Issues and ideas on adoption of innovation

Achieving scale and spread

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Introduction

The uptake of innovation in the NHS is subject to much attention, not least because of the scale of the market and political ambition. In early 2020, we published research into the real-life lessons on the spread and scale of adoption of innovation in the NHS. For the purpose of our work, we assume 'innovation' covers a novel drug, device, app, model of care, set of behaviours or way of working that is directed at improving outcomes, efficiency or experience. This companion paper takes a more theoretical lens to the subject. It describes some of the features of innovations – and their potential market – that may affect the extent of adoption in the NHS, as well as outline some actions available to innovators and national bodies.

The intention is that innovators, and the national bodies that oversee and regulate the health service, can use the insights to inform their strategy towards scale and spread of innovation. In particular, the paper highlights some 'special cases' – such as where national bodies might have different priorities to local bodies; or potential adopters have very differing sensitivity over, say, the innovation's cost – and what actions might be warranted in such circumstances.

About this paper

This paper has been developed, in the first instance, from a pragmatic, rapid review of relevant economics papers. Thereafter the identified considerations and incentives around adoption have been further developed through our emerging understanding of the specific literature on innovation adoption in the NHS, interviews with key stakeholders and expert roundtable discussions. This think piece is not intend to provide an exhaustive description or rehearse well-known literature but, instead, to raise some issues and ideas on the topic of innovation.

Due to the conceptual and theoretical nature of this work, some economic notation has been used to formalise the discussion points. However, those not au fait with such notation can ignore these descriptions without – hopefully – any loss of understanding of the framework. Some of the econometrics have also been translated into more accessible depictions in the tables below.

This paper begins with a discussion about the trajectory for spread of innovation before exploring what might affect this. In particular, the paper draws out consideration around

the innovation, innovator, potential adopters and national bodies. Some of the key considerations are outlined in the summary table below (Figure 1).

Figure 1. Summary of some key considerations affecting spread of innovation

Aspect	***Description***	*Some key considerations*
The market	The potential adopters of any innovation are likely to be large in number, diverse in nature and change over time.	- the number of potential adopters - changes to number or identify of potential adopters - grouping and subsets of adopters - the extent to which the NHS is the main market (i.e. private or international) - what adaptions to the innovation would be required to make it relevant to an new market
The value proposition and costs	Each innovation will have a number of costs and benefits associated with implementing it. These may vary in number, impact or timelag for realising them.	- the number and complexity of the benefits and costs - the cross-department (or budget-holding) nature of these costs and benefits - the type and strength of evidence on the value proposition - the time period for realising the costs and benefits
The potential adopters	Each potential adopter is influenced by its individual perceptions of, and priority, towards, each of the stated costs and benefits.	- the degree of certainty that the benefits are realised and costs incurred - financial positions of the adopting organisations / departments (and the variation between them) - process for final sign-off for adoption (e.g. involvement of finance department) - funding (e.g. 'block' versus pay-per-activity) and regulatory frameworks of the potential adopters - nature of the potential adopters (i.e. whether it is the purchaser of the innovation or not) and whether support from the user varies by service - recent experience of implementing innovations (particularly when similar)
The competition	Potential adopters not only have to weigh up an innovation's costs with its benefits but also compare this to current and future alternative solutions.	- the extent of, and timelag since, any alternative innovation was adopted - the scope for future alternative innovations to be marketed - the type and strength of evidence on the different innovations - the desirability of the status quo (e.g. any regulatory incentives to adopt a new innovation)
Pricing and support	The innovator can vary prices and support, as well as generate evidence, to help achieve its desired level of coverage for the innovation.	- the capacity of the innovator to deliver bespoke support or evidence to adopters - the priority placed on seeing widespread coverage as opposed to demonstrating it works; more generally the innovator's "goal" - short-term income requirements of the innovator

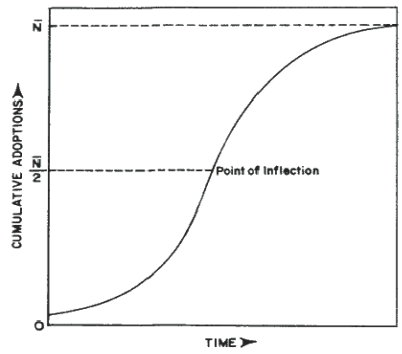
National oversight considerations	National or regional bodies may want to intervene to, for instance, ensure the NHS benefits from economies of scale or consistency across services.	- the level of inequity in care if the innovation is not adopted at scale - the extent to which the costs or benefits fall outside the adopting organisations (i.e. cost-effectiveness for the health and care services as a whole) - the increased purchashing power of larger groups of NHS organisations - benefits for NHS workers from having consistent use of the same innovation.

Adoption trajectories

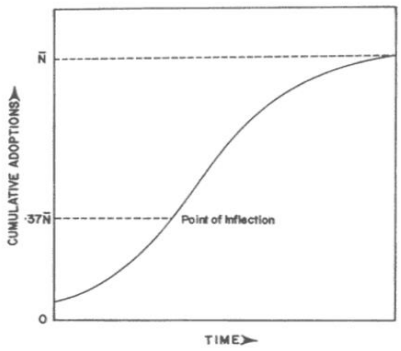
The economics literature can provide a theoretical basis for predicting the speed and scale of spread of innovations. Certainly, previous characterisations, such as the s-curve suggested by Rogers (2003), offer innovators, policy-makers and researchers a starting point to conceptualise the market. However, there are a multitude of models for predicting adoption of new innovation.[1] The examples given below show that the s-curve may be asymmetric – perhaps with a longer tail (i.e. more laggards) – or, contrarily, not s-shaped at all. The literature suggests the shape is likely to be influenced, to some extent, by the considerations outlined in this paper including the number of potential adopters, the nature of the innovation and the way in which information is shared. In recognising this, the stakeholders have a better chance of predicting the likely spread and to positively influencing the scale of adoption.

