

**Reflections on the Healthcare Technologies Programme
of the UK Engineering and Physical Sciences Research Council (EPSRC)
2017-2025**

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**Engineering and
Physical Sciences
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Summary

This paper records the history of the Healthcare Technologies programme the UK Engineering and Physical Sciences Research Council (EPSRC) since 2015.

My involvement with the EPSRC arose from work in the development of a series of software systems within the University Hospital Southampton (UHS) Clinical Data Estate (CDE) from 2009 onwards, which had come to the attention of officers of the EPSRC. I was therefore invited to apply to join the Strategic Advisory Team for Healthcare Technologies on a three year tenure from 2017-2019.

The EPSRC funds a wide range of research, doctoral training and infrastructure projects across the UK, with a primary focus on academia and the major universities. From 2015 onwards, the EPSRC became increasingly focussed on the needs and opportunities for support of engineering programmes within the Healthcare Technologies brief, and in the context of its overall funding strategy to generate societal benefits from Engineering..

As a Consultant Surgeon in the NHS and an honorary member of the Faculty of Medicine of the University of Southampton, I had a unique perspective on a Board which was comprised primarily of Professors of Engineering. I was therefore able to articulate the particular challenges of the NHS Digital Transformation Programme, and the potential for systems and software engineering to achieve beneficial changes.

There was also a strong case to make for front line health care professionals to be much more fully engaged at the earliest stages of healthcare engineering projects. These group discussions persuaded the EPSRC to embark on a Digital Health strategy which was matured and refined during the Covid years. It led to the launch of the first Digital Health Hubs Competition in 2022, which was funded with ~£25M for the creation of five regional hubs.

I was invited to join the selection programme which chose the 10 finalists, and to Chair the final selection committee, since when I have since continued to support the EPSRC on various projects, including as an assessor in grant applications, and on the Health Technologies Connectivity competition in December 2024.

The History of EPSRC engagement with Healthcare Technologies Funding

The public funding of academic research in medicine and health has traditionally been the remit of the Medical Research Council, The Wellcome Foundation and other charities. In more recent times, the National Institute for Health Research (NIHR) has played a significant role in funding health research infrastructure, including Biomedical Research Centres, Clinical Research Units and Trials Centres, and Commercial Research Delivery Centres.

The EPSRC is well known for its funding of a wide range of academic engineering groups, projects and resources nationally, and for the education of postgraduate researchers in Centres for Doctoral Training (CDTs). It had also supported the development of a range of medical imaging technologies, including Magnetic Resonance Imaging Scanning.

In March 2015, the EPSRC released The EPSRC Strategy for Healthcare, which set out the Four Grand Challenges to be addressed, vis:

Developing Future Therapies: to enhance efficacy, minimise costs and risks to patients.

Frontiers of Physical Intervention: To restore function, and to optimise interventions.

Optimising Treatment: through diagnosis, prediction and evidence-based intervention.

Transforming Community Health and Care: Using real-time information to best effect.

It also set out six Cross Cutting Capabilities for Healthcare (see Figure 1.), which were:

Advanced materials;

Disruptive technologies for sensing and analysis;

Future manufacturing technologies;

Medical device design and innovation;

Novel computational and mathematical sciences; and

Novel imaging technologies.

In 2016, the new EPSRC Strategy emphasised support for early stage development of new technologies (Technology Readiness Levels 1-3), within the healthcare funding landscape (Figure 2). Digital Connectivity and Usability did not feature explicitly in this plan.

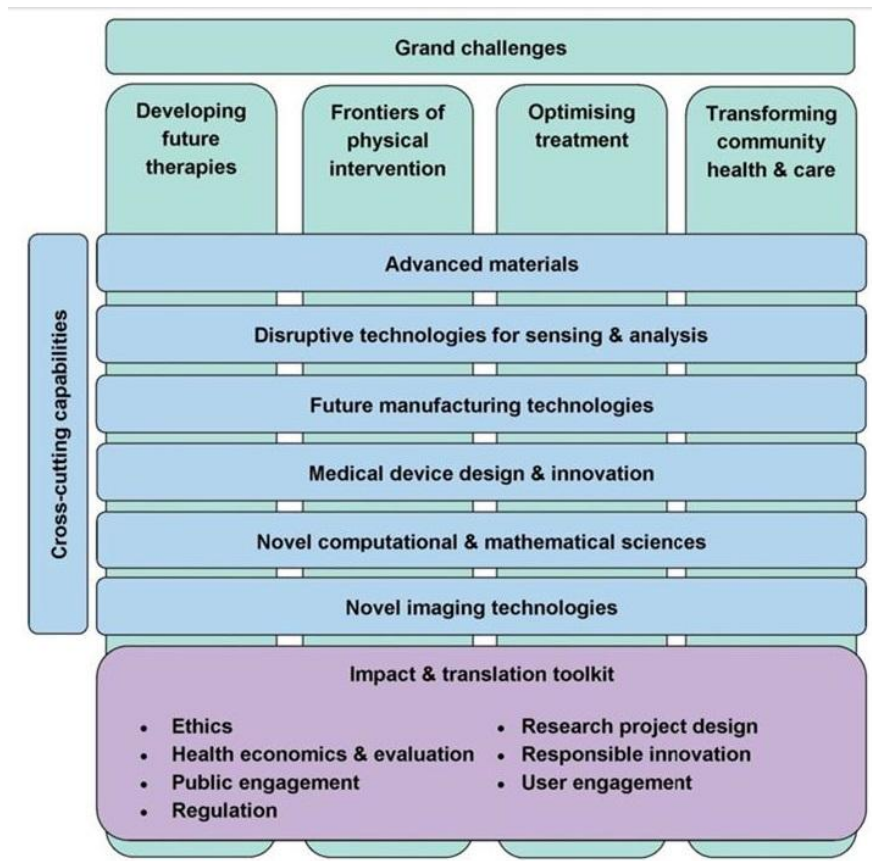


Figure 1. The EPSRC Grand Challenges in Healthcare Technologies March 2015.

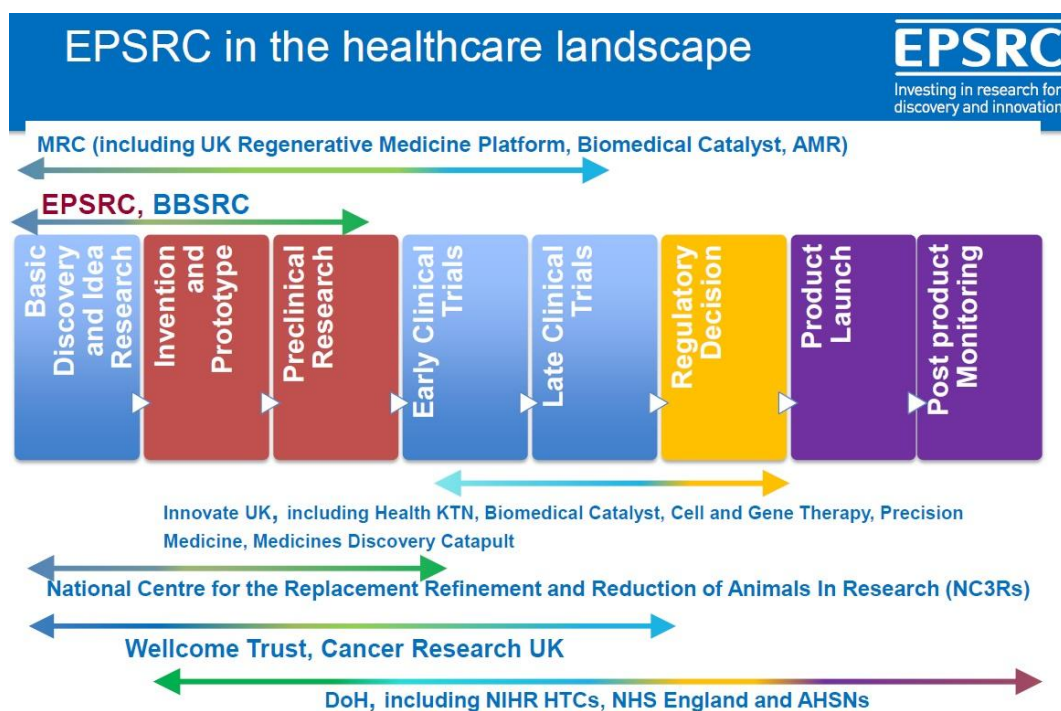


Figure 2. The intended place of the EPSRC in the healthcare funding landscape in 2016

The circumstances of my involvement with the EPSRC

In May 2016, I organised a symposium on the digitisation of healthcare at the Annual Conference of the Association of Surgeons of GB and Ireland. This was attended by Sarah Billingham and colleagues from the EPSRC. Sarah was the EPSRC Portfolio Manager for Digital Technologies, before her move to the University of Southampton.

