KADA

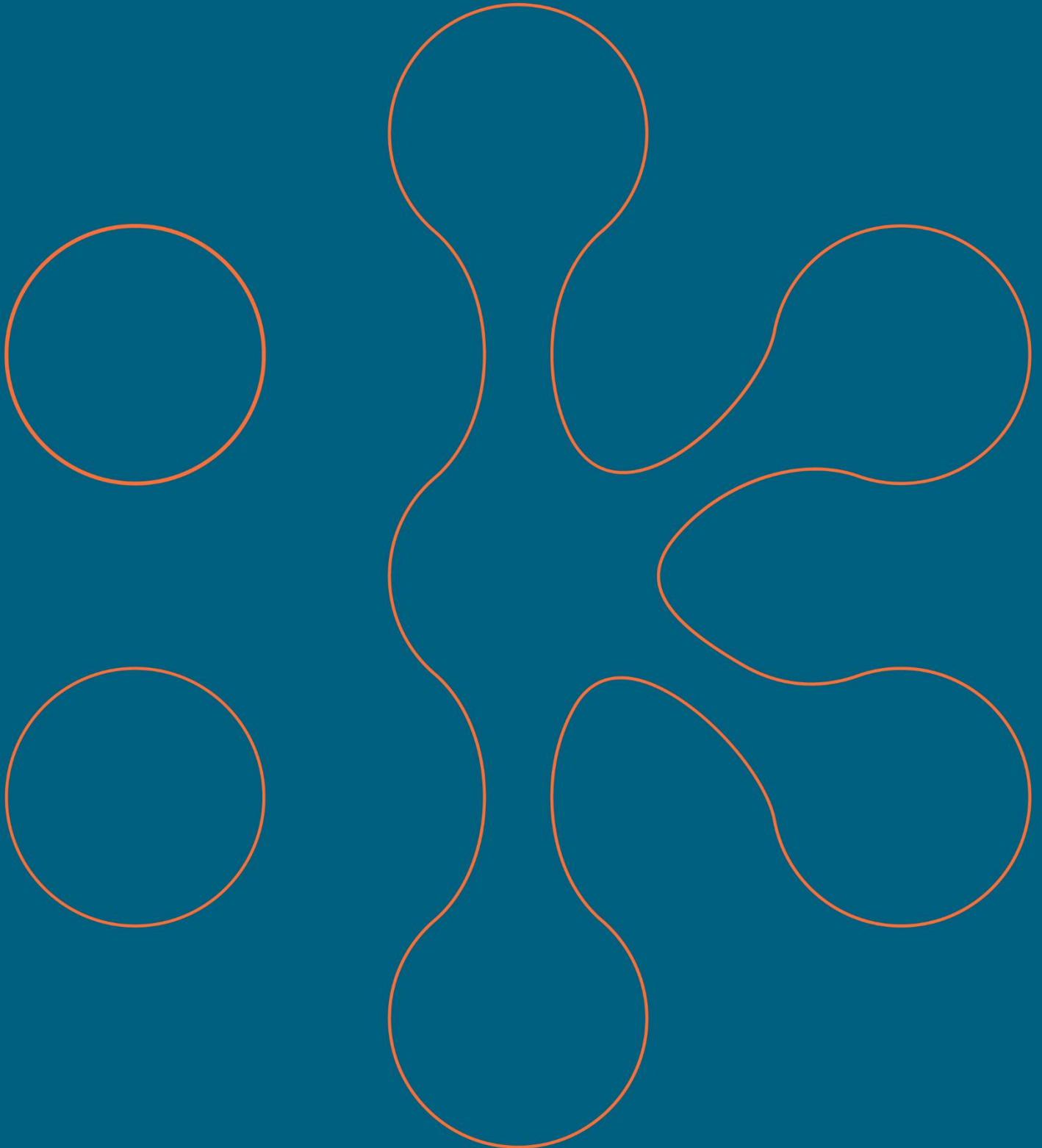# Evaluation of the Collaborate to Innovate: London Diagnostics Programme

A Final Report

For MedCity
April 2024

Contents

Executive Summary

This chapter is an executive summary of the findings of an independent evaluation of the Collaborate to Innovate: London Diagnostics (C2NLDx) Programme led by MedCity (now part of London & Partners).

Overview

This evaluation assesses the Programme against its aims, objectives, and outputs. The study draws on a desk review, stakeholder insights, and reviews project outcomes and outputs. It outlines the economic, and technological impacts of the projects funded as part of the C2NLDx Programme. It concludes with lessons learnt and potential improvements which stakeholders may wish to consider.

Output Analysis

A survey of the research teams was conducted during 2023. As the table in Section 3.1 outlines, **a wide variety of outputs were achieved** including the creation of 13.8 FTE equivalent roles, the meeting of match funding requirements, the completion of nine projects, and the very successful organisation and facilitation of two networking events with 151 attendees.

In addition to this C2NLDx was a **significant contributing factor in the raising of £32.55m in further investment** by participant SMEs. This investment will lead to an **estimated £3.5m in net GVA benefits for the UK economy** (national additionality) through R&D spend.

Economic Impact

C2NLDx has **created 21 gross FTE jobs (14 direct and 7 indirect)** and a total NPV GVA from employment of £2.44m. In addition, a further £4.1m of NPV GVA is estimated due to further investment secured by C2NLDx projects. The **estimated combined GVA of £6.54m[1] for the Greater London economy would result in a cost benefit ratio (CBR) of 1:5.03** i.e., each £1 of public investment will generate £5.03. This is **a better return than what might be expected for this kind of initiative**. For instance, a review by CRESR of evidence for R&D support cites a CBR of 1:1.8 to 1:2.5.

The total cost per business assisted is £144,444 and the cost per gross job generated is £61,495. The cost per business assisted at £144,444 is at the very high end of what is expected for business activity which ranges from £4,700 lower quartile to £10,000 (median) and £34,000 (mean)[2]. That said, the guidance does note that *"however, much higher unit costs can be used if the intention is for a smaller number of higher rates of support"*. The cost per gross job generated is also at the higher end expected for this kind of activity which varies from £12,000 (lower quartile) to £26,000 (median) and £71,000 (mean)[3].

Programme Strengths

In reference to many of its principal objectives, **C2NLDx produced a series of notable successes**. The administration and delivery of the project were widely regarded as successful. The strong relationships, expertise and experience built during previous C2N programmes, coupled with robust programme management, provided a strong foundation for the C2NLDx, facilitating and supporting the achievement

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[1] Regional additionality (Greater London).
[2] Regeneris Consulting (2013). 'England ERDF Programme 2014-20: Output Unit Costs and Definitions, A Final Report'. Available here.
[3] Ibid.

of a wide range of economic and collaborative impacts. As per previous C2N rounds, **C2NLDx provided SMEs with the means of accessing vital seed funding for early-stage research**.

Innovative activity was supported and catalysed with **significant knowledge transfer and commercial & medical progress achieved**. Job creation was a clear outcome of this Programme.

The Delivery Team successfully navigated the large, dynamic, and interconnected diagnostics ecosystem within London, using their strong relationships to facilitate an efficient and effective matchmaking process. Beneficiaries and stakeholders agreed that the **collaborative work demonstrated clear additionality generating important impacts.** This provides strong evidence that the Programme helps to pump prime early research work and secure further investment.

The **flexible management processes were praised by participants**. They supported project delivery and research progress. The disruption caused by the COVID-19 pandemic resulted in a delayed start. Nevertheless, the Programme's flexibility meant that collaborative groups were able to adapt to the logistical and practical difficulties caused by the pandemic.

Regular check-ins were supplemented with a six-month reviews and networking events. Progress monitoring was informative and not too onerous; beneficiaries felt well supported in this process **Effective partnership work ensured efficient initiation and delivery** under the difficult circumstances caused by the COVID-19 pandemic. Stakeholders regarded the efficient and relatively easy application process as a strength.

C2NLDx's **funding processes were regarded as well organised, relatively straightforward, and effective**. The only exception was some frustration with the relative slow pace of some university bureaucratic systems, but these continue to reflect their complex auditing and due diligence procedures.

Programme flexibility facilitated a dynamic approach to funding, with match funding gained from a variety of sources. Two highly successful networking events incorporating collaborative 'speed dating' exercises. Strategic targets focused upon delivering events to support more companies were significantly surpassed.

Significant improvements in research and commercial understanding were achieved across the suite of projects. A range of impacts and clear additionality have already been achieved partially, largely, or completely because of the Programme, with more impacts expected to be realised over the coming years. These are outlined in the infographic on the Page vii.

Through iterative changes across its suite of C2N Programmes, MedCity has developed a **best practice model that efficiently and effectively facilitates and catalyses collaborative partnerships** that generate clear commercial, scientific, and medical impact. The C2NLDx programme provides clear evidence that their model fills a significant gap in support for early-stage research and that it can be transferred to a variety of strategically important health sectors.

Technological and Medical Impact

The Programme supported a wide range of both technological and medical impacts. These included: further progress in the identification of markers that diagnose early-stage pancreatic cancer and cardiovascular disease, facilitating earlier and more effective treatment; the further development of cancer models for testing immunotherapies ex vivo; the use of AI to support the analysis of blood

samples for signs of Alzheimer's; and the development of technology that can help to predict patient responses to different treatments for kidney cancer.

Through participation in C2NLDx, all projects were able to accelerate the commercialisation of their products (see Technology Level Readiness (TRL) progress per project in Appendix Two). This was achieved from, amongst other forms of support, the receipt of vital external validation for data & wider research insights, the development of potential clinical pathways for products, the development of the evidence base & cost analysis required for clinical trial, and the refinement of products & processes.

Collaborative Impact

C2NLDx respondents were very positive about the benefits of collaboration. Five out of nine projects have plans for future collaboration progression of all the projects.

Numerous mutual benefits were cited by participants with the collaborations playing a significant role in the advancement of technology and the securing of further investment. They have broadened the expertise, experience, and capacity available to participant SMEs whilst providing some research partners with vital insights into the commercial and clinical application of their work.

The collaborative partnerships facilitated extensive knowledge transfer, provided access to live clinical information, introductions to wider academic networks and the development of new insights into the potential uses for the SME's products. The credibility and reputation of academic and commercial partners were regarded as critical factors in assisting with commercial progress and gaining wider research community attention.

Commercial and Wider Impact

SME representatives cited a wide range of impacts from their collaboration partnerships that had a positive impact upon the progress of their product development. C2NLDx was successful in pump priming early-stage research projects to the stage where they could apply for further funding. This was highlighted by the successful raising of £32.55m in further investment by participant SMEs, with representatives regularly crediting C2NLDx as a significant factor in securing these funds.

C2NLDx was able to de-risk innovation and collaborative work. Other additionality cited by participants included improvements in market understanding and how to attract investors, improved cost effectiveness and refined value & investment propositions.