Figure 2. Examples of theoretical adoption curves

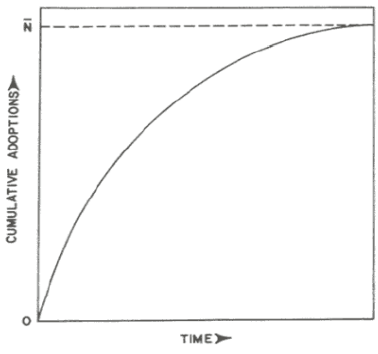
'Logistic' model of diffusion



'Gompertz' model



External influence diffusion model



Source: (Mahajan and Peterson, 1985; Pavlidou, 2010)

[1] e.g. Bass; Generalized Bass (Price); Bass model variant; Simple Logistic; Gompertz and the FLOG Box & Cox model.

And, indeed, real world data on adoption of technology in the US confirms the existence of different trajectories. Some appear in line with the s-curve (e.g. microwaves) and the other economic models. However, this real-world data also reiterate the likely uniqueness and complexity of the adoption journeys with, for example:

1. 'lumpy' uptake of washing machines;
2. falls in use of landlines since 2000; and
3. quick, linear uptake in tablets over the last decade (see Figure 3).

Similar characteristics can be seen in NHS data too. Data previously published by NHS Digital on adoption of three medical technology innovations[2] highlight that coverage doesn't always go upwards (one would expect some random change but the variation appears greater than that). This may suggest that any discussion on scale and spread needs to consider lessons on retaining early adopters. Similarly, there is no apparent convergence across the regions over time. Indeed, the trajectories might vary by region and therefore require regional intervention if more comprehensive coverage is to be achieved (see Figure 4 for an example of one of these technologies).

[2] Spinal cord stimulation for chronic pain of neuropathic or ischaemic origin; The 3M Tegaderm CHG IV securement dressing for central venous and arterial catheter insertion sites; The Debrisoft monofilament debridement pad for use in acute or chronic wounds. The latter is separated between adoption in primary and in secondary care.

Figure 3. Examples of adoption curves outside health care

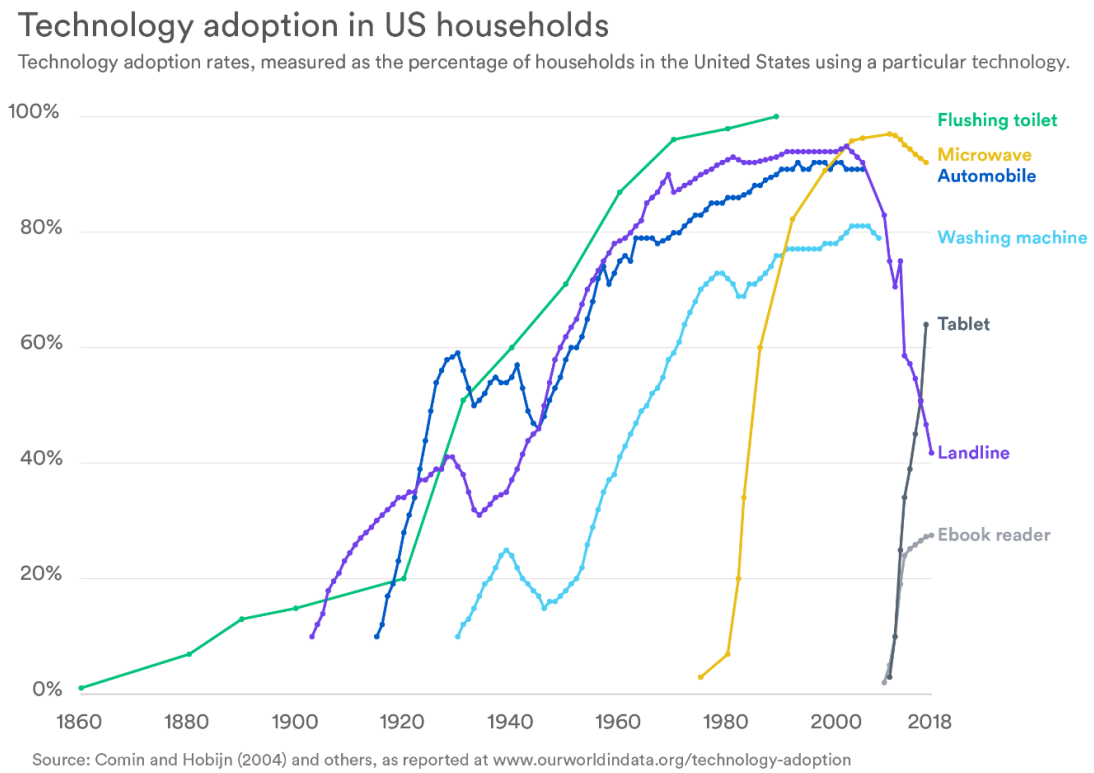
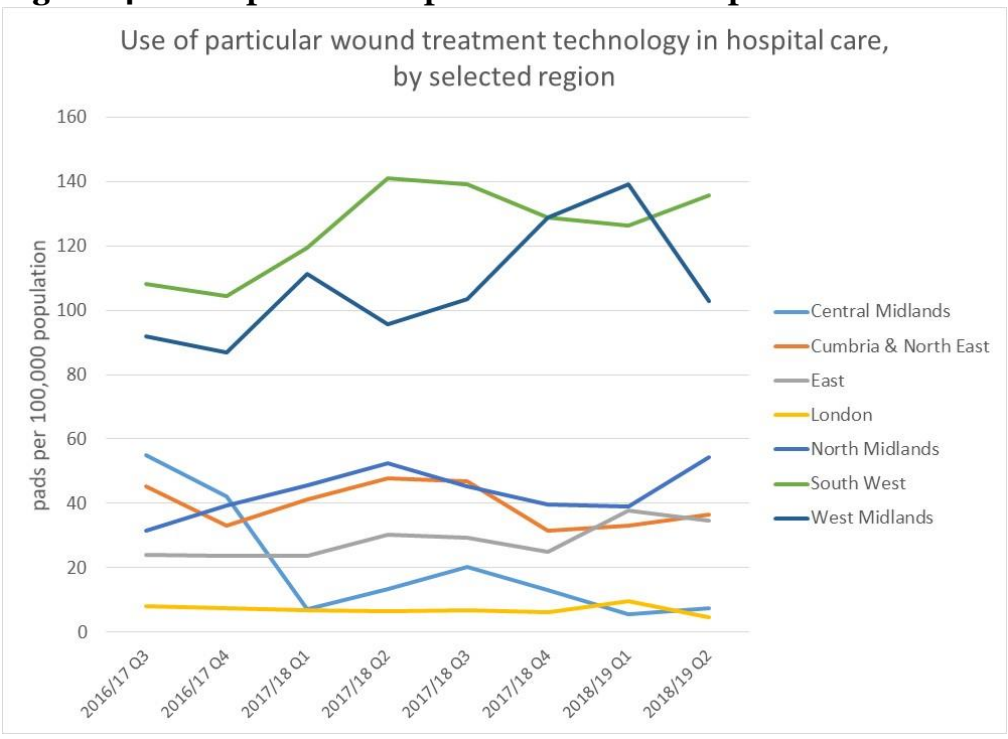