This led to an invitation to apply for membership of the Strategic Advisory Team (SAT) for Healthcare Technologies of the EPSRC, which was based at Polaris House in Swindon. I was appointed to the Board with effect from January 2017 for a three year tenure.

The EPSRC Impact and Translation Toolkit notes that the development journey for Healthcare Technologies can be long and complicated. Success requires understanding of the unique challenges to the healthcare sector.” I had acquired considerable practical experience of this observation in Southampton over the preceding decade.

Strategic Advisory Team Meetings in 2017

2017 marked a further shift in EPSRC thinking with the “NEXT STEPS” strategy and a balanced funding portfolio of 60% “community led” projects and 40% “strategic” projects. The overall philosophy is set out in Figure 3, whereby national capabilities in the EPS portfolio drive ambitions, which in turn support a Productive, Connected, Resilient and Healthy Nation to support overall national political objectives.

However, a number of EPSRC funded healthcare technology and doctoral projects had progressed from first concepts to TRL 3 or so without significant contact with real world clinical environments, at which point projects often failed in the face of practical implementation challenges.

Many engineering projects by early career researchers seemingly lacked meaningful clinical input, in consequence of which their ambitious ideas failed in the face of practical realities. Moreover, it was apparent that the common practice of the token listing of eminent clinicians on grant applications was no substitute for early exposure of the research idea to the working environment for which a new technology was intended.

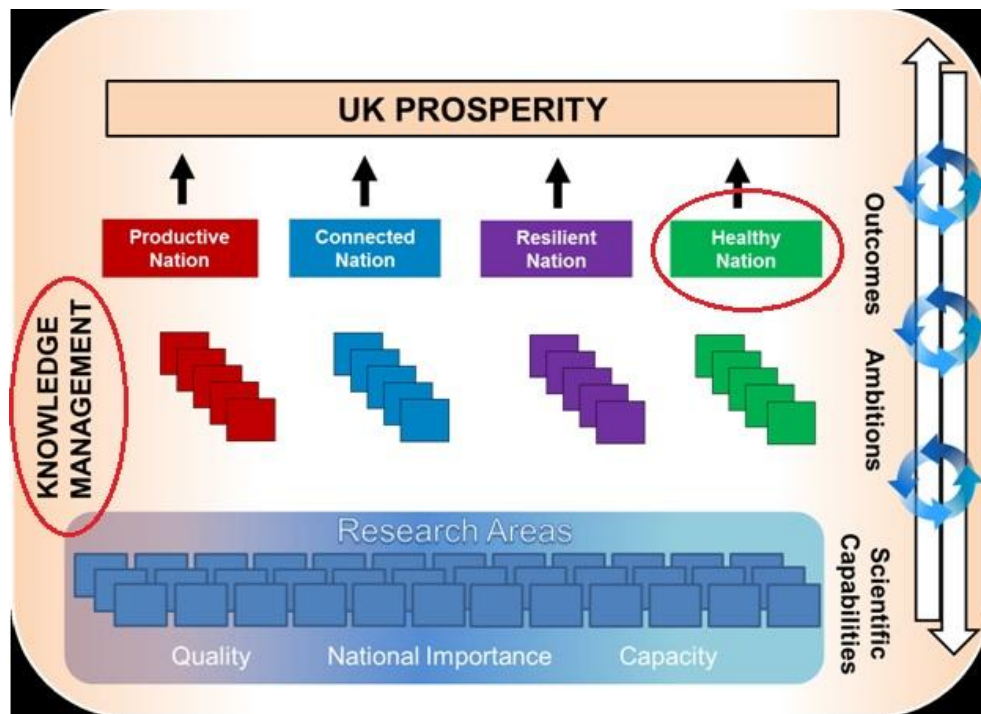


Figure 3. The 2017 EPSRC Strategy: I have highlighted the Healthy Nation and Knowledge Management elements which were of particular interest to me on the Healthcare SAT

There was a strong case to be made that clear evidence of prior and rigorous end user research should form a critical part of all such grant applications. The EPSRC had an opportunity to advance digital and electronic systems engineering to improve the productivity of healthcare professionals, in the face of the prevailing impediments to usability of most commercially sourced Electronic Patient Record (EPR) systems.

Digital transformation and the clinical usability of IT systems was not seemingly high on the agenda of the Medical Research Council or of the other funding agencies. It therefore provided a great opportunity for the EPSRC to create new research and development programmes in digital systems engineering to improve the wholly unsatisfactory state of digital healthcare systems in the UK and beyond.

This problem was subsequently eloquently described in the New Yorker magazine by Dr Atul Gawande on 5th November 2018, succinctly titled “Why Doctors Hate Their Computers” and as visualised in the accompanying image by Ben Wiseman as reproduced in Figure 4.

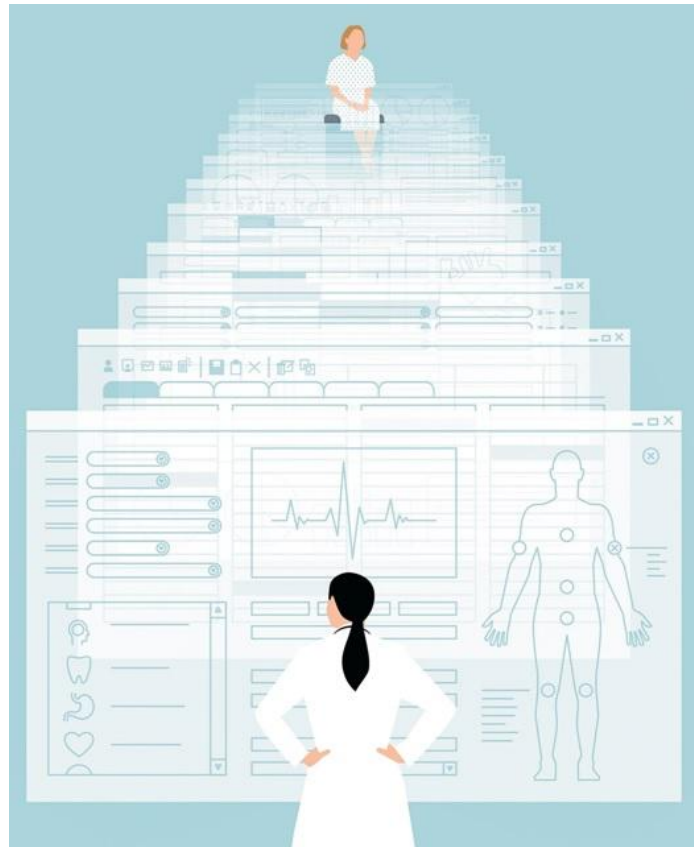


Figure 4. Doctors feel trapped behind their screens. Illustration by Ben Wiseman 5th November 2018 Copyright the New Yorker Magazine

In January 2017, I highlighted for Annette Bramley, then lead for the EPSRC Healthcare Technologies portfolio, the potential benefits of a digital healthcare strategy which could yield major benefits from very modest input. These included better tools for clinical data visualisation, human factor engineering; and a standard digital lexicon of descriptive terminologies, templates and metadata for documents.

