provides a potential bridge across which relevant concepts (and tools to support the construction of innovation management routines) might travel from a well-understood field to the newer one of soft innovation.

Part 3 considers some of the implications of soft innovation and its economic and other impacts. It explores some of the key policy issues and also offers some directions for future research – something which, given the economic significance of sectors engaged with soft innovation, is urgently needed. In policy terms, it is difficult to assess whether there is market failure which would justify intervention. On the assumption that policy intervention can be justified, options include tax incentives and targeted soft innovation initiatives, such as labour market stimulation. The main criticism, once again, is that much innovation policy making has hitherto been predicated on models linked to manufactured goods and the processes (especially R&D) which underpin them.

Overall, the book provides a good sketch map, but also recognizes that we are going to need more detail on much of the territory outlined. Soft innovation represents a huge field – everything from copyright industries, all the arts, design and creative industries, through to softer aspects of mainstream business. Developing our understanding will require a full-scale atlas and there is much more scope for in-depth studies. The strength of this book is that it gives us an analytical framework which provides a platform on which others can build; and for policy makers there are some valuable insights to help shape policies targeted towards key sectors. For too long we have relied on the blunt instruments of traditional innovation policy.

References

Cox, G. (2005) *Creativity in Business: Building on the UK's Strengths*, HMSO, London.
National Endowment for Science, Technology and the Arts (NESTA) (2009) *Soft Innovation. Towards a More Complete Picture of Innovative Change*, NESTA, London, July.

John Bessant
Business School, University of Exeter, UK
J.Bessant@exeter.ac.uk

Overcoming complexity and improving the safety of medical systems[1]

Safe patients, smart hospitals – how one doctor's checklist can help us change health care from the inside out, by Peter Pronovost and Eric Vohr, London, Plume, 2011, xxii + 282 pp., US$16 (paperback), ISBN 978-0-452-29686-2

The checklist manifesto – how to get things right, by Atul Gawande, New York, Henry Holt, 2011, xviii + 215 pp., US$15 (paperback), ISBN 978-0-312-43000-9

Improving health care safety and quality – reluctant regulators, by Judith Healy, Farnham, Ashgate Publishing, 2011, xix +328 pp., US$134 (hardback), ISBN 978-0-7546-7644-7

In 2000, two major national reports on safety in health care were published, one in the United Kingdom and one in the United States (US) – both outlining the substantial human and financial costs of treatment-related harm (Department of Health, 2000; Institute of Medicine, 2000). The reports made clear that each year in the UK and the US alone, hundreds of thousands of patients are injured, tens of thousands are killed and billions of dollars are spent on additional health care due to treatment-related harm. In the same year, the Quality of Health Care in America Project, initiated by the US Institute of Medicine, set as one of its goals the reduction of errors in medicine by 50% within five years (Institute of Medicine, 2000). These reports, along with the related media coverage, raised levels of professional and public concern about safety in heath care to all time highs, yet some believed the Institute of Medicine's goal of a 50% reduction in error was overly ambitious.

Health care is one of the last complex, high-technology industries to adopt a systematic approach to safety, and typically relies heavily on the resolve and vigilance of individual clinicians to avoid bad outcomes for the patient (Webster & Grieve, 2005). Although the vast majority of patients clearly benefit from modern health care, and such care may be safer than it has ever been, there remains substantial room for safety improvement – for example, the US Institute of Medicine claims that 'health care is a decade or more behind other high-risk industries in its attention to ensuring basic safety'. Other complex industries, such as aviation, nuclear power generation and high-rise construction, have better applied the science of safety, and health care currently lags behind (Webster, 2005).

Given the call to arms over this problem and the levels of concern, it is heartening in recent years to see the emergence of significant improvements and successful safety approaches in health care, despite the myriad challenges of technological complexity, politics and funding. The story of one of the most celebrated and successful movements to improve health care safety is covered in an accessible and fascinating way in the first two books above. In 2006, Pronovost's group published a landmark safety study in the *New England Journal of Medicine* showing a 66% reduction in catheter-related bloodstream infections in intensive care units – a reduction which saved lives and substantial costs in avoided subsequent medical care (Pronovost et al., 2006). Not only was Pronovost's study published only one year after the Institute of Medicine's five-year goal period, but he achieved a reduction in adverse events that actually exceeded the 50% goal. Pronovost's book, *Safe Patients, Smart Hospitals*, tells the story behind and around this landmark study, and of his continued safety research efforts.

