suggests the programme is performing well against its aims to “accelerate translation of research into practical solutions, best practices …” and encourage greater R&D in the sector. Although there are different emphases in the findings of the evaluation, the evidence across the three award types is consistent in terms of addressing the rationale, delivering against plans and achievement of outcomes and additionality. It is too early to assess whether this is then translating into “… applications of new technologies in agriculture”, increased turnover and exports, improved agricultural productivity and reducing environmental impacts, and

[10] 23% of projects related to livestock (breeding, nutrition, health, reproduction, housing and management), whereas 70% of projects related to crops and the remaining 7% focused on aquaculture. Source: Innovate UK (2016) Agri-Tech Catalyst Rounds 1 – 5: summary of response and funding across co-funders. Note this covers all ATC projects in Rounds 1-5, including those funded via DFID.

improved competitive position of the UK's agri-tech sector internationally. However, the foundations appear to be in place to achieve these wider impacts.

26. **More broadly, the programme appears to be delivering against the Agri-Tech Strategy's ambitions for the Catalyst**, which focused on supporting collaborative relationships between academics and industry, attracting co-investment from the private sector (it has secured match funding from those directly involved, but has been less successful in leveraging wider private sector investment), supporting SMEs to take part, and catering for a wide range of project types.

27. **The programme has also addressed many aspects of the original rationale**. For those involved, co-ordination failures have been addressed in a sustainable way, as evidenced by collaborations providing access to networks, partners continuing to work together on R&D post-Catalyst and a greater propensity of those involved to collaborate. It has also addressed – in part – information and risk failures and uncertainty, by enabling technological progression that reduces the risk associated with taking the idea to the next stage of development. However, many projects have or will require further R&D to fully address these issues, and there is some concern about projects' investment readiness to secure finance from the private sector (when appropriate).

Future evaluation planning

28. As part of this assignment, SQW was asked to develop an outline plan for the longer-term evaluation of the Catalyst, assessing what should be evaluated, *when* and *how*. This was to consider the original Evaluation Framework developed for the Catalyst (as part of the wider Agri-Tech Strategy) and reflect on the delivery of this evaluation.

29. The main purpose of any longer-term evaluation would be to gather evidence on outcomes and impacts (i.e. the bottom right of the Theory of Change presented in Annex A). The focus to date has been principally on 'direct' beneficiaries, but for full effects to be estimated the evaluation will need to track through to wider impacts on the agricultural sector. This poses substantial challenges, both practically (in terms of engagement and corporate memory, viability in accessing contact data, and proportionality in gathering evidence) and conceptually (significant 'noise' will be evident the further away from direct engagement you go, in a crowded/evolving policy landscape).

30. Overall, **the rationale remains for theory-based approach** (as per the original Evaluation Framework), given the small sample size available and diverse/complex routes to impact (as highlighted by this work). A number of methodological options were considered, and the recommended approach would include:

    - beneficiary surveys of leads and collaborators
    - "market tracing" case studies (where new products/processes have reached the market, gathering evidence from both beneficiaries and their customers)
    - datalinking, to enable tracking of company performance and access to finance: given sample sizes, direct quantitative comparisons to a 'control group' is not considered viable to generate meaningful (statistically robust) results, however, the progress of 'fundable but not funded' leads could be tracked to provide some evidence on the counterfactual, and the beneficiary cohort could be compared to wider trends in the

agri-tech sector to provide further insight on the effects of the programme. Projects should also be tracked in Innovate UK and BBSRC data, to identify follow-on funding.

- wider stakeholder interviews across the agri-tech sector and innovation landscape, including other components of the Agri-Tech Strategy.

31. The original Theory of Change anticipated these types of impact to be evident c2020-25 and given evidence from this evaluation that many projects expect to reach the market by three years' time, an impact evaluation around 2022 may be appropriate. At this point, the case for a further evaluation in 2025 to focus on the 'final' wider indirect effects, could also be considered, including whether this is proportionate and of value in on-going policy development at this point.

Detailed findings: Context and rationale

Key messages

- The large majority of applicants were already active in collaborative R&D before they engaged with the Catalyst, but the programme attracted some new organisations to engage in public sector R&D programmes and 'spill-in' of non-agricultural disciplines and companies who are new to agri-tech, and stimulated new partnerships.
- 'Feeder' schemes (i.e. other public funding that led to the Catalyst application) were also important in generating ideas for Catalyst projects.
- The key factors driving applications were uncertainty and risk associated with the R&D activity, a lack of finance to fund the activity, and limited alternatives in the innovation support landscape at the time, which align closely with the original rationale for the Catalyst.

Pre-programme experience

32. The surveys of beneficiaries and unsuccessful applicants indicate that the large majority of applicants to the Catalyst were already active in collaborative R&D before they engaged with the programme. This R&D was predominantly funded internally, or via other UK-based public sector schemes[11]. For example:

    - 98% of beneficiary respondents surveyed (96 of 98) and 100% of unsuccessful applicants surveyed (all 43) had engaged in some kind of R&D (public or private) in the three years before their Catalyst application. This is perhaps not unexpected; as a competitive funding stream, the Catalyst might be expected to attract businesses that consider themselves to have a strong enough R&D capability to be competitive and with the capacity and experience to deliver.
    - Nearly all of those surveyed had undertaken this R&D collaboratively (95% of beneficiaries and 100% of unsuccessful applicants). The most commonly-cited partners were universities or customers/clients from the private sector followed by competitors, consultants, public or private R&D institutes, or suppliers.

33. This significant experience in R&D (including collaborative R&D) amongst participants may have de-risked significantly the delivery of Catalyst projects; clearly, projects have been led by, and involved as partners, organisations with a track-record and experience in similar activities.

34. However, the Catalyst has been **successful in attracting some new organisations to engage in public sector R&D programmes**, primarily in a collaborative capacity. For example, only 38% of collaborators surveyed (24 out of 62 respondents) had used public sector R&D grants in the three years before their Catalyst application.

[11] 85% of beneficiaries surveyed who had engaged in R&D activities in the three years prior to the Catalyst had used internal funding for this, and 49% had secured UK-based public sector funding.

35. ‘Feeder’ schemes (i.e. other public funding that led to the Catalyst application) were also important in generating ideas for just over 40% of Catalyst projects covered by our surveys, most notably for early and industrial stage projects. This included other Innovate UK programmes (e.g. Collaborative R&D and Smart), BBSRC funding, and European programmes (e.g. H2020). This reflects the role of the programme in the wider innovation support landscape and emphasises the importance of ensuring effective links and pathways between programmes.

36. Indeed, many external stakeholders consulted felt the Catalyst **aligned well with the wider agri-tech innovation landscape**. With its focus on the translation of research, external stakeholders reported that the Catalyst filled a gap between academic and private research in the agri-tech sector, and it complemented and built upon support available through BBSRC and the Sustainable Agriculture and Food Innovation Platform (SAF-IP, which helped to stimulate demand for the Catalyst).