At the Board Meeting on 20th February 2017, I reflected upon the potential of Human Factor Engineering in Clinical Informatics for the UK Public Healthcare Sector” as an EPSRC “Grand Challenge”, noting that:

- Clinical Informatics is undergoing an epochal transition in from paper to digital technology
- The impact and costs of this transition on the true end user, the clinical/ admin/ allied health professional/clinical researcher are large but not well understood;
- Top down design and imposition of IT systems fails at huge cost;

- Commercial healthcare software systems are often poorly adapted for clinical end user needs; and are written in isolation by IT professionals & purchasers to poorly developed specifications, and acquired by “Digital by Diktat” rather than “Digital by Default” processes;
- End User Optimisation can be secured by agile and iterative builds in the workplace.

It seemed reasonable to consider that an EPSRC led “Programme for Clinical Informatics Optimisation” would catalyse a cultural change in expectations, delivery & performance across the UK Healthcare Informatics Sector at modest cost and as a major stimulus to Small and Medium Enterprises (SMEs).

Such a strategy would also be consistent with EPSRC core objectives to create a more Productive, better Connected, more Resilient and a Healthier Nation, and that it would match the Capability and Challenge Themes, across Information and Communication Technologies, the Digital Economy and the Healthcare Technologies portfolio.

Southampton and Opportunities for EPSRC Digital Health Funding

Concurrently with the EPSRC developments, Innovation South launched a Science and Innovation Audit with a call for evidence to be submitted by 28th February 2017. Innovation South was a public funded organisation to coordinate and represent the work of public and independent sector organisations across the “M3 Local Enterprise Partnership area”. It survives as the Innovation South Virtual Campus across a number of higher education establishments, including Basingstoke College of Technology, East Surrey College, Royal Holloway, University of London, Sparsholt College, **and the** University of Chichester.

I submitted a report for the Innovation South audit on behalf of the UHS IT team. Their unique technical leadership in the field of Electronic Patient Record (EPR) design and implementation would provide a foundation for a strategic regional digital healthcare hub in with vision and funding from the EPSRC and elsewhere.

In late February 2017 Professors Mark Spearing, Simon Cox and Peter J Smith kindly discussed the content of the report with me at the University, in the context of how the UHS approach might be applied to software development challenges at the University.

In March 2017, Jack Denny, PhD Researcher with the Blast Damage and Weapons Effects Research Team at the University of Southampton, was awarded EPSRC support for a project on the effects of primary blast injury on lower limb muscle tissues.

On 20th June 2017, we held the meeting of the EPSRC Healthcare Technologies SAT at the Chilworth Science Park of the University of Southampton. A local colleague wryly observed that:

“Health is often used as an excuse by computer scientists and engineers to get funding, when they have little understanding of the underlying health problem (and do not apparently wish to solve it).”

On 11th-12th September 2017, the Annual EPSRC SAT Conference was held in Manchester, where it was emphasised that the EPSRC is well funded to support healthcare research;

The next Healthcare SAT meeting was held in Bristol on 6th October 2017, in conjunction with a team from Cancer Research UK, to explore the research areas where there is the potential of added value from EPSRC and CRUK collaboration. We subsequently demonstrated the power of software design engineering in the “digital cancer space” at UHS in 2019, with the launch of the Enhanced Somerset Cancer Register (SCR+) module. This surfaced all cancer records at UHS for the efficient and fully informed working of the cancer multi-disciplinary teams, such as had not previously been possible.

The Digital Healthcare: Moving Forwards Report

In advance of the EPSRC Digital Health Workshop in London on 25th October 2017, Lisa Coles, Sarah Billingham and Tracy Keys circulated a review of the current EPSRC funding in Digital Health. They noted that Digital Healthcare, and the Information and Communications Technology (ICT) Healthcare interface had featured very little within the EPSRC portfolio. In FY2015-2016 only six projects with Healthcare co-funding had been submitted to an ICT panel for £2.27M of co-funding, of which two were funded for £1.2M. The core EPSRC Digital Health research portfolio amounted to £47.6M (Figure 5), with a spread of projects across the UK.

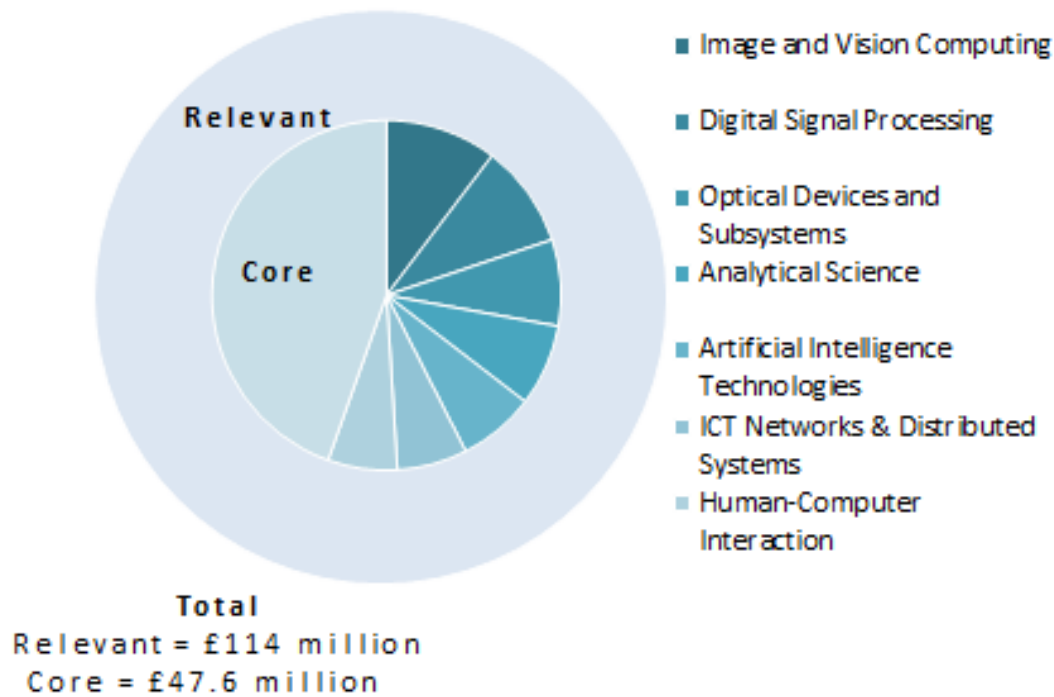


Figure 5: EPSRC Digital Health funding in 2016

Expenditure in the area did not demonstrate any discernible patterns of particular strength or critical mass in any research areas, with a spread between projects on sensors, the Internet of Things, Human-Computer Interaction and Imaging research..

In respect of the Healthcare Technologies Grand Challenge, the small numbers of studies were largely within the Transforming Community Health and Care Grand Challenge. An Intelligent Technologies Joint Call in November 2015 had received 42 proposals, of which eight would be funded for £10.2M for studies of Human Computer Interaction, software engineering, machine learning, ubiquitous computing and signal processing.

On 25th October 2017, The EPSRC Digital Health Workshop in London led to the publication by the EPSRC of a wide ranging report which highlighted examples of best practice in Health Systems Research; the need for early and continuing engagement and consultation with the intended users (health professionals and patients) in health technology projects; barriers to collaboration which included the adoption of getting solutions; finding suitable patient representatives: the need to be clear about who should be involved and their role; and research challenges, noting that the solutions to healthcare challenges did not always lie in technology.

The EPSRC inaugural Healthcare Technologies Health Innovation, Values and Excellence (HIVE) Event was held in Glasgow on 21st-22nd November, 2017. We discussed a range of topics, with a particular emphasis on charities in the assisted living space.

Following from contacts made at the HIVE meeting, I was invited to talk to Professor Goran Nenadic's group at the Manchester University Interdisciplinary Biocentre of the School of Computer Sciences on 22nd February 2018, and to Professor David Clifton's group at the Oxford Institute of Biomedical Engineering on 26th February 2018.