Programme Rationale and Summary

C2NLDx offered ten London-based health diagnostics SMEs cross-sector partnering opportunities and year-long support – including £100,000[4] - to help advance commercial readiness. They were partnered with a leading research organisation to undertake an objective-driven research project.

The Programme emerged out of discussions about how MedCity could utilise their networks to provide further support for this sector and how they could support the GLA's focus upon addressing health inequalities and improving the health of under-represented communities. The Programme was a continuation of the suite of Collaborate to Innovate (C2N) programmes that have been running successfully since 2017.

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[4] This was made up of £50,000 funding from LEAP and £50,000 from match funding/in kind resource.

A widely recognised key obstacle faced by diagnostic innovators in bringing products to market is limited academic, research or wider commercial collaboration. The C2NLDx Programme aimed to address this problem by matchmaking diagnostics SMEs with experts at leading universities, established diagnostics companies, charity research organisations and health care service providers. In previous rounds of C2N, MedCity had supported life science SME's innovation, research, and development by partnering them with academic institutions that offered wider expertise, experience, access to facilities & supporting technology and expert labour time. The C2NLDx Programme was focused on continuing this work, fostering a mutually beneficial supportive ecosystem within the diagnostic sector. Through this the MedCity hoped to catalyse knowledge transfer and product development.

Programme Context

Life sciences are a highly significant sector within the UK economy and generate an annual turnover of more than £73 billion. Recent government statistics show that the life science industry brings vital growth and high value jobs to the UK economy, with 280,000 people employed within the sector.

Rapid advances within life sciences over the last thirty years have produced a wide variety of important health breakthroughs in areas such as infectious diseases, oncology, and neurodegenerative conditions and, more recently, a COVID-19 vaccine. As the pandemic highlighted, breakthroughs are reliant on early discovery and an excellent diagnostic sector. The rapid improvement in COVID-19 testing showed that medical progress can been achieved at unprecedented pace if supported by investment, collaboration, and the focused effort of the UK's life science & healthcare industry and research base.

Diagnostic activity forms part of 85% of clinical pathways, with the NHS spending over £6 billion a year on diagnostic services providing an estimated 1.5 billion tests. Recent reports have called for an altered approach to diagnostic services, with a shift away from the hospitals to community centres. It is hoped that this will help to increase diagnostic capacity, efficiency, and efficacy. In August 2023 the UK Government announced its plans to expand the NHS's network of community diagnostic centres.

Evaluation Scope

The specific aims of the evaluation are to:

- Undertake a robust assessment of whether the programme achieved its initial objectives or not, what has worked well and what has not, for whom and under what circumstances.

- Establish an understanding of the outputs achieved by the projects including jobs created, investment raised, and commercial progress achieved.

- Assess the effectiveness of the process of programme delivery including its management, administrative and delivery mechanisms, and its operational characteristics through an evaluation of the key stakeholder's feedback. Analysing how much impact these had upon the successful delivery of the projects.

- Evaluate potential strengths, impacts, and areas of improvement of the programme, using qualitative data from stakeholder feedback and quantitative measures where available.

Programme Management and Governance

The Programme was delivered by MedCity, under the backing of the Diagnostics Growth Hub and funded by the Greater London Authority on behalf of the London Economic Action Partnership (LEAP). It built upon the existing collaborative links between the MedCity-led London COVID-19 Test Bed Alliance, National Institute for Health and Care Research (NIHR), London IVD Co-operative and other

research, commercial and strategic partners. The delivery team reported to the MedCity Board and the AHSC/N Executive.

A key partner engaged to support and shape delivery of the Programme was LifeArc, a self-financing medical charity that support the development of early-stage life science innovation and research. Life Arc supported through the provision of one hour of free advice to SMEs and the provision of £20,000 in match funding to eligible projects from the Innovation Award element of their Advise and Connect Programme. Other research collaboration partners Roche, the NIHR and Cancer Research UK, GSTT, KCL, QMUL, GSTT, and UCL provided match funding in the form of resource in kind. These contributions successfully unlocked the GLA funding. Key partner feedback was positive, indicative of the strength of the relationships developed by the Delivery Lead.

Ongoing support was available to beneficiaries throughout the process. An application process built on findings from previous C2N rounds was efficient and effective. C2NLDx received many strong applications.

The disruption caused by the COVID-19 pandemic led to several project teams requesting extensions. These were approved with no additional costs.

Project Completion

Nine out of the original ten C2N projects were successfully completed. One project was unable to be initiated after contractual difficulties led to Cancer Research UK pulling out as the research partner as their funding stipulations (that funds must go to the research partner) were incompatible with LEAP's (that funds must go to the commercial partner). One SME left the Programme following a company takeover, but their collaborative project was completed by their collaborative partners at Kings College London (KCL).

Lessons Learnt

Efficient management of C2NLDx was supported by MedCity's extensive understanding of the London life science and diagnostics ecosystem, strong relationships with academics & other research partners, and understanding of the requirements of beneficiary SMEs. Ongoing dialogue ensured projects remained on track, issues were flagged early, and solutions were effectively implemented.

MedCity continue to play a vitally important and unique facilitation role within the complex life science and diagnostics ecosystem. Their experienced and pro-active central operational/delivery teams have an excellent combination of strong links with both SMEs & research partners and a unique understanding of the complexities of inter-institutional work.

Recruiting new research partners was difficult. Attempts to engage large pharmaceutical firms proved to be challenging, often as they had their own differing strategic objectives and their own in-house collaborative programmes.

Although C2NLDx was praised for its flexibility, funding timelines became a restriction for activity. Extensions were welcomed as limited funding and short timescales were regarded by some respondents as restricting factors on the amount of tangible quantitative impacts that could be delivered.

Stakeholders acknowledged that the requirement for 50% match funding before GLA funds were released put the Programme at risk whilst match funding could be found. Creative solutions, such as research partners providing funding in kind, meant that this risk was successfully overcome.

There was only limited evidence of a concerted focus on under-represented groups with only two projects making explicit reference to this objective. Short recruitment windows for patients willing to work on project trials meant that more diverse groups were not recruited in the numbers originally hoped. As a key Programme objective, it needed to be hardwired into the application process to ensure that project leads maintained an ongoing focus upon it.

Gaining comprehensive feedback from collaborative partners and some SMEs was challenging, with many citing high workload, commercial pressures, and clinical priorities as reasons for not being able to provide detailed information. Four collaborative partners and one SME did not provide an end of project summary for this report.

Recommendations

The programme team may wish to consider the following recommendations for any future iterations of C2N and/or diagnostic, SME support projects:

Strategic Recommendations

I.   Use the suite of C2N evaluations to emphasise the unique and vitally important facilitation and catalysing role that MedCity plays within a very complex ecosystem.[5]

II.   Continue to scope out other potential health sectors where MedCity's model would be applicable. Develop proposals that emphasise that MedCity's best practice models have a strong track record of facilitating excellent effective collaborations and achieving significant commercial, scientific, and medical impacts.

III.   Undertake a mapping exercise to identify potential future strategic partners best suited to mutually benefit from access to MedCity's networks, expertise, and experience. This process should also identify the opportunities presented by access to L&Ps wider network.

Funding Recommendations

I.   Continue to allow for the use of funding in kind as a match funding source.

II.   Establishing a base fund that is not reliant upon match funding for its release will bring increased programme security and stability.

III.   Build a collaboration of public and commercial partners to explore opportunities presented by post ERDF funding pots such as the Devolved Investment Funds and UKSPF. This Steering Group could also look at innovative methods for gaining access to MRC and UKRI funding pots that reflect the fact that MedCity is neither a commercial enterprise nor a research organisation.

Commercial, Clinical and Technological Impact Recommendations

I.   Scope out the feasibility of running programmes over two-years thus providing further opportunities for the securing and embedding of impact/commercial & research progress.

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[5] For instance, the economic and scientific impact, scientific excellence, industrial & stakeholder relevance, and strong value for money clearly evidenced in evaluations provides an excellent foundation for a BBRSC funding bid.

II.   Undertake a consultation exercise with potential large commercial partners to investigate barriers to future involvement and scope out solutions. Other life science programmes, such as the University of Cambridge's iDMT, have successfully recruited large pharmaceutical representation to their steering groups.

III.   Disseminate the significant programme impacts to key partners, larger companies, and potential investors through MedCity's wide network.

IV.   Formalise wider socio-economic and medical impact targets into all programme documentation and reporting requirements to ensure a continued focus on key strategic objectives.

Administrative Recommendations

I.   Mitigate the disruptive impact of staff turnover within SMEs, research partners and the Delivery Team by scheduling transition meetings and, where possible, schedule some role shadowing.

II.   Ensure the continued presence of an experienced and pro-active central operational/delivery manager with strong links with participant research partners and an understanding of the complexities of inter-institutional work.

III.   The continued involvement of previous C2N leads and project partners within design processes ensures iterative improvements to administrative and governance processes.

IV.   Schedule an ongoing programme of administrative check-ins between the Delivery Team, SMEs, and collaborative partners to ensure contractual/reporting requirements/deadlines are met.

'Collaborate to Innovate: London Diagnostics' in Numbers

13.8
C2NLDx activity has led to the creation of 13.8 FTE equivalent roles in participant SMEs.

£2,444,491
Employment impacts of £2,444,491 in NPV GVA realised because of C2NLDx activity over the next five years.

£32.55m
in further investment secured by participant SMEs.

100%
of the six SMEs securing additional funding cited C2NLDx additionality.

£6,541,569
in NPV GVA over the next five years attributed to the C2NLDx Programme.

£5.03
C2NLDx delivered £5.03 in economic impact for every £1 spent.

67%
Collaboration to continue in 67% of the C2NLDx projects.

151/676
Two C2NLDx networking events held with 151 attendees and 676 meetings facilitated.

1 Project Context, Objectives, and Overview

This is an independent evaluation of the London Economic Action Partnership funded Collaborate to Innovate: London Diagnostics (C2NLDx) Programme led by MedCity (now part of London & Partners). This programme was designed to stimulate and further embed collaboration between leading academic & research institutions and SMEs working in the health diagnostics sector. This chapter sets the strategic backdrop and aims of the report and concludes with a brief description of the evaluation approach.