37. **The Catalyst has encouraged spill-in of non-agricultural disciplines and companies who are new to agri-tech**. Whilst most beneficiaries were from agricultural sectors (such as crop production, livestock and plant propagation, or the manufacture of agricultural and forestry machinery or agrochemical products), non-agricultural sectors were also represented amongst the beneficiary cohort, including computer programming, defence, engineering, unmanned ground vehicle design and manufacture, refrigeration, the manufacturing of chemicals/public health products/vitamins, heat exchange systems, specialist light sources, and connectivity services related to the internet of things.

38. Spill-ins also included applying existing agri-technologies in a different agri-tech context, as well as applying technologies that already exist in other sectors to the agri-tech sector for the first time. Our surveys also found that the need for greater agri-tech experience and understanding prompted many collaborators to apply for Catalyst funding. The programme’s role in **enabling technologies to converge** is particularly encouraging, creating opportunities for new and interesting technologies, products and services to be developed in the context of agriculture.

39. **The programme has also stimulated new collaborations, where some or all of the partners had not worked together previously**. According to the beneficiary surveys, over a third of respondents had not worked with any of their Catalyst partners before, and over half worked with at least one new partner through the Catalyst project. It is notable that leads in industrial stage projects commonly included at least some “known” partners to manage/mitigate the risks in delivering these larger-scale projects.

40. Case study evidence suggests that new collaborations are often formed via bilateral and personal relationships, rather than formal mechanisms. This raises the question around whether opportunities for other collaborations and technology convergence are missed because partners are not already known to each other. This may point towards a greater role for formal and informal organisations (such as Knowledge Transfer Network) and local networks in enabling collaborations to come together.

Rationale for engaging in the Catalyst

41. There is strong alignment between the reasons for applying provided by organisations during the evaluation, and the original rationale of the programme. The reasons primarily centred around **uncertainty and risk associated with the R&D activity, a lack of finance to fund the activity (absolutely and/or relative to other uses of internal finance, and the inability to secure external finance), and limited alternatives in the innovation support landscape at the time**. For many, it appears to be the mix of factors, rather than a single issue, that prevents project progress. The Catalyst also stimulated R&D ideas to address the challenges set out in the competition specification, most notably for early and industrial stage applicants.

42. Most participants were already "innovation active" and had a track-record of investing internal funds in R&D activity before the Catalyst, which does raise some questions over the validity of the finance-led aspect of the rationale. However, the underpinning reasons for the need for support is complicated and varies across different types of participant, sub-sector and stage of R&D. Stakeholders described how the agri-tech sector is relatively immature and suffers from a lack of sector-specific finance (especially from private sector investors) and often unfavourable terms, limited alternatives in the innovation support landscape (especially for high-risk, early stage R&D), and a lack of awareness amongst businesses of alternative finance sources. For participants with more experience of R&D, the Catalyst enabled projects that were competing against more established R&D activities (including those with a shorter payback period) for internal funds and would not have been prioritised otherwise. Alongside other 'feeder programmes', the Catalyst also had a catalytic effect in stimulating new ideas, especially for early stage projects, which were considered high-risk, and in enabling collaborative activity.

43. The evaluation also indicated that for the largest projects supported by the industrial stage grants the level of risk was a major barrier to project progress without Catalyst support, particularly when set alongside the uncertainty of outcome and the scale of the investment required at this stage. Further, for industrial stage projects, the programme encouraged projects to be more ambitious and tackle challenges through larger scale R&D, and supported projects focused on a new area for the business (e.g. a new sector or market application), which increased the need for match funding to justify the investment in the context of the 'mainstream' business activity. This evidence suggests that for industrial stage projects, the Catalyst was supporting R&D that was qualitatively different in its risk profile than more 'standard' R&D activities (as perceived by the beneficiaries), with the role of the potential collaboration also an important factor for some in making the case for public support.

44. On the supply side, stakeholders commented on the limited supply of private equity/investment funds specifically for agri-tech (at least, until very recently) reflecting the relatively immature nature of agri-tech as a sector, and the challenges faced by agri-tech innovators in securing public funding in very widely defined competitions (such as health and life sciences).

Detailed findings: Activities

Key messages

- There was generally a close fit between the activities delivered and the intentions of each stage of awards, but the ability of projects to move through from early to industrial to late stage awards on a "seamless conveyor/escalator" were limited by the short lifetime of the programme.
- The Catalyst has encouraged technology progression and enabled this to be realised more quickly than might otherwise have been the case.
- There was some evidence of integration between the Catalyst and wider innovation support landscape. Engagement with the Centres for Agricultural Innovation was limited by delays in establishing the Centres, which was viewed by some as a missed opportunity for synergies under the Agri-Tech Strategy as a whole.
- Project partners have undertaken dissemination activities, mostly focused on niche sub-sectors, and there have been efforts to showcase Catalyst innovations on a global scale and connect projects with venture capitalists towards the end of the programme period. However, there was concern amongst external stakeholders with the lack of dissemination more broadly (project progress, learning and success stories).

Project activity and progression

45. The findings demonstrate a generally **close fit between the activities delivered and the intentions of each stage of awards**, as set out in the Logic Model. That said, some of the industrial stage projects spanned a broader range of Technology Readiness Levels (TRLs) than anticipated, with some projects 'earlier' in the TRLs at project start than anticipated in the Logic Model, which may have implications for the time-paths to commercial (and wider) impacts of these projects.

46. The beneficiary survey suggests mixed views on the performance of the projects against their original objectives. At the time of the evaluation, 48% of survey respondents thought their project had/will fully achieve its objectives and 38% thought objectives would be achieved in part. Reflecting potentially varied levels of knowledge of the project, leads were more likely to report that the objectives had been or would be met in full compared to collaborators.

47. It was originally envisaged that projects could move through the different grant types within the Catalyst, with the programme acting as a "seamless conveyor/escalator" through the commercialisation process. However, given the short lifetime of the programme, the scope for achieving this was limited – only one project successfully moved through two grants, and the smooth transition from early to industrial stage projects was a key factor to the success of this project to date. External stakeholders consulted for the evaluation were concerned that this limitation of the programme could inhibit a project's route to impacts, particularly if they were unable to secure funding from elsewhere.

48. Despite this issue, **the Catalyst has performed well overall in terms of encouraging technology progression and enabling this to be realised more quickly than might otherwise have been the case**. The beneficiary surveys found that 60 out of 98 (61%) respondents reported that the Catalyst project had progressed a technology towards market readiness, and this rose to 94% when those that expect to experience this in the future are included. Moreover, over three-quarters of those observing technological progress said it was accelerated "to a significant extent" due to the Catalyst. However, for projects that progressed after their project closed, many required additional investment to reach their current position. Sources of funding varied (including combinations of customer or collaborator funding, EU and UK public sector grants), as did the scale of funding required (from £100k to >£1m).