Developments with the Healthcare Technologies Board in 2018

The Board next met in Swindon on 6th-7th February 2018, when we were invited to submit suggestions for "Big Ideas" and disruptive technologies rather than individual projects. Early 2018 also brought the administrative consolidation of the various UK Research Councils under the UK Research and Innovation (UKRI) brand. UKRI released a plan for building its strategy. The **Industrial Strategy Challenge Fund (ISCF)** was launched to support the four 'Grand Challenges' in respect of AI and the Data Economy; the Future of Mobility; Clean Growth and the Ageing Society. Each of these challenges contained opportunities for research in healthcare applications.

The next Board of the Healthcare Technologies SAT meeting was held on 25th July at Prince Philip House, 3 Carlton Terrace, London, with a briefing on EPSRC strategy. This was followed by the national Strategic Advisory Team meeting at the National Exhibition Centre in Birmingham on 18th-19th September, with a focus on debating the EPSRC Strategic Delivery and Balancing Capability Plans.

At St Catherine's College, Oxford, on 10th October 2018, we discussed the Interface between Healthcare Technologies and Mathematics; a paper on mental health; EPSRC support for community led research and the EPSRC large investment plans for 2019/20.

In late 2018, the University of Southampton was awarded MRC funding to stimulate research between Engineering and Medicine. A "Clinicians meet Engineers" meeting was organised by the Faculty of Medicine for 9th November 2018.

Strategic Advisory Team Meetings and Developments in 2019:

The Topol Report

In February 2019, Dr Eric Topol's report was released on the subject of "Preparing the UK healthcare workforce to deliver the digital future". Dr Topol observed that:

- The patient must be at the centre when implementing new technologies.
- Digital technology should improve the accuracy of diagnoses and treatments, the efficiency of care, and workflow for users, but implementation requires robust clinical validation.
- Patients will be empowered using digital tools and algorithms.
- The patient-clinician relationship will be improved through the gift of time from these technologies.

These observations were very relevant to the work of the EPSRC HT SAT.

Meetings of the board were held on 21st March 2019 at the Medical Research Council offices in Kemble Street, London, and in Edgbaston, Birmingham on 25th June. This included a presentation by Professor Chris Rogers, Director of the UKCRIC National Buried Infrastructure Facility at the University of Birmingham, on the challenges of engineering healthier environments in respect of infrastructure engineering, urban sustainability, resilience and liveability.

We also discussed plans for a cross-UKRI project to strengthen support for digital health research and innovation, and the potential role of the EPSRC, including support for Centres of Excellence. We also discussed the potential applications of artificial intelligence in health, and the development of assistive technologies and biomechanics.

At my final meeting of the Healthcare Technologies SAT in Swindon on 6th November 2019, we discussed the need to encourage Healthcare Technologies networks. At the end of my three year term on the board in December 2019, I noted that:

- I had been up a steep learning curve as an outsider to the EPSRC academic community.
- it was difficult to know whether I had been able to make a significant contribution.
- The problem with three year term limited appointments, is that by the time one has been up the learning curve and started to make a contribution, the time has come to move on.

From an NHS perspective, I noted the challenges for the EPSRC HT SAT to raise awareness of the EPSRC Healthcare Technology investments across the NHS; to highlight the critical importance of robust early user research by grant applicants.

The Evolution of EPSRC Healthcare Strategy after 2019

On 14th January 2020 Dr Jon Williams, who was then the Funding Manager at the University of Southampton for Research and Innovation Services, convened a meeting under the Chairmanship of Mark Spearing for the group of EPSRC SAT members who worked at the University to pool insights.

The EPSRC provided some 25% of Research Income for the University of Southampton. The EPSRC Quarterly Report highlighted that the university had a good success rate, but had low numbers of applications for EPSRC grants. The value of a local EPSRC Community of Practice and the potential for future meetings were considered.

However, Covid 19 arrived a few weeks later, and the local initiative did not progress. I was thereafter preoccupied with clinical service delivery for the duration of the pandemic. Nevertheless, a series of nine “Sandpit” meetings on Digital Technologies for Health and Care were held virtually in November 2020.

The Origins of the EPSRC Healthcare Digital Hub Competition in 2022.

In October 2022, I was pleased to be invited to review of an EPSRC grant application, and to be invited in December 2022 to sit on the “Digital Health Hubs Prioritisation Panel”.

The EPSRC had identified needs within academia and business in respect of understanding:

- the regulatory pathways for healthcare technologies;
- the healthcare environment and working with healthcare professionals;
- user needs and working with users of healthcare technologies;
- NHS infrastructure and systems;
- technical software development and data science skills.

A competition for funding was therefore proposed to increase **skills and capacity** in the development of digital health and care solutions across academic disciplines, healthcare and industry; to build **new partnerships** between industry, healthcare, social care, users of digital technologies and academia; to increase the **sharing of knowledge** between industry, healthcare and academia; to support the **co-creation** of solutions with a wide range of healthcare users; and to provide a mechanism for fostering academic **leadership** in digital health and care. A proposal was made to fund four or five EPSRC funded Digital Hubs across the UK.

The competition was launched in March 2022, with a closing date of 11th August 2022. Full proposals would be assessed through peer review against the posted criteria (Figure 6). Successful applications would be taken to a prioritisation panel to produce a rank ordered list. The top scoring proposals would then be invited to attend an interview panel. The reviewers would submit an initial written report, to which the applicants were given the opportunity to respond in writing with their definitive application.

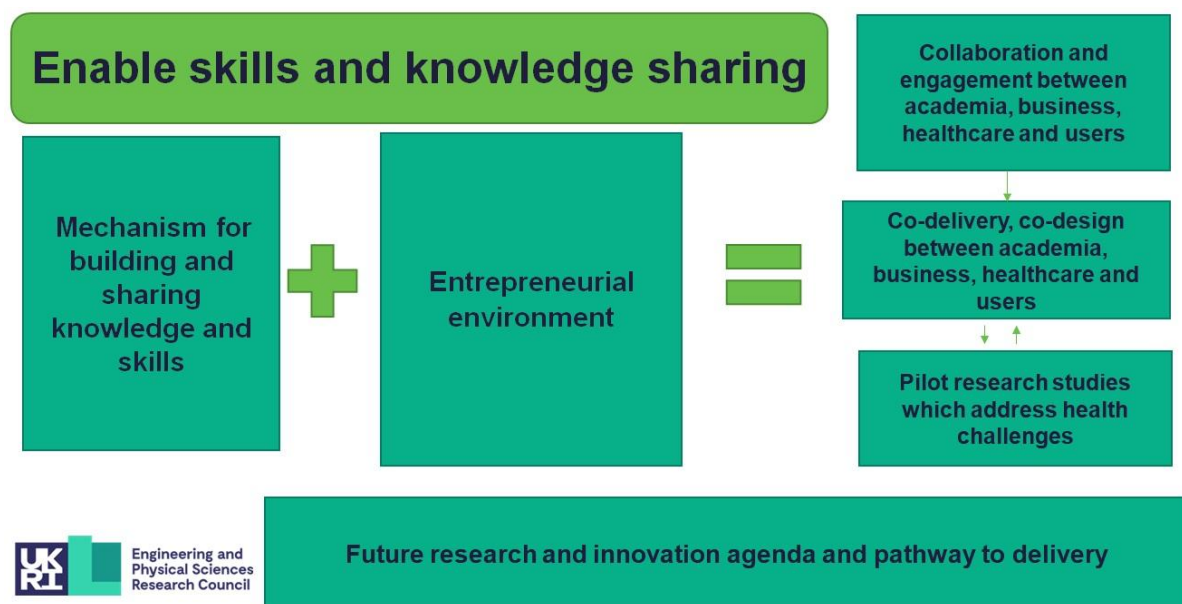


Figure 6. The broad objectives of the first EPSRC Digital Hub Competition, as provided to the competition applicants, in March 2022

- Up to £8M was initially made available, but this sum was increased to ~£25M to allow awards of ~£5M per award to five candidate teams;

- An assessment of all applications would take place on Zoom on 18-19th January 2023;
- The finalists would be interviewed on Zoom between 21st and 23rd February 2023.