1.1 Project Context

Life sciences are a highly significant sector within the UK economy and generate an annual turnover of more than £73 billion. According to the most recent government statistics, 280,000 people are employed within the life science industry[6] across the UK, bringing vital growth and high value jobs. According to the updated Life Sciences Industrial Strategy (2020) the UK is

> *"home to one of the strongest, most productive health and life sciences industries globally, with UK research accounting for 12% of all life science academic citations coming from UK research institutions."[7]*

Rapid advances within life sciences over the last thirty years have produced a wide variety of important health breakthroughs in disease diagnosis and treatment. As the COVID-19 pandemic highlighted these breakthroughs are heavily reliant upon the early discovery of conditions and diseases, and the support of an excellent diagnostic sector. The rapid improvement in COVID-19 testing showed that medical progress can been achieved at unprecedented pace if supported by investment, collaboration, and the focused effort of the UK's life science & healthcare industry and research base. As a recent paper by the Academy of Medical Sciences[8] highlights, finding improved ways for academia and industry to access and work collaboratively is a crucial factor if the UK wants to consolidate its position as a world leader in diagnostics.

Diagnostic activity forms part of 85% of clinical pathways, with the NHS spending over £6 billion a year on diagnostic services and an estimated 1.5 billion tests[9]. In his 2020 report 'Diagnostics: Recovery and Renewal' the Chair of the UK National Screening Committee Professor Mike Richards recommended a radical change in diagnostic services in the UK moving away from a hospital based approach and using ongoing innovations and developments to increase capacity, efficiency, provision and efficacy[10]. In August 2023 the UK Government announced its plans to open a further 13 community diagnostic centres with the ability to deliver an additional 742,000 scans and tests every year. These will complement the 114 already established.

The diagnostics industry is regarded as a crucial element of modern healthcare assisting medical professionals by detecting illness, conditions, and diseases early enough to prescribing effective treatment. According to Deloitte[11], excellent diagnostic tools can help the medical sector to move beyond "reactive, episodic treatment" to pro-active solutions that will "help avoid adverse health

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[6] Office of Life Sciences (2022). 'Bioscience and Health Technology Sector Statistics'. Available here.
[7] The Office for Life Sciences (2020) 'Life Science Industrial Strategy Update'. Available here.
[8] The Academy of Medical Sciences (2021) 'Building a Sustainable UK Diagnostics Sector'. Available here.
[9] Ibid.
[10] Richards, M (2020). 'Diagnostics, Recovery and Renewal'. Available here.
[11] Deloitte (2022) 'The Future of Diagnostics' – Available here.

outcomes and the cost of late-stage or unnecessary treatment". They cite a wide body of research that shows that an excellent diagnostic sector brings better outcomes for patients suffering from all major life-threatening diseases. The information gained enables health professionals to provide the best and most effective treatments. As the UK population ages and chronic/life-threatening diseases become more prevalent, innovative diagnostic tools that harness pioneering technology have the potential to improve clinical outcomes and the quality of life[12] for millions of UK residents. The sector is also increasingly important to the UK economy. According to the business intelligence provider Laing Buisson, there has been an 8%/9% increase in the number of MRI and CT scans undertaken and an average 2% increase in the number of pathology tests with continued sustained growth estimated. They estimate that the high growth and high value UK diagnostic sector is currently worth £7 billion.

Within London, Mayor Sadiq Khan has outlined his ambition to ensure that different sectors to work together to solve healthcare challenges. This includes exploring the safe use of health data for research, supporting increased investment to allow innovative life sciences & healthcare firms to grow, and enabling new life science & healthcare developments to expand in London[13]. MedCity were cited as a key organisation that continue to support the delivery of this ambition.

"With a unique ecosystem combining a rich network of world-class universities, renowned research centres, healthcare providers, medical charities, innovative small businesses and global industry players, London is highly attractive for investment in life sciences".[14]

In University College London, Kings College London, Queen Mary University of London and Imperial College, London has four world class universities for life sciences. It has over 2,000 health and life science orientated companies and an international reputation for research excellence, entrepreneurship, and sector vibrancy.

As the capital's cluster organisation for the health and life science sector, MedCity has long worked with these institutions and company building a strong reputation for supporting research, collaboration, commercialisation, and sectoral growth. They were the leading partner in the three previous highly successful iterations of Collaborate to Innovate and a lead partner in a very similar academic collaboration programme Confidence in Collaboration.

In April 2023 MedCity was assimilated into London & Partners (the Mayor of London's growth and destination agency). MedCity's focus upon maintaining and growing London's international reputation for health and life sciences sector excellence was regarded as an excellent strategic fit with London & Partners' expertise, experience, global reach, scale and investment, growth & innovation support for high growth sectors. Through this integration MedCity hoped to leverage London & Partners connections and expertise to accelerate sectoral investment and innovation.

The London Economic Action Partnership
The London Economic Action Partnership (LEAP) was the local enterprise partnership for London. It brought together entrepreneurs and businesses with the Mayoralty and London Councils to identify and implement strategic actions to support economic growth and job creation in the capital. C2NLDx was one such programme. Its work is now undertaken

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[12] The Kings Fund (2023). 'Time to Think Differently'. Available here.
[13] Mayor of London/London Assembly (2023). 'Supporting the Life Sciences sector'. Available here.
[14] Ibid.

by a variety of GLA hosted boards, including the London Partnership Board. It oversaw and managed a variety of different funding sources, distributing over £300m in growth funding. This included £114m through the Skills for Londoners Capital Fund and £70m through the Good Growth Fund.

Recent Policy Developments

In 2021, the UK Government's Life Science Programme was updated with a Life Sciences Vision. It emphasised the importance of providing opportunities for collaborative work between the UK's best academics whilst supporting the development of new drugs, diagnostics, MedTech and world leading digital tools. This document recognises the heavy reliance the life science sector has upon research institutions and its science base. The vision clearly emphasises the importance of driving forward innovative collaboration, ensuring that maximum impact is being gained.

Such aims are evident in the recent UK Innovation Strategy, which highlights the benefits innovation can bring to the wider economy. It places great emphasis on the importance of a policy environment that allows R&D performing institutions and organisations to thrive, "cementing the UK's position as a world leader in science, research and innovation[15]".

1.2 Rationale, Objectives, and Overview

Rationale

C2NLDx offered London-based health diagnostics SMEs cross-sector partnering opportunities and a year-long support to help advance commercial readiness. It was a continuation of the suite of Collaborate to Innovate (C2N) programmes that had been running since 2017, sharing their focus on supporting SMEs with the commercialisation process by partnering them with leading researchers and larger firms.

The investment hub of MedCity had been looking for a Programme that would engage diagnostic firms and provide links with to MedCity's Diagnostics Growth Hub. C2NLDx emerged out of discussions about how MedCity could utilise their networks to provide further support for this sector and how they could support the GLA's focus upon addressing health inequalities and improving the health of under-represented communities.

C2LD2x was built upon the understanding that limited or no industrial collaboration is one of the major obstacles faced by diagnostic innovators when bringing products to market. The C2NLDx Programme addressed this problem by matchmaking diagnostics SMEs with experts at leading universities, established MedTech companies, charity research organisations, and health service providers. It was based upon the understanding that, as the rapid development of a COVID-19 vaccine and large-scale testing capacity highlighted, "collaboration can save lives"[17], through the sharing of key knowledge and innovation[16]. Whilst outlining the strategic importance of C2NLDx, MedCity emphasised the global nature of the challenges facing the life sciences sector highlighting the numerous and significant advantages of collaboration and shared knowledge[17].

The principal rationale of all the C2N programmes has been to foster, develop and embed collaborative partnerships between academic institutions and the life science industry (with a particular focus upon SMEs). They have all supported SMEs to increase their levels of innovation, research, and development investment by partnering them with academic institutions that can offer expertise, experience, facilities,

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[15] Department for Business, Energy, and Industrial Strategy (2021). 'UK Innovation Strategy'. Available here.
[16] MedCity (2023). 'Diagnostics Growth Hub'. Available here.
[17] Jan Wauters (2023). 'The Impact of UK Collaboration in Life Sciences'. Available here.

supporting technology and expert labour time. The C2NLDx Programme was focused on continuing this work, fostering a mutually beneficial supportive ecosystem within the diagnostic sector. It was hoped that that this would drive forward knowledge transfer, shared research, product development and commercialisation.

Overview and Objectives

The London Diagnostics Programme built upon C2N's legacy focusing on cross sector partnering between diagnostic businesses and research partners.

According to the original objective's documentation limited collaboration is one of the main identified barriers to commercialising diagnostic products. C2NLDx was a clear attempt to help overcome this by facilitating collaborative practices between researchers and diagnostic SMEs, stimulating further R&D investment and progress towards commercialisation. To achieve this, 10 SMEs with relevant diagnostic technology were given £100,000 to support their research. They were partnered with a leading research organisation to undertake an objective driven research project. The project had the following objectives:

- Build upon London's strength and competitive advantage in digital health and MedTech supporting collaboration between diagnostic SMEs and partner organisations.

- Catalyse collaboration, promoting the transfer of knowledge and expertise across the life sciences ecosystem, with the aim of accelerating the commercialisation of innovations.

- Boost London's economic resilience by supporting the future growth of a key life sciences sub-sector and contributing to the national agenda to develop a resilient diagnostics sector.

- Improve health outcomes for Londoners by supporting diagnostic innovation and improvement. Addressing health inequalities and improving the health of under-represented communities.

1.3 Study Aims and Evaluation Approach

The specific aims of the evaluation are to:

- Undertake a robust assessment of whether the programme achieved its initial objectives or not, what has worked well and what has not, for whom and under what circumstances.

- Establish an understanding of the outputs achieved by the projects including jobs created, investment raised, and commercial progress achieved.

- Assess the effectiveness of the process of programme delivery including its management, administrative and delivery mechanisms, and its operational characteristics through an evaluation of the key stakeholder's feedback. Analysing how much impact these had upon the successful delivery of the projects.

- Evaluate potential strengths, impacts, and areas of improvement of the programme, using qualitative data from stakeholder feedback and quantitative measures where available.

Evaluation Approach

Upon completion of their projects each of the SMEs and Research Managers were asked to complete an End of Project Assessment. Eight of the nine SMEs and five research partners (out of nine) have completed these. The 72% response rate means that some intelligence is still outstanding and further work is required to ensure that all collaborative partners fulfil this contractual obligation.

The research team reviewed these reports and synthesised them with other stakeholder information from virtual interviews. The evaluator methodology involved a desk-based review and analysis of the qualitative and quantitative data contained within the End of Project Reports and interview transcripts.

2 Programme Management and Governance

This chapter outlines the management and governance of the Programme and outlines stakeholder & beneficiary feedback on this area.

2.1 Management & Governance Overview

The Programme was delivered by MedCity, under the backing of the Diagnostics Growth Hub and funded by the Local Enterprise Partnership for London. It built upon the existing collaborative links between the MedCity-led London COVID-19 Alliance, National Institute for Health and Care Research (NIHR), London IVD Co-operative and other research, commercial and strategic partners. The delivery team reported to the MedCity Board and the AHSC/N Executive.

The Programme outline and operational structures were scoped out by MedCity with continued dialogue with the GLA. They mapped out the different phases and how each element would be delivered. They then sought SME, research partner and previous MedCity programme leads input into the outline and timelines.

