The Role of Behavioural Science in Promoting Productivity and Innovation in Regional and Local Government

Main Report

Place Based Economic Recovery, Regeneration and Resilience Network

September 2022

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Executive Summary

This report investigates the role of behavioural science and nudging in promoting productivity and fostering innovative practices within the context of the UK's 'Levelling Up' local and regional economic development agenda. A literature review is conducted to this end.

This report finds positive evidence for using behavioural science in promoting productivity, mixed evidence in fostering innovation, and positive evidence in promoting adoption of innovative practices and technologies. However, in all instances, the efficacy of these interventions seems enhanced by, or contingent upon, the use of non-behavioural policy tools, such as financial incentives. Furthermore, in some contexts, behavioural interventions appear sub-optimal compared to financial incentives in fostering productivity and innovation.

Therefore, the central recommendation of this report is that behavioural science appears to offer some benefits for policymakers and businesses *in conjunction* with traditional approaches.

Acknowledgements

This research was generously supported by contributions from the University of Leeds, Leeds Beckett University, Bradford University, and the University of Huddersfield.

Introduction

Perhaps second only to completing the United Kingdom's (UK) withdrawal from the European Union (EU), the flagship policy of Boris Johnson's Conversative Party during the 2019 General Election was regional 'levelling up' (Payne, 2021). This agenda seeks to redress long-term spatial inequalities in economic prosperity across the UK (McCann, 2016), with particular emphasis placed on closing the gap between London and the South-East, and the North of England (Fransham *et al.*, 2022).

Key to accelerating economic development in the regions, relative to London and the South-East, is promoting productivity growth and innovation in target regions (UK Government, 2022). With innovation being vital to productivity growth (Huggins, 2018), and regional productivity highly correlated with various social and economic outcomes, such as disposable income and life expectancy, promoting regional development through these economic vectors has importance beyond political ambitions (Fransham *et al.*, 2022).

Yet productivity growth *across* the UK has historically been low – as acknowledged within the 'Levelling Up' white paper, with regional inequality between London and the South-East, and the rest of the UK, historically driven in-part by *absolutely* higher productivity in the former regions (UK Government, 2022). This demonstrates two challenges concerning productivity and innovation within UK regional development. *Firstly*, raising *absolute* productivity within local and regional economies in the UK. *Secondly*, inducing productivity growth and fostering innovative economic practices across the *whole* of the UK.

The UK's 'productivity puzzle,' is nuanced and demands a litany of economic interventions to resolve (Fernald and Inklaar, 2022; Huggins, 2018; Strauss, 2021; Tuckett and Dinh, 2019). The growth of information technologies and other labour-saving technologies, and *innovation* more broadly defined still, *may* be a solution to the productivity challenge (e.g., Acemoglu and Restrepo, 2018; Romer, 1990, 1986). Yet, the failure of these innovations to show up, "the productivity statistics," as Robert Solow (1987) famous quipped, reveals that productivity is not merely a matter of *innovating*, but innovative practices being *used in productive ways* (e.g., Acemoglu and Restrepo, 2017; Beer, 1979; Frey, 2020; Huggins, 2018).

Two further challenges face the UK's 'Levelling Up' agenda, as argued by Fransham *et al.* (2022). *Firstly*, following decades of underinvestment, many regions lack the capacity to utilise large-scale investment appropriately and efficiently. A programme of development based *solely* on capital investment will struggle without pre-existing institutional capacity. *Secondly*, the competitive system for localities and regions to bid for funds demands bidders *do more with less*, less they risk losing investment opportunities. For Fransham *et al.* (2022), this second challenge merely compounds the first, as those regions with the time and resources to develop a sophisticated bid – owing to pre-existing regional inequalities – stand a greater chance of receiving investment.

These three challenges – 1) promoting adoption of productive and innovative practices; 2) building institutional capacity; and 3) allowing localities and regions to do more with less – *may* represent an opportunity for behavioural science to support 'Levelling Up.' Where innovative practices or productive programmes *already exist*, behavioural science may be able to 'nudge' resistance to their adoption, and where these practices need to be fostered, 'nudge' incentive structures. Where business and government procedures can be simplified or streamlined to produce an outsized benefit, behavioural science and *choice architecture* may help build institutional capacity. *Finally*, where investment programmes – such as pay increases or grants – can be more effective when framed differently, behavioural science may be able to help firms and local government do 'more with less.' All these strategies, being inexpensive, may be worthwhile components within the 'Levelling Up' agenda.[1]

Yet, the emphasis by the UK Government and others on the importance of substantial economic investment and an appropriate legislative agenda, supported by a torrent of data and research demonstrating the scale of regional inequalities (UK Government, 2022), *may* suggest this is not a suitable domain for behavioural science. Behavioural science interventions typically have small effect sizes (e.g., Beshears and Kosowsky, 2021), and in recent years have come under fire for 'crowding out,' and 'distracting' from more substantive policy in a variety of domains (Chater and Loewenstein, 2022; Harford, 2022). One should be cognizant of this risk occurring here.

