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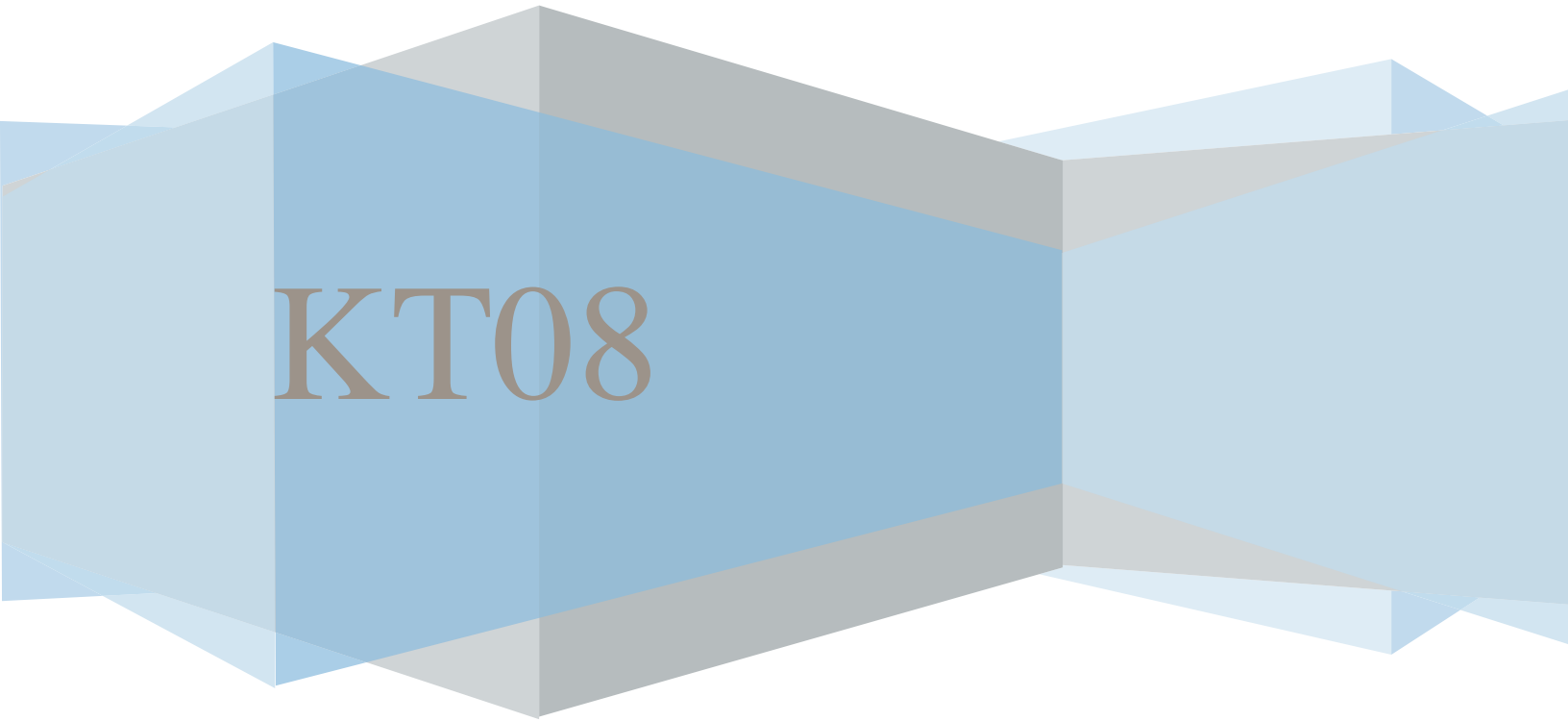
Speeding up the Spread

Putting KT research into practice and developing an integrated KT collaborative research agenda.

Alison Kitson and Mark Bisby



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About the Authors and the Reference Group

Alison Kitson

Alison Kitson is a Fellow of Green College, University of Oxford. She is the Nursing Education Fund Inaugural Fellow at the Royal Adelaide Hospital and Adjunct Professor of Nursing at the University of Adelaide and at the University of Alberta. She has a long career in KT research and innovation.

Mark Bisby

Mark Bisby, a neuroscience researcher for 30 years, was Vice-President Research of the Canadian Institutes of Health Research until 2006. In retirement, he continues to advise a number of health research funding agencies.

Reference Group

Donna Angus

Donna Angus is the Manager, Research Transfer Initiatives with the Alberta Heritage Foundation for Medical Research. Her portfolio includes managing the Health Research Transfer Network of Alberta, supporting knowledge transfer activities and initiatives within the Foundation, and involvement in several research projects on knowledge transfer.

Judy Birdsell

Judy Birdsell is a consultant in health research policy and strategy and an Adjunct Associate Professor in the Haskayne School of Business. She has been working with the International Scientific Planning Committee to plan and host Knowledge Translation 2008: Forum for the Future.

Carole Estabrooks

Carole Estabrooks is Professor and Canada Research Chair in Knowledge Translation, University of Alberta, Canada.

Michel Wensing

Michel Wensing, Ph.D. is associate professor at the Radboud University Nijmegen Medical Centre, Centre for Quality of Care Research. Currently he is Principal Investigator at the Nijmegen Centre for Evidence Based Practice (www.NCEBP.nl) and co-ordinates the programme “Implementation Science”. He is also chairman of Topas Europe Association (www.topaseurope.eu), a European network of quality of care researchers, and he holds honorary positions at the Universities of Heidelberg (Germany) and Manchester (UK).