49. TRL starting positions and progression sometimes varied within a project, with different components of a project spanning multiple TRLs, reflecting the multi-faceted and iterative nature of Catalyst projects. The evidence also demonstrates how projects are often iterative in nature, both in terms of refining the technology in question and how progress in one area raises new research questions that need to be addressed to ensure the wider 'supporting ecosystem' for a new technology is in place.

Engagement with the wider innovation landscape

50. **There is some evidence of integration with wider innovation support landscape during the delivery of Catalyst activities**. Just over one-third of leads surveyed (13 of 35) had received other forms of support to develop the idea during delivery of the Catalyst project. Support has been provided by other Higher Education Institutions (HEIs) not already part of the Catalyst collaboration, consultants, commercial labs or private sector R&D institutes, and Research and Technology Organisations (RTOs). There are a small number of examples where projects have engaged with DIT, but some stakeholders were concerned that this was not as widespread as might be expected given the programme's intention to encourage exports and inward investment. There was some concern amongst stakeholders consulted that the Catalyst had not worked in partnership with the Centres for Agricultural Innovation as effectively as originally intended (e.g. to assist in sharing research and scaling up implementation). This was owing both to delays in establishing the Centres, with many of the Centres research assets only relatively recently coming online, and the delivery period of the Catalyst. This was viewed by some as a missed opportunity for synergies under the Agri-Tech Strategy as a whole.

51. There is no evidence from the beneficiary survey that any particular project type or model is associated with seeking further external support from the innovation landscape alongside the Catalyst funding. The rationale for seeking additional support was dependent on the specific circumstances, and often became apparent as the project evolved. The case study evidence identified that one of the strengths of the programme was its flexibility, which enabled projects to evolve as they progressed, including in response to emerging findings and changing contexts.

Dissemination

52. One of the key assumptions in the Theory of Change was that project learning and results would be disseminated, both by partners and Innovate UK (and other funding partners), to ensure that wider knock-on impacts are delivered, such as knowledge spillovers and uptake of new technologies across the wider agri-tech/agricultural sector.

53. Whilst the **evaluation indicates that leads and collaborators have undertaken dissemination activities, this tends to be to a limited extent and targeted towards niche sub-sectors**. At a programme level, Innovate UK held a pilot "Collaboration Nation" event towards the end of the programme to bring some projects together to discuss outcomes and provide a platform for projects to connect with new agri-tech venture capitalist (VC) funds. DIT and Innovate UK also sought to showcase Catalyst innovations on a global scale.

54. Despite this, there was concern amongst external stakeholders with the lack of dissemination more broadly, in terms of both communicating the progress and learning from projects, and promoting projects that have successfully commercialised. Factors explaining this issue from a project participant perspective included concerns over IP, an unwillingness to share project-related issues or failures, project timing (it may be less appropriate for early stage projects, for example), and the fact that dissemination takes place after Catalyst funding has ended (so there is no incentive, funding to deliver it, or assessment to check it occurs). Consultees did note this issue is not unique to the Catalyst and is a challenge for R&D support programmes more generally, but it was identified as a particular challenge for the Catalyst given the need for dissemination to generate demand and knowledge of the technologies developed in the wider agri-tech sector for impacts to be realised fully.

Detailed findings: Outputs, outcomes and impacts

Key messages

- The Catalyst has successfully improved innovation behaviours, capacity and performance, particularly in terms of innovation skills and knowledge, partners' reputation and credibility, and an improved understanding of commercialisation processes and market position.
- Some participants have introduced a new or significantly improved product/service/process to the market already, and there is a high level of confidence that others will be introduced to the market in future as a result of Catalyst support.
- The Catalyst has led to modest impacts on employment and/or turnover for those involved to date, reflecting the fact that majority of projects were early and industrial stage awards.
- Further R&D activity/investment is needed in most cases to realise the anticipated product/ service/process outcomes, but there was concern/uncertainty about how this will be funded in many cases.
- Project-related outcomes appear to be sustained, whereby partners have continued to work together and the majority of beneficiaries surveyed said they are more likely to invest internal funds in other R&D in future as a result of the Catalyst.
- Organisations involved in projects have also reduced their environmental impacts or improved environmental sustainability, with some experiencing improved yields/productivity, produce quality and animal health.
- The collaborative approach to Catalyst projects has been critical in enabling the outcomes above. Other factors included scale (for industrial projects in particular), engagement with industry/end users, partner commitment, project management, and flexibility and a seamless transition to follow-on funding.

Innovation behaviours, capacity and partnerships

55. There is strong evidence that the programme has delivered benefits to participants in terms of improved or revised innovation behaviours, capacity and performance. Feedback from participants indicated that **projects in nearly all cases lead to improved staff skills and knowledge, and the large majority have benefited from (self-reported) improved reputation and credibility, and improved understanding of commercialisation processes and market position**. Outcomes relating to R&D capacity have even emerged from projects where the specific technology in question was unsuccessful.

56. In addition, most respondents have developed new and/or strengthened relationships with academic and industry partners, even where they had worked together previously. The programme has both stimulated new R&D collaborations and enhanced existing R&D collaborations; both of which are important.

New products, services and processes

57. The survey evidence indicates a high level of confidence that new or significantly improved products or services will be introduced to the market owing to Catalyst support. However, **product and service outcomes are mainly anticipated rather than realised at this interim evaluation stage**. The programme is also expected to deliver process improvements, often in combination with new products/services.

58. At the time of the surveys:

- around one in five (22 of 98) of survey respondents reported that a new or significantly improved product or service had been introduced to the market as a result of the project, and over half (60) expected this would happen in the future (most in the next three years); as expected, late stage projects were more likely to have reached the market compared to early stage projects.
- around one in four (26 of 98) of survey respondents had introduced new processes as a result of the Catalyst, and a further third (34) expect to do so in future.

59. Many beneficiaries identified achieved/expected effects for both new/improved products and processes as a result of the project.

Employment and turnover outcomes

60. Reflecting that most projects supported by the programme have yet to take new products or services to the market, **the Catalyst has led to modest impacts on employment and/or turnover for those involved to date**. This is unsurprising given the bulk of the projects covered by the evaluation were early and industrial stage awards and the lag time to impact.

61. Specifically:

- Just over a third (35 of 98) of beneficiaries surveyed had observed an increase in employment to date due to the Catalyst, and half (50 of 98) expected this in the future. Most employment generated so far was associated with R&D activity and small scale, but growth in staff has provided businesses with greater capacity to explore new markets and undertake further R&D.
- A modest proportion (16 of 98) of beneficiaries surveyed had observed an increase in turnover to date due to the Catalyst, although nearly two thirds (61 of 98) expected this in the future. There are a small number of strongly performing projects (both early and late stage) who have generated substantial levels of revenue, including through exports, as may be expected given the portfolio approach of the programme.