Figure 4. Examples of adoption curves for a particular technology in the NHS



Source: Analysis of NHS Digital (2019) data on Debrisoft monofilament debridement pad in secondary care

A market of many

While there is a single NHS in England, it is made up of a vast number of different providers of care. For example, there are around 7,000 GP practices, some 150 acute trusts, over 50 mental health trusts, with a further 35 community providers (NHS Confederation, 2017). The scope of the market may be even higher if you conceive, for example, of an innovation which could potentially be used by any of the over 300,000 nurses and health visitors in NHS hospital and community services (NHS Digital, 2018). This, in itself, poses a challenge for innovators to find the right organisation and the right people within them.[3] To further complicate this picture, the NHS may not be the only – or even main – market for an innovation, even from the outside.

Not only may the number be high – therefore making comprehensive adoption challenging, particularly for smaller innovators – but it may not be static. The number or identity of these potential adopters may, of course, change over time due to the creation of new services or turnover of staff who may be potential adopters. Moreover, it may be that adaptions to the innovation might make it relevant to a different or larger market. Such adaptions might be an intentional expansion strategy or an unintended consequence, perhaps of meeting some requirement for the innovation. With this in mind, innovators might need to continue to get additional numbers of adopters just to sustain the same proportion of coverage.

A further consideration is whether there are more than one 'group' of potential adopters. Consider, say, an innovation which is primarily designed for acute care but could potentially be used in mental health services. In such a circumstance, it might be that much of the early adoption is by acute trusts and that this happens at speed, but – while there is some interaction between the acute and mental health services – the nature of the innovation (which is hypothesised as being designed for acute care) means adoption is slower in mental health services. Geroski (2000) suggests that such a circumstance might result in an asymmetric s-curve with a long upper tail.

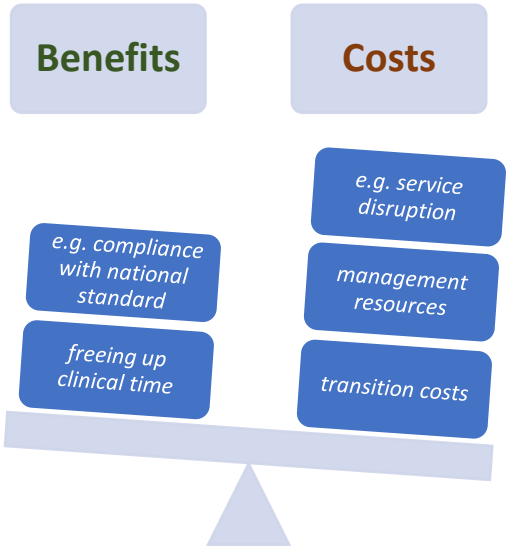
[3] Quilter-Pinner and Muir (2015) Improved circulation: unleashing innovation across the NHS. IPPR.

The market	
Consider the market to be made up of n organisations (potential adopters) := {a_1,…,a_n} *Some defining characteristics of the market:* - *the number of potential adopters* - *changes to number or identify of potential adopters* - *grouping and subsets of adopters* - *the extent to which the NHS is the main market (i.e. private or international)* - *what adaptions to the innovation would be required to make it relevant to an new market*	

