Health Innovation Manchester: Origins, Formalization, Operation

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Executive Summary

Aims of the Study

1. This study of Health Innovation Manchester is exploratory. It focuses upon the creation of Health Innovation Manchester in 2015, how it developed, achieved a formal structure and has subsequently operated.

2. The study is probably the first examination of the earliest implementation of the Academic Health Science System (AHSS) concept in the UK, and certainly the first at scale. The study contributes answers to two important questions: a) *how has Health Innovation Manchester supported innovation of health and social care in the context of the delivery of Devo-Manc*[1]*? b)* what value might the *AHSS concept have in supporting innovation in health and social care?*

3. The study explores the development of Health Innovation Manchester as an innovation actor in local, regional, and national health and social care systems. The study is not an evaluation in a formal sense, but an enquiry into the implementation an innovation concept in an important context.

4. The study seeks to uncover how identity and purpose have emerged, how functions have been acquired and developed. In the final section on the operation of Health Innovation Manchester, an account of its operation is presented, following which we provide analysis and conclusions.

5. The method for the generation of evidence from various forms of research data (interview, documents, presentations, web pages, research references) was to focus upon *capability acquisition*, over the course of three phases of Health Innovation Manchester's development. We term those phases, *origins*, *formalization*, and *operation*.

6. Interviews were provided to the Study Team by members of staff of Health Innovation Manchester under guarantee of anonymity. The study was carried out in compliance with the University of Manchester's policies on Research Governance, Ethics and Integrity. The study received the required consent from the University's Ethical Review Panel.

7. A review of literature has provided the study team with a broad understanding based on a set of prior expectations and comprises a set of concepts or prior *codes* for the collation and interpretation of responses from our fieldwork. Our

[1] 'Devo-Manc' so-called is a major change in governance of health and social care in terms of enhancing local responsibility for the management and operation of these two services, and significant change in that these two services are brought together within a common system of provision.

approach is also open to the discovery of regularities through inductive coding of our research data. Where responses were outside the coding system identified in the literature, we inductively coded from the individual [and therefore organisational] accounts of capability acquisition to identify novel forms of capability and related features of the interviewees' experiences.

Main Conclusions

Implementing an AHSS

8. In the UK, the AHSS approach has been considered particularly appropriate for those parts of the country which have led the way in terms of the implementation of devolved services through integrated care systems. The use of such systems across the country by 2021 is an objective of the NHS Long Term Plan (NHS England, 2019b) with Greater Manchester's implementation being an early example through the *devolution deal*. The form of operation adopted for Health Innovation Manchester therefore reflects this model:

> 'The Solution
>
> *An **academic health science system** [Study Team emphasis] tackles this problem by creating a 'Discovery Care Continuum' in a health economy to provide a smooth and integrated pathway from discovery science and innovation through experimental medicine and clinical research, to reliable consistent adoption and diffusion. A feedback loop will create a virtuous cycle so that the learning on each point on the pathway inform (sic) further refinement in research, innovation and implementation. Success with drive both economic benefits across the region and beyond.'*
>
> (Greater Manchester Combined Authority & Health Innovation Manchester, 2015, pages 4-5)

9. Our view is that the AHSS has not been a readily implementable concept although it is undoubtedly useful. A small academic / policy literature rightly outlines the AHSS as an evolving model with some limited examples of successful implementation but none that match the GM context. Indeed, there is significant ambiguity in the concept itself, which makes implementation of it an exercise in serendipitous learning by doing. A key paper outlining the AHSS concept by V.J. Dzau et al. (2010) does not help to clarify what organisational status an AHSS might have. Further comments by the authors V.J. Dzau et al. (2010) create uncertainty over the status, functions, and limits of an AHSS and lead to the question of whether the system is an *innovation model* for an organisation, a system within a system, or should be a system in its own right:

> 'Ultimately, human health is the most important outcome, and AHSSs should be held accountable for the health of the populations they serve,

both locally and globally' and 'Ideally, such vertically integrated AHSSs could evolve into accountable care organisations that are financially responsible for the health of the populations they serve'.

(V.J. Dzau et al., 2010, p. 951 and ff)

10. Over the first year of its existence, attempts to operationalize Health Innovation Manchester as 'banner' and 'system' did not fully meet with the success intended. In addition to the fact that there was no clear functional form for it, two further factors hampered implementation. Key elements of the innovation eco-system lay under the control of different organisations, with the Academic Health Science Network (AHSN) located within the Salford Foundation Trust, and other key resources residing elsewhere, particularly within the Central Manchester Foundation Trust (later Manchester Foundation Trust ['MFT']. This period also saw preparation for major changes to the organisations which hosted the key elements of the innovation eco-system. These developments were part of the reorganisation and rationalization of the resources of the Greater Manchester Health and Social Care Partnership ['the Partnership']. This reorganisation would lead in the autumn of 2017 to the formation of the Manchester Foundation Trust from the Central Manchester Foundation Trust which had existed since 2009 (and which had run six hospitals, but which now as of early 2021 runs 11[2]), while in the winter of 2017, a reorganisation of the Salford NHS Foundation Trust and the Pennine Acute Hospitals NHS Trust was undertaken.

11. We note that the difficulties experienced in attempting to establish a new approach to innovation – here based on a novel model referred to as an Academic Health Science System – are not untypical of the challenges that organisational innovators face in trying to find the right model (flexible yet structured) to approach highly complex social and economic landscapes.

12. The model adopted sees Health Innovation Manchester emerging as organisational catalyst for the NHS qua *delivery* system (locally) to become an *innovation* system (mainly of course within the confines of the Greater Manchester Health and Social Care Partnership). To use the terminology of the AHSS literature, and of the paper written in (2010) in particular, the creation of Health Innovation Manchester as an organisation may be the catalyst turning the Partnership into a Health and Social Care Innovation System (which we term an HESCIS), although we believe that it is more helpful analytically, and practically, to consider *delivery* and *innovation* as separate and overlapping systems.

[2] MRI, Wythenshawe, R.M. Children's, Eye Hospital, St Mary's, Dental, Altrincham, Trafford, Withington, North Manchester, the Nightingale.

Learning by Doing

13. The departure of the first chief executive in the middle of May 2016 was followed by a realization amongst the Board of Health Innovation Manchester of the need to find a suitable means with which to implement the AHSS. The approach chosen was to put an organisation at the centre of the implementation, and not to rely solely upon a networked model.

14. Based upon the work of management consultants brought in to advise the Board, the new approach addressed the need for an organisational basis for the AHSS. It outlined a number of enabling steps: a) an interim budget was identified, as was a budgetary cycle and budgetary requirements; b) a set of key performance indicators (KPIs) were identified; c) a different Board structure was proposed; d) recognition was given to the need for the organisation to operate in a complex environment and to make connections and establish links with other parts of the GM landscape, including other parts of the innovation system but also other elements, such as the industry, localities, and CCGs. It was with this new plan that the organisation has acquired *agency*, and has begun successfully to secure valuable outcomes for the Partnership.

15. Another key step in achieving agency that was identified by management consultants advising the Board in 2016-2017 was the need to monitor progress and to ensure the tangibility of achievements. Before the re-launch of Health Innovation Manchester, there was no single place where there was understanding of what innovations were being worked on, and there were no means for the organisation to answer such questions as what needs should be addressed, for whom, by when, i.e., at what stage is the work, who is doing the work, and what is the probability of success? The adoption of an 'Innovation Pipeline Pathway' was first proposed by the management consultants and has progressed further more recently with specific techniques introduced from commercial environments following the appointment of the digital director in 2019. This has not only provided better control of innovation activities allowing enhanced monitoring, but is also an important mechanism for agreeing on and selecting innovation projects for support by the Partnership itself. The approach has been recognized beyond the Partnership with NHS England now examining the HInM approach at scale across the AHSN national network and through the Accelerated Access Collaborative.

16. A further step, which we regard as crucial in the development of Health Innovation Manchester's role in the Partnership in particular, is the creation of a series of committees that systematically connect decision making by Health Innovation Manchester with other actors in GM. Health Innovation Manchester sought to achieve a connection to other parts of the local innovation eco-system through the creation of two committees in particular, the Innovation

Prioritization and Monitoring Committee (IPMC) and the Research and Education Committee (REC).

17. Important steps along the path to agency came with the involvement of strong and highly effective local leadership within the Partnership that maintained its commitment to the innovation agenda through the relaunch of Health Innovation Manchester as an *organisation*. Emphasizing the importance of organisational status even without the use of a statutory form, and adopting an organisational culture based on a variety of principles of governance that reflect the hybridity of the mission and diversity of methods, have yielded an effective innovation actor that supports the goals of health and social care devolution in Greater Manchester[3].

18. Once the decision to implement Health Innovation Manchester as an AHSS with *organisational form* was taken, the question of its leadership had again to be addressed. Our view was that it was highly desirable if not essential that an appointment was made of an individual with direct experience of working both within the NHS itself, ideally in an improvement or monitoring role, and also with outside experience in an industrial or services role (preferentially with the NHS as a client). The appointment of the new Chief Executive in February 2018 has enabled considerable progress to be made in responding to two significant challenges of internal organisational development and reconfiguration on the one hand, and on the other, the development of a distinct stance towards external organisations within the Partnership and beyond it. In more detail:

    a. Inwardly, within the organisation, the bringing together of capabilities from a range of constituent organisations has proceeded, and has been achieved through the promotion of a culture of collaboration through: i) an envisioning exercise built around a 'Big Picture' that recognizes the organisational journey from assemblage of different elements to attempts at synthesis; ii) defining the organizational capabilities required to deliver the HInM business objectives iii) outlining a set of organizational internal values stressing a collaborative approach internally and externally, an aspect supported by the creation of a board level strategic communications and engagement role in 2020; iv) an organisational change management approach.

    b. Externally, the organisation has developed an approach that shuns a simple 'If you build it, they will come' translational model of medical innovation and emphasizes awareness of the different contexts and the variety of actors that are involved in innovation and whose engagement [enrolment] is necessary condition for securing innovation, at pace and with the realistic promise of success.

[3] Sometimes referred to as 'Devo-Manc' in academic literature.

Looking Ahead

19. Health Innovation Manchester's further development will see the organisation encounter two challenges: a) its role in the GM H&C digital agenda and b) the organisation's scope and role.

The Digital Universe

20. Many organisations both public and private are beginning to engage with the opportunities provided by digital technologies. These opportunities exist at many levels. In its simplest form, digitalization [often simply termed digitization] converts a process using information held in analogue form to a digital form, without further changes in process. At the other extreme, digital transformation grasps the opportunities presented by technology in its widest context to transform radically the way health and care services are provided to citizens and the nature of many back-office functions. Digital approaches also *radicalise* the *knowledge management function* providing a basis through the use of data, including real-time data, to *transform* the organisation itself.

21. Central to successful innovation within digital transformation approaches is understanding of an overall picture of the components and their relationships at different levels with each other - the so-called *systems architecture*, and the relationship of the systems architecture with the organisation's business objectives.

22. Our view is that growing emphasis on integrated care currently occurring in the health and social care system in the UK, but also more widely, is a *transformation* to which *digital (transformation)* approaches are unusually suited as a response. Digital approaches have the potential to make feasible the integration and transformation at scale, i.e., at population level, right across the main functions of health and social care (prevention, diagnosis, treatment, monitoring and so on) in a way never previously considered. Within our context three further points appear salient, with a further implication:

    a. When organisations follow the data and its analysis, or indeed the transformational opportunities offered through technology, to what appears to be a logical conclusion, they are likely to challenge an existing organisational mission.

    b. Navigating the organisation by reference to its data – *flying on the instruments* – involves a risk that the data, however novel and however extensive, may be generated by processes in which biases exist that

misrepresent or obscure altogether the actual problem that needs to be solved.

c. It follows that a careful dialogue is needed between a transformative approach to services design and delivery supported by digital technologies (*the innovation agenda*) and the organisational mission (*the delivery agenda*).

Scope and Role

23. Health Innovation Manchester supports the innovation activities of the Greater Manchester Health and Social Care Partnership. It engages extensively in its own immediate context but also looks beyond. As an innovation actor, it necessarily operates – and asserts itself – in regional, national and international contexts. The wider its scope of operation, the more it can, in principle, bring back to and return to its 'home ground'. There is however a break-even point for this activity, and where this is, it is hard to tell. The question of at what scale Health Innovation Manchester should act should be approached as a matter of overall strategic positioning of the organisation.

24. A second choice it faces is how strongly should it support the digitalization of the institutions and services of health and social care within the Partnership? What level of support can the organisation provide to the Partnership as its various elements make major structural changes in response to the integration of health and social care and the adoption of population-based approaches to provision? That too is hard to determine but a strategic approach should be found.

A Final Observation

25. The performance of the health and social care system in the Partnership depends in substantial measure upon the contribution to be made through innovation. That contribution can only come from an organisation with exceptional leadership, deep understanding of the all the contexts in which health and social care are delivered, and a team with high capacities and a willingness to shape, and be shaped, by that system.

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1 A Study of Origins, Formalization and Operation

1.1 Introduction

This study of Health Innovation Manchester is exploratory. It focuses upon the creation of Health Innovation Manchester in 2015, how this body then developed and achieved a formal structure, and how it has subsequently operated. The study contributes probably the first examination of the attempt to operationalize an Academic Health Science System (AHSS) in the UK, and certainly the first at scale. The study contributes answers to two important questions: a) *how has Health Innovation Manchester supported innovation of health and social care in the context of the delivery of the devolution of health and social care in Manchester* [4]*; b)* what value might the *AHSS concept have in supporting innovation in health and social care?*

The study examines the development of a novel actor and considers its place within local, regional and national contexts, especially as regards innovation, the numerous relationships with other parts of the health care system, and the adaptations that have occurred to it and elsewhere to ensure coherence within what is increasingly a global network of innovation actors. The study seeks to uncover how its identity and purpose have emerged, how its functions were designated, acquired and developed and, in the final section on the operation of Health Innovation Manchester, an account of the operation of it as an organisation is presented.

Our approach to explaining and describing how Health Innovation Manchester was created, how and in what ways it formalized, subsequently developed, and has begun to operate, has been informed initially by a review of policy, legal and other documentation relating to our topic (a grey literature review), following which, to build our knowledge of material relevant to our study of the organisation, we undertook short and focused reviews of academic literature. Our study aims to (1) account for and describe how the organization was created, and (2) examine how and in what ways it was formalized and developed and has then c) begun to operate, including how it has operated during the crisis caused by SARS-CoV-2 of 2019-2021. In all, our review of material focused on the following areas, all of which relate to our topic, and to each other, in various ways:

a) the UK devolution agenda, which led to the Manchester based approach;
b) the Greater Manchester approach to the devolution of health and social care;
c) academic health science systems, to which Health Innovation Manchester has a strong correspondence and could be considered to be an example;
d) academic health science centres and networks, which Health Innovation Manchester performs the functions of as an 'AHSN' and 'AHSC' inter alia;
e) health innovation systems, of which Health Innovation Manchester could be considered to form part and applied research centres/collaborations (ARCs);
f) innovation in the UK health context;
g) NHS informatics systems, approaches and priorities;
h) NHS informatics systems approaches in Greater Manchester;
i) evidence-based medicine approaches;
j) physician led innovation;
k) digitalization including digital health;

[4] The so-called 'Devo-Manc' represents a major change in governance of health and social care in terms of increasing local responsibility for the management and operation of these two services, and significant change in that these two services are brought together within a common system of provision.

l) open and distributed innovation;
m) organisational capabilities;
n) reflexivity;
o) the sociology of translation;
p) Corona virus (SARS-CoV-2);

1.2 Our Approach

The review of literature is intended to identify the state of the art of understanding on topics that might be relevant to our case of actor creation and development, roles and goals, including material specifically focused on the case itself, so that we can develop and further reflect upon the state of the art of relevant knowledge.

We have been agnostic as to the initial status of Health Innovation Manchester *qua* research subject, considering it to be in common with many innovation actors, positioned somewhere along a continuum between a loose network of actors at one end to a formal organisation at the other.

In terms of how we gain and develop our understanding of the phenomenon, the existing literature provides a set of concepts that we use to categorize and assess our evidence. The review of literature provides the study team with a broad understanding based on a set of expectations and comprises therefore a set of concepts or prior *codes* for the collation and interpretation of responses from our fieldwork. Our approach is also open to the discovery of regularities through inductive coding of our research data. Where responses were outside the coding system identified in the literature, we inductively coded from the individual accounts of capability acquisition to identify novel forms of capability and related features of the interviewees' experiences.

Our method for the generation of evidence from our various forms of research data (interview, documents, presentations, web pages, research references) was to focus upon *capability acquisition*, over the course of three phases of development, *origins*, *formalization*, and *operation*. We justify our approach below, beginning with our view of the importance of capabilities.

2 Literature

2.1 Achieving Control: Importance of Agency and Roles – Lenses for the Study

2.1.1 Agency

Initially without agency – i.e., the capacity to act – an actor moves forward in time from the moment of its birth through the acquisition of and or the divesting of capabilities to meet a set of aims and objectives that form a mission. Health Innovation Manchester's objectives were first formulated in a memorandum of understanding (Greater Manchester Combined Authority & Health Innovation Manchester, 2015), see also University of Manchester (2015) in 2015. The Memorandum followed the political settlement to devolve power to Greater Manchester in the Devolution Agreement of 2014 (HM Treasury & Greater Manchester Combined Authority, 2014), [see also Jenkins (2015)] which was itself part of a range of devolution initiatives across the UK that included further devolution of power within London itself (London Finance Commission, 2013, 2017)[5]. Over time, actors establish themselves, acquiring the means to achieve initial objectives, clarifying objectives and defining new objectives, and developing an understanding of their purpose, often considered to be, within the commercial context, a business model [BM] (International Integrated Reporting Council, 2013).[6]

When considering how best to describe an actor's origins, development and operation, the view of the study team was that a coherent and consistent picture can be best drawn by taking a capabilities' focused approach. This centres on the actor's key features (its capabilities) in relation to its objectives and examines what capabilities were initially proposed, what capabilities were initially available, how new capabilities were acquired, and, what they now deliver to the mission. In our view the most appropriate means of acquiring that information were interviews with key staff, coupled with a review of secondary material on a multifarious organisational context that both set further objectives for Health Innovation Manchester but which also provided a range of extra-organisational capabilities with which those objectives could be realized. A study of an actor's creation, formalization and subsequent operation is therefore a study of emergence through the positing of an agency (by an outside body or bodies) with a set of responsibilities and powers that the subsequent acquisition of capacities and capabilities that then makes the actor a *reality*.

Within the organisational strategies literature there is perhaps no distinction more important than that made by Teece, Pisano, and Shuen (1997) in work on dynamic capabilities which highlights the importance of agility and preparedness to respond to changing perceptions of circumstances. But while we emphasize the importance of dynamic capabilities, and identifying capabilities is the most appropriate way to gain an understanding of what actors do to acquire agency, we also explicitly considered the importance to an actor located within a complex web of connections of the health innovation space of *agency as reflexivity* and the *relation to context*. In doing so we broaden our concept of agility from the initially firm-based views of Teece and draw on the structure and agency debate and in particular the work of Archer (Archer, 1982, 2008) whose notion(s) of reflexivity (which concern individual actors but which we consider appropriate here) suggest a range of dimensions of capacity to act in a complex environment that we broadly refer to as *agency as*

[5] According to some commentators, the transfer of power is not yet complete; see for example (Ayres, Flinders, & Sandford, 2017).

[6] IIRC considers the idea of a busines model to be appropriate to not for profit organisations and for public sector organisations.

reflexivity. We also draw, to a limited extent on the notion of *situational awareness* – the alertness to a wide and complex context that underpins *reflexivity* (Endsley, 1995).

Such reflexivity is valuable when environments are complex, constantly changing, and there is learning and development, and where priorities are not only the realization of immediate objectives, but also the reconfiguration of relationships within the overall context. We therefore focus on the actor, but within an innovation systems context, looking, initially at the innovation systems literature and then specifically at the health innovation literature and then more widely still to inform our account of how Health Innovation Manchester has evolved and *relates to its context*. These broad concepts provide an overall explanatory framework of structural elements with which to examine (and code) the responses from our programme of fieldwork.

In drawing up our conceptual framing for the research, we also draw from a range of work from the sociology of translation concepts identified in actor network theory. We do so to help consider the creation of an actor and its subsequent operation. While ANT itself is problematic in its addressing of the relations between actors at multiple levels such as exist within the UK health and social care context, we nevertheless consider the three steps or processes ANT puts forward towards the *creation* of a network analytically important in approaching the study of organisational genesis, formalization, and operation (Callon, 1996).

ANT emphasises that creation begins with the all-important step of *problematization* by which actors, who pre-exist, propose an objective and a means with which to realize it. A second step in the realization of the vision by which the objectives can be met is *interessement* where intermediation and interposition seek to engage actors whose support is essential, but is not yet agreed, and this is achieved by employing, classically, material objects / intermediaries / actants in the terminology of ANT). The purpose of *interessement* is however to bring about participation in and performance of roles (*enrolment*) – the third step - envisaged in the problematization or developed, ad hoc along the way to achieve the objectives. Once enrolment has taken place and roles are performed, *mobilization* of actors – the fourth step – confirms and reconfirms the existence of an actor network, which could be an organisation or a broader assemblage.

2.1.2 Role Playing

Moving towards the question of what roles Health Innovation Manchester plays to achieve *agency* in its own right, we draw on the of literature of innovation intermediaries. This literature conceives an environment that is characterized by a level of diversity that researchers have increasingly adopted the term 'innovation eco-system' to describe (Banda, Mittra, Tait, Watkins, & Omidvar, 2019; Etzkowitz & Zhou, 2018). For a recent survey of the classifications of environment, and the types of actor involved in such eco-systems, a recent work is Granstrand and Holgersson (2020).[Such alliances already exist within the health context[7].] The literature on intermediaries has identified a wide range of roles, but we consider three to be important. Drawing from the work of Siltaloppi and Vargo (2017) which builds upon Howells (2006) and Callon (1986), and on which Russo Spena and Cristina (2019) base their more recent work on e-health innovation, we emphasize three roles through which innovation actors achieve agency.

The first of these roles includes the transfer of information between actors, which a strong consensus in the literature what might be termed intermediation (by *intermediaries*); *mediators*, whose agency is used more actively to transform what is passed around the system; and *integrators* or *system actors* [Russo Spena and Cristina (2019, p. 396) use the term 'coalitionist'] who actively

[7] European Connected Health Alliance is one such and has a digital focus.

shape other actors and relationships within the system in which they are located. We imply a hierarchy with integrators possessing the most scope to determine what other actors do, and, in common with these approaches, we consider that innovation actors can perform multiple roles. As Russo Spena and Cristina (2019, p. 399) indicate, coalition management involves a higher number of linkages to other organisations, and therefore in our view, greater visibility within the eco-system. But coalition management also involves more access to the 'practices, rules and institutions' (Russo Spena & Cristina, 2019, p. 399 [Figure 391]) of the eco-system, and for this reason suggests that greater influence within the eco-system is required to maintain the role.

2.1.3 Research Focus

The success of any actor created with the aim of becoming a become a powerful and influential (with contributions into a wide range of frontline care contexts at pace and at scale), depends upon how innovation capabilities are acquired to support *agency* and *reflexivity*. A further insight from the literature is the presence of a variety of roles which can be played by innovation intermediaries. Actors locate along a spectrum on which there is increasing influence over the following: a) the meaning of information transferred; and b) the roles of the parties involved. A central focus of this study has been to document progress in the bringing together of such capabilities.

2.2 The Innovation Context

2.2.1 Systems and Change – Delivering and Developing

Having noted our initial framework for analysis, we now consider in detail the context for Health Innovation Manchester, which is that of a health and social care system in which *innovation* activities form part. In this context, Health Innovation Manchester is directed at innovation, leading some activities, and supporting others. The context should also be seen as one in which *integrated care approaches* are being attempted, as a result of health and social care devolution, several initiatives of the NHS, and by the bottom-up / autonomous spread of good practices. There is a very limited reporting of the operation of integrated care approaches in Greater Manchester, with Malik et al. (2020) being possibly the earliest to report on success and, importantly, the extent of integration, a study which used the methodology developed by Minkman, Ahaus, and Huijsman (2009).

Integrated care organisations are an international phenomenon, not by any means confined (see above) to the US, and are of long-standing. Interest in integration within healthcare has led to a growing discussion of its dimensions and ramifications. Journals and conferences have grown up to support discussion and problem-solving. The International Journal of Integrated Care, a leading journal in the area, was established in 2000 and the field of research continues to expand with the BMJ group of journals now including its own journal in the field, the Integrated Care Journal, (Dawda, 2019). Its associate editor (Dr Robert Varnam) is a GP in Manchester and the Head of General Practice Development at NHS England.

Integration in health and social care is, as Dawda (2019) later observes in the inaugural editorial of the Integrated Care Journal, a diverse process, and there are many definitions of how the different elements of care and their supporting activities can be assembled, coupled, integrated and to what purpose, and the lessons emerging, see (Stadnick et al., 2019) for one attempt to draw out the lessons from a review of cases from around the world. As (Stadnick et al., 2019, p. 1) note, 'Integrated care is the coordination of general and behavioural health and is a highly promising and practical approach to improving healthcare delivery and patient outcomes. While there is growing interest and investment in integrated care implementation internationally, there are no formal guidelines for integrated care implementation applicable to diverse healthcare systems.

Furthermore, there is a complex interplay of factors at multiple levels of influence that are necessary for successful implementation of integrated care in health systems.' And as Glasby (2016) has noted, integration can be seen as an aspect of healthcare provision and organisation well before the term itself was coined, even being an element of Central Policy Review Staff's Joint Framework for Social Policies in 1975 (Hughes, 2017, p. 72) in the UK, or even earlier (Schrijvers, 2017), and in the USA, part of the Older Americans Act (T. L. Wilson, Scala-Foley, Kunkel, & Brewster, 2020). Integration is a highly *elastic concept*, and can imply a reframing of the health and social system itself in fundamental ways that may have major and, very possibly, as yet unseen implications for the way in which change is induced and managed. Following Glasby, a critic of aspects of integrated care approaches, the emphasis should be upon outcomes rather than structures and processes (Glasby, 2016, p. 1). We further note a likely assumption of some writing on the subject that integration is an end state, whereas integration is a context in which, naturally enough, further innovation takes place, the better for certain practices to be followed, such as organisational learning using participation and co-generation (Lalani, Bussu, & Marshall, 2020).

Specific parts of the health and social care system not only find themselves in new relations to each other but those with responsibility for leading or facilitating change - innovation intermediaries particularly – must review their objectives and methods within what is a new paradigm for health and social care. The World Health Organisation (2016) analysis considers integration as taking four main forms, see our table below Table 1 World Health Organisation Typologies for Integration and these, in our view provide a new 'rules of the game' in which innovation has to take place. Nested within such levels are further attempts at integration, for example within the clinical level, specific integrated health service models are possible (Wendimagegn & Bezuidenhout, 2019).

As health systems transition and a new overall framework is assumed akin to an overriding *research programme* (Lakatos, Worrall, & Currie, 1980), innovation pathways will change, and a transition will occur, possibly at different levels as is suggested in the transition to sustainability literature (Geels, 2011; Geels & Schot, 2007). Innovation will in our view comprise a range of activities, some motivated by the new framework, for example, in relation to the WHO framework. But not necessarily all innovation would be shaped by the new framework.

Typologies of integration
Organizational Integration of organizations are brought together formally by mergers or through 'collectives' and/or virtually through coordinated provider networks or via contacts between separate organizations brokered by purchaser
Functional Integration of non-clinical support and back-office functions, such as electronic patient records
Service Integration of different clinical services at an organizational level, such as through teams of multidisciplinary professionals
Clinical Integration of care delivered by professional and providers to patients into a single or coherent process within and/or across professions, such as through use of shared guidelines and protocols

Source: (World Health Organisation, 2016) adapted from (Lewis R, Rosen R, Goodwin N, & Dixon J, 2010)

Table 1 World Health Organisation Typologies for Integration

2.2.2 Systems of Innovation

The innovation system so-called is therefore connected in various ways to the overall health and social care system and aims to effect change within it. Health Innovation Manchester's innovation activities draw then upon an understanding of the framework in which health and social care are

delivered, and upon existing actors and bodies of knowledge about what health innovation actually is and how it should be pursued that collectively could be termed the *health innovation system*. We review the literature firstly on the general topic of systems of innovation before moving to a discussion of systems for health innovation, such as they are.

Within innovation literature, the notion of systems of innovation is a central theme. The original systems of innovation literature has argued for the importance of *connectedness* of innovation actors (Lundvall, 1985) and, as the Organisation for Economic Co-operation and Development (1997) has suggested, understanding the flow of knowledge in an economy can ensure that inputs are turned effectively into outputs.

While the notion of systematic connection is important, much important later work, for example that by C. Freeman (1995) provides justification for policy makers, and those managing innovation, to consider that there is a role in *innovation* for them at a specific *locale* (locally, regionally and nationally) to attempt some kind of control within the system (C. Freeman & Soete, 1997)[8]. The work of Kline and Rosenberg (1986), which is a further and important dimension to the systems of innovation work, emphasises the *iterative* as essential to innovation activity, a claim that draws important support from science and technology studies (STS).

The literature on *systems of innovation* literature therefore has raised two major questions that face actors within such systems: a) where are goals defined; and b) where are the means of realizing them decided? Coupled to both of these issues is the further question of how should change to the system in terms of identifying goals and choosing the means of realizing them be decided? This can be termed the *meta-innovation* issue and is form of *reflexivity*. Any actor functioning within an innovation context will face such issues.

Considering first the issue of goals and how they are defined, this is in part a locus of control issue: do *systems* themselves – on an analogy with markets - deterministically generate the goals? Or are goals adopted at some other *point* (i.e., in a network model) or at some other *level* (i.e., in a hierarchical model) within the overall system, or are they even exogenous? Where could control actually lie?

There is much evidence that innovation is a phenomenon that operates at many levels. Such phenomena suggest self-similarity, and therefore with the system as a whole having, as some commentators have noted, a fractal character (Carayannis, Grigoroudis, Campbell, Meissner, & Stamati, 2018)[9], the control is open rather than closed. Considering the issue of how means are chosen, a major question is to what degree are innovation processes *iterative*, and *non-linear.* The answer to this question links back to the question of how goals are chosen, as, given the assumptions of non-linearity and iteration, a goal is not presumed until the means chosen for realizing it has operated. As we argue below, the central, and difficult, questions raised in the systems of innovation literature are raised again in the context of health innovation. A number of solutions have been proposed, which we outline, but a central assumption is that the issue of what is done and how it is done are closely bound together.

2.2.3 Health Systems for Innovation

Moving towards a discussion of the health innovation literature itself, it is clear that here, as in the wider innovation literature, there are attempts to articulate the presence of systems, with a long-standing attention to health systems at the global scale (Matlin & Samuels, 2009). There is even an

[8] Although at pages 372-373, the scope for local control is considered to be waning (C. Freeman & Soete, 1997).
[9] Our view is that innovation is not necessarily fractal but it will exist at a range of levels and is highly interconnecting.

attempt to relate innovation system design to innovation outcomes although not to patient outcomes (Proksch, Busch-Casler, Haberstroh, & Pinkwart, 2019). This study names Switzerland, The Netherlands and the Nordic Countries excluding Finland as the most successful innovation performers although in one measure, patents per country population, this cluster of countries does not perform so well.

The adoption of systems metaphors reflects a gradual abandonment of the idea as physician/clinician as principle or even sole health innovator (Alexander, 1999; de Micheli, 2016; H. I. Freeman, 2008; Furth, 2006; Gottumukkala, Le, Duszak, & Prabhakar, 2018; Henry, 2011; Johns, 1999; Lizza, 2005; Majmudar, Harrington, Brown, Graham, & McConnell, 2015; Preul, Stratford, Bertrand, & Feindel, 1993; N. A. Ross, Saedi, Yeo, & Cowan, 2015; Rubin, 1999). However, it has been claimed that research on innovation in health has rarely provided a fully developed *systems level view* (Larisch, Amer-Wahlin, & Hidefjall, 2016), cited in Proksch et al. (2019, page 170). Some studies do provide conclusions about systems as a whole, for example, Huzair and Sturdy (2017) discuss systems whose innovation (in terms of innovation) can be improved overall by increasing commercialization of knowledge from universities, however, more likely in discussions of health innovation has been the view that innovation is a meso- and micro-phenomenon nested within large scale systems (Consoli & Mina, 2009) and taking place at specific sites, and involving combinations of actors of various kinds. This way of thinking has led to work employing Triple-Helix framework (Edmunds et al., 2019) and Quadruple Helix approaches (European Commission, 2019; Savory & Fortune, 2015), and which, in addition to noting the importance of connectedness between organisations/institutions of various types, again emphasizes the importance of specific locations.

This discussion of which actor types and locations are most important has long noted changing patterns of innovation. A key finding in this literature is that single large firms have gradually withdrawn from an anchoring role in innovation processes (Cooke, 2004), with the hospital taking over as the major if not the central innovation actor (Kitsch, Botelho, Ruffoni, & Horn, 2019) albeit with the assumption of connectivity between organisations of different types as essential. In the innovation literature, Thune and Mina (2016) further emphasize the role of hospitals themselves and consider them to play the key role in the 'modern health innovation system' (Thune & Mina, page 1546), providing the opportunity for idea generation, development, testing and validation and then deployment / diffusion, across a range of innovations embodied in technological artefacts to protocols to approaches.

The view is increasingly adopted in other health economies, see for example Souza and de Carvalho (2015) on the Brazilian hospital system. Hospitals also play collaborative roles in innovation and can engage in co-production. They represent, to a significant degree, an opportunity to promote and conduct the kind of *open innovation* identified by Chesbrough (2003). Such changes in the way in which innovation in health has been thought about and practiced in terms of organisational design have led to important attempts to formulate models incorporating connectivity. These models of quasi systems have operated at various levels.

2.2.4 Recent Health System Embedding of Innovation

Firstly, in the US, distinct centres termed Academic Health Science Centres (AHSCs) have emerged with eventual adoption in the UK, the first example being established at Imperial College in 2007 (French, Ferlie, & Fulop, 2014). AHSCs were founded on the idea of an integration, at a single location, of three interdependent activities of research, clinical practice and education which should be managed to be mutually supporting (King, Thomson, Rothstein, Kingsnorth, & Parker, 2016), see

also (Delaney, 2010). In time, in the US context, AHSCs took a variety of forms, some being based in a single organisation and located in one place, others being constituted of a number of organisations and distributed in space. The AHSC concept has however been further developed and has been reconceived to operate at larger levels of *functional integration* with the possibility of also being part of a larger *federated system*.

The functional expansion (and diversification) of the AHSC concept has taken place in part to address problems of the US context where, as we have noted, the model has experienced difficulties and challenges, in particular in terms of profitability (V. J. Dzau et al., 2013; PricewaterhouseCoopers, 2012). Here, in the US, centres were encouraged to engage more widely in the innovation process and to obtain the value from operating at larger scale. They were recommended to draw more on the broad range of academic knowledges in their university partners, look for greater yield in their research in terms of IP earnings, to have a clearer focus on where they could obtain funding and to withdraw from areas where there was no research money. They were also recommended to leverage the data they held on patients, treatment outcomes and synthesize it to generate value. They were also encouraged to engage more broadly with partners outside, particularly industry, to consider how medical training, for which they have responsibility, could be made more effective, and identify changes to curricula and training methods, and even the duration of medical training.

The introduction of the accountable care organisation/system (ACO) concept in the US health-care reform programme of the Obama Presidency has been a further spur to broadening of the AHSC concept in the US[10]. The ACO / system concept sees a larger number and type of health care organisations working together within a system to deliver care. Part of such a system is an innovation function which has been termed the Academic Health Science Systems (AHSSs) (Delaney, 2010; V. J. Dzau et al., 2013; D.R. Fish, Chantler, Kakkar, Trembath, & Tooke, 2012; French et al., 2014; Tooke & Jacobs, 2010; van de Wijgert, 2010), although there is some confusion over exactly how extensive the concept is in terms of involvement with other actors, whether it actually represents the health system as a whole. One of the clearer outcomes of the debate on the form of the AHSS is that AHSSs can function to support innovation and could be decisive in changing systems of care. As V.J. Dzau et al. (2010) notes, to support the delivery of healthcare, innovation is essential and the AHSS is a more appropriate means of achieving connectivity across a broad range of sub-functions of the healthcare system.

