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Final Report

Appendix B. BE-ST.

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Table of Contents.

LIST OF APPENDIX FIGURES

LIST OF APPENDIX TABLES

Appendix B. BE-ST (Built Environment-Smarter Transformation).

1 Introduction.

BE-ST is Scotland's Innovation Centre (IC) for the built environment, connecting the Scottish construction industry to academia to build a culture of innovation that drives transformational change in the sector and delivers economic impact for Scotland.

BE-ST (formerly called Construction Scotland Innovation Centre (CSIC)) was established in October 2014 following a successful application to the IC Programme, supported Edinburgh Napier University (ENU). The Centre delivered Phase 1 activities from October 2014 to completion in May 2019 , with Phase 2 activities commencing in June 2019. This evaluation takes place at the of the Phase 2 period.

2 Development and Approach.

2.1 Main elements of Phase 1 proposal.

CSIC's Phase 1 Business Plan viewed innovation as an important catalyst for transformational change in Scotland's construction sector, especially as it responds to stringent sustainability agendas and emerging commercial opportunities. Nonetheless, it also recognised several constraints that prevented the sector from innovating at scale, especially the complexity of the innovation landscape and its broad failure to meet the sector's needs due to fragmented support and the misalignment of funding horizons with timelines of actual construction projects. The result was that Scotland's construction sector failed to systematically innovate, with most innovation that did occur being "evolutionary" in nature rather than "revolutionary".

The Phase 1 Business Plan sought to address these issues, establishing CSIC in October 2014 to provide a dedicated, streamlined point-of-entry for innovation support in Scotland's construction sector. Its "Vision" was to create a networked community of industry, academic and public sector talent, channelled towards providing necessary, effective, and appropriate innovation support to industry to deliver a paradigm shift in the sector's approach to innovation and drive transformational change within the industry. Its focus in this phase was primarily on *Building an Innovation Culture*' (cf. Phase 2's focus on '*Mainstreaming Innovation'*), catalysing transformational change in the industry in terms of innovative products and processes; systems thinking; collaborative research practices; open standard solutions; training provision; and task sharing approaches to marketing and commercialisation.

Its specific objectives for Phase 1 comprised: (i) uncovering and developing with industry the value that lies in innovating; (ii) driving future demand for innovation support available from Scotland's leading universities; (iii) empowering industry to take ownership of the innovation process; (iv) aligning academic expertise and public sector agency support; (v) bridging existing gaps by matching industry need to appropriate innovation support packages; and (vi) delivering support from inception to commercialisation. CSIC initially structured its work around three Pillars, namely (i) **Connected Ecosystem**, providing access to networks where industry-to-industry, industry-to-academia and academia-to-academia collaboration could flourish; (ii) **Collaboration Projects,** supporting industry-led projects with academic resources; and (iii) the **Innovation Factory**, providing space, equipment and support to develop new products, processes, services and business models.

2.2 Main findings from Phase 1 due diligence.

Scottish Enterprise (on behalf of the funding partners) commissioned Optimat and PKF-FPM to review CSIC's activity during Phase 1 to inform its funding allocation for Phase 2. Their Due Diligence Report was subsequently published in October 2018. Its key findings were:

- CSIC performed strongly on its Phase 1 core mission of *Building an Innovation Culture*, providing a firm foundation on which it can be more ambitious in terms of *Mainstreaming Innovation* across Scotland during Phase 2.
- CSIC has clearly become the focal point for the construction community in Scotland, developing strategic partnerships with influential stakeholders such as Construction Scotland (see its activity under *Connected Ecosystem*).
- It had supported some 185 individual Projects by the end of July 2018 (see its activity under *Collaborative Innovation*), of which 75 were collaborative research Projects, 75 were strategic industry-level Projects, and 35 were MSc Projects. Feedback from stakeholders indicated that, whilst some of this support could have been delivered by *other* sources, CSIC's unique offer is that it provides a fully managed process, which is especially important for SMEs.
- The *Innovation Factory*, launched later during Phase 1, has enabled CSIC to position itself to take full advantage for Scotland of the recently launched UK '*Transforming Construction'* Programme. It is a unique selling point relative to other innovation support providers.
- Industry engagement with CSIC during Phase 1 demonstrated that the Centre generated more demand for its support than it had the capacity to deliver, demanding an increased resource allocation during Phase 2.
- Some academic partners felt that they could have played a stronger and more strategic role in steering the Centre's project development processes. There was also a perception amongst academic partners that CSIC's primary focus was on housing, limiting broader engagement further. Other academics felt that they were already industrially active, but nevertheless recognized that CSIC provided opportunities to deepen existing relationships.

2.3 Main elements of Phase 2 business plan.

BE-ST finalised its Phase 2 Business Plan in November 2018, taking account of the Due Diligence Report explored above, as well as feedback from SFC, Scottish Enterprise, and Highlands & Islands Enterprise.

Though BE-ST contributed positively to stimulating innovation in Scotland's construction sector during Phase 1, the Phase 2 Business Plan recognised that the sector *still* invests little in innovation and R&D, as well as in the upskilling of its workforce, and is often reticent to exchange knowledge and ideas. The Business Plan thus recognised the opportunity that BE-ST had to continue driving the innovation agenda in Scotland's construction sector. BE-ST's ability to operate as a catalyst, build communities, and foster partnerships around common issues would continue to enable the sector to innovate and capture the resultant economic value.

Relative to Phase 1, BE-ST's Phase 2 of the IC Programme focuses on *Mainstreaming Innovation*, having already built the appetite for innovation within the sector. To enable BE-ST to achieve its Phase 2 ambitions, the Business Plan sets out activities that are structured around the following four pillars:

- **Connected Ecosystem**: BE-ST's ambition under this Pillar was to expand the depth and breadth of its network of industry, academic, and public sector partners across Scotland, the UK, and Globally, through engagement and community building initiatives.
- **Collaboration Projects**: BE-ST's ambition under this Pillar was to directly support individual collaborative projects that react to industry needs, with a view to scale successful approaches more broadly across Scotland.

- **Innovation Factory**: BE-ST's ambition under this Pillar was to develop the Innovation Factory further as a national asset, providing Scotland's construction industry with a physical hub for construction innovation, whilst connecting it to the country's wider innovation infrastructure.
- **Future Workforce**: BE-ST's ambition under this Pillar was to partner with other organisations operating within Scotland's construction skills space, to expand curricula to raise awareness of and provide training on innovative technologies and approaches.

The first three of these Pillars were covered under Phase 1 and were fully operational at the time of presenting the Business Plan for Phase 2. Having already accumulated significant traction in Scotland's construction sector, BE-ST's core proposition was, therefore, judged to be sound. Nevertheless, building on its proposition, the Business Plan added the *Future Workforce* pillar in order to consolidate some of the education and skills-related activities from Phase 1 (e.g., MSc programme, Building Information Modelling [BIM], etc.), but also to allow it to work in collaborative partnerships with education agencies and institutions in Scotland in order to better meet the skills needs of the construction sector.

The pillars of BE-ST's Phase 2 Business Plan remain relevant and operational today. However, BE-ST underwent a formal strategic refresh in 2022, reorienting its activities under a unifying vision of achieving Net Zero, though its intention to do so had been signalled from at least 2020. Today, BE-ST's mission is to accelerate the built environment's transition to zero carbon. Though 'sustainability' did feature in the Business Plan, the predominant focus was on mainstreaming innovation in broader terms. This shift responds to the increasing recognition that the built environment has as a critical component of climate action, but the inertia of the Scottish construction sector to act on the issue [26, 24, 1, 41, 2]. This shift has seen BE-ST better align with several strategic policy agendas that relate to the Scottish Government's climate ambition (i.e., Net Zero Nation). This is in addition to BE-ST's existing broader alignment to non-climate agendas such as the Scottish Government Economic Strategy and the UK Construction Sector Deal.

Concomitant with BE-ST's strategic focus on Net Zero, BE-ST has transitioned away from one-to-one projects to more encompassing one-to-many programmes. This shift was driven by the recognition that to achieve systematic and sustainable impact in areas such as Net Zero, BE-ST needed to engage with the industry at scale [26, 24, 41]. BE-ST's approach has therefore naturally evolved over Phase 2, where rather than delivering a series of scattershot and small-scale pilots, it strategically brings together multiple stakeholders across the construction sector to support innovation across entire fields, especially in (i) Digital, (ii) Modern Methods of Construction (MMC), (iii) Retrofit and (iv) Sustainability [20, 41, 6]. Today, it supports projects primarily in Digital, MMC, Retrofit and Sustainability. Early signs suggest that BE-ST's impact on the innovation landscape, as well as on its broader ambitions, has increased as it has shifted from a project-driven to programme-driven approach, with BE-ST emerging as an industry leader in this respect [24. 25].

2.4 Evaluation Logic Model.

The current approach of BE-ST, as outlined in its Phase 2 Business Plan and built upon by the consultants through stakeholder consultations, is summarised in the figure below (see Figure A. 1).

Figure A. 1 BE-ST logic model.

Context

The construction sector is one of the few that operate nationwide across Scotland. It is important source of employment and contributor to economic output, but its significance extends far beyond this taking into consideration its role as a provider of the built environment on which all other sectors operate and contribute to Scottish growth. An effective, efficient, and competitive construction industry is therefore of utmost importance in ensuring Scotland's prosperity. Nonetheless, the construction sector is one that struggles innovate organically. Productivity growth is around a third of that of the wider economy in the UK. BE-ST thus responds to this challenge delivering culture change, digital transformation, accelerated industrialisation, all the while ensuring sustainability is front-and-centre.

Market failures

- Procurement-Led Business Models: Construction operates on a project-by-project basis, with capital cost driving procurement decisions. This undermines the ability of firms to invest in innovation and R&D upfront, as it raises capital costs and puts them at a disadvantage relative to firms that are less innovative
- Industry Fragmentation: Innovative approaches tend to be held by individual firms and not diffused at industry-wide scales
- Collaboration Maturity: Firms rarely innovate alone. However, collaboration is not the default position in Scotland's construction sector, which has an adverse impact on the ability of firms to interact and deliver innovation.
- Indirect Benefits: Innovation often generates broader benefits that competing firms are able to profit from, reducing the tendency for individual firms to develop innovative ideas. This also affects investment in upskilling, especially given the transitory nature of the workforce.
- Open Information: Often ideas in the construction sector are difficult to protect and it is not always possible to stop others from using the innovation of others.
- Limited Awareness of Support: Firms engaged in innovative projects find it difficult to obtain funding due to informational asymmetries.
- Limited Awareness of Innovation Benefits: Firms in Scotland's construction sector are overly focused on short-term management, rather than long-term strategic planning, and so view innovation as an aspirational activity.

Programme Objectives

BE-ST's Phase 2 approach was organized around the following four strands of activity:

- Connected Ecosystem: To expand the depth and breadth of its network of industry, academic, and public sector partners across Scotland, the UK, and Globally, through engagement and community building initiatives.
- Collaboration Projects: To directly support individual collaborative projects that react to industry needs, with a view to scale successful approaches more broadly across Scotland.
- Innovation Factory: To develop the Innovation Factory further as a national asset, providing Scotland's construction industry with a physical hub for construction innovation, whilst connecting it to the country's wider innovation infrastructure.
- Future Workforce: To partner with other organisations operating within Scotland's construction skills space, to expand curricula to raise awareness of and provide training on innovative technologies and approaches. This objective was new for Phase 2.

Inputs

Connected Ecosystem
- Funded directly by core funders – SFC, SE, and HIE
- HR – inc. Marcomms, Events & Business Relationship Teams
- CRM System
- BE-ST's network of expert presenters and facilitators.

Collaboration Projects
- Funded directly by core funders – SFC, SE, and HIE
- HR – inc. Marcomms, Events, Business Relationship
- SE & HIE Impact Teams
- BE-ST's bid development and administrative expertise,
- BE-ST's network of external partner relationships (inc. funding sources)

Innovation Factory
- Funded directly by core funders – SFC, SE, and HIE
- HR – inc. Marcomms, Events, Technical & Facilities Teams

Future Workforce
- Funded directly by core funders – SFC, SE, and HIE
- HR – Future Workforce Team, Marcomms & Events
- E-Learning System
- BE-ST's bid development expertise

Outputs

Connected Ecosystem
- Communications & Engagement Platforms
- Campaigns & Events
- Partnerships & Network

Collaboration Projects
- Collaborative Projects
- Bootcamps
- Innovation Calls
- Signposted Opportunities

Innovation Factory
- Events
- Partnerships

Future Workforce
- MSc Placements
- Training Sessions
- Campaigns
- Partnerships w/ Skills Agencies

Main Activities

Connected Ecosystem
- Knowledge Transfer Programme
- Annual Events Programme
- Innovation Champion Network
- Workshop & Hackathon
- Campaigns & Community Building
- Learning Journeys

Collaboration Projects
- CSIC-Funded Collaborative Projects
- Innovation Bootcamps
- Supporting Business Access to SE & HIE Products
- Delivering Innovation Calls
- Competitive Bids
- Delivering Projects for Wider Partners

Innovation Factory
- Prototyping, Demos & Research
- Livebuild Workshops
- Upskilling & Demo Sessions
- Industry Hub & Meeting Spaces

Future Workforce
- BIM Awareness and Implementation Programme
- MSc Programme
- Summer Intern Programme
- Executive Education Programme
- Technical Skills Programme
- Industry Outreach Programme
- Develop an FE Sector Programme
- Expanded HE Sector Programme
- Strategic Partnerships with Skills Agencies

Outcomes

Generally, the outcomes of BE-ST's activity can be summarised as follows:

- Increased investment in R&D and innovation in Scotland's construction sector.
- Increased innovation activity in Scotland's construction sector.
- Increased confidence in construction sector in Scotland
- International perception of Scottish construction businesses as innovation leaders

Meanwhile, specific outcomes under each of BE-ST's four workstreams are as follows:

Connected Ecosystem
- Increased opportunity for B2A and B2B collaboration
- Increased profile of Scottish construction businesses

Collaboration Projects
- Increased frequency of B2A and B2B collaborations
- Improved and more diverse products, processes, services, and business models, and increased uptake of these

Innovation Factory
- Increased opportunities for innovators to undertake technical development
- Increased opportunity for B2A and B2B collaboration
- Increased exposure to new technologies

Future Workforce
- Increased access to training and upskilling in areas of innovation.
- Students increase academic expertise and business awareness.

Impact

Economic Impact
- Productivity: Greater productivity in the sector arising from new products, services, processes, and collaborative activities.
- Employment: Generation of new jobs and the safeguarding of existing jobs of those participating in BE-ST's activities.
- Skills: Scotland's construction workforce becomes more resilient and equipped for future change in the sector
- Turnover: Increased turnover for businesses participating in BE-ST's activities,

Wider Impact

Net Zero: Reduction of GHG emissions and removal of carbon from built environment
- Reduced Environmental Conflict: Changes in practices of Scottish construction firms that yield a responsible relationship with the natural environment
- Improved Built Environment: Improvements to quality and sustainability of built environment in Scotland, leading to positive health and wellbeing outcomes
- Diversity & Inclusion: Increased diversity in Scotland's construction workforce.

Source: adapted from BE-ST Phase 2 Business Plan.

3 Market failure and strategic fit.

3.1 Market failure rationale.

BE-ST's presence within Scotland's innovation ecosystem responds to a number of unique challenges faced by the construction industry that are best addressed by an entity with construction expertise.