Andy Van de Ven

Andrew H. Van de Ven is Vernon H. Heath Professor of Organizational Innovation and Change in the Carlson School of Management of the University of Minnesota.

Executive Summary

The purpose of this paper is to act as a primer for the KT08 Forum being held in Banff, Canada from the 9th-11th June 2008. Intended to stimulate discussion, debate and reflection, the paper is both challenging and exploratory: it covers a broad, panoramic sweep of KT-related policy, politics, research and practice.

Aimed at the necessarily broad range of stakeholders who need to be involved in KT policy, research and implementation, the first challenge for the authors has been to agree on how we could construct a meaningful dialogue around the topic. In attempting to cover the wide range of issues would we be confining ourselves to bland statements of conventional wisdom and avoiding anything controversial or challenging? Or would we endeavour to combine the growing evidence within the KT community with broader trends in the understanding of science? Could we argue that we are standing at a point that may change the way we think about knowledge and science and how we get new knowledge into everyday practice?

Reliable knowledge has to be both scientifically and socially robust. Knowledge can no longer be determined by narrowly defined scientific communities but by wider communities of knowledge producers, disseminators, traders and users. Indeed, we have to acknowledge some of the transformations that are already taking place in the research process, the role of society in it, and the implications, as yet unimagined, for KT, that will be wrought through technological change. In order to embrace the intellectual, theoretical, methodological and policy challenges facing KT research, we need to question some of the fundamental ways we think about the generation and spread of knowledge and look at society's relationship with the scientific community in enabling it to happen.

We have produced a high level summary of some of the key texts in this area (Gibbons et al 1994, Nowotny et al 2001). We have also outlined how research funding agencies are responding to this change and whether such changes will eventually lead to alterations in funding criteria. From these policy perspectives we have moved into more familiar territory for researchers – exploring some of the theoretical building blocks of KT as well as considering a possible KT research agenda. KT activity seems to involve two parallel processes: one is ensuring that KT is embedded within all research projects/processes ...the "doing " of KT ... and the second is KT as an independent research subject itself ...the "knowing " of KT: what are the roles and responsibilities of the different stakeholders in pursuing these parallel processes?

The paper finishes with an outline of the key stakeholders who need to be involved in generating the research agenda and a summary of the main arguments in the paper. In order to create a debate, the arguments are summarised in a series of seven propositions, each one building upon other.

The purpose of the Forum is to test these propositions and to build a conceptual framework and research agenda, articulating emerging processes for future refinement and use.

Propositions

Proposition 1
The public's and society's expectations of researchers and their role in generating new knowledge have changed from being perceived as passive recipients of KT to expecting to become active partners in each step of the research/ knowledge generating process.

Proposition 2
One consequence of this is the way that research is developed, conducted, rewarded, assessed and implemented is changing. Institutions that are closely connected to knowledge production will have to change accordingly or lose their influence and ultimately their funding and resources (i.e. universities, funding agencies, policy organisations, provider services).

Proposition 3
Researchers need to acquire KT sensitivity, understanding, appreciation and skills. This means a gradual move from legitimate 'end of grant' activities to a much greater emphasis on appropriate KT approaches. The consequences are ... more funding, explicit acknowledgement of KT as a legitimate part of the research process, more training and support, broader research teams and change in funding and evaluative criteria.

Proposition 4
In order to accelerate KT research, urgent attention needs to be paid to agreement on:

- Working/operational definitions that reflect the scope and boundaries of the domain of KT
- Broad conceptual frameworks and how they inform theory, methodology and method
- How to conceive, develop and run complex multidisciplinary research programmes that focus as much on process as outcomes.

Proposition 5
An international, interdisciplinary, collaborative research agenda can be created with priorities and preferences built into it, properly funded and with the right infrastructure in order to speed up the spread of K into practice. Research will span curiosity driven, theoretical research in KT as well as integrated applied practice-based research.

Proposition 6
All health researchers...from the molecular biologist to the sociologist...need training in how to contextualise KT for their particular type of research. As a researcher, what is it that I produce that might be of use to others? Who are the users? How do I reach them? How do I provide the information in the most useful way? How will I know if I am communicating effectively? As a researcher, a key class of user is my research peers, and I can start developing my KT expertise by communicating and sharing/collaborating better with them in order to accelerate the pace of discovery. How do I learn to do this more effectively?

Proposition 7
More effort/investment in evaluation and research on better evaluation methodologies needs to be made in order to learn if KT programs, structures, frameworks and theories are working and if not, why not.

Section 1: Setting the Scene

This background paper was commissioned by The Alberta Heritage Foundation for Medical Research (AHFMR), Canada, to stimulate debate and discussion prior to and during the KT08 Forum in Banff, Canada June 9-11, 2008. The format of the Forum is interactive and the overall purpose is to utilise the opportunity of the gathering of key stakeholders in KT to develop an agreed research strategy and consider some of the deeper conceptual, definitional, policy and political issues around this emerging discipline. Alison Kitson and Mark Bisby were commissioned to prepare the background paper. They were supported by a small reference group – Donna Angus, Judy Birdsell, Carole Estabrooks, Michel Wensing and Andy Van de Ven – who commented and critiqued the emerging document.