> 'To transform health care, we believe that AHSCs should evolve further into academic health science systems (AHSSs). The term AHSC connotes a specific location where patients receive care (e.g., a medical campus), whereas AHSSs are thought of as integrated health-care delivery systems that not only include the traditional medical centre but also a network of community hospitals and practices. Ideally, each AHSS has missions, resources, and standards that are shared by the system to improve the way in which it helps patients and communities. To catalyse the needed transformation, we believe that AHSSs should focus on organisational structures, external partnerships, research translation, models of care delivery, new educational models, and information technology. Further, tactics of AHSSs

[10] The concept has also seen implementation in the UK in the context of a further reform of the NHS through the introduction of what sustainable transformation partnerships (STPs) as precursors to Integrated Care Systems (ICS).

should include push (e.g., targeted grant support) and pull (e.g., creation of common resources) approaches, and active management and leadership. We address below each of the strategies and briefly describe efforts underway at our institution (Duke Medicine) and at others.'

(V.J. Dzau et al., 2010, pages 949-950.)

Our analysis of the differences between the more localized and less ambitious AHSC and the larger, more integrated AHSS is given below in the following table.

Features	**AHSC**	**AHSS**
Mainly Centre-Based	✓	×
Common Standards of Operation	×	✓
Other Hospitals	Usually no	✓
Technology-Push	✓	✓
Linear	✓	×
Funding Research	×	✓
Interfacing of Functions	×	✓
Integrator Organisation Required	×	✓
Care Model Innovation	×	✓
Accountable Care Organisation Compliant	×	✓
Networkable Globally	×	✓
Public Private Partnership	Limited	✓

Table 2 AHSC and AHSS: Feature Comparison

In the UK, the AHSS approach has been considered particularly appropriate for those parts of the country which have led the way in terms of the implementation of devolved services through integrated care systems [as we noted above]. The use of such systems across the country by 2021 is an objective of the NHS Long Term Plan (NHS England, 2019b) with Greater Manchester's implementation being an early example through the *devolution deal*. The form of organisation adopted for Health Innovation Manchester therefore reflects this model:

'The Solution

*An **academic health science system** [Study Team emphasis] tackles this problem by creating a 'Discovery Care Continuum' in a health economy to provide a smooth and integrated pathway from discovery science and innovation through experimental medicine and clinical research, to reliable consistent adoption and diffusion. A feedback loop will create a virtuous cycle so that the learning on each point on the pathway inform (sic) further refinement in research, innovation and implementation. Success with drive both economic benefits across the region and beyond.'*

(Greater Manchester Combined Authority & Health Innovation Manchester, 2015, pages 4-5)

We note however that in the UK context of the NHS's national framework, there has been scope for federated expansion of the hospital centred innovation model (the AHSC concept) and this trajectory has been followed since around 2011 with Science Networks later termed the Academic Health Science Networks (AHSNs) (Department of Health, 2012) introduction following Lord Darsi's report of 2007 (NHS London, 2007). Thus, while individual centres operate with considerable autonomy, their activities are part of a larger national programme. But as Fish has noted, (D. R. Fish, 2013), and as we have noted above, the policy had a number of challenges that are inherent in innovation systems: a) where does *agency* lie in a system that is, in fact reliant upon its parts, i.e. is clearly not monolithic – who or what is the prime mover or is there no prime mover(Aquinas, 1920); b) what model of interaction and iteration would be adopted; and c) following upon these issues of decision making and engagement, how exactly should success be measured?

> *'Several challenges to AHSNs must be met. First, tensions between central direction and local determination need to be navigated, guided by processes that work to create the best value and outcomes. Second, we need to develop a culture of implementation that embraces collaboration across boundaries for the benefit of patients, alongside increased choice and competition. This approach is established in many other settings. Early successes and sustainable cultural change are crucial for any AHSN, measured by enhanced clinical outcomes (organisational and population), improved adoption times for new ways of working, and creation of wealth in the local economy and beyond.'*
>
> (D. R. Fish, 2013, e18-e19)

2.2.5 UK Health Innovation – National and Local

The UK Health Innovation system continues to see changes to innovation activities at higher and lower levels with potentially slightly divergent developments: on the one hand there is greater engagement locally through the AHSS model, a model that has been adopted in part for consistency with the larger project of reforming the NHS along the ACO/Integrated Care System [ICS] principle; on the other, through the federated approach of locally based capacity being networked together across the country through the AHSNs under the NHS. Such broader national approaches beyond the NHS itself but comprised of NHS bodies include, for example, a network of the major teaching and research hospital trusts (The Shelford Group, 2020).

While coordination between centres with missions to contribute to local as well as national priorities appears possible, resource constraints will, at some point require decisions to be taken about priorities. Furthermore, innovations arising locally or national (from different levels in the hierarchy) need to be managed both at local and national level, with mechanisms found for the avoidance of *duplication*, *disjointedness* or *contradiction* between the innovations created at different levels. Such coordination in a system with many actors is, in our view, likely to be challenging.

2.2.6 Research and Innovation

Descriptions of innovation systems generally make reference to the contrast of innovation with invention (the generation of a new idea that is not itself a new product or service but might provide the basis for such), and the connection to *research* which is a closely and importantly related to it. Research is considered to take place along a spectrum of activities with, at one end, research that is undertaken without reference to practical outcomes while at the opposite end, experimental

development aims explicitly to prepare a product or service for use. Governments routinely fund research at all points along this spectrum but do so at different levels, with research activity closer to market being entitled to smaller support than research at the basic end of the spectrum. Such distinctions are described by the Frascati categories[11].

The level of support reflects a long-established view that basic research generates externalities (being a public good) and therefore incentives should be applied to increase it since firms would under-invest in their production of it. In many 'national research and innovation systems', different types of organisation support research at different levels. In developed economies, higher education institutions generally conduct basic research. They are incentivized to conduct it and over time have specialized to carry it out. While research and innovation can be seen as a range of activities lying along a continuum, the organisations which conduct it are in the UK system normally separated into types with a simple split into higher education institutions on the one hand, and firms on the other.

2.2.7 Research Focus

Our review of the literature suggests the importance of systems and inter-locking actors and models for innovation. Health Innovation Manchester's central mission is innovation and the operational model has been proposed for it is that of an Academic Health Science System (AHSS). Health Innovation Manchester's organisational context is however broader than the AHSS model envisages. In addition to Health Innovation Manchester, within the UK context there are many other actors pursuing innovation, at different levels and with considerable variation in objectives although two main incentive systems dominate, universities and firms. Some of these actors pursue innovation as primary objective, others as secondary priority. *The focus of this study on origins, formalization and operation of Health Innovation is to document how a model of action was implemented, and how as it relates to and adapts to a complex environment.*

2.3 Innovation Challenges

2.3.1 Introduction

We now consider some further aspects of innovation in the health context and we draw from the general innovation and health literatures to highlight what are relevant to a review of the origin, formalization and operation of Health Innovation Manchester. We consider the following: a) *reflexivity and linearity in health innovation* – with specific references to reflexivity of innovation actors in the health context and linearity; b) *the creation and management of knowledge* - in health innovation and health systems - through evidence-based medicine and digital technologies; c) *governance contexts* - including evaluation; d) *innovation in a crisis* - the case of SARS-COV-2.

2.3.2 Reflexivity and Linearity in Health Innovation

Innovation in health requires understanding of a range of actor positions within a system that is complex and interconnected (Moors, Fischer, Boon, Schellen, & Negro, 2018) and where there is *inter alia* co-production of technology, of need, of regulatory frameworks, and implementation protocols. Research which emphasizes the importance of actors shaping their context, and

[11] Relatedly, so-called technology readiness levels indicate the state of a technology at different points along a similar continuum, from the understanding of basic principles of a technology to full scale commercial deployment although the mapping of Frascati categories to TRL levels is difficult.

therefore practicing reflexivity within the system is a perspective that we believe important for an actor in an integrating role such as Health Innovation Manchester.

In a case study of the acceptance of Herceptin as a treatment, the role of institutional shaping has been shown to be vital (Kukk, Moors, & Hekkert, 2016) in influencing a technological innovation system (TIS), in the case of their example, the TIS of the NHS. The authors of this study draw attention to the need to consider how individual actors can shape the institutional environment in which they are located. Reflexivity at the level of actors is strongly connected to reflexivity inherent in the system itself. Some of the earliest writers talking explicitly of system in the context of health innovation have emphasized connectivity, see for example, Ramlogan, Mina, Tampubolon, and Metcalfe (2007) while more recent work [in the context of developing nations] has focused on the need for institutions to be aligned (Abrol, Sundararaman, Madhavan, & Joseph, 2016). While linearity implies connectivity between innovation actors, the linear model of translational research has been considered as inappropriate for the realities of innovation (Savory & Fortune, 2015).

The related notion of 'knowledge translation' ['bench to bedside, 'campus to clinic' (Greenhalgh & Wieringa, 2011, page 501)] has also been the subject a significant critical response, although it remains useful for visualization of objectives, and the immediate steps towards their realization. Micro-studies with implications at all levels include: in the context health technology assessment, the importance of a variety of organisational actors and processes (Facey, Henshall, Sampietro-Colom, & Thomas, 2015); the need to engage with patients in the co-design of innovation (Farmer et al., 2018) and be ready to incorporate changes that arise within evidenced-based paradigm. The assumption that knowledge of treatments can move effortlessly from the discovery stage to a implementation is seen by many as problematic (Mareeuw, Vaandrager, Klerkx, Naaldenberg, & Koelen, 2015). The authors, writing about the Dutch health system note the need for a range of measures to ensure effective translation. Miller outlines the case for a broader engagement of TTO type organisations in the context of health innovation to ensure that attention is paid to both the distal and proximal users of health innovations.

> 'We contend that the valuation process for health innovations engaged in by academic TTOs is poorly specified as a set of task-specific, if complex, judgments. Instead, we argue that TT professionals are active participants in the construction of the innovation and assign value by 'imagining' the end product in its ''context of use'' (Oudshoorn & Pinch, 2003). Oriented as they are to the commercialization of health technology, TTOs understand users primarily as market players. The immediate users of TTOs' efforts are commercial partners (e.g., licensees, investors) who are capable of translating current discoveries into future commodities. The ultimate end users – patients, clinicians, health systems – are the future consumers of the products to be sold. Attention to these proximate and more distal users in the judgement of innovation potential is a complex and constitutive feature of the work of health technology transfer. At the same time, these judgments are governed by a logic of valuation that is attentive to more than the specific features of technology, designer and user in a single case.'
>
> (Miller, Sanders, & Lehoux, 2009, p. 1482, page 1482).

> 'These different users may have different beliefs and interests relative to each other, and relative to the commercial partners that occupy the bulk of the TTO's attention. Some patients and clinicians may share a positive interpretation of the value of a health innovation with its sellers, in conflict with the attitudes of other patients, other clinicians, technology assessment agencies, public policy makers or citizens as a whole. Conflicting views are particularly likely when the opportunity cost of investing in one health innovation is experienced as diminished investment in some other health service or innovation – an explicit trade off that is both more likely and more evident in publicly funded health systems.'
>
> (Miller et al., 2009, page 1487)

Thus, the picture emerges from the description of the capabilities acquired by the organisation of the organisation's agency in terms of realizing its immediate goals, through an agency that is reflexive in that it changes the system in which it is located.

2.3.3 The Creation and Management of Knowledge

Actors taking responsibility for innovation have a range of complex knowledge management tasks. These cover the attempt to valorise the available knowledge resources both tacit and explicit. How knowledge is used depends upon an organisation's priorities and innovation models, for example whether novelty (innovation) is sought in terms of process, product, position or paradigm, or according to some other innovation typology such as the one noted by Tidd and Bessant (2018, pp. 50-51) which originated through the work of Sawnhey, Wolcott, and Arroniz (2006). Successful knowledge management depends upon suitable models for the acquisition, refinement, verification and use of knowledge, including approaches to exploiting *digitalization,* which can make information a ubiquitous and instantaneous organisational resource for decision making, but also new product and service offering. We note the existence of approaches to knowledge management and we note, in particular and as Bhatt (2000) states, quoted in J. P. Wilson and Campbell (2016, page 833) knowledge management is a cycle involving four main activities, 'knowledge creation, knowledge adoption, knowledge distribution and knowledge review and revision' and it is in all of these areas that an organisation such as Health Innovation Manchester must be involved. In all of these four activities, in the context of health and social care, knowledge management is carried out both at a personal level and as a systematic activity by organisations (individually and linked together).

In health and social care, a long-standing priority in terms of knowledge management has been to maintain a body of credible knowledge on best treatment choices. While many forms of knowledge capture, retention, dissemination have taken place over millennia and since well before Mixtures (Galen, 1969)[12], during the second half of the 20th Century, knowledge management of medical knowledge has been subject to increasing levels of systemization, one of the best known being the Cochrane Collaboration (Winkelstein, 2009), now known as Cochrane. This approach, increasingly termed the *evidence-based medicine approach* [EBM] and which can be seen to have many precursors, one prominent example being Florence Nightingale (McDonald, 2001) is now widely adopted. This approach seeks to manage the four activities noted above, and is assumed to be an important if not the key approach within any innovation system but particularly within health and, and also to a lesser extent, social care (Bell, 2012). A further approach which is that of the capturing

[12] The second century CE.

of tacit knowledge of individual actors and drawing it together to become available to all once it has passed through a process of review is inspired by the work of (Nonaka & Takeuchi, 1995).

While evidence-based medicine [EBM] may appear a panacea (metaphorically and literally), there have been many areas of concern noted and a lively debates within and by health and social care practitioners and researchers on its value, assumptions and status (Greenhalgh & Russell, 2009) and by those outside it, for example by social science researchers looking in, see for example Mykhalovskiy and Weir (2004). Recent debates over the wearing of masks (World Health Organisation & United Nations Children's Fund, 2020) as an appropriate response to the threat of SARS-CoV-2 transmission demonstrate the difficulties facing EBM when the context is new and scientific questions are connected to political debates (Greenhalgh, 2020; Heneghan, 2020).

Actors seeking to connect with EBM approaches either to draw from them or to contribute to them should be aware of the challenges associated with what some commentators have called a new paradigm in knowledge management in health and social care. We note a number of these difficulties. While evidence would appear to be an unassailable yardstick against which to measure current practice or novel treatments, the existing evidence base itself is sometimes itself unreliable – i.e., contains biases of various kinds which are unknown. Studies forming the evidence base are not necessarily comparable (Borgerson, 2009) and meta-analysis is far from an unproblematic methodology (Greco, Zangrillo, Biondi-Zoccai, & Landoni, 2013) that can only work when complex classification methods are employed. Furthermore, while evidence may point in particular directions, the EBM does not always or even necessarily provide clear theoretical understanding of the relevant cause and effect relationship to the treatment in question (Giacomini, 2009). Clear criteria for the judgement of outcomes are necessary but often lacking, (for a discussion of procedural versus lifetime risk comparisons, see Bridgewater (2011), and also (Grant et al., 2008) on the issue of exactly what type of risk model to apply.

Given the difficulty of advancing clear principles, some researchers have presented themselves as working in the EBM paradigm when in fact this *may* not be the case (Mykhalovskiy & Weir, 2004). Debate about the control of the evidence based by outside or even inside interests has also taken place, to some extent generated by the Cochrane Crisis (Ioannidis, 2019), a controversy that has focused on the commercialization of medicine. EBM has also been perceived as *mainly* and therefore *purposefully* a rationalist form of control on economic principles (cost-benefit) of treatment options employed as means to ration care. Other criticisms have emerged over the applicability of EBM to nursing as a health practice (Ou, Hall, & Thorne, 2017), and over the effect on practice of the publication of information on treatment outcomes at the level of specific medical practices (techniques) and practitioners (cardiothoracic surgeons) (Bridgewater et al., 2007; Bridgewater & Keogh, 2008; Bridgewater, Neve, Moat, Hooper, & Jones, 1998; Bridgewater & Soc For Cardiothoracic Surg, 2010), see also (Dunning et al., 2011) on improvement in the volume of patients receiving treatment as a result of greater understanding of the effect of various techniques. For those reasons, clinicians have not always been willing to accept the evidence base as reliable (Broom, Adams, & Tovey, 2009) and the whole approach has led some to call for an explicit comparison between traditional modes of evidence gathering and decision making (Devisch & Murray, 2009) to provide some evidence that the approach does in fact work[13].

Knowledge management in this context is also affected by existing systems that are nationally developed and also by local initiatives. The NHS at a top-level has a long-standing commitment to

[13] Such a comparison appears however to assume the appropriateness of the method which the test is being used to call into question.

the improvement of information systems that support its functions (Price, Green, & Suhomlinova, 2019) and which attempt to overcome the problems arising from information being held in different places, in different systems, and very often in forms (hardcopy) that prevent timely retrieval / transmission within primary care, for referral purposes and for provision to patients (Gibson, 2008). However, there has been limited success and uncertainty over impact, particularly in health record data development and sharing (Clarke, Watt, Sheard, Wright, & Adamson, 2017). As well as national initiatives, local city and region-based attempts have taken place (Greater Manchester Health and Care Board, 2018; Greater Manchester Health and Social Care Strategic Partnership Board, 2017b; Health Innovation Manchester, 2018; Leeming & Thew, 2017; Thew S, Leeming G, & J., 2018). On the importance of information sharing of patient records in a system this study shows the difficulties (Greenhalgh et al., 2008) although despite the problems, the NHS continues to promote information sharing of patient records, in one case, citing, in its promotion of the approach a success achieved in the GMHSCP area (Salford) itself (Local Government Association and the NHS, 2018)[14].

2.3.3.1 The Devil in the Digitalization

The exploitation of digitalization, digitalization being the creation, analysis of, and use of information in digital form, is in our view a means to more extensive and more involved management of the knowledge possessed by or available to the organisation. As Benjamin and Potts (2018) note, digitalization is not just about introducing new IT systems. However, digitalization is a complex process and is not one single approach to changing the way information is collected, stored and used. In terms of organisational innovation, digitalization can be used to achieve a range of outcomes that can be seen in a hierarchy with considerable differences in the scale of intended effect, or to put it another way, the level of *innovation*.

Writing with reference to NHS digital technology adoption, Maguire, Evans, Honeyman, and Omojomolo (2018) note the distinction made by Heifetz R. and Laurie D.L. (2001) cited in Wachter (2016), between change that is adaptive and change that is technical in order to explore and highlight the reasons for failure of IT innovations. Our view is that digitalization's objectives (and its sequalae of digital transformation) are indeed varied and can aim for any of the following: a) improvement of some single part of an organisation's operations and functions (which might be, following Heifetz R. and Laurie D.L. (2001) *technical)* ; b) a means of providing old services in new ways or providing new services (sometimes termed the digital solutions approach; c) a strategy to transform some part of or all the organisation by using data, including data in real-time that exists within it to re-shape the organisation itself.

This last form of effect may use anything up to the entirety of the data about the organisation and may employ analysis on 'big data' principles. This third form of change, which is transformative of the organisation, may see the information as *simulacrum* of the organisation. Arguments from big data and from the proponents of digital transformation may make such a stronger claim for an identity of the organisation with its data and also imply a greater potential for change – and innovation. The fluidity of such transformative change is noted as a feature of modernity by Archer (2014), and of contemporary capitalism (Tornberg & Tornberg, 2018). However, as (Tornberg & Tornberg, 2018) argue, digitalization has the potential to bring confusion over the nature of robust knowledge. Devlin et al. (2016) note the importance of implementation methodologies informed by understanding of the socio-technical. Writing about computational social science but making an

[14] The Salford Lung Study.

argument of wider applicability and, we believe relevant to organisational and management studies, the authors argue:

> 'This calls for a critical computational social science that does not sacrifice context, clarity, and critique for the automatic identification of large-scale patterns, predicated in the notion that breadth could replace depth and context as basis for interpretation. If we are not to be drawn by the siren-song of abundant data, sung by the owners of technological platforms precisely to lure us into drowning in the data deluge, we must tie ourselves to the mast of a critical and explicit metatheory: for only from a stable ontological position will we be able to hear not only what the data has to sing to us about the social world, but also to listen for those things about which they remain so curiously silent.'
>
> (Tornberg & Tornberg, 2018, p. 10)

Within the healthcare sector, there has been, despite the challenges, considerable interest in digitalization and the associated digital transformation (i.e changes in the nature of the services that are provided and the way the organisation is run) with the NHS taking a strong interest in national, regional and local initiatives and support to organisations and individuals (Digital Health London, 2019; Digital, 2019; NHS England, 2019a; Powell, Newhouse, Boylan, & Williams, 2016; Price et al., 2019). But as Jandoo (2020) has noted, digitalization is a challenge for health innovation as the evidence of improvement that can be developed from digitalization is not always convincing, particularly as regards demonstration of benefits (K. Wilson, Bell, Wilson, & Witteman, 2018). Indeed, it has been felt that there is an acute lack of a systematic approach to implementation (Van Velthoven, Smith, Wells, & Brindley, 2018). The need for action globally to address the need for methodologies has led WHO to issue guidelines (World Health Organisation, 2019) that argue strongly for new services based on digital technologies to be subject to the requirement for evaluation using evidence-based approaches, which can be time-consuming and onerous. Many examples of the development and implementation of digital services are being published, for an example of an NHS implementation of a diabetes control programme, see J. Ross et al. (2018), but the approaches are diverse and good practice is not always being followed (Puntis, 2019).

Digital transformations of organisations are as Walton (2019) observes, more difficult the larger the organisation, and involve organisational leaders in remaking connections throughout the organisation (Corso, Giovannetti, Guglielmi, & Vaia, 2018). Intermediary organisations in health may, in our view, constructively support digitalization – and therefore innovation - by acting to connect the information widely distributed across the organisational landscape.

The strategic management literature also supports this argument, Jacobides and Winter (2005) also noting the need for beyond the firm level capabilities to achieve the transformative effects upon the wider system in which an organisation operates. Digitalization capabilities, enabling diverse new insights, can change relationships within sectors at every level, and if initiatives are successful changes take place at the system level.

To exploit the potential of knowledge management and service delivery using digital approaches requires attention to be paid to the way in which IT systems at different levels – the systems'

architecture – are configured and relate to components (and sub-components), and are then modified. Without organisational awareness of these relationships between levels of infrastructure (hardware & networks) and applications, and within levels, coherence of the system itself is endangered. This will be an increasing challenge as the NHS and social care becomes increasingly digitalized.

Further key themes emerging from research on the transformation of the organisation to 'the digital organisation' are ability to transform and reconfigure, a collaborative culture with risk-taking and tolerance for failure, leadership from the top of the organisation (Kane, Palmer, Phillips, Kiron, & Buckley, 2015) the adoption of a so-called agile approach to meeting the organisation mission (Lewis, Andriopoulos, & Smith, 2014) but which entails the paradox of concerted focus on goals and means but also flexibility and a willingness to change course.

Transformative digitization approaches therefore promise much for organisations of every scale, but there is a need to address the question of how such changes, and not least in terms of the way in which private information is acquired, analysed and further disseminated, that results from the deployment of information systems should be governed.

> 'Digital Era Governance (DEG) offers a perhaps unique opportunity to create self-sustaining change, in a broad range of closely connected technological, organizational, cultural, and social effects. But there are alternative scenarios as to how far DEG will be recognized as a coherent phenomenon and implemented successfully.'
>
> (Dunleavy, Margetts, Bastow, & Tinkler, 2006, p. 467)

2.3.4 Governance Contexts

Health Innovation Manchester sits within a complex web of institutional actors and lies at the centre of a policy experiment in devolution governance. While the context is therefore complex in that Health Innovation Manchester is located within the Greater Manchester Health and Social Care Partnership, which is a local / regional organisation, it sits, as we note above, within a national system (currently comprising the Department of Health, NHS England, Clinical Commissioning Groups, and Foundation Trusts) which is itself nested within a European context (The European Parliament and the Council, 2004) (e.g. European Medicines Regulator 'EMA'). Furthermore, the overall devolution approach has multiple objectives, and in particular economic and social inclusion aims, that broaden governance dimensions.

The national system (the NHS) in which Health Innovation Manchester is located is a hierarchically organized governance environment, albeit with local and regional discretion. It has been prone to change, often fundamentally. Recent changes in the organisation of health and social care arising from the Long Term Plan that introduce Sustainability and Transformation Partnerships (STPs) (Ham, 2018; Raus, Mortier, & Eeckloo, 2020) and which in the case of Greater Manchester led to the adoption of an *integrated care systems* (NHS England, 2020), are significant reforms but with uncertain outcomes upon governance (Sanderson, Allen, Moran, McDermott, & Osipovic, 2020). Research upon STPs conducted by these authors identifies uncertainty on the question of whether this new form of governance system will allow greater self-management of resources, what the authors regard as, following Ostrom (1990), 'common pool resources' within STPs (and we suggest ICSs and ICOs, which are the actual organisational manifestation of the STP concept in the UK).

Central to the question how priorities can be identified and resources targeted is the autonomy which the state allows to NHS constituent organisations.

Considering the Greater Manchester governance system itself, we note the conclusions of Lorne, McDonald, Walshe, and Coleman (2019) that understanding of the devolution process in Greater Manchester requires an awareness of the variety of actors involved within the GM 'assemblage' including national actors, and which potentially complicate governance arrangements:

> 'New integrated governance arrangements and alliances were increasingly at odds with existing national regulatory systems which still majored on individual organisational oversight. Undoubtedly, performance targets inherited from previous NHS reforms and new national 'must dos' were not displaced entirely once Greater Manchester became devolved. However, as assembled relationships evolved in the region, attempts by national health bodies to directly reach into the region to shape priorities were able to be strategically reworked to bolster their regional interests.'
>
> (Lorne et al., 2019, page 11)

Within the GM context, the Partnership Board envisaged implementation of the ICO concept in 2016 through local care organisations (LCOs) at locality level (Greater Manchester Health And Social Care Strategic Partnership Board, 2016), since which time progress has been made although with different models of integration occurring (Naylor & Wellings, 2019; Salford Clinical Commissioning Group, 2014; Stockport CCG, 2019), following models outlined in the NHS Vanguards (NHS, 2016a, 2016b).

2.3.5 Responsiveness

If a mission includes a requirement for an actor to be able to deliver a response to changing circumstances, a greater challenge arises when circumstances change radically, when, for example there is threat that might be considered a Black Swan Event (Taleb, 2010 2nd edition) . As a result of the crisis caused by SARS-CoV-2 / COVID-19, around the world, health research and innovation organisations, and those they serve have been asked to react to an almost unprecedented challenge. How such organisations have reacted gives insight into their existing innovation capabilities, but also their capacity to change the way they operate in their environment including their relations with other organisations and therefore governance arrangements; and their approach to how they manage (acquire, process and disseminate) knowledge.

2.3.6 Research Focus

Whether innovation focused like Health Innovation Manchester or not, actors that enable innovation, face a variety of innovation challenges. Our review of literature draws attention to how an innovation actor functions and responds to its environment, and how a 'sense of place', and room for action are developed and understood and how governance arrangements affect organisational positioning. Our review also draws attention to how knowledge is managed and the role which digitalization is playing in extending control of knowledge and more broadly as a means of re-shaping the innovation process and this includes the organisations that deliver health and social care that Health Innovation Manchester supports and serves.

2.4 Main Assumptions of the Study Methodology/ Key Lenses of the Study conceptual Lenses

2.4.1 A Systems Lens

This study draws on and emphasises a number of aspects of the literature. We draw particularly on the literature of innovation processes and roles, including the role of innovation intermediaries, and the costs of innovation, which innovation intermediaries help to meet when market mechanisms are limited in what they can achieve in the context of uncertainty. While the performance of an innovation actor depends upon the models and methods used to manage *innovation,* the performance and functioning of Health Innovation Manchester as an innovation actor is significantly related to its being *situated* and *embodied* in a wide range of complex relationships extending from the very informal to properly statutory and legally based requirements. These relationships also exist at a number of levels (local, regional, national, international) and such organisations with whom these relationships exist have complex histories. For this reason, our focus has been upon both the relationship *between the setting* and the *models and methods* Health Innovation Manchester has been able to adopt to fulfil its innovation mission.

A key analytical distinction for this study is that of the difference between *delivery systems* and *innovation systems*. Delivery systems are, in sense, unreflective although they possess agency in relation to a set of fixed objectives, which are objectives as to aims and to methods, i.e., what is done by the system, and how a system delivers on its objectives. An innovation system exists to change the delivery system. Actors in these systems can be confined to delivery roles, to innovation roles or to hybrid roles. How hybrid role actors discharge their responsibilities – how they perform agentially - depends upon the respective balance which an organisation deems appropriate for them. The NHS is both a delivery system and innovation system, but its main priority is delivery. Nevertheless, innovation is vital to it.

Innovation intermediaries which operate within the NHS, such as Health Innovation Manchester are *innovation system* actors, but they must work with other actors who have hybrid roles to support innovation, but they also work with actors whose role is solely delivery in the attempt to understand better how delivery might be improved. The Academic Health Science System concept seeks to describe a delivery system that incorporates increasing levels of hybridity so that the delivery system is subject to greater levels of innovation, but the concept as defined by (V.J. Dzau et al., 2010) assumes the university as prime mover in innovation, and a traditional translational model. In our view, innovation does not necessarily begin at that point, i.e., with university research, even in health. Furthermore, to rely upon a matrix approach as V.J. Dzau et al. (2010, p. 950) suggest which can align *idea generation* with *need* within a large complex set of organisational arrangements such as exist in the UK's NHS semi-devolved system is in our view insufficient to deal with the coordination issue. The need for organisational intermediaries to manage the coordinating functions to support innovation in such a system appears *a priori* essential.

2.4.2 The Capabilities Lens

A study of the origins of an organisation at an early stage of development such as Health Innovation Manchester should carefully identify the capabilities that an actor possesses as these may come from existing organisations, networks, and also individuals. It should examine carefully the models and methods used to implement the mission, and examine how agency is acquired. This agency may then be used to transform the way the actor itself functions, including through the adoption of

new technology. It may be further employed to reshape relations with other actors, and even to the point of changing the way other actors behave.

3 Origins

'If a man will begin with certainties, he shall end in doubts, but if he will content to begin with doubts, he shall end in certainties.' — Francis Bacon, The Oxford Francis Bacon IV: The Advancement of Learning

3.1 Introduction

The creation of Health Innovation Manchester, which was formally proposed by memorandum of understanding in 2015 to be part of the National Health Service and located within the administrative body known as the Greater Manchester Health and Social Care Partnership, cannot be understood without reference to developments in approaches to both health policy, social care policy, and to governance at local, national and international level over a long period of historical time.

3.2 Devolution – Twists and Turns of a Policy

Since at least the 1960s, Manchester and its surrounding towns and the adjacent city of Salford have seen a slow but increasing move towards the integration of systems of governance to create what is now, in terms of governance arrangements, a city-region[15]. The emergence of Manchester as a 'City-Region' has not however been the result a simple progression towards the concentration of power at the regional level. In fact, over recent history, successive governments have experimented across the UK with a range of forms of devolved government and those which have today led to the current 'Devo Manc' /'Devo-Manc' arrangements are unlikely to be the end of the story.

In the Manchester context, different processes of aggregation of functions coupled with the devolution of responsibilities have operated over the period of the last 50 years. A general trend in terms of the creation of governmental and administrative units to create a 'Greater Manchester' begins with the passing of the Local Government Act of 1972 which led to the establishment, in 1974, of the Greater Manchester County Council (GMCC).

Increasing connectivity within the general area of the North West, and in particular the area around Manchester, coupled with a desire to find economies of scale in the provision of public services, had led to attempts to create governance structures that operate at levels larger than the individual county boroughs. This initial impetus for change in governance structures came from the report of a Royal Commission which produced 'The Redcliffe Maud Report' (Royal Commission on Local Government In England 1966- 1969, 1969) that promoted the notion of the 'unitary authority' at the level of large town or city, and, in the case of the Manchester and its environs and other locations in the UK, 'metropolitan areas', subsequently named 'metropolitan counties' as a result of the 1974 reorganization of local government.

By the 1980s, even closer integration of services and functions was being considered, but in 1986, as a result of the Local Government Act of 1985 (UK Parliament, 1985), and following a Conservative manifesto pledge to abolish the larger unitary authorities, which were all controlled by the opposition Labour Party, the Greater Manchester County Council was abolished. The unitary authorities had been castigated in the Manifesto thus:

[15] Although there have been reversals in the process, notably as a result of the 1985 Local Government Act.

> 'The Metropolitan Councils and the Greater London Council have been shown to be a wasteful and unnecessary tier of government. We shall abolish them and return most of their functions to the boroughs and districts. Services which need to be administered over a wider area - such as police and fire, and education in inner London - will be run by joint boards of borough or district representatives.'
>
> (Conservative Party Manifesto 1983, 1983)

The effect of the 1985 reforms was that while the larger authorities were disbanded, a number of functions in terms of the provision of services were retained at the higher level. In the case of Greater Manchester this was through the Association of Greater Manchester Authorities (AGMA) which took the form of a voluntary association of the 10 local authorities. Integrated working in a number of areas therefore took place and in Greater Manchester there were joint efforts (but not political integration) at the following levels: a) trading standards (The Greater Manchester Trading Standards Authority]; b) waste [Greater Manchester Waste Disposal Authority]; c) fire and civil defence [Greater Manchester Fire and Civil Defence Authority]; d) transport [Greater Manchester Passenger Transport Authority]; e) and the police [Greater Manchester Police Authority].

In the 1980s and into the early 1990s integration of the functions of government was pursued across the UK but without (the re-creation of) single governance systems that could take responsibility for those functions. However, during the period from around 2000 to around 2010, the UK Government attempted to re-activate a devolution policy at the level of regional government. This was not successful, and with the rejection, in 2004, by voters in the North East of England of a proposal for a regional assembly for that area, the devolution agenda took a new direction with the city-region emerging as the favoured form. It should however be noted that with the promotion of *well-being* in the Local Government Act 2000 (UK Parliament, 2000), a view was emerging that the devolution of power from national level (downwards) to some lower level might well support broader functions and broader social goals beyond those service areas traditionally included, which had been transport and waste.

By the last years of the Labour Government (2009-2010), two city-regions were identified as likely to be the first to adopt the powers provided in the Local Democracy, Economic Development and Construction Act 2009 (UK Parliament, 2009), these being West Yorkshire and Greater Manchester but the concept of regional devolution was being explored in other areas too. The devolution plans forming before the beginning of the Coalition Government (2010-2015) were *city-region* proposals, but after 2010, under the Coalition Government, when further devolution was promised as a result of the Localism Act (UK Parliament, 2011), devolution, across a wider range of scales and involving a wider range of bodies began to occur. The logic for the approach was to bring power [governance] to where it was needed:

> 'The Government is committed to passing new powers and freedoms to town halls. We think that power should be exercised at the lowest practical level - close to the people who are affected by decisions, rather than distant from them. Local authorities can do their job best when they have genuine freedom to respond to what local people want, not what they are told to do by central government. In challenging financial times, this freedom is more important than ever, enabling local authorities to innovate and deliver better value for taxpayers' money.'
>
> (DCLG, 2011, page 4.)

The approach of the Coalition Government was however to steer away from regional government and to achieve this, the nine Regional Development Agencies that had supported regional government economic development were disbanded and their functions assigned to smaller, city / locally based bodies of which there are now 38 (LEP Network, 2020). Furthermore, the approach now emphasized cities and their hinterland, an approach that promised advantages but also presented problems (Haughton, Deas, Hincks, & Ward, 2016).

The term 'City Deal' was coined, although there was to be a bespoke approach to the devolution process, in common with the previous government's 'variable geometry' approach to regional government (Shaw & Tewdwr-Jones, 2017). In Greater Manchester, a combined authority, the Greater Manchester Combined Authority (GMCA) was formed by means of a statutory instrument on the 1st April, 2011, as a successor to the Association of Greater Manchester Authorities (AGMA) ("The Greater Manchester Combined Authority Order 2011," 2011).

Following the 2015 General Election, the new government's approach to devolution was to consider granting more powers through a set of secondary deals, provided various conditions were met. In the case of Greater Manchester, the central condition was that the devolved authority agreed to an elected mayor. At this time, a number of studies were being undertaken by the City Growth Commission chaired by Lord O'Neill of Gatley to support, and these supported in often quite vigorous terms, the policy of devolution (Blond & Morrin, 2014; City Growth Commission, 2014; Cox, Henderson, & Raikes, 2014). The studies put forward arguments, already current at the time, that health and the economy were inextricably linked. A simple proposition was advanced: *without better health, economic improvement was not achievable*.