Construction is an important source of employment and contributor to economic output in its own right, but its significance extends far beyond this taking into consideration its role as provider of the built environment on which all other sectors operate and contribute to Scottish growth. An effective, efficient, and competitive construction industry is therefore of utmost importance in ensuring Scotland's prosperity.

Nonetheless, there are several characteristics of construction that undermine the sector's ability innovate, as identified in the Phase 1 and Phase 2 Business Plans. These are not necessarily unique to Scotland, but are rather unique to the sector itself. Construction operates on a project-by-project basis, with capital cost, not whole-life value, as the key driver of decisions. This undermines the ability of firms to invest in innovation and R&D upfront, as it raises capital costs and puts them at a disadvantage relative to firms that are less innovative (Relevant Market Failure(s): *Efficiency*) [1, 41, 2]. Fragmentation is also a well-known problem in construction, meaning that firms tend to be more combative than collaborative. It also means that innovative approaches tend to be held by individual firms and not diffused at industry-wide scales (Relevant Market Failure(s): *Coordination Failure*) [2,28]. Other challenges faced by the Scottish construction sector include limited awareness of benefits of innovation and limited access to finance to support uptake (Relevant Market Failure(s): *Imperfect Information; Coordination Failure*). The result is that Scotland's construction sector is one that severely lacks innovation, which differs somewhat to sectors that the other Innovation Centres are active in (cf. IBioIC) [1, 28, 6].

The need for an entity like BE-ST to address such challenges was reaffirmed during interviews, with stakeholders confirming the enduring relevance of these market failures [1, 41, 2]. Fewer than a third of BE-ST's clients (30%) report that there were no market failures for them at the time of their involvement with the Centre, suggesting that market failures are *still* a pertinent constraint on establishing innovation activities in the built environment sector. Moreover, in addition to those included in the Phase 2 Business Plan, stakeholders offered several other market failures that BE-ST has an important role in addressing:

- **Overall Complexity of the Innovation Landscape**: Though innovation support is already available to Scottish firms, it is often disjointed and poorly advertised. The result is that almost 12 percent of BE-ST's clients indicated there was a lack of qualified personnel and specialist support available to them prior to working with the Centre. BE-ST therefore has a role to play in assisting firms in navigating this complex ecosystem, signposting support that is relevant to Scotland's construction sector and overcoming this imperfect information and coordination failure. (Relevant Market Failure(s): *Imperfect Information; Coordination Failure*) [26, 24].
- **Limited Awareness of Benefits and Access to Academic Support**: BE-ST sits at the centre of an industry that initially did not realise the value of support it could receive from academia. Meanwhile, firms that *did* collaborate with academics wanted to solve issues over shorter horizons than they could feasibly deliver. BE-ST therefore has a role to play in connecting businesses to Scotland's academic community, whilst demonstrating that academics have something relevant to offer the private sector [24]. (Relevant Market Failure(s): *Imperfect Information; Coordination Failure)*.
- **Transitory Nature of the Workforce:** The transitory nature of the construction workforce undermines upskilling, as firms are reluctant to invest in training when others can benefit freely from such investments without contributing themselves. This relates to the fragmented nature

of Scotland's construction sector. BE-ST therefore has a role to play in addressing this market failure head on by providing training themselves (Relevant Market Failure(s): *Positive Externalities)* [45, 28, 6].

- **Limited Opportunities to Trial Innovation**: The little innovation that is occurring in Scotland's construction sector typically requires costly upfront investments to trial products, practices, and processes on site. This means the sector is typically resistant to innovation, necessitating a more hands-on approach. The Innovation Factory thus has a role to play in mitigating this market failure, providing firms a space to test new ideas, rather than making risky investments in untested equipment (Relevant Market Failure(s): *Opportunity*) [24, 45, 20, 2].
- **Providing Specialized Support to SMEs:** There is a strong rationale to support smaller firms within the Innovation Centre Programme given that firms of over 400 employees accounted for over half of Business Enterprise Research and Development (BERD) expenditure in Scotland. Within BE-ST's specific context, stakeholders noted that SMEs have typically found it more difficult to undertake innovation in the construction sector than their Tier 1 counterparts [24, 1, 41]. Moreover, that SMEs and sole traders comprise the majority of Scotland's construction sector necessarily means that BE-ST has an important role to play in extending its support to such organizations. Some 80% of BE-ST's portfolio involved Micro, Small & Medium Enterprises (MSMEs) during Phase 1 [Optimat, 2018: CSIC Phase 2 Diligence], and the corresponding figure for Phase 2 is c. 90%. Likewise, the networking events organized by BE-ST, including those held at the Innovation Factory, tend to be well attended by Tier 1s and MSMEs alike, creating further opportunities to connect and share knowledge about innovation [1]. (Relevant Market Failure(s): *Equity*)

3.2 Strategic fit.

Section 1 of the main report established the strategic fit of the ICs to Scotland's innovation landscape in broad terms. As highlighted in the Scottish Government's 2017 Enterprise and Skills Review and in the UK Governments 2015 Dowling Review, the research and innovation support landscape (in Scotland and the UK) is complex and often challenging for businesses to navigate. BE-ST, therefore, has an important role to play in addressing this complexity within the context of Scotland's built environment sector, in view that it is the only pan-Scotland, construction focused innovation support mechanism operating at the intersection between industry, academia, and the public sector.

BE-ST's strategy is also aligned with national and regional strategies specifically related to innovation in Scotland's built environment sector. Nationally, the construction industry has a clear part to play in delivering Scotland's recent *National Strategy for Economic Transformation*, with it playing a vital role in several important agendas, including innovation, infrastructure investment, and inclusive growth. BE-ST is therefore well-oriented to support the achievement of this strategy in driving growth and innovation in Scotland's construction industry. Regionally, the *UK Construction Sector Deal* and the associated Industrial Strategy Challenge Fund ("Transforming Construction") specifically targets innovation as driving improvements in the design, manufacture, and management of buildings, with BE-ST clearly playing an important role in realizing such innovation within the Scottish context.

BE-ST is also contributing to other important agendas for the Scottish Government. It has contributed to the Scottish Government's 50/50 by 2020 diversity objectives through its strategic ownership of the National Construction Equity and Inclusion Plan, on behalf of Scottish Government and Industry Leadership, as well as through its own programmes such as DiveIN. Its strategic refresh, which oriented its activities towards Net Zero, has also meant that BE-ST can help to deliver on Scotland's climate ambitions (i.e., Net Zero Nation), including its nationally determined contributions under the Paris Agreement. BE-ST's work in the area of residential construction is also aligned with the UK and Scottish Governments' ambitions in terms of addressing the affordable housing crisis, including the Scottish Government's Affordable Housing Supply Programme.

Contribution

BE-ST's Phase 2 Business Plan positions itself as a central element of the innovation support landscape for Scotland's construction sector. It claims that it is the go-to organisation for construction innovation within Scotland, and increasingly across the wider United Kingdom, with attributes such as its impartiality, network, and the physical spaces it has available to it to demonstrate innovation (i.e., the Innovation Factory) all claimed to support its role as the leader of innovation in Scotland's construction sector.

The 2018 Due Diligence Report confirmed BE-ST's centrality within the construction sector's innovation landscape, with Optimat and PKF-FPM independently claiming the Centre to be the focal point for innovation within the sector. Stakeholders, similarly, affirmed that there was no direct competitor to BE-ST in Scotland [26]. The same Due Diligence Report also found that BE-ST was aligned with the innovation agendas of entities such as Construction Scotland and the UK Transforming Construction Programme, deepening the support available to Scottish construction firms. It was unable to prove definitively whether BE-ST's offer was entirely additional to existing support, recognizing that it was likely that some elements would have been provided by other entities. Nonetheless, the Due Diligence Report found no evidence that it was simply displacing existing efforts, with anecdotal evidence suggesting that BE-ST complements and augments the support that is available to Scottish firms.

The Business Plan reaffirms BE-ST's role in this respect. BE-ST outlined its intention to take a collaborative approach to avoid duplication with other parts of the public sector, academia, or private sector organisations, offering complementary products and services in an integrated manner. This collaborative approach was frequently referenced in stakeholder interviews. Though there may have been collaboration between these stakeholders in the past, BE-ST brings more cohesion to this collaboration, adding strategic value to the innovation landscape of Scotland's construction sector [26, 6]. Likewise, even though stakeholders recognized that BE-ST was not the *only* source of innovation support for Scotland's construction firms, its offer is considered to be better tailored and targeted to the construction sector than these other sources (e.g., from Scottish Enterprise or Highland and Islands Enterprise, and so may be considered *additional* to the existing offer. Moreover, BE-ST is also able to signpost support that can be accessed from this broader landscape, providing cohesion, whilst sharpening the offer to Scotland's construction sector (cf. Market Failure) [26, 24, 41, 6, 64].

These conclusions were reaffirmed in the Client Survey. Some 14 percent of BE-ST's clients felt that they would not have received *any* of the benefits they had if the Centre had not existed. This can be taken as a crude measure of the *absolute* additionality. Nonetheless, BE-ST's additionally most often reveals itself through increasing the scale of benefits or reducing the time horizon over which these benefits materialize. Some 66 percent of BE-ST's clients indicated as such. Only five percent of clients felt that they would have achieved exactly the same benefits without BE-ST's support.

BE-ST can thus be viewed as a central element on the innovation support landscape in Scotland, with a clear ability to address the market failures outlined in the prior section. It has the capacity to deliver on sector strategies such as the UK Construction Sector Deal in a manner that is not only coherent with the existing offer, but one that also adds value to it.

3.3 COVID Response

BE-ST played an important role in articulating the needs of Scotland's construction industry during COVID-19. BE-ST provided a collective voice to the industry to express their needs and priorities, with its initial focus centring on helping restart the industry safely, by assisting in the development of a Construction Restart Plan and enabling the sector to develop national Safe Operating Guidance. BE-ST participated in a number of Working Groups to help communicate the construction industry's views on reintroducing people back to work during this time, especially via the Construction Leadership Forum (CLF) [26]

BE-ST then put these plans into action, with activities including the establishment of a digital collaboration portal, i-Con, via BE-ST's website, where clients and contractors could share examples of best practice being deployed across essential sites that were still operating. BE-ST's i-Con initiative brought together five key strands to support industry recovery and engage Scotland's academic community: (i) the *i-Con Knowledge Hub*, which provided a bank of resources to find current information and navigate the range of support services available to the built environment community during the crisis; (ii) the *i-Con Online Learning Catalogue*, which provided a suite of learning resources developed by BE-ST's network of industry, academic and public sector experts, together with its own programmes, that were free to use and accessible remotely; (iii) the *i-Con Events Programme*, which was a programme of webinars and other virtual events supported by industry and academic partners, aimed at sharing expertise and experiences that could help the sector during COVID-19 and future challenges; (iv) the *i-Con Matchmaking Platform*, which was designed to quickly match industry challenges with potential solution providers from industry and academia; and (v) the *i-Con Challenge Fund*, which enabled BE-ST's academic project funding to be targeted at projects focused on COVID-19 recovery, supporting six projects to date with £125k of investment matched by £125k of industry investment. Outside of i-Con, BE-ST also worked with the Government to develop an augmented reality tool that allowed construction workers to train from home and adapt to COVID-19 prior to returning to work. [26]

Beyond BE-ST's immediate response to COVID-19, the pandemic offered an opportunity for BE-ST to pause and reflect on its ambition, the result of which was a strategy refresh that increased BE-ST's concentration on Net Zero.

BE-ST's approach was already evolving. During Phase 1 its model was one of broad innovation support, designed to assist the industry explore innovation and become more innovation active, whilst in Phase 2 BE-ST took on a sharper focus, encouraging a shift towards larger scale, multi-partner innovation programmes. COVID-19, with the slight downturn in activity, allowed time for further evolution to ensure BE-ST was fit-for-purpose to respond to the impacts of the pandemic, key strategic priorities for Scotland, and life after Phase 2. BEZero was the result of this evolution - BE-ST's route map for Net Zero, setting out the direction of travel and necessary toolkits and support mechanisms needed over the next 25 years to decarbonise the built environment.

4 Inputs, Activities and Outputs.

This section draws primarily on MEF data, survey evidence, and stakeholder feedback. Note that, for some ICs, the number of survey responses is comparatively low, and the associated results are indicative only. For BE-ST, the number of responses to the Client Survey and Student Survey, amounted to 78 and 15, respectively. Please see Appendix A for further detail. Please also note that discussion of population level data, where available, is included in the delivery and Value for Money (VfM) section.

4.1 Inputs

The Phase 1 Business Plan requested £7.499 million in core operational support and £1.856 million in capital investment from the SFC over an initial five-year funding period, to enable CSIC to become the primary delivery mechanism for innovation support to the construction industry in Scotland. Likewise, the Phase 2 Business Plan requested core operational support from the Funding Partners to BE-ST to the tune of £10.980 million over the following five-year funding period to achieve similar ends. This amounted to a request of £20.355 million over both Phase 1 and Phase 2. To meet this request, the Funding Partners provided a total of £17.0 million to March 2023, comprising the following: SFC – £15.1 million; SE – £1.6 million; and HIE - £0.3 million (see Table A. 1). This relates to funders only and does not reflect any other funding that has been leveraged from elsewhere.

Table A. 1 BE-ST Funder Inputs (October 2014 – March 2023)

Level	Phase 1 Spend	Phase 2 Award	Phase 2 Spend	Total Spend to Date
SFC	£9.2m	£8.0m	£5.8m	**£15.1m**
SE	£0.0m	£2.5m	£1.6m	**£1.6m**
HIE	£0.0m	£0.5m	£0.3m	**£0.3m**
Total	**£9.2m**	**£11.0m**	**£7.7m**	**£17.0m**

Source: SFC, SE, HIE correspondence ('Summary funders awards and drawdowns to date', excel spreadsheet, Feb 2023). Figures are rounded to one decimal.

4.2 Activities and outputs.

The MEF returns indicate that BE-ST has achieved the following results across the following output measures:

Skills - Entrants to Education and Training: During Phase 1, BE-ST supported a total of 71 individuals to enter into education at the MSc level, narrowly short of its initial target of 75 entrants. As is the case for *Collaborative Projects* and *Events*, BE-ST raised its ambition during Phase 2. From June 2019 to August 2022, BE-ST has supported a total of 56 individuals to enter into education at the MSc level, against five-year Phase 2 target of 100. Many of the MSc students supported by BE-ST studied at its host university – ENU. Robert Gordon University, the University of Dundee, and the University of Stirling were also frequent choices [Client Survey: Q2.2]. Naturally, MSc degrees related to 'Built Environment, Construction, or Architecture' (53 percent) were most frequently selected by students supported by BE-ST, though 'Arts & Design' (7 percent), 'Civil Engineering' (7 percent) and 'Materials Engineering' (7 percent) were common choices too. BE-ST performs strongly in the provision of training and other skills development opportunities outside of supporting students to attend Scottish universities. Some 34 percent of respondents to the Client Survey indicated that they had received such support from BE-ST. To August 2022, some 3646 individuals had participated in Continuing Professional Development courses, such as BIM Awareness course or the Low Carbon Learning Programme, far exceeding its initial ambition of 125. These are delivered by BE-ST itself, though receive considerable input from academic partners (especially ENU) in the development of learning materials. Most are delivered online, though a small proportion are delivered face-to-face at the Innovation Factory.