It is commonly accepted that the spread of new knowledge into practice is a very slow and unpredictable process. Much time and effort have been put into trying to understand why individuals, teams and whole organisations do not embrace continuous change in a systematic, planned way and why the introduction of new technologies, practices and processes are not part of a repertoire of behaviours, skills and attributes possessed by most workers. The focus of this Forum is to try and understand these issues better and to produce an agreed international research agenda and action plan that will speed up the spread of knowledge into practice.

There are four main aims of the paper:

1. Create a dialogue through which an international research agenda around KT can be developed and refined ,which builds on evidence and embraces features of interdisciplinary, trans-boundary learning, multiple stakeholder engagement and collaboration.

2. Explore how the KT process can be improved within the research process itself.

3. Check out the shared understanding and use of the key 'building blocks' for KT research – the conceptual frameworks, theories and models – in order to develop a shared agreement on the scope and boundaries of KT practice and research endeavours.

4. Consider KT within the wider debates on the nature of science and knowledge generation within society at large.

Two additional aims have been set out which are more to do with how the paper will be used to shape the process of the KT08Forum. Participants are invited to use this paper as a 'primer' to stimulate a series of questions that will be solicited during the event:

5. Explore novel ways of sharing K at events such as KT08 i.e. participants themselves will be part of an "experiment" where they actively influence the products and outcomes of the Forum.

6. Produce a document that combines the Forum proceedings with the ideas stimulated by the background document.

1.1 Format and Style

The background paper is divided into five sections. The introduction sketches out the main trends in the discipline that need to be addressed; section two outlines reasons why we have to change how we are thinking and what we are doing about KT; the third section considers ways of framing the issues to create greater clarity and consistency; section four looks at who the stakeholders need to be in this venture and how they should be engaged, and the final section concludes with a series of propositions on what we should be thinking about and doing.

Section 1: Setting the Scene

1.2 Where we are in our thinking about KT?

"... researchers are doing an exceptional job in making discoveries and generating new knowledge that has the potential to improve the health of (country X) and strengthen the health care system and economy but unless this knowledge is actually translated into action, these benefits will not be realised" (Graham and Bernstein, 2007).

Knowledge Translation (KT) is the generic term that is increasingly coming to be used to describe the processes by which new knowledge is put into action – whether that is new policies, products, practices or protocols. KT has emerged out of a rich interdisciplinary mix of theories and methods and the task in front of policy makers, researchers and many other stakeholders is to work out how to make this process (or these processes) more effective. The logic is that the KT process will become more effective as we learn how to apply the evidence we know already about what works and what doesn't and how we identify, prioritise and fund relevant KT research that will generate new knowledge to inform our actions.

Like many new enterprises, KT theory, research and practice suffer from a set of limiting conditions. These include problems over definitions of terms and lack of clarity around the use of conceptual frameworks, theories and models that shape and put boundaries around the research endeavours. In addition, KT research is challenged by lack of clarity and agreement over what funding agencies should be requiring from researchers and research institutions in terms of KT activity; lack of substantial programmatic funding that encourages long term multi-centred research activity on KT and often a failure to engage the powerful decision makers in the early stages of new programme development to build in KT from the start.

These deficits of course can be reframed into a language of aspiration: each challenge in itself becomes a clear and exciting agenda to enhance the knowledge base of KT. So, it is therefore understandable and appropriate at this stage of the KT discipline's development to go through a process to agree on definitions and to map out the conceptual, theoretical and practice boundaries. This timely work will help to order the emerging research agenda, which in turn will create new ways of arguing for more investment in the science of KT.

What is it, though, that we hope to achieve? Would we recognise the ideal for KT? We can conjecture that among the many parallel universes there is one where knowledge translation (KT) in health care is done correctly, with the entire loop between research and delivery vertically integrated within a single, universal health care organization. Glimpses of that universe appear in our own, because there are organizations, such as the USA Veterans Affairs, where

"The research agenda is set by the organisations' needs; the research is done collaboratively between the managers, the clinicians and the researchers; and the results find their way directly into practice through integrated management structures and processes".(Lomas J, 2003).

Unfortunately, more often we encounter a curious disconnect between the production of new research knowledge and its implementation in health care practice or policy. At worst, we find researchers disinterested in the real-world issues of knowledge users, and unwilling to communicate with them, and users dismissive of the ability of researchers to provide them with useful information on which to base policy or practice decisions (Choi BCK et al., 2005). The goal of KT research is to bridge these two solitudes and achieve rapid, bidirectional flow of knowledge between research and implementation. Health Research Funding Agencies (HRFAs) will play a crucial role in achieving this goal.

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The emerging role of HRFAs in KT and KT research is one aspect of a fundamental change in the "social contract" that defines the place of research in society:

"the expansion of higher education has been accompanied by a culture of accountability... In research, many academics have had to accept objective-driven research programmes, whereas research funding agencies have been increasingly transformed from primarily responsive institutions, responsible for maintaining basic science in the universities, into instruments for attaining national technological, economic and social priorities through the funding of research projects and programme (Gibbons M, 1999).