> 'For Greater Manchester to reach its economic potential, more unemployed residents need to enter into work and progress into higher skilled (and higher paid) roles. Economic inactivity – mainly due to ill-health – amongst the working age population is one of the deep-seated causes of Greater Manchester's productivity gap and has driven the development of the Greater Manchester Growth and Reform Plan. In order to maximize the benefits of investment in growth, it is critical that residents of Greater Manchester are better connected to economic opportunities through the effective reform of public services.'
>
> (Blond & Morrin, 2014, page 26).

Furthermore, the integration of health and social care, discussed at various levels of government and already an objective in Scotland (Scottish Parliament, 2014) was also emphasized in the studies.

> 'Health and social care: Greater Manchester should complete its whole-system reform to integrate out-of-hospital and in-hospital care including primary care, community care, public health and social care, managing these services at a Greater Manchester level. This will allow local government to marry democratic accountability to local clinical insight and immediately integrate these services with existing localized provision. Pooling NHS and local authority budgets would ensure that funding is spread across the spectrum, and that outcomes are targeted at improving people's health and wellbeing and getting people into work
>
> (Blond & Morrin, 2014, page 40).

The authors producing the IPPR Report 'Decentralization Decade: A Plan for Economic Prosperity, Public Service Transformation and Democratic Renewal in England' noted that decentralization / devolution / delegation was complex, and involved many public services. In the context of health and social care, they noted that change would be needed at different levels: 'Some policy interventions require a highly individualised approach: key aspects of health and social care are increasingly personalised, while overall commissioning frameworks need to be decided at a higher tier ' (Cox et al., 2014, p. 30) .

These authors also cite earlier studies which had claimed to find extensive savings in health and social care amongst other areas if some form of de-centralized budgeting coupled with devolution of control was introduced.

> 'Whole Place Community Budget pilots built on this approach and developed the notion of a place-based budget between services to address cross-cutting challenges such as worklessness, complex dependency and health and social care. Evaluation of the four pilots showed that if all places adopted the approaches on health and social care, troubled families and work and skills, there was potential for better services and savings overall of between £9.4 billion and £20.6 billion over five years (Ernst & Young 2013). This is the most significant evidence of the potential savings that could result from scaling up place-based budgets, but they cannot be realised within an unreformed system. Savings that occurred from the pilots were found to accrue at a ratio of 80:20 to central government agencies and to councils respectively (CLG Committee 2013).'
>
> (Local Government Innovation Task Force, 2014).

There was however a long-standing tendency for the effort to move responsibility down from central government to lower levels not to work quite as intended. As Cox et al. (2014) note, below, partly because of lack of serious intention, partly because of the desire not to let go, efforts to move power down often faltered. Under these circumstances of realpolitik, such control as was moved down might not actually be devolution but delegation:

> Too often, any genuine attempt to decentralise power has been stymied by the inability for government departments to work in concert. For example, initiatives led by the Department for Communities and Local Government (DCLG) to 'join up' public services at the grassroots have faltered as ministers and officials from the relevant sections of the Home Office and Department of Health have been more reluctant to let go of the reins. The process of negotiating city deals has involved shuttle diplomacy from department to department to agree even the most minor freedom or flexibility. It is human nature that few ministers, having finally achieved high office, are then predisposed to give away the powers for which they have so long sought. There is a political problem too. Political parties come to power often riding high on a wave of good intentions to push power down to the grassroots organisers, upon whom they have depended for electoral success. Once in power, however, the premium is instead placed on 'making a mark', on doing things differently from the previous government. That very often that involves

> reasserting control from the centre, and the lustre of decentralisation soon fades. By the time a government gathers the confidence and perspective to recognise the value in giving powers away, the next election is upon them and more radical ideas are sent into the long grass.'
>
> (Cox et al., 2014, p. 18)

Nevertheless, in some areas the momentum for the policy of moving power and responsibility down to lower levels / tiers of government was building and changes were made possible by way of a second batch of deals under the Cities and Local Government Devolution Act 2016 (UK Parliament, 2016) that included far a wider range of powers. In the case of the GM second deal, the areas which now fell under the responsibility of the combined authority (House of Commons Briefing Paper, 2015) in addition to health and social care were the following: Further Education, Transport, Business support, Work Programme, Public Land Commission, Policing, Housing, Fire service, Spatial Planning, Economic Development, EU structural Funds. The following table, Table 3 UK Devolution Deals (House of Commons Briefing Paper, 2015, page 11.) lists the deals made by September 2015 and the proposals made within them for the devolution of functions.

Table 1: proposals in devolution deals agreed by September 2015

	Greater Manchester	West Yorks	Sheffield	Cornwall
Further education and skills	New FE system	New FE system	New FE system	New FE system
	Apprenticeship Grant for Employers	Apprenticeship Grant for Employers	Apprenticeship Grant for Employers	
			Adult Skills funding	
Transport	Funding	Funding options	Funding	Funding
	Bus franchising	Links with Network Rail and Highways England	Links with Network Rail and Highways England	Bus franchising
	Smart ticketing			Smart ticketing
Business support	Trade support funding	Integrated services	Integrated services	Integrated services
	Funding from 2017	Funding from 2017	Funding from 2017	Funding from 2017
Work Programme	Possible joint commissioning in 2017	Possible joint commissioning in 2017	Harder to help claimants joint commissioning in 2017	
Public land commission	Yes	Yes	Yes	Yes
Health & social care	Integration	-	-	Integration business plan
Policing	Mayor to become Police and Crime Commissioner	-	-	-
Housing	Some funding	-	*Under discussion*	-
Fire service	Mayor to take over	-	-	[Cornwall Council]
Spatial planning	Yes	-	Yes	[Cornwall Council]
Economic development	Mayoral Development Corporations; compulsory purchase	-	Mayoral Development Corporations; planning call-in powers	-
EU structural funds	Intermediate body	-	*Under discussion*	Intermediate body

Table 3 UK Devolution Deals (House of Commons Briefing Paper, 2015, page 11.)

3.3 Arriving at 'Devo Manc'

In July 2014 therefore, the GMCA and the Government agreed £476m of government funding for growth and reform plan, while in the November of that year [03-11-2014] a GM Devolution

Agreement set out further devolution of powers on planning, land, transport, and fire services, and changing governance of GMCA to introduce arrangements for a directly elected mayor from 2017.

This second set of devolution deals which included health and social care was not the first time there been a requirement for a single decision-making body located in the Manchester area to coordinate to health care provision. In 2005, the Association of Greater Manchester Primary Care Trusts had been established with formal joint decision-making authority jointly to commission health services across the area while in 2012, the Greater Manchester Association of Clinical Commissioning Groups had been created. What was now contemplated in the agreement was a much more significant bringing together of the institutions of the area. The key steps were in terms of agreements reached were as follows:

a) On the February 27th, 2015, agreement was reached to further develop the devolution of health and social care concerning the devolution of the budget which was for £6 billion and arrangements for future working (Greater Manchester Combined Authority (GMCA) & Association of Greater Manchester Authorities (AGMA), 2015), including a programme of shadow working from 1st April of that year with the intention of achieving full operation for the Partnership as it was to be called from 1st April 2016.
b) On July 10th, 2015, the key institutions across Greater Manchester signed a memorandum of understanding *Securing a Unified Public Health Leadership System in GM* ['The Public Health MOU'] as a Contribution to Delivering a Transformation in GM Population Health (Public Health England & GM Local Authorities & NHS England & Association of GM CCGs & GM NHS Providers & GM Blue Light Services (GM Police, 2015)
c) Three days later on the July 13th, 2015, a MOU was signed to agree the creation of Health Innovation Manchester (Greater Manchester Combined Authority & Health Innovation Manchester, 2015).
d) In December 2015: Strategic partnership board approves governance arrangements for health and social care and produces strategic plan (University of Manchester, 2015)
e) For a period no agreements in the form of MOUs were signed until January 27th 2017 when a Voluntary Sector MOU was signed (Greater Manchester Health and Social Care Partnership & The Voluntary Community and Social Enterprise Sector in Greater Manchester, 2017).
f) This was then followed by a Pharmaceutical Industry MOU on the 24th February 2017 (Greater Manchester Health and Social Care Partnership et al., 2017).

At this point in time, the fledgling innovation actor was located within the organizational structure of The Greater Manchester Health and Social Care Partnership. At this point (Greater Manchester Combined Authority, 2015), its members were as follows

From the Area

The Localities (10)

Bolton Metropolitan Borough Council
Bury Metropolitan Borough Council
Manchester City Council
Oldham Metropolitan Borough Council
Rochdale Metropolitan Borough Council
Salford City Council
Stockport Metropolitan Borough Council
Tameside Metropolitan Borough Council
Trafford Metropolitan Borough Council
Wigan Borough Metropolitan Borough Council

Providers (15)

Bolton Hospital NHS Foundation Trust
Central Manchester NHS Foundation Trust
Greater Manchester West Mental Health Foundation Trust
Manchester Mental Health and Social Care NHS Trust
North West Ambulance Service NHS Foundation Trust
Pennine Acute NHS Hospitals Trust
Pennine Care NHS Foundation Trust
Salford Royal NHS Foundation Trust
Stockport NHS Foundation Trust
Tameside Hospital Foundation Trust
The Christie NHS Foundation Trust
University Hospitals of South Manchester NHS Foundation Trust
Wrightington, Wigan and Leigh NHS Foundation Trust
Bridgewater Community Healthcare NHS Trust
5 Boroughs Partnership NHS Foundation Trust

Clinical Commissioning Groups (12)

Bolton Clinical Commissioning Group
Bury Clinical Commissioning Group
Central Manchester Clinical Commissioning Group
Heywood, Middleton and Rochdale Clinical Commissioning Group
North Manchester Clinical Commissioning Group
Oldham Clinical Commissioning Group
Salford Clinical Commissioning Group
South Manchester Clinical Commissioning Group
Stockport Clinical Commissioning Group
Tameside and Glossop Clinical Commissioning Group
Trafford Clinical Commissioning Group
Wigan Clinical Commissioning Group

There were two external parties to the arrangement Public Health England (PHE), and NHS England (NHSE). Earlier in the year, at a Joint Greater Manchester Combined Authority & AGMA Executive Board Meeting (Date: 27th February 2015), it was indicated that, while the partnership was to have a strategic role, it did not yet at that stage have statutory status:

> 'From April 2015 this Board will be formed to include local authorities and CCGs, Providers, NHS England and the regulatory bodies. It is proposed that this is the body that will include elected member representation from the local authorities. It will oversee the strategic development of the GM health economy, and will have specific responsibilities for the GM Health and Social Care Strategic Sustainability Plan and related investment funding proposals. The intention is that during 2015/16 work will be undertaken to explore with CCGs and Government whether the Board should become a statutory body as part of the enactment of legislation to give effect to the Devolution Agreement.'
>
> (Greater Manchester Combined Authority (GMCA) & Association of Greater Manchester Authorities (AGMA), 2015, page 6.)

Writing about the devolution of health and social care to Manchester, but addressing the issue of devolution generally within the UK, Walshe, Coleman, McDonald, Lorne, and Munford (2016) noted the degree of uncertainty over future arrangements. The option to 'explore' statutory status may have been a pragmatic response in the context of experimentation with 'devolution' at such a large scale. The authors are however prepared to go further to suggest that the changes proposed at that time were closer to *delegation* than true *devolution*, a point given support by John Rouse's comments (Rouse, 2016) at Manchester Statistical Society and again in his Telford Lecture (Rouse, 2020):

> 'Such devolution arrangements are normally spelt out in detail through primary legislation that defines the extent and scope of devolved powers (as has been done with devolution to Scotland, Wales, and Northern Ireland). Within England, no such legislative settlement is in prospect, and all the existing accountabilities and structures are to remain in place. *Some would describe this as delegation rather than devolution because the transfer of powers being offered to Greater Manchester has no legal force and, unusually, involves delegation to a coalition of public bodies rather than to a single statutory authority*.
>
> (Walshe et al., 2016, page 2.)

3.4 Health Innovation Manchester

Amongst the agreements surrounding the devolution settlement was the proposal to create Health Innovation Manchester by means of the Memorandum of Understanding of the July 13th, 2015. We conclude this section a brief discussion of the implications. The following states the organizational mission for Health Innovation Manchester outlined in the Memorandum, a set of objectives in fact largely common to all the memoranda signed following devolution (Association of Greater Manchester Authorities (AGMA), Greater Manchester Clinical Commissioning Groups, & NHS England, 2015; Authority & MoU, 2017; GMCA Greater Manchester Health and Care Board, 2018; Greater Manchester Health and Social Care Partnership et al., 2017; Greater Manchester Health and Social Care Partnership & The Voluntary Community and Social Enterprise Sector in Greater Manchester, 2017):

1. Improving the health and well-being of all the residents of Greater Manchester
2. Closing the health inequalities gap
3. Delivering effective integrated health and social care

4. Moving care closer to home where possible
5. Strengthening the focus on well-being, including a greater focus on prevent and public health
6. Contributing to growth and to connect people to growth
7. Forging a partnership between the NHS, social care, universities, and science and knowledge industries for the benefit of the population'

> (Greater Manchester Combined Authority & Health Innovation Manchester, 2015, page 2)

Our review of these objectives sees a group of essentially three mutually supporting activities: a) health and social care delivery improvement, which correspond to objectives 1-5 of the Memorandum; b) an economic development goal, with the implication that some people are not economically productive, which corresponds to objective 6; c) an innovation system shaping function, which corresponds to objective 7.

As an innovation actor, Health Innovation Manchester was given a broad remit to contribute on a number of dimensions and under governance systems operating at a number of levels, and would need to establish ways of reconciling the requirements of different governance systems – requirements in terms of defining priorities for action, in terms of means of achieving objectives, and, by implication, in terms of the meta-picture, which is that of how the innovation system itself should operate.

3.5 The Research Capability Background

Health Innovation Manchester was introduced as an innovation actor into an organisational environment in which there were already a number of bodies with related missions to foster innovation in health through research, translation, engagement with users and with industry, and with therefore a wide range of missions, streams of work and personnel. These organisations included in the Greater Manchester area, the following: MIMIT ('Manchester: Improving Medicine with Innovation and Technology), created in 2008; the local Academic Health Science Network (AHSN), created in 2011; the Manchester Academic Health Science Centre (MAHSC), created in 2009 (West, 2009); Collaboration for Leadership in Applied Health Research and Care (NIHR CLAHRC), created in 2008; Trustech which had been in operation since 2001 (Martin, 2012), and the Utilisation Management Team (then hosted by Salford Royal [Int.443]).

We note a number of contrasts between the bodies already present. The MAHSC, created in 2009 under the National Institute for Health Research (NIHR), was a research organisation, pursuing excellence in research with a funding capability. By 2020, the Academic Health Science Centre [MAHSC] had [Web of Science Data] 105 publications with over 2500 citations, involving 35 countries and 305 other funding body acknowledgments from around the world (including a number from Manchester). Reflecting the focus upon actual innovation including industry linkages and broader projects rather than academic research, the Academic Health Science Network [AHSN], had only a small number of publications that involved collaboration with just 17 countries. AHSNs generally prioritize challenge (demand side) and needs based activity and are the ' key innovation arm of the NHS' (Health Innovation Manchester, 2020a).

3.6 The Service Delivery Context – A Context for Innovation?

Health Innovation Manchester was also introduced into an emergent integrated care system, a new arrangement for delivering the service. Encouragingly, the systems to support health outcomes in the area were considered to be performing well, according to data from the Public Health England, and shown in Annex 2 GMHSCP General Tables. The information shows the area was considered to be one of the Category 2 areas, with some strong performances in terms of the service delivery. However, in terms of health outcomes, and also in terms of deprivation, the area was considered to

be facing many challenges of poor health. Comparison of the area with other combined authority areas (CA Regions) shows both relatively poorer levels of health outcomes, Table 4 CA Health Outcomes, Public Health England.

Combined Authorities (CA) Regions	Resident population	Percentage of people aged 16-64 in employment	Smoking Prevalence in adults in routine and manual occupations (18-64) - current smokers (APS)	Children in low income families (under 16s) (CA % Avg.)	Inequality in life expectancy at birth (Avg. Female)	Inequality in life expectancy at birth (Avg. Male)
	2018	*2018/19*	*2018*	*2016*	*2016 - 18*	*2016 - 18*
CA-Cambs and Peterborough	852523	79.60	29.09	13.20	5.77	7.63
CA-Greater Manchester	**2812569**	**72.60**	**28.78**	**18.53**	**8.53**	**10.71**
CA-Liverpool City Region	1551497	71.80	21.90	21.12	10.23	11.78
CA-North East	1983625		26.63	21.67	8.69	10.71
CA-North of Tyne	826455	71.10	24.88	19.67	9.43	11.60
CA-Sheffield City Region	1402918	73.30	26.14	22.38	8.88	10.05
CA-Tees Valley	674284	68.20	25.36	25.38	10.60	13.00
CA-West Midlands	2916458	69.00	23.73	23.37	7.77	9.59
CA-West of England	938155	79.20	26.97	13.23	5.83	7.43
CA-West Yorkshire	2320214	72.70	28.49	20.06	8.50	9.84
Total	16278698					

Table 4 CA Health Outcomes, Public Health England

In terms of life expectancies compared across all English CCGs, the CCGs covering the Greater Manchester Health and Social Care Partnership, were generally low although with a small number of better performing ones. As the following tables indicates, across the ten localities, population health outcome in terms of life expectancy for women Figure 1 Ranking of All Life Expectancy (LE) for women at age 65 by Clinical Commissioning Groups in England, 2010-2012 were poor and those for men were similar Figure 2 Ranking of All Life Expectancy (LE) for men at age 65 by Clinical Commissioning Groups in England, 2010-2012.

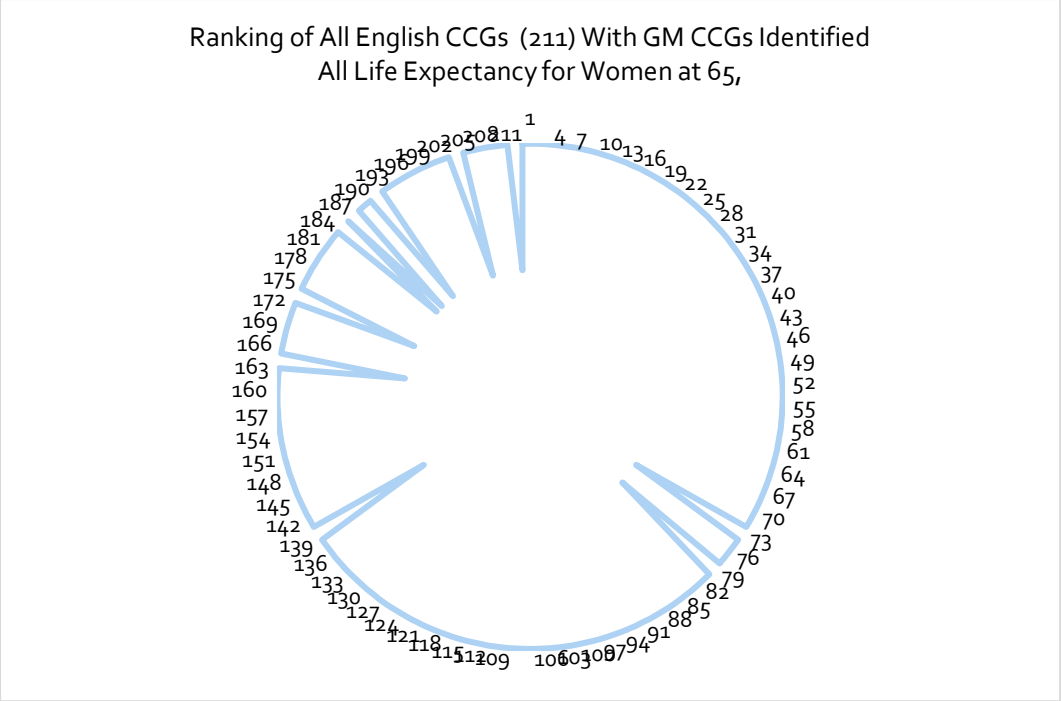

Figure 1 Ranking of All Life Expectancy (LE) for women at age 65 by Clinical Commissioning Groups in England, 2010-2012

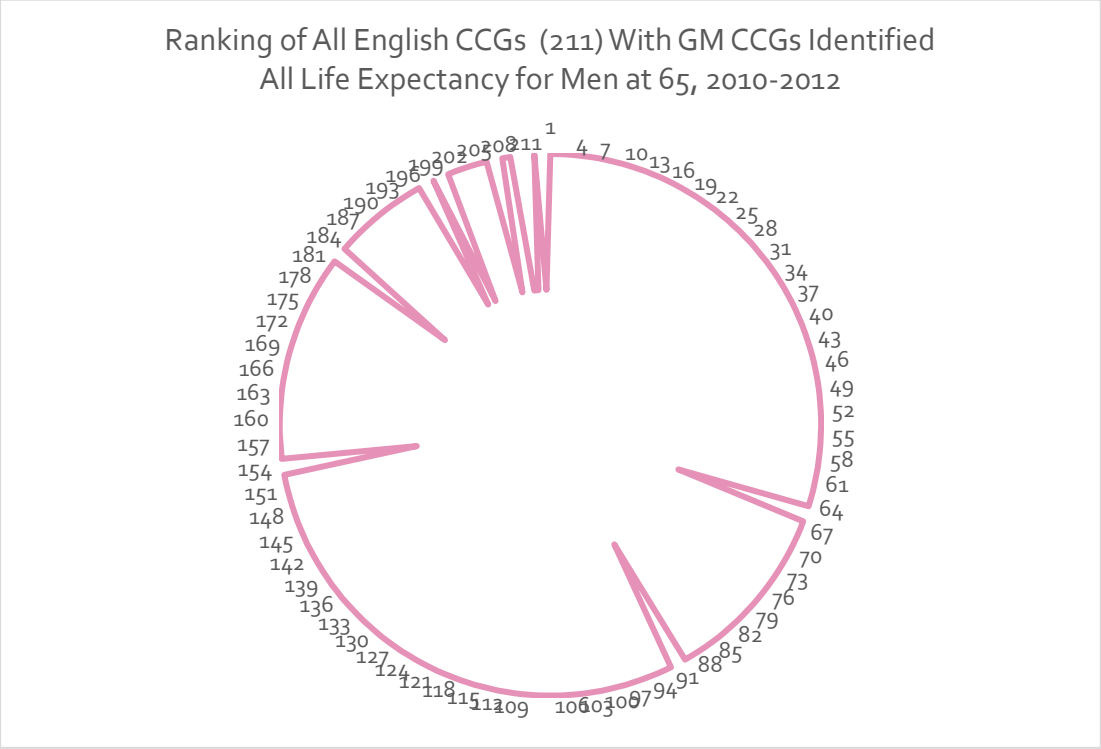

Figure 2 Ranking of All Life Expectancy (LE) for men at age 65 by Clinical Commissioning Groups in England, 2010-2012

A number of other sources of information can be used to assess the level of diversity across the GM area in terms of health outcomes. Information provided from Public Health England ['Public Health England. Public Health Profiles. [Date accessed] https://fingertips.phe.org.uk], some of which is sources through the Office of National Statistics has been used by us to prepare local authority (and corresponding CCG) measures of health outcomes including deprivation indicators. In preparing this information we have aimed to provide information as close in time to the date of the creation of Health Innovation Manchester in 2015.

Deprivation scores shown below Table 15 Source: ONS Deprivation – Index of Multiple Deprivation (IMD) Scores across the ten individual CCG areas confirm a picture of relatively poor health but with considerable variability across the CCGs areas. A central objective of Health Innovation Manchester was that it should begin to make an impact upon an area (the GMHSCP area) where public health across a large range of measures has been widely considered to be below national averages, and at the same time to contribute innovations to lead to health improvements more broadly.

Figure 3 Making A Contribution – Local and National

3.7 Early Steps Towards the Organisation

The appointment in September 2015 of a highly experienced clinician [FRCS] with an oncology background and senior roles at AstraZeneca in terms of innovation and business development was one of the first and important steps towards the creation of Health Innovation Manchester. The role faced considerable challenges, however.

The challenges comprised the following tasks: a) working out how best to deliver innovation across a wide range of levels (local, regional and national, reflecting the broad remit of the Memorandum and Health Innovation Manchester's constituent bodies); b) engendering innovation in an area of generally low but very diverse health and social care needs across the Partnership area; c) reconfiguring a range of pre-existing organisations to collaborate not only with each other but within a new context (i.e. within the varied resources of the devolved arrangements); d) uncertainty over internal governance arrangements for the partnership as a whole. As noted below, the general arrangements for the Partnership were complex and had a form of provisional status until

December 2015 when there was agreement about them was reached (Joint Greater Manchester Combined Authority & AGMA Executive Board, 2015). The revised governance proposals for the Partnership noted the following:

> 'GM NHS will remain within the NHS and subject to the NHS Constitution and Mandate;
> Clinical Commissioning Groups and local authorities will retain their statutory functions and their existing accountabilities for current funding flows;
> Clear agreements will be in place between CCGs and local authorities to underpin the governance arrangements;
> GM commissioners, providers, patients and public will shape the future of GM health and social care together;
> All decisions about GM health and social care to be taken with GM as soon as possible;
> Accountability for resources currently directly held by NHS England during 2015/16 will be as now, but with joint decision making with NHSE in relevant areas to reflect the principle of 'all decisions about GM will be taken with GM.'
>
> (Joint Greater Manchester Combined Authority & AGMA Executive Board, 2015, p. 3)

The issue of commissioning was foremost in the Updated Governance Proposals (Joint Greater Manchester Combined Authority & AGMA Executive Board, 2015) document which noted a complex structure with many organisations involved and the need for the Joint Commissioning Board to create a new research and innovation board:

> 'The membership of the GMJCB will be comprised of the 23 commissioning organisations in Greater Manchester, and the Greater Manchester Combined Authority to create an organization with 24 representatives in total: 'CA x 1 ; NHSE x 1; The CCGs x 12; The LAs x 10'
>
> (Joint Greater Manchester Combined Authority & AGMA Executive Board, 2015, pp. 8-9).

The Board outlined what were in effect principles of subsidiarity in terms of agreeing the levels at which commissioning would occur:

> '8.7 The GMJCB will only take GM wide commissioning decisions; any decision that currently sits with the commissioning responsibilities of Las and CCGS will stay with these organisations (or at a locality level where new commissioning arrangements are being developed).
>
> 8.8 Whilst the core principle of the GMJCB will be that that those commissioning decisions which are currently made in localities will remain in localities, there will be a mechanisms [sic] developed to ensure that remit of the GMJCB can be broadened should localities agree that it is in their best interests to do so.

> 8.9 It is accepted that there are certain specialised services that would be impractical to commission on a Greater Manchester footprint. However, NHSE will work collaboratively with the GMJCB to ensure that these services are not commissioned in isolation of Greater Manchester.'
>
> (Joint Greater Manchester Combined Authority & AGMA Executive Board, 2015, pp. 8-9)

Following the publication of the governance proposals, a strategy document was then released entitled 'Taking charge of our Health and Social Care in Greater Manchester - the Plan' but this did not define specific roles for Health Innovation Manchester or an organisational map or plan (Greater Manchester Combined Authority, 2015).

At this stage, the governance arrangements for the new body (Health Innovation Manchester) had been discussed but had been considered too complex, and, in a spirit of optimism, there was an expectation that in time, coherent working arrangements would emerge. This was however, despite KPMG's original strategy and business plan which had indicated that what was needed was more than simply 'creating an umbrella for all these groups' [Person 444]. Thus, while the shadow board 'had the right people on, it did not begin to make progress' [Person 444]. At this very early stage, the activities of Health Innovation Manchester were described by one interviewee as 'a coalition of the willing… there wasn't any proper resource assigned to a single organisation' [Person 192]. Causing some disruption to the project to establish Health Innovation Manchester was the departure of the chief executive in May 2016.

4 Formalization

'All good things which exist are the fruits of originality' – J.S. Mill, On Liberty

4.1 Early Steps

The attempt to instigate increasing collaboration and cohesive working from a range of locally based health innovation organisations had been difficult and had been attempted without an executive team to provide leverage over 'constituent parts'. The concept of running Health Innovation Manchester as an umbrella or 'virtual organization' under which bodies with established ways of working, based in different organisations within the Partnership gradually developed a collaborative approach, had not had the desired result. According to the person specification from the executive search (launched the following year) following the departure of the first chief executive, there was a need for a new approach:

> 'HInM has not hitherto had a dedicated executive team. An initial attempt to work via collaborative effort between partner organisations did not produce the inputs or pace required. In summer 2016, the Board made a number of changes.'
>
> (Russell Reynolds, 2017, p. 2)

Interviewee data suggests part of the difficulty lay in the tension between local and national missions and the goals of research:

> 'Some people don't really see themselves as part of the local. If there was a conflict between research excellence and local impact, research excellence wins out.'
>
> [Person 0018]

In summer 2016, the Board of Health Innovation Manchester attempted to re-establish the organization: in particular to give it more direction by appointing as new executive chair [Rowena Burns]; to strengthen the board; and to formally merge the Manchester Academic Health Science Centre and the Greater Manchester Academic Health Science Network. As the executive search body responsible for recruiting a new CEO noted, the changes that were planned were aimed at re-launching Health Innovation Manchester with a proper identity and with greater emphasis upon achieving a coherence to its objectives and functions.

> 'Strengthened Board membership - the Board meets quarterly;
>
> A decision to bring together the two bodies (MAHSC and GMAHSN) whose overlapping responsibilities map closely onto HInM's objectives, within a single HInM brand, organisational, and governance structure;
>
> Appointment of an Executive Chair (Rowena Burns, an existing Board member and CEO of HInM founder member, Manchester Science Partnerships), to oversee the appointment of a CEO and team, the integration of the AHSC/N, and to establish HInM as a formal entity, with an agreed long-term funding strategy;
>
> Review of the business plan.

> All of the above is in hand, and a revised business plan has been agreed. There is strong collaboration between the leadership of the AHSC and the AHSN through a shadow senior management team, and strong engagement from academic, clinical, and industry colleagues.'
>
> (Russell Reynolds, 2017)

The executive search briefing noted the need to re-form the organization to draw on a range of bodies that were committed to the overall goals of the memorandum but which had not been yet successfully brought into alignment.

> 'This is a shaping role. HInM is still a new body, with high expectations but a chequered beginning. The successful candidate will need to build quickly on the partners' deep commitment and ambition, articulate a vision and forward plan which inspires both trust and respect, and translate this into initiatives and successes which energise colleagues and stakeholders. The ability to think clearly and practically is essential, but so is the capacity to be comfortable with ambiguity and complexity.'
>
> (Russell Reynolds, 2017, p. 2)

By early 2017, there had been progress in bringing about greater coherence to the activities of Health Innovation Manchester (Greater Manchester Health And Social Care Strategic Partnership Board, 2017a). The Strategic Partnership Board in its report of March 2017 noted the early difficulties but sounded a positive note, showing what progress had been made to create a functional organization through the advice from KPMG's consultancy project.

> 'Launched in late 2015 as a virtual organisation without dedicated resource, Health Innovation Manchester (HInM) had a difficult first 18 months.
>
> 1.2. Over summer 2016, the Steering Group initiated a series of changes, strengthening and formalising the Group as a Board, appointing an Executive Chair, and initiating discussions on bringing together the Academic Health Science Centre (AHSC) and the Academic Health Science Network (AHSN) within a single HInM brand and governance structure.
>
> 1.3. 1 While the overall direction of the initial business plan remained appropriate, delivery had not matched its ambition, and efforts were renewed to sharpen the focus and get buy-in which was lacking from partner organisations.'
>
> (Greater Manchester Health And Social Care Strategic Partnership Board, 2017a, pp. 2-3)

By March 2017, the Board had developed a detailed plan for formalizing Health Innovation Manchester. Its work had been assisted by KPMG which had worked closely with the Board. In the report on behalf of the Health Innovation Manchester Board to the Strategic Partnership Board of the GMHSCP (Greater Manchester Health And Social Care Strategic Partnership Board, 2017a), there was clarification of a number of important details of the organization's future direction:

a) There was confirmation of the strategic priorities which Health Innovation Manchester would follow;
b) An interim budget until September 2017 was outlined;
c) A financial plan for the period to 2021 was also presented with a number of lines of activity;
d) There was also a prescription for organisational design;
e) Implementation strategies, and deliverables were outlined along with mention of key performance indicators to be used to monitor and assess progress;
f) And a commitment to learning from experience and evaluation was made.

4.2 Strategic Priorities

Three strategic priorities were outlined. These drew in a limited way on the Memorandum's explicit mission as the Board paper was more concerned with the task of establishing a working Academic Health Science System of which Health Innovation Manchester was considered to be an example. The first strategic priority outlined in the Board paper related to information and informatics: 'The implementation of Health Innovation Manchester will support GMHSCP's ambition of establishing a population-wide informatics capability and infrastructure to integrate health and social data and analytics.' The second priority sought 'to extend our already strong research and clinical trials expertise, creating a one-stop shop for industry wanting to access the GM health system'. A third priority was 'to leverage … existing strengths in Precision Medicine, through further development of … data analytics capabilities, and by the application of the 4P principles of Precision Medicine to the re-design of clinical pathways in the treatment of chronic diseases such as psoriasis'. (Greater Manchester Health And Social Care Strategic Partnership Board, 2017a).

Discussion in this document of the strategic priorities did not consider the balancing act that might be needed to address the regional mission of Health Innovation Manchester and its wider role as an innovation actor in national and international systems. Instead, while the local role was considered to be in terms of service delivery, bringing '… together basic research, translational research, clinical demand, and industry know-how and investment, within a single body, focused wholly on the needs of a population of 3 million people', the national role was presented more in terms of economic development.

4.3 Budgeting

Money was made available from the 2017-18 financial period (up until September 2017) in order to achieve explore organisational design questions, such as the incorporation of the two main arms of the organization, but also to identify the best form of corporate structure, and its longer-term funding model. It was then proposed that from September 2017, a revised Business Plan would be presented that took account of the two major parts of the organization, showed clearly all the activities that were being undertaken, what would be undertaken in the future and, perhaps most importantly, how they contributed to the goals of the Partnership. In respect of this last objective for the revised plan, a 'full suite of KPIs and measurement framework' (Greater Manchester Health And Social Care Strategic Partnership Board, 2017a, p. 7) were to be prepared. The budget for the organization for the three-year period beyond from October 2017 was to come from a bid to the GM Transformation Fund. The projected three-year cost for staff was at this stage £3.318 million, while non-pay service costs over the same period were assumed to be around £800K.

4.4 Organisational Design Issues

A number of important issues of design and functioning of the organization were considered. In addition to the decision to join together the AHSN and the (M)AHSC under one roof and within a single organization, the Business Plan for 2017 which was attached to the Board Report proposed a so-called Innovation Access Pathway (IAP) which the new organization would use to manage

innovation. The Pathway's functions were various, as befitted the diverse range of actions that are needed to support innovation. The Pathway set out as a systematic approach to 'capturing, evaluating and developing and prioritizing innovation' which would 'drive clarity for stakeholders'. It would therefore connect to the existing entry point that had been developed for innovations, the *Innovation Nexus*. It would be agile – 'being responsive and iterative' - and it would increase the speed of innovation and de-risk investment. Additionally, it was considered that the Pathway approach would allow Health Innovation Manchester to discover the actual priorities that were present across the Partnership for innovation.

The Pathway was integral to the management of innovation activities which was also to include a horizon scanning process, calls for proposals on digital and ehealth, and an evaluation function that might employ health economists through an SLA with New Economy[16]. Recognition was given to the need to be ready for unexpected innovations to be incorporated into the pipeline of innovations that might present unexpectedly. A further development of the approach to innovation was emergence of a classification of innovations with niche and transformative types both being noted.

A further feature of the organisation was a programme management approach based on a matrix structure, the importance of which was recognized early on in the formalization process. As interviewee 624 indicates, the need-to-know what progress was being made

> 'When x joined, they had very quickly realised there wasn't a programme management approach or an outcomes-focused approach to the work delivery, and so X saw that as a gap. I came in, in a matrix way, to try and bring in that programme management approach and a more structured, coherent programme approach, as well as a focus on outcomes. So ..[we could see] .. what was it we were actually delivering and why?'
>
> [Person 624]

4.5 Implementation

Changes within the components of Health Innovation Manchester had included the resignation of the Chief Executive of the AHSN (hosted at Salford Royal) with Amanda Risino becoming acting chief executive of the AHSN. The AHSC was at this point an organization with a different organisational status. As an independent not-for-profit organisation in the form of Company Limited by Guarantee (CLG), it ran with Jo Clegg as the chief executive and managing director, and had a handful of employees who were also university employees.