The objective of this report is thus to review the outstanding evidence on behavioural science as a strategy for promoting innovation and productivity. The report will evaluate the findings of the literature within the context of the UK 'Levelling Up' landscape to provide an appropriate assessment and recommendations. The structure of the report is as follows. *Firstly*, there is a brief overview of the literature search methodology. *Secondly*, there is a review of the literature itself, which is split into interventions to promote productivity, and interventions to promote innovation. *Thirdly*, there is a discussion of the literature findings in the context of 'Levelling Up,' and regional development, with some attention given to the challenges of scaling behavioural interventions. *Finally*, this report concludes.

[1] Also see Huggins (2018) on the role psychology can play in fostering innovative thinking and uptake of innovative ideas, and the Behavioural Insights Team (BIT, 2021) on the use of behavioural insights for employee motivation.

Methodology

Reviewed literature was gathered using a library scraping tool called *Elicit*. This programme utilises natural language processing (NLP) and artificial intelligence (AI) to allow a researcher to search through a compendium of online academic resources using research questions (RQs) alone. As such, *Elicit* avoids challenges associated with traditional systematic literature review (SLR) methods, such as identifying keywords and filtering strategies. Indeed, as most research projects begin life as a RQ or series of RQs, tools such as *Elicit* can provide much more rapid and interpretable approaches to literature such than traditional SLRs.

As with SLRs, AI-supported literature search still risks missing literature, either through a) system oversight (e.g., failure to properly index material; absent keywords/poorly formulated RQs); or b) researcher oversight (e.g., failure to identify appropriate keywords (or RQs); oversight when manually reviewing results). Literature identified via this method, therefore, is used as an initial starting point, with additional materials referenced within identified materials drawn into the analysis as and when appropriate.

A common disadvantage of SLRs, especially when searching large databases, is an overwhelming number of search results. Natural language search using *Elicit* results in substantially less results than keyword searches in large libraries (e.g., hundreds *vs.* thousands), and so all results were manually reviewed, with only the most relevant material utilised in this report.

Four RQs were used in the literature search: 1) "*Can Behavioural Science Increase Productivity?*"; 2) "*Can Nudges Increase Productivity?*"; 3) "*Can Nudging Promote Innovation?*"; 4) "*Can Behavioural Science Promote Innovation?*" These RQs lead several dozen research articles/chapters to be identified, and these constitute the basis of the review in the following section.

Review of Literature

Can Behavioural Science Increase Productivity?

The role of behavioural science within organisations has been debated for several decades (e.g., Beer, 1979; Lorsch, 1979; Shortell, 1983), and has seen a renewed vigour in recent years (e.g., Bolton and Newall, 2017; Ebert and Freibichler, 2017; Mažar and Soman, 2022; Rubenstein, 2018) as behavioural science applications have become more standardised as part of what Ebert and Freibichler (2017, p. 1) dub "Nudge Management."

Debate persists along a major axis. On the one hand, behavioural science applications often focus on individuals, while organisations consist of many individuals who influence and interact with one another in highly complex ways. For instance, organisations can have distinct cultures and values which are irreducible to any single individual *within* the organisation (Shortell, 1983). The notion that simple nudges and behavioural science interventions can have predictable and sustained effects on individuals within organisations – which ultimately spurs productivity – is said to be unrealistic, or at least limited (Bolton and Newall, 2017).

On the other hand, the presence of complexity and context within organisational practices does not necessarily mean behavioural science becomes *ineffective* (Rubenstein, 2018). Lorsch (1979) has argued that while complexity *does* matter, it is too easy to discount tools such as behavioural science because of it. *Equally*, Lorsch (1979) does express concern that the simplicity of behavioural science can lead some to view behavioural science interventions as easy 'solutions' which ultimately may not work. Rubenstein (2018) argues that, despite apparent complexity, there will likely still be opportunities for behavioural science interventions to be used effectively, again because complex organisational dynamics do not inherently mean that there are not individuals who cannot be influenced to be more productive.