Skills – Qualifications: Across Phase 1 and Phase 2 to date (October 2014 – August 2022), BE-ST has supported three PhD candidates and 127 MSc candidates to complete their education, with an additional 478 individuals receiving qualifications through BE-ST's Continuing Professional Development courses. As is the case in the other measures of Output, BE-ST has exceeded initial ambitions for Phase 2, with a total of 537 individuals receiving qualifications against a target of 225.

Table A. 2 BE-ST Entrants to Education & Training (October 2014 – August 2022)

Level	Phase 1 (a & b)	Phase 2	Total
PhD/EngD	0	0	**0**
MSc	71	56	**127**
HND/HNC	0	0	**0**
Other	0	3646	3646
Total	**71**	3702	3773

Source: MEF.

Table A. 3 BE-ST Qualifications (October 2014 – August 2022)

Level	Phase 1 (a & b)	Phase 2	Total
PhD/EngD	0	3	**3**
MSc	71	56	**127**
HNC/HND	0	0	**0**
Other	0	478	**478**
Total	**71**	**537**	**608**

Source: MEF.

Networking & Ecosystem Linkages - Events: During Phase 1, BE-ST hosted a total of 98 engagement events, far exceeding its initial ambition of 36. It hosted some 16 engagement events involving more than 100 Attendees, and an additional 82 engagement events of 10-100 Attendees. BE-ST thus raised its ambition during Phase 2, hosting a total of 195 engagement events to date (August 2022), of which 25 involved more than 100 Attendees, 178 involved 10-100 Attendees, and 14 involved less than 10 Attendees. This represents a near doubling on Phase 1 levels. Despite this considerable performance, BE-ST's delivery of events in Phase 2 is currently short of the five-year Phase 2 target of 250, due primarily to the hiatus associated with COVID-19, though there is still time for results to materialize over the remainder of Phase 2.[1] BE-ST's strong delivery in terms of events was confirmed in the Client Survey, with 68 percent of respondents indicating that they had attended conferences or events provided by, or supported by, the Innovation Centre.

Networking & Ecosystem Linkages - Events: **Follow-On:** Across Phase 1 and 2 to date (October 2014 – August 2022), BE-ST has engaged in a great deal of signposting to other innovation ecosystem partners. Indeed, 32 percent of respondents on behalf of BE-ST to the Client Survey indicated as such. No forecasts were made for Phase 1, but BE-ST has exceeded its ambitions for follow-on during Phase 2, with 130 instances achieved against an initial target of 100.

Across both Phases, follow-on has been mainly to other public funding or support bodies, rather than SE and HIE. Some 38 instances of project follow-on involved such entities, whilst only 31 involved either SE or HIE. BE-ST itself is also a major source of follow-on, accounting for 46 instances of the 202 from October 2014 to August 2022.

Often, BE-ST has also been able to attract follow-on support from outside the public sector. Indeed, 35 projects were signposted to the private sector, whilst 52 were able to be taken directly to market. The Client Survey confirms broadly BE-ST's ability to link its clients to the private sector clients or customers, with 25 percent of respondents indicating that the Centre had played a significant role in supporting relationships at this level.

Table A. 4 BE-ST Events (October 2014 – August 2022)

Level	Phase 1 (a & b)	Phase 2	Total
> 100 Attendees	16	25	41
10-100 Attendees	82	178	260
< 10 Attendees	0	14	14
Total	**98**	**217**	**315**

Source: MEF.

[1] Feedback from BE-ST indicates that a further 44 events have been held since August 2022, bringing delivery to date much closer to the five-year Phase 2 target.

Table A. 5 BE-ST Follow-On (October 2014 – August 2022)

Level	Phase 1 (a & b)	Phase 2	Total
Signposted to SE	5	16	**21**
Signposted to HIE	0	10	**10**
Signposted to other public funding/support body	13	25	**38**
Signposted to private sector	15	20	**35**
IC supported follow-on project planned or underway	20	26	**46**
Direct to market (by a business in Scotland)	19	33	**52**
Projects not taken forward	3	2	**5**
Total	**75**	**132**	**207**

Source: MEF.

Collaborative Projects: The MEF itself does not provide a breakdown of the sort of entities that BE-ST collaborates with. However, data from the Client Survey indicates that almost two-thirds (63 percent) of the Centre's beneficiaries were private sector entities. Accordingly, of the total of 116 Collaborative Projects supported during Phase 1, the majority were academic-to-business (A2B) involving at least one business based in Scotland. The data from the Client Survey also indicates that some 16 percent of the Centre's beneficiaries were public sector entities and so it is of no surprise that a significant portion of Collaborative Projects were academic-to-government (A2G), though not involving a Scottish business directly. Deficiencies in the standardized MEF make it difficult to assess the total number of Collaborative Projects supported during Phase 2. Nonetheless, *at least* 195 Collaborative Projects have been supported in Phase 2 to date (August 2022), against an initial target of 140. Again, the majority of these were A2B involving at least one business based in Scotland. However, BE-ST's A2G support involving Scottish businesses directly was stepped up in Phase 2, representing a slight departure from Phase 1. Most often clients accessed BE-ST's support only once over the period, though 29 percent of respondents to the Client Survey indicating that they had accessed three or more rounds of support. 98 percent of BE-ST's projects involved academic input, signalling a strong alignment with the original intentions of the Innovation Centre programme.

Table A. 6 BE-ST Collaborative Projects (October 2014 – August 2022)

Level	Phase 1	Phase 2		
	No. of collaborative projects (including completed)	No. of new collaborative projects	No. of continuing collaborative projects	No. of completed collaborative projects
Academic/IC to business (involving at least 1 business in Scotland)	60	95	14	**14**
Academic/IC to business (involving no businesses in Scotland)	4	13	1	**1**
Academic / IC to Academic	10	16	5	**3**
Business to business (involving at least 1 business in Scotland)	5	4	0	**3**
Academic/IC to public sector (involving no businesses in Scotland)	33	19	4	**2**
Academic/IC to public sector to business (involving at least 1 business in Scotland)	4	48	3	**40**
Individual Projects	0	0	0	**0**
Total	**116**	**195**	**27**	**63**

Source: MEF. Note: BE-ST only recently started collecting data on "continuing" or "completed" collaborative projects.

Commercial Launches & Other Applications: Across Phase 1 and Phase 2 to date (October 2014 – August 2022), BE-ST has supported a total of 1,164 commercial launches or other applications of innovation through its *Collaborative Projects*. Most of these were new or improved products for Scottish construction firms (c. 381), new or improved processes (278), or new or improved services (226). Relating to its Phase 2 targets, BE-ST has overachieved by almost 400 percent (Actual: 715 vs

Target: 180). The information in the MEF is broadly confirmed by the Client Survey, which finds that 53 percent of BE-ST's clients had established new or significant improved goods, services, or processes since starting to work with the Centre. That the number of commercial launches is higher than the number of individual collaborative projects supported by BE-ST also seems to indicate that the Innovation Centre is able to support the development and delivery of multiple products, processes, services through each of its projects, suggesting it engages in a manner that maximizes its impact.

Table A. 7 BE-ST Commercial Launches & Other Applications (October 2014 – August 2022)

Level	Phase 1 (a, b)	Phase 2	Total
New or improved products developed (with/for a business in Scotland)	147	234	**381**
New or improved processes (with/for a business in Scotland)	119	159	**278**
New or improved services developed (with/for a business in Scotland)	95	131	**226**
New or improved business models (with/for business in Scotland)	54	108	**162**
New or improved delivery of a public service in Scotland	34	83	**117**
Total	**449**	**715**	**1,164**

Source: MEF.

5 Outcomes and impacts.

This section draws primarily on MEF data, survey evidence, and stakeholder feedback. Note that, for some ICs, the number of survey responses is comparatively low, and the associated results are indicative only. For BE-ST, the number of responses to the Client Survey and Student Survey, amounted to 78 and 15, respectively. Please see Appendix A for further detail. Please also note that discussion of population level data, where available, is included in the delivery and VfM section.

5.1 Main findings from MEF.

BE-ST's approach to measuring the outcomes of its initiatives fully complies with the MEF Guidance set out by SFC, SE, and HIE at the outset of Phase 2 of the Innovation Centre Programme. As per the Guidance, BE-ST reports on the outcomes of its initiatives on a quarterly basis to provide confidence to the Funding Partners on the Centre's progress, but also to inform future evaluations as to the economic impact of the Innovation Centre Programme. Outcomes are forecast by BE-ST's project partners during the proposal stage, with actual performance subsequently tracked against this forecast through regular dialogue and information-sharing between BE-ST and the partner over the lifecycle of the project. BE-ST also collects detailed close-out information for projects that have ended during the period. There is therefore a reasonable level of confidence that BE-ST's MEF return is free from optimism bias due to this open and transparent process (see also the *Monitoring and Evaluation* section for further information).

The MEF returns indicate that BE-ST has achieved the following results across the following outcome measures.

- **Jobs Supported and/or Created:** Across Phase 1 and Phase 2 to date (October 2014 – August 2022), BE-ST has already or is projected to support some 10,359, of which 3,885 are creations, with the remaining 6,474 being safeguarded. This is a considerable potential contribution to Scotland's economy. BE-ST's achievement to date has not quite reached its ambition for Phase 2 (Actual: 4,484 vs Target: 6,568), though is on track to with over a year of Phase 2 still to take place.
- **Turnover Supported and/or Created:** Across Phase 1 and Phase 2 to date (October 2014 – August 2022), BE-ST has already or is projected to some £1,773 million in turnover through its activities, of which the majority (£1,643m) has been created, with the remaining £130 million being safeguarded. For Phase 2, BE-ST is marginally short of its initial ambition of £998 million (Actual: £945 million), but is nevertheless fully on track to achieve it with over a year of Phase 2 still to take place. Turnover per job is £171,159 on this basis, though these two measures are

not necessarily related. The MEF return is broadly corroborated by the results of the Client Survey. Of those responding on behalf of BE-ST, 17 percent indicated that they were able to grow commercially in the Scottish market, 11 percent in other UK markets, and a further two percent in international markets.

- **Posts Created in Scottish HEIs, Colleges and the Public Sector**: Across Phase 1 and Phase 2 to date (October 2014 – August 2022), BE-ST has helped create some 21 posts outside of the private sector. Most of these (19/21) are in Higher Education Institutes (HEIs) and are oriented towards providing support to A2B collaboration. Its results in Phase 2 exceed its initial ambition at outset (Actual: 17 vs Target: 12)

Table A. 8 BE-ST Jobs Supported and/or Created (October 2014 – August 2022)

Level	Phase 1 (a & b)	Phase 2	Total
New jobs generated (by business in Scotland)	2,601	1,284	**3,885**
Existing jobs safeguarded (by business in Scotland)	3,274	3,200	**6,474**
Total	**5,875**	**4,484**	**10,359**

Source: MEF.

Table A. 9 BE-ST Turnover Supported and/or Created (October 2014 – August 2022)

Level	Phase 1 (a & b)	Phase 2	Total
New turnover generated (by business in Scotland)	£828m	£815m	**£1,643m**
Existing turnover safeguarded (by business in Scotland)	£0m	£130m	**£130m**
Total	**£828m**	**£945m**	**£1,773m**

Source: MEF.

Table A. 10 BE-ST Posts Created in Scottish HEIs, Colleges and the Public Sector (October 2014 – August 2022)

Level	Phase 1 (a & b)	Phase 2	Total
New posts (in Scottish HEIs) created to support demand led academia-business projects.	4	15	**19**
New posts (in Scottish colleges) created to support demand led academia-business projects.	0	1	**1**
New posts (in Scottish public sector) created to support demand led academia-business projects.	0	1	**1**
Total	**4**	**17**	**21**

Source: MEF.

5.2 Main findings from survey of beneficiaries.

5.2.1 Outcomes

The immediate outcomes of BE-ST's activities are mostly relevant for Scottish construction firms and students studying subjects that are related to construction. The following outcomes were expressed during stakeholder interviews and confirmed as party of the Client and Student Surveys.

Businesses

- **Increased technical readiness of innovative products, practices, and processes.** Some 54 percent of Client Survey respondents felt that BE-ST had been very important in advancing the technological readiness of their innovations. At the outset of their collaboration with BE-ST, 70 percent of clients felt their technological readiness was Level 3 or below, meaning at most they had established experimental proof of concept. Some 56 percent of these same firms estimate that in the three years following support from BE-ST, their innovation products, practices, or processes will be commercially ready. As discussed in the section on Inputs, Activities and Outputs, BE-ST has already supported 52 innovators to bring their innovations to market.

- **Connections to Scottish academics that have expertise to meet industry needs** [24]. BE-ST has often been able to establish new connections between Scottish construction firms and academics. Responses to the Client Survey indicate that 28 percent of BE-ST's clients had established such relationships, and a further 24 percent indicating that they had even embarked on a joint venture with an academic institution as a result of BE-ST's networking support.
- **Capacity development to support R&D** [24]. 38 percent of those responding on behalf of BE-ST to the Client Survey indicated that their interaction with the Centre allowed them to invest in internal R&D.
- **Technology deployment and trialling of new products, services, and processes (e.g., via Innovation Factory)** [24]. Some 13 percent of those responding on behalf of BE-ST to the Client Survey indicated that they had made use of test and demonstration facilities as part of their interaction with the Centre. Of those that used such facilities, 67% indicated that they had launched new products, processes, or services as a result.
- **Training of staff in relevant concepts such as Passivhaus and Building Information Modelling (BIM)** [24]. Indeed, 29 percent of those responding on behalf of BE-ST to the Client Survey indicated that the Centre assisted them in training and skills development in emerging areas of innovation, with a further 17 percent indicating that skills had improved considerably as a result of such support.

Students

- **Funding and support for PhD and MSc students** [26]. Every student supported by BE-ST that responded to the Student Survey indicated that they were satisfied with the support received for BE-ST during their studies at Scottish universities, with the majority indicating they were "extremely" satisfied (53%).
- **Connections to Scottish firms during education to increase employability** [24, 45, 28]. 80 percent of Student Survey respondents commenting on support from BE-ST indicated that they had been partnered with a private sector firm as part of their research. Of those that had partnered with such an entity, 92 percent where "somewhat" satisfied or more with the relationship, with the majority indicating that they were "extremely" satisfied.
- **Training to ensure the skills and expertise match international standards, including via Scottish colleges** [24]**, and hands-on experience in innovative practices (e.g., via the Innovation Factory)** [20, 28]. Students felt that this training would help open career opportunities, with 60 percent of respondents to the Student Survey indicating as such [Client Survey, Q3.6c]. Some 66 percent felt that this support would directly help them find employment [Client Survey, Q3.6a].
- **Increased employability and employment after completing their studies**. Most students supported by BE-ST tend to find permanent, full-time employment in the construction sector following their studies [Client Survey, Q4.6]. This employment is attributed to BE-ST to varying degrees. Some 11 percent of employed students commenting on support from BE-ST in indicated they would not be employed without BE-ST's assistance, whilst 33 percent felt that they would be employed but that it would either have taken longer to find employment *or* would be renumerated less well. Some 44 percent indicated that they would be in the same position, even without BE-ST's assistance, suggesting potential for more efficient targeting of support [Student Survey, Q4.10]. Incomes for those employed after finishing BE-ST supported education tended to be in the ballpark of £35,000 [Student Survey, Q5.1].
- **BE Changemakers to provide students an opportunity to participate on BE-ST's Board and gain exposure to business leaders and policymakers (see also Impact Case Studies)** [26, 24, 1, 41].