Three years later, in 2009, Gawande's group published a multinational study, again in the *New England Journal of Medicine*, showing a 36% reduction in a host of post-operative complications in a wide range of surgical patients (Haynes et al., 2009). Gawande's book, *The Checklist Manifesto*, tells the story behind this impressive and wide-ranging safety improvement result – again saving many lives and significant costs. Both these landmark safety improvements have been achieved with something as apparently humble and unsophisticated as a checklist – a cognitive aide to ensure that critical steps in medical and surgical procedures are not omitted. However, as both books make clear, checklist design, particularly in complex work environments like health care, is far from straightforward; and designing an excellent checklist is only the beginning in terms of the challenges involved in achieving good compliance with its use during clinical care.

These first two books give the reader an insider's view of doctors changing health care systems from the inside out. The third book, entitled *Improving Health Care Safety and Quality*, by Judith Healy, complements this inside-out view by starting on the outside, at the level of governmental regulation of health care entities, and zooms in to the arena of clinical care and patient safety. Safety approaches must connect in a coherent way from the level of governmental and organisational regulation through all the layers of a health care organisation to the clinical environment where clinicians work and patients are treated.

The moving target of safety

Two principles ensure that what is considered to be an acceptable level of safety in any human endeavour must always be a moving target. First, increased repetition of any activity, even a very low risk one, will lead to increased numbers of accidents and failures. Second, increasing the complexity or sophistication of the technology involved in any activity will increase the risk of accident or failure.

Both principles operate in health care in spades. Advances in medical and surgical techniques have led to ever-increasing specialisation of clinicians who now perform procedures for an ever-widening array of ailments. While this means more people get treatment for more conditions, it also means that the absolute number of accidents and failures is on the rise, even in the face of falling risks due to the refinement of new techniques. Americans now undergo an average of seven surgical operations in their lifetime, with US surgeons performing more than 50 million operations a year. This equates to upwards of 150,000 deaths following surgery every year – more than three times the number killed in road traffic accidents.

The technology involved in medical and surgical therapies also continues to rapidly increase in complexity and sophistication – this means more powerful treatments are available for patients, but also means many new and more dangerous ways in which therapies can fail. Gawande points out the scope of what is now possible in modern specialised health care through fascinating case histories, but also points out the concomitantly wider scope of what can now go wrong.

Hard lessons and difficult questions

Pronovost begins his story of the improvement of safety with the tragic and preventable death of Josie King. This starts him on a journey to answer two difficult questions. How can I make what I do as a doctor safer? And how can I know for certain that things have actually gotten safer and that deaths like Josie's are less likely to occur? Both Gawande and Pronovost arrive at similar answers to these questions – both realise that the complexities of disease, the ever-exploding fields of medical knowledge, and the exigencies of clinical care can make it all too easy for a doctor to miss a symptom, misapply a piece of medical information, or to miss a step during a procedure. Their answer to the first question of how to make this situation safer therefore involves deriving a checklist, based on the most current and complete medical knowledge available, to remind clinicians of critical steps and the order in which they should be completed. Their answer to the second question of how to know whether things have become safer involves the collection of good quality data on the incidence of accidents and failures before and after the

introduction of the checklist in order to definitively detect reductions in adverse events.

Why do doctors need reminding?

To many of the public it may seem surprising that highly trained doctors should need something as pedestrian as a checklist to remind them how to do their jobs – after all isn't that what they are well paid for? But medical checklists are not the same as a checklist to make a cake (a recipe) or tune your TV (an instruction manual). Many aspects of particular procedures in medicine are not standardised and this is because many doctors do not agree on what is the optimal therapy in a given situation. This is partly due to the vast amount and technical nature of much medical knowledge, making a complete summary of this mass of information into a single list of easily understood steps difficult.

Doctors themselves can be sceptical of the value of checklists – they are experts in their fields, and many do not appreciate having their practices questioned when they have been successfully treating patients 'their way' for many years. Finally, even completed, agreed-upon, knowledge-based medical checklists should not include every single step in a procedure – after all, such checklists are to be used by experts not novices. The checklist must include the critical steps, or the steps where omissions or errors are known to occur, but must not overwhelm the user during a time when he or she is engaged in treating the patient – in this sense a medical checklist is a kind of cognitive safety net, guiding and supporting the actions of the clinician.