Ebert and Freibichler (2017) embrace a similar perspective in their development of their 'Nudge Management' programme, arguing that despite the multitude of organisations, and complexity contained within, all organisations have operating practices that can be acted upon (i.e., *nudged*) by managers to produce productivity gains. They offer three examples. *Firstly*, they highlight what they call *information bias* – the tendency to seek out more information simply because one *can*, even though that information is unlikely to change anything. They suggest a simple nudge – an organisation-wide standard meeting length – could alleviate this bias by reducing the likelihood of meetings unproductively spilling over because of unnecessary information search. *Secondly*, they discuss the so-called *planning fallacy* – that organisations make plans which are too optimistic, while often later diverging from the plan. They suggest encouraging workers to pre-commit to planned objectives in front of their peers, and adjusting their commitments based on peer feedback, would

alleviate this bias through levering social pressure. *Thirdly*, they highlight broad task inefficiency in organisations. Ebert and Freibichler (2017) argue that often people know what *needs to be done*, but various distractions within an organisation impede progress. They suggest a variety of interventions, from encouraging 'no meeting' days, to changing default email notification settings, could help alleviate distractions throughout an organisation and produce productivity gains.

Yet, in updating older perspectives, Bolton and Newall (2017) urge caution when applying ideas such as 'Nudge Management.' They suggest, returning to arguments made by Lorsch (1979), that there is a danger in seeing simple behavioural science solutions as *the* solution, and downplaying or 'crowding out' more substantiative solutions (see e.g., Chater and Loewenstein, 2022). Furthermore, Bolton and Newall (2017) worry that framing behavioural science as 'scientific policy,' gives a false prestige to practices such as 'Nudge Management,' and may once more distract from practices more likely to deliver meaningful, productive benefits for an organisation. They advocate what they call a 'Goldilocks Zone,' approach, supporting the use of behavioural science for tackling 'low hanging fruit,' but pushing back on the use of behavioural science as a core *part of*, or *replacement of*, an organisation's operating strategy.

Can Nudges Increase Productivity?

Several recent studies (Butle, List and van Soest, 2020; Field, 2015; Zeng *et al.*, 2022) suggest various behavioural science interventions can be induce productivity gains.

Bulte, List and van Soest (2020) investigate how reframing bonuses written into employment contracts given to 400 workers in Uganda increases worker output on a simple task. Reframing followed principles established in prospect theory (Kahneman and Tversky, 1992, 1979) that people are more sensitive to potential losses, than they are to equivalent gains. As such, Bulte, List and van Soest (2020) frame worker bonuses as bonuses *to be lost for not meeting a target* in the treatment group, while the control group receives a standard bonus framing as compensation to be *received if a target is met*. They find under different framing conditions (so-called 'claw-back regimes') that loss-framing leads to an average increase in productivity of around 23.9%. Similar results have been found by Imas *et al.* (2016) on a smaller (N = 83) sample of university students. In this study, framing bonuses as an incentive *to be lost*, rather than *to be gained*, led to a smaller 12.5% productivity increase in a simple task. In a large (N = 8,423) field experiment conducted on data entry workers in India, Kaur, Kremer and Mullainathan (2015) utilise a novel approach to investigating the use of loss aversion on productivity. In this experiment, workers are not offered bonuses, but can choose to work *additional* hours for a standard rate of pay. Participating workers are split into various cohorts who receive their weekly pay on a different day of the week (which is set randomly for different groups). Payday thus serves as a threshold to establish overtime as something which can be *lost*. Kaur, Kremer and Mullainathan (2015) find that worker productivity

significantly increases in days immediately before payday, while returning to normal levels after payday, with an average output increase attributable to loss aversion estimated at 8% of output. *Finally*, in another field experiment conducted by Hossain and List (2012) on a small (N = 118) group of Chinese workers in an electronics factory, loss aversion framing of bonuses significantly increased worker productivity, but only by 1%.