Partner Engagement

A Steering Group was established made up of representatives from MedCity's university partners, the British In Vitro Diagnostic Association (BIVDA), Cancer Research UK (CRUK), LifeArc and LEAP. The Steering Group shaped the design and development of the Programme. This process was also informed by the findings from a MedCity facilitated SME workshop.

LifeArc were a key partner who provided some supporting funding. They are a self-financing medical charity that support the development of early-stage life science innovation research. They have a specialist integrated diagnostic team who support SMEs that are developing diagnostic platforms and technologies. Initial scoping discussions with the MedCity team highlighted clear synergies with their Advise and Connect Programme (that providing SMEs with access to their network of partners and collaborators). These discussions led to LifeArc supporting C2NLDx through the provision of one hour of free advice to SMEs and the provision of £20,000 in match funding from the Innovation Award element of their Advise and Connect Programme.

Other research partners Guys & St. Thomas Trust, Roche Diagnostics, KCL, QMUL, UCL and the NIHR provided match funding in the form of resource in kind. These contributions successfully unlocked the GLA funding. CRUK were unable to provide this form of funding to the projects with their funding rules stipulating that funds or funding in kind must go to a research institution not to a commercial outfit. This stopped their further involvement in C2NLDx. Key partner feedback was positive, indicative of the strong ongoing relationships with MedCity. Efforts to recruit larger pharmaceutical firms as potential research partners were, except for Roche Diagnostics, unsuccessful.

2.2 Application Process

The application process involved two different stages. The first stage was an open call for initial applications where applicants outlined their technology/product, its application, impact, and the challenges that it is focused on addressing.

The SME applicant applied with an outline of who they wanted to engage with and what they required support with. The applicants outlined how a potential collaborative partner could support their product developments. MedCity then used their network and their partner's networks to matchmake the SME

with a research partner. An Expert Group, including partners from the Diagnostics Growth Hub, GLA and other partner representatives, supported the matchmaking process, informed the design process, and oversaw the application and selection process. 21 applications were received with ten initially selected. The Delivery Team stated that they were of varying quality, but many strong applications were received.

MedCity matched the applicants with appropriate potential partners with arrangements put in place to maintain confidentiality and IP protection. Once a potential suitable partnership was in place the application then proceeded to a second stage.

For this second stage the collaboration research teams had to formulate and submit a research proposal. This outlined how the challenge could be addressed/resolved within the 12-month timeframe improving diagnostic processes and technologies for major diseases with a focus upon better serving under-represented communities. This proposal was reviewed and scored against the Stage Two criteria by the Expert Group. All applicants had to have a novel collaboration partnership focused on a diagnostic technology involving a London based[18] SME with fewer than 250 employees and an annual turnover of less than £50 million. The applicants also had to demonstrate how their product could help meet a direct clinical outlining its potential impact and value for money.

2.3 Project Management Feedback

Strengths

The application process received frequent praise from the beneficiaries. They made positive comments about its simplicity and the support that was provided. The model, experience and expertise built up and developed over previous rounds of C2N allowed for an efficient and effective application process that resulted in several strong applications. Programme leads commented that the model and focus had been carefully thought out taking into consideration the opinions of the Expert Panel and previous MedCity Programme Leads.

"We worked around different opinions to try and find a balance. We were able to manage expectations to come to a shared opinion."

"I also reached out to previous MedCity workers to talk about the design phase – I wanted it to learn from previous programmes – I wanted to ensure that it didn't face the same issues".

Applications, decisions, and funding/bureaucratic systems were turned around and setup efficiently, freeing the SMEs and research partners up to make a prompt start to their collaborative research. As per previous C2N rounds, some frustration was again expressed with the slow pace of some university bureaucratic systems, but these continue to reflect the complex auditing and due diligence procedures they must undertake.

Stakeholders described most processes as relatively straightforward with MedCity regarded as an efficient, well organised, and agile institution that inspired confidence in beneficiaries and partners.

"The application process was relatively simple, and we had on-going support via check-ins."

"MedCity were agile in terms of making the projects happen within a short timescale."

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[18] Or with a London office that employs London residents

"It was a very straightforward process – things were excellent."

Respondents complimented MedCity with numerous positive references made to the support received, the relative simplicity of the application processes and programme management efficiencies. Frequent positive reference was also made to the support MedCity provided with sourcing research partners and reporting progress, issues, and impacts.

"I think MedCity were excellent. They were very diligent in following up and offering support."

"It really worked going through MedCity - they organised the funding, a company long list and different events. They brought us together with the startups and cross fertilisation across different groups."

Many respondents commented on the ongoing support and management provided by MedCity. Project progress monitoring steps were seen as helpful and not too onerous, providing clarity and actionable feedback to guide next steps.

"The Project Lead was always available to work things through and discuss. So very helpful"

"The ongoing support and management, including the kick-off, mid-point, and impact capture sessions, were not only insightful in monitoring progress but also instrumental in providing actionable feedback to guide our project towards success."

Respondents welcomed the constructive feedback they received with both strengths and areas for improvement analysed. Positive comments were also made about the level of communication throughout the project.

"Communication throughout the project was both effective and helpful, notably in facilitating discussions around intellectual property and laying the ground work for future collaboration with the research partner."

The disruption caused by the COVID-19 pandemic also impacted the Programme, resulting in a delayed start date. This was said to have impacted one participant's sample collection due to the reduction in patient clinic visits. However, due to the programme's flexibility this participant was able to adapt to the situation and implemented an altered approach to sample collection that reflected the constraints imposed by the pandemic.

Programme flexibility was regarded as a strength allowing collaborative groups to adapt to the logistical and practical difficulties created by the pandemic. Positive comparisons were made to other less flexible programmes. Wider programme flexibility also helped the Programme Lead to source and develop a variety of different match funding options.

Lessons Learnt
One beneficiary expressed concerns about the timeframe emphasising the constraints imposed by it only being twelve months and stating that they had found getting all work completed within that timeframe tough. They commented that they would have preferred a two-year timeframe.

Other comments were made regarding the programme timeframes. One beneficiary commented that they required more time than anticipated to recruit their patients to the project and that this had placed

significant pressure on project timescales. Another felt that the timescales made securing a collaborative partner challenging.

Beneficiary recommendations were largely focused upon increasing the opportunities for wider SME, partner, and network contact through MedCity organised events.

One beneficiary highlighted how funding process delays meant that they had to backfill salaries from their own financial resources. They emphasised how this potentially puts SMEs in a precarious position as their own funds were depleted as they awaited their award. This beneficiary would like to see more flexibility and administrative efficiencies from larger institutions with an improved understanding of the importance of cashflow to SMEs. A point that has been consistently raised within previous C2N evaluations.

The efforts made to recruit larger pharmaceutical firms to the Programme were, with the exception of Roche Diagnostics, unsuccessful. The feedback received inferred that large firms often run their own in-house collaborative programmes and that they therefore do not always look to work with third parties, such as MedCity, to facilitate collaborative work.

The incomplete feedback process, with one SME and five research partners not submitting end of project feedback, is an area that would need to be addressed for future programmes. Previous iterations have secured stronger response rates helped by the continued presence of a Programme Lead, with long established relationships and clear reporting structures/expectations to draw upon when pursuing feedback.

Case Study

Using AI Driven Screening Technology for the Early Diagnosis of Cardiovascular Disease

MultiplAI are a Cambridge and London based universal genomic screening company who are focused on developing RNA-based Artificial Intelligence cardiovascular disease screening technology. They were founded in 2021 by Dr. Charlie Luzzani, a molecular biologist and biotech specialist, Dr Santiago Miriuka, an experienced clinical cardiologist, laboratory director and data scientist, and Mark Ramondt an entrepreneur, investor, and advisor.

MultiplAI founders Dr. Muriuka, Dr. Luzzani and Mark Ramondt. MultiplAI's screening product focuses upon ensuring the early, cost-effective, and accurate diagnosis of cardiovascular diseases which are responsible for the deaths of nearly 18 million people every year. Early diagnosis significantly increases the chances of successful intervention through preventive measures and treatment. With around £1 in every £6 spent in UK healthcare related to combatting cardiovascular disease the potential health savings are also very significant.

As a pre-revenue recently created start-up MultiplAI are always seeking to extend their expertise, capacity and understanding through mutually beneficial collaborative partnerships. It is for these reasons that they applied for the C2NLDx Programme, seeking an academic collaboration that would provide vital external insights in how best to develop their algorithm product. They were particularly looking for a research partner that would help them to further develop their RNA sequencing analysis, providing them with knowledge development and help with scoping out potential future developments.

"Working with our field of genomics and AI you should always work with academia."

According to company co-founder Dr Miriuka, the application process was very efficient and straightforward. He found the MedCity team to be very helpful and highly professional, welcoming a matchmaking process that resulted in them being offered three potential collaborative partners.

"It was a very straightforward process – things were excellent. We have worked with them (MedCity) on various projects for a period of time and we will continue to work with them."

Once they had selected Queen Mary University of London (QMUL) researchers as the best fit as a collaborative partner (mainly because of their long-standing excellent reputation in cardiovascular research) their initial collaborative focus upon RNA sequencing soon evolved into a wider focus on both RNA and DNA sequencing. Dr
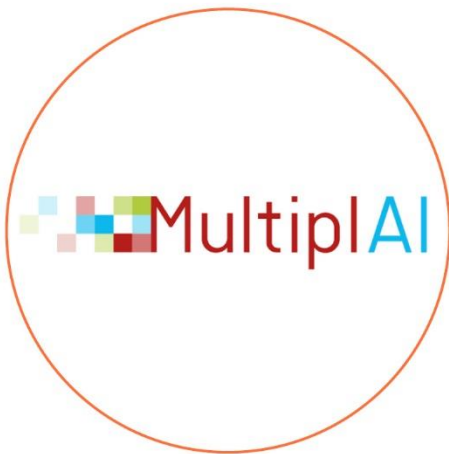
Miriuka credits this as particularly significant. Prices for both DNA and RNA samples are falling so MultiplAI are increasingly looking to focus on running both simultaneously.

"The cost of RNA/DNA has been prohibitive but sequencing prices are falling. We can foresee that we can run both samples as the prices have fallen from £1000 per sample to less than £100."

He credits their QMUL research partners with bringing particular expertise on how to decipher the relationship between RNA and DNA expression. He outlined how through the collaborative work MultiplAI have been able to bring both RNA and DNA sequencing work online, incorporating a new technology into their processes. He believes that this has helped to ensure that they are "on their way" to highlighting the molecular cardiovascular disease clues required for early diagnosis.