A variety of values

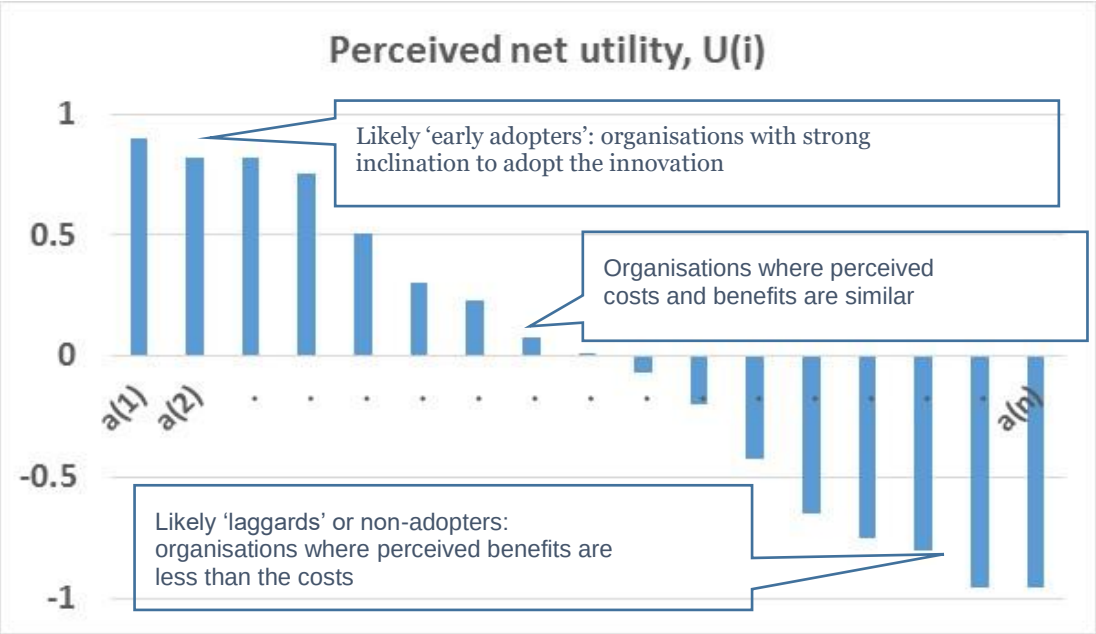
The decision to adopt a new innovation is unlikely to be straightforward. In particular, each innovation will come with a set of benefits and also of capacity and resource requirements to adopt it, including the upfront and ongoing costs to pay for it. This may include the need for retraining, new equipment and wider organisational changes. A decision to adopt an innovation on just this set of considerations will require comparing between potentially diverse dimensions of costs (including non-financial) and benefits and also of trade-offs between current and future benefits and resource demands.

The complexity of the innovation and its implementation is important here. Innovations that require, say, changes to care pathways or workforce configurations (particularly in other departments/organisations) in order to realise the savings can be considered as more complex, and will likely take longer to spread. More generally, a poor understanding of what drives productivity – something that is not exclusive to the NHS (Syverson, 2011) – makes understanding the benefits challenging.

Value proposition of the innovation	
An innovation has a set of: - benefits := {b_1, b_2, …} - capacity and resource requirements for adoption including the cost to pay for it, *p* (which may vary by organisation) := {p_i ,c_1, c_2, …} *Some defining characteristics of the innovation include:* - *the number and complexity of the benefits and costs* - *the cross-department (or budget-holding) nature of these costs and benefits* - *the type and strength of evidence on the value proposition* - *the time period for realising the costs and benefits*	

Across the population of potential adopters, even with equal information about the costs and benefits, there may be quite different conclusions drawn. This may be, in part, due to different personal / organisational priorities for, and perceptions of, the benefits, perhaps influenced by the specific nature or position of the organisation (e.g. current service challenges). For example, some services might place greater emphasis on short-term as opposed to longer-term benefits. It will also be a result of different capacities to meet the resource requirements (e.g. transition costs and management resources).

To demonstrate the importance of this in some of the subsequent sections, one can plot – based purely on randomly generated numbers from an arbitrary, simple distribution – a hypothetical market where those potential adopters – labelled as a(1), a(2),..., a(n) – who consider there to be a net benefit have positive values and those who are not convinced there is net benefit having negative values (see figure below – we return to this distribution later).



So far, the description of the market has implicitly assumed – by and large – that potential adopters are a single decision-making entity. This is likely to be a simplification with each potential adopter in fact containing a number of individuals and groups that have their own priorities and perceptions on the risks and the benefits. Commenting specifically on the NHS, one paper noted, for instance, an apparent disconnect between clinical and procurement departments and suggested aligning incentives for various decision-makers (Heitmueller et al., 2016). Certainly, there is additional complexity if the costs and benefits fall on different departments or budget-holders.

Unlike many other markets, the NHS is comprised of agents (commissioners or providers) acting on behalf of the 'principal' or 'consumer' (the individual patient, or in some cases the clinician).[4] The agent, acting as procurer, may have a different perception of risk to the individual (they may perceive financial risk to be more detrimental than the risk of delivering less clinically effective care). Agents may also have imperfect information about the values, preferences and types of care individuals themselves are demanding. This potential asymmetry can weaken or undermine demand for health innovations, but will also likely add to the variation in willingness to adopt an innovation (Quilter-Pinner and Muir, 2015).

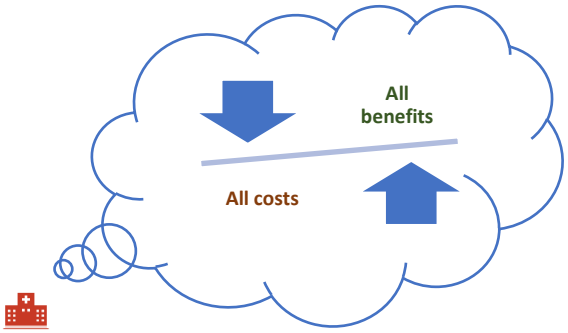
[4] Note this is not the case for some NHS programmes, eg. personalised budgets

However, there may be scope to influence the degree of variation in priorities and perceptions across the potential adopters and the decision-makers within them, so as to make conclusions that potential adopters draw more consistent. National bodies have, for instance, suggested: peer influence, transparent reporting, collaboration, competition and effective marketing from external suppliers (Department of Health and NHS Improvement and Efficiency Directorate, 2011). More consistent communication of costs and benefits across cohorts (i.e. hospitals) and levels (i.e. patient, provider and commissioner) could also reduce variation in perception. The role of information spread in the perceptions of the value proposition is highlighted later in the paper.