5.2.2 Impact

BE-ST's original Phase 1 Business Plan at inception did not forecast impacts such as Gross Value Added (GVA) and employment. Nonetheless, the EKOS Impact Report (2018) estimated that there was £65.5m of net additional GVA and 1,256 net additional jobs arising from Phase 1 of BE-ST's operations, though conceded that the estimate was based on forecast data provided by individual companies, did not consider additionality or attribution, and in some cases was based on missing or incomplete data.

BE-ST Phase 2 Business Plan (2018) provided forecasts in gross terms, indicating that its Phase 2 activity would support businesses to deliver £998 million of additional gross turnover, create 1,847 new jobs, and retain 4,721 existing jobs. The MEF return suggests that BE-ST is on track to achieve its ambition by the close of Phase 2 (see Main Findings from MEF above).

An assessment of additionality was included in the Client Survey, which revealed that 14 percent of BE-ST's clients felt that they would not have received any of the benefits they had if the Centre had not existed. Only five percent say they would have achieved the same benefits at the same time and scale without BE-ST's support. The majority of additionality is through increasing the scale of benefits or bringing forward the timing of benefits. The greatest percentage of respondents (29 percent) say they would have achieved a significantly smaller range of benefits, at a reduced scale, and it would have taken longer to achieve them, whilst a further 37 percent more limited benefits.

Using evidence from the Client Survey as a basis for calculation, the Evaluation finds that attributable employment benefits are fairly low (see section below). Estimates of net additional employment – that is, the difference that BE-ST's support has made over and above what would have happened occurred anyway – reached a peak of 187 in 2022 (Non-Grossed = 16). Though these figures are based on a small sample (N = 33), the difference between the gross employment figures reported in the MEF and those reported here point to difficulties identifying and attributing employment creation to BE-ST.

The employment benefits identified are associated with increased economic benefits in terms of GVA. Cumulative net additional GVA for the period 2012-2022 is estimated at £25.1 million. It is emphasised that the reported results relate to a relatively small sample of BE-ST's beneficiaries and that the grossed-up figures presented are indicative and do not fully include the wider economic impacts of BE-ST's interventions.

5.2.3 Wider Impacts

BE-ST's activities also give rise to broader benefits. Its contribution to such benefits is felt to have increased between Phase 1 and Phase 2, with BE-ST acknowledging that Phase 1 was rather economically oriented, at this slight expense of BE-ST's social and environmental impact. Phase 2 of BE-ST has had a clearer focus on such impacts, including the following:

- **Environment**: BE-ST's greatest contribution to environmental impact is its pursuit of Net Zero, with the recent strategy being reorganized around the decarbonization agenda. This shift was deliberate, given the increasing recognition that climate change is the world's foremost challenge, and that the built environment has a significant role to play in terms of mitigation and adaptation. Entire streams of BE-ST's work are now organized around Net Zero – e.g., the *Accelerate to Zero* programme [26, 24, 6]. Climate impacts are difficult to quantify, especially within the timeframe the Innovation Centre Programme has operated for, but initiatives that are part of *Accelerate to Zero* and beyond are nonetheless *likely* to contribute to positive impact on this agenda. BE-ST's own estimate is that they they will save 6.6m tonnes of CO2 equivalent savings through its initiatives. The Advanced Industrialised Methods for the Construction of Homes (AIMCH) project, for instance, could yield five tonnes of CO_2 equivalent savings per four bed dwelling when using timber panelised MMC methods. Moreover, 28 percent of respondents to the Client Survey felt that they had contributed to SDG 13: Climate Action as a result of their interaction with BE-ST, more so than any other Innovation Centre.

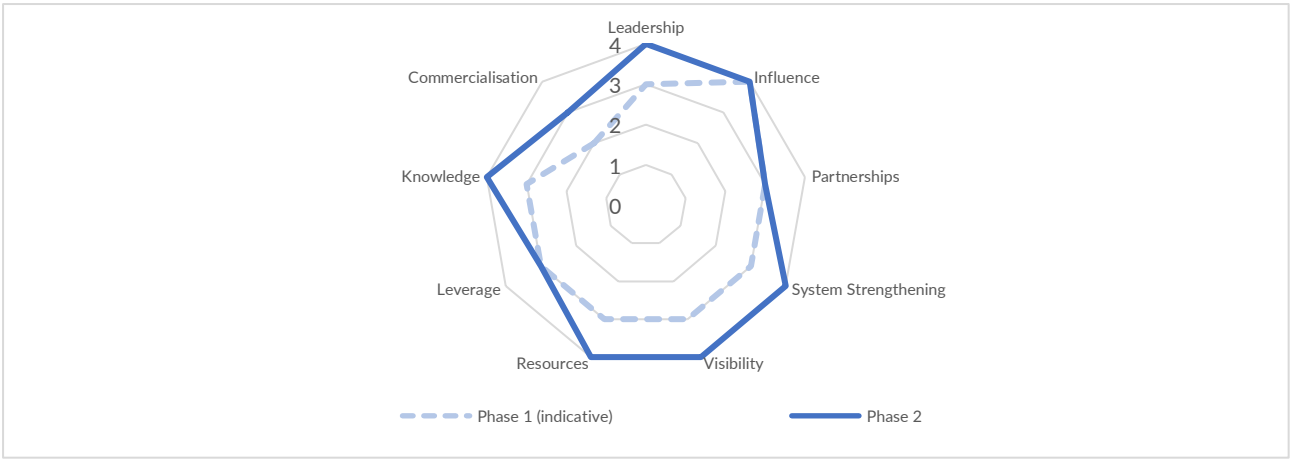
BE-ST's contribution to environmental impact is likely to also be broader than Net Zero in view of the clear link between the built and natural environment, coupled with BE-ST's commitment to ensure the relationship is responsible and to some extent symbiotic. BE-ST supports activity that reduces conflict with the environment, for instance in the area of circular economy through initiatives such as K-Briq[2] [26, 24]. The result is that some 16 percent of BE-ST's clients felt that they had contributed to responsible consumption and production patterns.

- **Equity and Social Inclusion**: BE-ST is actively supporting efforts to diversify the construction sector. Through its own DIveIn programme, BE-ST supports industry partners to address issues of diversity, allowing them to welcome a more diverse talent pool that is better representative of the Scottish population. Some 50+ industry leaders will be trained in Phase 2 of the project. Its contribution to gender equality was considered the second highest out of all the Innovation Centres in the Client Survey. At a more strategic level, BE-ST has influenced the National Equity and Inclusion Plan (as part of the Construction Accord), with the aim of supporting wider efforts to address inequality and promote greater diversity within the Scottish construction sector. Youth inclusion is also a significant focus of BE-ST, with its BE Changemaker programme being influential in providing youth an opportunity to steer innovation within the construction industry (see also Impact Case Studies) [26, 1, 45, 2, 28].
- **Human Health and Wellbeing**: BE-ST also supports innovations that improve building quality, with benefits in areas such as air quality that can ensure that Scottish people are healthy. Its efforts to improve public realm also increase human wellbeing, by providing nicer and safer places for Scottish people to interact [24, 45]. 16 percent of respondents to the Client Survey felt that they had contributed to SDG 3: Good Health and Wellbeing as a result of their interaction with BE-ST.

5.3 Assessment of innovation ecosystem benefits.

The Evaluation Team developed a framework to assess the extent to which each Innovation Centre supports the innovation ecosystem (see also Appendix A). Our assessment for BE-ST is presented in Figure A. 2, with justifications for the scores provided under the following sub-headings. Less evidence is available for a detailed assessment ecosystem benefits at the end of Phase 1. However, an indicative rating is noted for Phase 1 based on a review of BE-ST's programme documentation, stakeholder consultations, and client feedback.

Figure A. 2 BE-ST Innovation Ecosystem Benefits



[2] The world's first over 90% recycled brick, the K-briq® is stronger and more durable than a traditional brick. As an unfired facing brick, it also uses 90% less energy in its production, and has 10% of the carbon footprint of a traditional brick.

Source: Authors

System Leadership

Leadership

- BE-ST has become an "umbrella" for innovation occurring in Scotland's construction sector, pulling together the efforts of an incredibly complex ecosystem to ensure that these sum to something greater than their individual parts [26, 45, 20]. It has thus addressed the market failure relating to the overall complexity of the innovation landscape, as outlined in the Market Failure section (Relevant Market Failure(s): *Imperfect Information; Coordination Failure*).
- BE-ST plays a leading role in making the case for innovation in Scotland's construction sector. It helps to articulate to industry the need for change, whilst identifying products, practices, and processes that can help construction firms innovate in practical terms through collaborative projects between businesses and academia [41]. Consequently, its activity here responds to limited awareness of the benefits of innovation as outlined in the *Market Failure* section (Relevant Market Failure(s): *Imperfect Information*). The Client Survey also confirmed this contribution, with 33 percent of BE-ST's clients indicating that the Centre was a leading voice in Scotland's construction sector,
- BE-ST has played a particularly strong role in leading innovation in the area of Net Zero, where it has identified practices that can help construction firms mitigate and adapt to the climate agenda, but also generate GVA [41, 1, 2, 6].
- BE-ST have been independently recognised as contributing visible leadership through a variety of high-profile impactful appointments to, for instance, the Just Transition Commission (Commissioner), Construction Leadership Forum (co-chairs of Net Zero, Digital, and Data Groups), Climate Emergency Skills Action Plan (co-chair), and Building Standards Section 6 Energy Review (Chair).
- BE-ST also plays an important role in articulating and communicating the needs of the sector to Government. This was especially seen during COVID-19, where Scotland's construction industry initially lacked a collective voice to express their needs and priorities. Within the context of COVID-19, BE-ST participated in a number of Working Groups to help communicate the construction industry's views on reintroducing people back to work and eventually supporting Scotland's recovery during the emergency years [45].
- When questioned directly, some 33% of BE-ST's clients stated that it had been a significant source of support for the innovation ecosystem in terms of providing strategic leadership for the sector. In addition, 43% of its clients stated that BE-ST had been a significant source of support for their establishment in terms of acting as a source of sector expertise.

Influence

- BE-ST acts to influence the Scottish Government's agendas that relate to the construction sector. BE-ST views itself as a "critical friend" of the Government in this respect. Regular engagement with Scottish Government Ministers and senior civil servants has become a core aspect of BE-ST engagement activity.[3] It provides a space for the Government to sound out ideas in the built environment space, providing pragmatic and unbiased advice, and, in so doing, plays an active role in strategy development for the Government. BE-ST thus successfully bridges the gap between policymakers and technical experts [24, 45, 41, 6]. Explicit references

[3] Within the last with 24 months BE-ST has entertained visits from First Minister Nicola Sturgeon, Cab Sec for Net Zero Energy and Transport Michael Mathieson, Cab Sec for Economy Kate Forbes, Minister for Business, Trade, Tourism, and Enterprise Ivan McKee, Minister for Zero Carbon Buildings, Active Travel, and Tenants Rights Patrick Harvie, Minister for Higher Education, Further Education, Youth Employment and Training Jamie Hepburn, Gillian Mackay MSP, Director General Education Joe Griffen, Director General Economy Louise MacDonald, Director General for Net Zero Roy Brennan. Several Scot Gov policy teams have also engaged during this period.

are afforded to BE-ST in a range of Scottish Government policy and strategy documents. It has, for instance, made a considerable contribution to the Construction Accord, as well as to the Government's housing strategy – Housing to 2040 [26]. It has also been involved in consultations for the new Innovation Strategy too. In the area of Net Zero, BE-ST has provided strategic direction to the Government in terms of articulating the built environment's important role in achieving Scotland's climate ambitions. BE-ST has shaped the Government's approach to energy efficiency and zero-carbon heating in Scotland's buildings within the context of this engagement [24, 26, 1].

- BE-ST also exerts its influence over firms in Scotland's construction sector. Net Zero provides the strongest evidence of this. Scotland's construction sector had not really considered climate issues until relatively recently. BE-ST has been at the forefront of raising the issue to Scottish firms, supporting the Government's decarbonization agenda. It has been able to drive strong support for the agenda inside the industry, especially amongst Tier 1 contractors [1, 41].

Partnerships

- Given BE-ST's role as an "umbrella", it has sought out strategic partnerships with other organisations that have common missions, ensuring the innovation ecosystem for Scotland's construction industry is well-connected (see also *System Strengthening*) [45].
- Partnership is also at the heart of BE-ST's operating model in operational terms. BE-ST leverages the expertise of industry, academia, and policymakers in order to best serve the needs of Scotland's construction sector [26, 45]. It is able to do so because it is viewed as a "neutral" broker, providing a space where these stakeholders can interface and form partnerships [20, 2].
- Analysis of the Client Survey data reveals that respondents are working with a wide range of partners through BE-ST. Some 79% of respondents stated that they were involved in collaborative partnerships facilitated by BE-ST, 46% of which were of a multi-stakeholder nature. 72% of respondents indicated that their partnership facilitated by BE-ST involved a university or research institute. Respondents reported working with 15 Universities in total, the most common of which were ENU, University of Strathclyde, and Heriot-Watt University.
- Similarly, when questioned directly, 37% of BE-ST's clients report that it had acted as an important partner in developing or sustaining strategic partnerships, with 36 percent indicating that it has supported the development of trust between the client's organisation and other organisations in their sector (see also *System Strengthening*).

System Strengthening

- BE-ST's network building within Scotland's construction industry is a major contribution to the innovation ecosystem. This network has enabled BE-ST to connect multiple threads and present a joined-up approach across Scottish construction's value chain. This has enabled BE-ST to support innovation that strengthens the entire system, rather than specific stakeholders individually [20, 28]. When asked directly, 38 percent of BE-ST's clients stated that it had been a significant source of support for the wider innovation ecosystem in terms of fostering synergies and networking within their sector.
- BE-ST has successfully been able to forge a collaborative outlook on innovation in Scotland, even though this is at odds with the *status quo* of intense competition within the construction sector. BE-ST has been able to do so by connecting stakeholders to one another and articulating the importance of jointly pursuing shared goals. It has thus directly combatted the competitive tendency of the industry, supported through is attribute as a "neutral" convener, responding to the issue of fragmentation outlined in the *Market Failure* section (Relevant Market Failure(s): *Coordination Failure*) [26, 20, 28, 41, 2]. This role is an important one considering that many of the Scottish construction sector's challenges are systems challenges.

This means that firms must come together to address them collaboratively [41, 28]. 38 percent of BE-ST's respondents to the Client Survey indicated that they were able to establish successful relationships with other Scottish firms as a result of BE-ST's assistance, whilst 25 percent indicated that they had even embarked on a joint venture. 34 percent of respondents felt that cross-industry collaboration had improved more generally as a result of BE-ST's efforts.

- BE-ST has helped to overcome this competitive spirit especially well within the context of Offsite Solutions Scotland (see also *Impact Case Studies*), inspiring self-sustaining collaboration between firms that previously competed fiercely. BE-ST identified that these firms were experiencing similar challenges that prevented the market from growing. It advocated that addressing these challenges collectively would be beneficial to all firms within Offsite Solutions Scotland (OSS). Through OSS, Scottish firms have been able to collectively advocate for changes in policy frameworks and procurement that have enabled the market to operate more efficiently [41, 2].
- BE-ST's events also serve as a means of connecting the built environment sector in Scotland. The MEF indicates some 315 BE-ST-led engagement events, with the vast majority of these delivered in Phase 2.