Getting the balance of detail and simplicity just right isn't easy and Gawande draws on fascinating lessons from the high-rise construction and aviation industries in order to develop and refine his surgical safety checklist. For example, from medieval times most buildings were constructed using Master Builders – these were experts who designed the building, engineered the components and oversaw the construction. But, as Gawande points out, by the middle of the twentieth century Master Builders no longer existed in this sense – rapid advances in every stage of the construction process had overwhelmed the ability of any one individual to master all of them. Instead the design, engineering and construction processes fragmented into many specialities and sub-specialties in order to deal with the complexity brought about by the new technological developments. Modern high-rise construction is coordinated through a large web of structured checklists, each one tailored to the needs of the specialist working in his or her area. The specialists' checklists, in turn, are coordinated with master checklists involved in the oversight of the building project as a whole. Certain steps on a master checklist further up the line cannot proceed until tasks on the specialist's checklist are recorded as having been completed satisfactorily.

While learning about the use of checklists in construction, it became apparent to Gawande that health care was still operating in its Master Builder phase – despite the explosive technological advances in all branches of health care, doctors remain essentially lone Master Physicians taking almost sole responsibility for the care of their patients, in a way relatively uncoordinated with the other specialists involved in their patient's care. The technological advances and specialisation has occurred in health care, just as it did in the construction industry, but health care has yet to adopt a structured checklist approach to coordinate and manage the complexities

involved. To Gawande, checklists in health care now seemed not only like a good idea, they seemed inevitable, and on a wider scale than are currently being used.

The politics of compliance

Compiling an evidence-based checklist is only the beginning for saving lives. A significant challenge may then be involved in getting doctors to precisely follow the requirements of the checklist. This is not because doctors care little for their patients, but because there can be genuine doubt about whether a simple checklist will work, and whether it is worth the bother and cost involved. A checklist that is perceived as hindering a doctor completing a procedure may mean he or she has less time to treat other patients. In addition, all health care resources are finite, and a checklist that increases the cost of treatment may mean fewer patients receive care. However, these perceptions of the disadvantages to following the steps in an evidence-based checklist often do not consider the costs of treatment-related harm. Injuring and killing patients during their treatment is an extraordinarily expensive and inefficient way to operate a health care system, to say nothing of the human suffering involved – it is therefore important to consider the savings side of safety initiatives when considering costs.

Pronovost's five-step checklist for avoiding catheter-related bloodstream infections involves simple measures such as the doctor washing his or her hands, wearing a sterile gown during the procedure and disinfecting the skin before catheter insertion. However, even these relatively simple measures were not initially met with full compliance. Some doctors thought a certain level of bloodstream infection (and consequent patient death) was simply the cost of the use of an invasive technology like central venous catheters, that the rates of infection could probably not be reduced, and that despite this toll the benefits still outweighed the consequences. Pronovost disagreed, eventually gaining sufficient compliance with his checklist and collecting sufficient high-quality data throughout intensive care units in the State of Michigan to demonstrate beyond doubt that the checklist worked spectacularly well. Rates of bloodstream infection in hospitals using the checklist fell to almost zero, saving an estimated 2000 lives and approximately US$200 million a year!

Patient-centred health care

Models of modern patient-centred health care put the patient at the very centre of many concentric rings of influence and activity. In the next ring out from the patient are the doctors and clinicians who deliver patient care. Moving out further we find hospital procedures, managerial influences, certification agencies, guidelines from regulatory bodies and so forth. Healy's book starts at the very outer ring of influence, and talks about the changing nature of regulatory bodies, then moves inward to the patient, peeling back each of the concentric rings of influence like layers in an onion.

Health care was once governed centrally by the professional bodies of the clinicians involved and the government bodies that paid for hospitals. Starting in the 1980s, market forces were introduced into the health care systems of many first world countries in an attempt to gain efficiencies which it was presumed would come about through hospitals competing with each other to deliver care to patients – thus the pendulum of regulation swung for the first time from centralised to

decentralised regulation. However, as the concepts of patient-centred care became more prominent and the extent of treatment-related harm began to emerge, it became clear that a decentralised health care system was slow to respond to such concerns, and new ways to regulate the health care system were sought.

New agencies for safer health care were created in many countries and these began to form networks of relationships with existing regulatory bodies, old and new. The result is what is now called meta-regulation, in that many agencies and regulatory bodies essentially negotiate for desired regulatory requirements. Healy proposes that responsive regulation is seen as the solution to the long-term achievement of effective health care regulation – an approach that pushes the regulatory pendulum back towards the middle between centralised and decentralised regulation. A responsive regulatory framework applies a wide range of mechanisms to those involved in health care, from soft and collaborative mechanisms to encourage desired actions, to hard enforcement mechanisms to require them. However, the central safety message in Healy's book is that safety regulation must be a coherent strand that runs through all layers of the concentric rings of influence surrounding the patient in the modern patient-centred view. The safety actions of those in hospitals, such as Gawande and Pronovost, need to be supported and encouraged by regulation and to connect with the regulatory framework outside hospitals to maintain and promote safety.