Follow-on investment

62. Importantly, **further R&D activity and investment will be needed in most cases to realise the anticipated product/service and process outcomes**. This is expected, given that most projects were early and industrial stage awards (91 of 103) designed to move ideas towards the commercialisation stage, but not realise this commercialisation within the project period.

63. However, there was some concern amongst beneficiaries about how this next stage of R&D will be funded. Whilst the Catalyst has enabled projects to move technologies forward, in many cases this has not de-risked the proposition sufficiently to secure (solely) private investment. Public sector funding will often be required, but at the time of the surveys, beneficiaries were often uncertain about follow-on funding options[12], and the programme's impact on participants' awareness of external finance has been less widespread. There is a risk that uncertainty at this stage on the realisation of product/service and process effects could have implications for the overall impacts of the programme over the longer-term.

Other effects on participating organisations

64. In addition to the outcomes described above, there is evidence that the Catalyst is leading to sustained changes in the attitudes and behaviours of those involved after the funded project, which are crucial for further collaborative R&D activity in agri-tech in future. For example:

- where projects have been completed, over 80% of beneficiaries surveyed have continued to work with all or some of their Catalyst collaborators after the project completed
- three-quarters of beneficiaries reported they are more likely to invest internal funds in other R&D in future as a result of the Catalyst
- three-quarters of beneficiaries reported they are more likely to bid for Government funding to support other R&D activity in future as a result of the Catalyst.

65. There is also evidence from the case studies to demonstrate how the Catalyst experience has led to improved business planning, encouraging participant firms to be more commercially focused than in the past. Further, academics involved in the Catalyst reported they were more willing and able to engage in collaboration with industry and more committed to continued research in agri-tech because of their Catalyst experience and were using the knowledge gained to inform their wider research activity.

66. Beneficiaries have also observed some wider unexpected or unintended outcomes, including the potential application of the project's findings in new markets, influencing research priorities and investments (particularly in academia), and spin-off research opportunities in other sectors.

Wider agricultural sector outcomes

67. For the organisations involved in Catalyst projects, the evaluation found that **wider impacts have focused on reducing environmental impacts or improving environmental sustainability so far, with some experiencing improved yields/productivity, produce quality and animal health**. A wider cohort of beneficiaries expect these environmental, productivity and quality benefits to materialise

[12] Note, The Industrial Strategy Challenge Fund (ISCF) Transforming Food Production programme will provide opportunities for follow-on funding for some Catalyst projects, although has a narrower thematic focus.

in future, although future impacts on animal health/welfare is limited (possibly reflecting the nature of projects covered by the survey).

68. We also explored with beneficiaries whether their Catalyst project had impacted, or was expected to impact, on the wider agricultural sector, and found a similar pattern. However, there appeared to be greater confidence in the projects having a future impact on productivity, produce quality and environmental sustainability and more limited but positive effects on animal welfare across the wider agricultural sector. To achieve this, the test will be whether the new/improved technologies deliver improved financial performance for businesses adopting them – if they do, and if this message is effectively marketed to the relevant audiences, the technologies are more likely to be adopted. Wider regulatory and legislative changes will also play a role here, and the implications for farm income, which could influence the pace at which the farming community adopt new technologies.

69. In terms of *how* these wider impacts are expected to occur, the evidence from the evaluation (notably the case studies) is that the primary routes to market will be:

- the project lead implementing the new technology/process, which then benefits that business' supply chain or customer base, with an immediate and direct route to market for the new products/processes developed by Catalyst projects (and in some cases, engaging major global firms in projects provides a direct route to global markets)
- the lead or collaborator selling the new technology directly to the wider agricultural sector, which will also depend on demand-side awareness/ability to adopt new technologies.

70. Given the reliance on project leads (and in some cases collaborators) to generate the wider sector impacts that the Catalyst is seeking to achieve, it is essential these businesses have the necessary skills, expertise and finance to reach and effectively market their new products/process in UK and (in some instances) global markets.

Factors enabling or hindering pathways to impact

71. The evaluation has identified the key factors that have enabled or hindered the progress of Catalyst projects towards impact (see Table 1).

72. Both 'internal' and 'external' factors were identified; the latter can only be 'anticipated and managed' rather than 'created and prevented' in any meaningful sense. This said, they do reflect the practical challenges in the delivery of large-scale and high-risk R&D projects, working in collaboration, that need to be considered in the overall assessment of project progress at this interim evaluation stage.

Table 1: Factors enabling and hindering pathways to impact

Enabling factors	Barriers/Risks
The collaborative approach was consistently identified as critical to success, particularly in terms of sharing risk, and synergies arising from complementary expertise, skills and practical experience, leading to greater depth/quality of research, accelerated progress and technology convergence: • collaborations have enabled SMEs to work with leading Universities and large companies; the latter is key to a project's credibility when seeking follow-on VC investment • collaborations spanning the value chain have helped develop and facilitate routes to commercialisation • academic input was identified as a key enabler of success by industrial partners • within collaborations, clearly defined roles and collaboration agreements from the outset have been important. **Scale**, whereby multi-disciplinary projects delivered at scale is a key enabler for unlocking potentially transformational opportunities (e.g. gathering evidence at a scale to ensure robustness and validity). **Network opportunities**, whereby partners have provided access to a network of end-users to test new technologies/products. **Industry involvement,** which provides a commercial pull, understanding and experience of commercialisation, and a potential route to market (in addition to market testing and feedback). Involving large corporates also provides routes to larger markets and the mainstream agricultural sector, and so are an important mechanism to ensure wider impacts are achieved. Partners who are **committed**, enthusiastic, motivated and open, with **shared goals and clarity of purpose.** **Strong and committed (and agile) project management** by the project lead, alongside the role of Innovate UK's monitoring processes in providing structure, momentum and check/challenge to projects. **A smooth and seamless transition to follow-on funding** has been key in enabling projects' pathways to outcomes and impacts (where realised) **Flexibility**, for example by extending projects where the field trials were adversely affected by poor weather conditions.	**Misalignment** between application windows, decision-making and project durations compared to **growing seasons**, particularly where data gathering across more than one growing season is necessary. As expected given the focus on high risk R&D, some projects have failed due to **unforeseen technical issues**, and others have been more complicated than expected, leading to delays/tracking back to earlier TRLs. Some projects failing is 'healthy' in this context and demonstrates the right type of projects (i.e. high risk and uncertain) were funded. Environmental factors and 'in-field' issues, such as drought. Capacity to manage the R&D process, especially for some SMEs, leading to some scaling back of involvement. **The ability of SMEs to meet match funding** requirements was also an issue for some. **Limited integration with Agri-Tech Innovation Centres** in terms of helping businesses to exploit new technologies. **IP, licencing and royalty issues** between partners that have hindered progression. **Limited dissemination and "socialisation"** of findings, with no clear knowledge exchange strategy/mechanisms (at project and programme level) or clarity on dissemination responsibilities post-project. Lack of awareness of follow-on funding opportunities (i.e. "what next" post-project) and **difficulties in securing follow-on finance**. Some consultees argued competing with other sectors (health and life sciences) in open competitions has been difficult, and projects had not been sufficiently de-risked to seek/secure private sector investment. Also, there is a lack of dedicated VC funds that understand the dynamics of the agriculture sector. **Limited alignment with wider support needed for market entry**, including for late stage projects. e.g. signposting/brokerage with private investors; mentoring; exporting advice; and access to networks. **Insufficient emphasis on *how* spillover benefits will be achieved**, which are critical to achieve the Catalyst's ultimate goals for the wider agricultural sector. **Challenges/uncertainty around future agricultural policy and regulation,** especially for long-term crops.