System Resources

Visibility

- BE-ST has raised the visibility of innovation occurring in Scotland to some degree. Its participation in events such as COP26 has also raised the profile of innovative Scottish construction firms internationally, especially in the area of Scottish timber. BE-ST has also been approached by several foreign governments to explore how to establish an innovation centre such as BE-ST in countries such as Australia, Canada, and Ireland [26, 24, 2]. The Client Survey thus revealed that 47 percent of BE-ST's clients felt that the Centre had raised the profile of Scotland's construction sector within the country, and 18 percent felt it had done so internationally.
- BE-ST has been recognised by the United Nations as one of twenty-six global Centres of Excellence under the UN High Performing Buildings Initiative. This enables BE-ST to promote Scottish capability to a wide range of international partners whilst gathering intelligence and insights of value to key Scottish based objectives. Meanwhile, BE-ST have also been recognised as an international Centre of Excellence in modern methods of construction by a range of partners in the USA through the MODx programme. Partners included in an ongoing collaboration include the US Department for Housing and Urban Development, Saint Gobain, International Council of Codes, and more.
- BE-ST Fest has now been established as a major series of built environment events in Scotland with the BE-ST Fest Summit alone attracting over 400 delegates from across the ecosystem. BE-ST now have an annual digital audience of over 70,000 stakeholders.

Resources

- The offer of the Innovation Factory has presided over a sea change in the way that the construction industry approaches innovation. Typically, what little innovation that had been occurring in Scotland's construction sector had been occurring on site, but the Innovation Factory provides a physical space where firms can trial innovative ideas [24, 45, 20]. This is a novel approach in Scotland [45, 2]. As such, BE-ST has contributed considerably to addressing the limited opportunities to trial innovation, as outlined in the *Market Failure* section (Relevant Market Failure(s): *Opportunity*).

- The Innovation Factory also contributes significantly to the socialisation of innovation within Scotland, due to the demonstration effect that it has on stakeholders in the sector [20, 2]. These offers are powerful in an industry that is traditionally resistant to innovation.
- The Innovation Factory is also a helpful offer to Scotland's students. Students are able to access the Innovation Factory via their colleges and universities, allowing them to gain hands-on experience that can supplement their theory [20, 28]. Likewise, the Innovation Factory is also beneficial for college and university staff in that it allows them to get a more practical understanding of their curricula [28].

Leverage

- BE-ST not only provides technical and financial construction-specific support, but also signposts peripheral support. This is a necessity, given BE-ST's limited resources and the scale of demand placed on the Centre. BE-ST thus recognises that it is not the only source of innovation funding in the UK, but that Scottish construction firms can in fact benefit from existing support that it can leverage from elsewhere [26, 24]. This activity thus responds to the limited access to finance amongst Scottish construction firms, as outlined in the Market Failure section (Relevant Market Failure(s): Coordination Failure). Some 17 percent of BE-ST's clients felt that the Centre had been a significant source of support in promoting further investment into the sector from within Scotland, whilst 14 percent felt that it had attracted foreign funds. Innovate UK, for instance, has been one important source of additional funding that BE-ST has successfully been assisting Scottish firms to apply for and access [24, 1].
- BERD in construction in Scotland has increased year-on-year since the inception of BE-ST in 2014. Direct attribution cannot be demonstrated, but the increasing interest and engagement from industry partners in BE-ST suggests the Centre is likely playing an important role in this area.
- BE-ST have successfully secured additional investment from a range of European and International Funding programmes including ERDF, Horizon, Erasmus, Intereg and the United Nations. BE-ST have also secured funding from a range of UK based funding partners including UK Government, UKRI, Innovate UK, Skills Development Scotland, Construction Industry Training Board, various Scottish Government Departments, Transport Scotland, Scottish Enterprise, Highlands and Islands Enterprise, Historic Environment Scotland, and more.

Knowledge

- BE-ST partners widely with Scotland's academic community, including outside of its host university (ENU), putting the latest academic research front-and-centre. Its intention is that academic partners have entry points at *all* phases of implementation. Two examples of programmes with significant academic input are the Transforming Timber Programme and the Low Carbon Learning Programme. Academics are often invited to sit on steering groups to ensure that BE-ST's activities reflect the latest knowledge in construction innovation [6, 24, 45, 41, 2].
- One of the core market failures that BE-ST responds to is the lack of awareness in Scotland's construction industry of the benefits of collaborating with academics. BE-ST therefore plays a major role in translating the knowledge generated in Scotland's academic institutions into terms that construction firms can understand and react to. BE-ST openly recognises that academics are not driven by the same incentives as the industry itself, and so research is not always directly relevant. BE-ST therefore takes the latest research and presents it to firms in a manner that is more relevant to their needs and priorities [26, 45, 2]. Simultaneously, BE-ST feedbacks the needs and priorities of the industry to academics to ensure that research is increasingly relevant [45, 2]. Over time, Scotland's industry has increased its awareness of

academic capabilities through such support, with 25 percent of those responding on behalf of BE-ST to the Client Survey indicating as such.

- BE-ST's network also contributes to the diffusion of knowledge. First, BE-ST is able to offer firms direct connections to academics, which would be unlikely to occur if innovation support was provided by an entity like Scottish Enterprise [41]. Second, due to BE-ST's success in reducing the competitive nature of the industry, its network also enables SMEs to exchange knowledge with Tier 1 contractors [1]. 37 percent of BE-ST's clients felt that the Centre has played an instrumental role for them in the diffusion of knowledge, and 33 percent felt their firm had increased their technical understanding of emerging areas of innovation as a result of this diffusion activity.
- BE-ST also plays a significant role in upskilling the workforce. Given the transitory nature of the Scotland's construction workforce, it is in the interest of all firms for one another to invest in upskilling. Nonetheless, the free rider problem tends to block investments in training (see also 'Transitory Nature of the Workforce' in the *Market Failure* section). BE-ST resolves this market failure by directly providing training itself [45, 28, 6]. Initiatives like the Low Carbon Learning Programme is an example of this, supporting the industry to improve their skills in order to accelerate progress towards Net Zero [20]. BE-ST also advocates for training within Scotland's construction firms itself, outlining the benefits to the sector as a whole of firms providing an equal share of upskilling [28]. BE-ST's MEF puts the number of individuals engaging in BE-ST-led or BE-ST-supported training at 3,773. Some 17 percent of the clients that had interacted with BE-ST felt that their employees' skills had improved through such interactions.
- BE-ST has done well to influence skills and training in further education.. It actively leverages its academic network to improve skills and training offer in Scotland's colleges, with the relationship with City of Glasgow College being particularly developed. Ensuring that the workforce is prepared for the future is a considerable contribution by BE-ST [26, 41, 2, 28, 6].

Commercialisation

- Though BE-ST's business model has shifted towards programmatic delivery over time (see also *Main Elements of Phase Two Business Plan*), its clients felt that it has still encouraged smaller-scale commercialisation in Scotland. 23 percent of those responding on behalf of BE-ST in the Client Survey indicated as such. This role in encouraging commercialisation is supported by the presence of the Innovation Factory, which serves as an incubation space for smaller-scale initiatives. Questioned directly, 28% of BE-ST's clients said that it encouraged experimentation and commercialisation in Scotland.

- As highlighted earlier, MEF data provided by BE-ST indicates that at least 311 collaborative projects have been initiated during Phase 1 and Phase 2. Respondents involved in collaborative projects through BE-ST have typically started towards the lower end of the TRL scale with 70% between TRL 1 and 3, half of which were between TRL 1 and 2 (it is noted this may include project work before IC involvement). By the end of the projects, just 6% of respondents were or expected to be still at TRL 1 to 3, with 56% expecting to be at TRL 8, meaning that they would be commercially ready. This indicates that BE-ST has played a major role in assisting clients to advance their innovations, with 81% of clients recognizing as such. BE-ST's MEF itself estimates that the number of commercial launches from such collaborative projects is as high as 1,164, suggesting a keen ability to translate ideas into commercially viable products and services.

6 Delivery and Value for Money.

6.1 Governance and Management Arrangements.

CSIC's Phase 1 Governance structure consisted of:

- an **Operations Team** of 15 staff, led by the CEO (Stephen Good), responsible for developing the Centre's strategy and day-to-day operations.
- a **Project Advisory Group** of thirteen members, to support the Operations Team in the appraisal of project applications;
- a **Governance Board** to oversee the strategic direction of CSIC and to approve funding for projects where the request was above the CEO's delegated authority;
- a **Host Institution** (ENU), responsible for financial and legal administration of the Centre.

This structure remained broadly intact for Phase 2, though the constituents of BE-ST Governance and Management arrangement naturally evolved to some degree.

By the start of Phase 2, the Operations Team had already grown from seven FTEs to 16.6 FTEs, due to an initial underestimation of the human resource needs to deliver the volume of activity required to delivery on BE-ST's Phase 1 ambitions. BE-ST additionally engaged nine part-time consultants, providing an additional four FTEs. This increase in human resources was achieved without the need for additional funding from the Funding Partners, with BE-ST instead funding these posts through budget re-allocation, commercial income from Scotland's construction industry, as well as funding from other public sector sources. The Phase 2 Business Plan predicted the need for an increase in core staff by 5.4 FTEs. By December 2022, BE-ST's Operations Team had grown to 29.4 FTEs, meeting its Business Plan's ambitions.

The Project Advisory Group needed to evolve considerably between Phase 1 and Phase 2 due to the increasing demands placed on members' time as BE-ST's momentum increased. Initially, the Project Advisory Group comprised ten members, but it soon became apparent that these individuals were not always fully qualified to review the diverse set of project applications, nor were they always available to as the number of applications increased. BE-ST introduced the 'Innovation Champions Network' in April 2018 to address this issue, deploying a pool of experts from which review panels could be selected. This approach was carried through to Phase 2, with Innovation Champions Network now comprising 70 individuals.

BE-ST's Governance Board remained broadly unchanged between for most of Phase 1. Nonetheless, BE-ST's first Chair – Bill McBride - stepped down in December 2017, ushering in a major refresh of the Board at the onset of Phase 2. The Governance Board is currently chaired by Andy Outram. Andy is supported by an additional 18 individuals hailing from both the private and public sector.

In terms of its Host Institution, BE-ST remains hosted by ENU since its Phase 1 funding was approved in March 2014. ENU provides administrative support across several areas via specialised staff. BE-ST is charged for the services it draws on, aside for property and facilities which ENU provides in-kind. The Phase 2 Business Plan recognised there were some institutional tensions between BE-ST and ENU. ENU's support services, whilst appropriate for the needs of an organisation the size of the University, were often felt to limit BE-ST's ability to operate as effectively as it would like to. It set out an ambition to streamline processes by way of a Service Level Agreement to allow BE-ST to operate within the constraints of a public sector organisation, but with sufficient flexibility to better meet the needs of its industry.

Of all BE-ST's Governance arrangements, its relationship with ENU was the only one commented on by stakeholders, with mixed opinion about the relative costs and benefits. Stakeholders noted the usefulness of ENU providing reduced cost administrative support, which BE-ST would have to provide in-house if not situated within the University. Having to fulfil these services themselves would detract from BE-ST's offer to industry [41, 2, 64]. Outside of the administrative support provided by ENU,

stakeholders acknowledged that being hosted within a University allows BE-ST to connect well with the academic community. It provides direct access to academics within ENU, as well as the channels through which it can access other academics within the Scottish university system [41, 2]. Another benefit is that BE-ST can benefit is that it can draw on ENU's other grant funding for innovation, as well as jointly bidding, expanding its resource base to meet the needs of industry [2, 64]. ENU, for instance, provided BE-ST with a grant of £1.9m to purchase One Watt Place, so although there are issues, ENU are supportive of BE-ST's ambitions.

Other stakeholders felt that BE-ST is hampered by its position within ENU. There are certain constraints and overly bureaucratic processes that BE-ST experiences due to being part of ENU. Its bureaucracy prevents BE-ST from moving at pace and addressing the industry's needs in real time [1, 2, 6, 64]. These same stakeholders did recognise that the relationship between BE-ST and ENU has improved and that processes have been refined over time [2, 64]. Nonetheless, it is clear that more still can be done to achieve the vision of a streamlined institutional relationship as outlined in the Phase 2 Business Plan.

6.2 Monitoring and Evaluation.

BE-ST fully complies with the MEF Guidance set out by SFC, SE, and HIE at the outset of Phase 2 of the Innovation Centre Programme. Consequently, its shortcomings in terms of shortcomings in M&E broadly follow those of the other Innovation Centres, given that they are required to complete the same MEF (see also 2.6.3 Monitoring and Evaluation Arrangements for further detail).

Nonetheless, BE-ST has gone to great effort to ensure that its performance monitoring mechanisms surpass the minimum standard required by SFC, SE, and HIE, especially in recent years. BE-ST's internal systems for monitoring and reporting have steadily evolved over the lifecycle of the Innovation Centre Programme. At the start of Phase 1, BE-ST was using basic Microsoft office tools such as Excel and Dynamics 365 to track client relationships. However, as BE-ST has matured as an entity and its scale increased, more sophisticated software has been integrated to enable more robust management [45].

BE-ST has, for instance, recently developed and launched a new system for data collection and analysis, intended to better inform the Centre's internal decision-making relating to impact. This system takes the form of a data dashboard, powered by Lumen software. It is aimed, primarily, to assist BE-ST in monitoring the outcomes of its initiatives on a more periodic basis, supplementing the basic processes already required of the Centre by its funders, with the Lumen software automated to continually track project updates and aggregate information centrally within the data dashboard. BE-ST indicated during interviews that this system may over time help improve the targeting of its support, for instance to the HIE region, due to the data-driven approach enabling better decisions about tailored support. Likewise, the Lumen software can be leveraged to track the outputs and outcomes of projects beyond their close, helping BE-ST to capture the long-term impact of its work. [45]

Updates to project and programme performance are captured through regular dialogue and information-sharing with BE-ST's project partners, as well as internal quarterly Programme Performance Review Meetings that are intended as a point of reflection and an opportunity to adjust to maximise the Centre's impact [45].

BE-ST's internal management system is powered through the 'Monday.com' platform. 'Monday.com' acts as BE-ST's basic Customer Relationship Management tool and is utilised for project and programme management, tracking day-to-day information on commitments, expenditure, and activities. It ensures that BE-ST has all relevant project and programme information in one secure place, assisting in the quarterly reporting to the Funding Partners, and also feeding into the aforementioned data dashboard [45]. BE-ST did not migrate over its data from the previous system when moving to the 'Monday.com' platform and so population data relating to prior collaborative projects are not readily available for this Evaluation. Nonetheless, during the Infrastructure Investment

phase, profile characteristics such as organisation type, sector, size, and location will be available to SFC, SE, and HIE for future oversight.

During the Infrastructure Investment phase, BE-ST has an ambition to improve further on this standardised form provided by the Funding Partners, developing a MEF that can better take account of the mission-driven approach that the Centre has adopted – that is, its strategic reorientation towards Net Zero. This Mission is targeting transformative change, so merely reporting on outputs may not appropriately demonstrate BE-ST's impact [26, 24].

6.3 Value for Money

This section of the report sets out the main findings of the evaluation with regard to VfM.