The potential medical impact of their technology is very significant with the long-term goal within the UK being the NHS using their product within their cardiovascular disease diagnostic processes. Dr Miriuka highlights the large impact this would have upon patients. Early diagnosis would facilitate the early efficacious treatment of tissue damage reducing the long-term impact of the disease and improving the quality of life and long-term survival chances of those with cardiovascular disease.

Dr Miriuka states that he was very satisfied with his experience of the C2NLDx Programme attributing the Programme with the creation of two full-time jobs and crediting the collaborative project as having a partial role in the successful securing of £13.2m in private investment.

"Overall, it was a very good experience we have gained a lot from this collaboration. We worked with an excellent QMUL team."

MultiplAI and QMUL collaborative work is continuing with further combined research projects planned with a focus on expanding their data pool and making further progress to the eventual commercial and clinical use of their product.

MultiplAI founders
Dr. Muriuka, Dr. Luzzani and
Mark Ramondt

3 Project Outputs, Impact, and Benefits

This chapter provides a summary of the outputs and outcomes delivered by the projects in terms of their scientific/academic and commercial impacts.

3.1 Output Overview

Outputs

Milestone/Outcome	Completion Date	Status
Contract and IP agreements between MedCity and SMEs	December 2021	9/9 CRP agreements completed
Contract and IP agreements between SMEs and collaboration partners	December 2021	9/9 CRP agreements completed
25 jobs created	Jan 2024	13.8 FTE equivalent jobs created
15 Indirect jobs created	Jan 2024	7 indirect jobs created
Programme design	July 2021	Completed 20/05/2021
Match funding secured	July 2021	All project agreements in place outlining match funding arrangements
Launch of applications for research collaboration programme	July 2021	Call launched 01/06/2021
Research collaborations launched	Dec 2021	10 launched in early 2022
Up to 10 SMEs receiving grant funding	Dec 2021	9/10 SMEs being supported and all agreements in place
Event one designed and organised	April 2022	Held 25/04/2022 with 56 attendees
Event two designed and organised	January 2023	Held 19/01/2023 with 95 attendees
Number of companies attending events = 100	April 2022	151 attendees in attendance over two events
Up to 10 collaborative meetings facilitated through partnering events	January 2023	See above.252 meetings took place during Event One and 424 during Event Two.

Source: MedCity, 2023

A survey of the research teams was conducted during 2023. When asked about the impact of the C2NLDx Programme, five respondents reported some form of continued collaboration would take place with their research partners in future. Other positive impacts included the generation of six IPs, the creation of 13.8 FTE equivalent roles and C2NLDx being cited as a significant contributing factor in the raising of £32.55m in further investment (see chart). C2NLDx has directly led to £524,000 of R&D spend and it will also be a significant contributing factor in an estimated £4.07m R&D spend by the beneficiary SMEs.
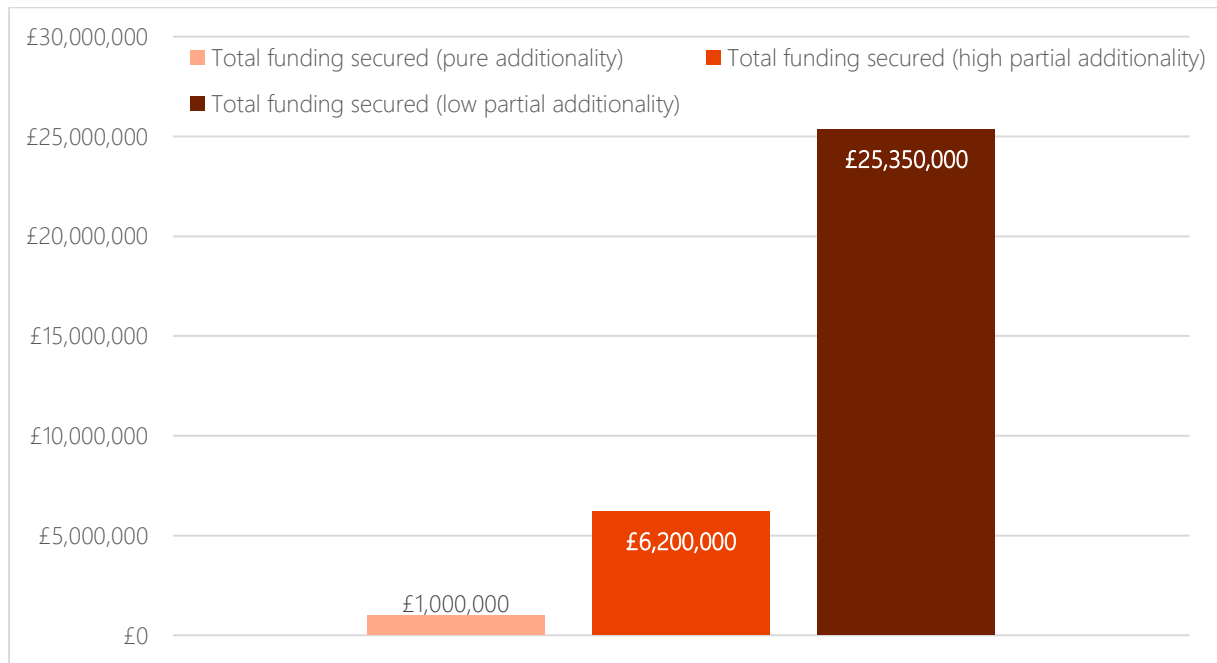
The following chart illustrates the impacts achieved (as of January 2024) As the following sections note, some of these impacts are yet to be fully realised.

Number of Projects Achieving the Following Impacts
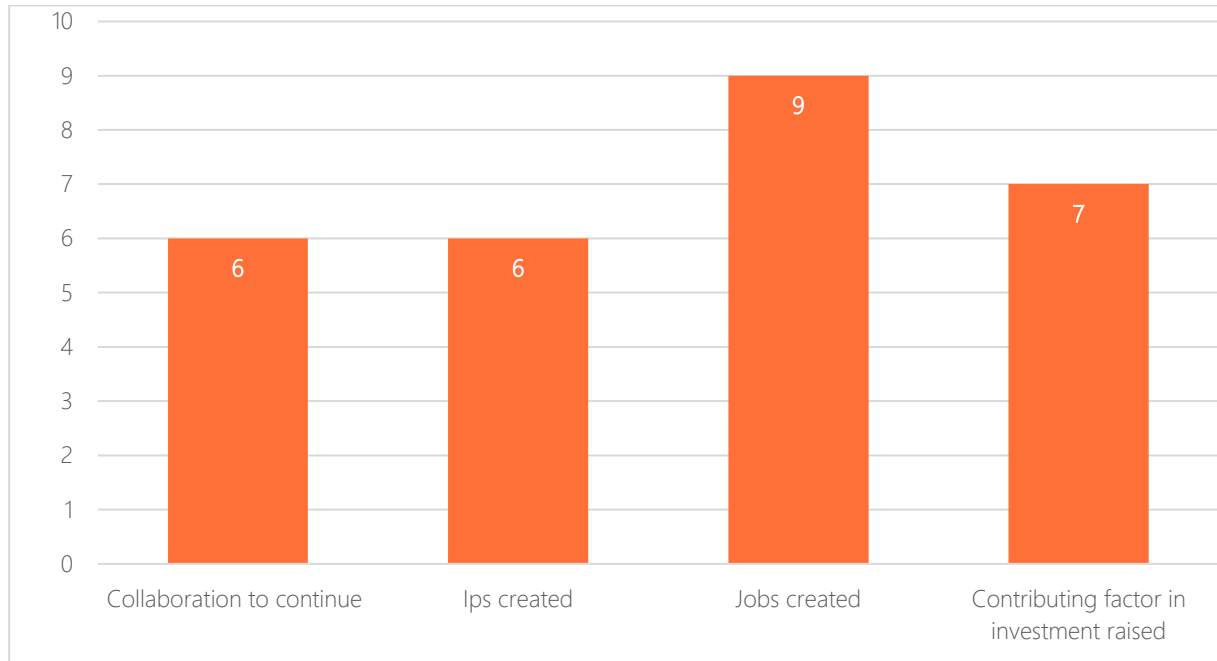
Investment Secured by Participant SMEs

3.2 Technological and Medical Impact

All nine C2N projects were successfully completed, with a wide variety of technological and medical impacts reported.

Project One supported research that is seeking to identify markers that will help to diagnose early-stage pancreatic cancer. The SME representative cited a "newfound proficiency in in distinguishing in distinguishing early cancer cases from noncancerous subjects" as a key outcome of the collaborative work with their initial ideas recognised and validated. They stated that the generation of unique molecular signatures from their RNA sequence data has "transformed" their initial findings into a tangible product that they believe will drive more cost-effective in vitro pancreatic cancer diagnostic tools.

The SME reported that the project had moved them closer to a" groundbreaking approach" to cancer diagnostics where the focus is on the analysis of immune responses rather than the traditional focus of detecting tumour activity. They believe that their product will identify early-stage cancer through blood tests bringing much early detection rates and higher chances of survival. They now plan to offer their algorithm-based services to a much wider customer base. In the long-term they believe that their product has the potential to significantly reduce healthcare costs, increase survival rates, enhance the quality of care, and reduce healthcare inequalities.

"Our contribution to the project has been pivotal in advancing the field of bioinformatics, particularly in the context of cancer diagnostics. C2NLDx changed the whole trajectory of our work."

"This achievement not only benefits our individual organisations but also sets a foundational precedent for larger-scale clinical validation and future developments in early cancer detection."

Project Two was focused on the further development of cancer models for testing immunotherapies *ex vivo*. The collaboration provided the SME with access to stem cell data. Their representative credited the niche expertise of their academic partner with helping them to develop their knowledge of how best to analyse this data for their research purposes. They have now been able to develop a prototype with the supporting data providing evidence required for validation, a breakthrough that they partially credit to the work undertaken during C2NLDx. With the immunotherapy market estimated to be worth £300 billion by 2026 they predict that in the long-term their product could bring significant savings for the NHS (up to £100,000 per patient).

"This has put us in a better position now as we have a prototype and supporting data evidence – it has shown that we can take a research project from the start to the end."

Project Three's primary focus was on the use of AI to support the process of using blood samples to help diagnose Alzheimer's and other forms of dementia. The collaboration was designed to help validate and refine the SMEs algorithms testing out their products and assumptions. The research partners' long established medical and commercial expertise also helped to refine their proposition, route to market and clinical pathway. The SME representative credited their research partner with assisting them in significant product development.

"We now know exactly what needs to be built. The full product definition validated with a potential user wouldn't have happened without the collaboration."

"Their (the research partners) engagement went well beyond the original C2N scope providing expertise, product validation, market analysis and help with fine-tuning our product development."