A small steering group of five, comprising leadership from both organisations, steered the initial design and implementation of the Health Innovation Manchester agenda. These leaders include the chair of Health Innovation Manchester, the acting chief executive of AHSN, the Medical Director of the AHSN, the chief executive officer of the AHSC (also a Dean at the University of Manchester) and the chief operating officer and deputy chief executive of the AHSC. The chair, Rowena Burns, was the executive and responsible for the leadership of the system, while the acting chief executive of AHSN and the chief executive of AHSC collaborated to manage the planning, delivery and implementation of the programme of change agreed for the integration of AHSN and AHSC to form Health Innovation Manchester.

In March 2017, the leadership from both organisations began deliberations on what the right model for the new organisation would be. One of such deliberations was on whether Health Innovation Manchester was to be a hosted organisation (as the AHSN was) or an independent not-for-profit organisation (or CLG), which was the form taken by the AHSC. Eversheds, which was contracted to

[16] Now the GMCA Research Team

the service the Board indicated that the new organization be 'hosted' and that this should be preferentially within an existing NHS organization as VAT charges would arise on any transactions, including salary payments between it and other parts of the NHS if the organization was located outside. The AHSC survived as a CLG because the University was its host organisation and was responsible for paying VAT charges. While hosting was considered within the Steering Committee to restrict some forms of action, a hosting arrangement offers additional benefits beyond VAT charges, such as allowing employees coming from the NHS to remain within the NHS pension scheme and having the host organisation, with a significant cash reserve, underwrite the finance of the organization. The organisation can also save substantial operational cost by taking advantage of finance and HR system of the host organisation.

Efforts to merge AHSN and AHSC continued in the summer of 2017, towards the 1st of October 2017 deadline, with the hiring of a consultancy group, PA Consulting, to design an operating model that would be adopted for the new organization. The engagement with PA Consulting was useful for creating and formalizing functions and structures for the early phase of the organisation.

Health Innovation Manchester was formed in October 2017 following the dissolution of the boards of AHSN and AHSC. A new governance infrastructure and framework, developed in collaboration with external consultants came into effect the same month. Following the decision of the steering committee, Health Innovation Manchester remained a hosted organisation and was hosted by Salford Royal Hospital (with few employees hosted at the University of Manchester), which continued the hosting relationship with the now-defunct AHSN. However, the new Health Innovation Manchester board decided that the new organisation needed a new host that should be selected through a competitive bid/ tender process. The rationale for such a procurement process for a host organisation is presented in the quote of [Person 443] below:

> 'And the new board, quite rightly so, felt that to be fair to the system, because Health Innovation Manchester is a representation of the Greater Manchester system, it was agreed that we would go out to tender for the hosting element of the organisation. It was probably not correct to just make an assumption that Health Innovation Manchester would continue to be hosted by Salford Royal.'
>
> [Person 443]

The competitive tender process to select a host for Health Innovation Manchester began around August 2017 and ran through November 2017. It was a local tender implemented under the guidance of NHS procurement experts. The tender process had an interview panel made up of members of the Board of Health Innovation Manchester. It was validated independently by the business development authority to assure GM partners that the process of awarding the hosting contract was open and transparent. The tender process was robust and received three competitive bids, including bids from Salford Royal Hospital. The agreement was that Health Innovation Manchester is a customer of the successful host organisation and expects a high quality of service from the host. The result of the tendering process was that Manchester University NHS Foundation Trust was awarded the hosting contract. The outcome of the tender process was presented to the board and ratified in November 2017. The transition process to transfer staff and all the assets of Health Innovation Manchester from Salford Royal Hospital to Manchester University foundation trust commenced in December 2017 and lasted through April 2018.

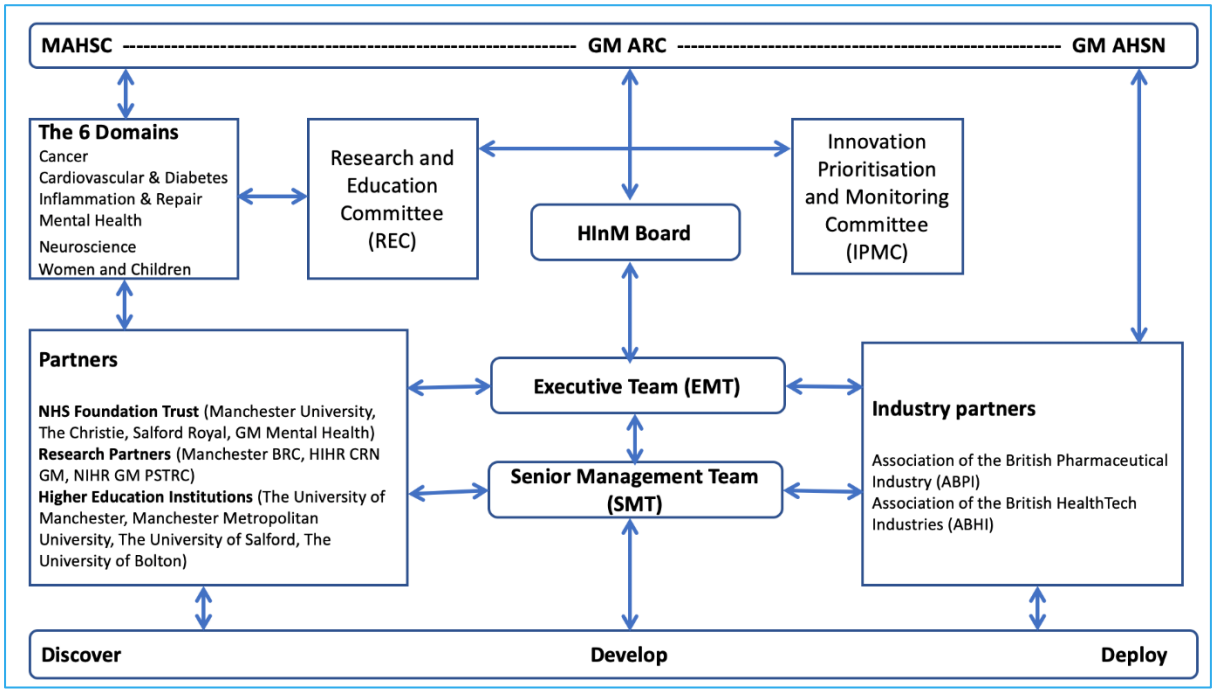

Figure 4 Health Innovation Manchester's Structure and Relationships [Source, Authors Analysis]

4.6 Envisioning the Future

In February 2018, Health Innovation Manchester appointed a new CEO, with an interdisciplinary background, while having experience in the mechanics of global digital commercial businesses, he also used to run a department in an NHS organisation and had received an academic chair from the Academic Health Science Centre within the University of Manchester. His appointment marked the start of a new approach to defining the organisational culture and integrating previously distinct and relatively unrelated resources, albeit resources with high levels of achievement and capacity.

> 'So, the CEO came in right at the heart of us coming across from Salford over to MFT. And that was exciting because obviously he brought a very different set of skills to the organisation, particularly in that strong leadership skill, but also that ability to understand the digital landscape as well.'
>
> [Person 443]

While Health Innovation Manchester was already established therefore, it had not discovered how best to contribute to the needs of its principal client. Establishing a new vision became an essential task to coalesce all this effort into a highly functioning coordinated endeavour. To formalise the organisation, it was imperative that the different views of key stakeholders about the future of their organisation formed a coherent vision, practical enough to guide the organisation into concrete actions. For this reason, the new leadership focused on engaging in 'visual dialogues' to acknowledge such heterogenous perspectives and to draw together different elements to create shared understandings sand shared culture. It was necessary to take the best of each one of them and translating them into a well-articulated health system for Manchester.

> 'I think probably one of the most significant things that I have done is commissioning that rich picture. I think getting people to think

about this in a different way, actually go through a kind of established methodology about how you could bring people around a single kind of vision and idea I think was quite an unusual thing, it was quite a significant investment trying to do things in a different kind of way, but felt to me quite important kind of thing'.

[Person 716]

The rich picture [shown in Annex 14 Health Innovation Manchester – the Rich Picture] not only demonstrates the way the organisation is meant to function currently, but also gives insight into its constituents and how they had previously operated, albeit in a disconnected way.

'The left-hand side of the picture is how we came together, and it was almost, like you say, this mismatch of a system. You had the academic health science centre here, you had the AHSN here, and then the water across into the right-hand side of the picture is how we brought the two organisations together and we brought the staff along with us.'

[Person 443]

The need for such envisioning arises in part from the creation of a new organisation but also as the organisation was itself seen as unique – a mix of types or indeed of none:

'We worked with an external partner who was very experienced in this area, but again we didn't just use a traditional NHS survey. We mapped a number of surveys both from the private sector and the public sector, because we're a different type of business, we're not an acute trust, we're not a CCG, we're not a university, we're not a local authority, but we're not a private sector company as well.'

[Person 443]

A key outcome of such 'visual dialogues' and imagining was identifying what made the organisation unique. While other academic-health organisations, such us Oxford or UCL, might legitimately perceive themselves as a being international actors, Health Innovation Manchester saw itself as being part of a 2.8 million people community in Manchester. It was essential to understand what resonated within the global landscape with Manchester's health context. Also, the new management emphasized the need to establish new forms of knowledge management mechanisms supported by digital technologies that could be transversal to the organisation. The wide reach of the application of digital technologies was considered to include anything that requires data to make a decision.

This challenge also required the right institutional context: devolution had enabled local organisations from the health system with greater agency. This new landscape influenced the creation of a less hierarchic form of governance at the regional level, which in turn allowed the creation of complex forms of coordination ready to support more dynamic processes of innovation. An essential aspect of this coordination was that the local actors in collaboration had not only the interest to collaborate to overcome the most typical hurdles, but also enough resources to make things happen.

'I believed that through devolution, the various different relationships and governance had progressed to such a stage that the kind of collective will, as a city region to do some good stuff,

had kind of overpassed some of the political in-fighting that had been in place, historically, going back in for the last 20 years.'

[Person 716]

In this sense, Health Innovation Manchester's main objective is to articulate health innovations for Manchester, from a wide array of sources and with the collaboration of heterogenous actors coming from the regional, national, and international health sector. Health Innovation Manchester evaluates and assess which projects could be the most promising from the patient's perspective, and supports them to be deployed and scaled up. Such initiatives are centred to benefit Manchester citizens, and the articulation of information is underpinned by digital technologies.

4.7 Pooling Capabilities

To establish a connection with the population of the Partnership area (2.8 million), it was necessary to understand their wants, needs and aspirations in relation to the health sector. From the perspective of the new leadership, the only way of doing this at the necessary depth, was by establishing a data driven approach that had not yet been seen in Manchester's health systems context.

The main aim was not to set complex forms of analysis that would provide information about the past, instead to generate high quality datasets that were prospective in nature and flexible enough to face a dynamic context. This required to re-arrange the ICT infrastructure to host new types of data, so that it becomes part of a workflow that generates positive outcomes. Then, it required to bring into the organisation analytical skills to make sense of all that information and to identify new patterns of emerging behaviour. For example, how to better understand the way people use the health resources available to them, or understanding the impact of social media in health-related issues or even people's genomics. Also, this may change under different types of social groups. This way Health Innovation Manchester would be in a better position to understand the patient's needs, and to guide the direction of future health innovations.

'So, in terms of understanding your population and define their needs, understanding your population is understanding beat by beat IOT data about how they're actually functioning. And in terms of defining their need, that's about routing that with an algorithm to actually understanding early-stage deterioration in your heart failure from your physiological parameters. So, this isn't sweating existing datasets, this is about generating new datasets.'

[Person 716]

For instance, to engage more directly with patients, greater effort was placed on monitoring closely how distinctive social groups, such as the ageing population, adopt new medical treatments before scaling them up. Improving this aspect, also involved adopting new technologies to better visualise the implications. These helped the teams in charge to identify what to prioritise next and enabled them to show with greater clarity the outcomes of their projects.

Building these research capabilities has the capacity to strengthen the vision as much as it allows the organisation to pursue scientific led processes of discovery that can be aligned with the patient's current or future needs. Such capabilities also enable Health Innovation Manchester to be in a position to coordinate with other academic institutions as well as businesses. An important organisational change that brought together the local health services was the establishment of the Northern Care Alliance in 2017, formed by bringing two NHS Trusts, Salford Royal NHS Foundation Trust and The Pennine Acute Hospitals NHS Trust together. In October 2017, Manchester

Universities Foundation Trust was formed, a further consolidation of providers in the area, to include nine hospitals, Altrincham Hospital, Manchester Royal Eye Hospital, Manchester Royal Infirmary, Royal Manchester Children's Hospital, Saint Mary's Hospital, Trafford General Hospital, University Dental Hospital of Manchester, Withington Community Hospital, Wythenshawe Hospital, and eventually to include North Manchester Hospital (and of 2021 the Nightingale Hospital).

Further movement towards aggregation of research and innovation capabilities 2019, was the inclusion of the Applied Research Collaborative (ARC) within the ambit of Health Innovation Manchester. The link with the ARC aimed to facilitate greater exploration and exploitation of broader research findings from anywhere in the world to Greater Manchester. An interviewee reported [below] the hope that by including these organisations under the control of one head, there would be scope for collaboration.

> 'Then I think the bringing together of our infrastructures, so the starting point being the AHSC and the AHSN, and putting them in essence under one roof with one chief executive, was also something that hasn't happened to the same extent in other places. And that has made people work together…'
>
> [Person 369]

The bringing of a new range of tangible and intangible capabilities together under one organisation required an approach to integration that also allowed those with specific functions still to carry them out. Furthermore, as to funding, amongst the groups that came under the umbrella [the Academic Health Science Network and the Applied Research Collaboration], a proportion of the income remains tied to priorities identified outside the GM system. Health Innovation Manchester's subscription model in which the partners pay a fee generates an important form of income. The extent to which Health Innovation Manchester can define priorities independently of the exogenously defined objectives of its constituent organisations and allocate resource to locally defined priorities is a key issue, as is the need to maintain these streams of income over time.

While new heterogenous capabilities were brought together, the challenge was not to build a deterministic model that would focus only on patients need disregarding new scientific discoveries, or vice-versa. This sort of balance had to be reflected in an operating model capable of being flexible enough to the changing context of both patients and science, without losing the determination of bringing to fruition health innovative projects to Manchester.

4.8 Creating a New Operating Model to Transcend Organisational Boundaries

The building of these capabilities go hand in hand with changing the operating model. If there is a constant inflow of new information, then the organisation needs to be re-configured to respond in a timely way to the new insights. This involves being fast enough so that the actions of the organisation become pertinent to the current context, but not so fast that risks the organisation losing connectivity with its constituency.

Health Innovation Manchester model involves establishing connections between all the parts of a complex system, making it come together in order to identify the most promising innovation projects for the patients. To establish a porous non-linear innovation process, that even when it follows the discover, develop, deploy phase logic, is non-deterministic and open to integrate new ideas and feedback at any stage of those phases.

The operating model needs to be constantly evolving in relation to the context, so that it remains flexible in identifying what needs to be done (what to do?) in taking action in the right measure (how to do it?) and responding at the right time (when to do it?).

4.9 Establishing Two-way Connections in Manchester's Health Innovation Eco-system

Both the research capabilities and the continuous engagement with patients, allowed Health Innovation Manchester to connect its stakeholders with world leading scientists and clinicians; with research infrastructure, for instance, to discover biomarkers, for advanced imaging, for evaluation, and for digital research, as well as research support in clinical research through the Greater Manchester Research Hub.

> 'Industry partners, both large corporations and SMEs, also produce a constant flow of innovations which can benefit the population of GM, across life sciences, biotechnology and technology. It can be very challenging for industry to understand the priorities of a complex health system and get access to relevant decisions makers to support their evaluation and go-to-market requirements, and subject matter expertise to enhance their offerings.'
>
> (Business Plan, 2018)

Besides providing all this access to their multiple collaborators within and beyond the Partnership, Health Innovation Manchester's added-value comes from the analysis and insights it obtains from drawing on multiple sources of information. This ensures a coherence of information and insight on innovation for the GM health system as a whole, a function that was previously provided by a disjointed set of actors. This places Health Innovation Manchester in a unique position to develop new innovation led pathways in health.

> 'I talk about academic health science innovation system and I talk about system rather than centre or network, place being the nature of where our system is based but actually academic health science is, and innovation being the things that are key to what we do. So that's the way I look at it.'
>
> [Person 716]

Health Innovation Manchester established strong partnerships with local academic organisations such as the University of Manchester, Manchester Metropolitan University, the University of Salford and the University of Bolton, to collaborate in research projects, but also to develop education and training programmes for the sector. Health Innovation Manchester collaborate with these organisations in amplifying the impact they have with their research. In turn, these organisations enable Health Innovation Manchester access to a wider pool of knowledge that is at the frontier of science, supported by funding bodies and which aims at having the world's highest research standards in terms of methodologies and publications. At a national level, it has established also strong collaborations that cut through various networks of actors around the health sector. For example, it has strong bonds with NICE, the Royal College Physicians Edinburgh and the Royal College of Surgeons of England.

> '(...) what we've done previously is we've worked alongside the four HEIs, i.e., University of Manchester, MMU, Salford, Bolton, who are all partners within Health Innovation Manchester, sort of working on the kind of agendas that each of those universities deliver anyway. And I think we weren't doing a particularly good job. I don't think we were bringing added value. So, one of the things that we decided to do from last year was to concentrate on improving digital literacy in our undergraduates and also to think

about in our workforce. Because that was sort of common ground for the four HEIs and it was an agenda that everybody was interested in partaking in.'

[Person 369]

Processes of creation of new health products and services, or the adoption and diffusion of latest innovations that need to match with the patient's needs, require the involvement in the decision-making process of representative patients, commissioners, health and care providers and researchers that are part of the system. Health Innovation Manchester operative model needs to include these arrays of heterogenous perspectives organically. To accomplish this a new governance had to be created in the form of new boards and committees where the main decisions could take place.

Since October 2017 a new governance framework was created. Both the academic health science centre board and the academic health science network board were replaced by the Health Innovation Manchester board. This diverse board includes the senior leaders of the organisation that overview functions of clinical execution, digital implementation, general management, and research and education, but also external stakeholders such as representatives from the local universities, from the partner trusts, and from local industry and the cities of Manchester and Salford.

The approach Health Innovation Manchester has towards these bodies involves interacting with various stakeholders when trying to understand the system and its problems, rather than participating in them with preconceived solutions. In some cases, this involves re-designing the composition of those governance instances to have the right mix of representatives.

'So, we're not saying Health Innovation Manchester are the only people and resources responsible for delivery, we work with and through other partners as well. (...) we work through other groups and other governance structures to be able to get to where we want to be. But the one thing is making sure we've got the clarity about what the problem is and what it is that we're wanting to do and what that will deliver.'

[Person 624]

Part of this balancing of representation and resources is essential when, for example, the NHS trust requires more strict standards around urgent care. Important members of the GM system would be concerned with such standards, some of whom might be at Health Innovation Manchester board, and would require not only a fast response on Health Innovation Manchester's part, but also one that is coordinated across the whole system. For this reason, it is important for Health Innovation Manchester to have a balanced portfolio of innovation projects and an organisation capable of aligning to the new context, so that they can respond more resiliently to new pressing requirements.

> (…) we're trying to have a balanced portfolio that's got the right mix of stuff being pulled through academia, the right mix of stuff coming from industry, the right mix of stuff coming from direct care to address health and care issues, through to delivering an in-year return on investment, to keep people happy now, and transforming healthcare and outcomes in the long term. So, it's a real mix to get your head around, of how to balance it all, and keep all the stakeholders happy, of which there are a lot of them.
>
> [Person 871]

As well as exploring and defining problems in the sector, Health Innovation Manchester has an important role within the Partnership during the deployment phase of projects. An important aspect of that phase involves receiving feedback from the main stakeholders such as the Provider Federation Board, the Joint Commissioning Board or the Primary Care Board, as well as working with local organisations to make sure that the infrastructure and local capabilities for deployment are in place. While Health Innovation Manchester provides knowledge and understanding of digital technologies, it also emphasises and supports service re-design without which innovations are not successfully implemented. This has wide positive externalities to the system as it opens opportunities for new jobs, new types of trials, new forms of growth, new type of research etc.

In addition, Health Innovation Manchester has sought to develop an ecosystem attractive for SMEs around the world who wish to collaborate with actors within the Great Manchester's health innovation system. To accomplish this, it is providing support to such organisations through training, by organising conferences, inviting keynote speakers or providing more specific training such as procurement; by providing assessment tools to detect new promising technologies in the sector (i.e., MedTech Early Technology Assessment); and funding, by organising twice a year funding calls.

4.10 Model to Respond to Manchester's Current and Future Needs

Such a model needs to be responsive to a wide spectrum of potential innovation opportunities and Health Innovation Manchester has faced a need to focus the available resources into those areas that could give the greatest benefits for the population in Manchester. Staff perceive the task, see the comment below, as challenging.

> 'And then it's about transforming your operating model because actually unless you get yourself configured to be able to respond in real time or near real time to those data flows, you won't actually deliver the benefit. So that's about routing actual insights into workflow, so that's a new workflow model, so that's the third bit of the jigsaw. And then the fourth bit of the jigsaw is actually transforming your business model. So then how do you actually sustainably pay for that stuff based on the demonstration of proof of value.'
>
> [Person 716]

Health Innovation Manchester aims to coordinate assets, capabilities and skills from universities, industry partners and the NHS. A main supporting structure to support this relies upon the Innovation Prioritisation and Monitoring Committee (IPMC) which prioritizes new health products or services that emerge from Health Innovation Manchester's scanning of the innovation horizon.

The outcome of the process aims to define and oversee the innovation pipeline for Greater Manchester's health and social care system.

The model supports the attempts to discover new science, prediction and prevention of disease, and the development of new therapeutics. The organisation seeks to achieve this through its research and education activities in six domains to operationalise the strategy. These domains comprise cancer, clinical trials, neuroscience and mental health, women and children, cardiovascular diseases and inflammation, infection, immunity and repair.

Research on cross-cutting themes, such as applied health research and implementation science depends also on institutionalised groups such as the Applied Research Collaboration (ARC). The ARC is funded as one of 15 national centres by National Institute for Health Research ['the NIHR'] has an established programme of work on condition of its NIHR funding. Some of these priorities are locally relevant while others contribute to more national priority areas. The ARC has seven domains, of work, [17] with significant but not complete overlap with those of Health Innovation Manchester. The integration aims to balance the autonomy of the various groups and units, while allowing greater connectivity through all the components of the organisation to contribute locally.

Another important aspect of the innovation process is how projects are prioritised. As projects move along the discover, develop, deploy phases of the pipeline, they need to go through decision-making gates. A process through which projects are assessed from the perspective of different executives and stakeholders, giving Health Innovation Manchester greater insights to decide which projects are still not mature enough, which ones need more research, which ones do not fit with the organisation, or which projects should move to proof of value phases. As projects move forward into the process, more resources are allocated into them.

> 'So, we went from nothing, there was no internal reporting previously within the AHSN, not at all, and I brought in the biweekly reporting on those ten quick-win projects because there was no oversight. And so now we've got a system oversight, we've got executive oversight, and all that in such a short period of time is pretty phenomenal really.'
>
> (Person 624)

A form of governance that permits a fast and systematic decision-making, requires also an efficient counterpart to implement these innovations. For this reason, Health Innovation Manchester has a programme management office (PMO) to support the management and implementation of projects. While the function of project management was part of Health Innovation Manchester since its origins, over time much more attention was placed in the delivery of outcomes and on time management. Also, while projects can follow hard metrics to accomplish results, these metrics must also make sense from the citizen's perspective. Therefore, there is a constant questioning within the teams that work on the projects about what each project means to the patients, what are the problems they need to solve, and how might these solutions change people's lives for good.

The PMO has to work across the organisation as well as with external partners. For example, the Utilisation Management (UM) Unit provides a range of health services to the NHS and to clinical commissioning groups (CCGS) for which it receives income, it has the objective to improve patient's outcomes by assessing the quality of the health services as well as the way these are delivered.

Overall, the transformation aims at understanding better Manchester's population, defining better it's health needs, and transforming the operating model so that it becomes flexible enough to

[17] Healthy ageing, Digital health, Mental health, Organising care, Evaluation, Implementation science, and Economic sustainability [(National Institute for Health Research, 2019)

deliver appropriate responses. It needs to be an organic system that integrates not only the use of new technology, but also the way the organisation takes decisions, the processes, and the adequate culture to produce concrete solutions and value to the system as a whole. It has to be multidisciplinary in nature as the system needs to understand people's healthcare utilisation, by following new data sets, new scientific discoveries, the development of new technologies as well as the social environment. Most importantly, it is a system that needs to work, because the investment it requires needs to be justified in terms of the health benefits it produces for society.

5 Operation

'The best physician is also a philosopher.' – Galen, On the Ideal of the Physician

'I am made all things to all men, that I might by all means save some.' - 1 Corinthians 9:22, 21st Century King James Version

5.1 Introduction

We consider the operations stage of Health Innovation Manchester from April 2018. April 2018 marked the start of the first year for the organisation to deliver on national programmes of work to meet NHS England's patient benefit targets. It was also the month that Health Innovation Manchester completed its move from Salford Foundation Trust to Manchester Foundation Trust (MFT). At that time, the organisation had 29 staff. On the basis of the PA Consulting report, which had designed its operating model, Health Innovation Manchester expanded quickly (i.e., from 2 to 28 staff in 18 months in one team; to 95 staff in total, at June 2020). A number of these staff were taken on initially as fixed-term contracts, but many appointments were transferred to permanent status.

5.2 Operating Model and Organisational Structure

The first publicly available version of the business plan was attached to a report by Rowena Burns for the GMHSCP board dated 31st March 2017.[18] This pre-integration business plan set out the vision, principles and priorities of the organisation. It further stipulated plans for operationalisation and funding, and the need to revise the business plan post-integration (Burns, 2017). A summary of the most recent business plan, which covers 2018-2021, sets out a vision to be 'a recognised international leader in accelerating innovation that transforms citizens' health and wellbeing', and the 3Ds concept allows them to deliver their (five) business aims through ten primary functions.[19] These business aims are at the core of Health Innovation Manchester's activities and operations. The current business plan, including the five core aims, is likely to be reviewed next year (2021) [Person 871].

In terms of the services and activities that Health Innovation Manchester delivers, this can be summarised in three phases of activities across a spectrum, nominally the Discover, Develop, and Deploy (3Ds) continuum. The AHSC and AHSN are both national bodies, operating regionally in GM and focused on different parts / ends of the 3Ds continuum. While based nominally within Health Innovation Manchester, and with a requirement to contribute to its mission, they work to nationally defined schemes and priorities, the AHSN in Manchester dating from 2013, the AHSC dating from 2008 (The AHSN Network, 2021; University of Manchester, 2008).

The AHSC focus on discovery and the translation of discoveries are pursued through 6 domains of research excellence: Cancer, Cardiovascular and Diabetes, Inflammation and Repair, Mental Health, Neuroscience, Women and Children. The AHSC has been re-designated to operate as an AHSC (MAHSC) in 2019 for a further five years, while recent re-licencing for the AHSN in April 2018 allows it to continue within the organisation setting of Health Innovation Manchester for a further period

[18] https://www.gmhsc.org.uk/wp-content/uploads/2018/04/06-Health-Innovation-Manchester-Report-Business-Plan-FINAL.pdf

[19] https://healthinnovationmanchester.com/wp-content/uploads/2019/10/Health-Innovation-Manchester-Business-Plan-2018-Web.pdf

of five years. The AHSN's nationally agreed programme of work addresses two complementary functions: 1) to understand the local health needs of the population and broker innovative solutions; 2) to identify effective local and regional innovation and collaborate quickly to spread across the national network. As such, the activities of the AHSN are within their locality or region, although they benefit from being part of the national network. The benefit of such an arrangement is intended to allow for interaction between the national and regional domains, with expertise and experience, shared learning, pooling intelligence, contributing to pipelines of innovation both nationally and locally.

MAHSC Domain	GM NHS Foundation Trust
Cancer	The Christie
Cardiovascular & Diabetes	Manchester University Foundation Trust (MFT)
Inflammation & Repair	Manchester University Foundation Trust (MFT)
Mental Health	GM Mental Health
Neuroscience	Salford Royal
Women and Children	Manchester University Foundation Trust (MFT)

Table 5 The 6 MAHSC Domains and NHS Foundation Trust in GM

The integration of AHSC and AHSN was vital for aligning the discover, develop and deploy activities in GM into an innovation pipeline that prioritises the need of the GM population. The Health Innovation Manchester innovation pipeline is not linear with end-to-end movements of activities. It is porous and admits diverse activities and programmes at different points in the pipeline. The non-linear and diversity of activities that contribute to Health Innovation Manchester's innovation pipeline is visible in the excerpt from person 443 below. The innovation pipeline has provision for the output of innovation activities near deployment, generated at the NHS and not necessarily developed through the AHSC programme. Health Innovation Manchester has an active portfolio of innovation projects that are being deployed in GM to enhance the health and wellbeing of the local population. The portfolio covers all parts of health and care – including maternity, cardiovascular, cancer, respiratory, mental health and frailty as well as cross-cutting areas, such as patient safety, medicines and precision health.

> '… you might think that Health Innovation Manchester is all about amplifying existing academic value propositions. So, it's all about taking some of the stuff that comes out of the university domains and kind of making that have more of an impact. Or you might think it's all about driving industry-led innovation to drive economic value to Greater Manchester and the local industrial strategy. Or you might think it's all about place-based population health management strategies and kind of prevention and early detection and stuff.'
>
> [Person 443]

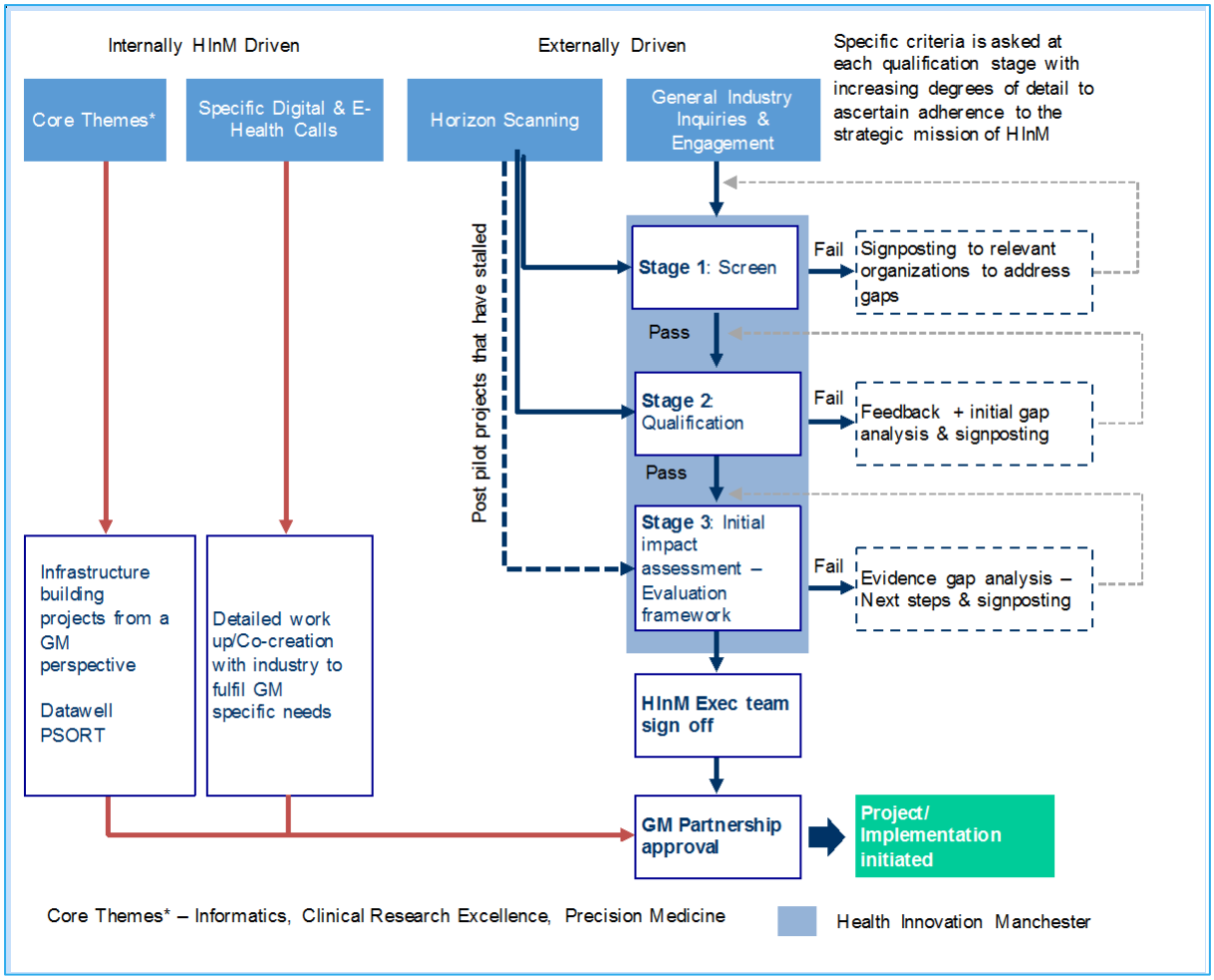

Figure 5 Health Innovation Manchester - Sourcing Innovation and the Paths to Implementation (Greater Manchester Health And Social Care Strategic Partnership Board, 2017a)

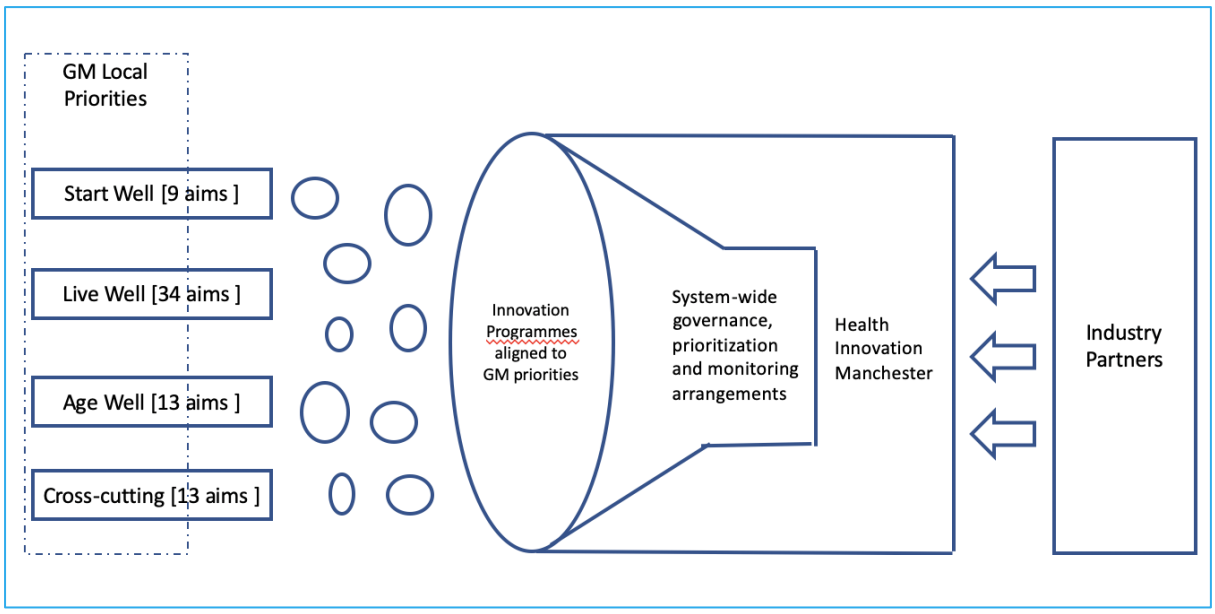

Figure 6 GM Priorities, Health Innovation Manchester and Industry Innovation [Source: from (Health Innovation Manchester, 2019c)]

As an AHSN, before the integration with AHSC, project completion and delivery were often considered a challenge due to the lack of definite project scope, and the attempt to deliver projects in less than two years was perceived as unrealistic. The innovation pipeline which was introduced is central to Health Innovation Manchester's activities and is used for organising and monitoring innovation programmes and projects in Health Innovation Manchester and for effectively communicating those to stakeholders. The potential for the Applied Research Collective (ARC) to support the AHSC and AHSN to generate innovation that feeds into the Health Innovation Manchester's innovation pipeline was also cited as one of the two primary reasons for integrating the ARC into Health Innovation Manchester in October 2019 [Person 443]. The Health Innovation Manchester's Programme Management Office (PMO) supports the activities of MAHSC, AHSN and the ARC.