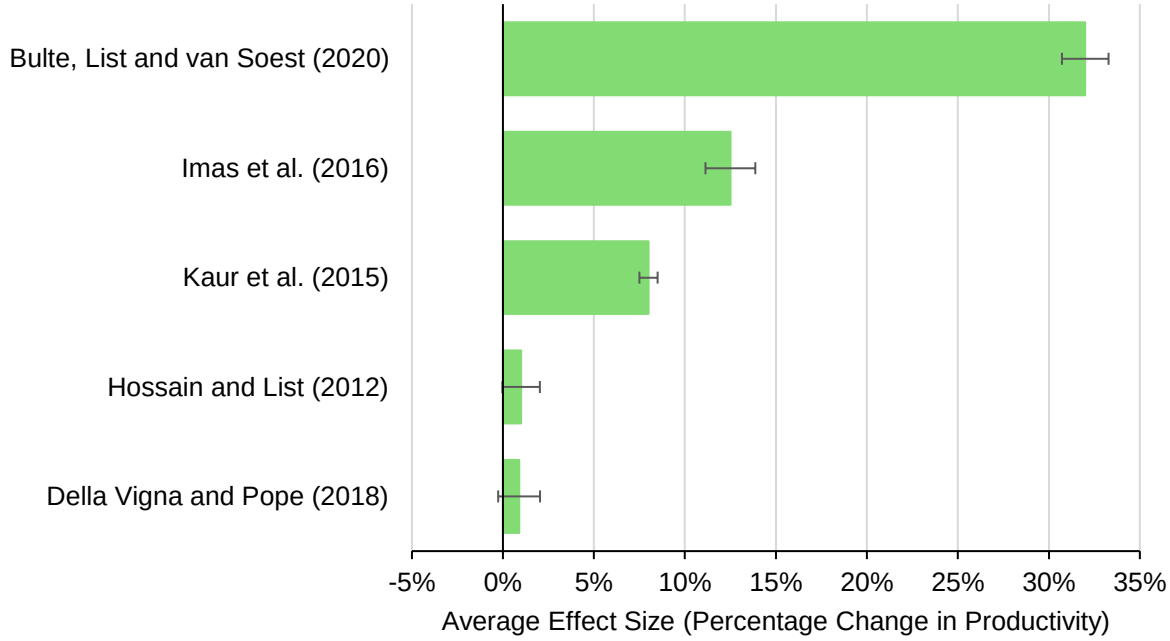

Figure 1: Average Effect Sizes (Percentage Change in Productivity) from Loss Aversion Framing

In each study (summarised in Fig. 1), employee welfare is considered as an important policy factor. Various authors are aware of the potential harm 'incentivising' pay by threatening losses can cause. Yet, each study finds positive evidence in terms of welfare benefits, with broad conclusions that loss-aversion-framed contracts serve as commitment devices (Imas *et al.*, 2016), make potential compensation more salient (Kaur, Kremer and Mullainathan, 2015), and allow employees to plan their tasks more effectively (Bulte, List and van Soest, 2020). Yet, perhaps with the exception of Kaur, Kremer and Mullainathan (2015), these studies remain small in terms of their sample, and *all* involve employment tasks which are simple, physical and repetitive (e.g., folding envelopes, Bulte, List and van Soest, 2020; skewering items, Imas *et al.*, 2016; data entry; Kaur, Kremer and Mullainathan, 2015; component assembly, Hossain and List, 2012). These studies are thus potentially limited in their applicability to jobs where productivity is harder to quantify (e.g., the service sector, knowledge work). Furthermore, while a behavioural mechanism (i.e., loss aversion) does appear to drive this productivity increase, the variability of the productivity increase suggests the *amount* of compensation is

still a significant factor. For instance, in Kaur, Kremer and Mullainathan (2015), where there is no *additional* compensation, only the *opportunity* to earn more at a standard rate, productivity increases are *comparatively* modest. This is supported by a worthwhile study undertaken by Della Vigna and Pope (2018) which finds that although behavioural interventions – including loss framing – can induce more effort in various tasks, economic incentives remain the greatest motivator. Della Vigna and Pope (2018) find only a slightly positive effect when loss aversion framing alone is used.

Zeng *et al.* (2022) investigate a different behavioural mechanism – social influence – and its impact of productivity within an online content creator domain. The basis of this 'social nudge' intervention draws on a large literature within social psychology regarding social norms and conformity (e.g., Bernheim, 1994; Cialdini and Trost, 1998). They conduct a large (N = 993,676) randomised controlled trial in which video content creators on a large, online platform are randomly assigned to a treatment group which receives encouraging messages and prompts from viewers (i.e., *peers*), or a control group, which does not. Within the study, both the supply of videos (i.e., the number of videos produced) and the quality of videos (i.e., audience engagement) were recorded. Zeng *et al.* (2022) find frequent, encouraging feedback increased the supply of videos (and thus the productivity of the content creator) by 13.21% compared to the control group, with no change in the video quality.

This study contributes a novel perspective on the use of social norms to motivate productive efforts insofar as it examines the use of *peer* feedback, rather than feedback from authority figures such as *managers*. It may therefore represent a novel behavioural strategy for business implementation *beyond* existing management practices. Nevertheless, feedback from authority has also been shown to increase productivity. In a randomised controlled trial examining interventions to promote condom sales for the prevention of HIV/AIDS in Zambia (N = 771), Ashraf *et al.* (2014) find that receiving a publicly displayed 'gold star' reward significantly increased sales by 108%, while financial incentives – though still *increasing sales* – produced a much smaller increase (11.1%). A further randomised controlled trial conducted by Gallus (2017) on *Wikipedia* contributors (N = 4,007) found that symbolic rewards (e.g., on-site badges) significantly increased contributor retention by 20%, and *contributions* to the site (e.g., contributor productivity) by 12.5%, compared to a control group.