Source: SQW

Detailed findings: additionality and other contributing factors

Key messages

- The programme has catalysed new activity in the sector, supporting R&D that might not otherwise have occurred across all award types.
- Self-reported outcome additionality is high, particularly for early and industrial stage projects reflecting potentially the higher level of risk, uncertainty and longer lead-time to impact.
- The collaborative approach was important in realising outcome additionality – outcomes often require complementary expertise, which no single partner could bring to the project; enabling this collaboration is an important part of the Catalyst 'added value'.
- The Catalyst is in most cases one of several mutually reinforcing factors that are required to realise outcomes, of which the Catalyst is an important – and can be a decisive – one.

Additionality

73. **The Catalyst has catalysed new activity in the sector, supporting R&D that might not otherwise have occurred across all award types**. Specifically, three quarters of beneficiary leads (27 of 36) responding to the surveys said they would probably or definitely not have progressed their activities without Catalyst funding; the explanations aligned with the rationale for the Catalyst, focusing on lack of finance and risk. Full additionality was particularly high for industrial stage projects, where projects were much larger in scale.

74. Further, there is broad alignment between what beneficiaries said they would have done in the absence of Catalyst funding, and what unsuccessful applicants have done without Catalyst funding, although there may be some optimism bias amongst beneficiaries (particularly for industrial stage projects). A quarter (8 of 36) of lead beneficiaries stated they probably/definitely would have progressed anyway using internal or public funds, and two-fifths of unsuccessful applicants (17 of 43) did in practice progress their project without Catalyst funding, mostly using internal funds or (in a small number of cases) other public funds. Put another way, of the 43 leads of unsuccessful applications (nearly all of which were "fundable"), well over half (26) did not progress the project without Catalyst support.

75. Even where unsuccessful applicants did progress, the lack of Catalyst funding had adverse effects in terms of timing (by two years or more), scale and/or quality of the project. Some that did progress also undertook the project in-house without collaborators.

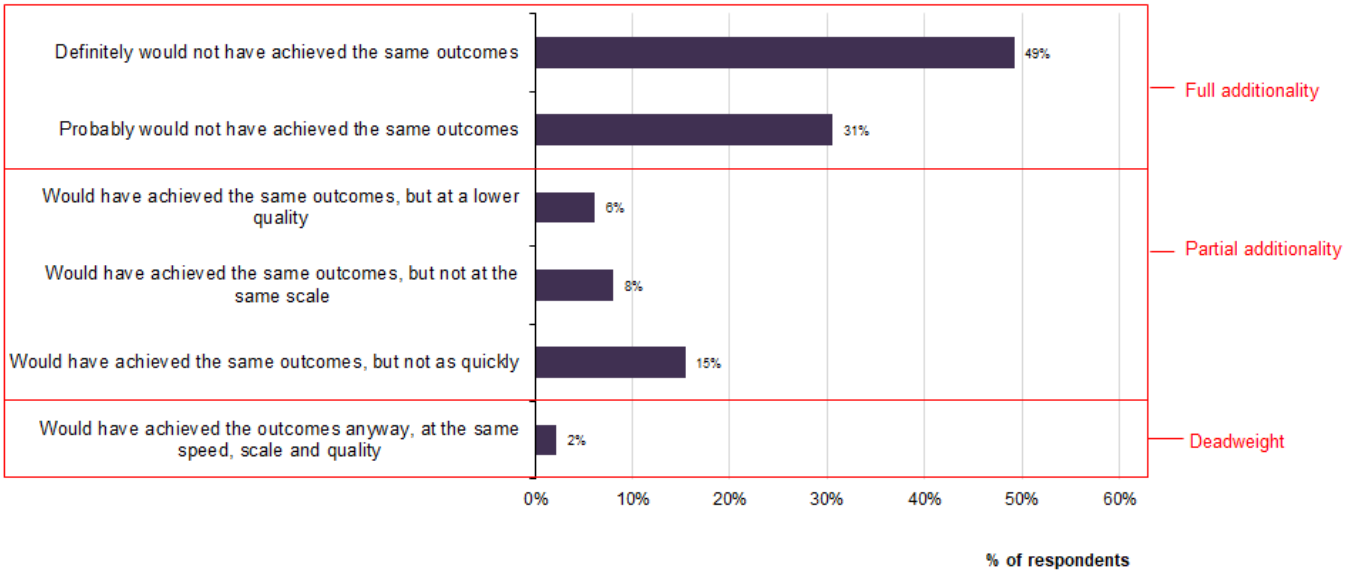
Case study examples demonstrating the activity additionality of Catalyst funding

Harnessing Natural Fungi to Control Insect and Mite Pests in Grain Storage (early stage): technical success of this project required complementary expertise which no single partner could bring. The lead partner was an SME and could not have borne the risk of funding the research institutes that were essential to the project, especially given the relatively modest returns expected. ATC support was instrumental in bringing the partners together and building on prior research.

Integrating control strategies in oil seed rape (industrial stage): without ATC funding, it would have been very difficult for the project to have progressed, if at all. For the lead partner, making the case for investment in R&D projects involves internal competition to secure financial and strategic support. Given the scale of the potential market, and the uncertainty around outcomes securing the requisite funding without support from ATC was considered very challenging.

76. The **self-reported evidence suggests the programme has delivered high outcome additionality**. Across award types, 80% of survey respondents indicated they would probably or definitely not have achieved the same outcomes without Catalyst support. Early and industrial stage projects demonstrated a particularly high level of additionality, reflecting potentially the higher level of risk, uncertainty and longer lead-time to impact at these stages, as set out in the original rationale. Across all three project types, the evaluation found that the collaborative element of the funding was important in realising outcome additionality; outcomes often require complementary expertise, which no single partner could bring to the project; enabling this collaboration is an important part of the Catalyst 'added value'.