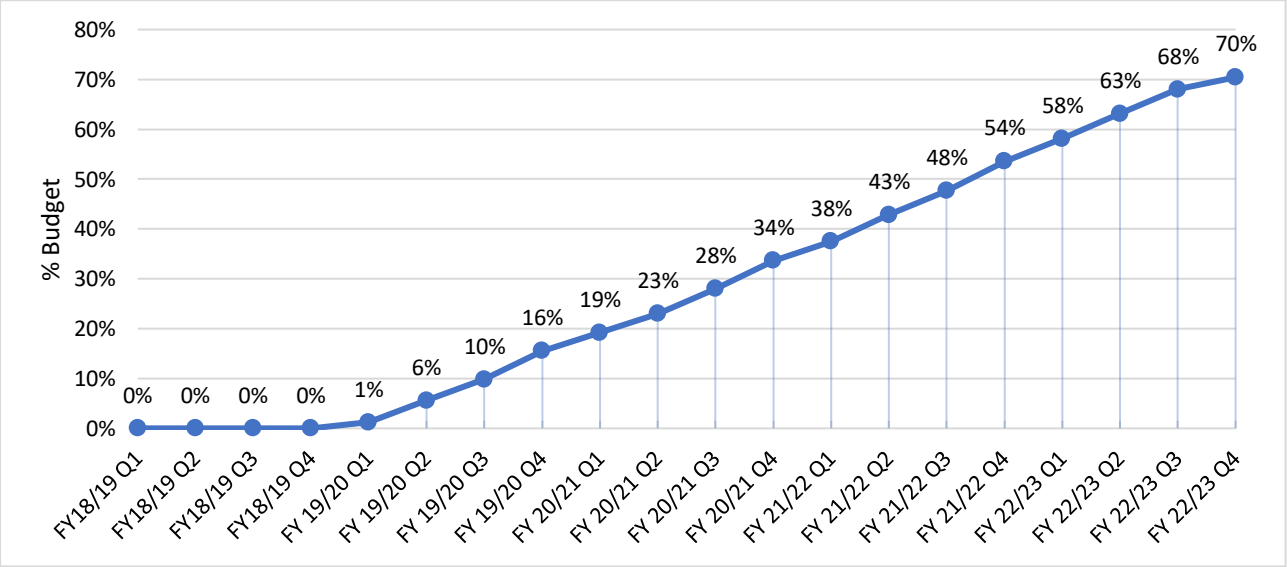
6.3.1 Limitations.

The overall programme MEF provides a limited framework of quantitative metrics that can be used to assess VfM. The main body of the report discusses the limitations in greater detail. This report uses the latest financial data available, i.e., to Dec 2023 and /or March 2023.

6.3.2 Budget execution.

Total Phase 1 spend is as £9.2 million. Funder budget drawdown is used as a proxy for expenditure. Phase 2 budget execution is noted in the table below. Quarterly drawdown is approximate. Some 70% of the funder budget has been drawn down for the period up to March 2023 with IC spend on track for the remainder of Phase 2.

Figure A. 3 BE-ST budget execution.



*Source: SFC, SE, HIE correspondence ('Summary funders awards and drawdowns to date', excel spreadsheet, Feb 2023). * funders indicate awarded at outset of Phase 2.*

6.3.3 Finance mobilised.

Finance mobilised (public or private) is not recorded as a specific MEF indicator. Here, it is assessed as all recorded MEF commitments (project and centre combined), excluding all funder commitments. MEF commitments are presented as supplied by the IC.

On this basis, some £28.4 million was mobilised over Phases 1 and 2. Of this, 47% was industry finance. Comparing funder inputs (to closest period- Dec 2022) to finance mobilised, this indicates an estimated favourable leverage of £16.7 million to £28.4 million, or 1.7:1 (benefit to cost ratio). For industry finance mobilised this is 0.8:1 (see table below). Though no detailed breakdown of external funding is

included in the MEF, BE-ST Annual Reports identify Innovate UK as a particularly important source of public funding.

Table A. 11 Finance mobilised, BE-ST, to Nov 2021/22

	Phase 1	Phase 2	Total
Higher Education Institutes	£966,562	£1,605,576	£2,572,138
Other Public	£6,592,047	£5,997,719	£12,589,766
Industry	£7,108,561	£6,133,182	£13,241,743
Other	£34,035	£-	£34,035
Total	**£14,701,205**	**£13,736,477**	**£28,437,682**

Source: MEF.

6.3.4 Cost per impact measure.

It is important that VfM assessments consider programme effectiveness, that is, the relationship between the intended and actual results of public spending. In other words, what are the higher-level outcomes / impact of the programme and at what cost. In this regards, two impact measures are examined: jobs and GVA. It is acknowledged that all ICs to a greater or lesser extent, have a focus on wider environmental, health, social benefits, and therefore these impact measure do not capture all of the benefits of ICs.

However, assuming costs as funder inputs of £16.7 million to December 2022, BE-ST net additional peak employment of 187 equates to £89,217 per net additional job. Similarly, funder input to net additional GVA equates to a benefit to cost ratio of 1.5:1.

Table A. 12 Cost per job, BE-ST.

	Employment	Cost per job
Net Additional Employment (peak)	187	£89,217
Net Additional Employment (peak) (no multiplier)	104	£160,420

Source: authors.

Table A. 13 GVA ratio, BE-ST

	GVA	Benefit: cost Ratio
Cumulative Net Additional GVA , Constant Prices, Discounted	£25,123,430	1.5
Cumulative Net Additional GVA (no multiplier), Constant Prices, Discounted	£13,957,461	0.8

Source: authors.

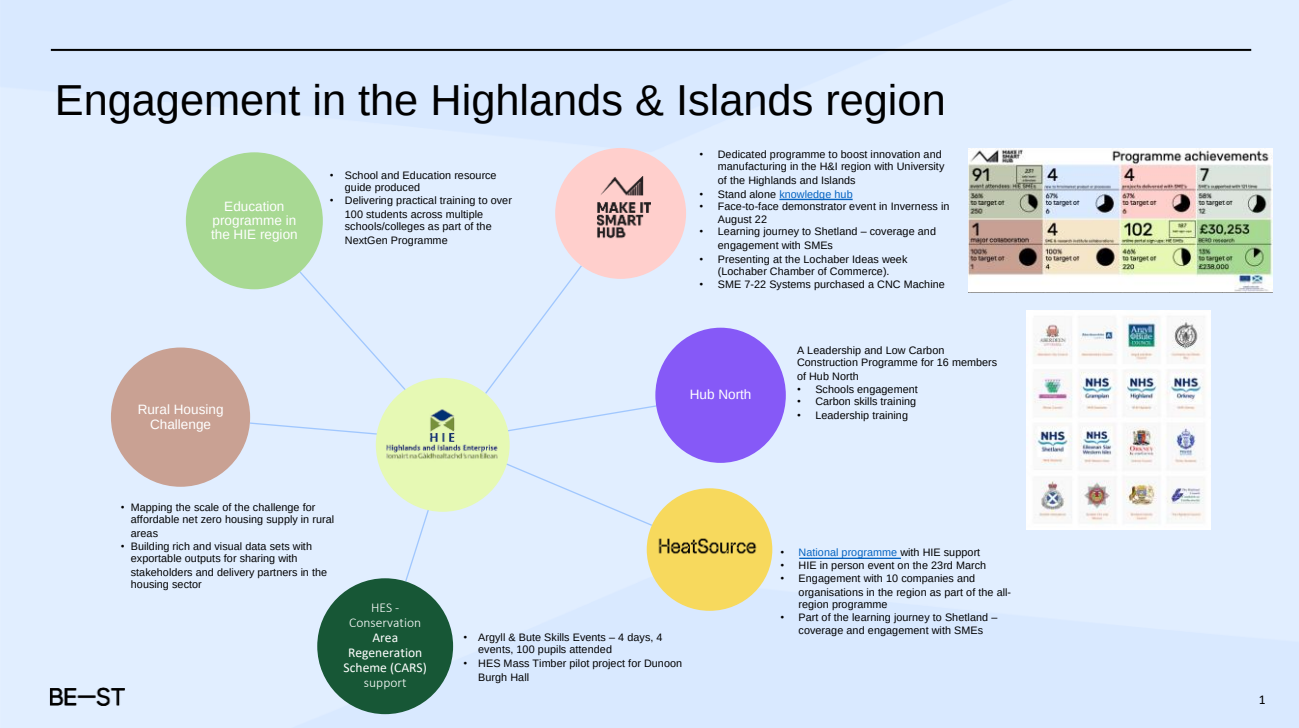
6.3.5 Equity.

This section reports on the degree to which the results of BE-ST's work are equitably distributed. According to Client Survey data, BE-ST's activities take place for the most part in the East and West regions of Scotland, with the cities of Glasgow and Edinburgh accounting for 29% and 13% of activity, respectively. This is perhaps unsurprising given that the Centre is hosted by ENU but headquartered in Glasgow. All other Council Areas account for 5% or less of respondents, but nevertheless amount to 43% of clients, suggesting that BE-ST also supports businesses in areas with lower levels of Business Enterprise Research and Development (BERD) spend.

Some 8% and 7% of clients were from the rest of the UK or other areas, respectively. BE-ST's activity in the HIE area is relatively low based on the Client Survey data, accounting for two percent of

respondents, though it is important to note that the Centre has recently moved to hire a Business Development Manager based in the HIE region to address this issue. It is currently delivering a Hub North Programme the HIE region, addressing skills on decarbonization issues (see Figure A. 3)

Figure A. 4 BE-ST Engagement in HIE



Source: BE-ST.

Meanwhile, 88 percent of BE-ST's clients are MSMEs, 81 percent of which are small or micro businesses [Client Survey]. This broadly confirms the figures emerging from BE-ST's internal CRM (c. 90%) and reflects an increase on Phase 1 figures (c. 80%).

According to the Student Survey, there is a roughly equal split between female (40%) and male (50%) students supported by the Centre. These students have attended a range of universities, though the most frequent are ENU and Robert Gordon University.

Turning to social equity, BE-ST is actively supporting efforts to diversify the construction sector through programmes such as DIveIn. Its contribution to gender equality widely recognized in the Client Survey. BE-ST has influenced the National Equity and Inclusion Plan (as part of the Construction Accord), with the aim of supporting wider efforts to address inequality and promote greater diversity within the Scottish construction sector. Youth inclusion is also a significant focus of BE-ST's, with its Change Maker programme being influential in providing youth an opportunity to steer innovation within the construction industry [26, 1, 45, 2, 28].

7 Progress against targets and objectives

7.1 Targets.

As of Phase 2 to date (August 2022), BE-ST had exceeded seven of the 12 Phase 2 KPIs as set out in the MEF (see table below). There has been exceptional overachievement in some areas, especially in relation to BE-ST's education and training offer. This has been driven primarily by the centre's Continuous Professional Development (CPD) courses, where BE-ST perhaps did not fully anticipate its capacity to deliver at such scales during Phase 2 considering its rather limited skills programme during

Phase 1. BE-ST may thus consider setting are more ambitious target during the Infrastructure Investment phase to capture both the scale of demand for and its capacity to deliver skills training, though otherwise its targets are reasonable.

Of the three not yet met, BE-ST is on track to achieve its ambitions by the close out of Phase 2. This is especially true of 'Turnover Supported & Created', where businesses supported by BE-ST have reached £945 million in turnover against an initial target of £998 million. The KPIs relating to 'Project Income Committed' and 'Centre Income Committed' are Non-Verifiable due to the standard MEF not including a column for targets.

Table A. 14 BE-ST, Progress Against Phase 2 Targets.

KPI	Actual	Target	Status
Activities			
Events	**217**	**250**	**On Track**
- >100 Attendees	*25*	*25*	*Achieved*
- 10-100 Attendees	*178*	*225*	*On Track*
- < 10 Attendees	*14*	*0*	*Exceeded*
Entrants to Education/Training	**3702**	**225**	**Exceeded**
- PhD/EngD	*0*	*0*	*N/A*
- MSc	*56*	*100*	*Partially on Track*
- HND/HNC	*0*	*0*	*N/A*
- Other	*3648*	*124*	*Exceeded*
New Collaborative Projects	**195**	**140**	**Exceeded**
- Academic/IC to business (involving at least 1 business in Scotland)	*95*	*85*	*Exceeded*
- Academic/IC to business (involving no businesses in Scotland)	*13*	*5*	*Exceeded*
- Academic / IC to Academic	*16*	*0*	*Exceeded*
- Business to business (involving at least 1 business in Scotland)	*4*	*20*	*Off Track*
- Academic/IC to public sector (involving no businesses in Scotland)	*19*	*5*	*Exceeded*
- Academic/IC to public sector to business (involving at least 1 business in Scotland)	*48*	*5*	*Exceeded*
Outputs			
Follow-On	**132**	**100**	**Exceeded**
- Signposted to SE	*16*	*24*	*Partially on Track*
- Signposted to HIE	*10*	*12*	*On Track*
- Signposted to other public funding/support body	*25*	*22*	*Exceeded*
- Signposted to private sector	*20*	*11*	*Exceeded*
- IC supported follow-on project planned or underway	*26*	*9*	*Exceeded*
- Direct to market (by a business in Scotland)	*33*	*18*	*Exceeded*
- Projects not taken forward	*2*	*4*	*Partially on Track*
Commercial Launches & Applications	**715**	**180**	**Exceeded**
- New or improved products developed (with/for a business in Scotland)	*234*	*60*	*Exceeded*
- New or improved processes (with/for a business in Scotland)	*159*	*55*	*Exceeded*
- New or improved services developed (with/for a business in Scotland)	*131*	*40*	*Exceeded*
- New or improved business models (with/for business in Scotland)	*108*	*20*	*Exceeded*
- New or improved delivery of a public service in Scotland	*83*	*5*	*Exceeded*
Qualifications	**537**	**225**	**Exceeded**
- PhD/EngD	*3*	*0*	*Exceeded*
- MSc	*56*	*100*	*Partially on Track*
- HND/HNC	*0*	*0*	*N/A*
- Other	*478*	*125*	*Exceeded*
Outcomes			
Jobs Supported & Created	**4,484**	**6,568**	**On Track**
- New jobs generated (by business in Scotland)	*1284*	*1847*	*On Track*
- Existing jobs safeguarded (by business in Scotland)	*3200*	*4721*	*On Track*
Turnover Supported & Created	**£944,683,033**	**£998,000,000**	**On Track**
- New turnover generated (by business in Scotland)	*£814,743,043*	*£998,000,000*	*On Track*
- Existing turnover safeguarded (by business in Scotland)	*£129,939,990*	-	*Exceeded*
Posts Created in Scottish HEIs/ Colleges/ Public Sector	**17**	**12**	**Exceeded**
- New posts (in Scottish HEIs) created to support demand led academia-business projects.	*15*	*10*	*Exceeded*

KPI	Actual	Target	Status
- New posts (in Scottish colleges) created to support demand led academia-business projects.	*1*	*0*	*Exceeded*
- New posts (in Scottish public sector) created to support demand led academia-business projects.	*1*	*2*	*On Track*

Source: MEF.

7.2 Objectives.

As outlined in Chapter 2, the Evaluation Team identified 10 Objectives at the level of IC Programme, considering objectives set out in the Phase 1 Call for Proposals and Phase 2 Business Planning Guidance. The table below explores the varying degree BE-ST's focus on these 10 programme Objectives. Taken together, BE-ST has delivered on *all* of the IC Programme's objectives over Phase 1 and 2. Only in the areas of securing inward investment and enhancing public services is BE-ST's contribution more modest, though still not negligible.

Table A. 15 BE-ST achievements against objectives.