It is no longer sufficient for a public HRFA to fulfil its mission by operating a rigorous review process so that only the best ideas of talented researchers are funded. The "fund and forget" approach has led to "all break-through and no follow-through" (Woolf SH, 2006), and governments are increasingly questioning the return on investment of the traditional funding agency role. In 1998, the wording used in the Canadian federal budget documents to justify an increase in the budget of the national HRFA was simply:

"to provide research grants, scholarships and fellowships for advanced research and graduate students (Department of Finance Canada, 1998).

But 10 years later this had become:

"The granting councils will ... partner with public and private stakeholders to ensure that practical solutions are found. CIHR will be provided with an additional $34 million per year for research that addresses the health priorities of Canadians, including the health needs of northern communities, health problems associated with environmental conditions and food and drug safety (Department of Finance Canada, 2008).

One can infer not only a growing government interest in health research (the good news), but also exasperation that HRFAs are not delivering the returns to society expected from growing investments in health research (the bad news). These expected returns encompass improved health through evidence-based medicine and public health policies, a more effective and efficient health care system, and economic prosperity resulting from growth of national industry manufacturing health products and delivering services.

1.3 The Broadening of KT beyond Commercialization

While expansion of broader KT activities is a recent development in the role of HRFAs, funding programs to accelerate commercialization of academic research have been in place for many years. For example, the Small Business Innovation Research Program in the USA has been in place since 1982, shortly following the passing of the Bayh-Dole Act in 1980, which allowed universities and small businesses to retain intellectual property rights to inventions resulting from federal grant funds, and marked the beginning of the modern era of commercialization.

Greater involvement of HRFAs in all forms of KT is not just the right thing to do: it is essential for the maintenance of the health research enterprise in the face of many competing and compelling demands on the tax base. HRFAs are responding to this societal change, even those whose mandates have traditionally drawn the KT line at commercialization and clinical trials. In Canada, this change was reflected in the creation of the Canadian Institutes of Health Research in 2000, with a mandate for

"the creation of new knowledge and its translation into improved health for Canadians, more effective health services and products and a strengthened Canadian health care system (Canadian Institutes of Health Research Act, 2000).

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In the USA, the NIH Office of Behavioural and Social Sciences Research and several Institutes sponsored a workshop on "Building the Science of Dissemination and Implementation in the Service of Public Health" in September, 2007 (Office of Behavioural and Social Sciences Research, 2007) and, for example, NIMH has launched a Dissemination and Implementation Research Program to support:

"studies that will contribute to the development of a sound knowledge base on the effective transmission of mental health information to multiple stakeholders and of the process by which efficacious interventions can be adopted within clinical settings (National Institute of Mental Health, 2008)".

In the UK, the Wellcome Trust's 2005-10 Strategic Plan goes beyond its traditional focus on commercialization to acknowledge that it must:

"support researchers to promote the clinical, healthcare and public policy take-up of their own research (The Wellcome Trust, 2005).

The UK Medical Research Council (MRC) held its own workshop on "Accelerating the Translation of Medical Research" in February 2007, which recognised the need for:

"Cultural change within the research community and recognition that translating research findings and communicating findings to research users was part of a researcher's role (Medical Research Council, 2007).

A recent survey (Tetroe JM et al., 2008) of support and promotion of KT practices by 33 HRFAs in Europe, North America and Australia revealed that, despite confusion over terminology and uncertainty about the boundaries of their KT mandates, almost all these HRFAs reported increasing involvement in KT. Pioneers such as AHRQ (The Agency for Healthcare Research and Quality, 2008), ZonMw (The Netherlands Organization for Health Research and Development, 2008) and CHSRF (Canadian Health Services Research Foundation, 2008) are going to be joined by the big players, and it is important to reflect on the specific roles that HRFAs should play.

Such changes in the research policy and funding worlds point to a bigger change that seems to be taking place in the relationship between society and science in the way they each view "knowledge":

"Knowledge is now regarded not as a public good, but rather as 'intellectual property', which is produced, accumulated and funded like other goods and services in the 'knowledge society'.
In the process, a new language has been invented – a language of application, relevance, contextualisation, reach out, technology transfer and knowledge management" (Nowotny H et al., 2003).

It would seem therefore that the struggle the KT community is going through in order to find greater understanding of the intersections between the worlds of knowledge generation and knowledge use is paralleled by a bigger debate that is going on in society about the nature of knowledge and science in society. Some understanding of these bigger issues is important for us to work out our contribution to the wider debate.

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2.1 Do we need to change the way we think about KT and what we are doing?

Over the last decade or so, an interdisciplinary, international team of academic researchers (Gibbons M et al., 1994; Knorr Cetina K, 1999; Nowotny H et al., 2001) have been developing an argument which, at its most fundamental, states that the production of knowledge and the process of research are being radically reformed in society. The traditional paradigm of scientific discovery (what they call Mode 1) has to engage with more novel ways of producing knowledge (Mode 2). Mode 1 knowledge production is familiar to us all: it is the traditionally accepted way that science is conducted – from 'blue skies', curiosity driven, pure, theoretical science through to clinical or applied science. Knowledge generators are separate from the communities who use their products and the spread of knowledge operates in a linear, sequential way. In contrast to this, key characteristics of the Mode 2 approach include:

1. Knowledge is generated within a context of application. This is different from the process of application by which 'pre'-science generated in theoretical/experimental environments is 'applied', any technology is 'transferred', and knowledge is subsequently 'managed'. The context of application, in contrast, describes the total environment in which scientific problems arise, methodologies are developed, outcomes are disseminated and users defined.