The objectives for the EPSRC Digital Hubs were set out very broadly. The applicants should:

- Enable Skills and Knowledge Sharing between businesses, academic disciplines, and the health and care system, with a focus on unmet health needs.
- Create an Entrepreneurial Environment for new digital health technologies.
- Support Market-Led Innovation in digital health and early commercialisation;
- Establish Strong Connections with patients and the public
- include costs for funding Pilot Interdisciplinary Projects;
- Focus on research in ICT, mathematical sciences and engineering.

39 applications proceeded to the Assessment Panel, on which I sat, in January 2023. The 11 members of the Assessment Panel were tasked to use the expert reviews, and the Principal Investigator (PI) responses to those comments, to rank the proposals in priority for funding.

The panel members were briefed “to assess proposals for creation of a digital health hub, focused on promoting the transfer and sharing of knowledge and skills, enabling new partnerships to form, and creating a space for new research ideas and digital technologies to be developed. Specifically, the EPSRC was looking to provide funding for a knowledge and skills digital health hubs, which were focused upon:

- increasing skills and capacity in the development of digital health and care solutions across academic disciplines, healthcare and industry;
- the co-creation of solutions across healthcare, including patients, carers and clinicians;
- enabling the accelerated translation of digital technologies into the healthcare space and rapid commercialisation of emerging digital technologies;
- building new partnerships between industry, healthcare, social care, users of digital technologies and academia;
- increasing the sharing of knowledge between industry, healthcare and academia
- providing a mechanism for fostering leadership in digital health and care.

Panel members would be excluded from the discussions around any application for which they had declared a conflict of interest, so I was not party to the Southampton application.

The objectives were set out somewhat vaguely. This prompted overly wide-ranging and unfocussed applications from many groups to cover “all the bases” and to demonstrate textual inclusiveness to mirror the phraseology of the award document.

The Digital Health Hubs Prioritisation Panel on 18th & 19th January 2023,

Prior to the Panel meeting, each assessor was allocated a cohort of up to 12 applications to review in detail, so that each application would be scored by three assessors. Their scores would be examined and justified in turn by the entire panel during the meeting.

Our role during the meeting, which was held online, was to reduce the 39 applications to 10 “finalists”. The running order of the meeting was based on these scores, taking the average of the overall scores of three assessors (introducers). Overall, this was a most enjoyable and collegiate exercise, and my experience was reflected in the very positive oral feedback at the end-of-meeting wash-up.

Discussions were rigorously structured and outlier opinions were accommodated and moderated with courtesy and good humour across the board. Credit was due in many quarters, but in particular for the organisational contributions of Katherine Freeman and Cheryl Norcross for the EPSRC. Each panel member evidenced detailed preparation and carefully considered opinions and arguments.

The major challenge for the assessors was to distil a huge and diverse quantity of qualitative text, statements and ambitions by the applicants; the feedback from the reviewers of each application; and the opinions of the individual panel members and assessors, into a quantitative score and ranking for interview of the 39 applications.

In general terms, the applications were each based around one UK University, with a Principal Investigator and a number of Co-investigators. The net of collaborators on the application in each case was thrown very widely, and inclusively, to ensure that all colleagues were “at the table” when the awards were made.

Therefore, the paperwork for some applications amounted to 100+ pages each, including:

- 10-20 pages of outline plan, financial costs and cvs of key individuals in each consortium;
- 50+ pages of letters of support for regional organisations, companies and individuals;
- +/- 20 pages of reviewer comments and feedback for 3-5 reviewers per application
- 2-3 pages of responses to the reviewer comments;
- +/- 6 pages of Standard Introducer Feedback forms;
- + supporting and admin documentation and background information from the EPSRC.

There were a number of features both in the form and presentation of the applications which could be improved. The letters of support for grant applicants were repetitive. I noted that: *"I have scrolled through hundreds of pages of identikit letters of support for each and every applicant, none of which add any real value because they all say the same thing, to the effect that "we support this application in the strongest possible terms".*

Some letters ran to three pages to say this. The costs of generating, distributing, filing and reproducing these letters was large, as was the time penalty of sorting through them for EPSRC staff and for reviewers and assessors. It seemed sensible to develop a standard, structured, standard and much more concise support form.

In consequence, the applications were unnecessarily challenging to read. The text was often densely packed, repetitive and frequently loaded with jargon and soft focus statements. There was much extraneous information which obscured rather than clarified the key intentions of the applicants.

The **Scoring Methodology** also posed challenges. There would have been better discrimination of scores if the scoring options for each reviewer had been on a 10 point scale rather a 6 point scale.

Factors in my adjudication of the applications.

The judges brought a range of perspectives to the discussions. I was particularly seeking evidence of clarity of purpose and practical relevance of proposals to the digital challenges to optimal clinical service delivery the following domains, as expressed in:

- **The quality and clarity in the writing** of the application document, with the clear expression of original ideas and plans
- **Evidence of a clear effort to understand the key challenges** around digital systems which face the public and independent national health providers in hospital, primary, social and specialist care, along with mental health units, HM Prison and Armed Forces healthcare, dentistry and so on). These challenges include a nationwide lack of joint and integrated information flows, siloed systems resource wastage and clinical risk.

Regrettably, only one set of applicants in my allocation acknowledged the challenges to the NHS in their locality, or the issues that might be amenable to “engineered” solutions. I felt that applicants should have been obliged to demonstrate some basic research of their local and regional healthcare systems to help understand the problems and to help shape their future digital health research programmes, as there was little evidence of such.

I noted that the academic engineering community has much to offer in terms of possible solutions to **digital health system integration**, including reliable health information transfer, robust but user friendly identity checks and effective security protocols to improve the flow of healthcare information around the individual patient and citizen.

In terms of project governance, the applications generally appeared to me to be too broad in terms of ambitions and in terms of the numbers of collaborators to achieve effective and sustainable outputs within three years. Large grants of public funds require rigorous focus and daily hands on management by a disciplined and dedicated team if any meaningful outcomes are to be secured. Many of the **“Big Names” on the applications** appeared to be lack significant management engagement with the programmes to which they were nominated.

In terms of measurable outcomes and milestones: There was a general lack of clear, measurable and auditable outcomes which would allow the EPSRC to judge the success or failure of any particular grant or its component elements.

- Few mechanisms were apparent for **internal quality control over expenditure within the applications**.

Less is more: Overall, too many applications were seemingly attempting too much for too many organisations in their network. £5M is a small and finite sum of money to underwrite grand gestures, and evidence of budgetary focus was very important.

Topic-focussed and specialist applications would be more likely to produce measurable and sustainable outcomes within the remit of the competition than were applications broad, distributive funding.

Focussed project Leadership is essential: In general terms, there was a lack of evidence of commitment of time and effort by the senior applicants in any one grant application. Projects of this nature are complex and leadership is needed to define the specific objectives and to deliver measurable outcomes. Too often, the sense was of a rapidly assembled conglomeration of applicants in search of funds for their own projects, without a unified vision.

The Scoring Model: The reviewers' opinions were reduced to a single score on a scale of 1-6 which lacked discrimination or nuance. This in turn put a substantial onus on each panel member to distil the entire application to a single quantitative score. The consensus view of panel members at the immediate wash-up was that a more structured, more rigorous application format would have made the task much easier.

The e-application format that is used by Innovate UK for its various competitions would have been a much better approach. This would have obliged reviewers and panel members to give much more structured adjudication with quantitative scores on 1-10 scales, thus creating a wider, detailed and more granular range of scores, with far less supporting paperwork.

Chairing the Digital Health Hubs Interview Panel on 21st-23rd February 2023.

Following this Assessment Panel meeting, I was invited on 24th January to Chair the Final Interview Panel for the 10 successful finalists. The panel comprised five members. I reflected on the role and the requirements of the task, noting the particular factors that we were asked to take into account when assessing the relative strengths of the proposals, vis:

- The national importance of the proposal,
- The strategic rationale for each of the research areas
- The relevance to other research that is currently supported by EPSRC.
- Creative and ambitious research that has the potential for high impact for the UK.
- Quality of the application, however defined.
- The entry criteria were broad in order to capture the widest possible interest.
- There were no historical reference points either for the EPSRC team or for the panellists.
- We were therefore on a steep learning curve.