These results suggest productivity can be nudged using 'social nudges' implemented by both peers and authority figures. Yet, evidence also suggests various limitations. Ashraf *et al.* (2014) explain the economically counterintuitive result – that financial incentives are less effective than social feedback – by investigating distributions of pro-social attitudes in their sample. They find that the nudge was especially effective for pro-social individuals (e.g., those who care a lot about others, and their opinions), with the domain itself (sexual health for disease prevention) susceptible to attracting these types of individuals. The relatively low impact of financial incentives on productivity may therefore be explained by a sample

containing a non-representative distribution of participant motivations. Other studies *do* demonstrate the importance of financial incentives. For instance, Burtch *et al.* (2018) investigate the relationship between financial incentives and social nudges to encourage online movie reviews. They find that financial incentives lead to *more* reviews than social nudges, though social nudges lead to longer and more detailed reviews. Burtch *et al.* (2018) – much like Ashraf *et al.* (2014) – link this result to some individuals being more susceptible to social influence than others, though they suggest their results show the optimal use of financial incentives *and* social nudges is *in conjunction*. Furthermore, as with loss aversion framing, evidence regarding social nudges covers a diversity of domains, and given the apparent importance of domain and individual characteristics, one cannot necessarily extrapolate these results to different areas of work (e.g., service work).

Can Behavioural Science and Nudging Promote Innovation?

A reasonably compelling body of work exists exploring the role of behaviour in innovative practices, and thus the role of behavioural science in spurring such practices. Potts (2016, p. 1) calls this body of literature (e.g., Bhaduri and Kumar, 2010; Cohen and Jabotinsky, 2020; Morrison and Potts, 2009; Potts, 2016) "behavioural innovation economics."

An authoritative contribution to this literature comes from Morrison and Potts (2009), who distinguish between choice under *uncertainty*, which has been the traditional domain of behavioural science and behavioural economics research since Tversky and Kahneman (1974), and choice under *novelty*, which they argue is the cognitive domain in which innovation occurs. The former concerns acting within a world where elements are known but outcomes are uncertain, while the latter concerns acting within a world where neither all elements are known, nor outcomes certain. Thus, Morrison and Potts (2009) argue that where choice under uncertainty is often about making the 'right' decision, *given what is known*, choice under novelty is about *exploration* and *knowledge discovery* (see Table 1). How an individual goes about exploring novel situations is described by their 'behavioural theory of the entrepreneur,' who is characterised as making efficient, satisficing decisions quickly, rather than deliberating to achieve maximising outcomes. Thus, Morrison and Potts (2009) reject neoclassical accounts of innovative motivations (e.g., incentive-driven innovation), and suggest behavioural accounts (e.g., *bounded rationality*; Simon, 1955) can produce better strategies for encouraging innovation and entrepreneurialism. This is reiterated by Potts (2016), who argues too often economists and policymakers attribute failures to innovative to market-based mechanisms, rather than failures to align incentives with behaviour under novelty.

Bhaduri and Kumar (2010) offer a complementary conceptual account. They draw greatly on Schumpeterian perspectives on innovation, and argue innovation consists of three broad stages. *Firstly*, idea generation. *Secondly*, experimentation. *Thirdly*, application. This framework is used to explore how motivations to innovate emerge and change. Drawing on

Schumpeter's notion of the 'joy of creating,' Bhaduri and Kumar (2010) argue that idea generation and experimentation are almost always driven more by intrinsic motivations to 'create,' 'get things done,' and 'delight in ventures.' It is only during *application* that entrepreneurial motivations become *extrinsic*, and can benefit from strategies such as financial incentives (see Table 1). Thus, Bhaduri and Kumar (2010) argue that focus on financial incentives to foster innovation may be misguided if adequate focus is not paid to initial, intrinsic motivations. This, they suggest, is an opportunity for behavioural science.

TABLE 1: BEHAVIOURAL INNOVATION ECONOMICS 'CRIB SHEET'

Term	Detail
Choice under Uncertainty	This is the standard domain of behavioural economic research, where uncertainties and risks exist within known or stable environments which a decision-maker is familiar with.
Choice under Novelty	This is the domain of behavioural innovation economics and is typically the domain in which the entrepreneur/innovator resides. Uncertainty and risk dominate this domain, and the environment is unstable and unfamiliar. Behaviour is driven by exploration and knowledge discovery.
Idea Generation	This is the intrinsically motivated first stage of the innovation process, where a problem or an opportunity is spotted, and an entrepreneur/innovation is motivated by the challenge itself.
Experimentation	This is the intrinsically motivated second stage of the innovation process, where an entrepreneur/innovator explores solutions to their challenge and is motivated by the 'joy of creating' and desire to 'get things done.'
Application	This is the extrinsically motivated third stage of the innovation process, where an entrepreneur/innovator adapts and alters their solution to a challenge for the purposes of applying the solution to the real world and receiving a benefit – often economic – in exchange.