2. Knowledge is transdisciplinary. This calls for the mobilization of a range of theoretical perspectives and practical methodologies embodied in research teams.

3. A much greater diversity of the situations at which knowledge is produced and in the type of knowledge produced.

4. The knowledge generation process is highly reflexive and calls for much greater dialogue between all participants.

5. New forms of quality control of research processes and products are required, for example, the redefinition of peers, different stakeholders, embracing more multiple determinants of quality.

The paradox of course is that socially distributed knowledge generation (what Mode 2 is called) cannot be adequately described within the traditional forms of scholarly publication and Nowotny et al (2001) argue that this is a classic dilemma of any emerging paradigm shift – the language to describe the changes taking place is not legitimised by the current knowledge system which leads to confusion and greater disconnect.

Nowotny et al (2003) defended their position by presenting a number of trends in science policy and by describing changes taking place in the production of knowledge within society which were impacting on traditional ways of thinking. The first science policy trend, which they detected across most societies, included the steering of research priorities at super national, national and systems level where arguments were increasingly centred on programmatic, relevant, collaborative, cost-effective research rather than investment in blue-skies, or curiosity driven research.

Again, Canada provides a case in point: in 1996-7 the national health research funding agency invested 95% of its research funding budget (then $219M) in investigator-initiated, curiosity-driven research of the Mode 1 tradition: in 2007-8, this proportion had fallen to 70%, with 30% of the budget (now $ 700M) targeted to funding programs with specific goals and outcomes, more aligned to Mode 2, which were oriented around both policy-laden health issues (e.g. "The built environment, obesity and health") and specific types of outcomes (e.g. drug discovery).

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At this point, we would like to make it clear that in emphasising the characteristics of Mode 2, we are doing so because it provides an imperative for increasing attention to KT, not because it is in some objective way better that Mode 1 knowledge production. Clearly the progress of scientific knowledge and its application to real-life problems in health will require both modes: indeed, it can be argued that a standing army of researchers trained in the disciplinary tradition of Mode 1 is a pre-requisite to being able to mobilise multi-disciplinary taskforces to conduct Mode 2 research focussed on solving specific and pressing societal problems. Furthermore, an individual scientist can work in both modes at different times: about half of those funded by the obesity program noted above were also investigators of curiosity-oriented grants provided by the same agency.

A second trend was the increase in commercialization of biomedical research accentuated by the need to get research funds from a variety of sources as reflected in the changes in the increasing value of intellectual property. At the centre of this change was the tension of the ideal as science as a public good (i.e. disinterested knowledge generation for the good of society) and science as a commercial enterprise (i.e. knowledge generation as the new wealth creation). It is relatively easy to project from this argument how KT ideology and practice could be caught in the intellectual crossfire of considering whether KT is an agent of improving capacity for getting knowledge into practice, and thereby contributing to wealth creation, to the detriment of knowledge generation for its own sake.

While commercialization as a "special case" has a number of important differences from health KT applied to the not-for-profit improvement of health practice and policy, it also shares many features, including, as we will see in a later section, common roots in concepts and theories of innovation in complex systems. Appendix 1 summarizes some of these similarities and differences (mostly a matter of degree) between commercialization and other forms of health KT, and points out areas where there may be a common research agenda. In fact, for the majority of health researchers, that is, those focussed on biomedical research, health KT is commercialization. We should keep in mind how the discussions at the Forum about a health KT research agenda, likely to emphasize practice and policy, can also assist commercialization of products and services.

The third policy trend Nowotny and colleagues (2003) identified was the increasing accountability of science to society. Autonomous and self directing behaviour were being replaced by greater accountability for spending of public money. Earlier examples of the changing expectations of funding agencies illustrate this point well for the KT agenda. Equally, the whole acceleration of the evidence-based healthcare movement could also be explained as a way of creating greater accountability for the use of evidence from research in clinical practice. It could also reflect a demand for greater accountability by practitioners and managers to the funders for the utilisation of healthcare resources.

From this summary of the work of Nowotny et al (2001,2003), a number of questions can be posed. If knowledge/science within society is moving from an "independent object" to a commodity, how is a new language developed and what are the characteristics of the new context into which this new conception of knowledge/science emerges? And importantly for us, what impact does this bigger picture change (if we believe it to be the case) have on the changes that are taking place in KT policy and research?

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Efforts to develop a new language around socially distributed knowledge (Mode 2) have been characterised by two polarities: first a story of regret and loss about the demise of quality research, the loss of independence and scientific freedom contrasted by a story of modernisation. And the second, for those who believe that socially distributed knowledge (Mode 2) represents a more integrated approach, then an emerging political and policy agenda that emphasises the importance of research within the knowledge society and the need to align research priorities more closely with social, economic and political goals, is a welcomed development.

Products of this latter movement have been the various "Foresight" documents mapping out research programmes together with significant realignment and refocusing of national research funding agencies, for example, the setting up of the UK Clinical Research Collaborative (CRC) and a National Institute for Research in the UK that mirrors the rationalisation that has taken place in many other countries such as the US, Canada, and Australia.

