

HIA Pipeline Analysis

Analysis of HIA Associated Hubs

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Foreword

The aim of this review was to assess the opportunity for the newly forming AHSNs to interact and work with the NHS Innovation hubs as the AHSNs develop plans for technology commercialisation. The review was conducted by PA in collaboration with the HIA and NHS South of England.

This review presents a summary of the commercial and clinical opportunities captured and commercialised by the six NHS Innovation Hubs associated with the Health Innovation Alliance (HIA). The review highlights the breadth of hub activity and shows that this is broader than the original remit of the hubs, which was to secure clinically generated IP. It now includes the identification, development and commercialisation of novel cost saving and cash releasing technologies that have the potential to increase patient outcomes.

This review is a snap shot of the HIA pipeline and presents a number of high-value technologies that without the work of the hubs would not have been developed. By having organisations charged with capturing the value of clinical IP and more importantly 'know-how' the hubs have become a vehicle for commercialisation and the identification of cost savings within the health care environment.

The outcome of this work is a high-level review of the commercial and clinical value/benefit of the technologies within the hubs. It was clear to the team conducting the review that the value of the hubs is greater than their historical remit and that the AHSNs need to be aware of the wider activities and services offered through the hubs. The review team recommends that the forming AHSNs engage with their respective hubs to review the services and capabilities of the hubs in terms of how the AHSNs implement technology commercialisation moving forward. Indeed the formation of the AHSNs represents an opportunity to realign the innovation, health and wealth needs of the AHSNs with the hubs ongoing activities.

This review identified a number of questions that need to be addressed in light of the changing AHSN landscape. We recommend that these be explored in more detail with the HIA, associated hubs and the forming AHSNs; these should include but not be limited to:

- How can the hubs best serve the forming AHSNs?
 - IP capture, IP exploitation, cost savings technology development, spin-out creation?
 - Implementation of a well-defined innovation assessment and adoption pathway with highly visible points of entry for local, national & international companies to work with AHSN partners
 - Bid writing and project management of Translational research projects involving industry, HEI and NHS partners e.g. i4i, Wellcome, MRC, TSB
- How should the Hubs best work with the AHSNs to deliver initiatives such as SBRI activity?
 - SBRI activity should be reviewed and placed in context of the on-going work by the HIA
- How should value be attributed to organisations that generate technologies that have the potential to save the NHS money?
- What is the most appropriate vehicle for the hubs to market their services to the AHSNs?
- What is the most appropriate vehicle for the AHSNs and local SHAs to disclose their strategic needs to the hubs?

Executive Summary / Recommendations

This review assessed 112 technologies submitted by the HIA associated hubs. This analysis was conducted during July and August and was based on data & information held by the hubs. Due diligence was not conducted on the data received, all data was assumed to be correct at time of submission. PA understands that the ~20 technologies submitted per hub represent a proportion of the overall pipeline and, as such, any figures included in this report do not represent the total opportunity offered through the HIA associated hub pipeline.

- The HIA pipeline is composed of four main types of technology; Medtech, Software, Diagnostic, and Training & Development the pipeline also included one Drug discovery project. To evaluate the potential financial and clinical impact of these technologies a 10% and 100% impact model was used where 10% equated to 20% adoption and 50% efficacy. These two values (10% & 100%) were used to guide the evaluation of the technologies. PA, like the HIA, appreciate that the 10% is an under estimate and 100% is a significant over estimate of the market impact these technologies may have. In reality the market impact of these technologies lie somewhere within this range and will be different for each type of technology.
- When using the aforementioned evaluation methodology the total financial value (based on expected royalties and cost savings to the NHS) of the submitted pipeline is £395m (at a 10% underestimate) when this is broken down by time to market the following financial opportunities exist:
 - On market or near to market (within 12 months): £312m
 - Near market (12-30 months): £50m
 - Requires development (>30 months): £33m
- All financial (wealth) information provided in this report has grouped the various wealth opportunities (royalties, cost savings, jobs, equity and investment) into one figure. For ease these are broken out in section C2
- When evaluating the financial impact of these technologies, the team were clear to capture a range of financial factors including; royalties, cost saving, job creation, new revenue, equity growth and investment. Royalties and cost saving represented ~60% of the total value of the financial impact of the technologies. When assessing only these two factors, cost savings alone represented 84% of the financial impact, the emphasis on cost-saving was seen throughout the pipeline and is an important driver in the generation of new technologies from the NHS. As such new tools are required that measure the impact of these cost saving technologies so that value can be appropriately recognised by organisations and contributors.
- Using a scoring matrix (see report) the review team identified a group of 28 technologies that have the potential to generate £132m (at 10%) of new wealth for the NHS. These technologies are put forward by PA as those technologies that should undergo further scrutiny by the HIA and by the forming AHSNs.
- This review focuses solely on technologies that have the potential to generate a Health and Wealth benefit. It is important to note that not all technologies fell in this grouping. Indeed many had the potential to increase health benefit whilst generating small financial return and others had the potential to generate significant revenues yet impacted very few patients. This review has not focused on these technologies, however, PA recommends that the HIA establish which of these technologies are appropriate for AHSN adoption moving forward.

- A high proportion of the technologies had the potential to reduce costs in the NHS. Indeed, in many cases a number of the technologies are already having significant impact in the healthcare system. Interestingly PA's review would suggest that in a majority of cases the originator and associated hub are not fully recognised for the value created through these cost savings. It is important that this is addressed and incorporated into any technology processes adopted by the AHSNs. As the AHSNs will be required to implement the most cost-effective technologies moving forwards.
- Only a proportion of the overall pipeline was reviewed, from this analysis it is clear that the hubs have been important in ensuring new technologies are identified and captured for the benefit of the NHS. In a new AHSN landscape it would be expected that there is a significant potential for more innovations to arise from the NHS Trusts associated with the forming Networks. PA suggests a review is required that establishes how all of the forming AHSNs ensure they have the right systems in place to identify, capture and develop new technologies. It is recognised that the innovations known to HIA members is only one part of the picture about the pipeline that AHSNs will want to consider but it is important as the purpose of the innovation hubs is to identify innovations which benefit health and create wealth and so they comprise a substantial proportion of such innovations.
- When reviewing the data submitted by the hubs there was a range in the 'robustness' of the data submitted. It was clear some hubs have a very thorough approach to technology triage which has not been implemented across all hubs. In an evolving AHSN landscape PA recommends that the hubs (where possible) align systems and processes to provide a fairer and more consistent evaluation process that would facilitate uptake and review by the AHSN network.
- Finally we acknowledge the time taken to develop new technologies may not always be in line with NHS expectations. AHSNs will need to take a proactive long-term view on establishing the systems required to develop and implement new technologies. The AHSNs will need to work closely with those identifying and commercialising new clinical technologies to ensure they have the appropriate processes in place to facilitate early validation (fail early fail cheap), efficient uptake and dissemination.