The process promised some stimulating and informative discussions, in respect of:

1. Social Impact and return on taxpayer investment

We knew that primary and secondary health and social care services in the public and private sectors were under severe strain. Therefore:

Is (engineering) academia able and willing to help find solutions?

Is there evidence of serious research on the part of the applicants to secure a clear understanding of the fundamental digital challenges to efficient and effective national health and care services delivery?

2. The Time Constraints

The competition was time limited and funding limited. This posed a number of questions.

- Is there a clear management and leadership structure to ensure delivery?
- Is the proposal clear, simple and understandable in leadership terms, or is it so complex that meaningful outputs are unlikely in the time frame?

3. Clarity and coherence

- Is the project clear in its objectives and therefore auditable in terms of its benefits, or is it merely re-distributive of public funds to the local network.
- Are there clear and credible objectives?
- Is there evidence of a clear route to success?
- How will success and failure of the component measures be measured and acted upon, and who will take responsibility?
- Are there clear and credible measures of impact?

4. Sustainability

- Is there clear and credible evidence of a route to sustainability beyond the current funding round? This may include: a robust and sustainable management infrastructure; geographic coherence; “Strength in depth” without excessive independence on individuals; and demonstrable uplift in human skills, whether in workforce training systems, school, Undergraduate and post-graduate education, and in doctoral training programmes

Overall, it was unclear whether the applications would meet the EPSRC Intent of stimulating digital innovation on a hub and spoke basis, and whether the allocated money from the taxpayer would be spent wisely and effectively.

The five member panel and two EPSRC convenors interviewed the three lead applicants for each application. The scoring was tight, as were the rankings. We were invited specifically not to use journal based bibliometrics as surrogate measures for quality in any component of each application; and to rate the proposals for their “transformative potential”.

The Outcomes of the First EPSRC Digital Health Hub Competition

In June 2023, the EPSRC announced the award of £16.5 million to establish five new Digital Health Hubs, and that the hubs would focus on five key healthcare challenges, vis:

- Antimicrobial Resistance;
- Health & Care outside hospital and disease prediction, diagnosis & intervention;
- Tackling health inequalities with digital healthcare technologies at the point of use;
- Addressing the unmet health needs of underserved communities, and digital exclusion;
- Development of symptom tracking apps and wearable devices to improve health.

The successful applicants were:

1. The King’s Health Partners Digital Health Hub (£2.6m award), incorporating four King’s Faculties, all King’s Health Partner NHS Trusts, 20 industry members and a further 10 organisations and NHS Trusts across the UK. The applicants state on their website that:

“The Hub will support the development of new digital technologies and reduce the time it takes for these to benefit patients. By providing expertise, partnerships with industry, and a physical location for technology developers to work together, this project will enable new

businesses to grow rapidly, increase the availability of digital health technologies nationally and make a more immediate difference to patients' lives”.

2. The NorthFutures application, centred on Newcastle University. The applicants state on their website that: “NorthFutures is envisioned as a world-leading healthcare technology (health-tech) innovation ecosystem. Based in the North East and North Cumbria (NENC) with a consortium of over 50 partners, the hub involves six regional universities (Cumbria, Durham, Newcastle, Northumbria, Sunderland and Teesside), in collaboration with: NHS Trusts and NENC Integrated Care Board; Local Authorities; Industry; Voluntary, Community and Social Enterprise – across NENC, UK, and globally....”

3. The South Yorkshire Digital Health Hub, is based around Sheffield University. The team state on their website that:

“The Hub covers a region of 1.4 million people affected by high levels of disease and health inequalities. It includes NHS organisations including GPs, adult and children’s hospitals, mental health services and the recently introduced South Yorkshire and Bassetlaw ‘Integrated Care System’, researchers from the University of Sheffield and Sheffield Hallam University, large and small companies, and patient and public groups”.

4. The University College London Digital Health Hub (Awarded £4M). The team state that: “We will bring together an interdisciplinary team to better deploy digital technologies against antimicrobial resistance across humans, animals and the environment”.

5. The Leadership, Engagement, Acceleration & Partnership (LEAP) (awarded £4.11 million) is based around The University of Bristol. The team state on their website that: “LEAP is a groundbreaking Digital Health Hub for the South West of England and Wales. The Hub aims to build on the strengths of each of its institutional partners to provide opportunities for training, research and collaboration It was launched to catalyse innovation, research, and collaboration in the South West of England and Wales....the hub is set to revolutionise the region’s digital health landscape”.

Developments in the EPSRC Healthcare Technologies Theme from March 2023

The EPSRC team published an updated Health Technologies Strategy in March 2023, in which they re-iterated the challenges to which the EPSRC could contribute in respect of:

- Improving population health and preventing ill health;
- transforming early prediction and diagnosis;
- discovering and accelerating new interventions.

They announced in mid 2023 that the EPSRC would fund a series of Health Technologies Connectivity Awards of up to £500K to encourage EPSRC Researchers to develop cross-disciplinary links with health research teams.

At the time of writing this paper, (October 2025) it is too early to know whether and how the aspirational statements which each of the successful applicant teams have made have translated into specific and measurable outcomes, and if so, how the product of the invested taxpayer money will be measured and audited.

My continued involvement with EPSRC activities beyond 2023

The EPSRC Digital Health Policy Event at The London Institute for Healthcare Engineering by St Thomas' Hospital in Lambeth, London on Wednesday 9th October 2024, provided an opportunity to meet with some of the successful applicants of the first competition.

I have also been pleased to be able to help with other EPSRC activities, including:

- As a reviewer for a Centre for Doctoral Training funding application in September 2023;
- By invitation to contribute to The EPSRC Future Blood Testing Network+ Conference at Henley Campus of the, University of Reading on 21st-22nd November 2024, to present our work at Southampton on the "The Radical Transformation of the Electronic Patient Record through Better Data Visualisation".
- As a member of the Expert Adjudication Panel in evaluating the Health Technologies Connectivity Awards competition in December 2024.

“Growing the Southampton University Healthcare Technologies Portfolio”

The Digital Health Hub projects which were funded in original competition have still to run their full course to mid 2026. However, the EPSRC’s interim judgement has been that the competition was successful, such that a new competition was launched in July 2025 for funding of up to £12.5M per bid for further Research and Partnership Hubs.

A meeting was organised by Sarah Billingham of the Faculty of Engineering and Physical Sciences and by Alex Mant of the Institute for Life Sciences at UoS on 24th April 2025. The key objectives were:

- To consider funding opportunities from the EPSRC HT portfolio;
- To discuss the forthcoming EPSRC T Research and Partnership call;
- To consider local capabilities and HT Challenges
- And to develop collaborative teams.

During the meeting, I wondered whether we could replicate the US Mayo Clinic Centre for Innovation as an EPSRC centre of excellence in Southampton, by “Thinking Big, Starting Small and Moving Fast”. Such a centre would allow Small, Medium and Large Healthcare enterprises to undertake clinical and engineering evaluation programmes in a supervised and well resourced clinical setting to which they could otherwise not secure access.

The Second EPSRC Digital Hub Competition of July 2025

The EPSRC subsequently launched a second Digital Hub competition for “Research and Partnership Hubs for a Healthy Society” in July 2025. This competition offered up to £12.5M to deliver a large scale multidisciplinary research hub from across the EPS and Health Research communities:

- to support healthier lives and self-management of health;
- to prevent ill health, including that caused by infectious diseases and cancer;
- with public and patient involvement and engagement (PPIE);
- and with a clear plan to maximise the impact of research outputs.

Building on lessons from the 2022 competition, the funding call mandated applications:

- With a clearly defined lead institution;
- With an academic director;

- With a multidisciplinary leadership team and an efficient management team;
- With named leads for PPIE, partnership, translation and impact;
- With affiliated research staff, and
- With governance structures under supervision of an independent advisory board, but
- Without duplication of activities that were funded in the first competition.