Such evident structural changes –increased commercialization of research, the development of mass higher education policies thus increasing the research capacity, the reconfiguration of research funding agencies – have led inevitably to more difficult process challenges. Fundamentally, the new way of thinking about science has questioned the linearity and predictability of the research process and called into question definitions of applied as well as pure research. The traditional route from curiosity- driven, pure research through to applied research has been challenged by a much more integrated, collaborative, discursive approach to knowledge generation and application – more cyclical than linear in construction.

In their book *Rethinking Science* Nowotny et al (2001) introduced two new ways of tackling these issues. First, they suggested the creation of a new context where knowledge production takes place – what they called the "agora" – the problem generating and problem-solving environment in which the contextualisation of knowledge production takes place, combining experts and the public.

The second new way of thinking was the context of application – not conceptualised as some end-point on a hierarchical, positivistic journey where knowledge is put into practice but conceived more as a state where knowledge is being applied in conditions of uncertainty and unpredictability towards what Nowotny et al (2001) call the unknowable context of implication. Here knowledge seekers have to reach out and anticipate reflexively the implications of research processes ...this fuzziness helps to create the transactional spaces in which socially distributed knowledge develops.

These 'contexts of application' could be 'strong' or 'weak' i.e. conducive or inhibitors of the generation of 'socially distributed knowledge'. Weak contexts were those where traditional R&D programmes continued to conceptualise the creation and transfer of knowledge as a predictable, step wise, linear process. Strong contexts were environments where the dialogue between science (those who were involved in the generation of knowledge) and society (the partners/ co-creators and users of the knowledge) could take place effectively. This would lead to more informed and continuous debates around the public's understanding and use of science and science's role in generating knowledge to enhance society.

Other process issues were the need to develop new concepts, theories and methods that would reflect

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the paradigmatic shift that was taking place. Resistance to recognising this as an important piece of work was thought to be linked to the potential shift that would follow in powerbases and funding streams – why should a traditional and very successful community choose to support a movement that might call into question the very epistemological core of the scientific process and thus change it?

However, the growing reality is that reliable knowledge has both to be scientifically and socially robust and a central tenet of Mode 2 knowledge production is that knowledge no longer can be determined by narrowly circumscribed scientific communities but by wider communities comprising knowledge producers, disseminators, traders and users. Indeed, we have to acknowledge some of the transformations that are already taking place in the research process, the role of society in it, and the implications, as yet unimagined, for KT, that will likely to be wrought through technological change and particularly the "Web 2.0" culture of interaction, collaboration and sharing as applied to the scientific enterprise (Schneiderman B, 2008). Science 2.0 combines the hypothesis- based inquiry of laboratory science with the methods of social science research to understand and improve the use of new human networks made possible by today's digital connectivity. Through Science 2.0, the societal potential of such networks can be realized for applications ranging from homeland security, to medical care, to the environment.

At least, these technologies provide powerful levers both for propelling the research enterprise ever more firmly in the Mode 2 direction, and for generating new modes and models for KT. At most,

"it's time for the laboratory research that has defined science for the last 400 years to make room for a revolutionary new method of scientific discovery."

2.2 How do Mode 1 and Mode 2 thinking impact on the KT research agenda?

How does this description of the bigger shifts that are taking place impact upon the way KT is conceptualised, funded and operationalised? In order to anchor some of the more abstract or esoteric arguments in the earlier section, we will now concentrate on providing some evidence on how funding agencies are responding to the requirement of ensuring that knowledge is translated into practice.

The summary data presented draws from Tetroe et al's (2008) survey of health research funding agencies (HRFAs) in Canada and internationally to ascertain the funders' expectations of researchers in terms of KT; what HRFAs perceived their own role was in promoting research results they funded; how they promote the use of research they funded, and the extent of their capacity to support KT.

A total of 33 funding agencies were surveyed. Using a mix of semi-structured interviews and data from websites the categories including role, background, research requirements, application process, dissemination activities, agency activities, evaluation and audience were explored.

2.3 What Health Research Funding Agencies Think

1. Lack of clarity between HRFAs about what KT is and how it is operationalised

KT was found to be a relatively new concept (although 23/33 agencies referred to KT in their mission/mandate). There was often no link between what was in the mission and activities of the agency. A total of 29 different ways of describing KT were found, illustrating the need for some conceptual clarification of the terminology and agreement of definitions. (See Table 1)

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Table 1: Descriptors of KT themed by primary focus. *(Adapted from Tetroe et al, 2008)*

Primary Concept	Descriptor
KT focusing on ***knowledge***	Communication; cycle; exchange; management; mobilisation; transfer; translation; getting into practice
KT focusing on ***research***	Into practice; mediation; transfer; translation; applied health
KT focusing on ***process***	Translation; transmission; utilisation; diffusion; dissemination; exploitation; implementation; linkage and exchange; popularisation; science communication; teaching
KT focusing on ***miscellaneous factors***	Capacity building; science communication; co-opt; co-operation; competing

2. Varying degrees of engagement in the process.

The researchers found a range of levels of engagement within agencies varying from 'light touch' approach – little engagement to a more integrated approach e.g. from the Netherlands Organisation for Health Research and Development where project profiles were evaluated against the potential to improve practice and then were targeted for additional dissemination and implementation activities. Such selection provided the project with additional time and support which were then built into the overall objective and review of the research project. This meant that additional training and investment were targeted to projects that were considered to provide the most return on the investment.