1 Background

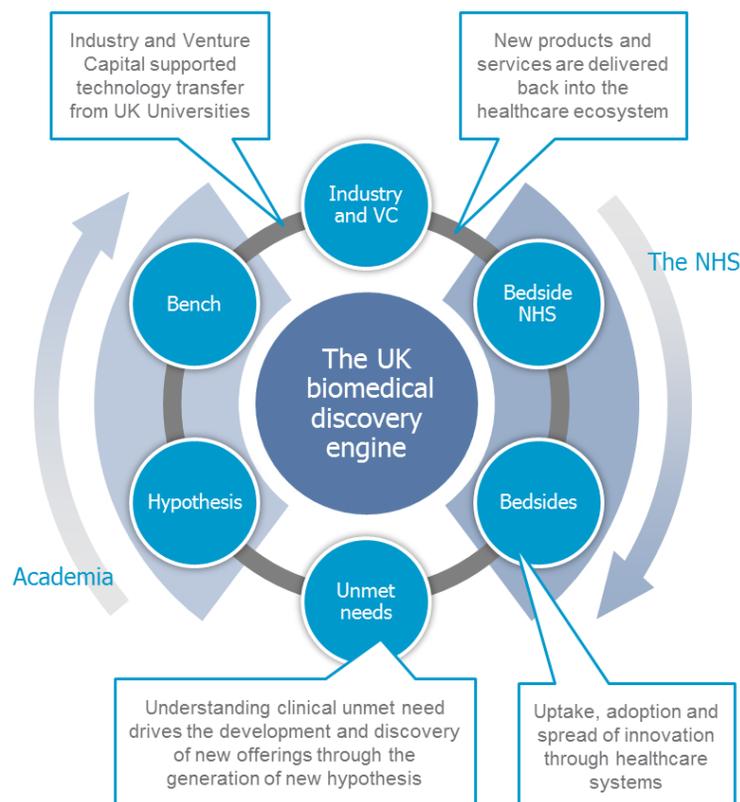
The Health Innovation Alliance (HIA) is a partnership of six NHS Innovation hubs that offers streamlined healthcare innovation services aimed at improving quality of care and ultimately reducing costs in the NHS. One innovation hub lies outside of the HIA and was not included in this review. The historical remit of the hubs was the identification and capture of NHS derived IP, as such the hubs have been a vehicle for innovations to be identified, validated and commercialised from NHS clinicians. The scope of the activity has since been broadened and now included the identification of cost-saving technologies through to helping support technology adoption. Each hub manages a pipeline of technologies across a range of sectors; these technologies have the potential to improve both health and wealth and as such are an important asset to the NHS.

1.1.1 UK Life Science Strategy and Innovation Health and Wealth

The UK has identified the Life Sciences and the Healthcare as important sectors in generating new economic growth and as a result two government reports were published in 2011 that set out the government's approach to further developing and growing these areas. These two documents, the UK Life Science Strategy and Innovation Health and Wealth highlighted the need to focus on increasing the flow of innovation into and out of the NHS and ensuring that the value created by these innovations was captured appropriately. The HIA hubs are better placed to have oversight of the types of technology being generated from the NHS and to be able to review the potential financial and health benefits of commercialising and adopting these new technologies.

The HIA represents a substantial proportion of technologies currently under development by the NHS, as such; an evaluation of the HIA pipeline provides a good indication of the overall value of the technologies emerging from the NHS as a whole.

Figure 1 - PA's view of the UK Biomedical Discovery Engine



2 Methodology and approach

PA Consulting was commissioned to review a pre-defined selection of the total project pipeline of the HIA-associate Innovation Hubs. Each hub was asked to provide ~ 20 projects that represented both near (on-market or close to market) and short (2-3 years from market) term opportunities. It is understood that the majority of hubs will have projects that are: under negotiation, actively being pursued, under triage and those that have been archived. In responding to the request for project information, the Hubs have submitted technologies from across the first three of these categories. As such, the submitted technologies represent a proportion of the overall pipeline held by the HIA. The projects were submitted to PA under CDA and the aim of this review was to identify the market potential of the top innovations being developed or launched by the innovation hubs.

2.1 Methodology

Working with the HIA and the HIA associated hubs, PA developed a questionnaire that sought to identify the type of technology, the clinical and economic benefits it could create and the hurdles / next steps to the development of the technology. The data provided for the analysis was based on readily available information held by the hubs. Upon receipt of the technologies PA conducted no due diligence and treated all received data to be accurate at time of submission. To structure the analysis PA classified each technology based on a high-level analysis (column 1) and a further detailed analysis (column 2) that sub-classified each technology into one of ten sub-classifications.

High-level	Sub-classification
MedTech	Medical Technology Direct: any device that is an invasive procedure
	Medical Technology indirect: Any device that assists or supports an invasive procedure
	Hardware Non-clinical: A physical item that isn't attributed to the clinic
	Hardware Clinical: A physical item that is not directly used in procedures but present in clinics e.g. a clinical waste disposal system
Software	Software Clinical: A device that monitors a parameter or helps manage a condition e.g. ECG
	Software Non-clinical: A device that supports hospital admin and/or management efficiency
Education and Training	Software - Education and training: An online training programme etc.
	Hardware Education and training: - A training process or manual
Diagnostics	Diagnostics
Drug Development	Drug Development: A procedure that contributes to development of an investigational medicine

2.1.1 Pipeline breakdown

A breakdown of the pipeline by source, type and function can be found in Appendix A

2.1.2 Assumptions used for pipeline analysis

To ensure a consistent approach was taken across the submitted technologies a number of up-front assumptions were made. These were applied to all technologies regardless of source or application. These assumptions can be found in Appendix A.

3 Review of HIA pipeline

3.1 Scoring system

Submitted technologies were scored on three metrics:

Time to market: Near -Green (within 12 months), Short -Orange (12-30 months), Far - Red (30 months plus).

Health: Number of patients impacted from 10,000 to >1m, scored A through to E

Wealth: Monies received, scored from £10,000 to >£100m

Full details of the scoring system can be found in Appendix B

Once scored using the scoring system, each of the technologies were plotted on charts similar to that shown in Figure 2. A quadrant representing technologies with the potential to impact >100,000 lives and generate >£10m was used to identify high impact technologies. Note, as this was based mainly on UK figures the global potential for impact could therefore be significantly higher. For the purposes of this analysis PA has focused on the indicated quadrant. For a full overview of the pipeline the individual sub-classification plots can be found in Appendix C.

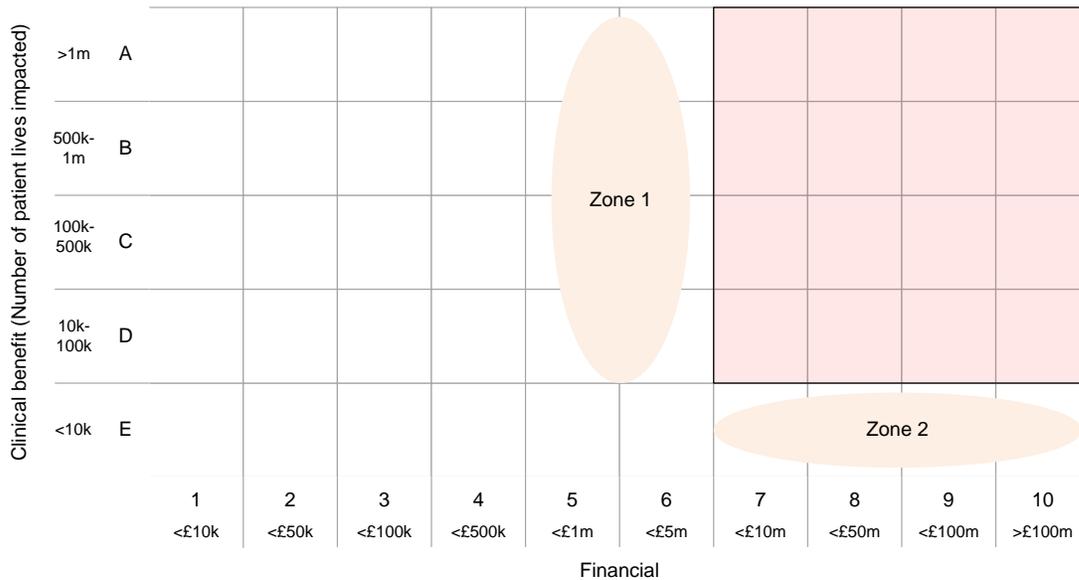


Figure 2 - Example chart for plotting relative health/wealth benefit of the innovations

The innovations in the top right-hand quadrant are those that represent both high clinical benefit and also claim to provide a high level of financial benefit through generation of royalties and or significant cost savings to the NHS. Importantly there are two zones (1 & 2) that represent technologies that impact high number of patients that have the potential to bring in small amounts of revenue (Zone 1) and those technologies that impact low numbers of patients that have the potential to generate significant revenue (Zone 2). Although this analysis focusses on technologies that increase both Health and Wealth (top right) it will also seek to identify important technologies within Zone 1 and 2.