Objectives and strength of focus		Explanation of rating
O1: Direct businesses to right support	High	The MEF indicates that BE-ST has supported *at least* 233 businesses across Phase 1 and Phase 2, the majority of which are based in Scotland (93%). The MEF also includes a measure of follow-on from completed projects. In Phase 1, BE-ST signposted 33 businesses to either SE, HIE, and other public support bodies, or the private sector. During Phase 2, this figure has *already* risen to 71 (see also *Inputs, Activities and Outputs*). Though the Phase 2 Due Diligence Report and interviews recognise that many of these businesses are already connected to these sources of support, BE-ST plays a core role in helping businesses that it supports navigate this complex ecosystem (see also *Market Failure* and *Assessment of Innovation Ecosystem Benefits*). This support to business has enabled 381 products and 226 services to be brought to market. It has also enabled the implementation of 278 new processes and led to changes in 162 business models (see also *Inputs, Activities and Outputs*).
O2: : Build and promote innovation ecosystems & sectors	High	The MEF records the number of engagement events delivered by BE-ST. In Phase 1, 16 events with more than 100 attendees were delivered and 82 events with between 10 and 100 attendees. In Phase 2 to date, 25 large events and 192 smaller events have been delivered (see also *Inputs, Activities and Outputs*). A conservative estimate puts the total number of attendees at 19,777 over both phases. In the last year alone BE-ST has also been able to reach 1.4 million people through its digital channels [BE-ST, 2022. Impact Report 2021-2022]. Stakeholders consistently highlighted that BE-ST plays a core role in building and promoting the ecosystem (see also *Assessment of Innovation Ecosystem Benefits*).
O3: Engage industry and academics in collaborations that drive business growth	High	The MEF records new jobs created and existing jobs safeguarded in businesses, along with increased turnover. The jobs and turnover figures that BE-ST provides are based on initial forecasts at project inception and then updated during implementation through regular dialogue and information-sharing. In Phase 1 BE-ST reports helping businesses create 2,601 jobs and safeguard an additional 3,274. In Phase 2 to date, BE-ST reports creating 1,284 jobs and safeguarding 3,200. Turnover of supported firms is estimated to be £1,773 million (see also *Outcomes and Impacts*).
O4: Secure external innovation funding	High	According to its MEF, BE-ST has leveraged £28.4m in investment from external sources across Phase 1 and Phase 2, 47% of which is from industry, and 53% is from the public sector (including HIE). Sources include a range of European and International Funding programmes including ERDF, Horizon, Erasmus, Interreg, and the United Nations. BE-ST have also secured funding from a range of UK based funding partners including UK Government, UKRI, Innovate UK, Skills Development Scotland, Construction Industry Training Board, various Scottish Government Departments, Transport Scotland, Scottish Enterprise, Highlands and Islands Enterprise, Historic Environment Scotland, and more.
O5: Exploit academic base to solve industry problems	High	This objective encourages Centres to exploit academic research to solve industry-defined problems. The Phase 1 and Phase 2 Business Plans set out clear market failures that BE-ST will tackle (see also *Market Failure*). BE-ST is widely viewed as tackling these broad market failures, whilst all the while supporting individual businesses to access support for specific issues. Its strongest contribution to solving industry problems is in the area of 'System Strengthening', where BE-ST has been able to mitigate the combative nature of the industry and forge a collaborative outlook (see also *Assessment of Innovation Ecosystem Benefits*).
O6: Address major policy priorities	High	Stakeholders highlighted that during Phase 2 BE-ST has demonstrated close alignment with Government's major policy priorities. This is especially true in the area of Net Zero, where BE-ST has actively restructured its programme to deliver on the Government's climate agenda (see also *Strategic Fit*). BE-ST also supports a suite of environmental and societal benefits that are relevant to Government policy, as well as economic benefits that deliver on

		the Scottish Government's Economic Strategy such as in the area of infrastructure investment and inclusive growth (see also *Wider Impacts*).
O7: Secure inward investment	Moderate	The MEF doesn't record number of businesses assisted to relocate or establish new facilities in Scotland. BE-ST's latest Impact Report highlights that some £14.7 million had been secured in industry investment[4], but it is not clear to what extent this came foreign sources [BE-ST, 2022. Impact Report 2021-2022]. Interviews did not particularly highlight inward investment as an area that they see BE-ST delivering strongly. Nonetheless, BE-ST's participation in events such as COP26 is likely to have raised the profile of Scotland's construction sector (see also *Assessment of Innovation Ecosystem Benefits*).
O8: Enhance public services	Moderate	The MEF records the number of collaborative projects leading to new or improved delivery of public services. In Phase 1, BE-ST reported 34 instances of improved delivery of public services, and in Phase 2 to date they report to have delivered 83 instances (see also *Inputs, Activities and Outputs*). However, interviews did not highlight any particular collaborative projects which have led to new or improved public services, with the consensus that BE-ST is more oriented towards industry than the public sector.
O9: Develop skills addressing industry needs	High	The MEF records the number of individuals gaining new qualifications. Across Phase 1 and Phase 2, BE-ST has supported 127 MSc and three PhD students to gain qualifications. Many more are currently in education, especially in in CPD courses such as the Low Carbon Learning Programme (see also *Inputs*, *Activities and Outputs*). BE-ST's contribution to upskilling was very frequently cited during interviews, counteracting the sector's reluctance to invest in training (see also *Market Failure* and *Assessment of Innovation Ecosystem Benefits*). BE-ST also provided frequent opportunities for students to gain practical hands-on experience, be that through connecting students to industrial partners through its MSc support or through visits to its Innovation Factory (see also *Outcomes and Impacts* and *Assessment of Innovation Ecosystem Benefits*).
O10: Develop next generation of innovators	High	The tenth objective encourages Centres to '*grow an environment to develop the next generation of business innovators, academics and entrepreneurs.*' The MEF does not include any measures that enable us to assess BE-ST's progress on this objective. Nonetheless, BE-ST's engagement with Scottish colleges was considered strong by stakeholders, future proofing the skills of the next generation (see also *Assessment of Innovation Ecosystem Benefits*). The BE Changemakers Programme is considered a unique offer amongst Innovation Centres, providing young people an opportunity to participate on BE-ST's Board, connecting them directly to industry and offering them opportunities to influence the direction of the sector (see also *Outcomes and Impacts*

Source: authors

8 Impact Case Studies.

8.1 Introduction.

The section presents the findings from a number of case studies linked to the work of BE-ST in order to provide a more an in-depth and comprehensive understanding of selected projects and to gain an understanding of why, for whom and under what circumstances it achieves its objectives.

8.2 Case 1. BE Changemakers

Background

The Built Environment Changemakers (BE Changemakers) initiative was launched in November 2021, aimed at providing Scotland's most talented early-career professionals from across the industry an opportunity to shape systemic change. The first cohort of BE Changemakers comprised a group of 12 individuals from industries such as architecture, engineering, construction, and sustainability.

This cohort has concentrated primarily on determining the initiative's strategic purpose, given that BE-ST intentionally chose to leave it undefined in an effort to afford those involved an opportunity to shape it in a way that best meets Scotland's needs, drawing on their individual expertise. This effort has involved gathering insights on issues of core interest to the BE Changemakers, such as embedding

[4] This is slightly higher than the figure reported in the MEF due to differences in accounting periods.

sustainability, enhancing skills development, promoting diversity and inclusion, and embracing digitisation, and understanding how these can be leveraged to move the needle in Scotland's construction industry. The BE Changemakers undertook consultations, as well as produced surveys, to this end. Its "Vision" was later defined to challenge the built environment sector to transform into one that is sustainable, inclusive of Scotland's diversity, and fair in terms of opportunity.

Benefits

Given BE Changemakers nascence, much of the systemic impact of has yet to reveal itself, but nonetheless a solid foundation has been laid for the initiative's next cohort to contribute towards achieving its Vision. Despite the limited systemic impact on Scotland's construction sector to date, the initiative has had several immediate benefits for the individuals that participated in it.

BE Changemakers, for instance, has exposed these students and early-career professionals to the sector's business leaders and policymakers, affording them opportunities to have their voices heard in spaces that are otherwise dominated by those in senior positions. Interviews with the BE Changemakers themselves revealed that, beyond establishing the initiative's strategic purpose, their proudest achievement has been opening the minds of these business leaders and policymakers to the possibilities of there being different approaches in the sector especially in areas of sustainability, inclusivity, and opportunity. BE-ST's network was also credited by the BE Changemakers as being curious and receptive to change, giving their viewpoints more traction than they may have otherwise had in other circles.

BE Changemakers also provided some of these individuals opportunities to participate on BE-ST's Board or the Construction Leadership Forum, embedding them in the strategic policymaking landscape of built environment and construction in Scotland. This has helped them to make an impact on the direction of travel of the industry in Scotland, beyond which they would be able to have in their profession. Indeed, some of the BE Changemakers felt that they only had limited potential to make an impact in their ordinary role.

The BE Changemakers also highlighted the importance of the networking that they did as part of the initiative. The connections that many BE Changemakers made have not only provided avenues for future collaboration, but in some instances have already helped them move up the career ladder. The BE Changemakers also recognized that the initiative has helped them develop "soft" skills, such as public speaking, with BE-ST supporting them to develop the fundamental skills to become tomorrow's leaders.

Feedback

Nonetheless, BE Changemakers did offer BE-ST some issues for consideration ahead of the next iteration of the initiative. Whilst the BE Changemakers appreciated the space afforded to them to manage the initiative themselves, at times BE-ST's role may have been too advisory, with some workstreams likely to have progressed faster had BE-ST played a more active part and short-circuited some processes. This was not thought to be a major issue during BE Changemakers' first iteration given the older profile of its cohort, but if a younger group comprises the next cohort then progress may be a little more sluggish. Moreover, given BE Changemakers' ambition to improve diversity in Scotland's construction sector, this needs to be reflected in the next cohort, not just in terms of marginalized characteristics, but also in terms professions, given that most of the cohort were in "white collar" construction jobs.

8.3 Case 2. Low Carbon Learning Programme

Background

The Low Carbon Learning Programme is a course offered by BE-ST aimed at accelerating the transition to Net Zero in the built environment through free and easily accessible training. Low Carbon Learning Programme initially began as 'Passivhaus in Practice', Scotland's first national training programme on

Passivhaus – an international design standard aimed at increasing energy efficiency and comfort in housing. The 'Passivhaus in Practice' training programme aimed to increase the adoption of Passivhaus standards and secure the industry a long-term, sustainable, and inclusive pipeline of work. Following the success of the Passivhaus training, and with funding from Skills Development Scotland and Scottish Funding Council, BE-ST officially launched Low Carbon Learning on 11 November 2021 during COP26.

Benefits

The Low Carbon Learning Programme is delivered both online and face-to-face. According to BE-ST's data, over 2,000 individuals have been trained through the Low Carbon Learning Programme to date on retrofit and Enerphit, whilst almost 600 individuals have been trained on Passivhaus standards. According to those close to the Low Carbon Learning Programme the demand for the it is ever increasing too. BE-ST has therefore played an important role in upskilling the workforce on contemporary construction practices, especially those that accelerate progress towards Net Zero.

The links between the Low Carbon Learning Programme and Scotland's academic community are clear. The Low Carbon Learning Programme courses bridge the gap between experts in Scotland's universities and practitioners in the construction industry. Academics, especially those from ENU, were felt to be instrumental in putting the latest academic research front-and-centre within the context of the Low Carbon Learning Programme, helping BE-ST to develop training materials that are based on the latest research in *Passivhaus*. The Glasgow School of Art has also been important in the co-design of training materials, especially those drawing on digital modalities. BE-ST also ensured that training materials were tailored specifically to the Scottish context and its unique challenges, adding considerable value over and above the generic training material that were available across the UK.

The importance of the Low Carbon Learning Programme to the decarbonization agenda was underscored by several stakeholders. Indeed, several interviews felt that the Low Carbon Learning Programme has been instrumental in shifting retrofit from the periphery to the centre of discussions about achieving Net Zero in the built environment. The issue is particularly important in Scotland given the age of its residential and non-residential stock. Hence, the ability of the Low Carbon Learning Programme to supply Local Authorities (LAs) and Housing Associations with a workforce that is skilled in Passivhaus can really increase the pace of Scotland's shift to net zero in the built environment. Moreover, that BE-ST ensured.

8.4 Case 3. Offsite Solutions Scotland (OSS)

Background

Offsite Solutions Scotland (OSS) is regional co-operative of nine firms and other stakeholders active in offsite construction in Scotland. Its aim is to improve market awareness of offsite manufacturing and drive the necessary cultural shifts to foster national and international growth of the sector. It also seeks to address foundational constraints relating to the enabling environment, such as skills shortages in Scotland, to catalyse greater uptake of offsite manufacturing. Having evolved from an informal initiative called the 'Offsite Hub' in Phase 1, OSS has now been established as its own entity and limited company, with BE-ST acting as an Observer on the Board. ENU acts as the academic partner to the initiative.

Benefits

OSS is frequently credited for forging a collaborative outlook between stakeholders in the sector, especially where firms such as CCG and Stewart Milne Timber Systems had previously been fierce competitors. In identifying common challenges that prevented the offsite construction sector from developing further, BE-ST has successfully been able to demonstrate that the benefits of collaboration between those involved in OSS outweigh the costs. This is to say that addressing such challenges collectively is likely to beneficial to all firms within OSS That OSS was initially focused on identifying

and addressing skills shortages, which could be perceived as a "neutral" issue, likely helped competing firms to collaborate in the first instance. Nonetheless, the mandate of Offsite Solutions Scotland (OSS) has now widened, and these same firms are now also collectively advocating for changes in policy frameworks and procurement to enable market to operate more efficiently. Those interviewed within OSS indicated that the networking support received by BE-ST was really valuable in this respect, with collaboration unlikely to have materialized without BE-ST's ability to identify opportunities for and facilitate collaboration.

Outside of the broad networking benefits of OSS the immediate outputs of it include a series of training modules that cover specific processes and products that are used in the manufacturing of offsite construction components. These are intended to address the skills shortages in Scotland that were identified as major impediments to the sector's development. Both ENU and Herriot Watt University (HWU) have played significant parts in developing such materials, shaping them in a manner that is mutually beneficial for all parties to OSS, as well as wider stakeholders. BE-ST joined-up network of neutral academics has clearly added value to the initiative in this respect.

The Edinburgh Homes Demonstrator is another important output of OSS. It is an initiative that seeks to demonstrate that better business models for the construction of affordable homes using offsite construction methods exist. This ambition was to be achieved through a pilot of 75 homes in Edinburgh, with construction having started in April 2022. The Edinburgh Homes Demonstrator is already receiving considerable traction within the Scottish Government, recognizing that it has incredible potential to transform both the productivity and performance of affordable housing, especially within the context of the *Affordable Housing Supply Programme*. According to stakeholders within OSS, offsite construction is also receiving due attention in the Scottish Government's future 'Housing to 2040' strategy as a result of the Edinburgh Homes Demonstrator, with significant potential in enabling a move towards homes built to Net Zero standards. Again, ENU has been an instrumental partner in the Edinburgh Homes Demonstrator, conducting research and building the case for offsite construction in terms of its cost, quality, and efficiency.

9 Conclusions.

The conclusions and lessons are structured around the seven high level objectives of the evaluation.

BE-ST is well positioned as the dedicated, streamlined point-of-entry for innovation support for Scotland's construction industry and continues to drive the innovation agenda forward. It has matured from an organization building the foundations of an innovation culture, to an organisation that is actively mainstreaming innovation across Scotland, especially in the area of Net Zero. As such it supports the Government's climate ambitions, as well as broader sector strategies relating to construction in Scotland and the rest of the UK.