Project Four focused upon evaluating the SME's ophthalmology software within a clinical setting. Their product is designed to find the optimal point at which eye injections can be given to ensure maximum efficacy and reduce costs for one of the health services most in-demand services. The SME reported that C2NLDx provided them with credible baseline data on how it performs, a vital element of the regulatory process. This will now allow them to progress to the next stages of clinical trial.

"The whole purpose of this was to ensure our algorithm performs in a real-life setting. The feedback we received on what works and doesn't and what we might change was absolutely invaluable."

With widespread blindness incurring very significant associated health, health economics and social care costs the research partners highlighted the very significant potential impact of their product. They cited early diagnosis, reductions in social care costs, and huge health service time savings (they modelled 25% consultant capacity savings) as the key long term potential impacts of their product.

Project Five was focused on using AI to analyse RNA sequencing data to facilitate early non-invasive heart disease diagnosis. The preliminary data from the collaborative research is, according to the SME, helping to highlight the molecular clues for early diagnosis. They reported that the research undertaken has helped them to make progress toward the development of novel predictive biomarkers for early-stage heart disease. They also credit it with widening their scope from RNA analysis to also include DNA analysis.

"Academic collaboration makes you bigger and widens the brain/talent pool."

Project Six's primary research objective was to demonstrate that their AI-driven platform could effectively use detect early HCC liver cancer in high-risk populations using blood tests. At the time of writing, the SME had provided no project evaluation documentation to ascertain whether this had been achieved.

Project Seven looked at further developing the SME's technology for predicting patient responses to different kidney cancer treatments. C2NLDx funding allowed the SME to undertake their first expansion into kidney cancer having solely previously focused upon breast cancer. The SME reported that because of C2NLDx they were able to develop a 3D cell culture model (that they have now filed a patent for) meaning that they are moving closer to being able to test the efficacy of kidney cancer immunotherapy treatments. They are now proceeding on to a clinical study for predicting the response of different kidney cancer treatments.

The SME cites the transformative impact immune-oncology therapies upon life expectancy when emphasising the long-term potential impact of their product. They state that being able to ascertain the efficacy of these therapies on patients prior to treatments would limit the effects of drug toxicity and reduce costs down to a level where treatment can become significantly more widespread.

"Our kidney cancer technology is now our 2nd most advanced product (behind breast cancer). This project helped overcome funding challenges and technology risk by funding the second cancer in our R&D pipeline."

Project Eight concentrated upon health economic analysis of the SME'S precision dosing technology. They had identified this as a strategic focus for which they did not have the capacity or expertise to undertake internally. An economic evaluation of the SME's technology was undertaken in collaboration with the research partner. For the SME this was vitally important, improving their understanding of the potential clinical pathway for their product, building the economic evidence & cost/utility/impact analysis required for further clinical trials and developing a viable business case for its eventual potential introduction into clinical pathways.

"It (C2NLDx) has done its job. Through the pricing, cost, and business case analysis it has pump primed our research and shown how cost effective it is."

3.3 Collaborative Impact

C2NLDx respondents were very positive about the benefits of collaboration, a sentiment reflected by the fact that five out of the nine projects have plans to continue their collaborative work.

The SME involved in **Project One** talked of the invaluable clinical and biomedical insights provided by their research partner. They stated that their support and expertise was instrumental in their collecting, storing, and processing of blood samples and their identification of the early-stage pancreatic cancer markers. They also cited sample processing & analysis and laboratory & validation assistance provided as other examples of significant added value.

Mutual benefits were gained from the significant progress made in both research and clinical diagnostic methods. The SME representative concluded by stating that their first experience of academic collaboration had been transformative, reporting that it has played a significant role in the advancement of their technology and their recent securing of £3 million in private investment. They will now continue to collaborate with their academic partner, broadening their research to include other diseases associated with the pancreas and undertaking joint fundings bids.

"This has fundamentally transformed our approach to working with universities and research bodies."

"This experience has set a new standard for our future collaborations, making them more strategic, focused, and productive, ultimately driving innovation in our field."

The SME representative for **Project Two** described their research partners as very helpful, providing essential medical knowledge with regards to the clinical application of their product. They stated that their collaborators had provided new insights into the wide range of potential uses for their technology and provided support with overcoming the gap between technological development and medical application. They also valued the introductions they made to wider academic networks describing their relationship as strong and ongoing. Further collaboration is planned, with the SME believing that it will continue to provide niche clinical insights and access to key data.

"All the collaborators were very helpful – particularly with the medical knowledge – it has opened my eyes to the medical application of AI."

The collaborative partners involved in **Project Three** were very positive about the benefits that came from their partnership. The SME representative described it as an "amazing process" crediting the support, validation, and further credibility their research partner provided with having a very significant impact in their successful receipt of £3m in investment funding. They cited the access they had to their

Head of Business Development as particularly significant added value. They stated that their partner had gone above and beyond their original expectations, remaining fully engaged in their work even after the project's completion. For them, and the research partner, the collaboration was highly successful providing compelling evidence that the C2NLDx Programme was fulfilling its objective to pump prime early-stage research.

"(The support provided) was indicative of a highly refined support mechanism."

Project Four's SME reported that the direct feedback they had received from using their product in a real-life setting was very important in pump priming further research funding. They highlighted that their research partner had been very engaged in helping them to develop the most effective trial structure. The research partner's access to a large wealth of ethically approved live clinical information was also regarded as vitally important. The SME also recognised the credibility and reputation of their partner as a critical factor in allowing them to move their research forward and gaining wider research community attention. Continued collaboration is planned with the SME looking to continue data collection.

"Having them on board as a user of the system giving us very direct feedback on what works and doesn't work and what we might change was absolutely invaluable."

The SME representative for **Project Five** was positive about the benefits of collaboration, declaring that their experience had been very positive, crediting it with expanding their pool of knowledge and expertise. They stated that the project was mutually beneficial with the research partner gaining vital insights into the commercial application of their research and them receiving essential external validation for their processes. Both parties plan to continue their collaborative work.

"Overall, it was a very good experience we have gained a lot from this collaboration."

The collaborative partner for **Project Six** was positive about the experience stating that the SME had clearly benefitted from access to specialist staff and the advice/guidance that they had provided as part of their "highly refined support mechanisms".

Project Seven's collaborative partnership will continue beyond the life of C2NLDx, with both partners believing that a strong and mutually beneficial relationship had been established. The SME credited their research partners with providing vital support as they moved into the field of kidney cancer diagnosis for the first time. The academic partner cited the important learning that came from working with a commercial partner in the early stage of their clinical application trials. They will now collaborate on a subsequent clinical study looking to demonstrate whether the product can predict patient response to treatment.

"The support connected us with a long-term collaborative partner and helped fund the initial development of our technology for kidney cancer."

"This was the first collaboration with an SME for the department, it has improved our understanding of the benefits of working with SMEs and as it has been positive it will support future partnerships."

The SME involved in **Project Eight** described their research partner's collaborative support as a vital aspect of their ongoing development towards product commercialisation. They stated that engaging

them was a key milestone which had gone very well, described the partner as "very engaged in ensuring that they got the right outcomes". This positivity was shared by the research partner who described the collaboration as very fruitful citing the consequence model they jointly built as a tangible example of partnership working. They also cited the provenance of the live patient data and the direct feedback from senior clinical staff on the potential application of their product as crucial pieces of added value. The research partner cited evidence of the commercial impact of their expertise as particularly important.

"We now have a better understanding of the benefits of collaborating with a university or research organisations."

"Their evidence base (the SME) has been moved on – they are now able to continue with their progress and I hope we continue to collaborate because they have the possibility of eventual implementation."

3.4 Impact Upon Under-Represented Groups

This was a GLA strategic focus for the Programme. The COVID-19 Pandemic not only highlighted the disproportionate effect that certain diseases and conditions have upon BAME communities but that many groups are significantly unrepresented with diagnostic data. Only one project made direct reference to this project objective within their feedback.

Project Five aimed to partially address this issue by focusing upon the predictive value of the SME's diagnostic tool when looking at the cardiovascular disease in the British South Asian community. Despite initial difficulties recruiting sample patients, a four-month extension allowed them to create a dataset for 180 British South-Asian participants to analyse their genetic risk of developing cardio-vascular disease with increased accuracy.

3.5 Commercial and Wider Impacts

Across the nine completed projects an average of 1.29 Technology Readiness Level steps were taken toward eventual commercialisation (please see Appendix Two). SME representatives cited a wide range of impacts from their collaboration partnerships that had a positive impact upon their progress toward the eventual commercialisation of their products. These included provision of clinical data, external product and commercial process validation, cost analysis, specialist laboratory access & support, clinical pathway mapping, long-term impact analysis, the creation of adverse drug databases, and numerous examples of significant technology & knowledge transfer.

The organisation of networking events by MedCity was also recognised as an important piece of added value. SMEs cited these as an invaluable means of connecting with IP specialists, potential research/collaborative partners, and service providers.

"The regular talks and networking events within the MedCity community have been highly beneficial, offering ongoing support and connections vital for our continued development."

Many SME representatives believed that these impacts highlighted how successful the Programme had been in meeting its primary objective of pump priming early-stage research projects to the stage where they could successfully apply for further funding. This is highlighted by the raising of £32.55m in further investment by the partner SMEs, with representatives regularly crediting C2NLDx as a significant factor in the securing of all these funds. They cited the partial de-risking of innovation and collaborative work as a particularly important factor. Representatives also credited their involvement in C2NLDx with

improving their market knowledge and how best to attracting investors, seeing them as important ways to improve their cost effectiveness and value & investment proposition.

"The (C2NLDx) Programme has been instrumental in fostering new commercial partnerships. These represent significant commercialisation demonstrating the project's impact beyond the research phase."

"C2NLDx has delivered much more. It led to valuable new partnerships, advanced our bioinformatics capabilities, and opened doors to global collaborations. These achievements surpassed our initial goals, making a substantial impact in our field.

3.6 Job Created/Safeguarded, IP Generation and Investment Secured

The creation of 13.8 jobs (FTE equivalent) were reported as a direct result of the Programme.

Jobs Created by Project

Project Number	Jobs Created
One	1
Two	1.5
Three	1
Four	1
Five	2
Six	2.3
Seven	3
Eight	1
Nine	1
Ten	0
Total	**13.8**

Source: Kada Analysis, January to December 2023 (n=9)

Six projects reported that intellectual property measures have be taken because of the work undertaken during the C2N projects.

Case Study

Using AI Bioinformatics and Sequencing to Develop Effective Early Diagnostics Tools for Pancreatic Cancer

BioMavericks®

BioMavericks are a bioinformatics start up that were created in 2021 in London by Andrew Guo. Their work focuses upon the development of bioinformation and sequencing AI tools that assist with cancer screening and monitoring.