In the context of the newly forming AHSNs, there is an important question as to how AHSNs will (or should) prioritize new innovations based on Health, Wealth or a combination of the two.

3.2 Overview of the wealth benefit of the HIA pipeline

To review the wealth opportunity represented by the pipeline information was sought on a number of financial benefits created by the technologies under review. The parameters used to assess these wealth benefits included; royalties; cost savings; job creation; revenue; asset/equity growth and investment opportunities. For each of these parameters a 10% and 100% adoption number was sought to ensure that both the upper and lower limits of the technologies potential was captured. It is understood that both the 10% and 100% are significantly unrealistic, the 10% figure used in this report should be used as a guide and the reality will be that the real-world market impact will be different to this. It was felt , in collaboration with the HIA that these parameters would provide a reasonable overview of the pipeline.

When analysing the data it was found that the combination of royalties and cost savings represented 61% of the total pipeline wealth opportunity. The total value of the pipeline (assuming 10% adoption) is estimated to be £395m. When this is broken down by near and short term opportunities and we consider only royalty and cost saving opportunities we see that the wealth opportunity ~£360m (at 10% adoption).

	Near (on market now or within 12 months)	Short (on market in 12-30 months)
Royalty received by trusts (£m)	15.6	18.1
Potential cost savings to the NHS (£m)	296.1	32.5
Sum (£m)	311.7	50.6

Figure 3 - Estimated portfolio values for all near and short term innovations at 10% adoption

3.2.1 Job creation

In addition to these estimated financial benefits, there additional economic advantages including the generation of over 40-400 (10-100%) jobs being created as a result of the successful commercialisation of these technologies. PA has not conducted an analysis of commercial benefit of the potential for job creation. As a guide, analysis of this sort would usually use a rule that the creation of a high-skilled job equates to £100,000 being brought into a local economy.

4 Technology Analysis

Using the analysis approach outlined in section three, each of the 112 technologies were scored and provided with a unique identifier. Figure 4 below shows the technologies that scored in the top right hand quadrant only (25% of the submitted pipeline), these technologies have the potential to impact over 100,000 lives and generate over £50m for the NHS. Note that 36 technologies were excluded from the analysis due to incomplete information. To see how all 112 technologies scored across the different sub classifications see Appendix C.

Figure 4 below shows that of the submitted innovations, 28 were scored high for health and wealth benefit, of these 14 are on, or close to market (within 12 months), 9 are short term opportunities (12-30 months) and 5 long-term prospects (>30 months).

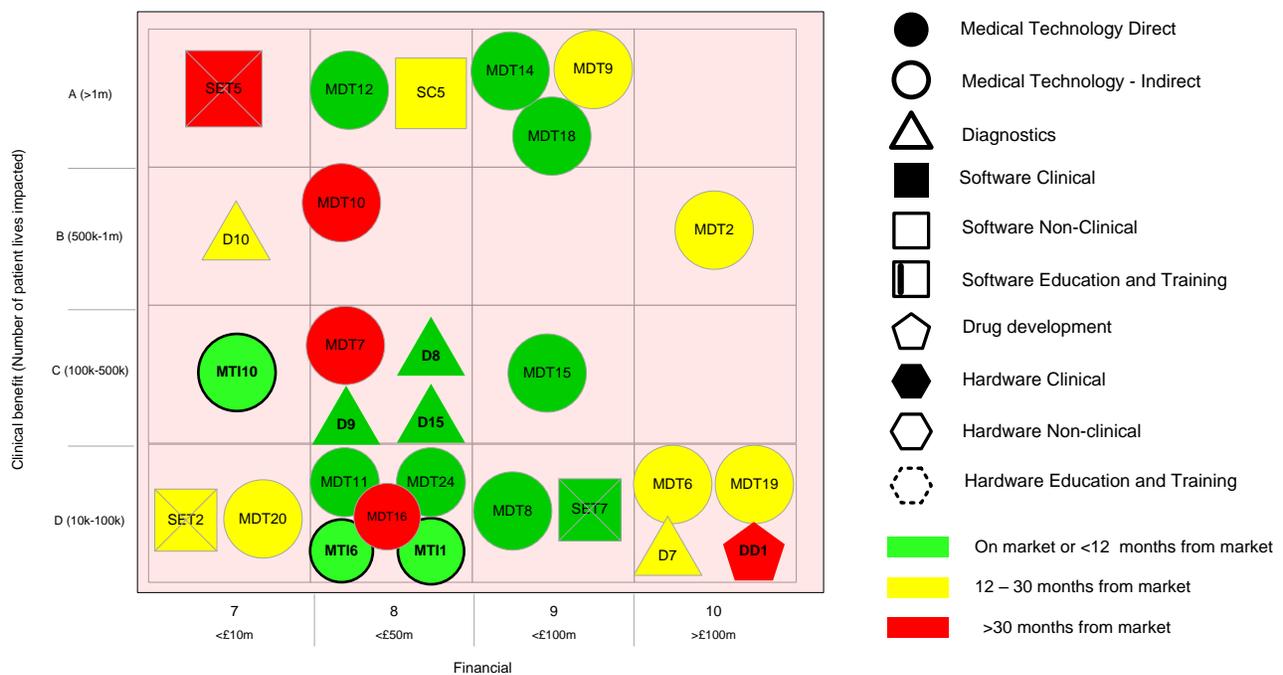


Figure 4 - Overall scores of the complete innovation portfolio

The majority of the high scoring technologies are medtech (64%) which, based on the way in which the innovation hubs have historically worked whilst the next high-scoring technologies were diagnostics (17%) with 14% of the high-scoring technologies being software related. This analysis is a snap shot of a proportion of the technologies identified by the hubs and as such it is not possible to analyze trends in the technologies. PA suggest that the HIA review the proportions of technologies to identify if the proportion of diagnostic and software based technologies has risen over the past 2-3 years as this may be a good indicator of the types of technologies likely to be created by the newly forming AHSN. Understanding future technology flow out of the NHS will better position the ANSNs to proactively adapt to the uptake of new technologies based on pre-planned technology uptake policies and processes.

4.1.1 Scoring matrix

The chart below shows the selected projects which scored high in both clinical and financial benefit. The key below provides a brief description of the selected technologies.

Technology	Description	Technology	Description	Technology	Description
 MDT8	Handytrach - a novel device for percutaneous dilational tracheostomy	 MDT19	Knee Meniscus repair device	 D15	Memory problem/dementia diagnostic
 MDT11	Earfold	 MDT20	Raman cancer device	 D7	Novel BP monitor device
 MTD12	Asthma spacer technology	 MTD7	Scar reduction innovation	 D10	In-vitro diagnostic haemostasis assay
 MTD14	Low cost ambulatory acute pain management system	 MTD10	Cardiac resynchronisation therapy device	 SC5	Epaq Systems Ltd
 MTD15	Orthopaedic implant technology	 MDT16	Laparosphere	 SET7	Novel No Counter-Traction Technique for Closed Reduction of Supracondylar Elbow Fractures in Children
 MTD18	Continence triage service direct to GPs	 MT11	Laboratory Apparatus for IVF and Stem Cell Procedures	 SET2	The Family's Voice
 MDT24	Papworth BiVent Endotracheal Tube	 MT16	Novel tracheostomy dressing	 SET5	Medicines management training package
 MTD2	Spin out company - renal dialysis technology	 MT110	Pre-operative limb sterilisation device	 DD1	Pharmaceutical preparations for the treatment of Cdif and Crohn's Disease
 MDT6	Bimodal Electric Tissue Ablation (BETA)	 D8	Soft tissue biopsy device		
 MTD9	Non-cuffing catheter	 D9	Cervical Cancer diagnostic		

Figure 5 - Key of the highest health/wealth benefit innovations

4.2 Review of value created through the top technologies

The technologies that scored within the high health and wealth benefit (at 10% impact) collectively have the potential to generate a total of £135m. It is important to note that this is not purely from new revenue generation from royalties but instead from cost savings and cash realisation by the implementation of new processes and efficiency savings through the use of new technology solutions. If this is taken in consideration of time to market the financial opportunity in the near term is £57.2m, short term is £45m and in the long term is £30.3m (full details are found in Appendix C). This review shows that the HIA pipeline has real potential to generate both health and wealth benefit and with appropriate support could positively impact the NHS.