Figure 8: Outcome additionality (n=98)



Source: Beneficiary survey. Partial additionality options were not mutually exclusive

77. Of the unsuccessful applicants who took their projects forward in some form, the survey evidence suggests that in terms of product development and wider effects from R&D, the outcomes are similar to Catalyst funded projects at this stage. This may not be unexpected and reflect in part that despite the delays, the use of internal funds as the principal source of finance increased the pressure to commercialise and generate a

return on investment. For some of these projects, the Catalyst stimulated the initial idea/concept.

Other contributing factors

78. The evaluation found that **the Catalyst is in most cases one of several internal factors, which, taken together, may be contributing to outcomes for programme participants**. Other R&D activities, new innovation partnerships (outside of the project collaboration) and the implementation of new business plans strategies and purchase of new equipment were all very common. These other factors were in practice often regarded as more, or equally, as important as the Catalyst in realising the outcomes identified by beneficiaries that were associated with the project. In most cases, Catalyst projects rely on other investments and activity for the commercial and economic potential of outcomes to be realised fully.

79. However, the picture is complex, as the survey evidence also indicated that the Catalyst support regularly led – directly or indirectly – to the implementation of these changes/developments. In practice, as with many types of R&D intervention, there are often a number of mutually reinforcing factors that are required to realise outcomes, of which the Catalyst is an important – and can be a decisive – one. The relative level of the Catalyst's influence in delivering outcomes, is in practice, very varied and context specific.

Reflections and implications

Key messages

- The strategic backing from Government was important in raising the profile of the Catalyst, helping to generate high demand and quality of applications.
- The collaborative approach has been key to success,
- There was a missed opportunity to better facilitate synergies between projects and with the wider landscape, especially the Agri-Tech Innovation Centres.
- Balancing the imperatives of unlocking high-risk and uncertain projects, and avoiding crowding-out private investment in R&D that might have happened otherwise, is key for programmes of this kind and demonstrates how the rationale for funding at the project level is complex and nuanced.
- In designing a theory of change for an intervention of this kind, there needs to be recognition of tensions between project-level dissemination and commercialisation, and where the assumed responsibility for wider impacts (and routes to these) lies.
- There is a clear need for further follow-on support to enable technologies to reach the market. The availability and awareness of follow-on finance is key, alongside wider support such as mentoring and export advice.
- A key challenge in delivering the ultimate impacts of the Catalyst relates to demand-side capacity and capability across the agricultural sector to adoption these new innovations. This may include aligning finance and skills development support more closely with R&D interventions to strengthen the demand-side pull, as well as the need for “accessible” innovations.

Issues to consider

80. In light of the evaluation findings above, there are a number of key issues to consider in the design of agri-tech R&D programmes in future:

- **The Catalyst represented a significant and valued commitment to the sector by Government**. Crucially, the Agri-Tech Strategy and the Catalyst were mutually reinforcing; the Strategy demonstrated government’s strategic commitment to the sector, with the Catalyst indicating its financial and delivery-level commitment, providing resource and direct support for applied R&D and translational projects. The strategic backing has been important in raising the profile of the Catalyst, and helping to generate demand from organisations, which may have contributed to the observed (by stakeholders) and evidenced (by the monitoring data) quality of applications.
- **Within projects, the collaborative approach has been key to success**, in project set-up, delivery, and (planning for) commercialisation. It has enabled partners to share risk, draw on multi-disciplinary inputs to allow R&D to progress more quickly and to a higher quality than would otherwise have been the case. In some instances, the involvement of key players has given the consortium credibility when seeking follow-on funding and provided routes to (sometimes global) markets. Although any

successor scheme will need to be designed to respond to specific issues, this evaluation suggests that support for collaborative R&D in the agri-tech sector should be considered as a core characteristic of any approach adopted.

- **There was considerable scope to better facilitate synergies between projects and with the wider landscape, especially the Agri-Tech Innovation Centres**. This appears to have been a missed opportunity for the Catalyst. Whilst the large variety of projects reflects the fragmentation and diversity of the sector more broadly, there may have been synergies between the technologies and applications that could have been better leveraged. Linked to this, partnership working/networking with other sectors could have been strengthened, to encourage more spill-in to the agri-tech sector and potentially "game changing" innovations. Thinking through how knowledge sharing between projects and integration with other investments and assets in the innovation landscape can be facilitated successfully should be a priority for programme partners and funders going forward.
- **Balancing the imperatives of unlocking high-risk and uncertain projects, and avoiding crowding-out private investment in R&D that might have happened otherwise, is key for programmes of this kind**. The Catalyst has nearly always supported organisations that are already investing in R&D, most of whom are already established in the agriculture sector. However, the programme has levered further private sector investment in projects that were too high risk and too large in scale (for industrial projects in particular) and which would not have been undertaken collaboratively without the Catalyst. The evaluation shows the rationale for funding at the project level is complex and nuanced, and that this needs to be recognised in considering the case for and design of any successor schemes.
- **The need to recognise and address (where possible) tensions between dissemination and commercialisation in projects of this type**. There appears to be less knowledge sharing and learning more widely than may be optimal. This was a key assumption in the original Theory of Change in order to generate knock-on benefits across the sector more widely. In many cases, commercial sensitivities/value lead to a reluctance to disseminate findings, and/or dissemination is only appropriate after the Catalyst project has ended. There is a reliance on firms involved in Catalyst projects taking new products/services/processes to market themselves and generating the wider sector impacts that the Catalyst is seeking to achieve. This raises a question around whether businesses involved have the skills, resources and capabilities to do this successfully, and, if not, what further support is necessary.
- Linked to the point above, **there is a clear need for further follow-on support to enable technologies to reach the market**, reflecting remaining barriers in commercialisation and time-paths to impact. A key challenge for the Catalyst has been the timespan of the programme, not allowing progression through the grants – combined with challenges in agri-tech projects successfully securing follow-on funding from Innovate UK's broader competitions and the relatively nascent private sector finance market for agri-tech. Ensuring a clearer pathway to follow-on investment is particularly important to embed technology spill-ins into agri-tech, and enable sufficient R&D progression to test/prove the case for applying different technologies in the agri-tech context. In addition to finance, the evaluation also highlighted the need for wider support (such as mentoring and export advice) needed post-Catalyst to enable projects to reach the market, and in some cases a lack of awareness of where to find this support.