Andrew is a biologist who has spent over ten years working in cancer research, developmental biology, and immunology. He undertook his undergraduate degree at Hongqiao University in China before undertaken a Masters in Cancer Research and Molecular Biomedicine at the University of Manchester. Following this, he completed a PHD in Molecular Developmental Biology at the University of Hong Kong and a post doctorate position at Cambridge University before setting up BioMavericks.

As a diagnostic start up, BioMavericks became involved in the Collaborate to Innovate: London Diagnostics Programme because they recognised they needed innovation support from a prestigious academic institution to help further their research. Andrew describes this first-time collaboration with University College London as a transformative experience for both him and BioMavericks. By the end of their collaboration, they had not only received recognition and external validation of their original ideas, but they had also developed a unique set of molecular signatures from their RNA-sequence data, signatures that can now be used to help differentiate between early-stage pancreatic cancer and non-cancerous conditions.

For Andrew the full C2NLDx experience was very positive, outlining the application & selection process, continued constructive feedback, ongoing support & management and assistance with intellectual property matters as evidence of MedCity's professional and supportive role.

"The project kick-off, mid-point, and impact capture sessions, were not only insightful in monitoring progress but also instrumental in providing actionable feedback to guide our project towards success."

Like many biotech start-ups, BioMavericks wanted to develop their market knowledge in order to attract investors, but they were restricted by limited funding and capacity. Andrew credits CN2LD, alongside other programmes they participated in, with developing their market understanding providing crucial commercial development insights into the clinical and commercial application of their product.

Andrew cites attendance at C2NLDx networking events as another example of very significant added value for BioMavericks. He outlines how they provided invaluable opportunities to interact and connect with IP lawyers, potential collaborators, service & product providers and other parts of the life science and diagnostic network. In terms of research progress, BioMavericks C2NLDx collaboration with University College London academics led to the identification of the cancer specific molecular signatures. Andrew emphasises how this constitutes a very significant scientific success with these signatures now being able to assist with the crucial early detection of pancreatic cancers. Andrew
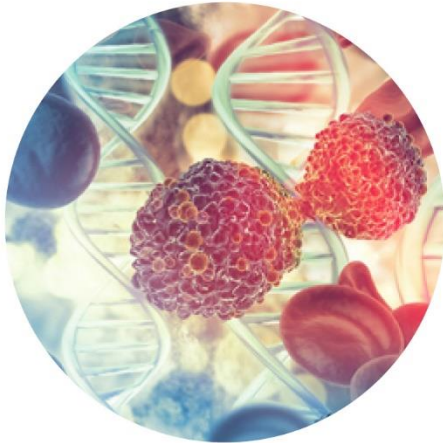
believes that this breakthrough has the long-term potential to greatly improve survival rates for one of the deadliest forms of cancer. He also states that a shift to blood test diagnostics will significantly lower annual diagnostic costs potential reducing the cost from £6,500 per patient to £150 per patient. Andrew also credits CN2LDx with helping to foster a series of new commercial partnerships, stating that the Programme played a significant role in BioMavericks successful obtaining of £3,000,000 in private investment and a large grant from Innovate UK. Through attendance at a MedCity networking event they established a connection with Discovery Park, a Kent based life science park and this link has led to ongoing business support. Attendance at these events also established a connection with NHS Trust East Kent who they are now collaborating with on joint clinical trials.

"C2NLDx has also paved the way for other collaborations with other NHS Trusts, opening doors to new opportunities and partnerships. These engagements and collaborations are significant steps forward, building on the momentum and success of the project."

Andrew states that UCL's role in the collaboration project was instrumental in their recent research and commercial progress providing collection, storing, processing and analytical expertise that they did not possess. He argues that without their contribution they would not have been able to generate the substantial clinical insights that they did. For him the project has now created the foundation for larger scale clinical validation of their product and further, exciting, developments in cost-effective early cancer detection.

There are plans in place for further collaboration with two joint grant applications recently submitted. These outline plans for a continued focus upon using AI-driven algorithms and blood RNA-seq data to develop early pancreatic cancer diagnosis. Andrew believes that these projects will further streamline biomarker discovery making it increasingly accurate and user-friendly. Alongside this work BioMavericks will continue to pursue further academic and research collaborations hoping that they will be as fruitful as their C2NLDx experience.

"The support from C2NLDx significantly exceeded our expectations. We aimed to improve our diagnostic tools, but it delivered much more. It led to valuable new partnerships with universities and healthcare organizations, advanced our bioinformatics capabilities, and opened doors to global collaborations."

4 Economic Impacts

This Chapter looks at the collective outcomes and economic impacts, and value for money for the London Economic Action Partnership funded C2N: London Diagnostics Programme.

4.1 Overview

The chapter assesses the employment and R&D related gross value added (GVA) of the Programme and the extent to which it is making a difference compared to if the intervention had not been implemented. The analysis is based upon reported outputs and responses to the surveys that have been carried out as part of this evaluation by SMEs.

4.2 Approach

A comprehensive assessment of economic impact was undertaken comprising:

- Direct and Indirect Employment: Employment impacts and resultant GVA from jobs created.

- Investment: The effect of investment income (added turnover) on regional GVA.

The Magenta Government guidance on evaluations offers some suggested guidelines in assessing the true impact of interventions. In line with these, several steps have been taken to assess gross and net GVA of employment impacts and further investment secured:

- The number of jobs created to date and the expected indirect number of jobs created used in the model are based on beneficiary responses.

- Investment spend was calculated based on funding received across all SME beneficiaries. These were broken down by level of additionality (low partial, pure and high partial additionality). These were then changed to gross GVA figures by multiplying by 0.4.

- A regional composite UK employment multiplier was used at 1.51 for Business Development & Competitiveness to calculate indirect employment effects/investment spend (from ONS).

- Estimates for GVA per FTE were calculated using the BRES (The Business Register and Employment Survey) and the ONS (Office for National Statistics), for London.

- The persistence of the benefits was calculated i.e., how many years the benefits are expected to persist and the period over which benefits will accrue until they reach their full potential. In this instance, a modest five-year time frame was chosen based on experience elsewhere. No persistence was calculated for investments accrued as these were a one-off sum.

- A decay of 10% per annum has been used over a five-year period i.e., the proportion of annual benefits expected to be lost from one year to the next due to economic changes, other investment decisions etc. No decay was calculated for investments.

- Calculation of Net Present Value (NPV) of the GVA benefits over a 5-year persistence time period taking account of discounting. Discounting by 3.5% to determine NPV has been recommended by Central Government's guidance on evaluation. NPV was not calculated for R&D investment.

- Gross GVA to Net GVA was calculated for employment and investments considering multipliers of assumptions for deadweight, displacement, and leakage. For employment, these were the same as above. For low partial additionality, deadweight was assumed at 80%, displacement at 29.3% and 11.5% leakage. For high partial additionality, deadweight was assumed at 25%, displacement and leakage were assumed the at the same rate. For pure additionality, no deadweight was assumed,

and displacement and leakage were assumed at the same rate. Additionality levels were based upon the SME end of project responses.

In addition, steps were taken to calculate the national additionality that came from the interventions:

* Gross Investment to Net Investment was calculated considering multipliers of assumptions for deadweight, displacement, and leakage. For low partial additionality, deadweight was assumed at 80%, displacement at 29.3% and 11.5% leakage. For high partial additionality, deadweight was assumed at 25%, displacement and leakage were assumed the at the same rate. For pure additionality, no deadweight was assumed. Displacement was assumed at 29.3% using BEIS guidance for Business Development & Competitiveness programmes. Leakage was only applied for investment where the participant SME has a significant presence in another country.

* Investment was then converted to GVA using a PWC metric.

* With all the participant firms engaged in pre-revenue early-stage research it was assumed that 100% of investment would be spent upon R&D activity.

4.3 Headline Economic Impacts and Value for Money

The following table shows that the Programme has **created 21 gross FTE jobs** (14 direct and 7 indirect) and a **total NPV GVA from employment of £2.44m**. In addition, a **further £4.1m of NPV GVA** for the regional economy is estimated due to further investment secured by C2NLDx projects. The estimated **combined GVA of £6.54m** would result in a **cost benefit ratio (CBR) of 1:5.03** i.e., each £1 of public investment will generate £5.03. This is a higher return than what might be expected for this kind of initiative. For instance, a review by CRESR of evidence for R&D support cites a CBR of 1:1.8 to 1:2.5. An **estimated NPV GVA of £3.5m** was added to the national economy because of R&D investment that resulted from SME participation in C2NLDx.

The total **cost per business assisted is £144,444** and the **cost per gross job generated is £61,495.** The cost per business assisted at £144,444 is at the very high end expected for business activity which ranges from £4,700 lower quartile to £10,000 (median) and £34,000 (mean)[19]. That said, the guidance does note that *"however, much higher unit costs can be used if the intention is for a smaller number of higher rates of support"*. The cost per gross job generated is also at the higher end expected for this kind of activity which varies from £12,000 (lower quartile) to £26,000 (median) and £71,000 (mean)[20].

Estimated Employment Impacts

	Gross Jobs	Net Jobs	Net GVA	NPV Over 5 years
Operations	21	9	£622,520	£2,444,491
Direct Jobs	14	6	£412,265	£1,589,273
Indirect Jobs	7	3	£210,255	£855,218

Source: Kada Analysis, 2023

Estimated Regional GVA Additional Impacts as a Consequence of Secured Further Investment

	Net GVA	NPV GVA Over 5 Years
Investment Secured Total	£4,079,077	£4,079,077
Investment Secured (pure additionality)	£382,190	£382,190
Investment Secured (high additionality)	£1,777,184	£1,777,184
Investment Secured (low additionality)	£1,937,704	£1,937,704

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[19] Regeneris Consulting (2013). 'England ERDF Programme 2014-20: Output Unit Costs and Definitions, A Final Report'. Available here.
[20] Ibid.

Estimated Combined GVA (Employment and Further Investment)

	Net GVA	NPV GVA
Total	**£4,719,598**	**£6,541,569**
Operations	£412,265	£2,444,491
Investment Secured	£4,079,077	£4,079,077

Estimated National GVA Additional Impacts as a Consequence of R&D Investment

	Net Investment	Investment to GVA	NPV GVA
Investment Secured Total	**£7,579,040**	**£4,547,424**	**£3,501,516**
Investment Secured (pure additionality)	£707,000	£424,200	£326,634
Investment Secured (high additionality)	£3,287,550	£1,972,630	£1,518,925
Investment Secured (low additionality)	£3,584,490	£2,150,794	£1,656,111

5 Conclusions and Recommendations

This final chapter briefly summaries how the Programme has performed against its objectives and highlights some emerging lessons for MedCity, similar projects, and policy makers. Lastly, potential improvements are considered.