PA has direct experience of developing technologies through working with clients and through our own laboratories from idea to product development and commercialisation. Through this experience in the sector, we are aware that when developing technologies (unlike drugs) the attrition rate is driven more by having the right business case (costs, price and timing) and in finding the right adoption route rather than the technical challenges/risks of developing the product. Here the AHSNs will be an invaluable partner in establishing the appropriate routes for validation, market access and uptake. It will be important that the AHSNs are aligned with hub activity to ensure the AHSNs gain access to and realise benefits from new technologies under development by the hubs.

Time lines for technology development are normally longer than initially anticipated, from PA internal development time lines we would expect that a simple medical technology (e.g. a new wound care product) takes between 18 months and 3 years to develop whilst a clinical diagnostics system can take between 3 and 6 years to convert from an early concept to a clinically ready product. The AHSNs must therefore work closely with the Hubs to ensure that they adopt a forward looking approach to technology uptake and that the AHSNs appreciate the long-term implications of working with the hubs.

PA has undertaken a significant number of technology evaluations and due diligence and is aware of the difficulty of predicting the market potential of new technologies. The HIA's process of scoring products based on a 10% impact (20% adoption and 50% efficacy) and 100% impact is a robust way of gauging a low and high impact guide, with the understanding that both the 10% and 100% are likely to be unrealistic. However, for this system to be used reliably, then all Hubs must work to and use the same system.

4.2.1 Impact on the AHSNs

The AHSNs represent a significant opportunity for industry to gain access to the NHS, both as a single regional portal for industry (rather than through individual hospital Trusts) and as a national network of AHSNs that will have the potential for the National adoption of new innovations.

A significant number of technologies included in this review were designed to cut costs out of healthcare systems (15 innovations projecting £148.7m savings at 10%), rather than generate revenue. In a time when the NHS is being pushed to both innovate whilst also cut costs, the NHS must adapt to recognize the significance of technologies that reduce healthcare costs. PA understands that technologies processed and developed by the HIA associated hubs that are designed to cut costs never generate any material (financial) return to the innovation hubs. The process used by the hubs to identify, protect and develop technologies is important in capturing cost-saving technologies. To ensure this process is maintained and developed it is imperative that it is also rewarded. PA has worked with other technology commercialisation units and is aware of the difficulties of attributing 'credit' to cost savings technologies and it is one of PA's recommendations that the DH/NHS through the AHSNs formally recognize cost saving innovations through new processes. These processes could potentially return monies back to the

bodies identifying and developing the cost-saving technologies, but this need not be the case. Indeed it is possible that new AHSNs or national systems that quantitatively recognize and value this input is all that is required.

4.3 Future support required to develop near, short and long term opportunities

All hubs were asked to detail any help / support required to get each project to the next stage of technology development. PA reviewed all of these statements, and although the innovations are from a number of different technology areas, there are themes that run across technology type or stage. Of the technologies reviewed, the most commonly stated 'next step' was clinical and or regulatory validation of the innovations. Indeed, this was the most popular answer within those technologies under the medtech and diagnostic classification.

The AHSNs have an important role to play in being the 'sand-pit' for companies to test their medical technology, diagnostics and clinical software. The AHSNs represent a new opportunity to develop more systemized and transparent process for technology testing and adoption. This analysis suggests that for the AHSNs to lead the way in this area that each of the AHSNs must review its process for evaluating and adopting novel technologies. It is suggested that best-practice in this space should be shared through a 'network of networks' allowing dissemination across the country in a far more rapid and efficient process than has hitherto been possible.

In addition a number of technologies quoted the need for funding and marketing support. Here it may be possible for the HIA to partner with other organizations such as the British In Vitro Diagnostics Association (BIVDA), Association of British Healthcare Industries (ABHI) and UK Trade and Investment to leverage their networks in securing investment and marketing or partnering opportunities. Indeed it would seem logical for the network of AHSNs to work closely with these organisations and others in the sector.

4.4 Learning for future modelling

This report is based on innovations selected by the HIAs for inclusion in the analysis. This approach is associated with several issues:

- The technologies are selected from those available to the HIA, and may not be indicative of the relative depth of innovation within the associated Trusts.
- In general, the data were provided in a timely fashion, and in as much detail as available. However, the differing stage of development of each technologies is reflected in the quality of the associated information. PA has tried to formalise this where possible, but not all numbers may be directly comparable.
- Technologies were ranked on financial opportunity and clinical benefit, and these fields were not completed for all technologies. Where possible, PA extrapolated from other data fields, but this was not possible in all cases. Only those technologies where both were completed were ranked. From an initial inspection, PA does not believe many significant opportunities have been excluded from the analysis on this basis, but this should be reviewed.
- In some cases, financial benefit was calculated from potential royalties. However, where savings to the NHS were provided, these were also considered. It was agreed these two potential sources of financial benefit should be considered at par. However, it is more difficult to understand how individual

innovations, particularly in areas such software, or training and education, would contribute to the potential maximum savings. In addition, no consideration of impact of the cost of development to present value was included

Based on these caveats, PA suggests some further analyses be considered.

- Technologies that have not been ranked should be further reviewed to understand if there is any utility in further analysis being undertaken.
- The HIAs consider an approach to standardisation of potential financial benefits based on NHS cost savings. The utility of this approach may increase further following the establishment of the AHSNs.
- Based on the information provided, the clinical benefit and some indicator of potential financial benefit were selected as pragmatic differentiators of candidates. High-ranked candidates could be further analysed to understand the impact of development time and costs on these selections. This suggests a preparing a very simple, standardised discounted cash flow template across the HIAs.

5 Conclusion

PA has reviewed 112 technologies submitted by the HIA associated hubs. This analysis was conducted during July and August and was based on data / information held by the hubs. The team did not conduct any due diligence on the received data and took all information to be correct at time of submission. PA understands that the technologies submitted represent a proportion of the overall pipeline and as such any figures included here do not represent the opportunity under development by the HIA.

- The review of the pipe line showed that the technologies could be classified as Medtech, Software, Diagnostic, Training and development and Drug discovery. Using a 10% impact model (20% adoption, 50% efficacy) the total financial value of the submitted pipeline is £395m. The true market value is likely to be above £395m in a range within the 10%-100% model used in this analysis. When this is broken down by time to market the following financial opportunities are apparent
 - On market or near to market (within 12 months): £312m; Near Market (12-30 months): £50m; Requires development (>30 months): £33m
- When evaluating the financial impact of these technologies, the team were clear to capture a range of financial factors including; royalties, cost saving, job creation, new revenue, equity growth and investment. Royalties and cost saving represented ~70% of the pipeline with cost savings alone representing 84%.
- PA identified a group of 28 technologies that have high health and wealth potential and in this review PA have focused solely on technologies that meet both these criteria. It is important to note that there were two other groups of technology (Figure 2) that were either high impact in health benefit or wealth benefit. This review has not focused on these technologies, but PA recommends that the HIA establish which of these technologies are appropriate for AHSN adoption moving forward.
- PA noted the high number of potential cost saving technologies, in many cases a number of these are already having significant impact to the healthcare system, yet in a majority of cases the originator and associated hub are not appropriately recognised for the cost saving . It is important that this is addressed and incorporated into any technology uptake routes adopted by the AHSNs.
- It is clear when analyzing this proportion of the pipeline that the hubs have been an effective mechanism for capturing new technologies. In a new AHSN landscape it would be expected that there is a significant potential for more innovations to come from the NHS Trusts associated with the forming Networks. A review is required that investigates the most appropriate vehicle to ensure all Networks have the appropriate mechanism in place to identify, capture and develop new technologies as the hubs have provided to their respective NHS Trusts.
- When reviewing the data submitted by the hubs there was a range in the 'robustness' of the data submitted. It was clear some hubs have a thorough approach to technology triage. In an evolving AHSN landscape PA recommends that the hubs (where possible) align systems and processes to ensure that all technologies, regardless of origin are given a fair and rigorous evaluation.
- Finally PA acknowledges the time taken to develop new technologies and recognises that the AHSNs will need to take a proactive long-term view on technology development and uptake. The AHSNs will need to work closely with those identifying and commercialising new clinical technologies to ensure they have the appropriate processes in place to facilitate early validation (fail early fail cheap), efficient uptake and dissemination

Appendix A: Analysis

A.1 Assumptions

To ensure a consistent approach was taken across the submitted technologies a number of up-front assumptions were made. These were applied to all technologies regardless of source or application.