Besides working with ARC GM as an integrated part of the organisation, Health Innovation Manchester also works with other NHS agencies across GM, such as the BRC and CRN to better position its research activities to address the needs of the local population. The AHSN status also allows Health Innovation Manchester to engage at the national level utilising its network in collaboration with industry partners to improve the health and wellbeing of the GM population. Health Innovation Manchester also partners with the industry to conduct reputable clinical trials. It is responsible for the GM strategic partnerships with the ABPI and ABHI that is focused on developing a strong pipeline of industry-led innovation.

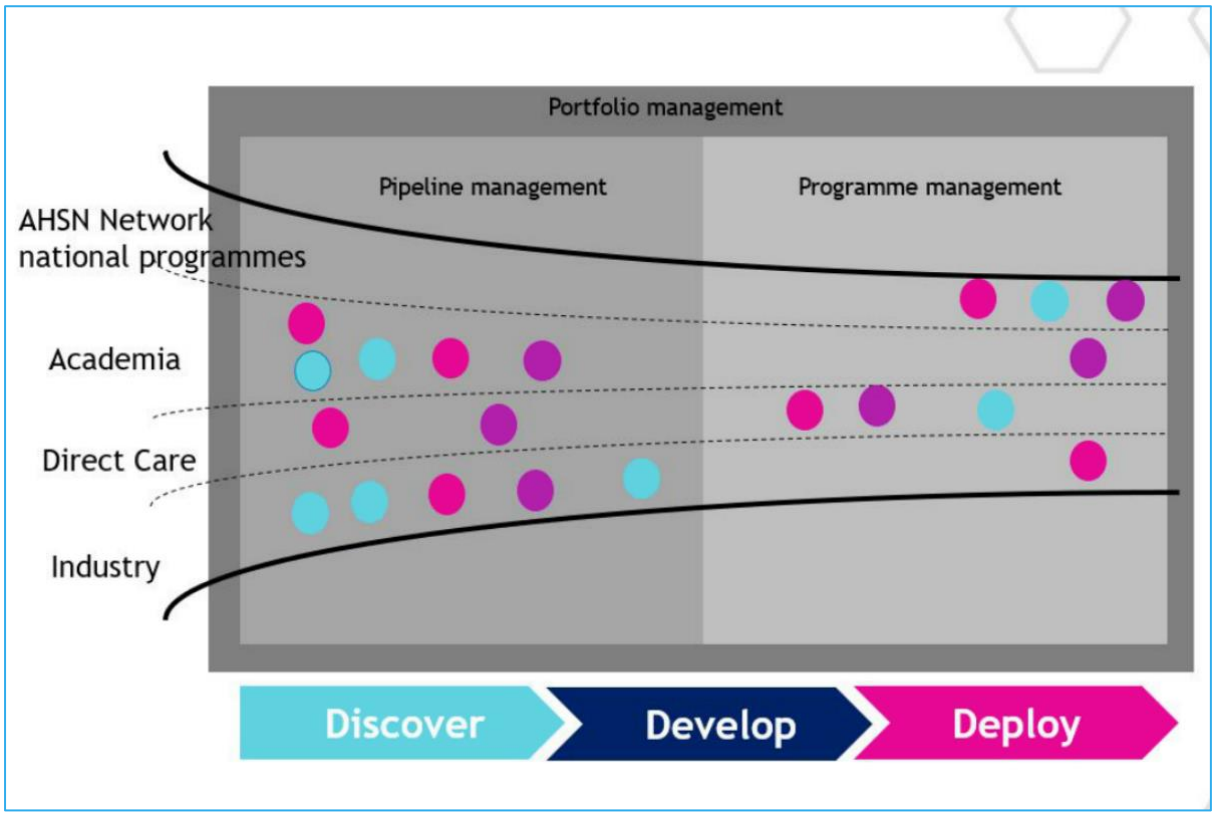

Figure 7 Pipeline and Portfolio Approach Demonstrated to AHSN in August 2020

(Source: (Health Innovation Manchester, 2020b)

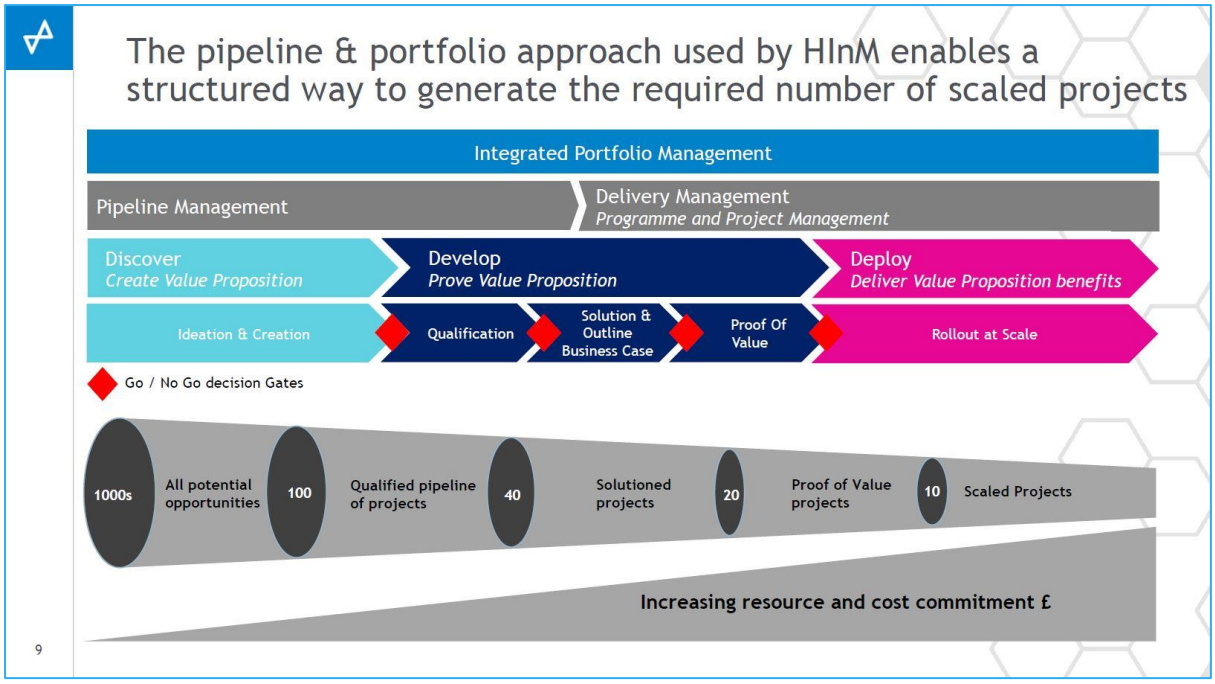

Figure 8 The Pipeline Approach to Portfolio Management at Health Innovation Manchester

(Source: HInM web site)

Health Innovation Manchester has an executive board whose activities are supported by two key committees - Innovation Prioritisation and Monitoring Committee (IPMC) and the Research and Education Committee (REC). These committees exist to facilitate the innovation pathway and quick decision making with members nominated from across the GM. The IPMC comprises of stakeholders from the entire GM system with the focus of providing system oversight of the entire Health Innovation Manchester's portfolio. It prioritises and oversees the innovation and improvement programmes of work across the GM health and social care system to ensure system-wide engagement before commissioning programmes across the GM system. The REC includes senior leadership from across GM's higher education and research infrastructure. It is setup to 1) provide strategic leadership of translational research to position GM to secure crucial research and innovation funding 2) strategic leadership to actualise the vision of GM as the 'Education City' – Ed City and 3) maintaining a steady pipeline of translational research generating innovation programmes that can be deployed across the GM system. For a visual representation of the pipeline, please see above, *Figure 8 The Pipeline Approach to Portfolio Management at Health Innovation Manchester.*

The merging of the AHSN and the AHSC to form Health Innovation Manchester, and the subsequent integration of the ARC, did not eliminate the statutory obligations of these entities from an operational perspective. These entities work within the system but also operate as a system. Working within the system allows them to retain statutory funding and to present their results. For instance, Health Innovation Manchester has a licence to operate as an AHSN that it must renew periodically. It receives funding as a part of the 15 AHSNs in the country and fulfils the obligations of an AHSN. The existence of such obligations for constituent parts of Health Innovation Manchester is evident in the comment of person 624:

> 'The accountability has not gone out of the window because we've still got our national asks. There are still things the HSC has to deliver, there are still things the ARC has to deliver, but we're still doing that as well as responding. So, there's still some core work that has to be done, for us to deliver, because we've got national money coming in.'
>
> [Person 624]
>
> "The two bits. It's just like now we've got the ARC that's joined us. The ARC is still the ARC but it's all part of Health Innovation Manchester as an organisation, as a system. So, it's all those component pieces come together to form Health Innovation Manchester." [Person 624]

The first year of operation provided challenges for Health Innovation Manchester as NHS England expected the AHSN to deliver the national programmes at the same time as attempts were being made to integrate the AHSN. There were quarterly meetings between the national and regional team to review and report on programmes and outcomes.

> 'So, there were national programmes of work that we had to do and NHS England set patient benefit targets that we had to achieve over that first year. So, the first year, from April 2018 to 2019, was a massive step-up in activity.'
>
> [Person 624]

Previous national programmes and priorities (2018-2020)	**Ongoing national programmes**	**National programmes and priorities selected across the AHSN Network from April 2020**
Atrial Fibrillation (AF) Emergency Laparotomy Collaborative (ELC) ESCAPE-pain Preventing prescribing errors PReCePT Serenity Integrated Mentoring (SIM) Transfers of Care Around Medicine (TCAM)	The Innovation Exchange Patient Safety Collaboratives	Early Intervention Eating Disorders Improving Diagnosis of ADHD Supporting primary care in the prevention and management of cardiovascular disease

Figure 9 Past, Present and Future AHSN Projects

Source:[20]

Health Innovation Manchester's development included defining an approach to innovation that was stated to be 'flexible, agile and promoting collaboration', but also a involved an overall attempt to define an organisational culture. This was done with the help of external consultants which ran workshops that presented a range of different sets of values and behaviours from various sources

[20] https://healthinnovationmanchester.com/partnerships/the-ahsn-network/

[Nolan principles, the NHS constitution values, MFT values] on which the staff reflected. These were used as reference points to develop the organisation's own identity. The resulting values from the workshop were traditional, with accountability, respect and citizen-focused making the list of five values, but did not minimise the appetite for a creative, flexible and agile organisation. Beyond the values, Health Innovation Manchester also worked with its employees to decide appropriate behaviours to be associated with their values. Commenting on the role that the organisation's staff played in developing organisational values and behaviours, person 443 enthused:

> '… I am proud to say that 90 per cent of the content has been driven by the colleagues in the organisation.'
>
> [Person 443]

These values and behaviours are documented and are a critical component of the Health Innovation Manchester's appraisal process. Achieving project or programme objectives is not sufficient for the appraisal process. Employees are required to demonstrate how they have achieved their objectives in a way that is consistent with the values and behaviours that the organisation promote. The comment of person 443 below mentioned this integration of values and behaviour in the appraisal process.

> 'So, you've achieved your objectives, you've achieved all what you set out to achieve, but how did you go about doing that? How did you behave in the organisation?'
>
> [Person 443]

The organisation's connectivity within the Partnership and with other local organisations is also an important feature of its operation. Some members of the Executive Management Team take positions of responsibility elsewhere in the Partnership and related organisations, such as the University of Manchester, contributing expertise to other organisations in the region, but also ensuring a high-level connection between Health Innovation Manchester and other key players that serves the goal of mutual understanding. The need to articulate the organisational vision within and beyond the partnerships has also led to the creation of a director level post for strategic communications and engagement in 2020 and a successful appointment internally.

5.3 Governance Arrangements

The process of establishing the organisation has extended to the point of developing a specific organisational culture. As interviewee 443 has noted, the organisation has developed its own principles of governance:

> 'We had the Nolan principles, we had the NHS constitution values, and we also had the MFT values…'
>
> [Person 443]

The development of organisational culture has also addressed the need to create a flexible and collaborative work environment and regular meetings are used to provide mutual support. The approach to team meetings is that they are problem solving events that rely upon preparation to achieve a set objective. Person 485 referring to team meetings emphasised that:

> 'They're for solutioning. They're not for imparting information.'
>
> [Person 485]

Health Innovation Manchester has different internal programmes designed to promote collaboration. Briefings also take place to provide opportunities for members of the executive management team to meet staff. An interviewee also mentioned the coaching relationship with a colleague that culminated into an invaluable source of analytical insights for the team. The relevant roles the chief executive of Health Innovation Manchester played in promoting a collaborative culture in the organisation is highlighted in the comments below:

> 'There's also this sense that I know that … [the CEO] … wants us to be a rounded organisation. He loves nothing more than to see us crosscutting and engaging in that highly collaborative way that I've held onto his extreme collaboration perhaps more than most … So, his leadership almost gives me an innate permission to do that kind of stuff and to stretch out in that kind of way.'
>
> [Person 485]

However, this collaborative culture does not seem to be fully institutionalised in the organisation. The answer given above presents a view of a personal approach to realize the organisational aspiration which the chief executive has strongly supported that there should be a stronger collaborative culture, drawing on the core skills and talents of staff across the entire organisation. Similar changes were also recommended in terms of project management. Person 871 in the comment below highlights the need for more flexibility in operations:

> '… But how we operate, I think, will absolutely change, because we need to be more agile. We need to close down projects that aren't going to go any further. And this is where the pipeline process is really going to kick in. We've kept hold of things for too long, probably, and we need to move things on quickly to make room for the new stuff coming through.'
>
> [Person 871]

The feasibility of moving so quickly, as person 871 also later acknowledged, is limited because Health Innovation Manchester is still relatively new and operates within a complex domain. According to person 624, a staff survey at Health Innovation Manchester has indicated that not all staff fully understand the complex environment in which the organisation is embedded, partly because of fast-paced change to that environment but also and ambiguity in the system. Health Innovation Manchester operates a complex structure within a complex domain. The complex nature of its structure is evident in the numerous stakeholders and partners that it works with to deliver on its core objectives. For example, Health Innovation Manchester has national programmes of work and also programmes for responding to the needs of GM localities. It receives funding from national bodies, such as NHS England, the National Institute for Health Research [NIHR] for the work of Manchester's Applied Research Collaboration, the Office of Life Sciences [OLS], and NHS Improvement, for being licensed to operate as an AHSN. A small amount of industry funding is also

received of around 3.5% of income. The local GM funds for Health Innovation Manchester's activities come from GM authorities, the 10 GM localities and universities, such as the University of Manchester, Salford University, Manchester Metropolitan University and the University of Bolton. Health Innovation Manchester has recently negotiated a sustainable financial model that supplements its income from NHSE, NHSI and OLS with contributions from GM-based commissioners, providers and universities. It also receives significant investments for its AHSC designation and funding from GM system partners. The variety in national and local sources of funding for the organisation complicates deliverables and expectations from Health Innovation Manchester because of the specific nature of their demands, which can differ across the different local funding entities.

Source of Funding	Arrangement/ Agreement
NHS England (NHSE)	Under the AHSN Settlement
NHS Improvement (NHSI)	
Office for Life Sciences (OLS)	
Greater Manchester Strategy (GMS) and Greater Manchester Health and Social Care Partnership (GMHSCP)	Seed Funding
NIHR Applied Research Collaboration	Five-year Contract
Clinical Commissioning Groups (CCGs)	Agreement to Sustainable Funding Model
Providers	
Universities	
Industry	By Negotiation

Table 6 Health Innovation Manchester's Funding and the Sustainable Financial Model

One of the primary challenges to fast and uniform adoption of innovation in health and social care generally is that decision making is split across multiple governance structures. Operating in such a complex environment with diverse stakeholders and partners contributing and making different demands necessitates strong governance arrangements. It should also be noted that under their national funding responsibilities, the AHSN and ARC deliver in the Cheshire West CCG area which is not itself part of GM Partnership. Separate governance arrangements exist for this but are not discussed here. The governance arrangements at Health Innovation Manchester can be grouped into two broad categories: corporate governance and the GM system-wide governance that extends to the city region and locality level.

The corporate governance arrangement focuses on providing assurance to the board and members of the executive management team on business operations. It is similar to the role of internal audit. However, since Health Innovation Manchester is a hosted organisation and not a CLG, it has no statutory requirement to conduct audits. The team responsible for corporate governance at Health Innovation Manchester work with an assurance partner, Merseyside Internal Audit Agency (MIAA), to enable the organisation, which includes deciding the extent of the flexibility or innovativeness of activities in the system. In essence, the internal governance arrangement at Health Innovation Manchester ensures activities in the organisation do not depart significantly from plans. The hosting trust, MFT, grants the Health Innovation Manchester's team some flexibility with regards to corporate governance. The overarching principle of the Health Innovation Manchester's internal governance arrangement is to be agile and flexible. It has processes and systems that are strict enough for audit purposes but not restrictive.

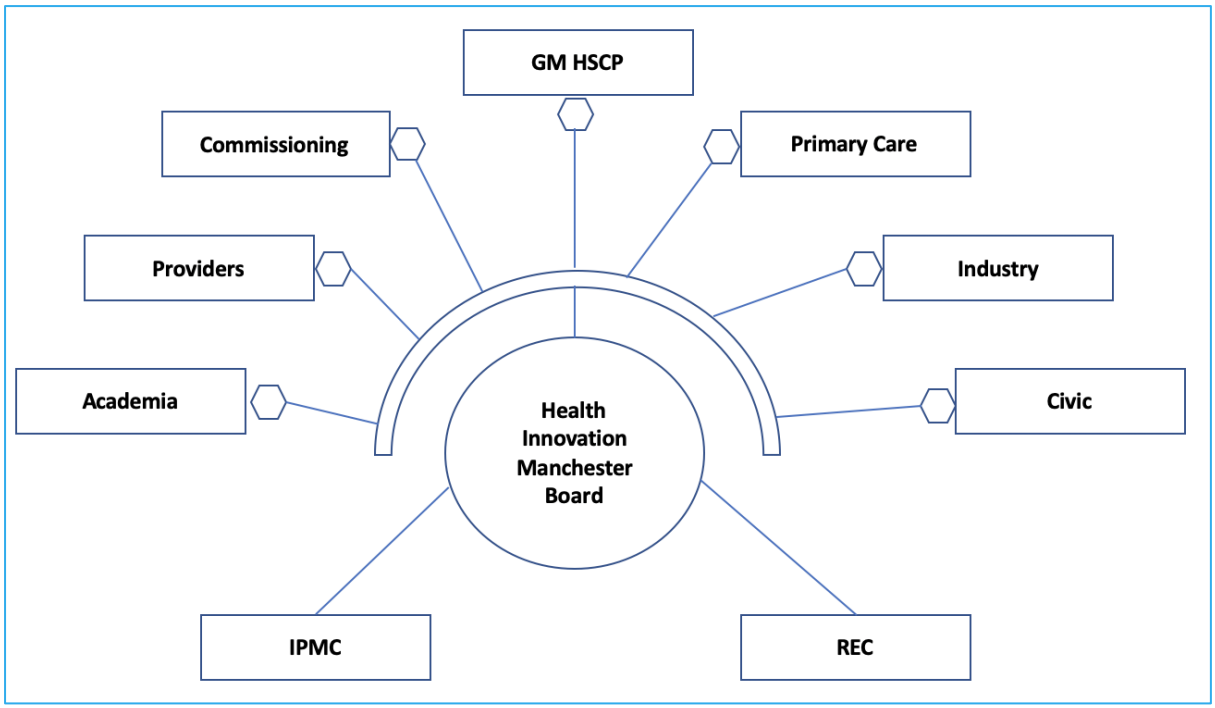

Figure 10 Health Innovation Manchester and the System-wide Governance and Commissioning [Source: Authors Analysis of (Health Innovation Manchester, 2019c)]

The second, system-wide governance arrangement, extends from Health Innovation Manchester to the city region and locality. This governance protocol exists for approving or commissioning health and social care projects and programmes in the GM system – including Health Innovation Manchester's programmes or projects. Health and social care innovation, interventions or programmes of work for implementation in GM can take different governance pathways for qualification and approval. These pathways can be placed into three broad categories – programmes or projects that have been implemented elsewhere, medicines-related and new innovative programmes. For projects or programmes that are not new (i.e., implemented elsewhere), the Health Innovation Manchester team presents ideas to the Provider Federation Board (PFB) that meets every 2-weeks. An accelerated delivery plan is developed for promising ideas, which the PFB builds on for an accelerated delivery plan.

The projects that are strictly within the domain and purview of the providers are progressed and completed. Meanwhile, projects that are outside the responsibility of providers are submitted to either the GM Joint Commissioning Board (JCB) or the Primary Care Board (PCB) for approval. Programmes of work that are medicines related are first forwarded to the Greater Manchester Medicines Management Group (GMMMG) board for approval before making their way to the GM JCB. Innovative or new project ideas or those within the patient safety collaborative or medicines optimisation domain are initially sent to the Health Innovation Manchester's Innovation Prioritisation and Monitoring Committee (IPMC) for qualification. The qualification process assesses if the innovation meets a range of criteria, such as has it been tested, is it desired and appropriate for the GM population, are there funds for implementation and the potential for widespread implementation or commissioning across the GM system. Discussions at early meetings of the IPMC included discussion of a number of proposals for innovation that were considered

inappropriate for Health Innovation Manchester itself to pursue as they were either insufficiently innovative, or were not system level innovations (Health Innovation Manchester, 2019a, 2019b).

The following figures indicate the governance arrangements of the Partnership, Figure 11 GM Governance of Programmes, and the interaction between Health Innovation Manchester's committee system and the Partnership's committee and board structures, Figure 12 Health Innovation Manchester – GM System-wide Governance Arrangement [Source: Authors Analysis of Documents]. Health Innovation Manchester does not have formal representation in the committees shown in the first figure but connects to them in the manner shown in the second figure, and as described in the text.

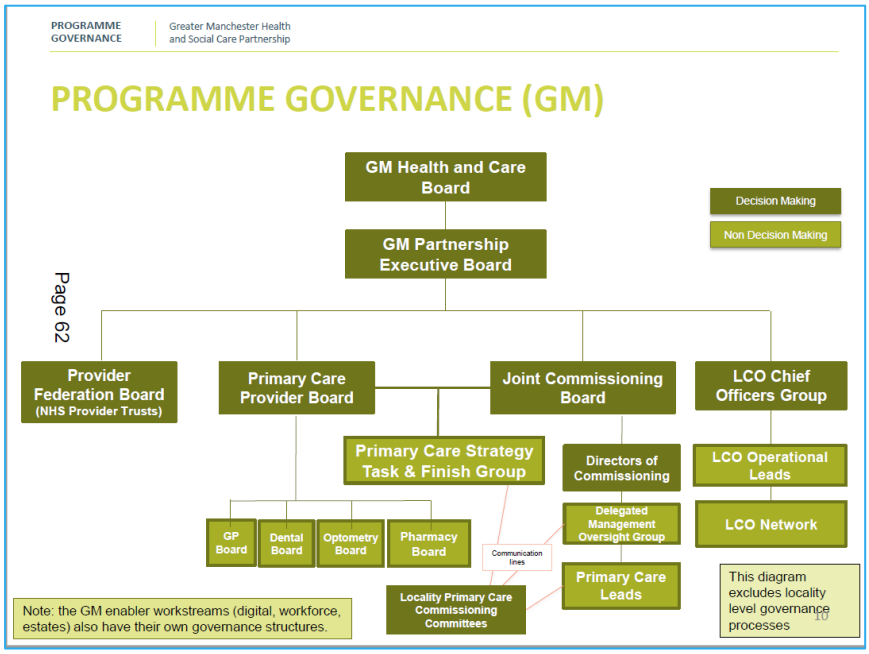

Figure 11 GM Governance of Programmes

(Source: (Greater Manchester Health And Care Joint Commissioning Board, 2020)

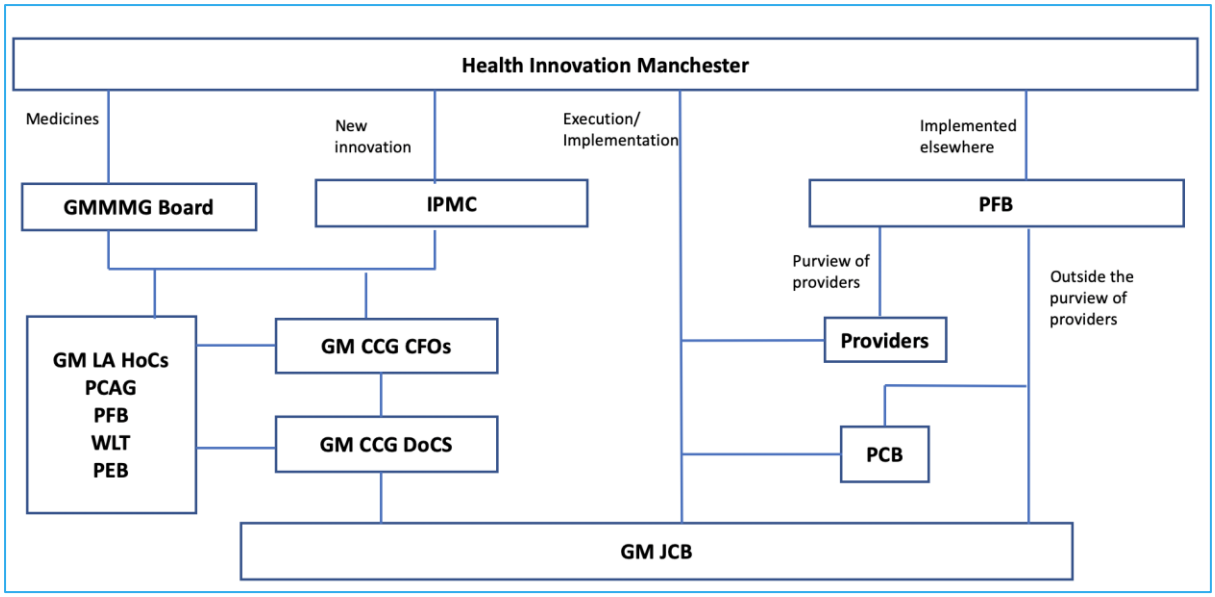

Figure 12 Health Innovation Manchester – GM System-wide Governance Arrangement [Source: Authors Analysis of Documents]

Innovative ideas, successfully qualified by the IPMC, are subsequently forwarded to the GM Joint Commissioning Board (JCB). The JCB is the central body responsible for commissioning projects or programmes in GM. The process of the JCB commissioning of innovative projects for GM further requires that the proposal is discussed with other sectoral governance groups before submitting it to the GM JCB. Justification is required for decisions not to engage any of the sectoral governance groups on any proposal. The seven different sectoral governance groups are Primary Care Advisory Group (PCAG), Provider Federation Board (PFB), Wider Leadership Team (WLT), Strategic Partnership Executive Board (PEB), GM CCG Directors of Commissioning (DOCS), GM CCG Chief Finance Offers (CFOS), GM LA Heads of Commissioning (HOCS).[21] The project execution commences after GM JCB ratification.

5.4 Digitisation and Digital Transformation

The Health Innovation Manchester business plan authored by Rowena Burns in March 2017 contained initial attempts to introduce digital to health and social care in GM.[22] Such attempts were centred on Health Innovation Manchester supporting the ambition of GMHSCP to 'establish a population-wide informatics capability and infrastructure to integrate health and social data and analytics'.[23] The DataWell, a federated data integration platform, was part of the earlier strategies of utilising digital tools to enable better and connected care to benefit patient outcomes with the GMHSCP responsible for the implementation of the DataWell exchange and the building of new

[21] https://democracy.greatermanchester-ca.gov.uk/documents/s5093/09%20Summary%20Update%20Report%20from%20JCB%20Executive%20Final%20-%20January%202020.pdf
[22] https://www.gmhsc.org.uk/wp-content/uploads/2018/04/06-Health-Innovation-Manchester-Report-Business-Plan-FINAL.pdf
[23] https://www.gmhsc.org.uk/wp-content/uploads/2018/04/06-Health-Innovation-Manchester-Report-Business-Plan-FINAL.pdf

computer links. Meanwhile, Health Innovation Manchester was responsible for mobilising system stakeholders to engage and support the successful implementation of the platform.

Following the arrival of the new chief executive, Health Innovation Manchester expanded its plans with the decision to prioritise digital transformation activities. While the patient is at the heart of all they do, 'digital' underpins all of Health Innovation Manchester's work and is considered to be a significant enabler. There is a digital theme that runs through everything that is done at the organisation. The emphasis on digital transformation is captured in the comments of Person 624 and 871.

> 'Then the [CEO] joined us and brought in that strong digital element as well, so from his perspective, everything that we did was digital. And his definition of digital, and it was a bit of a lightbulb for me when I realised, includes anything where you're just looking at data.'
>
> [Person 624]
>
> 'We lead on digital transformation, so that is about not just deploying technology, it's wrapping around service re-design, and improving people's services and outcomes through technology. So, we're all about pushing that out.'
>
> [Person 871]

The digital transformation drive of Health Innovation Manchester focuses on using digital technologies to improve how products and services are offered to the GM population for maintenance of wellness and detection and treatments of ailments. Digital, in this case, is used as an enabler of better care, and not an end in its own right. Access to the latest patient information is crucial for the decisions of clinicians and care professional's delivery of the best possible care and support. Locally, programmes of work have been undertaken to enable data sharing across organisations within the 10 GM localities.

To support HInM's focus on the GM Digital agenda, in June 2019, Health Innovation Manchester made a further appointment to a director position of the chief Technology Officer Healthcare and Life Sciences at Computer Sciences Corporation (CSC). This appointee was Guy Lucchi, who had extensive experience in health in his previous role and an earlier role as Chief Technology Officer of the CSC Alliance NHS Programme. Since appointment he has taken on a joint role for both HInM and as the Chief Digital Officer for the GMH&SCSP, with an aim of cementing the digital agenda across the City.

Health Innovation Manchester's digital transformation agenda is utilising the potential of digital technologies across a range of health and care projects and real-world evidence studies. This has involved new forms of working through collaboration with patients, citizens, professionals and industry to improve the standard and quality of care of the GM population. Digital transformation requires technology expertise, but the organisational change management challenges are likely to be more important in delivering the benefits of technology investment. These changes have tended to build on the historical AHSN role for innovation adaption and adoption. We note that that HInM is only one of a relatively small number of players in the digital agenda in the city region in health and care, particularly alongside the Global Digital Exemplar at Salford Royal, and the newly forming Christabel Pankhurst Centre[24]. As digital moves up the organisational agendas, there will be a need for and increasing scope in the region for a collaborative approach in this area of innovation.

The digital transformation programme positions Health Innovation Manchester for continued focus on the development and delivery of digital solutions and technology into health and in the use of technology in health and care services to improve the health and wellbeing of the GM local population and also support economic growth. Health Innovation Manchester has about 17 live digital projects with and across multiple partners and agenda out of which 13 are at the GM level, 2 at the national level and the remaining 2 cuts through multiple levels.

Projects	Level	Agendas / Partners
COVID-19: Digital Primary Care	GM	Digital Transformation
COVID-19: Accelerating Data Sharing Across GM	GM	Digital Transformation
COVID-19 Mental Health	GM	
COVID-19: Digital Care Homes	GM	Digital Transformation
Reducing Medication Errors in Primary Care through Digital – SMASH	GM	Digital Transformation
Providing Patients, Visitors and Staff with Access to Free NHS Wi-Fi	GM	Digital Transformation
Supporting People with Dementia to Live Well	GM	Digital Transformation
Detecting Early Signs of Frailty and Preventing Deterioration	GM	Digital Transformation
Smart Hearts: Using Data to Improve Care for People with Heart Failure	GM	Digital Transformation
Giving Children the Best Start in Life Through Digital Technology	GM	Digital Transformation
Greater Manchester Digital Health Accelerator	Various	Digital Transformation, Industry Partnerships
Greater Manchester Healthy Hearts: Systematic Identification of High-Risk CVD Patients	GM	
Life QI Quality Improvement Tool	GM	Quality Improvement
NHS England Innovation & Technology Schemes	Various	Academic Health Science Network, Digital Transformation, Industry Partnerships, National Bodies
NHS Innovation Accelerator	National	Academic Health Science Network
T-MACS: Troponin only Manchester Acute Coronary Syndromes	GM	
The Utilisation Management Unit	National	Utilisation Management

Table 7 Live Digital Projects in Greater Manchester [GM]

Source: [25]

Health Innovation Manchester has a digital accelerator programme, the GM Digital Health Accelerator, for mentoring digital technology companies and operates an innovative Data Lab project in collaboration with NICE to assess the possibility of using routinely collected data to evaluate the effectiveness of medicines, new technologies and interventions.

Participating in the digital accelerator programme offers tech companies access to engage with the GM digital health ecosystem with opportunities to connect with NHS stakeholders, industry investors, patients, and other healthtech innovators. Health Innovation Manchester, through the AHSN Network, is pioneering the SMASH dashboard project, a digital technology developed by the University of Manchester. The SMASH dashboard has been deployed in Salford to help minimise medical errors in primary care that could cause harm to patients.

Data access and IG issues are some of the key challenges to digital transformation in GM, as indeed they are across the whole of the UK. They slowed down the Health Innovation Manchester digital transformation agenda. However, following the Covid-19 pandemic, the government notified healthcare organisations, GPs, local authorities and arm's length bodies to share information under the Health Service Control of Patient Information (COPI) regulations to support the fight against the coronavirus.[26]

This COPI directive has enabled the digital transformation agenda of Health Innovation Manchester to make significant progress. A case in point is the Digital Integrated GM Care Record.

> '... IG and data access were always big stumbling blocks and made things slow. ... Now since COVID, they've also been able to work as a system in unblocking some of the IG issues as well. So, one of the projects that we're working on at the moment is the Digital Integrated Care Record. You know, systems over the country wide have been struggling to get Integrated Care Records for years and it always comes down to IG and the risk, and I think COVID has been a massive catalyst.'
>
> [Person 624]

There is an ongoing effort to speed-up the deployment of data sharing across GM using the GM Care Record. The GM Care Record is being extended to improve the care of patients as a consequence of the Covid-19 pandemic.

This extension makes it possible to enhance clinical decision making, provide access to vital information on medications, test results, allergies, care plans and priority alerts, reduce instances of harm, enhance care planning and inform care coordination across settings and geographies. The GM Care Record is supported by the GM-wide strategy for data protection and information sharing that is consistent with national guidance. This ensures patient record is shared safely, securely and legally.

[24] The Christabel Pankhurst Centre will have academic strengths in digital health and advanced materials.
[25] https://healthinnovationmanchester.com/digital-section/
[26] https://www.gov.uk/government/publications/coronavirus-covid-19-notification-of-data-controllers-to-share-information

5.5 Putting the AHSS Concept to Work

5.5.1 Introduction

The AHSS concept emphasizes connections between innovation actors. The following instances below, show the responses which Health Innovation Manchester has made in a range of contexts to connect actors together and to choreograph their activities to effect successful outcomes. The first example is within the context of SARS-CoV-2, and then some less recent examples are then covered, Hepatitis C elimination, the Rainbow Clinic and the heart failure monitoring service. The examples examine a set of diverse roles played by Health Innovation Manchester where a common theme is connecting different actors within the innovation system and shaping the health and social care itself in important ways.

5.5.2 A Case Study of Crisis Response – SARS-CoV-2

The arrival of the SARS-CoV-2 and the associated disease spectrum COVID-19 in early 2020 has stimulated massive response to one of the largest threats to public health in recent history.