5.1 Programme Successes

In reference to many of its principal objectives, C2NLDx produced a series of notable successes. The administration and delivery of the project were widely regarded as successful with the straightforward and efficient process seen as a real strength of the Programme. C2NLDx was able to build upon the foundations created under previous C2N projects utilising MedCity's network and strong relationships to attract a wide range of applicants and partner organisations. It was also recognised as an egalitarian funding opportunity where small SMEs have a means of access vital funding for early-stage research.

The MedCity leads worked closely with established partners, such as the long-standing university partners Kings College London, University College London, Queen Mary University of London, and Imperial College, to support SMEs. Partner organisations and previous programme leads were also involved in the design process ensuring that it was built upon key previous learning.

A range of collaborations were initiated with seed funding successfully deployed to support and progress numerous diagnostic research areas including, oncology, cardiovascular and infectious disease. Innovative activity was supported and catalysed with significant knowledge transfer and commercial & medical progress achieved. Job creation was also a clear outcome of this activity. The sharing of expertise will make an ongoing contribution to London's internationally recognised life science, digital health and MedTech sector.

MedCity's effective navigation of London's dynamic and interconnected life science and diagnostics ecosystem facilitated an efficient and effective matchmaking process. For instance, the partner universities have a long track record of supporting C2N projects and the experience and expertise provide very significant added value to SMEs. Beneficiaries and stakeholder agreed that the collaborative work demonstrates clear impact generating very important impacts for the scientific and healthcare sectors. They also provide clear evidence that the Programme helps to pump prime early research work and secure further investment.

The simple, straightforward, and efficient application process was a real strength of the programme. The administrative and flexible management processes were praised by participants, once again supporting project delivery and research progress. Regular check-ins were supplemented with a six-month reviews and networking events. Due to the impact of the COVID-19 outbreak and ensuing lockdowns the Programme began virtually with effective partnership work ensuring effective initiation and delivery under difficult circumstances.

Programme flexibility facilitated a dynamic approach to funding, with match funding gained from a variety of sources. The allowance of in-kind funding as a match funding source was regarded as a particularly significant piece of flexibility that supported the viability of many individual projects.

The application, decision-making and implementation processes were smoothed by the strong relationships, expertise and experience built during proceeding iterations of C2N. It was also once again supported by the presence of an experienced and well-respected programme lead.

Two highly successful networking events more than fulfilled the Programme's strategic target focused upon delivering events to support more companies. During these events SMEs were able to interact with potential partners (including larger pharmaceutical firms and professional services) sharing their ideas, building contacts and sourcing advice & guidance. As the table in Section 3.1 outlines, 151 attendees were attracted to the events with beneficiaries reporting back that they provided an excellent development opportunities and support. The second event widened the pool of beneficiaries incorporating C2N's Stroke Therapies and London Advanced Therapies cohorts. It attracted corporate sponsorship, and this funding facilitated a wide range of activities including presentations and a central networking area where all attendees could interact sharing ideas, best practice, research findings and source guidance.

As the report demonstrates, significant improvements in research and commercial understanding were achieved across the suite of projects. At the time of writing, a range of impacts and clear additionality have already been achieved partially, largely, or completely because of the Programme:

- 13.8 FTE equivalent direct jobs have been created because of research progress achieved.
- 5/9 of the collaborative projects are set to be deepened with plans for future collaborative work.
- £1,000,000 in funding has been secured by SMEs solely because of the work undertaken in their C2NLDx project (pure additionality).
- £3,200,000 in funding has been secured by SMEs largely because of the work undertaken in their C2NLDx project (high additionality).
- £25,350,000 in funding has been secured by SMEs partially because of the work undertaken in their C2NLDx project (partial additionality).
- Research progress achieved across 100% of projects with an average of 1.16 Technology Readiness Levels steps taken per project.
- Six IPs established by SMEs because of the work undertaken during their projects.
- An average of 1.29 TRL steps taken per project.
- A cost per job of £61,495.
- A CBR of 1:5.03.

5.2 Lessons Learnt

As per previous C2N programmes, the ongoing efficient management of the Programme relied heavily upon MedCity utilising their strong relationships and understanding of partners' & beneficiaries' pressures and contexts to ensure that delivery and reporting milestones were met. Ongoing dialogue ensured that projects remained on track, issues were flagged early, and effective solutions implemented. Effective solutions were found when, in two cases, project partners had to pull out.

MedCity continue to play a vitally important facilitation role within the life science and diagnostics ecosystem. Their experienced and pro-active central operational/delivery teams have an excellent combination of strong links with both SMEs and research partners and a unique understanding of the complexities of inter-institutional work. The presence of a MedCity member of staff in a central facilitation role is a central factor in the success of their Programmes.

Some difficulties were experienced when trying to recruit new collaboration partners to the Programme. Attempts to engage larger pharmaceutical firms proved to be challenging, often as they had their own differing strategic objectives that did not align with the Programme's and their own in-house collaborative programmes. An attempt to involve Cancer Research UK as a research partner was also unsuccessful because of their stipulation that supporting funds had to go to a research institution rather than a commercial organisation.

Although the Programme was praised for its flexibility, funding timelines did restrict some activity. Extensions were welcome as limited funding and short timescales were regarded by some respondents as limiting factors on the amount of tangible quantitative impacts that could be delivered.

Stakeholders acknowledged that the requirement for 50% match funding before GLA funds were realised put the Programme at risk whilst funds were found. Creative solutions, such as funding in kind, meant that it was able to go ahead but this process was recognised as challenging.

There was only limited evidence of a concerted focus on under-represented groups with only two projects making explicit reference to this objective. Short recruitment windows for patients willing to work on project trials meant that more diverse groups were not recruited in the numbers originally hoped. As a key Programme objective, it needed to be hardwired into the application scoring process, reporting structures, feedback, and update agendas to ensure that project leads maintained an ongoing focus upon it.

Gaining comprehensive feedback from collaborative partners was challenging, with many citing high workload and clinical priorities as reasons for not being able to provide detailed information. Four collaborative partners and one SME did not provide an end of project summary for this report.

5.3 Recommendations

The programme team may wish to consider the following improvements for any future iterations of C2N and/or diagnostic, SME support projects:

Strategic Recommendations

I.   Use the suite of C2N evaluations to emphasise the unique and vitally important facilitation and catalysing role that MedCity plays within a very complex ecosystem.[21]

II.   Continue to scope out other potential health sectors where MedCity's model would be applicable. Develop proposals that emphasise that MedCity's best practice models have a strong track record of facilitating excellent effective collaborations and achieving significant commercial, scientific, and medical impacts.

III.   Undertake a mapping exercise to identify potential future strategic partners best suited to mutually benefit from access to MedCity's networks, expertise, and experience. This process should also identify the opportunities presented by access to L&Ps wider network.

Funding Recommendations

I.   Continue to allow for the use of funding in kind as a match funding source.

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[21] For instance, the economic and scientific impact, scientific excellence, industrial & stakeholder relevance, and strong value for money clearly evidenced in evaluations provides an excellent foundation for a BBRSC funding bid.

II.   Establishing a base fund that is not reliant upon match funding for its release will bring increased programme security and stability.

III.   Build a collaboration of public and commercial partners to explore opportunities presented by post ERDF funding pots such as the Devolved Investment Funds and UKSPF. This Steering Group could also look at innovative methods for gaining access to MRC and UKRI funding pots that reflect the fact that MedCity is neither a commercial enterprise nor a research organisation.

Commercial, Clinical and Technological Impact Recommendations

I.   Scope out the feasibility of running programmes over two-years thus providing further opportunities for the securing and embedding of impact/commercial & research progress.

II.   Undertake a consultation exercise with potential large commercial partners to investigate barriers to future involvement and scope out solutions. Other life science programmes, such as the University of Cambridge's iDMT, have successfully recruited large pharmaceutical representation to their steering groups.

III.   Disseminate the significant programme impacts to key partners, larger companies, and potential investors through MedCity's wide network.

IV.   Formalise wider socio-economic and medical impact targets into all programme documentation and reporting requirements to ensure a continued focus on key strategic objectives.

Administrative Recommendations

I.   Mitigate the disruptive impact of staff turnover within SMEs, research partners and the Delivery Team by scheduling transition meetings and, where possible, schedule some role shadowing.

II.   Ensure the continued presence of an experienced and pro-active central operational/delivery manager with strong links with participant research partners and an understanding of the complexities of inter-institutional work.

III.   The continued involvement of previous C2N leads and project partners within design processes ensures iterative improvements to administrative and governance processes.

IV.   Schedule an ongoing programme of administrative check-ins between the Delivery Team, SMEs, and collaborative partners to ensure contractual/reporting requirements/deadlines are met.

6 Appendix One – Project Overview

Name	SME	Research partner	Project description
C2N Project One	BioMavericks	UCL	Developing profiles for early-stage pancreatic cancer by single-cell analysis
C2N Project Two	Curenetics	KCL	GVHD Immuno-Predict: Using AI to predict the development of graft versus host disease
C2N Project Three	ILoF	Roche	Blood based optical diagnosis of Alzheimer's disease and other dementias
C2N Project Four	Macusoft	Guys & St Thomas' Trust	Validating the design and implementation of Macusoft AI Clinical Decision Support Software (called MacuSense) for the management of DMO, RVO and AMD.
C2N Project Five	MultipliAI	QMUL	AI tool for cardiovascular risk using polygenic and transcriptomic profiling
C2N Project Six	Mursla	Roche	Demonstrate that Mursla's blood test can detect early HCC in high-risk (mostly cirrhotic) population better than current standard of care (Ultrasound and/or alpha fetoprotein test)
C2N Project Seven	Pear Bio	UCL	Developing a diagnostic test that helps oncologists identify potential treatment options for cancer patients.
C2N Project Eight	Vesynta	NIHR	Health economics of precision dosing innovation
C2N Project Nine	Vatic	KCL	Next Generation Diagnostic Devices for the Detection of Viral Infectivity. SME left the Programme following a takeover, Project completed by KCL.

7 Appendix Two – Technology Readiness Impact

Name	TRL Prior	TRL Post	TRL Increase
One	TRL 3 - Proof of concept	TRL 4 – Initial testing of product or service	One stage
Two	TRL 2 – Applied research of product or service	TRL 3 – Proof of concept	One stage
Three	TRL 5 – Full testing of product or service	TRL 7 – Product or service demonstrated	Two stages
Four	TRL 3 – Proof of concept	TRL 4 – Initial testing of product or service	One stage
Five	TRL 6 – Product or service verified	TRL 7 – Product or service demonstrated	One stage
Six	Not disclosed	Not disclosed	Not disclosed
Seven	TRL 2 – Applied research of product or service	TRL 4 – Initial testing of product or service	Two stages
Eight	TRL 3 - Proof of concept	TRL 4 – Initial testing of product or service	One stage
Nine	Not disclosed	Not disclosed	
Average			1.29 stages

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