Submitted data

- All data provided by the HIA Associated Innovation Hubs was taken to be accurate. No due diligence was performed on the values, or patient impact provide by the hubs
- Hubs were asked to provide information about their respective technologies under two assumed adoption levels (both clinical and financial). The two values were 10% and 100% adoption. Where 100% is where a technology reaches 100% market access and 10% where the product achieves a 20% adoption and 50% efficacy. In instances where the hub provided the 10% figure PA extrapolated to calculate the 100% and vice versa for these hubs that only provided the 100% figures.
- It was noted that claimed benefit can be contentious e.g. a hospital consumable device can claim to benefit several million patients, but the actual benefit could be negligible when compared to a device that comes in direct contact with a patient. This analysis has referred to claimed patient numbers impacted but these figures may need to be reviewed. As such any reference to patient benefit in this analysis refers to the number of patients impacted by the technology
- It has been assumed that each set of claimed cost savings is independent, in reality, innovations in the same market could be making claims on the same cost savings and this may affect the impact of the technology market potential of the pipeline. Furthermore it should be noted that the level of this impact will differ between different technologies, for example, it is likely that there are more 'similar' software based technologies than medtech technologies. As such the financial and clinical impact of the analysed software technologies is smaller than estimated.

Financial data

- Financial analysis: It was assumed that £1 revenue is equivalent to £1 NHS cost saving i.e. there was no distinction made between revenues generated and costs saved by the NHS. Due to the way impact was measured (10% impact = 20% adoption and 50% efficacy) it was possible to correlate cost savings with revenue
- US Dollars have been converted into GBP with a conversion rate of £1 = \$1.5
- Where no royalty figures are given, there have been no revenues attributed i.e. there have been no attempts made to estimate the level of sales for that innovation
- Only year 1 royalties and UK figures (or 5% of Global) were used for the financial benefit analysis

A.2 Pipeline overview

Figure 1 below show the number of innovations submitted by each of the hubs and also how these fall within the defined categories

		HEE	N	NW	SE	SW	Y&H	Total
Medical technology	Direct	7	4	8	3	7	6	35
	Indirect	3	5	1	4		1	14
Software	Clinical		1	3	3		4	11
	E&T	2	2		2	2	2	10
	Non clinical	1			2	1		4
Diagnostics		3	5	2		3	3	16
Drug			1					1
Hardware	Clinical	1		1	1	1	1	5
	E&T	2		1	3	1	1	8
	Non clinical	1	2		5			8
Total		20	20	16	23	15	18	112

Figure 1 - Distribution of the innovations received

Figure 2 outlines the breakdown of innovations submitted by function, as expected a high proportion (73%) of these technologies were classified as clinical innovations, 12% were non-clinical and 15% were education and training-related.

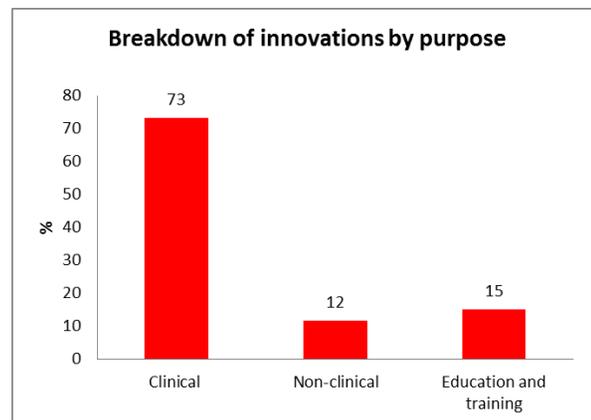


Figure 2 - Innovation portfolio by purpose

Figure 3 shows that a majority of submitted technologies were MedTech, occupying 54% of the pipeline submitted.

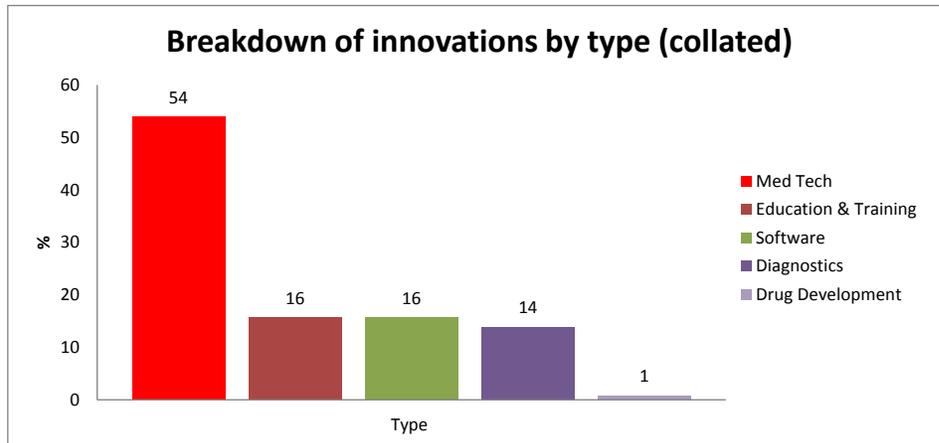


Figure 3 - Innovation portfolio by type

Appendix B: Analysis

B.1.1 Analysis of Clinical Benefit

Innovations were analysed within each of the aforementioned ten sub-classifications for both wealth (financial) and health (clinical) benefit. The clinical benefit was assessed by considering the number of patients impacted by an individual technology and/or the number of uses of the device. As a result, where data was provided, the innovations were rated a letter between A to E with A being equal to or greater than 1m patients impacted to E (10k or less).

Group	Patients impacted/number of uses of the innovation
A	>1m
B	500k-1m
C	100k-500k
D	10k-100k
E	<10k

B.1.2 Analysis of Financial Benefit

The financial benefit of the innovations was scored on a ten-point scale between 1-10 with 10 relating to a claimed financial benefit of >£100m and 1 equivalent to a benefit of less than £10k p.a.

Group	1	2	3	4	5	6	7	8	9	10
	<£10k	<£50k	<£100k	<£500k	<£1m	<£5m	<£10m	<£50m	<£100m	>£100m

Figure 10: Breakdown of Financial Benefit classification

The output of the analysis is given in section 2.3 onwards.

B.1.3 Analysis of time to market

Using the data provided by the hubs, the technologies were scored in terms of their time to market. Here PA sought to classify those technologies that were near to market (on-market or within 12 months), close to market (12-30 months) and those that required further development (30 months plus). For ease, these three scores were colour coded green, orange and red respectively and these colours are used throughout the analysis to delineate time to market.

Time to market	Score
Within 12 months	Green

12 – 30 months	Yellow
Over 30 months	Red

B.1.4 Received score for all 112 technologies

Using the analysis approach outlined in section three, each of the 112 technologies were scored and provided with a unique identifier. For the purpose of clarity we provide each of the full scoring matrix based on the ten sub-classifications in the appendix.