In conclusion

We are at the beginning of what may be a new era in evidence-based patient safety. For the first time in decades relatively simple interventions are having surprisingly dramatic effects in terms of the reduction of treatment-caused harm in health care – something that many would not have believed possible only a few years ago. We are beginning to understand how to change the operation of health care organisations for the better – reducing injury, death and costs. Based on the definitive results discussed above, it now seems that the US Institute of Medicine's goal of a 50% reduction in medical error is not so ambitious after all – albeit that gains of this magnitude have not yet been achieved across the board in health care. Given more responsive regulation that encourages and institutionalises safety initiatives, such as those of Gawande and Pronovost, it seems possible that safety gains can become widespread and longstanding.

Notes

1. The author owns shares in Safer Sleep LLC, Nashville, TN, a company that aims to reduce error in anaesthesia, and has authored many papers in the area of safety in health care.

References

Department of Health (2000) *An Organisation with a Memory – Report of an Expert Group on Learning from Adverse Events in the NHS*, Stationery Office, London.
Haynes, A.B. Weiser, T.G. Berry, W.R. Lipsitz, S.R. Breizat, A.S. Dellinger, P. *et al*. (2009) 'A surgical safety checklist to reduce morbidity and mortality in a global population', *New England Journal of Medicine,* 360, pp.491–9.

Institute of Medicine (2000) *To Err is Human – Building a Safer Health System*, National Academy Press, Washington, DC.

Pronovost, P. Needham, D. Berenholtz, S. Sinopoli, D. Chu, H. Cosgrove, S. *et al.* (2006) 'An intervention to decrease catheter-related bloodstream infections in the ICU', *New England Journal of Medicine,* 355, pp.2725–32.

Webster, C.S. (2005) 'The nuclear power industry as an alternative analogy for safety in anaesthesia and a novel approach for the conceptualisation of safety goals', *Anaesthesia,* 60, pp.1115–22.

Webster, C.S. and Grieve, D.J. (2005) 'Attitudes to error and patient safety', *Prometheus,* 23, pp.253–63.

Craig S.Webster

Centre for Medical and Health Sciences Education at the University of Auckland,
Auckland, New Zealand
c.webster@auckland.ac.nz

Darwinism and economics, edited by Geoffrey M. Hodgson, Cheltenham, Edward Elgar, 2009, 457 pp., £125 (hardback), ISBN 978-184844-072-2

The evolution of path dependence, edited by Lars Magnusson and Jan Ottosson, Cheltenham, Edward Elgar, 2009, 228 pp., £59.95 (hardback), ISBN 978-1-84376-137-2

Geoff Hodgson's edited volume, *Darwinism and Economics*, is an updating of his former volume in Edward Elgar's International Library of Critical Writings in Economics, *Economics and Biology* (Hodgson, 1995), which is number 50 in the series. The present volume (number 233) contains 24 contributions in the familiar format of photocopied articles, book chapters etc. dating from 1990 to 2007, and is a judicious selection. Hodgson can also be seen as responding to another earlier volume in the series, Ulrich Witt's *Recent Developments in Evolutionary Economics* (number 228), as will be clear in some of Hodgson's arguments below and in the arguments of his contributors, evidently selected for their affinity with Hodgson's evolving views over the last couple of decades.

The term 'evolution' and its cognates are, I suspect, deliberately missing from the title of this volume in favour of 'Darwinism', which more clearly reflects Hodgson's current thinking on these subjects. As he writes in his Introduction, 'Evolution has recently become a popular word in the social sciences, especially among economists' (p.xiii), but as he goes on to say,

> The term can be used to describe a varied group of approaches in economics, perhaps in contrast to the exclusive focus on equilibrium in neoclassical theory, but it does not indicate a well-defined type of analysis. At best, 'evolutionary economics' is an umbrella term to describe a loose collection of theoretical approaches and empirical studies.

As examples of evolutionary models other than Darwinism, Hodgson gives the self-transformation over time, or 'self-organization', of Ulrich Witt and others, and Kenneth Boulding's metaphorical account whereby consumer goods, such as cars, are