Value and cost proposition for potential adopter

Each organisation is influenced by its individual perceptions of, and priority towards,(α) each of the stated benefits so that the perceived benefit for organisation *i* := $\{\alpha_{i1}b_1, \alpha_{i2}b_2, \ldots\}$

Similarly each organisation also has an individual capacity and appetite (β) for the costs of adopting, including the price, *p* and additional resource and capacity requirements := $\{\beta_{ip}p_i, \beta_{i1}c_{i1}, \beta_{i2}c_{i2}, \ldots\}$



The net perceived utility of adopting the innovation for organisation *i* can therefore be considered as the sum of the perceived benefits minus the perceived impact of the costs:

$U_i := \sum_j \alpha_{ij}b_{ij} - \sum_j (\beta_{ip}p_i, \beta_{ij}c_{ij})$

For simplification, the values that organisations place on each individual benefit and cost – α and β – are also intended to capture the extent to which future costs and benefits are discounted.

Some defining characteristics of the perceptions (and variation in them) towards the innovation include the:

- *degree of certainty that the benefits are realised and costs incurred*
- *financial positions of the adopting organisations / departments (and the variation between them)*
- *process for final sign-off for adoption (e.g. involvement of finance department)*
- *funding (e.g. 'block' versus pay-per-activity) and regulatory frameworks of the potential adopters*
- *nature of the potential adopters (i.e. whether it is the purchaser of the innovation or not) and whether support from the user varies by service*
- *recent experience of implementing innovations (particularly when similar)*

Alternative innovations

In deciding whether or not to implement an innovation, a potential adopter should not only be weighing up the costs and benefits of that specific innovation but also should do so against current and future alternatives. While the extent to which demand within health services for a product is affected by changes in the price for a comparable good (i.e. cross-price elasticity) is questionable (Grant et al., 2009) [citing (Ringel, Hosek & Vollard 2002)], this consideration against current and future alternatives adds another dimension of complexity to the decision-making.

The existence of current alternatives is likely to lead to a larger degree of non-adoption, as those that have already adopted the alternative are less likely to switch due to the sunk costs associated with their current scenario. Similarly, where there is high prospect of potentially more beneficial or less costly alternatives, there might be reticence across certain potential adopters to commit to implementing the current innovation. Adopters may therefore anticipate alternatives on the horizon, without full information about said future alternative (the future innovation's features, costs, usability and sustainability), and therefore be unable to make a fully informed comparison with an existing innovation, or the opportunity cost of waiting.

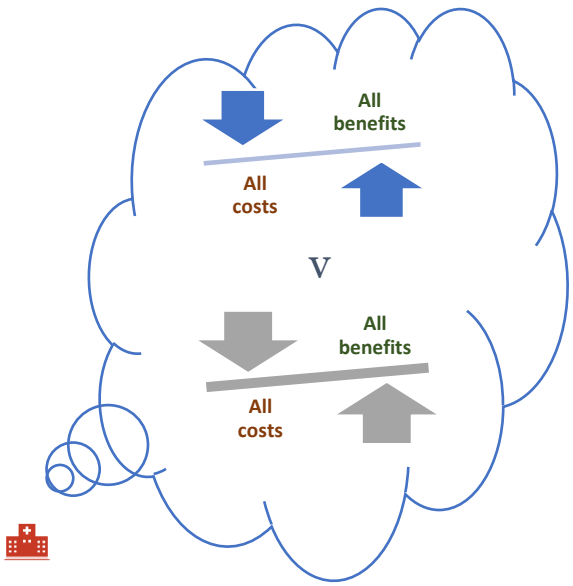
Adoption decision-making and the 'tipping point'

A (crude) simplification would be to assume that where $U_i > 0$ then the organisation *i* will adopt the innovation as the benefits outweigh the costs. However, it is likely that the requirement will be more demanding, as U_i will have to be sufficiently positive to outweigh:

- any sunk cost bias towards the existing process or technology used by the potential adopter
- any perceived net utility of current or future alternatives (U_i', U_i'',…), i.e. $U_i > U_i'$, U_i'',…

There may be a strong time-dependency here as the perceived net utility of an innovation will change as emerging evidence appears on the actual costs and benefits. Moreover, over the course of time, expectations on future competitor innovations may change, as such we can characterise the tipping point for deciding to adopt being, at time *t* for organisation *i*:

$$U_{it} > \max\{0, U_{it}', U_{it}'', \ldots\}$$



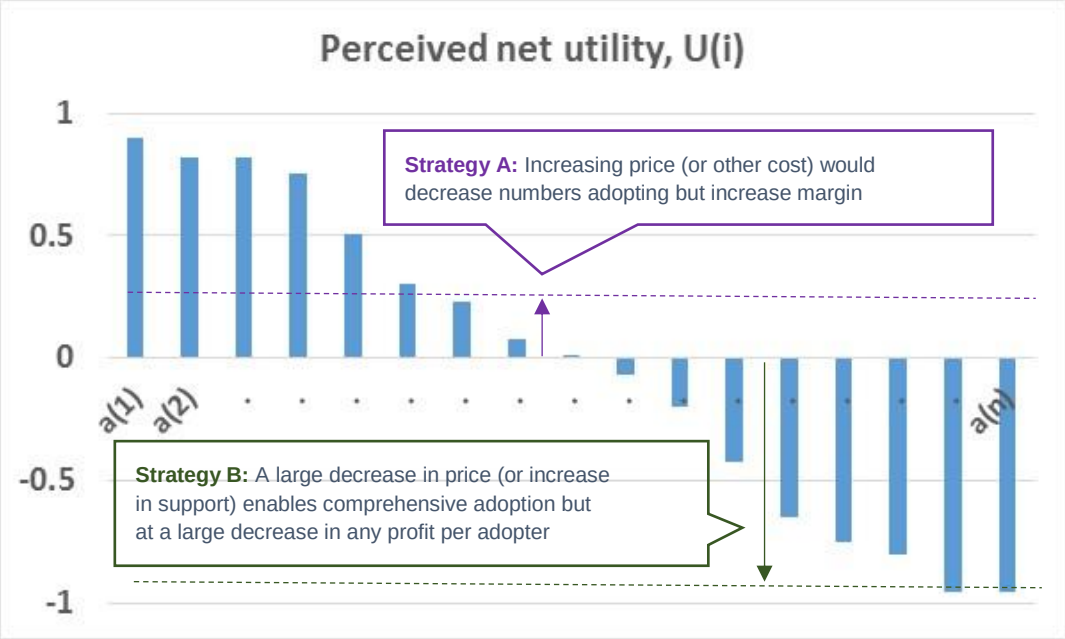
Some defining characteristics of the decision-making include:

- *the extent of, and timelag since, any alternative innovation was adopted*
- *the scope for future alternative innovations to be marketed*
- *the type and strength of evidence on the different innovations*
- *the desirability of the status quo (e.g. any regulatory incentives to adopt a new innovation)*

Flexible pricing, tailored support and evidence

For most innovations there is a non-negligible level of resource required to provide potential adopters the knowledge and support they need to take up the innovation. Potential adopters may also require a certain level or type of evidence before committing to the innovation. Some of these 'costs' are likely to fall on the innovator.

Policy approaches often assume that there is a willingness from both the system and innovators to achieve wholesale adoption of innovation. However, this is not always the case with, for example (as described below), potential circumstances where an innovator might rather maximise profits by selling at a higher price to more willing adopters. Similarly, they may also not feel they have sufficient capacity to support uptake in some more resource burdensome potential adopters; or may do so but at a slower pace than they originally wanted.



For simplicity, if we first assume – as Grant and colleagues did (2009) – the innovator is profit maximising (in the broadest sense such that prestige of broad adoption is correlated with hypothetical profits), then the key consideration for the innovator is whether the costs it bears for broader adoption are outweighed by the profits. For simplicity, if we first consider just the price charged to potential adopters, and further assuming that the innovator is required or chooses to set a consistent price, then it uses its knowledge of the willingness to pay across the market to set a price which maximises net profits (the sum of prices paid minus the costs of supporting adoption). At the extremes, if the variation in price sensitivity between organisations is:

- **Large** then the innovator may be incentivised to charge a high price to keen potential adopters and not seek a more comprehensive scale of dispersion (consider strategy A).
- **Limited** then the preferred strategy for the innovator may be to set the price at a level which seeks more comprehensive coverage (strategy B).

However, such changes in price may have to be considerable. A paper by RAND suggested there is good evidence that in health sectors price changes have limited effect on demand (i.e. low own-price elasticity) (Grant et al., 2009; Ringel et al., 2002).

That said, the innovator will be able to vary at least some of the support given, or price charged, to adopters to achieve its goals. One area where variable prices might be considered fair and broadly preferable is around addressing economies of scale given

smaller organisations might derive less benefit or have less capacity to implement (Heitmueller et al., 2016).

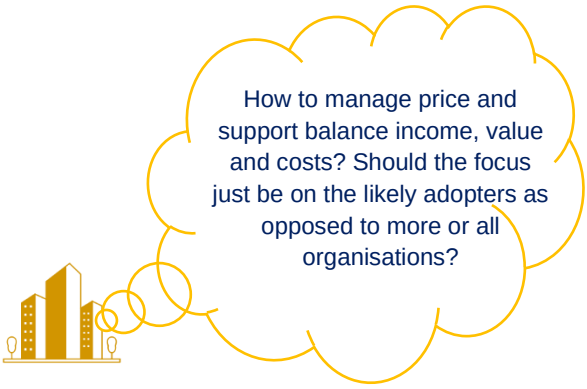
Of course, many innovators will be motivated by other things in addition to – or instead of – profit. However, the arguments outlined above still hold if we substitute the terms above on profit and income with instead, say, improvements in health care. Maximising the latter, for instance, may require focusing efforts away from organisations where implementation might be particularly resource heavy (and so hinder more time- or cost-effective improvements elsewhere). Of course, a particular innovator may be motivated by having a consistent, comprehensive health care service so that each and every potential adopter can use their innovation. In such instances, the innovator may be motivated to manage the market in line with some of the principles set out below around 'oversight intervention'.

Innovator intervention

The innovator is separately seeking to maximise its own utility (V), including profit and its valuation :=

$$\sum_i (p_i - d_i + v_i)$$

where d_i is the resource required to support implementation in organisation *i*, and v_i is the value to the company over-and-above income from adoption by organisation *i*.



Some defining characteristics of the incentives for innovators include:

- *the capacity of the innovator to deliver bespoke support or evidence to adopters*
- *the priority placed on seeing widespread coverage as opposed to demonstrating it works; more generally the innovator's "goal"*
- *short-term income requirements of the innovator*

The value that an innovator derives from having their innovation adopted may, in some instances, be characterised as having diminishing returns. For instance, the prestige of having an innovation adopted in two organisations might not be twice that of having it in just one organisation. In generalised terms, according to the notation above, in such instances $V_{n+1} < V_n*(n+1)/n$, where the next adopter would be the $n+1^{th}$. That said, you can also hypothesise that there are instances where there are increasing returns [i.e. $V_{n+1} > V_n*(n+1)/n$, where the next adopter would be the $n+1^{th}$].