		Financial										Total	
		n/d	1	2	3	4	5	6	7	8	9		10
Clinical	A	5	1	1	5	2	2	3	1	2	3		25
	B	3		3		3		4	1	1		1	16
	C	4		1		3	1	3	1	4	1		18
	D	2	2	2	1			2	2	5	2	4	22
	E	2	1			1	2	2	3				11
	n/d	10	1	1		5	1			2			20
Total		26	5	8	6	14	6	14	8	14	6	5	112

Appendix C: Results

C.1 Table of the top 28 technologies and the associated financial benefit that could be achieved (10%)

On market or within 12 months)		On market in 12-30 months		On market in >30 months	
MDT8	7.6	MTD2	0	MTD7	24
MDT11	1.8	MTD6	6.4	MTD10	4
MTD12	4.5	MTD9	10	MDT16	2.3
MDT14	7.5	MDT19	25	SET5	0
MDT15	4	MDT20	2.6	DD1	0
MTD18	10	D7	0		
MDT24	1.8	D10	1		
MTI1	0	SC5	0		
MTI6	3.3	SET2	0		
MTI10	0.9				
D8	3.1				
D9	3.5				
D15	1.7				
SET7	7.5				
Total (£m)	57.2		45		30.3

C.2 Summary of Financial breakdown of near term, medium term and long term opportunities at 10% adoption

Near Market Technologies

	Medical Technology		Software			Hardware			Diagnostics	Drug Development
	Direct	Indirect	Clinical	Non-clinical	Education and training	Clinical	Non-clinical	Education and training		
Royalty (£m)	12.5	1.8	0	0.2	0	0	0.2	0.6	0.3	n/a
Cost saving (£m)	74.9	6.4	107.4	28.4	19.5	4.7	5.4	30	19.6	n/a
Job creation	15.6	0.9	0.1	0.5	0	1.7	0.1	0.5	1.4	n/a
New revenue (£m)	8.2	0	0	1.6	0	0	0	0.2	3.1	n/a
Equity growth (£m)	0	0	0	0	0	0	0	0	0	n/a
Investment (£m)	1.5	0	0	0	0	0	0	0	0	n/a

Medium term

	Medical Technology		Software			Hardware			Diagnostics	Drug Development
	Direct	Indirect	Clinical	Non-clinical	Education and training	Clinical	Non-clinical	Education and training		
Royalty (£m)	16.1	1	0	n/a	n/a	n/a	0	n/a	1	n/a
Cost saving (£m)	32.5	0	0	n/a	n/a	n/a	0	n/a	0	n/a
Job creation	8	0	0	n/a	n/a	n/a	0.1	n/a	0	n/a
New revenue (£m)	37.3	0	0	n/a	n/a	n/a	1.3	n/a	0	n/a
Equity growth (£m)	0	0	0	n/a	n/a	n/a	0	n/a	0	n/a
Investment (£m)	8	0.3	0	n/a	n/a	n/a	0	n/a	0	n/a

Long term

	Medical Technology		Software			Hardware			Diagnostics	Drug Development
	Direct	Indirect	Clinical	Non-clinical	Education and training	Clinical	Non-clinical	Education and training		
Royalty (£m)	29.5	n/a	n/a	n/a	0	n/a	n/a	n/a	0.1	0
Cost saving (£m)	2.9	n/a	n/a	n/a	0	n/a	n/a	n/a	0	0.3
Job creation	12.5	n/a	n/a	n/a	0	n/a	n/a	n/a	0	0
New revenue (£m)	61.5	n/a	n/a	n/a	0	n/a	n/a	n/a	0	0
Equity growth (£m)	124.8	n/a	n/a	n/a	0	n/a	n/a	n/a	0	0
Investment (£m)	0	n/a	n/a	n/a	0	n/a	n/a	n/a	0	0

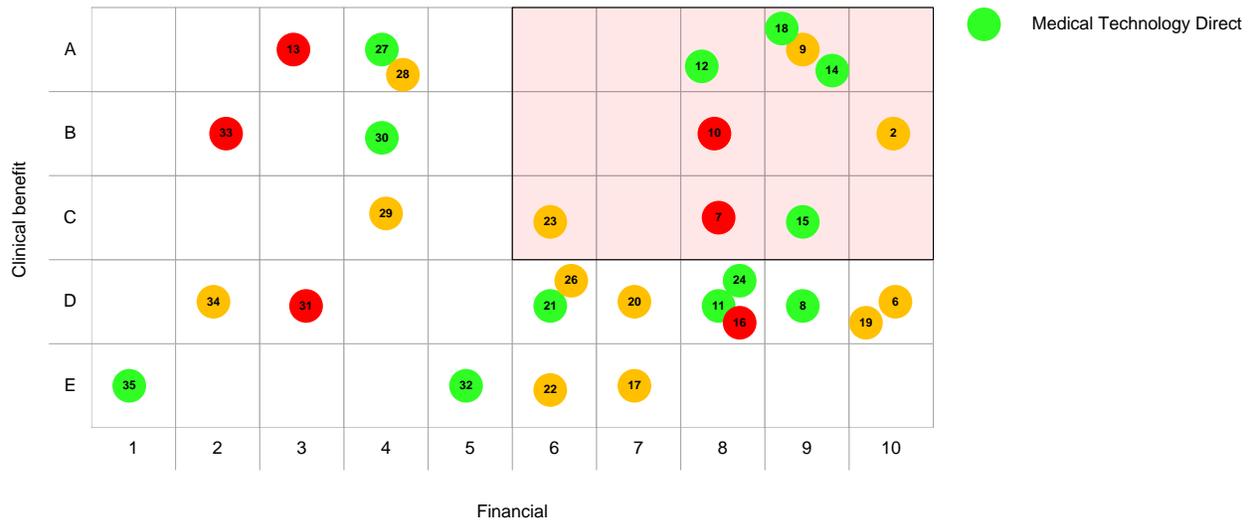
C.3 Results by sub-sector

The initial outputs from the ranking analysis are summarised below. PA has only reviewed those technologies where the data supplied were sufficient to draw preliminary conclusions regarding Clinical Benefit and Financial attractiveness.

Note, as is typical in analyses such as this, the data were not all provided in a coherent fashion. Where possible, Financial benefit was based on royalty payment (and the numbers indicated represent 100% impact) on global sales, where provided, plus any savings to the NHS (only). Where appropriate, the UK market was assumed to be ~5% of the total global, although this will vary by indication. These data were provided in various levels of detail, and these should be taken as being indicative only.

For the purposes of this analysis, it was agreed technologies that were of significant potential in *both* Clinical Benefit and Financial return. However, other attributes, such as investment required, were not included at this time.

C.3.1 Medical Technology Direct

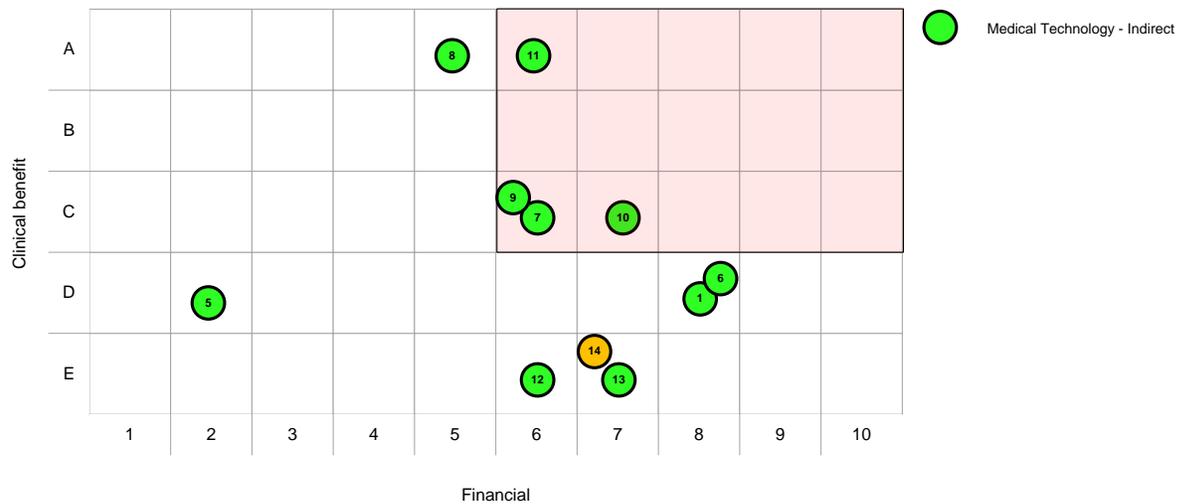


The majority of technologies in this category had significant financial benefit as compared to clinical benefit and of all the sub-classifications had the most technologies in the top right had quadrant

Note, 5 technologies were judged to have insufficient data on one or both categories to be assessed, and are excluded from this analysis.