- Finally, **a key challenge in delivering the ultimate impacts of the Catalyst relates to adoption across the agricultural sector**. Whilst the creation of new innovations is essential to realising transformational change, demand-side capacity and capability to adopt these new technologies is also crucial, and this varies hugely depending on farm scale, sub-sector, profitability, attitudes and behaviours, etc. Notably, change within farming is often incremental, driven by path dependency and financial constraints, and focused on process innovations[13]. The translation of new products/processes into "quick(er) wins" and "accessible" innovations for the target market is therefore critical, alongside their capacity to adopt them. This may include aligning finance (including farming productivity grants) and skills development support more closely with R&D interventions to strengthen the demand-side pull.

[13] E.g. see https://www.oecd.org/agriculture/topics/agricultural-productivity-and-innovation/

Annex A: Logic model and theory of change

A.1 A logic model is set out in Figure A.1, covering the Catalyst's rationale and strategic context, aims and objectives, inputs and intended outputs, outcomes and impacts. 'Nested' logic chains were also produced for each grant type, reflecting variances in the emphases relevant to each stage of technological development; these are contained in the accompanying detailed reports.

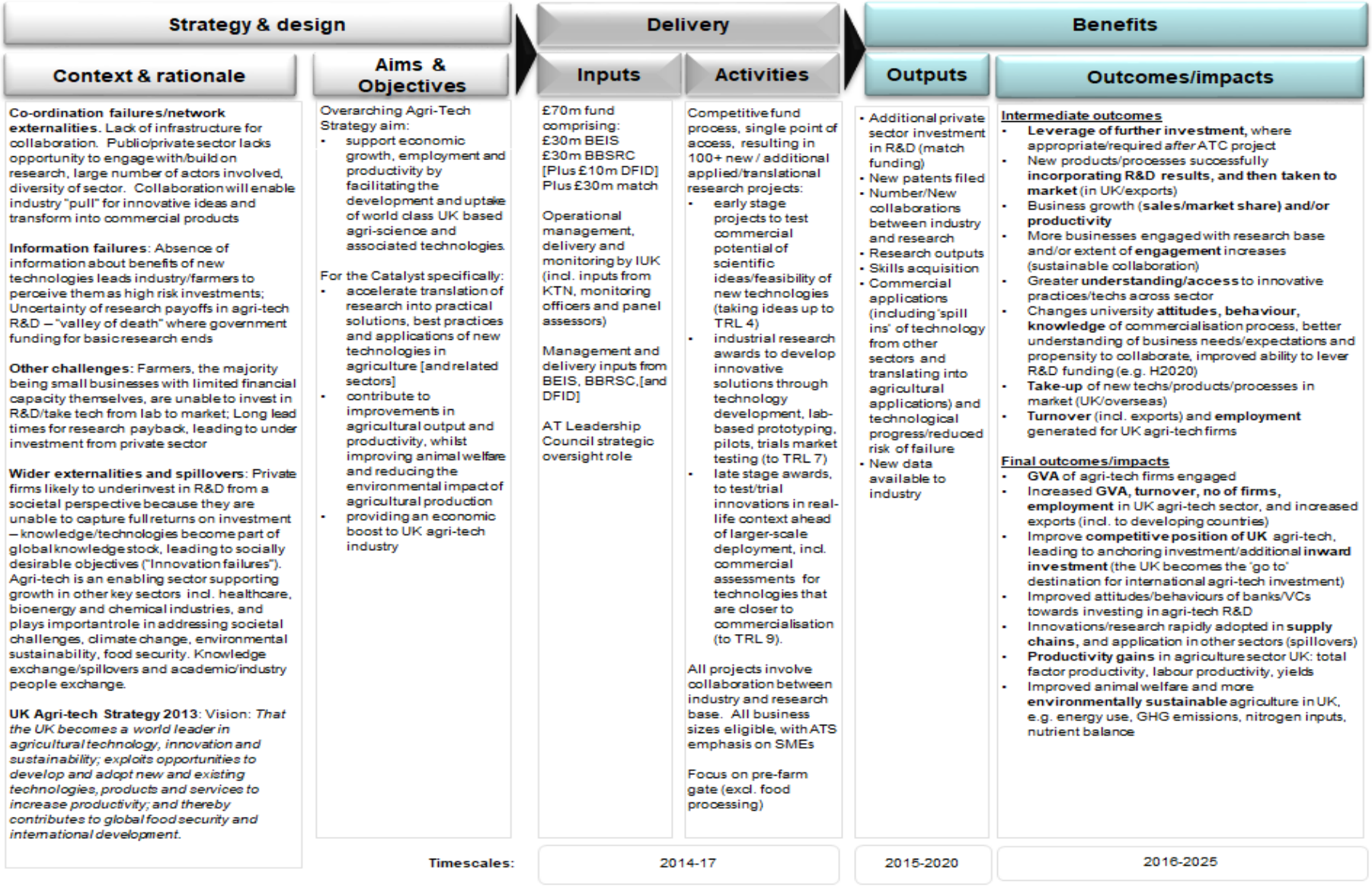
A.2 The Catalyst is a complex intervention, with projects covering a diverse range of topics (reflecting the nature of the agri-tech sector) at different stages of the R&D process, with different project start dates/timeframes and heterogenous outcomes. The logic models therefore provided the principal framework around which the evaluation was based.

A.3 In Figure A.2 presents a more detailed interpretation of the **Theory of Change (ToC) for the programme**. This attempts to depict *how* and *why* the Catalyst might be expected to bring about outcomes and impacts, by setting out causal links between activities, outputs, outcomes and impacts, and associated assumptions and risks or reasons why the logic might break down.

A.4 The theory-based evaluation sought to test the extent to which this has been realised in practice, noting any differences in enablers or barriers at each stage of the process compared to expectations. Given the timing of this interim impact evaluation, the starting hypothesis was that the Catalyst would be delivering against intermediate outcomes – and potentially also final outcomes/impacts for industrial and later stage projects.