However, it appears fair to assume that most will have some potential limiting factor on the scale and rate of adoption, including capacity to provide support. The size and structure of the innovator may be important here (Grant et al., 2009); while smaller innovators may be more flexible (and indeed some companies spin off units when they grow too large (Fritsch and Meschede, 2001), large organisations can take more financial risk (Dewar and Dutton, 1986). The implication is, therefore, that the NHS may want to analyse the size and structure of the innovator to give some insights into its likely behaviour. And, similarly, innovators need to assess whether they have the appropriate capacity to meet their goals.

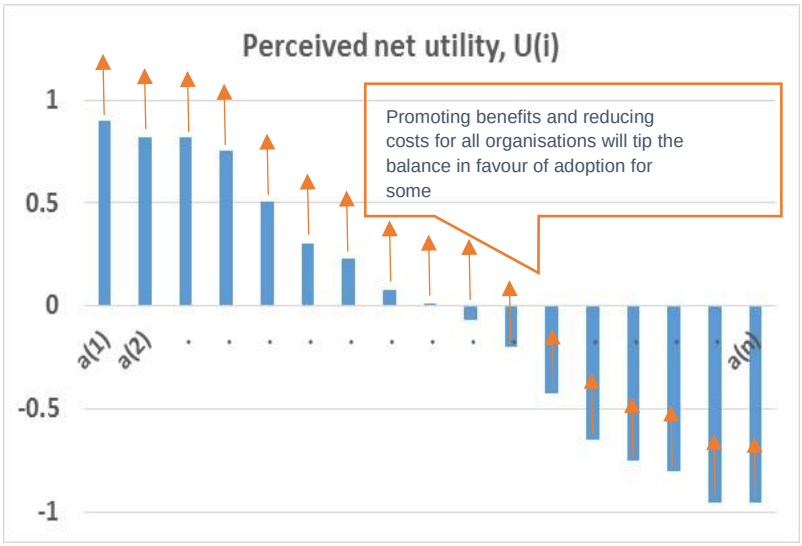
Oversight intervention

While this think piece has already mentioned the role of national bodies, the levers available to oversight organisations warrants further discussion. These bodies – such as NHS England & NHS Improvement – might want to intervene to get the most preferable level of adoption of a particular innovation for the NHS as a whole. For instance, when a national body considers promoting stability, consistency of care or cost-effectiveness for the health service as a whole, then this may have implications for the preferred level of adoption of specific innovations.

In the first instance, oversight bodies may want to make use of the bargaining power offered by the NHS as a whole relative to individual organisations. At the very least, they will want to ensure that individual organisations do not lose out as a result of any asymmetry in information between innovator and potential adopter. Grant and colleagues (2009) suggest, for instance, that publishing price comparisons might ensure a more transparent market.

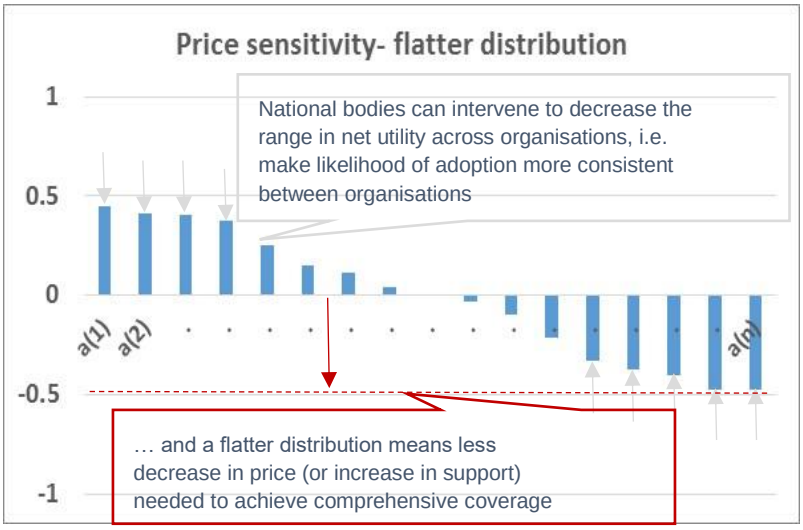
In addition, there are general tactics which would help increase the enthusiasm for potential adopters across-the-board (see figure below). One strategy might be to negotiate national prices which would be lower than the average had adopters negotiated separately but, as the upside for the innovator, would likely lead to a greater number of adopters. Others include:

- using co-payment (Grant et al., 2009) or other mechanisms to reduce cost implications (Heitmueller et al., 2016)
- where needed, working with innovators to develop a better 'value proposition' for the NHS
- relying less on upfront capital or revenue investment, and more on taking income from downstream revenue savings (Department of Health and NHS Improvement and Efficiency Directorate, 2011)

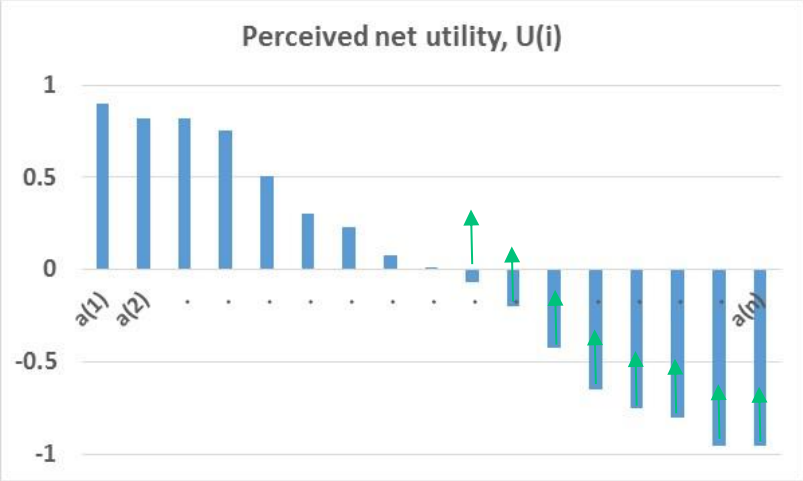


- mandating adoption or including targets
- publishing uptake of recommended innovation to improve the cultural imperative to adopt innovation (Heitmueller et al., 2016).