MTD1	MTD3
MTD4	MTD5
MTD25	

C.3.2 Medical Technology - Indirect

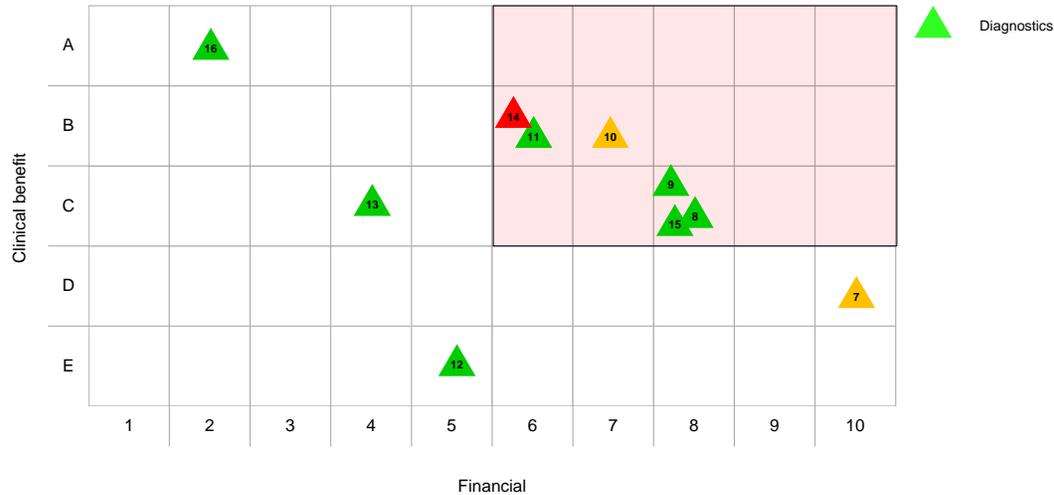


Medtech Indirect had few technologies, but interestingly most were near term with potential financial benefit to the HIA and NHS.

Note, 3 technologies were judged to have insufficient data on one or both categories to be assessed, and are excluded from this analysis.

MTDI2	MTDI4
MTDI3	

C.3.3 Diagnostics



The majority of diagnostics were of both clinical and financial benefit and reflect the growing trend to stratify patient populations or disease types based on some form of biological signal.

Note, 6 technologies were judged to have insufficient data on one or both categories to be assessed, and are excluded from this analysis.

D1	D2
D3	D4
D5	D6

Of these, D1-D4 and D6 were all rated A for clinical benefit, and D5 was rated B, but on the basis of information supplied at this time, although PA was unable to determine the market size, and recommends additional clarification be sought.

C.3.4 Software Clinical & Non Clinical

For the purpose of this analysis, the following categories were grouped:

- Software (Clinical), Software (Non clinical), Software (Education & training)



The majority of software based technologies had a far higher clinical benefit than wealth benefit and reflect the opportunity of innovative software packages to improve quality of life for patients and system level improvements in the NHS.

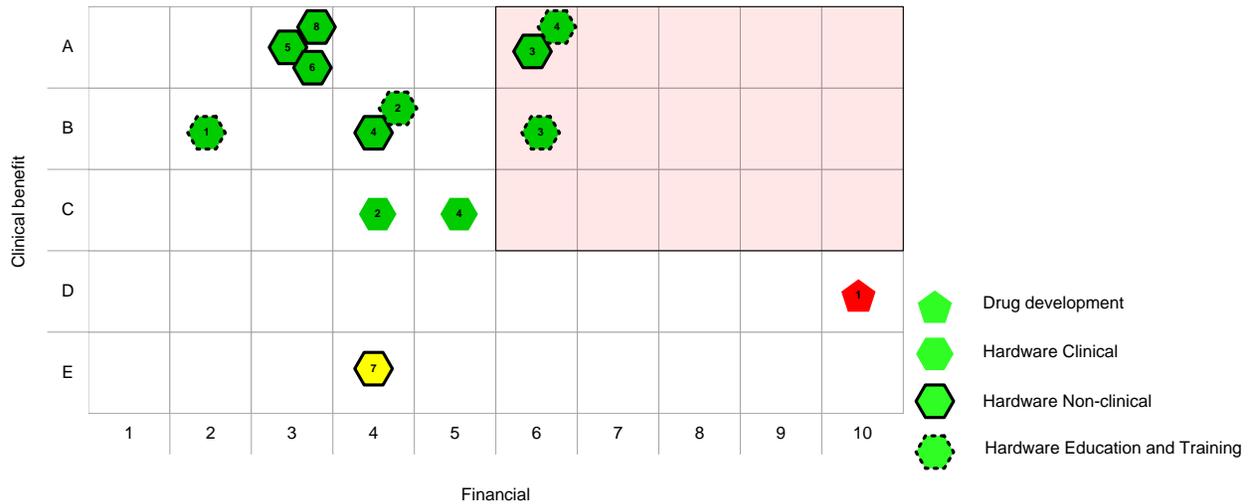
Note, 13 technologies were judged to have insufficient data on one or both categories to be assessed, and are excluded from this analysis.

SC1	SC2	SC3	SC4
SC6	SC7	SNC2	SNC4
SET3	SET4	SET8	SET9
SET10			

C.3.5 Drug Development & Hardware

For the purpose of this analysis, the following categories were grouped:

- Drug development, Hardware (Clinical), Hardware (Non clinical) and Hardware (Education & training)



The hardware sub-classification showed significant clinical benefit compared to financial benefit and reflects the fact that a number of low-tech hardware innovations have the potential to significantly improve wealth

Note, 9 technologies were judged to have insufficient data on one or both categories to be assessed, and are excluded from this analysis.

HC1	HC3	HC5
HNC1	HNC2	HET5
HET6	HET7	HET8

5.1 Full list of technologies reviewed

The analysis was based on the following summary data set. Full details are available in an associated Spread Sheet. The financial and clinical number represent 100% impact.

#	Title	Source	Sub-Group	Clinical	Financial	PA ID
1	Hand Splint	N	MedTech - direct	n/d	n/d	MTD1
2	IF Sensing (Spin out)	NW	MedTech - direct	n/d	n/d	MTD3
3	Inhaler Incentive device	NW	MedTech - direct	C	n/d	MTD4
4	Constraining mitten	SE	MedTech - direct	D	n/d	MTD5
5	Spin out company - renal dialysis technology	NW	MedTech - direct	B	10	MTD2
6	Bimodal Electric Tissue Ablation	HEE	MedTech - direct	D	10	MTD6
7	Knee Meniscus repair device	SW	MedTech - direct	D	10	MTD19
8	Handytrach	HEE	MedTech - direct	D	9	MTD8
9	Non Cuffing Catheter	Y&H	MedTech - direct	A	9	MTD9
10	PainKwell	Y&H	MedTech - direct	A	9	MTD14
11	OrthoSimilaris	Y&H	MedTech - direct	C	9	MTD15
12	ELAROS Ltd	Y&H	MedTech - direct	A	9	MTD18
13	Insulin for Scar Reduction	HEE	MedTech - direct	C	8	MTD7
14	Cardiac Resynchronisation Therapy Device	SW	MedTech - direct	B	8	MTD10
15	Earfold	HEE	MedTech - direct	D	8	MTD11
16	Pocketflow	HEE	MedTech - direct	A	8	MTD12
17	The Laparosphere	NW	MedTech - direct	D	8	MTD16