A final, worthwhile contribution to 'behavioural innovation economics' can be found in the work of Cohen and Jabotinsky (2020). They focus less on the innovator or the entrepreneur, adopting instead a governmental or regulatory perspective, and argue that regulators can rarely – if *ever* – predict the consequences of innovation, or the best regulation *given* innovation. This is because regulators are subject to the same challenges of navigating *novelty* as innovators are. Thus, Cohen and Jabotinsky (2020) argue nudging represents an opportunity for regulators to take a 'light touch' approach to the regulation of novel

enterprises: regulators should 'nudge first,' and only later, once an innovation is better understood, consider more coercive regulation. Through nudging, they (p. 1-2) suggest this, "leaves room for technological developments while allowing the regulators to rely on the 'Wisdom of the Crowd' to move regulation in the most efficient direction."

What applied evidence can be found within the 'behavioural innovation economics,' literature? As the theoretical perspectives suggest, much applied research has focused on using behavioural science to guide incentives. Kremer and Williams (2010) investigate new approaches to incentivising innovative practices. They note that intellectual property rights (IPR) have traditionally been used to 'compensate' innovators for their ideas, but that IPR has the disadvantage of delaying innovation *upon these ideas* through legal and economic restrictions. They also note that publicly funded prizes have been used to promote innovation in society. Here, innovators are immediately rewarded with a prize for their innovation, and the idea immediately enters the public domain. However, Kremer and Williams (2010) argue public prizes do not guarantee all innovators a prize, and thus restrict innovation to those with the upfront capital to pursue a project, and the residual capital to survive *losing* a competition. These can be substantial barriers which *overemphasise* the application stage of innovation – following Bhaduri and Kumar (2010) – and *underemphasise* the idea generation and experimentation stages.

Thus, Kremer and Williams (2010) argue a simple, behaviourally informed approach to incentivising innovation, is to offer smaller but more frequent public prizes. In doing so, upfront costs to innovating are expected to be reduced for innovators, while the risk of losing is also diminished. Sanches and Barbalho (2021) find evidence supporting this strategy. Investigating how governments can 'nudge' innovation via the tax system in the Brazilian auto-industry, they find that providing smaller but more frequent tax incentives on investment in research and development (R&D) leads to a significant increase in automobile manufacturers allocating capital towards R&D.

However, other studies suggest Kremer and Williams' (2010) approach may be too simple. Also investigating Brazilian firms, Barros and Lazzarini (2012) find that *promotion* incentives (e.g., change to job title, more resources for one's team) *in conjunction* with pay incentives fosters more innovative practices within firms than pay incentives alone. This suggests that there may be different ways of engaging extrinsic motivation for innovative ends, beyond economic compensation. However, Barros and Lazzarini (2012) also find that the marginal benefits of promotion-based incentives on innovative behaviours falls quite rapidly, and comes to be 'crowded out,' by economic incentives. Thus, incentivising innovation likely also depends on the structure of an organisation, and the *status* of innovators *within* the organisation, not merely the *timing* of incentives. Framing of incentives may also matter. Ederer and Manso (2013) find, within an experimental setting, that teams who are told their compensation is dependent on *long-term* performance, rather than *short-term* performance

– and who are compensated in accord with these time frames – adopt more innovative strategies, and generally perform better. Though, Ederer and Manso (2013) note that *any* compensation above a baseline, regardless of framing, increases innovation relative to a control group. This finding suggests that one need weigh strategies for increasing *absolute* innovation (such as smaller, more frequent incentives; Kremer and Williams, 2010) against strategies for fostering *desired* innovation (such as emphasising the importance of the long-term; Ederer and Manso, 2013).

Applied research into 'behavioural innovation economics' has also been greatly concerned with fostering *adoption* of innovative ideas once those ideas have been generated. Such a challenge has been seen as a classic challenge of innovation and productivity (Frey, 2020; Huggins, 2018), and – it has been argued – represents an opportunity for behavioural science and nudging. Stryja and Satzger (2019) identify three behavioural biases which they regard as serious impediments to the adoption of innovative information technologies. *Firstly*, the status quo bias may lead people to favour 'how things have always been done,' over new strategies (also see Samuelson and Zeckhauser, 1988). *Secondly*, loss aversion may cause people to resist innovative practices for fear that the new practices may be harmful ('if it isn't broken, why fix it?'; also see Kahneman and Tversky, 1992, 1979). *Thirdly*, framing may cause people to misunderstand the purpose of innovation, for instance, seeing innovative practices as a threat to one's livelihood ('machines stealing my job'; Frey, 2020). Several other authors (Claudy *et al.*, 2015; Neto *et al.*, 2019; Renz, 2021) have also offered these biases as likely impediments to innovation adoption.