Despite BE-ST's efforts, many of the market failures that the Centre was established to address remain as relevant as they were at its inception, especially those relating to procurement and sectoral fragmentation. There is a strong case for BE-ST's continued presence in Scotland's innovation landscape on this basis. The case is made even stronger considering BE-ST's complementarity and additionality with the existing offer available to Scottish construction firms.

It has become the "umbrella" for innovation efforts occurring in Scotland's construction sector and plays a leading role in defining the sector's needs. Testament to this is the fact that BE-ST has received a number of high-profile appointments in groups such as the Just Transition Commission (Commissioner), the Construction Leadership Forum (Co-Chair), and the Climate Emergency Skills Action Plan (Co-Chair) (see also 'Leadership' in the Assessment of Innovation Benefits section). As a leading voice in Scotland's construction sector, BE-ST exercises significant influence over the strategic direction of Government policy, with regular dialogue with Scottish Government Ministers and senior civil servants having become a core aspect of its engagement activity. Explicit references are afforded to BE-ST in a range of Scottish Government policy and strategy documents, such as 'Housing to 2040'.

It also exercises strategic influence over the firms operating in Scotland's construction sector, by articulating the systemic need for innovation, but also mainstreaming practical approaches to improving products, practices, and processes (see also 'Influence' in the Assessment of Innovation Benefits section). BE-ST has not only raised the visibility of the construction sector in Scotland, but through its participating in events such as COP26 has showcased innovation internationally, earning the centre accolades such as "Centre of Excellence" under the UN High Performing Buildings Initiative (see also 'Visibility' in the Assessment of Innovation Benefits section.

Assessing the extent to which ICs have delivered routes to economic benefits through increased levels of collaboration between industry and academia.

BE-ST's *raison d'être* is to connect the Scottish construction industry to academia to build a culture of innovation that drives transformational change in the sector and delivers economic impact for Scotland. The Evaluation finds BE-ST is successfully delivering against this core aim of the Innovation Centre Programme.

BE-ST clearly views academics as fundamental to its programme, with nearly every collaborative project to help solve industry-defined problems directly involving an academic partner (98%), be that from its host ENU or elsewhere. The benefits mentioned in this Evaluation have necessarily hinged on increased collaboration between Scotland's construction sector and the academic community. That BE-ST in hosted in ENU has been a benefit in this sense.

One of the core challenges that BE-ST seeks to address is the limited awareness amongst Scottish construction firms of the benefits of collaborating with academics. BE-ST has therefore played a crucial role in connecting businesses to Scotland's academic community and demonstrating that these academics indeed have market-relevant knowledge to share with them, with about a third of its clients indicating that they had established sustained connections with an academic *and* embarked on a joint venture with an academic institution due to BE-ST's relationship brokering. These sorts of relationships sit at the heart of the Innovation Centre model, with stakeholders indicating that other entities operating in the space unable to broker relationships of a similar quality.

Assessing the role each IC has played in supporting colleges and universities to maximise their value to Scotland.

BE-ST partners widely with Scotland's academic community, providing them important opportunities to mainstream research across Scotland.

BE-ST's network allows for the diffusion of academic knowledge on wider scales. The Centre understands that its principal clients – that is, Scottish firms operating in the construction industry – generally speak a different "language" to the academic community, and so it has an important role to play in streamlining academic inputs and translating them into terms that businesses understand and react to. BE-ST's advisory role to the Scottish construction sector in this sense enables academic research to have an impact beyond formal A2B or A2B collaborations. Moreover, as BE-ST's relationship with the academic community has matured and the needs of the industry have incrementally been communicated to Scottish universities, a positive feedback loop has emerged that has increased the relevance of research to Scottish firms and so too the potential for economic benefit through such a channel.

BE-ST also collaborates with Scotland's academic community to develop and deliver training materials. To August 2022, some 3646 individuals have participated in Continuing Professional Development courses, such as BIM Awareness course or the Low Carbon Learning Programme. These have both receive considerable input from academic partners (especially ENU) in the development of learning materials. This has enabled Scottish universities and colleges to make an impact on upskilling beyond the courses they directly offer in subjects relating to the built environment, thereby increasing their value within Scotland's innovation ecosystem. Meanwhile, BE-ST has played an active role in helping

to define curriculums in Scotland's universities and colleges, suggesting that a symbiotic relationship has emerged.

BE-ST also invites academics to participate in steering groups to ensure that BE-ST's programme reflects the latest knowledge in built environment innovation. This has increased since Phase 1, where consultations by Optimat and PKF-FPM revealed that academic partners felt that they could have played a stronger and more strategic role in steering the Centre's project development processes. This has thus provided Scottish universities and colleges opportunities to practically shape the direction of travel of the sector, beyond their immediate offer of research and training.

Examining performance against targets and achievement of objectives.

BE-ST has supported an increase in collaborative projects between academics and industry between Phase 1 and Phase 2, supporting at least 331 instances of collaboration, which has resulted in some 1,164 commercial launches of new or improved products, processes, and services. BE-ST's support to individual businesses has centred on light-touch consultancy services to identify areas of improvement, connections to Scottish and other academics that have special expertise to meet business needs, direct capacity development in R&D, technology deployment and trialling of innovation (especially within the context of the Innovation Factory, and the training of staff to mainstream innovation more widely. BE-ST has also supported the diffusion of innovation and knowledge by hosting some 315 events to date, as well as enabling almost 4,000 individuals to enter into training (including to CPD courses such as the aforementioned Low Carbon Learning Programme), of which 608 had received a formal qualification. BE-ST has exceeded all its initial Phase 2 activity and output targets on this basis.

BE-ST's steady transition away from one-to-one projects to more encompassing one-to-many programmes is likely to have mainstreamed innovation more widely in Scotland too. Its offer of the Innovation Factory has provided Scottish firms practical opportunities to prototype and trial innovation, presiding over a sea change in the way that the construction industry approaches innovation. Collaboration between a fragmented and highly competitive industry is starting to increase as a result of BE-ST's networking role, especially through co-operatives such as Offsite Solutions Scotland. Equipping the workforce for the future was raised as an ambition during Phase 2, and BE-ST training over 4,000 individuals, especially through CPD courses such as the Low Carbon Learning Programme.

Its potential impact on the Scottish economy is high, with some 10,359 jobs forecast to be safeguarded or created, and turnover of firms associated with the centre forecast to be to £1,773m in gross terms. It is on track to achieve its full ambition by the close of Phase 2, though actual complete impact may reveal itself beyond Phase 2 as many forecasts are converted into actual achievements. Its impact in net terms is comparatively less than the gross figures reported in the MEF, with net additional jobs peaking 187 in 2022 and cumulative net additional GVA for the period 2012-2022 is estimated at £25.1 million, though these figures are based on a relatively small sample of respondents to the Client Survey (n = 33).

Exploring how effectively each IC builds engagement with the innovation ecosystem.

Many of the market failures that BE-ST seeks to correct are best addressed through engagement across Scotland's entire construction ecosystem, rather than through one-to-one collaborative projects. BE-ST's greatest impact is at therefore at the systemic level, with the available evidence suggesting that that BE-ST has been highly effective in building engagement in this ecosystem over the course of the IC Programme, acting as a leader and source of strategic influence, strengthening networks, spotlighting innovative practices in Scotland, and providing open resources such as the Innovation Factory and knowledge materials.

BE-ST's attribute of "neutrality" has enabled it to emerge as the focal point for innovation that is occurring within Scotland's construction sector. It has become the "umbrella" for innovation efforts

occurring in Scotland's construction sector and plays a leading role in defining the sector's needs. Testament to this is the fact that BE-ST has received a number of high-profile appointments in groups such as the Just Transition Commission (Commissioner), the Construction Leadership Forum (Co-Chair), and the Climate Emergency Skills Action Plan (Co-Chair) (see also 'Leadership' in the Assessment of Innovation Benefits section). As a leading voice in Scotland's construction sector, BE-ST exercises significant influence over the strategic direction of Government policy, with regular dialogue with Scottish Government Ministers and senior civil servants having become a core aspect of its engagement activity. Explicit references are afforded to BE-ST in a range of Scottish Government policy and strategy documents, such as 'Housing to 2040'. It also exercises strategic influence over the firms operating in Scotland's construction sector, by articulating the systemic need for innovation, but also mainstreaming practical approaches to improving products, practices, and processes (see also 'Influence' in the Assessment of Innovation Benefits section). BE-ST has not only raised the visibility of the construction sector in Scotland, but through its participating in events such as COP26 has showcased innovation internationally, earning the centre accolades such as "Centre of Excellence" under the UN High Performing Buildings Initiative (see also 'Visibility' in the Assessment of Innovation Benefits section.

BE-ST has successfully been able to forge a collaborative outlook on innovation in Scotland, even though this as at odds with the status quo of intense competition within the construction sector. BE-ST's breadth of expertise also means that it both complements *and* augments the support that is already available to Scottish firms. Its deep integration within the ecosystem has allowed it to connect multiple threads and present a joined-up approach to addressing the construction sector's challenges, something of utmost importance given that many such challenges are systemic. It's most substantial contributions to the ecosystem include: (i) *Leadership*, where BE-ST has become the "umbrella" organization for innovation occurring in Scotland's construction sector and actively plays a leading role in defining the sector's needs; (ii) *Influence*, where BE-ST has played the role of a "critical friend" of the Government and influenced the sector's strategic direction; (iii) *System Strengthening*, where BE-ST has been able to mitigate the combative nature of the industry and forge a collaborative outlook; (iv) *Resources*, where the Innovation Factory plays the role of a one-of-kind space to test innovative ideas; and (v) *Knowledge*, where BE-ST plays a significant role in upskilling the workforce on.

BE-ST offer of the Innovation Factory has provided Scottish firms practical opportunities to trial innovation, presiding over a sea change in the way that the construction industry approaches innovation (see also 'Resources' in the Assessment of Innovation Benefits section). Meanwhile, BE-ST's training offer has provided a natural entry point for colleges and universities to maximise their value to Scotland. BE-ST partners widely with Scotland's academic community, including outside of its host university (ENU), putting the latest academic research front-and-centre and tailoring it to the needs of the industry. The Low Carbon Learning Programme, offered as a series of online training modules by BE-ST, has received significant input from academics. BE-ST is also able to offer firms direct connections to academics where relevant, which would unlikely occur to the same extent if more generic innovation support was provided by an entity like Scottish Enterprise. That BE-ST is hosted by ENU has facilitated such connections to some extent. Finally, BE-ST has done well to influence skills and training in colleges, having formed successful partnerships with Scotland's college network (see also 'Knowledge' in the Assessment of Innovation Benefits section).

Identifying wider impacts learned.

BE-ST is regarded as contributing to an array of broader impacts. BE-ST underwent a strategic refresh during the COVID-19 pandemic, resulting in the reorientation of its strategy toward Net Zero ("BE Zero"), signalling the Centre's recognition of its potential to make an impact beyond the immediate economic benefits of innovation. It's work in the area of Net Zero is beginning to have traction in Scotland (inc. references to decarbonization of the Scottish Government's future 'Housing to 2040' strategy), whilst the Centre also supports broader efforts to create a responsible relationship between the industry and the natural environment. BE-ST is actively supporting efforts to diversify the

construction sector, influencing most notably the National Equity and Inclusion Plan (as part of the Construction Accord). BE-ST also supports innovations that improve building quality, directly improving public health, as well as the public realm, providing nicer and safer places for Scottish people to interact. These "missions" are not currently captured in the standardised MEF, suggesting there is scope to provide opportunities for tailored indicators alongside the core set of indicators needed for programme management.

Assessing the degree to which IC benefits have reached all parts of Scotland.

There is scope to increase BE-ST's benefit to the Highlands and Islands, with the Centre engaging with stakeholders in this region comparatively less than those from Glasgow and Edinburgh and their surrounding areas. This is perhaps unsurprising given that the Centre is hosted by ENU in the East, but is headquartered in Glasgow in the West. It is, however, stepping up engagement in this area considerably.

Identifying lessons learned from IC operations.

BE-ST has emerged as the dedicated, streamlined point-of-entry for innovation support in Scotland's construction ecosystem, tailoring and targeting its assistance in a way that is truly additional to the existing offer of entities.

Nonetheless, BE-ST's recognition that it cannot address the totality of industry need alone during Phase 2 has been an important milestone in defining a role in which it aims to provide cohesion to the existing ecosystem, adding value by ensuring support offered by the funders and others like UKRI and Innovate UK sum to something greater than their individual parts.

BE-ST's attribute as a "neutral" convener has allowed it to mitigate the competitive tendency of the industry and forge a collaborative outlook on innovation, presenting opportunities for joined-up, transformational approaches.

Transitioning away from one-to-one projects to more encompassing one-to-many programmes is likely to translate to more systematic and sustainable impact, something that is especially important considering that many of the Scottish construction sector's challenges are systems challenges.

This one-to-many approach means that BE-ST can support several firms to develop and deliver multiple products, processes, services through individual projects, maximizing VfM.

Academic input has been foundational to the economic benefits that have materialized during Phase 1 and Phase 2, either directly through A2B and A2G collaborations, or more indirectly through the diffusion of knowledge through BE-ST's network.

BE-ST's situation within ENU has likely facilitated such academic input, providing direct access to academics within ENU, as well as the channels through which it can access other academics within the Scottish university system.

The *Innovation Factory*, introduced during the later stages of Phase 1, continues to be a unique selling point relative to other innovation support providers, providing Scottish firms a physical hub to trial new products, services, and processes.

Expanding BE-ST's programme of activity to include *Future Workforce* was a wise decision given the sector's widespread recognition that upskilling is its foremost priority and BE-ST demonstrated ability to deliver training at scale in partnership with education agencies and institutions in Scotland.

Delivering through free-to-access, online modalities (e.g., Low Carbon Learning Program on *Passivhaus* and retrofit) has enabled the widespread diffusion of knowledge within BE-ST's *Future Workforce*, maximizing the value of research generated within Scotland's universities and colleges.

Adopting a mission-driven approach, demonstrated by BE-ST in the reorientation of its strategy toward Net Zero ("BE Zero"), has considerable potential to increase the Centre's wider benefits in Scotland and may provide a helpful model for the other ICs.

BE-ST has gone to great effort to ensure that its performance monitoring mechanisms surpass the minimum standard required by SFC, SE, and HIE, including the better tracking of impact, which may serve as a model for the other ICs.

BE-ST's potential impact is substantial, but the standardized MEF needs to be refined to better identify differences between gross and net impacts, which appear to be considerable in BE-ST's case due to difficulties identifying and attributing employment creation to the Centre.

BE-ST's operational approaches to monitoring and evaluation are robust, with actual performance tracked against forecasts through regular dialogue and information-sharing between BE-ST and the partner over the lifecycle of the project, including during close-out. However, the standardized MEF needs to be refined to better distinguish between forecast and actual achievements, providing the Funders with more confidence on direction of travel.

The standardized MEF does not provide an opportunity to capture wider benefits, which does not align well with BE-ST's recent move to adopt a mission-driven approach in the area of Net Zero.

The institutional arrangement with ENU provides additional benefits to BE-ST in terms of saving on administrative costs, but certain constraints and overly bureaucratic processes remain in need of streamlining.

BE-ST's participation in events such as COP26 and its recognition by the United Nations as one of twenty-six global Centres of Excellence under the UN High Performing Buildings Initiative offer opportunities to leverage further external funding into innovation in Scotland, in addition to that which it is able to leverage from across the UK.