However, it was reasonable to infer that the EPSRC still did not have an explicit view of any particular solution. The applicants were therefore given a clear field to submit a compelling and distinctive proposal, subject of course to compliance with EDI and PPIE requirements. In this context, I felt that a project with a particular focus on improving the Electronic Patient Record, and which was linked to the 2024 proposal from NHS England for a federated national Single Patient Record would have considerable potential. The competition remains open as of the time of writing in Mid October 2025

In Conclusion

My participation since 2017 to date with the EPSRC Healthcare Technologies Team has provided me with valuable professional experience and insights into the organisation, from the perspectives of the supply side rather than as a consumer of grant funding, in an area of national enterprise which will be generally unfamiliar to clinicians.

I trust that the observations which I have set out in this paper, which have been drawn both from official documents and from my extensive personal records, will prove to be of some interest and value to future applicants for EPSRC Healthcare Technologies funding and for other clinicians who may wish to follow this supplementary professional career path in public service.

Appendix 1: David Rew: Relevant Biography

Clinical Career:

I graduated MB BChir from the University of Cambridge in 1981 and was awarded the Fellowship of the Royal College of Surgeons of England in 1985

Academic Career:

- Mastership of Surgery of Cambridge University in 1991;
 - Hunterian Professor of the RCS England in 1992;
 - Senior Lecturer in Surgery to the University of Leicester, 1994-1999;
 - NHS Consultant Surgeon and Honorary Senior Lecturer, Southampton in 1999;
 - Editor in Chief of the European Journal of Surgical Oncology from 2003 to 2009;
- Since 2009, I have served as the global Subject Chair for Medicine to the SCOPUS Content Selection and Advisory Board.

My “Digital Healthcare Career”:

From 2009 to 2023, I led the development of the UHS Lifelines interface and related projects within the Southampton Electronic Patient Record;

My career with the EPSRC:

I served as a member of the Strategic Advisory Team, for Healthcare Technologies, EPSRC from 2017 to 2019, and as Chair, of the EPSRC’s first national Digital Hub Competition Assessment Panel in February 2023

My current professional circumstances:

I have worked part time for the NHS since 2023, so as to focus on my academic interests, including assessment work for Innovate UK and the EPSRC.

I hold visiting contracts with the UHS Digital Service and with the Faculty of Medicine of UoS under the aegis of the Clinical Informatics Research Unit (Professor James Batchelor).

I am pleased to discuss any aspects of this paper on request. I can be contacted via my UoS email address, dr1@soton.ac.uk

Appendix 2. A Surgeon among Engineers

Rew DA: The Bulletin of the Royal College of Surgeons of England Volume 102, Number 4
<https://doi.org/10.1308/rcsbull.2020.121>: 767 Downloads to 17th October 2025

Abstract

A bridge from technology funding to healthcare solutions.

The role of the UK Engineering and Physical Sciences Research Council (EPSRC) in health technology funding is not well-known. Most surgeons will associate national research funding in health with the Medical Research Council, the Wellcome Trust, Cancer Research UK and other major charities, along with specialist project funding from organisations such as the Royal College of Surgeons. In fact, EPSRC is funded by the government to the tune of approximately £800 million per annum. As of April 2019, £297 million of the funding has been used for grants to support the healthcare technologies theme. Other core themes include future manufacturing, energy, the digital economy, quantum technologies and major national research infrastructure assets (national capability).

Money from these budgets is primarily allocated to support grant and doctoral programmes among consortia of UK universities, with primary representation (self-evidently) from the high performing engineering faculties. The core mission of EPSRC is to stimulate and to fund fundamental and applied research at the earliest stages in the development of a new technology. Infrastructure investment that EPSRC has supported in recent years includes the Alan Turing Institute, the Henry Royce Institute, the Physical Sciences Institute, the Cavendish Laboratory and the National Quantum Technologies Programme.

Specifically in respect of the health technologies theme, EPSRC recognises four ‘grand challenges’. These challenges are perceived to reside in:

1. developing future therapies – with technologies to enhance efficacy, minimise costs and reduce risk to patients
2. frontiers of physical intervention – by restoring function, by optimising surgery and through other physical interventions to achieve high precision with minimal invasiveness
3. optimising treatment – through effective diagnosis, patient specific prediction and evidence-based intervention
4. transforming community health and care – using real-time information to support self-management of health and wellbeing, and to facilitate timely interventions

These are in turn matched to the general objective of increasing UK national prosperity through the development of a productive, connected, resilient and healthy nation ([Figure 1](#)), and EPSRC corporate objectives of balancing capability, accelerating impact and building leadership.

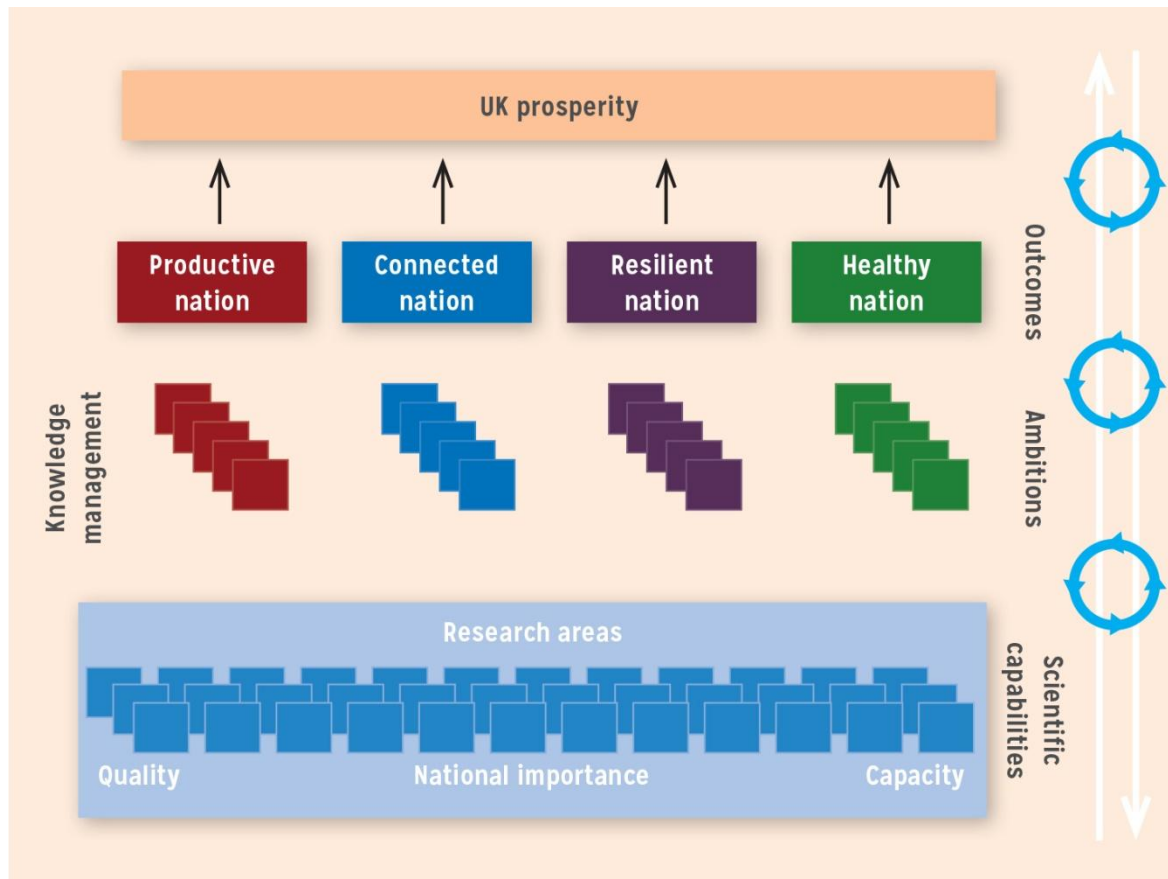


Figure 1 The overarching strategy of the UK's EPSRC to contribute to national prosperity (based on image supplied by EPSRC)

Around 60% of EPSRC funding is allocated in response to researcher and community driven projects. Meanwhile, 40% is reserved for projects that are driven by national strategic priorities and specific objectives, such as the Global Challenges Research Fund. Another key purpose of the funding is to generate and maintain a stream of doctoral students and high performing postdoctoral career engineers with the broad skills to lead academic groups or successful teams in industry and other non-academic fields.