In a quasi-experimental setting (N = 821), Stryja and Satzger (2019) find the presence of *any* of these behavioural biases reduces the likelihood of participants using new technologies by 44%. They also find weak evidence (significant at the 10%-level), that nudges in the form of messaging which target these biases increases adoption likelihood. Renz (2021) find corroborative evidence of the impeding power of behavioural biases, but is more supportive of the possibility of nudging adoption. In a randomised controlled trial experiment, Renz (2021) finds that *intentions* to adopt innovative practices are high in *both* the control and treatment group, but *uptake* remains low in the control group. By contrast, targeting loss aversion and negative framing in the treatment group saw a significant increase in *uptake*, bridging this apparent intention-behaviour gap. These studies thus offer worthwhile evidence that behavioural science is important to understanding the *impediments* to innovation adoption. The evidence on the use of overcoming these impediments using behavioural science is more mixed. While Renz (2021) seems to support this assertion, Stryja and Satzger (2019) struggle to.

In sum, there is a vibrancy of ideas within 'behavioural innovation economics,' which could be drawn upon, though empirical consensus is lacking, and context appears important, while further investigation appears necessary.

Discussion

The review of the literature reveals opportunities for behavioural science to inform various business practices and policy approaches, but also several nuances and important considerations.

The framing of monetary incentives to emphasise potential losses over gains does appear to increase the productivity gains from those incentives, without inducing negative welfare effects (Bulte, List and van Soest, 2020), at least within manufacturing-style work. Yet, this intervention still necessitates businesses have monetary incentives they are willing and able to provide. In economically disadvantaged regions, such incentives may not be realistic. The use of social nudges, such as peer feedback and praise, also appears to boost productivity, and this *may* serve as a partial substitute for monetary incentives (Ashraf *et al.,* 2014). Yet, social feedback alone appears to have a limited and diminishing effect, and again, is better as a boost *in conjunction* with monetary incentives, rather than as a replacement (Barros and Lazzarini, 2012).

Therefore, this report recommends serious consideration be given to how behavioural science can be incorporated into incentive programmes, and that local and regional government business development resources should ensure behavioural science tools are communicated to businesses. However, behavioural science interventions should not be regarded – either by government or by business – as singularly *sufficient* to produce productivity growth, as the evidence for this is limited. Within the context of 'Levelling Up,' and the above challenges discussed, behavioural science interventions such as loss framing and social nudges *may* be useful in building *some* capacity within local economies and to authority regions by implementing low-cost tweaks to *existing* incentive programmes. Furthermore, bids for central government funding *may* benefit from incorporating behavioural science strategies to increase the expected return on investment given as part of said bids. Once more, however, the limitations of these interventions must be acknowledged. For instance, evidence supporting these interventions has emerged from studies examining easy-to-quantify work, such as manufacturing, and thus these results may not map onto different sectors, or economies dominated by different types of work, such as service work or knowledge work (Deaton and Cartwright, 2018).

The role of behavioural science within innovation is less clear-cut than some of the interventions discussed to promote productivity. This must be acknowledged as a meaningful weakness of the literature. *Theoretically*, the so-called 'behavioural innovation economics' literature presents an elegant account of how innovation happens from a behavioural and motivational perspective. It is likely true that innovative ideas do not emerge merely as a product extrinsic motivation such as monetary incentives, but also as a product of intrinsic motivation, such as the joy of problem solving (Bhaduri and Kumar, 2010). There is also likely

a broad opportunity for local and regional government to act as a means of communicating innovative new practices and technologies with local business, and to act as a platform connecting local knowledge centres – such as universities – with local businesses, as has been done with various 'anchor institution' projects within the community wealth building space (Brown and Jones, 2021). This may help businesses navigate what the behavioural innovation economics literature has called 'choice under novelty' (Morrison and Potts, 2009).

Taking on this intermediary role may unlock opportunities for local and regional government to further 'nudge,' innovative ideas and uptake (Cohen and Jabotinsky, 2020). However, quite *how* government can do this reveals the *application* difficulties present in the behavioural innovation economics literature. Once more, changes to incentive structure *may* help foster innovative practices (Kremer and Williams, 2010), with a behavioural understanding of how humans respond to incentives and perceive risk aiding in this domain. *Equally*, incentivising *more* innovation does not necessarily lead to innovation which is *desirable* or *economically beneficial* for a community (Frey, 2020), and alternative behavioural science studies do suggest that incentive framing can change whether people prioritise short-term solutions over long-term solutions (Ederer and Manso, 2013). Insofar as there may be a push to quickly build capacity at the local and regional level, and furthermore, collect political capital through showing rapid returns on 'Levelling Up' investment, using behavioural science to reframe innovation incentives to foster short-term innovations may be strategically worthwhile. Insofar as an investment project should seek to promote sustainable and long-term economic development, such a strategy may also be harmful. In this regard, it is difficult to determine the optimal role for behavioural science in promoting innovation, and indeed, behavioural science does not appear to be the 'magic sauce' of innovation, though it *may* be an ingredient.