Wensing, Sales, Armstrong, and Wilson (2020), note a wide range of possible actions in the clinical context, and the NHS itself has responded with many, (NHS Digital, 2020b). Specifically in the Gold Report (NHS Digital, 2020a), notes a range of actions undertaken:

- Provide digital channels for citizen guidance and triage (p.4)
- Enable remote and collaborative care with systems and data (p.5)
- Increase COVID-19 Test access and process efficiency (p.6)
- Identify and protect vulnerable citizens (p.7)
- Support planning with data, analysis and dashboards (p.8)
- Get data and insights to research communities (p.9)
- Support clinical trials (n/a)
- Provide secure infrastructure and support additional capacity (p.10)
- Plan for recovery, restarting services and new needs (n/a)

(NHS Digital, 2020a, page 3)

Health Innovation Manchester's response has been to work with partners across the local health and care system to coordinate aspects of the GM response to the Covid-19 pandemic. It undertook a review of its plans and priorities, and working within the regional and national directive, it categorized is programmes of work in the following way: a) that should be accelerated, for their potential to directly support the Covid-19 response; b) paused and reviewed in 3-months' time, and; c) stopped entirely. Some of the high priority programmes being developed in GM in response to Covid-19 and in collaboration with Health Innovation Manchester's health care, academic and industry partners are presented in the table below Table 8 Health Innovation Manchester's Programmes of Work Supporting Covid-19 Response

Programmes of Work Supporting Covid-19 Response		
GM Research Rapid Response Group	Accelerating data sharing across GM	Digital Primary Care
Digital Care Homes	Mental Health	Long-term conditions management
Coordinating digital health and care activity	Supporting Patient Flow	Placental Growth Factor (PGF) COVID-19 Accelerated Response

Table 8 Health Innovation Manchester's Programmes of Work Supporting Covid-19 Response

A very important step, achieved in part as a result of the crisis, was acceleration of the digital strategy to share patient records across the health organisations of the Partnership. The wide, system-level sharing of data across the Partnership had been a long-term goal but there had been little progress in bringing it about. In the short term, the sharing of data which has now been achieved may improve clinical decisions and health outcomes in responding to COVID, but the benefits are likely to go much further:

> 'The GM Care Record will have a direct impact on the quality and precision of care we are able to provide patients, particularly those with complex needs across multiple specialties. Sharing this information has never been more important as it will greatly aid clinical decision making and will reduce the burden on both patients on clinicians, freeing up valuable time to care.'
>
> (Tameside and Glossop Integrated Care NHS Foundation Trust, 2020)

During 2020, Health Innovation Manchester has supported the integration of care records from all areas of the Partnership and this has now been achieved far sooner than had ever been imagined. There is now a single system [the GM Care Record which uses Graphnet's CareCentric shared record software - The Greater Manchester Integrated Digital Care Record (GM IDCR)]. This holds a significant quantity of patient data for all of the 2.8m citizens of the Partnership area. The speed with which integration of the records from the principal health and care providers [GP practices, hospitals, community and social care teams] has taken place reflects a realization of the importance of information sharing in the context of pandemic conditions for urgent monitoring of the extent / prevalence of, and the effects of disease, but also the commitment of the Partnership to the long-standing goal of exploiting data larger population level sets for mining, and more extensive research. During the spring and summer of 2020, content of the care record grew from 2.2 million people covered and 297 GP practices involved, to 3.1 million covered with 443 GP practices involved (Lucchi, 2020). The success of the implementation an IT deployment at this scale demonstrates the viability of working at the level of the region. At the request of the Partnership, the Graphnet system was made to include data on an individual's COVID-19 status, whether they have been tested, their test result, and whether they are self-isolating.

For the Covid-19 digital primary care programme, Health Innovation Manchester, in collaboration with partners, is supporting and implementing a digital-first service that provides patients with digital access, triage and consultation to address the urgent need to move online following the national lockdown as a result of the Covid-19 pandemic. The Covid-19 digital care homes programme focused on providing care homes greater access to technology, tools and patient information, in partnership with social care partners, to protect and care for the venerable member of society. In terms of mental health, Health Innovation Manchester, through the GM Mental Health Programme Board, has identified series of digital services and support for children and adults across GM to manage the extra burden the Covid-19 pandemic presents to mental health services in the region. Such digital services include 1) SHOUT – a confidential 24/7 text service operated by trained crisis volunteers who will chat using text responses 2) Kooth – an online counselling and emotional wellbeing platform for children and young people 3) BlueIce – an evidenced-based app to help young people manage their emotions and reduce urges to self-harm 4) SilverCloud – an online therapy programme for adults proven to help with stress, anxiety, low-mood and depression.

Projects	Level	Agendas / Partners
COVID-19: Digital Primary Care	Greater Manchester	Digital Transformation
COVID-19: Accelerating Data Sharing Across GM	Greater Manchester	Digital Transformation
COVID-19 Mental Health	Greater Manchester	
COVID-19: Digital Care Homes	Greater Manchester	Digital Transformation

Table 9 Live Covid-19 Related Digital Projects in GM

Within days of the notification of the disease, scientific and research organisations began to publish research. By June 2020, around five and half thousand publications were indexed in the Web of Knowledge[27] across over 100 Web of Knowledge Subject Categories.

UK universities have been important contributors to this body of research. As one of the interviewees noted, Health Innovation Manchester's response has engaged extensively with the Partnership and has covered many different forms of action

> 'During the COVID crisis we've been looked to and we kind of took the initiative to set up the rapid research group. We've been on the front foot around saying what should GM do about mass testing. And I think the system, the city, whoever, tends to come to us to say can you help with this.... that's not surprising in some ways, because we'd done all the thinking about how all these bits fit together, so actually when COVID-19 came along we said, right, well, we've got this bit and this bit and this bit and this is how we make it all work, so let's just do it. And we did it and we did it very quickly.'
>
> [Person 369]

The University of Manchester, which was placed 133 overall in the world and was equal 12th in the UK in terms of publications in this area, see Table 22 UK Universities' Papers on SARS-CoV-2 / COVID-19, June and August 2020 with International Comparisons and Rankings *UK and World. The analysis was repeated in August, 2020 and showed Manchester's position to have risen by a factor slightly greater than the sector (UK Universities) average.

While the research output measured in publications is a significant measure of the responsiveness of an innovation actor, health system or country, there are many ways of reacting, and through the One Manchester COVID-19 Rapid Research response group, as well as driving COVID-related research outputs there have also been other significant initiatives from the HEIs in GM including secondment of academic workforce with the appropriate expertise to support COVID mass testing, the deployment of research manufacturing capability towards PPIE, driving and coordinating the enrolment of patients into international, national and local clinical trials, a strong industry engagement function supporting the validation of new technologies, and the development of an Expert Group to support the GM mass testing strategy.

5.5.2 Greater Manchester Hepatitis C Elimination

Hepatitis C is a highly infectious disease caused by a virus (HCV). No vaccine exists although research to find one has been taking place for many years. Across the whole population, of those infected with Hep C, around a quarter experience less severe reactions, but in the majority of cases, the virus causes long term damage in the form of the decay of liver tissue and potentially cancer.

[27] Search terms 01-06-20: ts = ('COVID-19' or 'SARS-CoV-2') Refined by: PUBLICATION YEARS: (2020 OR 2019) Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=All years

However, new treatments have emerged that use Direct acting antivirals (DAAs) which are an improvement over previous treatments using interferon. As the report by (Prison Health Expert Group, 2013, p. 3) has noted, Hepatitis C is the only cause of liver disease which is now 'amenable to intervention and is also preventable'.

In the UK, the NHS has established national programmes to reduce the prevalence of Hep C in 2015 (NHS England). National targets now underscore the realistic hope that the levels of the disease can be significantly reduced by 2025. However, treatment interventions are challenging as medicines are costly and its administration has to be closely controlled. Hep C is more common amongst the UK prison population, where it is estimated that 7% of prisoners have antibodies. The prevalence of Hep C in what is captive population (incarceration) presents the NHS with a promising opportunity to detect and eradicate the virus from general circulation. Aware therefore of this possibility, NHS England established an 'elimination deal' for Hep C across its Operational Delivery Networks (ODNs).

ODNs are regional delivery actors that provide clinical leadership and which arrange for the delivery in their respective geographical area and care speciality of new treatments. They operate within a nationwide commissioning framework that was introduced in 2013 (NHS Commissioning Board, 2012). Four areas were originally specified: a) Adult critical care; b) Neonatal critical care; c) Major trauma; d) Burns care.

The Hep C elimination deal which is provided in the Greater Manchester area operates through ODN for Hep C which is based in North Manchester General Hospital, and is led by Professor Andy Ustianowski with assistance from Dr Martin Prince.

Health Innovation Manchester's role in the delivery of the deal has been to jointly lead the initiative on behalf of NHS England in the GM / North Region (Northwest). This involved working on behalf of the lead providers for that area and within the GM which were, at 1st August, 2015 (Pennine Acute Hospitals NHS Trust& Central Manchester University Hospitals NHS Foundation), and with the Prison Service and other related organisations.

Choosing Styal Prison to develop a proof of concept for diagnosis and treatment of Hep C, Health Innovation Manchester coordinated the work of the ODN through a collaborative approach with the Prison Service and Spectrum Health which handles medical care within the prison, and also with clinical and pharmacy teams at North Manchester General Hospital. Diagnosis and treatment processes have been significantly improved with the rapid testing and treatment approaches using dry blood spot and with PCR testing for viral RNA providing results in around 1.5 hours, compared with three days for the previous diagnostic regime. Time to treatment has fallen, and is down weeks to as little as three days.

Recognition of the key role played by Health Innovation Manchester in the development of a viable approach to dissemination has led to the centralization of the ODN budget for Hep C treatment with the organisation. A subsequent implementation of the approach developed at Styal at HMP Forest Bank has begun but the SARS-CoV-2 pandemic has limited progress.

5.5.3 Specialist Antenatal Service - the Rainbow Clinic

Pregnancies which follow stillbirth or neonatal death are both very psychologically challenging to mothers and their families and a time of significant further medical risks to both mothers, the unborn child and neonates. While understanding of the condition is increasing, a large proportion of stillbirths cannot be explained. The condition is therefore of major public health concern. As Bhattacharya, Prescott, Black, and Shetty (2010, p. 1243) note, 'Stillbirth continues to be a major

concern for obstetricians in both the developing and developed world. In approximately 60% of cases attribution of cause of death is possible, but unexplained stillbirths continue to baffle obstetricians and neonatologists alike. From the point of view of the couple hoping to start a family, there are few events more distressing than the loss of a first pregnancy.'

Professor Alex Heazell, Senior Clinical Lecturer in Obstetrics and Clinical Director of the Tommy's Stillbirth Research Centre at the University of Manchester, is a leading researcher in the area of pregnancy following stillbirth as well as in the area of neonatal health. His research within the Tommy's Centre aims to understand the causes of stillbirth and its effects, its implications for further medical treatment of mothers during subsequent pregnancies and children. His work supports a clinical role in the Manchester Foundation Trust and has led to the establishment of the Rainbow Clinic (Abiola et al., 2016) which has pioneered new care pathways for mothers and their families who have experienced stillbirth. Mothers attending the Rainbow Clinic receive an enhanced form of maternity care that not only addresses the psychological effects of their previous experience but provides increased and more sophisticated monitoring and if necessary, intervention by specially trained obstetricians with access to equipment not necessarily present in all hospital settings in GM.

The approach of the centre is now being delivered across GM to all localities, with all bar one currently adopting the approach. The Rainbow Clinic model is also being assessed for further dissemination across the NHS. Health Innovation Manchester reports the following for outcomes of the introduction of the Rainbow Clinic (Health Innovation Manchester, 2020c): 'The Rainbow Clinic at St Mary's, a specialist antenatal service for families who are going through a pregnancy after previously experiencing a stillbirth, has now cared for more than 700 families, helped to reduce the stillbirth rate by 34% and delivered 20% cheaper than routine antenatal care for this group of women.' Health Innovation Manchester's Research and Education Committee reported that the clinic (Health Innovation Manchester, 2019d) 'has been placed within the top 14 of AHSN programmes, with Rainbow clinic seeing returns of £6.10 on every £1 invested'.

The development and implementation of new treatment requires the development of a secure evidence base from clinical engagement, and assessment of the economic benefits of treatment to justify investment in the collection of further evidence and changes to clinical practice – changes that might lead to the introduction of new services. Wider adoption of new treatment requires a governance mechanism to secure agreement for commissioning beyond an initial trial and test site. Health Innovation Manchester's Innovation Monitoring the Prioritization Committee (the IPMC) has provided such a governance mechanism by including within its structure one of more representatives from the Provider Federation Board of the Partnership. This has ensured initiatives to test and trial are adequately resourced, and that when demonstrated to be effective, they can be spread within the Partnership, and, in this case generating further interest elsewhere in the NHS.

5.5.4 Heart Failure Monitoring Service

Heart failure is a significant health problem in GM with around 27,000 people suffering heart failure of some kind or other and with 4,330 hospital admissions in Greater Manchester annually. The cost of treatment for the condition within the Partnership's care system is estimated by Health Innovation Manchester at more than £17 million. While treatment can include medicine or surgery, an important technology for heart failure is monitoring by means of implanted devices of the kind provided by Medtronic, a medical devices company.

Health Innovation Manchester began formally to support a project in 2018 to investigate how implantable devices could be used for remote monitoring of patients' conditions. In November of that year, it began a partnering activity with Medtronic, already a supplier of devices in the area, that then led to an application for financial support from Health Data Research UK (HDR UK). The UK HDR grant comes from Innovate UK's Industrial Strategy Challenge Fund which recognizes the value to the economy of this particular sector. KVB Research, a research company considers the global market to be worth $714.4 Million by 2024 with annual compound growth rate of 7.6% (KVB Research, 2019).

The bid for funds was secured in January 2019 and was led by the GM Cardiovascular Speciality Lead, Dr Fozia Ahmed, who is based in the Manchester Academic Health Science Centre and at the Manchester Royal Infirmary. The HDR grant provided £338,000 for the project partners, Health Innovation Manchester, Manchester University NHS Foundation Trust, University of Manchester and NorthWest EHealth.

The work undertaken as a result of funding builds upon existing capacity and the expertise within the Manchester Heart Centre at Manchester Royal Infirmary to develop greater understanding of the potential of the technology (Ahmed et al., 2020). It is expected that the approaches to treatment developed in the trial may be extended across the Partnership. Data from implanted devices is being used to develop risk models, and to provide personalized care for heart patients. Playing a key role within the project is NorthWest Ehealth Ltd, a company wholly owned by Salford Royal Foundation Trust, and University of Manchester, which has provided the clinical trials expertise to the work, establishing the consent required for a study in which 1000 patients are participating.

Developments in understanding and improvements to treatment are arising from the combination of supplier side actors (Medtronic) and demand side actors (the clinicians and patients) supported by an innovation intermediary that has secured access to the resources necessary to work at the necessary scale and in the required depth to establish a proof of concept for innovation.

6 Analysis

6.1 Introduction

The focus for our analysis is upon the attempt by the Greater Manchester Health and Social Care Partnership to establish Health Innovation Manchester as its health innovation model and how that organisation has acquired and developed *agency*, and what the limits of this agency might be. Our view is that the attempt to establish the organisation has raised a number of questions about how innovation is to be embedded and contribute to the goals of the Partnership.

Our analysis, which draws on the findings of the fieldwork we have conducted, looks at three issues all of which centre on the innovation model for Health Innovation Manchester: a) how was the model for Health Innovation Manchester established: b) what is the relationship between the model and its environment; and looking more towards the future; c) what are the limits of the model in terms of achieving innovation and on what does this depend?

In regard to the first of these issues, which is the establishment of Health Innovation Manchester, our findings demonstrate the challenges of organisational genesis in an already complex system that contains existing capabilities that may need to be re-purposed, that is multi-tiered, and which contains many possible paths to supporting innovation.

Innovation actors that attempt to meet the needs of organisations that are quasi-clients or collaboration partners may achieve more when they begin to shape the actions of the organisations that they serve. The relationship can be more effective if it is bi-directional. We examine how Health Innovation Manchester has begun to shape its environment and with what effect.

The current trajectory for the organisation sees a gradual accumulation of capabilities and technologies to support innovation across the Partnership. As these capabilities and technologies are acquired, questions arise over how transformative Health Innovation Manchester should be within its environment. The relationship between visions of innovation - the Partnership's, Health Innovation Manchester's, and those of other bodies is central here. Questions over governance and understanding of innovation and how to pursue it are pressing but difficult.

6.2 Establishing a Model

The Memorandum of Understanding which created Health Innovation Manchester in 2015 introduced the idea of an Academic Health Science System (AHSS) as the model upon which the organisation would be based. This foundational document outlined the context for the creation of Health Innovation Manchester, showing how the needs of the Partnership would be met by amongst other things, the introduction of a discovery care pathway, the strategic and systematic use of data, and a feedback loop approach that would ensure innovations would not be 'fire and forget', but subject to evaluation. Indeed, the understanding of feedback was a sophisticated one with innovation seen in terms of a linked series of steps and not a single burst of activity.

A collaborative approach was emphasized and the role of industry as key partner was identified at a number of points in the document. It announced the intention to bring together key assets of a number of key organisations, which were named, in 'a seamless way'; and there was acknowledgement of the need for new governance arrangements. The document refers at one point to 'current organisations', perhaps implying that the AHSS itself would be in time an organisation, but the document does not specify clearly that it would be an organisation in its own

right. At this stage, the notion of *system* is emphasized rather than the term *organisation*, as the form which Health Innovation Manchester would take.

This emphasis upon system and an assembly of parts rather than a single organisation is strengthened by the use of the term 'banner' as the model with which to establish 'Health Innovation Manchester'. Herein lay recognition of the challenges of creating a new body in an eco-system already well-supplied with very strong research and innovation actors based in Manchester, national programmes for innovation in health on which Manchester could draw and participate in that had existed for some considerable time and were supported by highly reputable bodies already well-integrated into the NHS. How the different existing organisations would work together and create synergies is not addressed in the document. Their individual strengths are acknowledged by the Memorandum but how their activities would be integrated and made coherent by means of the AHSS concept was not articulated.

It was not a foregone conclusion that this document would not by itself prove to be sufficient foundation to 'ground' Health Innovation Manchester as an operational system or as an organisation, but in our view, it left too much to be decided for there to be an immediate implementation, despite the commitment made in the Memorandum to a plan of action, including the need for new governance arrangements.

Our view is that the AHSS is not a readily implementable concept. The limited academic / policy literature rightly outlines the AHSS as an evolving concept with few examples of successful implementation and non that match the GM context. Indeed, there is significant ambiguity in the concept itself, which makes implementing it an exercise in serendipitous learning by doing. A key paper does not help to clarify what organisational status an AHSS might have. Further comments (V.J. Dzau et al., 2010) create uncertainty over the status, functions, and limits of an AHSS and lead to the question of whether the system is an *innovation model* for an organisation or the *system itself*:

> 'Ultimately, human health is the most important outcome, and AHSSs should be held accountable for the health of the populations they serve, both locally and globally' and 'Ideally, such vertically integrated AHSSs could evolve into accountable care organisations that are financially responsible for the health of the populations they serve'.
>
> (V.J. Dzau et al., 2010, p. 951 and ff)

Thus, over the first year of its existence, attempts to operationalize Health Innovation Manchester as 'banner' and 'system' were unsuccessful. In addition to the fact that there was no clear functional form for the organisation, two further factors had made progress difficult. Firstly, key elements of the innovation eco-system lay under the control of different organisations. The AHSN lay in the Salford Foundation Trust, while other key resources were based within the Central Manchester Foundation Trust. Secondly, this period also saw preparation for major changes to the organisations which hosted the key elements of the innovation eco-system. These developments were part of the reorganisation and rationalization of the resources of the Partnership. This reorganisation would lead in the autumn of 2017 to the formation of the Manchester Foundation Trust from the Central Manchester Foundation Trust which had existed since 2009 (and which ran eight hospitals), while in the winter of 2017, reorganisation of the Salford NHS Foundation Trust and the Pennine Acute Hospitals NHS Trust was completed with the creation of the Northern Care Alliance that included

Salford Royal, The Royal Oldham Hospital, Fairfield General Hospital in Bury, Rochdale Infirmary and North Manchester General Hospital[28].

When a new attempt was made to create the AHSS as organisation in 2016 and 2017, the decision was taken to create Health Innovation Manchester as an *organisation* within a *system*. This was the only possible option in our view. Central then to organisation formation, formalization, and then to operation was leadership. The capabilities that were required to lead this process of organisational instantiation – the bringing of the idea of an AHSS into a concrete form - were broad, and were required at a very high level.

We suggest that three elements were necessary. A background in the NHS as a clinician at a senior level was in our view not only highly desirable but essential as it provided understanding of context and gave assurance (credibility) to the other organisations in the local, regional and national contexts in which Health Innovation Manchester was to operate. Here, our assessment is very different from the recruitment consultants whose person specification indicated that 'the knowledge of the health or social care sectors may be useful, but is less important than an understanding of the pressures facing these sectors, and an intelligent perspective..' (Russell Reynolds, 2017, p. 3).

In addition, we suggest that experience of leading and promoting innovation in treatment outcomes would be a major advantage that would be strengthened by understanding the importance of systematic data to plan and evaluate interventions. A further requirement was understanding of, if not experience of, working at a high level in the commercial healthcare sector. The Board was fortunate in our view that its recruitment process ultimately identified and agreed the appointment of an individual with capabilities in all these areas.

6.3 The Model and the Environment

The departure of the first chief executive in the middle of May 2016 was followed by a realization by the Board of the need to find a suitable model with which to implement the AHSS. The approach chosen was to put an organisation at the centre of the implementation, and not to rely solely upon a networked model.

Based upon the work of consultants, the new model addressed the need for an organisational basis for the AHSS by outlining a number of organisational enablers: a) an interim budget was identified, as was a budgetary cycle and budgetary requirements; b) a set of key performance indicators (KPIs) were identified; c) a different Board structure was proposed; d) but there was also recognition given to the need for the organisation to operate in a complex environment and to make connections and establish links with other parts of the GM landscape, including other parts of the innovation system but also other elements, such as the localities, and CCGs. It was with this new plan that the organisation had the chance of achieving *agency* in a context where the primary goal - innovation - is a distributed phenomenon, requiring action across a wide and often disparate network of actors, all of whose involvement, however small, may be needed for success.

For the newly appointed chief executive who began work in February 2018, an immediate need was to achieve orientation and understanding of the context for the organisation. This was true for both those located inside the organisation and those outside it. This strategy of envisioning which was pursued through 'visual dialogue' has created an image, presented on a large-scale mural in the

[28] From 1st April, 2020, North Manchester General Hospital is managed by MFT.

organisation's premises, and also present on its electronic media, of the eco-system in which the organisation is located.

Another key step in achieving agency, which was identified by the consultants advising the Board in 2016-2017, was the need to know what was being achieved. Before the re-launch of Health Innovation Manchester, there has been no central place where there was understanding of what innovations were being worked on, and there were no means for the organisation to answer such questions as what needs should be addressed, for whom, by when, i.e., at what stage is the work, who is doing the work, and what is the probability of success? The consultants' approach was to propose a 'Pathway Pipeline' which has now developed with the use of IT methods to 'fix' the position of the innovations in terms of various dimensions. This approach has found support outside the Partnership with the NHS England AHSN now examining the concept, although individual AHSNs have been aware of the basic principle of pipeline management for some time. Distinctive in the pipeline approach adopted is the connection of the pipeline (and a focus on outcomes as defined through the lens of fiscal, societal and economic outcomes), to decision making on initial project selection by the Partnership itself and then monitoring of projects as they mature.

In this process we regard as crucial the development of Health Innovation Manchester's role in the Partnership through the creation of a series of committees that systematically connect decision making by Health Innovation Manchester with other actors in GM. Health Innovation Manchester sought to achieve a connection to other parts of the local innovation eco-system through the creation of two committees in particular, the Innovation Prioritization and Monitoring Committee (IPMC) and the Research and Education Committee (REC). These two committees engage external organisations in decision making processes about priorities for the Partnership (for innovation and for research respectively), and by allowing external organisations to participate in decision making with Health Innovation Manchester, a number of important objectives are achieved: firstly, these external organisations are connected to GM goals in ways that would not have been possible before: secondly, there is visibility about innovation priority setting, management of innovation, and assurance across GM that priorities are being identified, relevant innovations identified and managed effectively. The future success of both the Partnership's innovation activities and Health Innovation Manchester as an organisation depend upon the continuation of these connections.

The development of the organisation under the new chief executive after February 2018 has though emphasized connectivity with exploration of the network / systems model aspects of the AHSS. Health Innovation Manchester therefore has an organisational core but connects widely and has features of a hybrid organisation being linked within the Partnership and other organisations across of range of types. This apparent hybridity allows for engagement and sustains links that can deal with the coordination needed to find the best way to innovate. The cases examined in 5.5 Putting the AHSS Concept to Work, provide evidence of the validity of the assumption that the attempt to innovate needs clinical practice, medical research, technological expertise (tool making in effect) and governance to be engaged in a dialogue that can remove or reduce the coordination costs faced by the actors who are attempting to answer the question, how are we to innovate? We make the suggestion that such a dialogue can only take place when an innovation intermediary joins such a conversation.

6.4 The Limits of the Model

Health Innovation Manchester operates as an organisation that enables health innovation in a dense and complex web of connections that are local, regional, national and international. Its aim to work with these connections and organisations as a system, and as a system that is integrated in

the sense of being coordinated, and where links are organised and not simply the result of the *ad hoc* exploitation of opportunities. Innovation actors stand in for market actors where markets do not have the capacity to allocate resources. Health Innovation Manchester's main remit though is to deliver in the region, to the Partnership, although it may, under certain circumstances be part of deployment of innovation more widely. While it can draw on a range of diverse actors, and needs to work with these, its mission to deliver regionally in the first instance but also in other areas presents a challenge of where exactly to put the effort.

The dilemma of where to contribute – in the region or beyond – is not one that is faced solely by Health Innovation Manchester, but by those other actors it works with that are based locally, and which Health Innovation Manchester relies upon, to varying degrees. Much of the research capability within the system that Health Innovation Manchester can draw on is very strongly incentivized to contribute internationally. Will such capability – in particular that of the Manchester Academic Health Sciences Network - be ready to narrow its focus – 'to divert its gaze' - to the region when research agendas are set internationally and excellence at that level is historically the main yardstick of success? Would incentivization from within the Partnership be sufficient? It is not clear from the analysis of REF data that Manchester capabilities are as strong as other benchmark institutions in the area of contributing impact.

Across the Partnership area, we have noted significant diversity in existing health outcomes by locality. While there is a strong attempt to manage health and social care at this scale, local differences may lead to differences in priority. The adoption of the LCO model places increasing emphasis upon taking action locally.

Taking substantial responsibility for supporting system-wide changes to health and social care requires a thorough understanding of the Partnerships activities. Such overview is difficult to obtain without detailed and real time information from across the Partnership. It has been demonstrated recently in the context of the Partnership that information sharing of the patient record across the sector can be achieved and that it brings many benefits in principle. Using information technology at this level is an example of digitalization. What the Partnership requires however is not only digitalization of specific systems but an integration of the information it holds that can support broader and more ambitious transformations of services. A systematic digital approach is one of the promises of the MOU which created Health Innovation Manchester. A broader digital approach needs not only a different set of governance arrangements for information but far greater expertise across the Partnership. More ambitious use of data to transform healthcare will though conflict with existing interests. Health Innovation Manchester, like it or not, will have an important role to play in managing this difficult tension. Who then defines data, defines collection mechanisms, defines the future?

7 Conclusions

7.1 Organisation

Health Innovation Manchester was launched into a context that was complex by virtue of having many actors at different levels of development, some of whom were already well-established, and because that context was itself evolving quickly and uncertainly. The conditions in 2015 were not therefore easy ones in which to establish a new organisation, although they presented opportunities. An initial attempt to create Health Innovation Manchester as 'a coalition of the willing' and under a banner of collaboration met initially with only partial success. Only when it was acknowledged that in order to establish Health Innovation Manchester in *organisational form* rather than as *label* for a range of activities were the foundations for agency effectively laid, and the potential for purposeful action, including action through a networked model, became possible.

Important steps along the path to agency came with the involvement of strong and highly effective local leadership within the Partnership that maintained its commitment to the innovation agenda, by relaunching Health Innovation Manchester as an *organisation*. Emphasizing the importance of organisational status even without the use of a statutory form and adopting an organisational culture based on a variety of principles of governance that reflect the hybridity of the mission and diversity of methods have yielded a functioning and capable innovation actor to support the goals of health and social care devolution in Manchester, and to contribute more widely to the NHS.

We note that the difficulties experienced in attempting to establish a new approach to innovation – here based on a novel model referred to as an Academic Health Science System - are not untypical challenges that organisational innovators face in trying to find the right model (flexible yet structured) to approach highly complex social and economic landscapes.

It attempting to understand what an AHSS might be in practice, it may help to distinguish between a health system as a delivery mechanism, and a health system which adapts, in other words, which innovates. A health system that is a delivery mechanism is static, and means of delivering today what it delivered yesterday. A health system that innovates is capable of changing.

7.2 Keeping Track of Innovation – Knowledge Management

A key step, recognized by the consultants brought in to establish Health Innovation Manchester as an organisation (within a system), and by the management of some of the constituent organisations, was the need to identify precisely the work being done by the organisation. The chosen mechanism to achieve this was the introduction of an *innovation pipeline* management tool. The activities of the organisation then become visible, and are then *negotiable*, subject to *systematic control*, *monitorable*, *deliverable* and ultimately therefore, *evaluable*. Digitalization is important here, as it enhances understanding of what is being done. But the visibility of any process is a two-edged sword. Under effective management, what appears in an innovation pipeline is what is desired, but visibility brings into relief any work that does not appear to meet the needs of the Partnership, or any particular part of it.

We note that while the pipeline model gives a valuable overview over an entire portfolio of innovations, such a model may discourage learning from failure as the experience from innovations that are ejected from the pipeline could be overlooked. An emphasis on success based on a principle that delivery leads to legitimacy for an organisation is a sound basis generally, but in innovation, the risks of failure are high, and there is a vital role to be played by ensuring that the lessons of failed

innovation projects are learned. It is very early in the development of the organisation for this issue to be critical, but the organisation should be prepared for it.

7.3 Negotiating the System

Health Innovation Manchester is an organisation that aims to work with others in a coordinated manner. It uses a range of means to collaborate with various parts of the Partnership and outside it. Collaboration is achieved through formal committee style entities, ex-officio positions and dual appointments, and through the strategic use of communications including the creation in 2020 of a director level post with a strategic communications and engagement portfolio. A message to staff within the organisation to *collaborate maximally* is highly appropriate. To achieve added value, intermediary organisations such as Health Innovation Manchester must maintain an openness to context. But the more links there are, and there are many, the more difficult it becomes to achieve that added value.

The arrival of a new Chief Executive in February 2018 has led to this distinct stance towards external organisations within the Partnership that shuns a simple 'If you build it, they will come' translational model of medical innovation and emphasizes awareness of the different contexts and the variety of actors that are involved in innovation and whose engagement is needed to secure innovation, at pace and with the realistic promise of success.

If we now consider the system itself, a question then arises about who is in the system, who is integrated, and on what terms. Within the Partnership, the answer to this question is becoming clearer, with the means of integration coherent and well-thought out. It is at this level, i.e., the level of the Partnership, that the AHSS concept makes most sense and is closest to being realized. But the real innovation system in which Health Innovation Manchester sits is not a system of its own making. It is a global system – a distributed system - in which there are powerful trends, subject, in part, to trade agreements that ride on perceptions of national interest. There are national actors, driving agendas with potentially different priorities, and preferred methods. In this overall system, Health Innovation Manchester has the level of influence of a regional actor. Furthermore, and to underline the point about control, this is a system that exists for the protection of human health, which, as the events of 2020 continue to show, may have to address new priorities with great urgency. Very little, in terms of meeting the need for health innovation overall can be controlled regionally, but it can be influenced, and, at the level of delivering in the region, as the COVID-19 pandemic has shown in terms of moving towards the sharing of patient records, there is considerable scope for action.[29]

The question of where exactly Health Innovation Manchester makes an impact is a key one. Just how much effort should it expend to create benefits outside the region? This is a difficult calculation to make and cannot be avoided because scientific resources are costly and health challenges are vastly expensive when not tackled effectively. Where there are benefits that arise beyond the Partnership, why should those capabilities – the spending on and the building up of resource – be supported by the Partnership? This dilemma could be avoided – for a time – by drawing on resources that come from beyond the Partnership, and this occurs, to a significant extent. But as the range of what might be termed 'export work' increases, does not the focus of the organisation move away from the region?

[29] COVID-19 appears as *actant* in the new information sharing arrangements (Callon, 1996).

7.4 Innovation at Pace – Driven by Digital?

Many organisations both public and private are beginning to engage with the opportunities provided by digitalization. These opportunities exist at many levels. In its most extreme form, digitalization *radicalises the knowledge management function* and constitutes a strategy to use data, including real-time data, to transform the organisation itself including changing or redefining the services it offers, the way such services are offered, and support (back-office) functions[30].

When managers follow the data and its analysis, they can be come into conflict with the existing organisational mission, even challenging that mission. Navigating the organisation by reference to its data – *flying on the instruments* – carries another form of risk which is that data, however novel and however extensive, may be generated by processes in which there are biases that need to be understood before the data can be used to proper effect. A careful dialogue between such a transformative approach to services design and delivery and the existing organisational mission is essential.

As recent events have shown, the need for innovation in the technologies of healthcare at pace can be a national priority. We conclude that the organisation needs to retain the capabilities and structures for understanding threats and for reacting to them quickly. A key part of reacting is understanding. Data is vital here, but needs to be systematic. Partnership wide data collection and analysis strategies to support the need for reactive and short-term responses should be considered.

7.5 Embedding Innovation – The Capabilities of the Partnership Organisations

Those engaged in innovation know that 'innovation is not invention' and that the introduction of new products or services needs meticulously planned implementation to be successful. While Health Innovation Manchester is engaged in 'discovering, developing and deploying' innovations, it has to consider how these improvements can be achieved in practice and at a time when the Partnership members are making major structural changes to their delivery of health and social care as a result of the adoption of the integrated care organisation concept (now taking shape through the LCO model in the localities). Health Innovation Manchester is already aware of the need for understanding of context, and surrounds new innovations with training to support introduction. But under the major changes now envisaged to health and social care based at population level, this challenge has become more complex.

7.6 Capturing Benefits – the Novelty of the Case

Within the next half year, Health Innovation Manchester will have operated for around three years in this nationally and internationally significant role to support the Partnership and Devolution of Health and Social Care. As an innovation intermediary organisation drawing heavily on the Academic Health Science System concept for an understanding of its mission and methods, and standing as one of the few UK based implementations that involve health, social care, universities, and it is an example that is unusual if not unique. After three years of operation, it will be appropriate to conduct a systematic evaluation of its activities.

Evaluation best practice employs a number of concepts which are relevant to the assessment of organisational and programme performance and all can be considered relevant to the evaluation of an organisation such as Health Innovation Manchester. Firstly, there is a contrast made between evaluations that examine activities that are current and which are carried out to shape future development (*formative evaluation*), or evaluations that are undertaken to examine what has been achieved at some point in time (*summative evaluation*). There is also the contrast made between

[30] 'Digital disruption'.

efficiency, effectiveness and appropriateness which are often cited as the classic criteria of evaluation. Such criteria frame the attempt to understand an organisation or a programme as a *mechanism* for making changes to practices in some way, premised upon a particular view of how the world should change, i.e., with certain specific methods. Evaluation as a body of knowledge of how to assess the impact of organisations or programmes also emphasises the need to establish net effects of activities. Net effect (additionality) is what has happened only as a result of the intervention, but reliable additionality assessment has to consider a wide range of counterfactual situations which might have occurred in the absence of the programme and compare them with what has happened as a result of an intervention. Net effects or additionality can be considered as input additionality or as output additionality. In the context of the evaluation of organisations embedded within a web of relations with a variety of other actors, input and output additionality are difficult to assess since counterfactuals cannot sensibly be determined. Nevertheless, the attempt must be made to assess counterfactuals to give some sense of the efficiency, effectiveness and appropriateness of the organisational mission.

With an organisation such as Health Innovation Manchester, which is at an early stage of its development, it is appropriate to focus evaluation on both the formative and summative aspects but be mindful that the outputs and outcomes of its activities are likely to be at a very early stage. It is also important here to consider the theory or view of reality upon which the organisational mission is based (the programme logic) and the connection between the mission and the means by which the organisational mission is implemented. As we have noted above, despite the difficulties of assessing net effects, the attempt must be made in order to answer the central questions of organisational effectiveness and appropriateness.

7.7 A Balancing Act

In Health Innovation Manchester's further development, it will encounter a number of major issues. Two of these issues poses two fundamental choices, and the third issue presents an unavoidable challenge. Firstly, as to the choices, the organisation must determine how much should it build itself up to engage with and integrate in national and international systems of research, knowledge and innovation so that it may deliver on its mission for the Partnership? A second choice it faces is how strongly should it support the digitalization of the institutions and services of health and social care? Finally, a challenge, which relates to the second choice the organisation has to make over the role of *digital*, is about how to support the Partnership members as they make major structural changes in response to the integration of health and social care and the adoption of population-based approaches to provision. None of this can be approached without a deep understanding of the global health innovation system, a leadership team of high capacities and a willingness to engage with and shape that system.

Annexes

Annex 1 Conceptual Framework

This study aimed to establish a body of evidence to help understand the emergence, formalization and operation of a regionally-based innovation actor.