3. Methods and mechanisms to promote/do/support KT differed between agencies.

Table 2 summarises the main interventions found by the research team by researcher and agency.

4. Evaluating the effectiveness of KT strategies remains a methodological challenge.

It is perhaps not surprising that this emerged as a key finding – the state of the science is still at an early stage and what is needed are mechanisms by which agreement can be reached on the language, definitions, conceptual frameworks and methods used to explore some of the complexities. This conclusion was reached by participants in a workshop organised by the research team to feedback their results and to elicit users' views. The key comments are summarised in Table 3.

It would seem therefore that the empirical evidence offered by Tetroe et al (2008) reinforces some of the bigger picture arguments put forward by Nowotny and colleagues (2001, 2003). It would appear that the scientific community is changing in the way it perceives its role in the translation of new knowledge into the public domain – whether that is into a healthcare setting, a school or a private company. What also seems to be emerging is the fact

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Table 2: Summary of Methods and Mechanisms to Promote KT

Researcher Interventions

At the time of application
- Relevance
- KT plan
- Lay summary of plan
- Partnership with stakeholders
- Define KT analysis

End of study
- Publish
- Final report
- Acknowledge funders
- Attend workshop
- Lay summary
- Report comm.
- Report fro decision makers

Allowable expenses
- Hosting workshops
- Publications
- Dissemination
- Translation

Agency (broader) interventions

Tools and techniques
- Audience tailored (AT) publications
- Media
- AT web-pages and web-sites
- Development of tools
- Use of drama

Services
- Translation e.g. helping researchers comm. with media
- HTA/political/R synthesis
- Tech transfer
- Lectures

Linkage
- Joint setting of research agenda
- Linkage and exchange
- Web-based/real time networking
- Programmes for decision makers
- Meta-linkage
- Video conferences

Allowable Funding
- Targeted workshops
- Conferences
- Special issue journals
- KT requirements for applications
- Teams
- KT centres
- Research chairs

Table 3:

- Variability in terminology, concepts and constructs
- Importance of funding 'science' of KT
- Synthesis function of agencies
- Training function of agencies
- Having a forum for funders
- Role of agency in 'push', 'pull', 'linkage and exchange'
- Role of agency as 'knowledge brokers' responsible for KT
- Problems of evaluating effectiveness of KT strategies at funding level

Source: Tetroe et al 2008.

that the process is still very fluid and lacks conceptual clarity. Different stakeholders are trying to elucidate their bit of the picture but may still not be clear were the edges of the picture are located. For the purposes of the background paper and the emerging task of the Forum there seems to be a number of practical consequences flowing from this section:

- How do we come up with a set of working definitions for key terms within KT?
- KT activity seems to involve two parallel processes: one is ensuring that KT is embedded within all research projects/processes ...the "doing " of KT ... and the second is KT as an independent research subject itself ...the "knowing " of KT: what are the roles and responsibilities of the different stakeholders in pursuing these parallel processes?

2.4 KT as an end of grant activity versus KT as an integrated activity

How are these two activities integrated, if at all? The CIHR (Canadian Institute of Health Research, 2005) definition of KT, widely adopted, refers to "the exchange, synthesis and ethically-sound application of knowledge - within a complex system of interactions among researchers and users...(Canadian Institute of Health Research, 2005), and this makes it tough to determine who is responsible for ensuring T of research K. Is it the HRFA that provided the funding, the investigators who did the work, the institution that employs them, or perhaps it is the potential users, who should have sentinels posted to detect incoming information? The answer to this complex question is "yes", but an HRFA can ensure that it plays its part in this shared responsibility by:

- Requiring involvement of potential knowledge users, and those impacted by the research, in the formulation of the research proposal, and appropriately in the conduct, analysis, interpretation and dissemination of the research results.
- Requiring an appropriate dissemination/KT plan for funded projects that defines the user audience and the strategies and methods that will be employed.
- Evaluating the dissemination plan as a component of the overall merit review of an application. Obviously, this will require the creation of guides and templates to assist reviewers (Goering P et al., 2006), currently unaccustomed to this new dimension of assessment, to understand the features of appropriate plans.
- Involving potential users in the merit review process .
- Allowing KT costs.
- Supporting activities that increase the ability of researchers to communicate with users, and/or develop a cadre of knowledge brokers.
- Including rapid-response programs in their funding "toolkit" that will allow pre-qualified research teams to provide timely solutions to urgent health issues.
- Funding needs assessments, knowledge syntheses, production of systematic reviews, and other efforts that make research data more easily accessible to knowledge users, using when appropriate existing organizations such as the Cochrane collaboration.
- Requiring open access to all publications resulting from their funded research.
- Providing forums where encounters can occur between researchers and knowledge users.