As noted in the introduction, several scholars regard the challenge of innovation and productivity growth to be less about *innovating new ideas and technologies*, but *adoption of new ideas and technologies* (Acemoglu and Restrepo, 2017, 2018; Frey, 2020). On the question of adoption, the contribution of behavioural science may be clearer and more promising. The behavioural science 'toolkit' of cognitive biases has allowed various scholars (Claudy *et al.*, 2015; Neto *et al.*, 2019; Renz, 2021; Stryja and Satzger, 2019) to identify several biases which seem to impede the adoption of innovative ideas and technologies within organisations. Evidence suggests that nudges which target these biases, such as the status quo bias and loss aversion, can indeed promote adoption (e.g., Stryja and Satzger, 2019). This report therefore recommends behavioural science be seen as a worthwhile tool for interrogating barriers to adoption, and for overcoming these barriers. Yet, as with reframing incentives, it is important to acknowledge that this perspective may be overly homogeneous, assuming adoption challenges arise more so from human fallibility (e.g., failing to understand the benefits of innovative practices) rather than *legitimate* employee objection or concern. Historically speaking, both have been important barriers to technological adoption (Frey,

2020). Therefore, and *once more*, this report caveats this recommendation with the note that behavioural science interventions likely should be used *in conjunction* with a wider programme addressing innovation and is unlikely a panacea to innovation challenges in local economies.

A final contribution of this report is to reflect on the challenge of scaling behavioural science interventions to local and regional government. Throughout, study participation sizes have been given when discussing behavioural science interventions. With few exceptions (e.g., Zeng *et al.*, 2022), many behavioural science studies discussed in this report have utilised extremely small sample sizes *relative* to the populations of local and regional economies such as Greater Manchester or West Yorkshire. It is a well-documented phenomenon within behavioural science that the effect sizes of interventions tend to reduce as an intervention is scaled to a larger population (al-Ubaydli *et al.*, 2021; al-Ubaydli, List and Suskind, 2017; List, 2022), and this phenomenon is likely applicable to all interventions discussed within this report. For instance, several estimates of the effect size of loss aversion framing on productivity have been given in this report (see Fig. 1), and owing to likely scaling challenges, smaller effect sizes should be presumed. This serves as an additional caveat to the use of behavioural science interventions.

Scaling challenges can occur for several reasons, including that the sample and environment in which an intervention is initially tested is often very different from the population and environment in which the intervention is used (al-Ubaydli, List and Suskind, 2017; Deaton and Cartwright, 2017). This is a persistent problem, but does not necessarily invalidate behavioural science results (Soman and Hossain, 2021). A more substantial challenge is that behavioural science interventions are often used *in conjunction* with traditional policy tools, such as monetary incentives. While a nudge – such as loss framing – may scale very cheaply, a traditional policy tool – such as an overtime bonus – may have a substantial scaling cost. As such, the policy *programme* struggles to scale. There is a risk that the cheapness of many behavioural science interventions obscures the true cost of an effective policy programme, leading to over-promising and mis-investment (Chater and Loewenstein, 2022). When evaluating the use of behavioural science within local and regional government – be it for productivity and innovation, or for any number of other challenges, such as health and education – scaling challenges should not be overlooked.

Conclusion

This report has examined the potential role of behavioural science interventions in promoting productivity and innovation at the local and regional government level. Productivity and innovation are key drivers of economic prosperity, and strategies for fostering them have become more important as the UK Government's 'Levelling-Up' agenda has progressed.

This report finds that behavioural science may be a worthwhile tool *in conjunction* with other policy tools, such as monetary incentives, to promote productivity. The framing of incentive programmes, and the use of non-monetary incentives, may bolster productivity gains which come from incentivisation. This report broadly recommends behavioural science be used within a productivity-promoting agenda, though urges caution that some behavioural science interventions – such as social nudges – appear limited, and much of the evidence supporting the use of behavioural science interventions to promote productivity is derived from the manufacturing sector, and thus may not map onto different areas of work, such as the services and knowledge sectors.

This report discusses worthwhile theoretical ideas concerning motivation in fostering innovation, and of the behavioural challenges of navigating novel information. Broadly, these theoretical accounts seem worthwhile for grounding policymaker thinking in terms of the behavioural mechanisms by which new ideas and practices emerge. However, the applied evidence for fostering innovation is much more mixed, and less clear-cut in terms of tangible recommendations. Where behavioural science appears more useful is in tackling barriers to the adoption of innovative ideas. Behavioural science provides a 'toolkit' of cognitive biases which may help businesses understand why employees may not be engaging with new technologies or working practices and can help design interventions to target these biases. Yet, this report also urges caution insofar as cognitive bias may only be one of several reasons hindering the adoption of innovative technologies, and that once more, behavioural science should likely be viewed as only one of several tools for unpicking challenges associated with innovation adoption.

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