In order to inform the strategic direction and to improve the responsiveness and 'national situational awareness' of EPSRC and its constituent funding themes, EPSRC runs a strategic advisory team (SAT) for each of the themes. SAT members are recruited primarily from the UK university engineering sector. However, SATs are increasingly enriched by members from industry: the charity sector,

defence technology, the health sector and other research councils, including the Medical Research Council and Innovate UK.

Each SAT comprises 15–20 members who serve for 3 years on a *pro bono* and rotating basis, with a third of the membership moving on each year. One-day meetings are held three to four times per annum around the UK, along with annual group meetings of members of the SATs of other themes, to further increase strategic debate and cross-pollination of ideas. Members are also invited to act on peer review panels for EPSRC grant applications.

For the past decade, I have developed and led a digital transformation programme at University Hospital Southampton NHS Foundation Trust. This has brought me into contact with many interesting and diverse members of the digital engineering community. In May 2016, we brought members of this group together for a novel joint surgical–EPSRC symposium at the Association of Surgeons of Great Britain and Ireland national conference in Belfast.

In consequence, I was invited to apply and to join the SAT for health technologies, with effect from January 2017. At the time, the principal focus of the theme had been in imaging technologies, perhaps with a ‘radiology-centric’ emphasis. Membership of this team imposed on me a steep learning curve among a professional community of very experienced, able and talented individuals who were drawn primarily from the major university engineering faculties.

However, as with all such boards, diversity of background and experience produces vigorous debate and fascinating perspectives. The key to making a productive contribution is wide background reading and knowledge, and the courtesy and confidence to offer constructive insights and personal professional perspectives on any general subject under discussion. In challenging established assumptions and practices, it is often possible to achieve common ground among specialists with diverse starting points through ‘ideas ping-pong’ around a boardroom table. This exchange produces more effective outcomes than were initially apparent to anyone.

EPSRC SAT roles are both advisory and stimulatory of new perspectives, and discussions and recommendations are inevitably rinsed through the higher corporate structures and policy making boards. Despite this, over the course of three years, our board discussed a grand diversity of subject areas in which engineering in all its forms may impact on individual and community health, from micro-sensors to smart cities and environmental monitoring.

Our horizon scanning and search for the next big thing in technology was balanced by the recognition that we are often blindsided by advances from unforeseen places and directions. As part of the recent Transformative Healthcare Technologies for 2050 call, EPSRC is looking to support excellent research with impact. The projects of the researchers should look to the future and beyond current requirements. Indeed, I have expressed the view that the search for future directions should be as much focused on the extraordinarily creative minds among the world's science fiction writers, film and electronic games producers as on literature search strategies and grand scientific committee meetings. As a child of the 1960s, I believe that the original 26 episodes of *Thunderbirds* and the first series of *Star Trek* were probably the best predictors of the extraordinary digital and mobile technology boom of the later 20th century.

Did I make a difference to the discussions and the work of EPSRC health technologies SAT? I would like to think so. At the outset of my tenure, it was very clear that major EPSRC grants were being submitted and awarded for health technology research without adequate, rigorous or in-depth research of the practical needs of the true clinical end users. Such clinical input and representation as was appended to grant applications sometimes seemed to have little more than token value. In consequence, technologically clever solutions were not coming up against real world practicalities until much time and effort had been expended.

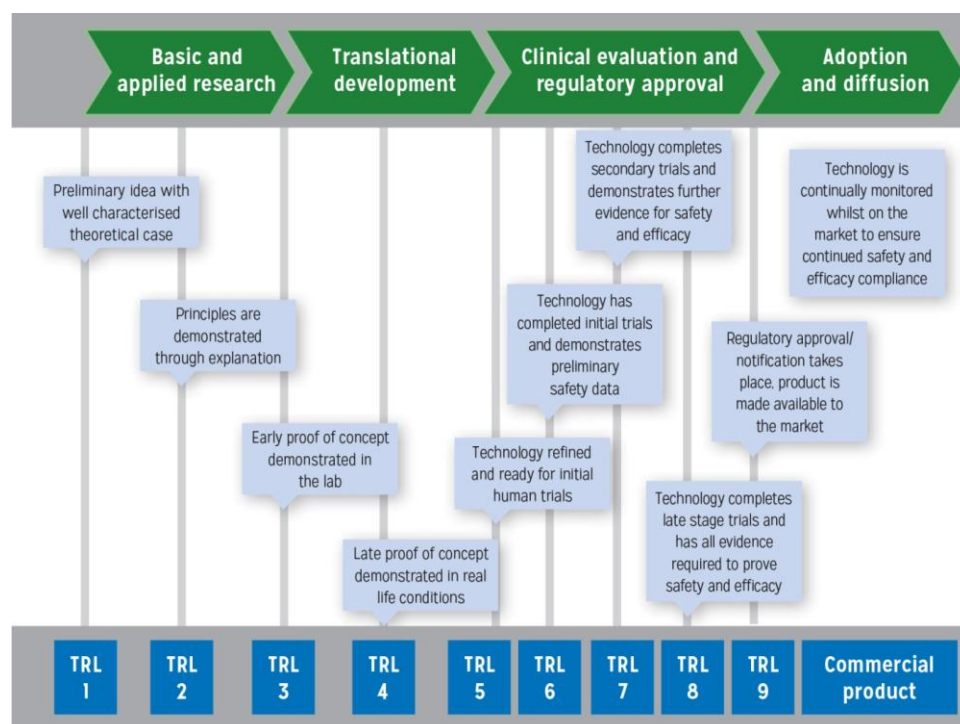


Figure 2 The overarching strategy of the UK's EPSRC to contribute to national prosperity (based on image supplied by EPSRC)

The EPSRC recognises a process from the original idea to societal adoption and public impact as passing through nine technology readiness levels (TRLs). In a progressing project, each level takes approximately a year to transition ([Figure 2](#)).

Unfortunately, inadequate end user research at TRL 1 leads to project failure, frustration and disappointment at the TRL 3–4 interface. I have therefore pressed the case for a much tougher policy towards insistence on evidence of really robust and in-depth clinical user research and user case development within the original application. In military parlance, time spent on reconnaissance is seldom wasted.

This, in turn, leads to the question of where engineering researchers can go to test out early hypotheses and meet with appropriate and sympathetic groups of healthcare professionals within that particular technical field, whether it be for a new mobility aid, a microorganism detector or a ventilation assist device in intensive care. There is a strong case to be made for the creation and integration of ‘meet, greet and test’ centres of excellence on a regional basis, akin to clinical trials incubators such as are run by the Wellcome Trust. I would also like to think that the insertion of a practising NHS surgeon into the health technologies SAT has helped broaden the practical ‘health technology consumer’ focus of EPSRC debate.

Most importantly, I would hope that my time-limited contribution to this process will raise awareness of the work of EPSRC in the healthcare space. I also hope that it will provide a conduit for laterally thinking colleagues into a parallel universe of resources and engineering talent to help shape the world of work of the 21st-century surgeon.

Postscript: At the time of proofing this article in the first week of April 2020, events related to COVID-19 have highlighted the importance of a wide range of engineering skills and an advanced national manufacturing base to healthcare delivery.

These contributions have been manifold. They have included the rapid construction by civil engineers of emergency field hospitals across the UK, the development and resourcing of large numbers of continuous positive airway pressure (CPAP) devices by a combined team from University College London and the Mercedes Benz Formula 1 team,^{[1](#)} and the creation of high fidelity analytical instruments for COVID-19 RNA sequencing and for antibody testing. As new threats to human health are met and overcome, these remarkable programmes presage a new era of awareness and cooperation between clinical and engineering teams.

Reference 1.

F1 team helps build new UK breathing aid for Covid-19 patients.

www.theguardian.com/world/2020/mar/30/f1-team-helps-build-new-uk-breathing-aid-for-covid-19-patients (cited April 2020).