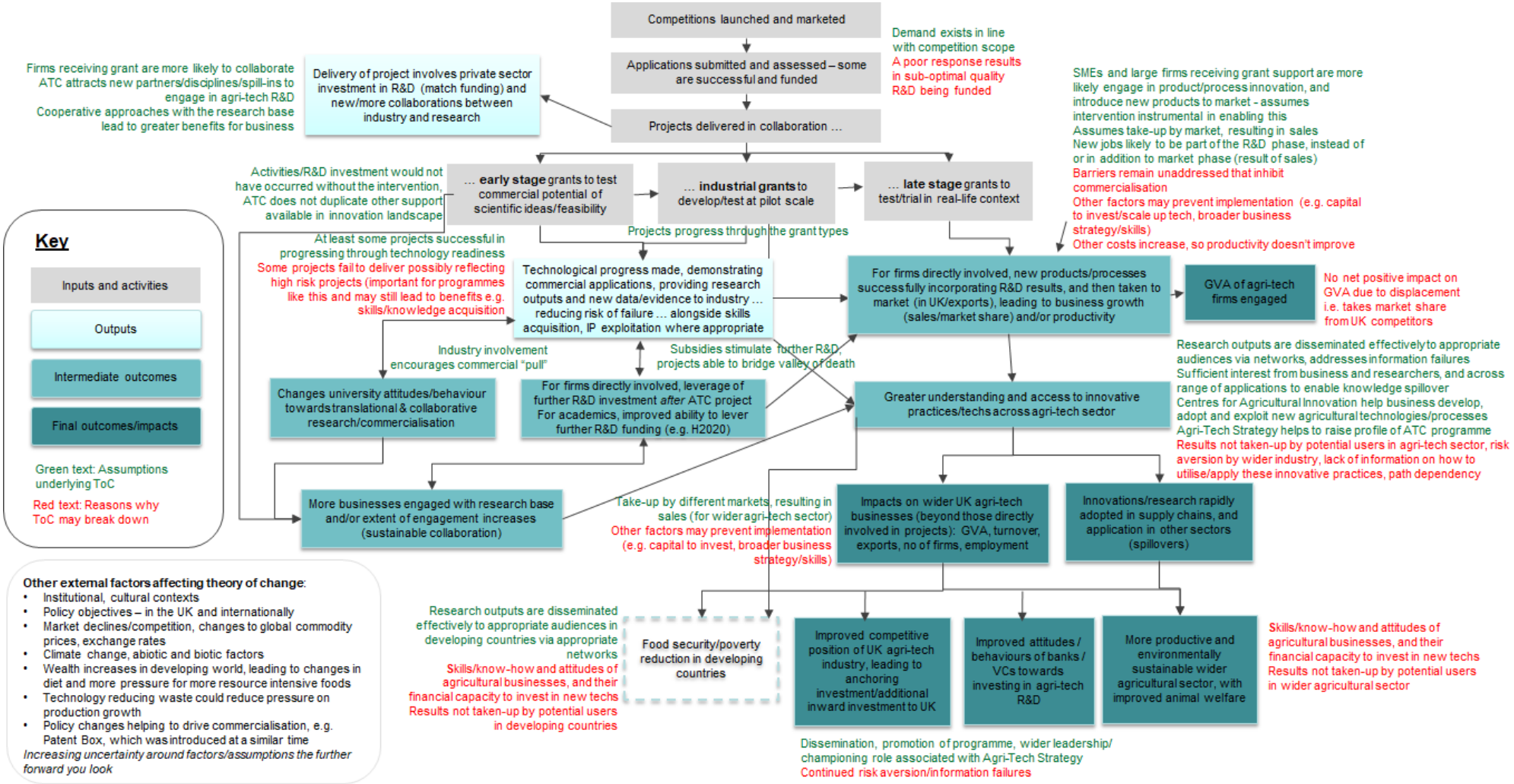
A.5 Finally, Figure A.3 presents how the theory of change was delivered in practice. This provides a summary of the evaluation findings, focused on the outcomes and impacts achieved/expected, and factors that have enabled or hindered pathways to impact.

Figure A.1: Programme-level logic model



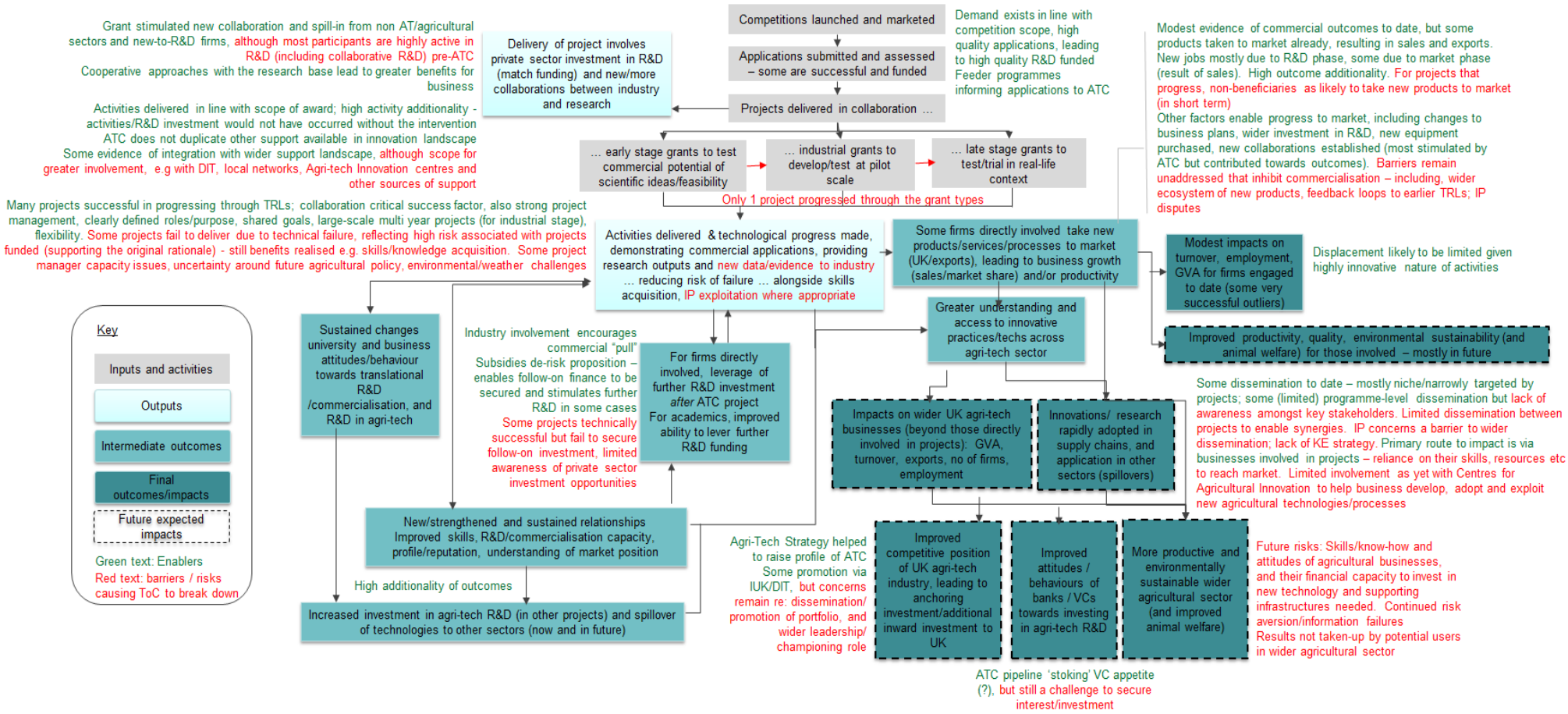
Source: SQW

Figure A.2: Theory of Change, assumptions and risks



Source: SQW

Figure A.3: Theory of Change … in practice



Source: SQW

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