We sought to do this by references to historical documents and interviews and the literatures relevant to innovation actors, their contexts, emergence of actors, their operation and efficacy.

Central to understanding action are descriptions which informants and documents provide of capabilities which are brought to a setting (in this case the creation of Health Innovation Manchester).

Our interview programme sought to acquire from informants based in Health Innovation Manchester an understanding of these capabilities.

Evidence was provided by informants of how capabilities had been developed prior to the formation of Health Innovation Manchester, and how those capabilities were further developed within the organisation and how they contributed to formation and operation. Not all capabilities are individually possessed. Many exist in other organisations and can be accessed.

Annex 2 GMHSCP General Tables

Authority	CCG Name	CCG population
Bolton	NHS Bolton CCG	308260
Bury	NHS Bury CCG	203438
Manchester	NHS Manchester CCG	635683
Oldham	NHS Oldham CCG	253787
Rochdale	NHS Heywood, Middleton and Rochdale CCG	232300
Salford	NHS Salford CCG	270436
Stockport	NHS Stockport CCG	310932
Tameside	NHS Tameside and Glossop CCG	247082
Trafford	NHS Trafford CCG	241314
Wigan	NHS Wigan Borough CCG	326673

Table 10 GMHSCP Constituent Authorities and CCG – Population [Source Public Health England Data, 2016-2018]

CCG Name	Admission episodes for alcohol-related conditions (Narrow)	Excess winter deaths index	Deprivation score (IMD 2015)	Children in low-income families (under 16s)	Infant mortality rate	Killed and seriously injured (KSI) casualties on England's roads
NHS Bolton CCG	703	32	28	20	5	29
NHS Bury CCG	626	35	22	15	4	22
NHS Manchester CCG	775	25	41	27	6	32
NHS Oldham CCG	737	33	30	22	5	26
NHS Heywood, Middleton and Rochdale CCG	704	32	34	21	5	27
NHS Salford CCG	885	30	33	21	5	30
NHS Stockport CCG	709	26	19	14	5	22
NHS Tameside and Glossop CCG	713	30	29	19	4	25
NHS Trafford CCG	601	26	15	12	4	22
NHS Wigan Borough CCG	761	27	25	15	3	22

Table 11 GMHSCP CCG Health Outcome Data including IMD Data Alcohol Related Admissions to KSI [Public Health England Data, 2016-2018] [IMD ONS Data for 2015]

CCG Name	Life expectancy at birth	New STI diagnoses (exc. chlamydia aged <25) / 100,000	Inequality in life expectancy at birth	Percentage of adults (aged 18+) classified as overweight or obese	Percentage of people aged 16-64 in employment	Percentage of physically active adults
NHS Bolton CCG	80	607	10	67	71	62
NHS Bury CCG	80	602	11	59	71	66
NHS Manchester CCG	78	1411	8	60	69	66
NHS Oldham CCG	79	646	11	63	68	59
NHS Heywood, Middleton and Rochdale CCG	79	624	9	66	70	63
NHS Salford CCG	79	1237	10	63	76	67
NHS Stockport CCG	82	590	11	63	79	67
NHS Tameside and Glossop CCG	79	742	9	71	74	63
NHS Trafford CCG	82	758	8	64	77	69
NHS Wigan Borough CCG	80	467	10	71	75	64

Table 12 GMHSCP CCG Health Outcome Data Other Measures Life Expectancy at Birth to Physically Active Adults [Source: Public Health England, 2016-2018]

CCG Name	Smoking Prevalence in adults (18+) - current smokers (APS)	Smoking Prevalence in adults in routine and manual occupations (18-64) - current smokers (APS)	Smoking status at time of delivery	Suicide rate	TB incidence (three year average)	Under 18s conception rate / 1,000
NHS Bolton CCG	15	28	14	12	15	19
NHS Bury CCG	16	30	12	9	8	23
NHS Manchester CCG	17	28	10	9	21	22
NHS Oldham CCG	18	32	14	8	16	28
NHS Heywood, Middleton and Rochdale CCG	16	30	16	11	13	23
NHS Salford CCG	20	36	11	11	9	29
NHS Stockport CCG	13	28	9	9	6	15
NHS Tameside and Glossop CCG	17	29	15	12	11	28
NHS Trafford CCG	14	26	5	7	9	12
NHS Wigan Borough CCG	16	23	15	12	3	19

Table 13 GMHSCP CCG Health Outcome Data Other Measures Smoking Prevalence at Birth to Under 18s Conception Rate per 1000 [Source: Public Health England, 2016-2018]

CCG Name	Under 75 mortality rate from all cardiovascular diseases	Under 75 mortality rate from all causes Directly standardised rate - per 100,000	Under 75 mortality rate from cancer Directly standardised rate - per 100,000	Year 6: Prevalence of obesity (including severe obesity)
NHS Bolton CCG	96	403	143	21
NHS Bury CCG	86	371	137	21
NHS Manchester CCG	125	516	190	26
NHS Oldham CCG	104	435	164	23
NHS Heywood, Middleton and Rochdale CCG	107	441	157	23
NHS Salford CCG	98	448	163	23
NHS Stockport CCG	69	328	131	18
NHS Tameside and Glossop CCG	105	420	154	21
NHS Trafford CCG	69	313	130	18
NHS Wigan Borough CCG	91	394	146	23

Table 14 GMHSCP CCG Health Outcome Data Other Measures Under 75 mortality rates from cardiovascular diseases to Year 6 Obesity Prevalence [Source: Public Health England, 2016-2018] [Year 6 - NHS Digital, National Child Measurement Programme]

CCG Name	CCG population	Deprivation score (IMD 2015)	Children in low-income families (under 16s)	Percentage of people aged 16-64 in employment	Violent crime - hospital admissions for violence (including sexual violence)	TB incidence (three-year average)	Percentage of physically active adults	Life expectancy at birth	Inequality in life expectancy at birth	Excess winter deaths index
NHS Bolton CCG	308,260	28.42	20.1	70.6	52.86	14.99	61.6	159.5	20.2	32.0
NHS Bury CCG	203,438	21.769	14.7	71.4	44.22	7.74	65.6	160.4	21.1	35.2
NHS Manchester CCG	635,683	40.512	27.1	68.8	69.56	21.16	66.1	155.9	15.1	25.2
NHS Oldham CCG	253,787	30.291	22	68.1	75.57	15.65	59.2	158.6	22.3	32.6
NHS Heywood, Middleton and Rochdale CCG	232,300	33.684	21.2	69.9	68.75	13.43	63.0	158.1	17.7	32.5
NHS Salford CCG	270,436	32.959	21.1	76.4	81.36	9.15	67.5	158.0	19.9	29.9
NHS Stockport CCG	310,932	19.108	13.5	79.2	50.24	5.50	66.9	163.4	21.0	26.3
NHS Tameside and Glossop CCG	247,082	29.38	18.9	73.8	57.12	11.0049	62.8	158.3	18.5	30.2
NHS Trafford CCG	241,314	15.388	11.6	77	45.7	8.9226	69.0	164.0	16.7	26.1
NHS Wigan Borough CCG	326,673	24.857	15.1	74.8	70.57	2.874	64.3	159.1	19.9	27.1

Table 15 Source: ONS Deprivation – Index of Multiple Deprivation (IMD) Scores, 2015

Annex 3 Research Capability of the Manchester Academic Health Science Centre [MAHSC]

This annex outlines and discusses using Research Excellence Framework impact data the pre-existing Manchester Academic Health Science Centre [MAHSC] and University of Manchester research capabilities and achievements that were available to Health Innovation Manchester at merger. The discussion in this annex builds on findings from reviewing impact cases of the University of Manchester [REF2014].

The University of Manchester [REF2014] submission has three main folders: Impact Case Studies, Impact templates and Environment templates. Each of these folders has 35 documents. A search through all documents in these folders shows no mention of Health Innovation Manchester. However, Manchester Academic Health Science Centre (MAHSC) was mentioned in the 5 documents in the Impact and Environment template folders (see tables 1 and 2 below) and not mentioned anywhere in the impact case studies folder.

The mention of MAHSC in the Impact and Environment template documents is important for establishing the connection between REF impact agenda and Health Innovation Manchester. This is because MAHSC came under the control of Health Innovation Manchester in October 2017 following the merger with the former Greater Manchester Academic Health Science Network (GM AHSN).[31] MAHSC was established in 2008/ 2009 as a partnership between the University of Manchester and five NHS organisation (including MFT) to connect top healthcare providers with world-class academics and researchers.[32] The University of Salford, Manchester Metropolitan University and The University of Bolton are also listed as MAHSC's higher education institutions.

MAHSC focuses on six domains cancer, cardiovascular, human development, inflammation and repair, mental health and population health. Its activities are crucial for the integration of translational research and NHS healthcare delivery through harmonization of research programmes and governance procedures between partner Trusts and FMHS. Following the founding of Health Innovation Manchester in 2017, research programmes implemented through MAHSC and GM's other research agencies are coordinated through Health Innovation Manchester's innovation routes, which offers rich pipelines for fast-tracked deployments that can scale.[33]

Findings from reviewing UoM's [REF2014] impact cases from the environment and impact template folders show that MAHSC plays a huge role in the research activities of UoM researchers. For example, in table 1, MAHSC is discussed as central in facilitating translational research in collaboration with researchers at different faculties in the University of Manchester. In the case of UoA1 of table 1, it facilitates collaboration with other private and public organisations such as AstraZeneca, GSK and the NHS. Similarly, MAHSC, in table 2 provides significant support to projects across the five UoAs including collaborating with researchers to fast-track the implementation of innovation from researchers. Numerous academics hold significant positions in MAHSC and the Trust such as Sibley doubling as MAHSC Research Director and Head of Research & Innovation for CMFT.

The UoM [REF2014] impact cases benefited significantly from the partnership with MAHSC through the provision of infrastructures, increased access to research funds and revenue from engaging with industry partners. For example, findings from UoA3 of the environment template (table 1) mentioned

[31] https://healthinnovationmanchester.com/about-us/
[32] https://mft.nhs.uk/withington/research/manchester-academic-health-science-centre-mahsc/
[33] https://healthinnovationmanchester.com/partnerships/manchester-academic-health-science-centre/

that MAHSC provides infrastructures to facilitate access and collaboration between researcher of UoA3 and their clinical colleagues. The partnership with the university also creates an opportunity to gain increased access to research funding. This is captured in UoA2 of impact template (table 2) where £10m contract from the NIHR (that is matched by local NHS providers and commissioners) focuses on planned programmes of work that UoA3 helped develop in congruence with the objectives of GM AHSN and MAHSC. Furthermore, UoM generates significant revenue from industry partners. This is highlighted in UoA4 of table 1 below where key UoM industry partners in MAHSC's m-Health Ecosystem are listed to include firms from different sectors such as pharma, telecoms and computing, all collaborating to fast-track the adoption of mobile-health innovation.

As visible in university [REF2014], the REF Impact Agenda of UoM benefited significantly from the MAHSC partnership. The UoM has programmes of reward to incentivise experts, academics and researchers to participate in MAHSC. Some of such incentives were highlighted in some [REF2014] UoAs. For example, UoA1 of the Environment template (REF5) mentioned the existence of MAHSC Professorship positions that are designed to reward NHS clinical colleagues for excellence and leadership. Twenty of such awards were given to NHS consultants working in UoA1 programmes in 2012 and 2013. The UoA1 of the Impact template (REF3a) also highlighted the university's integration of knowledge transfer activities (with research, teaching and service/leadership) as one of its four promotion criteria up to professorship level. Furthermore, the university also has a lucrative academic inventor – university IP sharing arrangement where the inventor can directly receive over 85% of net income. This arrangement - according to details from UoA1 of the Impact template (REF3a) – has motivated staffs to integrate impact and innovation as part of any research programme leading to direct and indirect impacts in different research areas.

REF 2014 Performance Comparisons

A comparison between Manchester and four benchmark institutions using REF 2014 data across four heath related units of assessment can be used to compare Manchester capabilities with other institutions in the UK. Performance on the REF categories outputs and impact are noted. Environment is excluded in this presentation. Manchester impact shares at 4* in all healthcare relevant UOAs are lower than benchmark organisations.

Institution name	Unit of assessment name	Profile	FTE Category A staff submitted	4*	3*	2*	1*	unclassified
University of Cambridge	Clinical Medicine	Outputs	192.05	39.4	45.0	13.7	0.6	1.3
		Impact	192.05	86.0	2.0	12.0	0.0	0.0
	Public Health, Health Services and Primary Care	Outputs	57.07	45.8	45.2	7.7	0.0	1.3
		Impact	57.07	28.6	65.7	5.7	0.0	0.0
	Psychology, Psychiatry and Neuroscience	Outputs	75.95	43.8	48.2	7.7	0.0	0.3
		Impact	75.95	73.3	17.8	8.9	0.0	0.0
Imperial College London	Clinical Medicine	Outputs	334.18	26.9	51.7	19.4	1.3	0.7
		Impact	334.18	94.1	5.9	0.0	0.0	0.0
	Public Health, Health Services and Primary Care	Outputs	54.60	39.2	46.6	12.8	0.5	0.9
		Impact	54.60	83.3	16.7	0.0	0.0	0.0
	Psychology, Psychiatry and Neuroscience	Outputs	44.33	33.2	53.8	12.0	1.0	0.0
		Impact	44.33	84.0	16.0	0.0	0.0	0.0
University of Manchester	**Clinical Medicine**	**Outputs**	**136.18**	**22.3**	**56.1**	**20.0**	**0.7**	**0.9**
		Impact	**136.18**	**61.3**	**33.4**	**5.3**	**0.0**	**0.0**
	Public Health, Health Services and Primary Care	**Outputs**	**33.33**	**13.9**	**46.0**	**33.5**	**5.1**	**1.5**
		Impact	**33.33**	**10.0**	**50.0**	**40.0**	**0.0**	**0.0**
	Allied Health Professions, Dentistry, Nursing and Pharmacy	**Outputs**	**112.65**	**29.4**	**51.9**	**16.6**	**1.4**	**0.7**
		Impact	**112.65**	**86.7**	**13.3**	**0.0**	**0.0**	**0.0**
	Psychology, Psychiatry and Neuroscience	**Outputs**	**67.70**	**23.6**	**50.2**	**23.7**	**1.8**	**0.7**
		Impact	**67.70**	**60.0**	**40.0**	**0.0**	**0.0**	**0.0**
University of Oxford	Clinical Medicine	Outputs	238.51	33.5	54.1	11.8	0.1	0.5
		Impact	238.51	82.4	17.6	0.0	0.0	0.0
	Public Health, Health Services and Primary Care	Outputs	47.70	42.2	44.8	10.9	1.6	0.5
		Impact	47.70	90.0	10.0	0.0	0.0	0.0
	Psychology, Psychiatry and Neuroscience	Outputs	98.30	54.0	38.8	6.9	0.3	0.0
		Impact	98.30	85.5	14.5	0.0	0.0	0.0
	Social Work and Social Policy	Outputs	27.40	67.9	21.8	10.3	0.0	0.0
		Impact	27.40	100.0	0.0	0.0	0.0	0.0

Table 16 REF 2014 Data Manchester Benchmarks (Study Team Selection)

Unit of Assessment	Key Audience	Comments on MAHSC
1 - Clinical Medicine	Over 3,000 peer-reviewed papers were published in the REF period of which more than 80 were in elite journals. Grant income totalled £194m during 2008-2013, compared to £108m during the period 2001-2007, with an increase in new awards of 64% in 2012-13 compared to previous year. Programme-level funding includes 50 grants of over £1m, and 81 5-year grants (CRUK, NIHR, Wellcome, FP7, MRC, NIH, Breakthrough), and a total of £75m industrial funding.	MAHSC is central to our integration of translational research in UoA1 with NHS healthcare priorities in programmes such as: 1) Manchester Collaborative Centre for Inflammation Research (MCCIR, established 2013): a unique £15m collaboration between UoM (involving Faculty of Life Sciences (FLS) and Faculty of Medical & Human Sciences (FMHS)), and AstraZeneca and GSK, for pipeline molecular targets. 2) NIHR Greater Manchester Collaboration for Leadership in Applied Health Research and Care (GM CLAHRC, 2008, renewed 2013): a £10m contract from NIHR, with matched funding of £10m from NHS partners, involving UoM with 20 Greater Manchester NHS Trusts, with a focus on cardiovascular disease management in primary and community care.
2 - Public Health, Health Services and Primary Care	Primary Care: We have realised the objectives set out in RAE2008 (UoA8) to develop and evaluate strategies to improve quality of care in general practice. In making these achievements we: Secured £20m income from new research awards. Public Health: Secured £16m income from new research awards totalling £75m.	The second generation CLAHRC, secured in 2013, will focus on improving cardiovascular disease management in primary and community care, building on the success of the first generation CLAHRC. The planned programmes of work are aligned with the forward objectives of the Greater Manchester Academic Health Science Network (GM AHSN) whose strategic plan we helped to develop; and with the forward objectives of the population health and cardiovascular domains of Manchester Academic Health Science Centre (MAHSC).
3 - Allied Health Professions, Dentistry, Nursing and Pharmacy	Selected 428 outputs from over 2200 peer-reviewed papers published by returned staff in the REF period, of which 27% are in the top decile of subject-specific citation scores. The REF period has seen a dramatic increase in UoA3 research activity. Our total grant spend has increased to £42.7m, thus UoA3 annual research spend climbed from £5.7m/year in RAE period 2001-7 to £8.5m/year in REF period 2008-13.	UoA3 research focuses on (i) policy and population health-oriented health services research, (ii) clinical research, and (iii) basic science laboratory and methodological research. Much of this research is undertaken through partnerships with NHS Trusts in Greater Manchester, through the Manchester Academic Health Science Centre (MAHSC) and with colleagues in Research Institutes across FMHS and the University (structures described more fully below).
4 - Psychology, Psychiatry and Neuroscience	Since 2008, the UoA has: Secured new awards of £68m (24 awards >£500k) across the translational pipeline. Published 2557 journal papers, an average of 33 unique papers per returned staff. Made 94 inventive disclosures, 7 patent applications and 1 licensing agreement. Sustained and further developed national and international collaborations.	Implementing translational research with NHS Partners: The delivery of translational research into health care is coordinated by Manchester Academic Health Sciences Centre (MAHSC). MAHSC, established in 2008, is one of five Department of Health-designated Academic Health Science Centres in the UK. MAHSC brings together UoM and 6 NHS Trusts in a company limited by guarantee with unified research governance, standards, processes and priorities. Mental Health is one of 5 priority areas for MAHSC, mapping directly to IBBMH.
5 - Biological Sciences	Highlights in the REF period include: Establishment of the Manchester Collaborative Centre for Inflammation Research (initial £15m joint investment with industry. The opening of the Manchester Institute for Biotechnology (current research portfolio £46m). 34 outputs in Nature, Science and Cell by FLS staff. Recruitment of ten Chairs and 28 Research Fellows	Biomedical research in FLS partners closely with FMHS and the MAHSC. Twenty-eight FLS PIs are co-located with 15 FMHS clinician scientists in the AV Hill and Core Technology Facility buildings, which optimises joint working on clinically-focused research projects in areas such as immunology, inflammation and neurobiology. During the REF period, the success of this approach is evidenced by the 92 grants held jointly between FLS and FMHS and 160 joint publications. Through representation on the MAHSC Executive team, FLS is able to contribute to MAHSC's two key goals of delivering world-class excellence in basic science relevant to medicine and health and conducting translational and clinical research to link discovery science to patient benefit.

Table 17 Environment template (REF5)

Unit of Assessment	Key Audience	Key Beneficiaries	Comments on MAHSC
1 - Clinical Medicine	National and international health care providers and users including: Dept of Health (policy makers), regulatory bodies, charities, patients and the public.	Patients and the public, and wider society. Our work is intended to improve the health and well-being of the population through research that impacts at all levels	The core partnership of academic staff in UoA1 with NHS care providers across GM is supported through MAHSC. Many of the academic staff in UoA1 hold clinical contracts, and the major research themes are embedded in the teaching hospital sites of GM. The Trusts, as part of MAHSC, are committed strongly to patient focused research activity and alongside NIHR have facilitated clinical trials to move rapidly to impactful observations
2 - Public Health, Health Services and Primary Care	The key audiences for this research are: Healthcare policy makers in national government departments and agencies; and Healthcare provider organisations.	Patients – who receive improved quality of care and experience of care; and Payers – who fund healthcare systems (notably taxpayers in state-funded healthcare systems such as that in the UK and across the EU).	MAHSC and CLAHRC have created forums in which we have been successful in mobilising knowledge from research to implement improvements in primary/ community care for people with long term cardiovascular conditions across NHS providers in GM and beyond. Within MAHSC, the 'Population Health and Implementation' domain is led by the Chief Executive of Salford Royal Foundation NHS Trust (SRFT) with academic leadership from the UoM Institute of Population Health.
3 - Allied Health Professions, Dentistry, Nursing and Pharmacy	National and international health care providers and users including: Dept of Health (policy makers), regulatory bodies, charities, patients and the public.	Our research impact benefits patients and the public.	UoM and its partners have developed structures and processes to support impact. For example, the MAHSC supports our core partnership with NHS care providers across Greater Manchester (GM). Key to supporting impact within MAHSC is the 'Population Health and Implementation Domain' which is led by the Chief Executive of SRFT working closely with Tickle, the academic lead for the domain. UoM funds the Business Engagement Support Team (BEST), which links commercial organisations to relevant UoM expertise to support impact through research partnerships, knowledge transfer and commercialisation.
4 - Psychology, Psychiatry and Neuroscience	Patients and service users, Healthcare policy makers in gov, Healthcare provider orgs (NHS and non-NHS) and healthcare practitioners, Industry partners: pharmaceuticals, telecoms, computing and software.	People who have, or are at risk of, mental health problems, neurodegenerative or developmental disorders, and their families and Mental health practitioners and service providers.	MAHSC provides a clinical test-bed and accelerates the implementation of innovations from our research. Mental health is a priority area in MAHSC, with the Academic Lead of the area being the Director of IBBMH (Lewis).
5 - Biological Sciences	Natl & international commercial companies including pharmaceuticals, biotechnology, bioprocessing and academic publishing houses, healthcare professionals and local and national governments both in and outside the UK	Commercial partners through supporting innovation and economic competitiveness, patients and associated healthcare professionals and general public (particularly urban dwellers) and ecosystems	FLS's approach to translating fundamental biomedical research is achieved through three strands: ... Integrating appropriate biomedical research in FLS with FMHS and the Manchester Academic Health Science Centre (MAHSC) to create research collaborations. ...

Table 18 Impact template (REF3a)

Annex 4 Public Health England Context Information

		Hospital Performance		Patient Focused Change		Transformation	
		Emergency	Elective	General practice		Leadership	Finance
STP	**Overall progress** **Category 1 Outstanding** **Category 2 Advanced** **Category 3 Making Progress** **Category 4 Needs Most Improvement**	Mar-17	Mar-17	Mar-17	Jul-17	Jun-17	2016/17
Bath, Swindon and Wiltshire	**C2**	85.5%	91.1%	7.5%	77.7%	3 - Developing	0.5%
Birmingham and Solihull	**C2**	85.8%	92.5%	14.9%	74.1%	2 - Established	1.1%
Bristol, North Somerset, South Gloucestershire	**C4**	84.9%	90.9%	4.3%	76.7%	3 - Developing	-2.4%
Buckinghamshire, Oxfordshire and Berkshire West	**C2**	92.8%	91.5%	21.7%	75.6%	3 - Developing	-0.2%
Cambridgeshire and Peterborough	**C2**	92.8%	92.9%	20.0%	75.9%	1 - Advanced	-1.2%
Cheshire and Merseyside	**C3**	90.2%	91.8%	17.3%	78.0%	3 - Developing	-1.3%
Cornwall and the Isles of Scilly	**C3**	79.2%	90.1%	6.3%	79.7%	3 - Developing	-1.7%
Coventry and Warwickshire	**C2**	85.5%	89.4%	25.0%	77.1%	2 - Established	1.1%
Derbyshire	**C2**	91.0%	93.6%	5.1%	79.0%	2 - Established	0.9%
Devon	**C3**	91.2%	88.5%	3.4%	78.6%	3 - Developing	-2.0%
Dorset	**C1**	96.2%	91.4%	0.0%	80.1%	1 - Advanced	1.3%
DDT, Hambleton, Richmondshire and Whitby	**C1**	96.1%	93.6%	31.5%	79.1%	1 - Advanced	0.7%
Frimley Health	**C1**	91.7%	92.8%	34.2%	75.3%	1 - Advanced	0.9%
Gloucestershire	**C3**	84.9%	90.4%	76.8%	78.3%	2 - Established	-2.4%
Greater Manchester	**C2**	86.7%	92.8%	55.1%	77.6%	1 - Advanced	1.9%
Hampshire and the Isle of Wight	**C3**	89.9%	92.0%	20.3%	75.7%	3 - Developing	-0.4%
Herefordshire and Worcestershire	**C2**	84.6%	82.5%	33.7%	77.7%	1 - Advanced	-0.4%
Hertfordshire and West Essex	**C3**	82.9%	92.6%	17.3%	74.8%	2 - Established	-0.7%
Humber, Coast and Vale	**C4**	90.5%	85.5%	0.6%	77.5%	3 - Developing	-1.6%
Kent & Medway	**C3**	86.7%	85.2%	5.0%	73.4%	2 - Established	-1.5%
Lancashire and South Cumbria	**C2**	84.7%	91.3%	9.7%	79.2%	1 - Advanced	0.3%
Leicester, Leicestershire and Rutland	**C2**	84.3%	91.9%	18.7%	73.6%	1 - Advanced	0.5%
Lincolnshire	**C3**	87.8%	89.9%	0.0%	76.0%	2 - Established	0.0%
Mid and South Essex	**C2**	90.3%	87.8%	18.6%	72.2%	2 - Established	0.2%
Milton Keynes, Bedfordshire and Luton	**C1**	95.1%	92.6%	13.0%	74.5%	1 - Advanced	0.6%
Norfolk and Waveney	**C2**	90.4%	86.9%	1.8%	77.8%	3 - Developing	-0.2%
North Central London	**C3**	89.1%	93.2%	55.5%	73.9%	3 - Developing	-0.7%
North East London	**C2**	88.4%	92.2%	52.1%	72.9%	1 - Advanced	-0.3%
North West London	**C2**	88.4%	89.2%	41.2%	74.0%	1 - Advanced	1.5%
Northamptonshire	**C4**	84.1%	84.9%	0.0%	74.8%	4 - Early	-0.3%

Northumberland, Tyne and Wear	**C2**	94.9%	94.2%	14.5%	78.2%	1 - Advanced	-0.2%
Nottinghamshire	**C2**	87.5%	94.7%	3.6%	77.2%	1 - Advanced	0.8%
Shropshire and Telford and Wrekin	**C3**	84.2%	88.1%	10.0%	76.3%	2 - Established	-1.2%
Somerset	**C3**	95.6%	88.5%	1.4%	78.8%	3 - Developing	-1.2%
South East London	**C2**	86.1%	83.7%	46.0%	74.9%	1 - Advanced	0.3%
South West London	**C3**	90.4%	92.4%	21.7%	77.0%	2 - Established	-1.5%
South Yorkshire and Bassetlaw	**C1**	90.9%	93.4%	42.8%	75.2%	1 - Advanced	1.0%
Staffordshire	**C4**	85.4%	89.2%	8.3%	76.8%	3 - Developing	-4.1%
Suffolk and North East Essex	**C2**	94.3%	90.1%	36.5%	76.9%	2 - Established	1.4%
Surrey Heartlands	**C2**	91.6%	92.3%	14.7%	72.2%	2 - Established	0.8%
Sussex and East Surrey	**C4**	90.0%	89.6%	13.0%	76.4%	4 - Early	-4.5%
The Black Country	**C3**	89.0%	91.9%	1.6%	75.7%	2 - Established	-0.1%
West Yorkshire	**C3**	93.3%	89.6%	10.7%	76.9%	2 - Established	-0.2%
West, North and East Cumbria	**C2**	85.3%	91.0%	2.4%	78.6%	1 - Advanced	-0.2%
* indicates shadow Accountable Care System (ACS), or contains an ACS, or is a devolved system							

Table 19 Public health England STP Performance Metrics 2015

Annex 5 Timeline

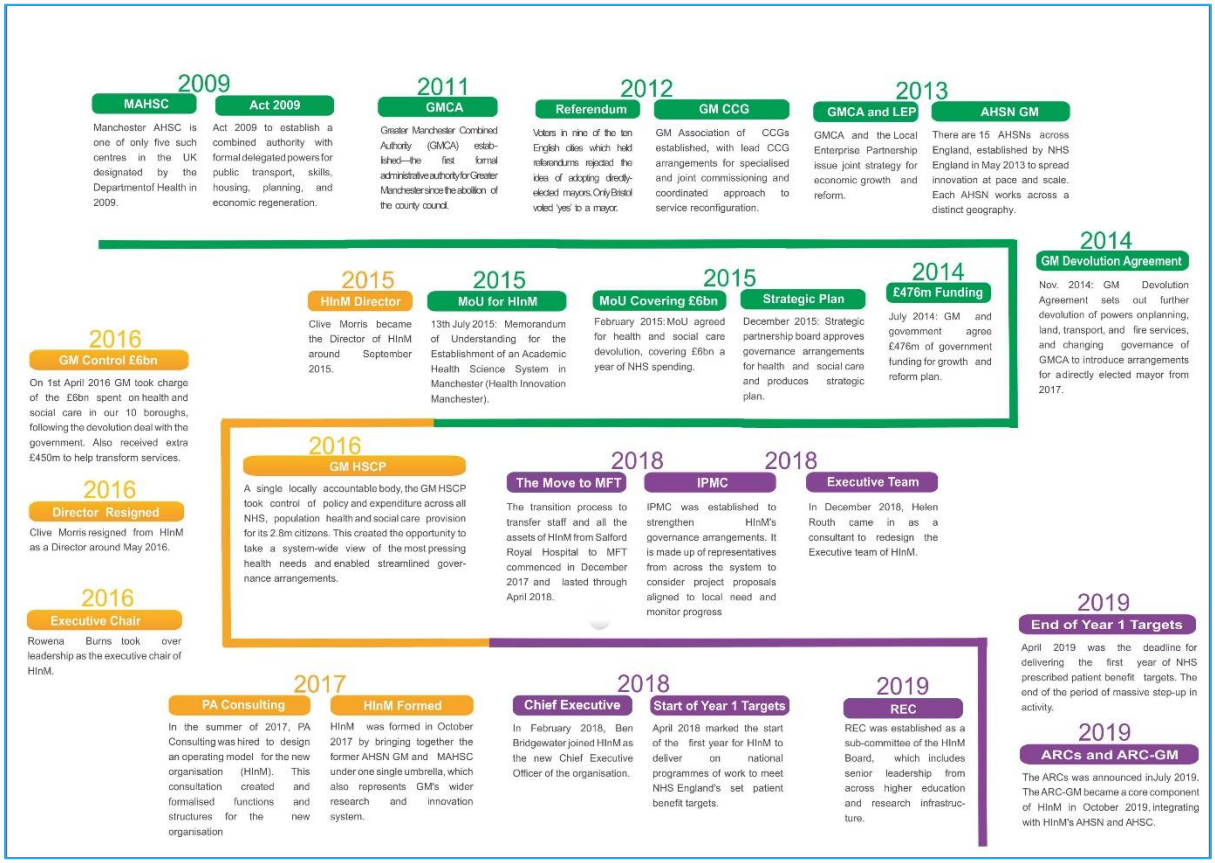

Figure 13 Timeline of the Organisation and Context [Created by the Study Team]

Annex 6 Clustering of the CCGs

The study team examined a range of health outcome data as shown in the earlier Table 14 GMHSCP CCG Health Outcome Data Other Measures Under 75 mortality rates from cardiovascular diseases to Year 6 Obesity Prevalence [Source: Public Health England, 2016-2018] [Year 6 - NHS Digital, National Child Measurement Programme]. This data was compiled from PHE, ONS and other sources and included CCG data on the size of populations. We have assumed each locality can be represented by the local authority data and CCG population data. The purpose of the exercise was to explore contrasts and commonalities across the locality / authority areas of the GMHSCP area in terms of various population health measures, and, in particular, to explore the question of the extent to which localities were different in terms of health needs.

Two clustering approaches were taken to clustering the localities, Hierarchical Clustering and K-Means Clustering. Data from the table were clustered using both of these methods. Standardized values were used (0-1). Clustering was carried out using between group linkages and Euclidian distances. 2 and 3 cluster solutions were sought. A consolidated table reporting the cluster solutions from both clustering algorithms is presented below. Ward's method was also used but produced no differences between the between group linkage solution for the hierarchical analysis. The table below shows the common grouping of areas. Commonly, across the clustering approaches chosen, Bolton and Wigan group [2] together, Bury, Oldham, Heywood, Middleton and Rochdale, and Tameside and Glossop group together [4]. Manchester normally forms a separate cluster [1]. Manchester forms a unique cluster with hierarchical clustering, but joins Salford in a group with k-means clustering.

	Standardized Hierarchical	Standardized K-means
Bolton CCG	1	1
Bury CCG	1	1
Manchester CCG	2	3
Oldham CCG	1	1
Heywood, Middleton and Rochdale CCG	1	1
Salford CCG	1	3
Stockport CCG	3	2
Tameside and Glossop CCG	1	1
Trafford CCG	3	2
Wigan Borough CCG	1	1

Table 20 Consolidated Table of Clustering of the Areas Using CCG Data – from Data given in Origins Section

A further clustering approach was taken by following the steps outlined below based on splitting the data for each measure at the median.

- Calculate the median for population and each of all the other factors

- Score 0 if Town was below the median and 1 if equal or above, and also for each of the factor medians
- Sum all the scores for each Town across all the factors
- The data shown below is ordered by population of the CCG area.
- Split the CCG areas into two based on the sum of factors

CCG Name	CCG Population	**Sum of factors by Towns**	**Group**
NHS Bury CCG	203438	**6**	**1**
Middleton and Rochdale CCG	232300	**15**	**2**
NHS Trafford CCG	241314	**5**	**1**
NHS Tameside and Glossop CCG	247082	**15**	**2**
NHS Oldham CCG	253787	**17**	**2**
NHS Salford CCG	270436	**17**	**2**
NHS Bolton CCG	308260	**10**	**1**
NHS Stockport CCG	310932	**5**	**1**
NHS Wigan Borough CCG	326673	**8**	**1**
NHS Manchester CCG	635683	**13**	**2**
		Median	
		11.5	
		Average	
		11.1	

Table 21 Clustering of Areas Using Median Values

The grouping achieved here is similar but not the same as that achieved by methods that are regarded as more standard clustering techniques. Nevertheless, the analysis demonstrates the existence of differences in a variety of health outcomes and population (part of the function of demand) between the localities of the GM area.