Another key strategy may be to reduce the variation in willingness to adopt across the potential adopters (see figure adjacent). Some of the interventions outlined above – including sharing costs and increasing transparency – may help to this end by reducing the extent of the variation in price (or other cost) sensitivity across potential adopters. The benefit would be that innovators are then more likely to set their level of price and support to get more comprehensive coverage, rather than just benefit from picking the low-hanging fruit in a more varied market.



The oversight bodies could also specifically target the potential laggards (see figure adjacent). Interventions could include: using tariff flexibilities at local level to support diffusion and providing direct support to help the NHS with implementation (Department of Health and NHS Improvement and Efficiency Directorate, 2011). A softer approach might be to stimulate increased bottom-up pressure through, for example, patient and public demand for best practice (Department of Health and NHS Improvement and Efficiency Directorate, 2011).



More generally, individual NHS organisations should be incentivised to achieve overall policy goals. Current payment frameworks, which often reimburse based on activity as opposed to outcomes, may create a barrier here although there are many examples of incentive schemes – financial or otherwise – already in the NHS which could help to this end.

National intervention	
Oversight bodies will usually want to maximise the aggregate utility across the NHS of the organisations but may also have additional objectives which may mean: - they have different weights to capture the various appetites for each of the potential costs and benefits (α'_{ij}, β'_{ij}) - there are additional benefits (b') and costs (c') The utility function for an oversight body can therefore be characterised as: $\sum_i (\sum_j \alpha'_{ij} b_{ij} - \sum_j (\beta'_{ij} p_i, \beta'_{ij} c_{ij})) + \sum_k b'_k - \sum_k c'_k$ Where the appetite for costs and benefits of the oversight body is the same as for the individual organisations then this can be simplified to: $\sum_i U_i + \sum_k b'_k - \sum_k c'_k$	

Some defining characteristics which may determine when national intervention is most appropriate include:

- *the level of inequity in care if the innovation is not adopted at scale*
- *the extent to which the costs or benefits fall outside the adopting organisations (i.e. cost-effectiveness for the health and care services as a whole)*
- *the increased purchashing power of larger groups of NHS organisations*
- *benefits for NHS workers from having consistent use of the same innovation*

Information spread

Potential adopters need to have a certain level of understanding of an innovation before deciding on whether to adopt – this may cover knowledge of its existence, sufficient understanding on how to use it and also the costs and benefits of adopting it. There are (at least) two key ways in which such information can be spread:

- interpersonally through a common source, perhaps general marketing or a user manual; and
- person-to-person, such as on lessons from early adopters, which could be characterised as word of mouth information (Geroski, 2000).

In reality, there is probably likely to be a mixture of information sources, combining both common source and word-of-mouth. However, understanding the likely nature in which information about the innovation spreads may help understand, predict – and even influence – the scale of adoption. For instance, we can hypothesise that significant non-adoption may be the results of, for example:

- some potential adopters not being receptive to common source information;
- the existence of silos of potential adopters meaning there are limits (or boundaries) to word-of-mouth communication; and
- an increasing quantity of less-than-positive word of mouth information.

On this latter point, it is conceivable that early adopters are zealous about the innovation and so particularly positive which, in turn, may drive a steep increase in the rate of adoption. However, subsequent adopters, who may have been less enthusiastic from the outset, might be less favourable when passing on information to those still yet to adopt and, therefore, cause a decrease in the rate of adoption. This dynamic would produce an 's-curve'. As discussed earlier, different adopters may require different information (evidence) with each type of evidence having different cost and time-lags for the innovator to subsume.

In terms of potential interventions to stimulate information spread which may help to get more comprehensive adoption could be to use:

- "breakthrough systems" in which large numbers of teams from services can learn from recognised experts and (afterwards) teach themselves; and
- an "evaluation system" that captures and disseminates effective practice e.g. in hospitals (Grant et al., 2009)

Discussion

Our framework builds on ideas put forward by RAND Europe in relation to innovation adoption in the NHS and innovation price (Grant et al., 2009). That research highlighted, for instance, differences in the price sensitivity of the various potential adopters might mean that innovators are incentivised to tailor their price and adoption strategy to focus on only a subset of (less price sensitive) targets rather than for more comprehensive coverage of their innovation. However, our framework highlights a broader range of considerations.

It is evident from the general economics literature that a 'central feature of most discussion of technology diffusion is the apparently slow speed' of adoption (Geroski, 2000). This may be particularly marked in health services, where many policies have created 'innovation fatigue' (Grant et al., 2009). Indeed, comments on slow nature of adoption are apparent in past discourse about the NHS including, for instance, "although day case surgery has been practised for nearly 40 years and is advocated by government reports and by the Royal College of Surgeons, its adoption in the UK has been fairly slow" (Morgan and Beech, 1990).

However, that is not to say that a better understanding of the incentives within the market could help deliver greater scale and spread of innovation when this is to the benefit of the health service. As a starting point, there needs to be a recognition that decision-making is likely to be extremely complex and that national bodies, innovators and potential adopters are unlikely to have the same appetite for adoption. In such instance, ensuring information and incentives are as consistent and transparent as possible seems an important starting point.

Acknowledgements

Many individuals kindly contributed to the wider study, who are thanked in the acknowledgements of the main report. Special thanks go to Amanda Begley (Director at the NHS Innovation Accelerator) and Laura Boyd (Deputy Director) for their input into this think piece and to colleagues, including Professor John Appleby, Sophie Castle-Clarke, Nina Hemmings and Rachel Hutchings, who provided valuable comments on an earlier draft.

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