18	Papworth BiVent Endotracheal Tube	HEE	MedTech - direct	D	8	MTD24
19	Cryo-ablative catheter device	SW	MedTech - direct	E	7	MTD17
20	Raman cancer device oesophageal cancer	SW	MedTech - direct	D	7	MTD20
21	Rotator Cuff Shoulder Brace	HEE	MedTech - direct	D	6	MTD21
22	Haemodialyser	N	MedTech - direct	E	6	MTD22
23	Rehabilitation Device	N	MedTech - direct	C	6	MTD23
24	"Yorkshire" Obstetric Forceps	Y&H	MedTech - direct	D	6	MTD26
25	Biopsy Forceps	SE	MedTech - direct	n/d	5	MTD25
26	Graftbolt	NW	MedTech - direct	E	5	MTD32
27	Single use disposable female incontinence device	NW	MedTech - direct	A	4	MTD27
28	Pulse Oximetry	SE	MedTech - direct	A	4	MTD28
29	Epimark / Episcissors	SW	MedTech - direct	C	4	MTD29
30	RehabAngel	NW	MedTech - direct	B	4	MTD30
31	Drain Secure	Y&H	MedTech - direct	A	3	MTD13
32	Finger Traction Device	SW	MedTech - direct	D	3	MTD31
33	The Swabwasher	NW	MedTech - direct	B	2	MTD33
34	Rectus Sheath Catheter	SW	MedTech - direct	D	2	MTD34
35	Angiography Sling	N	MedTech - direct	E	1	MTD35
36	First Step Leg Bath	N	MedTech - indirect	n/d	n/d	MDT12
37	Leg Exerciser	N	MedTech - indirect	C	n/d	MTI4

38	Vitro Safe Systems Ltd	N	MedTech - indirect	D	8	MT11
39	TracheSeal Dressing	HEE	MedTech - indirect	D	8	MT16
40	Limb Sterilisation Sleeve	HEE	MedTech - indirect	C	7	MT110
41	Stereotactic frame positioner	HEE	MedTech - indirect	E	7	MT113
42	Leeds Solution Ltd	Y&H	MedTech - indirect	E	7	MT114
43	SafePlace	N	MedTech - indirect	C	6	MT17
44	Cannulation Device	SE	MedTech - indirect	C	6	MT19
45	Cannula fixing	SE	MedTech - indirect	A	6	MT111
46	Webber Privacy Device	SE	MedTech - indirect	E	6	MT112
47	Tracheostomy Collar	SE	MedTech - indirect	A	5	MDT18
48	Arterial Dressing	N	MedTech - indirect	n/d	4	MDT13
49	Proximat	NW	MedTech - indirect	D	2	MDT15
50	Pupilometer	N	Diagnostics	A	n/d	D1
51	Separate & Sense	N	Diagnostics	A	n/d	D2
52	Urine Flow Meter	N	Diagnostics	A	n/d	D3
53	Pulse Diagnostics	N	Diagnostics	A	n/d	D4
54	Vibratip	SW	Diagnostics	B	n/d	D5
55	Femmeze	SW	Diagnostics	A	n/d	D6
56	Novel BP monitor device	SW	Diagnostics	D	10	D7
57	Soft tissue biopsy device	HEE	Diagnostics	C	8	D8
58	ZILICO Ltd	Y&H	Diagnostics	C	8	D9
59	Test Your Memory	HEE	Diagnostics	C	8	D15

60	Haemostasis Assay	HEE	Diagnostics	B	7	D10
61	U Flow Meter	N	Diagnostics	B	6	D11
62	Rapid Rhythm ECG device	NW	Diagnostics	B	6	D14
63	Dried Blood Spot testing technology	NW	Diagnostics	E	5	D12
64	Telewound management	Y&H	Diagnostics	C	4	D13
65	Verified Login	Y&H	Diagnostics	A	2	D16
66	Hi We Can Help	N	Software - clinical	n/d	n/d	SC1
67	ASARM patient/clinician management tool	NW	Software - clinical	n/d	n/d	SC2
68	Mersey Burns Tool	NW	Software - clinical	n/d	n/d	SC3
69	Vitalpac	SE	Software - clinical	D	n/d	SC4
70	Epaq Systems Ltd	Y&H	Software - clinical	A	8	SC5
71	Ecat	Y&H	Software - clinical	n/d	4	SC6
72	Patientrack Early warning scoring system	NW	Software - clinical	n/d	4	SC7
73	i-Tracker	Y&H	Software - clinical	A	3	SC8
74	Ennovations Online Store	Y&H	Software - clinical	C	2	SC9
75	Minalgo - Bone Disease management Algorithm	SE	Software - clinical	D	1	SC10
76	Anti-TNF Therapy Assessment Clinic	SE	Software - clinical	D	1	SC11
77	Kent Oncology Management System	SE	Software - non clinical	B	2	SNC1

78	Locum management porthole	HEE	Software - non clinical	n/d	4	SNC2
79	Cloud based clinical trials management	SE	Software - non clinical	B	6	SNC3
80	Doc.Com Solutions	SW	Software - non clinical	n/d	n/d	SNC4
81	Be Smart Cart	SW	Software - E&T	n/d	n/d	SET3
82	Central Venous Catheter (CVC) Insertion Best Practice Training Aid	HEE	Software - E&T	C	n/d	SET9
83	Ladders and Bladders	SE	Software - E&T	B	n/d	SET10
84	Novel No Counter-Traction Technique	HEE	Software - E&T	D	9	SET7
85	The Family's Voice	N	Software - E&T	D	7	SET2
86	COUNT	SE	Software - E&T	A	7	SET5
87	Portrait of a Life	Y&H	Software - E&T	A	5	SET6
88	IRPS	Y&H	Software - E&T	n/d	4	SET4
89	DVD Chest Ultrasound	N	Software - E&T	n/d	2	SET8
90	Cardiac Rehabilitation DVD	SW	Software - E&T	A	1	SET1
91	Neonatal positioning aid	NW	Hardware - clinical	E	n/d	HC1
92	Hy-Vac Fluid Disposal System	Y&H	Hardware - clinical	C	4	HC2
93	TIM Tubes	HEE	Hardware - clinical	E	n/d	HC3
94	Dignity Undergarment	SE	Hardware - clinical	C	5	HC4
95	Safety clip to prevent needlestick injury risk	SW	Hardware - clinical	n/d	1	HC5

96	Midwife Stool	N	Hardware - non clinical	n/d	n/d	HNC1
97	Simple Music Player	SE	Hardware - non clinical	n/d	n/d	HNC2
98	Food & Beverage Trolley	N	Hardware - non clinical	A	6	HNC3
99	Mains Isolated Power Socket	SE	Hardware - non clinical	B	4	HNC4
100	Evacuation Mattress	SE	Hardware - non clinical	A	3	HNC5
101	Portable transfer board for wheelchair users	SE	Hardware - non clinical	A	3	HNC6
102	Medical Gas Management System	HEE	Hardware - non clinical	E	4	HNC7
103	A disposable container for food at the bedside	SE	Hardware - non clinical	A	3	HNC8
104	BEACH - HCA training	SE	Hardware - E&T	B	n/d	HET5
105	The Living Well Handbook	SW	Hardware - E&T	C	n/d	HET8
106	Emotional First Aid Training Course	SE	Hardware - E&T	n/d	8	HET6
107	ALERT	SE	Hardware - E&T	n/d	8	HET7
108	Safe Management of Medicines in Care Homes	Y&H	Hardware - E&T	B	6	HET3
109	SAGE & THYME training	NW	Hardware - E&T	A	6	HET4
110	Top Grub	HEE	Hardware - E&T	B	4	HET2
111	Cardiotocographic Interpretation Wheel	HEE	Hardware - E&T	B	2	HET1

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