Annex 7 UK University SARS-CoV-2 Publication Analysis

Organization	Jun-20				Aug-20				Period	
	Papers Attributable	% of 5528 Papers on Topic	World Ranking	UK Rank	Papers Attributable	% of 24987 Papers on Topic	World Ranking	UK Rank	Change in Rank	Proportionate Change in Papers June to
All Institutions [World]	5528	NA	NA	NA	24987	NA	NA	NA	NA	3.5
University of London	189	3.42	1	1	764	3.06	1	1	0	3.0
University College London	80	1.45	6	2	347	1.39	7	2	0	3.3
University of Oxford	65	1.18	13	3	258	1.03	14	3	0	3.0
Imperial College London	51	0.92	22	4	232	0.93	16	4	0	3.5
King's College London	46	0.83	28	5	218	0.87	22	5	0	3.7
London School of Hygiene Tropical Medicine	45	0.81	32	6	116	0.46	77	7	-1	1.6
University of Cambridge	35	0.63	48	7	145	0.58	59	5	2	3.1
University of Birmingham	34	0.62	49	8	134	0.54	64	6	2	2.9
University of Liverpool	25	0.45	82	9	101	0.40	99	7	2	3.0
Newcastle University	22	0.39	90	10	48	0.19	292	20	-10	1.2
Queen Mary University London	20	0.36	112	11	99	0.40	103	9	2	4.0
University College London Hospitals NHS Foundation Trust	20	0.36	112	12	89	0.36	124	11	1	3.5
University of Leeds	18	0.33	133	13	81	0.32	141	12	1	3.5
University of Manchester	**18**	**0.33**	**133**	14	98	0.39	106	10	4	4.4
University of Edinburgh	17	0.31	149	15	109	0.44	88	8	7	5.4
University of Nottingham	17	0.31	149	16	65	0.26	203	14	2	2.8
Public Health England	16	0.29	167	17	34	0.14	430	30	-13	1.1
University of Warwick	15	0.27	183	18	44	0.18	331	22	-4	1.9
Barts Health NHS Trust	14	0.25	196	19	40	0.16	359	24	-5	1.9
University of Sheffield	14	0.25	196	20	59	0.24	228	17	3	3.2

*Table 22 UK Universities' Papers on SARS-CoV-2 / COVID-19, June and August 2020 with International Comparisons and Rankings *UK and World.*

Annex 8 Ethical Statement

Research Governance, Ethics and Integrity
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The University of Manchester
Oxford Road
Manchester
M13 9PL
Tel: 0161 275 2206/2674
Email: research.ethics@manchester.ac.uk
Ref: 2019-7230-11943
02/10/2019
Dear Dr John Rigby, Dr Jillian Yeow
Study Title: Health Innovation Manchester: Origins, Formalization, and Operation Assessing the Impact of an Academic Health Science System Innovation in the
context of devolved Health and Social Care
Proportionate UREC
I write to thank you for submitting the final version of your documents for your project to the Committee on 01/10/2019 11:01 . I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form and supporting documentation as submitted and approved by the Committee.
Please see below for a table of the title, version numbers and dates of all the final approved documents for your project:
Document Type File Name Date Version
Data Management Plan Annex 2[34] Data Management Plan Version 0006 [01-10-19] 01/10/2019 0006
Additional docs Annex 9 Data Collection Tools Planned Version 0006 [01-10-19] 01/10/2019 0006
Consent Form Annex 3 GDPR Compliant Consent Form Version 0006 [01-10-19] 01/10/2019 0006
Participant Information
Sheet
Annex 4 Participant Information Sheet Version 0006 [01-10-19] 01/10/2019 0006
Letters of Permission Annex 5 Introductory Emails that will be sent to Gatekeepers Version 0006 [01-10-19]
01/10/2019 0006
Additional docs Proposal HIM Origins Formalization and Operation Proposal Version 0006 [01-10-19]
01/10/2019 0006
This approval is effective for a period of five years however please note that it is only valid for the specifications of the research project as outlined in the approved
documentation set. If the project continues beyond the five-year period or if you wish to propose any changes to the methodology or any other specifics within the project,
an application to seek an amendment must be submitted for review. Failure to do so could invalidate the insurance and constitute research misconduct.
You are reminded that, in accordance with University policy, any data carrying personal identifiers must be encrypted when not held on a secure university computer or

[34] These references are as per the original email sent out and correctly record that. The documents are referred to in different annexes in this report.

kept securely as a hard copy in a location which is accessible only to those involved with the research.

Reporting Requirements:

You are required to report to us the following:

1. Amendments: Guidance on what constitutes an amendment
2. Amendments: How to submit an amendment in the ERM system
3. Ethics Breaches and adverse events
4. Data breaches
5. Notification of progress/end of the study

Feedback

It is our aim to provide a timely and efficient service that ensures transparent, professional and proportionate ethical review of research with consistent outcomes, which is supported by clear, accessible guidance and training for applicants and committees. In order to assist us with our aim, we would be grateful if you would give your view of the service that you have received from us by completing a UREC Feedback Form. Instructions for completing this can be found in your approval email.

We wish you every success with the research.

Yours sincerely,

[redacted]

Secretary to Proportionate UREC

Annex 9 Participant Information Sheet Version 0002 [13-06-19]

Health Innovation Manchester: Origins, Formalization, and Operation

Participant Information Sheet (PIS)

You are being invited to take part in a research study to develop understanding of the role played by Health Innovation Manchester [HInM] in supporting health innovation in the Greater Manchester area and in the wider context of the NHS. Before you decide whether to take part, it is important for you to understand why the research is being conducted and what it will involve. Please take time to read the following information carefully before deciding whether to take part and discuss it with others if you wish. Please ask if there is anything that is not clear or if you would like more information. Thank you for taking the time to read this.

About the research

- **Who will conduct the research?**

  Dr John Rigby (JR) is Senior Research Fellow in Manchester Institute of Innovation Research

  Dr Jillian Yeow (JY) is Lecturer in Business Model Innovation, Civil Engineering Division, School of Mechanical, Aerospace & Civil Engineering, Manchester Institute of Innovation Research IMP Innovation, Strategy and Sustainability

  Dr Dimitri Gagliardi is Senior Research Fellow IMP Innovation, Strategy and Sustainability Alliance Manchester Business School - Innovation Management and Policy Division, Manchester Institute of Innovation Research IMP Innovation, Strategy and Sustainability

- **What is the purpose of the research?**

  This research aims to understand in detail the reasons for the formation of Health Innovation Manchester, its formalization and development in the first 18 months of its existence.

  You have been chosen as a potential participant in the study as you work for Health Innovation Manchester and are likely to have some knowledge of the organisation and its development. Our study intends to speak to around 30 people.

- **Will the outcomes of the research be published?**

  A report will be provided for Health Innovation Manchester, and there will be a popular journal paper and a more in-depth academic paper contributing to the literature on the academic health science system (AHSS).

- **Who has reviewed the research project?**

  Indicate that the project has been reviewed by The University of Manchester Research Ethics Committee 1/2/3/4/5/The University of Manchester Proportionate Research Ethics Committee or the name of the Division/School Ethics Committee.

  For studies approved by an NHS REC, provide the full name of the NHS REC and reference.

What would my involvement be?

- **What would I be asked to do if I took part?**

You will be asked some questions about Health Innovation Manchester's origins and further development. You will be asked these questions by one of our researchers named above. Possibly, there will be two researchers interviewing you at once. Your interview will be in person in Health Innovation Manchester premises. The interview may take up to an hour to complete. We may wish to interview you a second time. A second interview might take less than one hour.

We will make contact with you one week before interview. We will seek your consent at that time. After the interview, we will send your recorded interview away for transcription to an approved provider of transcription services. Your recorded interview will be stored on a GDPR compliant recording device and it will be therefore stored with encryption and with password protection. A transcript will then be provided to you for you to agree. The transcript will be sent by email and will be encrypted and password protected. You will then be asked to agree the transcript is a correct representation of the interview. It will then be analysed by the study team. In all, your involvement in this research will take around two hours: 15 mins to read the invitation, 15 minutes to sign the consent form, 60 minutes to be interviewed (if one interview is requested), 30 minutes to review the transcribed version of the interview and give us permission to use the transcript.

- **Will I be compensated for taking part?**

No payments are to be paid.

- **What happens if I do not want to take part or if I change my mind?**

It is up to you to decide whether or not to take part. If you do not wish to take part, you should email the study leader, Dr John Rigby cc Dr Jillian Yeow at the following email addresses: John.Rigby@manchester.ac.uk Jillian.Yeow@manchester.ac.uk. If you do decide to take part you will be given this information sheet to keep and will be asked to sign a consent form. If you decide to take part you are still free to withdraw at any time without giving a reason and without detriment to yourself. However, it will not be possible to remove your data from the project once it has been anonymised as we will not be able to identify your specific data. This does not affect your data protection rights. If you decide not to take part you do not need to do anything further. It is essential to your participation in the study that your interview is recorded. You should be comfortable with the recording process at all times and you are free to stop recording at any time.

Data Protection and Confidentiality

- **What information will you collect about me?**

In order to participate in this research project, we will need to collect information that could identify you, called "personal identifiable information". Specifically, we will need to collect:

- Your name
- Your role(s) in the organisation
- The experience and capabilities which you have brought with you from your prior employment and training.

Recordings are voice only and will arise from an interview with you or a meeting of your organisation which you attend and to which the study team has agreed access with the management of Health Innovation Manchester i.e. the Executive Management Team (EMT) of HInM.

- **Under what legal basis are you collecting this information?**

We are collecting and storing this personal identifiable information in accordance with data protection law which protect your rights. We have a legal basis (specific reason) for collecting your data, and for this study, the specific reason is that it is "a public interest task" and "a process necessary for research purposes".

- **What are my rights in relation to the information you will collect about me?**

You have a number of rights under data protection law regarding your personal information. For example, you can request a copy of the information we hold about you, including audio recordings.

If you would like to know more about your different rights or the way we use your personal information to ensure we follow the law, please consult our Privacy Notice for Research. [http://documents.manchester.ac.uk/display.aspx?DocID=37095]

Please see the link if this is hard copy version of the PIS.

- **Will my participation in the study be confidential and my personal identifiable information be protected?**

In accordance with data protection law, The University of Manchester is the Data Controller for this project. This means that we are responsible for making sure your personal information is kept secure, confidential and used only in the way you have been told it will be used. All researchers are trained with this in mind, and your data will be looked after in the following way:

Important note: UoM requires identifiable data to be anonymised as soon as the objectives of the project allow. The standard retention period for data once anonymised is 5 years unless funders or regulators have specified longer retention requirements.

Participants will be assigned an ID number only known to the research team (pseudonymised). Data will be pseudonymized following transcription.

Data will initially be held on voice recorder in encrypted and password protected recordings. Data will be identifiable at that stage. Data will be uploaded to the transcription service in encrypted and password protected files. It will then be transcribed by the transcription service which is an approved supplier to the University of Manchester. It will then be returned to the University of Manchester by download. The files created by the transcription service will be in Word format and will be downloaded to a University fileserver and will have password protection and will be encrypted. A recording will be erased from all sources as soon as its transcript is returned to secure file storage at the University of Manchester. Data will not be shared with any other organisation. Contact data will be destroyed at the end of the study on agreement with Health Innovation Manchester that it is satisfied with the final report which we submit in April 2020.

Potential disclosures:

If, during the study, you disclose information about any current or future illegal activities, we have a legal obligation to report this and will therefore need to inform the relevant authorities.

- Voice recordings will be used to create transcripts, transcription will be performed by 1st Class Secretarial which is a UoM approved supplier.
- The personal identifiable information will be removed in the final transcript.
- Recordings will be destroyed – erased from storage media at the end of the study on securing the agreement with Health Innovation Manchester that it is satisfied with the final report which we submit in April 2020.
- Your responses will not be shared with any individual within Health Innovation Manchester in any way such that your comments or observations will be attributable to you.

Please also note that individuals from The University of Manchester or regulatory authorities may need to look at the data collected for this study to make sure the project is being carried out as planned. This may involve looking at identifiable data. All individuals involved in auditing and monitoring the study will have a strict duty of confidentiality to you as a research participant.

What if I have a complaint?

- **Contact details for complaints**

If you have a complaint that you wish to direct to members of the research team, please contact:

DR JOHN RIGBY

T +44 (0) 161 275 5928

F +44 (0) 161 275 0923

JOHN.RIGBY@MANCHESTER.AC.UK

If you wish to make a formal complaint to someone independent of the research team or if you are not satisfied with the response you have gained from the researchers in the first instance then please contact

The Research Governance and Integrity Officer, Research Office, Christie Building, The University of Manchester, Oxford Road, Manchester, M13 9PL, by emailing: research.complaints@manchester.ac.uk or by telephoning 0161 275 2674.

If you wish to contact us about your data protection rights, please email dataprotection@manchester.ac.uk or write to The Information Governance Office, Christie Building, The University of Manchester, Oxford Road, M13 9PL at the University and we will guide you through the process of exercising your rights.

You also have a right to complain to the Information Commissioner's Office about complaints relating to your personal identifiable information Tel 0303 123 1113

Contact Details

If you have any queries about the study or if you are interested in taking part then please contact the researcher(s):

DR JOHN RIGBY
PGR COORDINATOR (AHPGR) FOR THE INSTITUTE OF INNOVATION RESEARCH AND IMP DIVISION |
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Annex 10 Interview Protocol

Health Innovation Manchester: Origins, Formalization, and Operation

Assessing the impact of an Academic Health Science System

Innovation in the context of devolved Health and Social Care in Greater Manchester

INTERVIEW PROTOCOL – HInM Staff

Interview

Theme: Origins of the Organisation

Evidence to be gathered from documents via request to HInM on the following:

Why was HInM established?

What organisations were involved in its creation either directly or indirectly?

What was the organizational mission at the start?

1. If you were involved at the start of HInM, what was/were your role or roles?
2. How did your role contribute to the organizational mission?
3. On what did your role depend in terms of resources within the organisation?
    a. How available were those resources?
    b. What challenges did you face in obtaining them?
4. On what did your role depend in terms of resources outside the organisation?
    a. How available were those resources?
    b. What challenges did you face in obtaining them?

Theme: Formalization

1. What is/are your current role or roles in the organisation?
2. Has your role changed?
3. How does your role *now* contribute to the organizational mission?
4. How has HInM developed and changed since its establishment in terms of the following:
    a. priorities;
    b. organisational design;
    c. and resourcing to address those priorities? [General overview]
5. How does this fit into the Health and Social Care landscape?
6. What has made it easy to do this? [Organisational and outside enablers]
7. What has made it more difficult? [Organisational and outside barriers]
8. What could have been done differently?

Theme: Operation

1. What services and activities is HInM currently delivering?
2. To whom and how are these being delivered?
3. What are the organisation's short term plans (within 6 months)?
4. What are its medium-term plans (between 6 months and 2 years)?
5. What are its long-term plans (beyond 2 years)?

Annex 11 Consent Form

ASSESSING THE IMPACT OF AN ACADEMIC HEALTH SCIENCE SYSTEM INNOVATION IN THE CONTEXT OF DEVOLVED HEALTH AND SOCIAL CARE IN GREATER MANCHESTER

If you are happy to participate, please complete and sign the consent form below

	Activities	Initials
1	I confirm that I have read the attached information sheet (**Participant Information Sheet Version 0002 [13-06-19]**) for the above study and have had the opportunity to consider the information and ask questions and had these answered satisfactorily.	
2	I understand that my participation in the study is voluntary and that I am free to withdraw at any time without giving a reason and without detriment to myself. I understand that it will not be possible to remove my data from the project once it has been anonymised and forms part of the data set. I agree to take part on this basis.	
3	I agree to the **interviews** being **audio recorded**	
5	I agree that any data collected may be published in anonymous form in **academic books, reports or journals.**	
6	I understand that data collected during the study may be looked at by individuals from The University of Manchester or regulatory authorities, where it is relevant to my taking part in this research. I give permission for these individuals to have access to my data.	
9	I agree that the researchers may retain my contact details in order to provide me with a summary of the findings for this study.	
10	If, during the study, you disclose information about any current or future illegal activities, we have a legal obligation to report this and will therefore need to inform the relevant authorities.	
11	I agree to take part in this study.	

Data Protection

The personal information we collect and use to conduct this research will be processed in accordance with data protection law as explained in the Participant Information Sheet and the Privacy Notice for Research Participants.

_____	_____	_____
Name of Participant	Signature	Date

Annex 12 Glossary

Terms	Description
Academic Health Science Centres (AHSCs)	AHSCs are partnerships between top universities and NHS organisations that combine excellence in research, health education and patient care. There are eight partnerships designated AHSC for the next five years 2020-2024.
Academic Health Science Networks (AHSNs)	AHSNs were established by NHS England in 2013 to spread innovation at pace and scale – improving health and generating economic growth. Each of the 15 AHSN works across a distinct geography serving a different population in each region.
Accelerated Access Collaborative (AAC)	The AAC is a national, fast-track route into the NHS for 'breakthrough' medicines and technologies co-ordinated by a unique partnership comprising representatives of healthcare landscape organisations and the health technology industry. It supports innovation at all stages across the development pipeline.
Association of British HealthTech Industries (ABHI)	ABHI is the UK's leading industry association for health technology (HealthTech). It supports the HealthTech community to save and enhance lives.
Association of British Pharmaceutical Industry (ABPI)	The ABPI, along with life science organisations, supports the research, development and use of new medicines in the UK. It works closely with the Government and the NHS to provide new treatments.
Association of Greater Manchester Authorities (AGMA)	The AGMA represents the ten districts in Greater Manchester (GM) working with Central Government to support a move towards formal status for the 'Manchester City Region'.
BioIndustry Association (BiA)	The UK trade association for innovative bioscience enterprises. Its members include emerging and more established bioscience companies, pharmaceutical companies, academic research and philanthropic organisations, and service providers to the UK bioscience sector.
Clinical Commissioning Groups (CCGs)	CCGs commission the majority of health services, including emergency care, elective hospital care, maternity services and community and mental health services. The GM Association of CCGs (GMACCGs) have a strategy that focuses on improving health and wellbeing in Manchester.
Commissioning Support Units (CSUs)	CSUs provide a wide range of commissioning support services that enable clinical commissioners to focus their clinical expertise and leadership in securing the best outcomes for patients and driving up quality of NHS patient services.

Connected Health Cities (CHC)	A Department of Health funded programme that operates across the North of England in four city-regions (North East and North Cumbria, GM, the North West Coast and Yorkshire).
Control of Patient Information (COPI)	The Health Service (Control of Patient Information) Regulations 2002 allow the processing of Confidential Patient Information (CPI) for specific purposes. Regulation 3 provides for the processing of CPI in relation to communicable diseases and other threats to public health and in particular allows the Secretary of State to require organisations to process CPI for purposes related to communicable diseases.
Darzi Review	A review by Lord Darzi in 2018 to examine solutions for protecting and strengthening services in the face of current pressures on the NHS.
Devolution	In England, devolution is the transfer of power and funding from national to local government. It enables the devolved region or area to make decisions that affect and improve public services within the locality.
Devo-Manc	The ongoing project to devolve health and social care in Manchester
Digital Care Homes	Priority Programmes in GM: providing care homes with greater access to technology, tools & patient information
Digital Mental Health	Priority Programmes in GM: introducing digital tools and apps to support adult and child mental health
Digital Primary Care	Priority Programmes in GM: implement digital-first services and provide patients with digital access, triage and consultation
GM Digital Platform	A programme for local health and care shared records, working with the NHS, councils and other public sector bodies across GM to invest in new technologies.
GM Local Industrial Strategy	The GM Local Industrial Strategy outlines a set of long-term policy priorities to help guide industrial development and provides a plan for good jobs and growth in GM.
GP Excellence Programme (GPEx)	GPEx is the strategic partnership between the Royal College of General Practitioners (RCGP) and the HSCP coordinating and delivering support to general practice across GM.
Greater Manchester Academic Health Science Network (GM AHSN)	The GM AHSN is one of the 15 AHSNs in England operating as the key innovation arm of the NHS in Manchester. It is currently a part of the Health Innovation Manchester.
Greater Manchester Cancer	The cancer programme of GM's devolved health and social care system, focusing on the prevention and early diagnosis, living with and beyond cancer and end of life care.

Greater Manchester Care record	A system used across GM for care and treatment that uses new technology standards to enable professionals involved to access and share information when necessary.
Greater Manchester Combined Authority (GMCA)	The GMCA consists of 10 councils, the Mayor, the NHS, transport, the police and the fire service, working together on a strategy to create a more inclusive and productive city-region.
Greater Manchester Health and Social Care Partnership (GM HSCP)	The GM HSCP was formed to oversee the devolution of the health and social care services. The Partnership is made up of local NHS organisations and councils, NHS England and NHS Improvement, emergency services, the voluntary sector, Healthwatch and others including the mayor of GM.
Greater Manchester Medicines Management Group (GMMMG)	The GMMMG is a coordinating group (consisting of GPs, pharmacists and other key healthcare professionals) for decision making around medicines and in particular high-cost medicines for GM. It also has a role in performance monitoring of health economies prescribing.
Greater Manchester Patient Safety Translational Research Centre (GM PSTRC)	The GM PSTRC is a partnership between The University of Manchester and Salford Royal NHS Foundation Trust. It is funded by the NIHR for five years, to undertake research to improve patient safety in primary care. It is one of only three PSTRCs in England.
Greater Manchester Strategy	The plan explains the ambitions for the future of the city-region, it covers health, wellbeing, work and jobs, housing, transport, skills, training and economic growth.
Greater Manchester's Academic Health Science and Innovation System	The bringing together of the former GM AHSN and MAHSC under one single umbrella, to form the HInM in October 2017, represents Greater Manchester's wider research and innovation system.
Health Education England's Genomics Education Programme (GEP)	Founded to deliver the learning and development necessary to enable current and future NHS professionals to utilise genomic medicine for patient benefit.
Health Innovation Manchester (HInM)	HInM is an academic health science and innovation system, at the forefront of transforming the health and wellbeing of GM's 2.8 million citizens. It collaborates with innovators to discover, develop and deploy new solutions.
Healthy.io	Healthy.io is a health-tech company with a mission to improve healthcare outcomes by turning the smartphone into a regulatory approved clinical device.
Improving Outcomes Guidance (IOG)	The IOG was published in 2002 by the National Institute for Health and Care Excellence (NICE). It encourages a regionalised multidisciplinary approach in managing urological cancer cases and recommended centralisation of urological pelvic surgery.

Innovation Prioritisation Committee (IPMC)	The IPMC is a part of Health Innovation Manchester. It matches innovation to the needs of the population.
Joint Commissioning Board (JCB)	The JCB is established as a joint committee of GM's CCGs. It is the forum for collective commissioning / decommissioning decision making.
Local Care Organisation (LCO)	These are locally-based implementations of the accountable care organisation / integrated care organisation concept developed under and required by GM Partnership which bring together to varying extents, depending upon circumstances, service providers at locality level (Greater Manchester Combined Authority, 2015). In GM, services and providers respond to CCG specifications which are to some extent co-generated. Different models apply, PACS and MSCP being the most widely used (Salford Together (Integrated primary and acute care system – PACS); Stockport Together (Multi-specialty Community Provider - MSCP); Salford and Wigan Foundation Chain (Multispecialty chain); Accountable Clinical Network for Cancer (ACNC) (UK based).
Local Health and Care Record Exemplar (LHCRE)	LHCRE programme is designed to support local areas that are already adopting best practice in the collection, protection and ethical use of health and care data to go further, faster and encourage others to follow swiftly in their footsteps.
Local Health and Care Records (LHCRs)	LHCRs enable the safe and secure sharing of an individual's health and care information, as they move between different parts of the NHS and social care.
Manchester Academic Health Science Centre (MAHSC)	One of the eight partnerships designated AHSC in England. Manchester was designated AHSC in March 2009. MAHSC is a partnership between The University of Manchester and six NHS organisations.
Manchester Cancer Research Centre (MCRC)	MCRC is a partnership that brings together world-class research into cancer biology, drug discovery and clinical trials. It is the cancer research arm of the MAHSC
Manchester Clinical Trials Units (M CTU)	Manchester CTU are specialised biomedical research units which design, centrally coordinate and analyse clinical trials and other studies. It was formerly known as MAHSC-CTU.
Manchester Connected Health Ecosystem	A collaborative network that brings together academic expertise, industry partners from SMEs to major international digital & pharma companies, Health and Social Care professionals across the NHS, Public Health and local government, and patient and service user representatives.
Manchester Improving: Medicine with Innovation and Technology (MIMIT)	MIMIT is a community of healthcare practitioners, academic researchers, industry experts and patients, working in collaboration to find new solutions to healthcare problems.

Manchester Local Care Organisation (M LCO)	Manchester LCO is a public sector partnership organisation that is bringing together the city's NHS community health and mental health services, primary care and social care services.
Medicines Discovery Catapult	A national facility connecting the UK community to accelerate innovative drug discovery. It is funded by Innovate UK, an agency of the UK government.
Medicines Healthcare products Regulatory Agency (MHRA)	The MHRA regulates medicines, medical devices and blood components for transfusion in the UK. It is an executive agency, sponsored by the Department of Health and Social Care.
Medicines Optimisation in Care Homes (MOCH)	The MOCH programme ensures that pharmacy professionals working in care homes work alongside the clinical pharmacists in general practice, particularly where those pharmacists have care homes as part of their portfolio of work.
Merseyside Internal Audit Agency (MIAA)	The MIAA delivers internal audit and related services to public-sector organisations across the UK.
Momentum Fund	The Momentum Fund is established to support the introduction and adoption of needs-led, evidence-based innovations into the healthcare system within the Health Innovation Manchester footprint.
National Institute for Health Research (NIHR)	The NHIR is the nation's largest funder of health research working in partnership with the NHS, universities, local government, other research funders, patients and the public, to deliver and enable research that promotes economic growth and advances science. Amongst other things, NIHR funds the Applied Research Collaboration in Manchester, one of 15 ARCs funded under a 2019 allocation of funds [https://www.arc-gm.nihr.ac.uk/about-us].
NHS Innovation Accelerator (NIA)	The NIA supports faster uptake and spread of high impact, evidence-based innovations across England's NHS, benefitting patients, populations and NHS staff.
NHS Utilisation Management Unit (UMU)	The UMU helps commissioners and providers to use health data and insight to drive sustainable and cost-effective change. The team comprises experienced NHS clinicians and analysts.
NHSX	NHSX is a joint unit bringing together teams from the Department of Health and Social Care and NHS England and NHS Improvement to drive the digital transformation of care.
NIHR Clinical Research Network Greater Manchester (CRN GM)	The NIHR CRN GM supports the delivery of high-quality clinical research in NHS, Public Health and Social Care settings. It is one of 15 Local Clinical Research Networks in England.
NIHR Collaboration for Leadership in Applied Health	The NIHR CLAHRCs are collaborative regional partnerships between universities and NHS organisations, focused on improving patient

Research and Care (CLAHRC)	outcomes through the conduct and application of applied health research. There are 13 CLAHRCs in England funded by the NIHR.
NIHR Greater Manchester Applied Research Collaboration (ARC-GM)	The NIHR ARC-GM supports applied health and care research that responds to, and meets, the needs of local populations and local health and care systems. It is part of the Health Innovation Manchester and one of 15 ARCs across England.
NIHR Manchester Biomedical Research Centre (BRC)	The NIHR Manchester BRC connects world-leading researchers based at The University of Manchester and three NHS Trusts in GM, with a vision to drive health improvements and lasting change for all through creative, inclusive and proactive research that identifies and bridges gaps between new discoveries and individualised care.
NIHR Manchester Clinical Research Facility (CRF)	The NIHR Manchester CRF comprises four dedicated experimental medicine research units at The Christie NHS Foundation Trust, Manchester Royal Infirmary (MRI), Royal Manchester Children's Hospital (RMCH) and Wythenshawe Hospital. CRFs provide dedicated space and a safe, quality assured environment for delivering clinical research studies.
North West Research Project Managers' Network (RPMN)	The North West RPMN encourages, facilitates and supports effective research management. It was set up in 2013 with a peer support network that allows members to discuss issues in research grant management and make contributions to research innovation.
Patient and Public Involvement and Engagement (PPIE)	PPIE is about building partnerships that give 'the public' a say on research programmes. It supports researchers on how to engage, inform and include public audiences in research. The goal is a culture of active Patient and Public Involvement (PPI), where research is carried out with or by members of the public rather than 'to', 'about' or 'for' them.
Patient Safety Collaborative (PSC)	The PSC programme is a joint initiative, nationally funded and co-ordinated by NHS Improvement (NHSI) and locally organised and delivered by the 15 regional AHSNs in England created to support the call for the NHS to make care safer for all.
Primary and Acute Care Systems (PACS)	A PACS is a population-based care model based on the GP registered list. It aims to improve the physical, mental and social health and wellbeing of its local population and reduce inequalities.
Primary Care Networks (PCNs)	PCNs bring health and care professionals together to provide joined-up primary and community-based care in line with the NHS Long Term Plan.
Primary Care Provider Board (PCB)	The PCB is the discipline-specific board for general practice, pharmacy, optometry and dental, facilitate wider engagement.
Project Assessment Form (PAF)	Project assessment mechanism: reviewed and provided feedback on Health Innovation Manchester's PAF which is used with innovators to

	inform resource investment decisions around specific innovation and innovation programmes.
Provider Federation Board (PFB)	The PFB enables GM providers to collectively influence and inform approaches at the developmental phase through a single conversation. GM localities develop their LCOs which will have a potentially significant impact on the overall provider landscape.
Public Experience Group (PEG)	The PEG is a resource that delivers programmes and projects which are grounded in the lived experience.
Safe Steps	A digital falls risk assessment tool, designed to reduce the number of falls in care homes. It is one of four innovative companies selected to help improve care in the NHS as part of the GM Digital Health Accelerator.
Strategic Clinical Networks (SCNs)	SCNs bring together those who use, provide and commission the service to make improvements in outcomes for complex patient pathways using an integrated, whole system approach.
Total Digital Triage	Total triage means that every patient contacting the practice is first triaged before making an appointment. It is possible to do this remotely (online, phone, video). This is important for reducing avoidable footfall in practices and protect patients and staff from the risks of infection.
TRUSTECH	The TRUSTECH is an NHS organisation that improves health and social care through innovation. It provides membership services for NHS organisations across the UK and Consultancy Services to industry, the public sector and academia globally.
Voluntary, Community and Social Enterprise (VCSE)	The HW Alliance is jointly managed by the Department of Health and Social Care (DHSC), Public Health England (PHE) and NHS England and is made up of 20 VCSE Members that represent communities who share protected characteristics or that experience health inequalities, to provide a voice and to improve their health and wellbeing,

Annex 13 Orientation Diagram

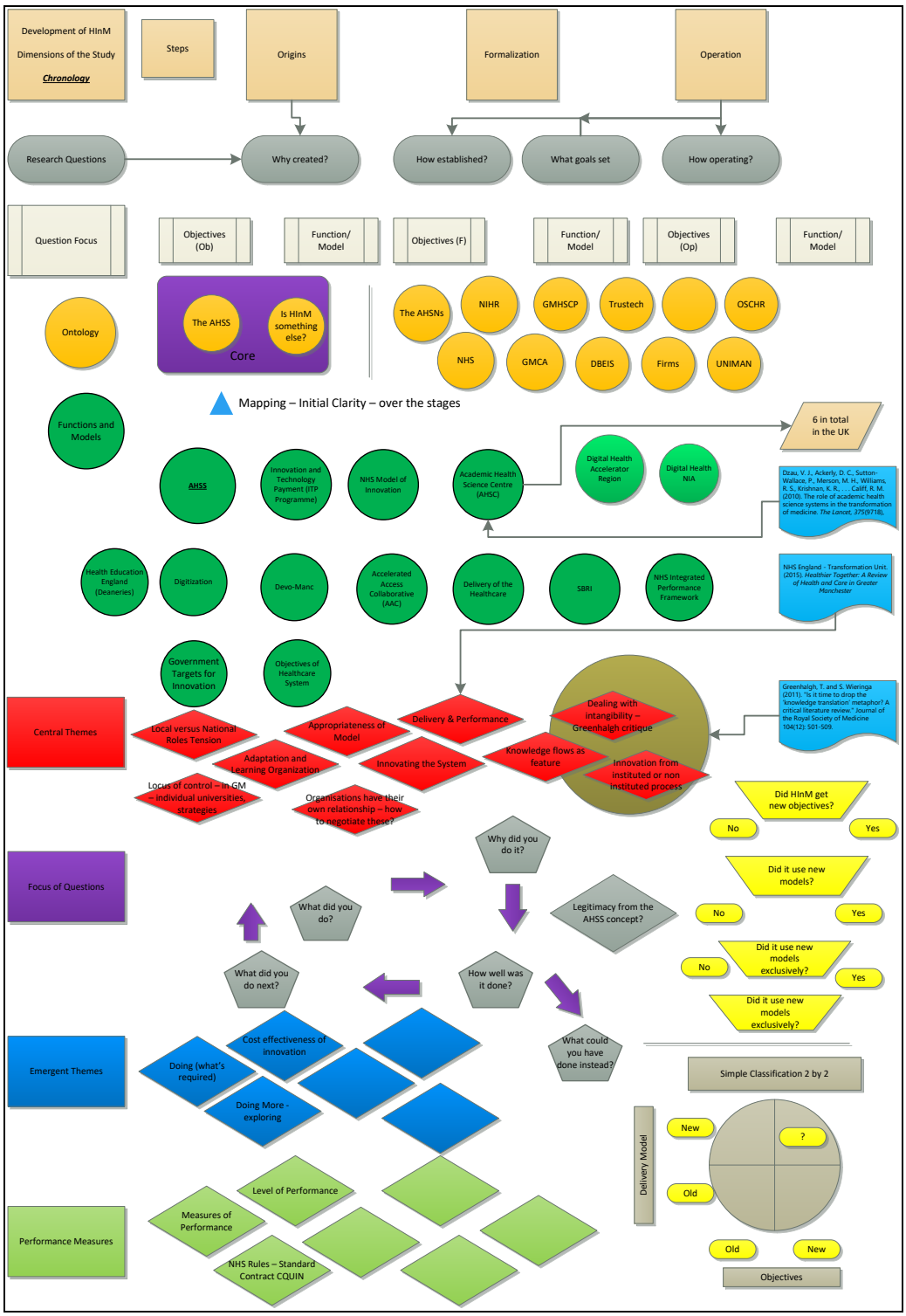
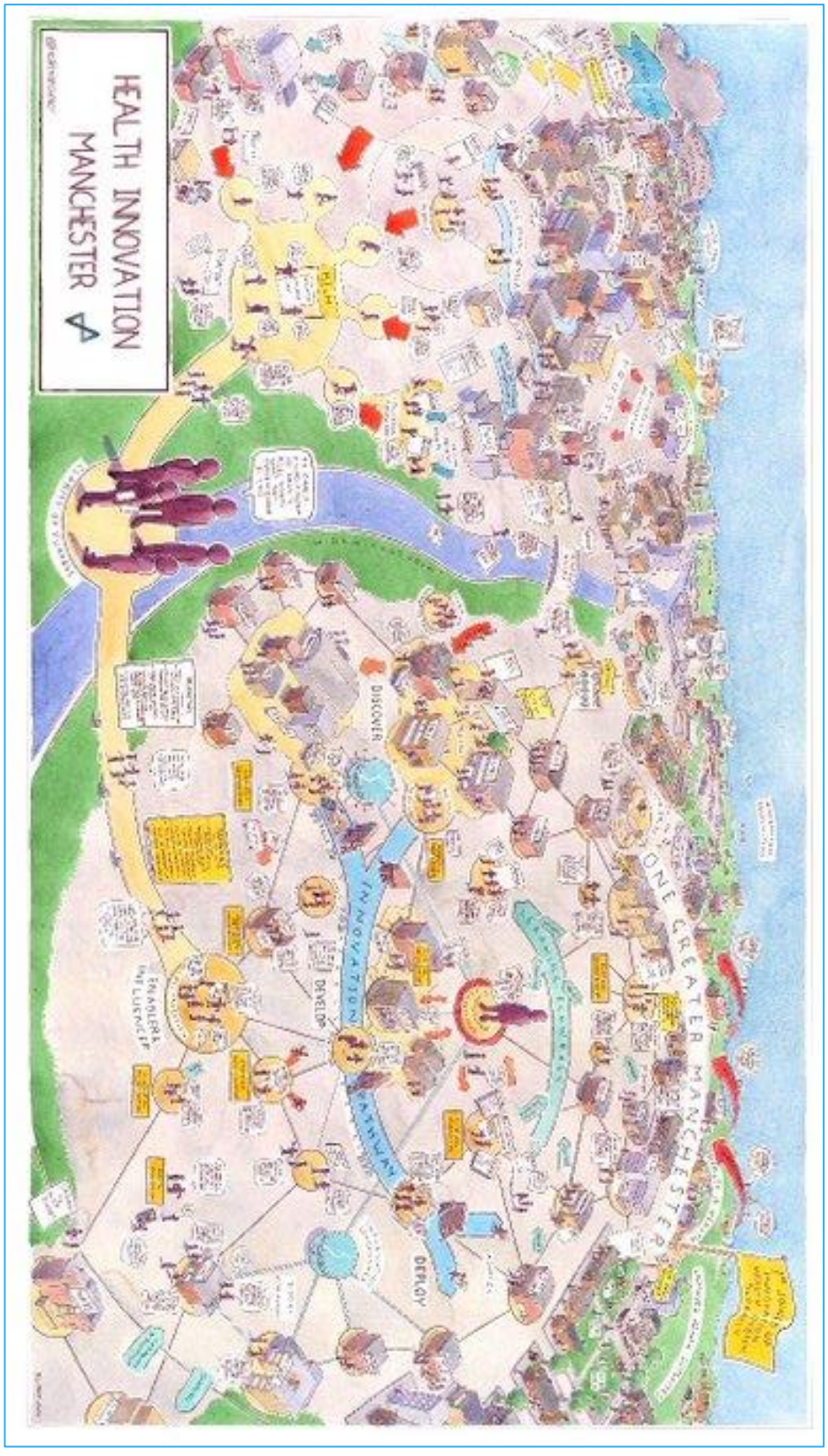


Figure 14 Orientation Diagram [Study Team]

Annex 14 Health Innovation Manchester – the Rich Picture



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