In thinking about users of research, the range of receptors for health research knowledge is dauntingly broad. This comprehensive list may be aspirational for many research teams who may find themselves more at the 'end of grant' end of the continuum rather than at the 'collaborative' end. What should they do? Graham and Tetroe (2007) have provided a very useful typology of the KT Continuum:

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A very useful typology of the KT Continuum

Traditional 'blue skies' primary/pure bench research experimental	**Collaborative, action-oriented, co-production of knowledge**
End of grant	Integrated within research
1. Validation/testing of science Peers/research/k generation comm. Purpose –test science Gain acceptance Contribution to knowledge V/R Quality assessment	1. Validation/testing of science Creating a new discourse where new criteria around Q/V/R are used to judge the rigour, appropriateness, timeliness, impact of research
2. Who are the key stakeholders? People you expect to use the R Funders – report Users – possibly a tailored message to specific audiences e.g. summary briefings; more interactive approaches e.g. educational sessions to key groups; media engagement; use of knowledge brokers.	2. Who are the key stakeholders? Users, decisionmakers, funders, managers Priority to bring key stakeholders into the research process/active collaboration: shaping of research q. Decisions about method; involvement in data collection and tool development; implementation of findings; dissemination; implementation of research
3. Developing commercialization potential Technology Transfer Patents Creating a commodity business	3. Developing commercialization potential Same can happen but who owns it? Tension over K as commodity How do we sustain investment/innovation/development?
4. Further development and testing Sustainability of research programme Setting up of programmatic/international research activity	4. Further development and testing New funding models Creating sustainable integrated international trans-disciplinary research Programmes with clear goals and processes

Adapted from Graham and Tetroe (2007).

What appears to be developing is the confirmation that KT is both an emerging and increasingly important process within the research process, and an emerging scientific discipline in its own right. The complexity of setting up effective programmes has to take account of this dialectical tension, made more complex by the (still) loose language and terminology used within the discipline and a continuing challenge to draw the conceptual, theoretical and methodological boundaries in a way that promotes good science.

The next section begins to tease out some of the ways in which the KT scientific community, together with key stakeholders could begin to map the co-ordinates more clearly.

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At one level, the previous explanation of the major shifts that are taking place in the relationship between society and science is vaguely reassuring: the complexity and confusion are not necessarily products of ineffectual, lazy or limited thinking but rather reflect the sheer size and significance of the changes taking place. If we adhere to this explanation, then the important pursuit is to try to shape the emerging KT discipline, embedding it with "good enough" definitions, propositions, conceptual frameworks and methodologies. The nice thing about KT research is its peripatetic nature – it can legitimately and of necessity has to raid the conceptual and methodological boxes of many diverse and complementary disciplines. Equally, the emerging discipline also needs to address the need for basic or fundamental knowledge development in what is "uniquely" KT theory and science.

In the next section we have selected a set of conceptual frameworks, theories, models and methodologies that begin to show the convergence of ideas within the discipline. The purpose of doing this illustrative analysis is to guide discussion and debate towards ways of creating new and integrated research agendas. There are an increasing number of reviews to draw from and this overview does not attempt a comprehensive or thematic analysis: it commences with an outline of the seminal work of Evert Rogers (1995) whose research has influenced several decades of study in the area, and then moving to more recent conceptual frameworks that change from the traditional linear approach to implementation to considering it as a three-dimensional (or multifaceted) construct.

The section concludes with a composite list of research topics that have been produced by a range of research teams and synthesised in the paper (See Table 6). One of the tasks at the Forum is to consider which of the multiple possibilities for research we think are most relevant and appropriate or to create a set of criteria that could be used to determine the sorts of research priorities required.

3.1 The Building Blocks for KT research

The challenge facing the relatively new discipline of KT is coming to a shared agreement on the scope and boundaries of the domain of KT; agreeing on the way that conceptual frameworks, theories, models and mechanisms that explain activities influence the selection and use of appropriate research methodologies and methods, and agreeing on a research agenda.

How do conceptual frameworks, theories, models of KT help our understanding and guide the framing of research questions?

The purpose of looking at these 'high level' issues in this background paper is to help with ways of framing the complexity and multidimensional nature of KT and KT research. This will enable us to ask more focused questions, construct more testable hypotheses and to begin to look systematically at the range of relationships within contexts.

We will do this by using the standard conceptual building blocks – conceptual frameworks, theories, models and mechanisms. Working definitions are offered for each of these terms. No attempt has been made in this paper to go into the epistemological origins of the terms (although this will be the subject of a separate paper being developed by one of the authors). Table 4 summarises the working definitions being used.

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Table 4: The Working Definitions for Key Terms

Term	Working Characteristics/Descriptors	Source(s)
Conceptual Framework (CF)	CF defines a set of variables and relationships that should be examined in order to explain the phenomena under scrutiny. CF can range from a skeletal set of variables to an extensive constellation of beliefs, values and techniques shared by a community. CF need not specify the direction of the relationships or identify critical hypotheses but they are more useful if they do. CF organise diagnostic and prescriptive enquiry and provide a more general list of variables that can be used to analyse types of relationships (institutional, interpersonal etc). CF provide a meta-theoretical language that can be used to compare theories and they attempt to identify universal elements of any theory relevant to the same CF.	(Ostrom E, 1999) cited by (Kitson A et al., 2008).
Theory (T)	T is an abstract, coherent set of principles that enable one to explain, understand and (ideally) predict some aspect around a set of interrelationships. A good theory is a statement of scope. Numerous theories may be consistent within the same CF.	(Van de Ven AH et al., 1999)
Model (M)	M is a precise assumption about a limited set of parameters and variables. M is a projection in detail of a theory that depicts a possible system of relationships, events, actions. Can have multiple models within theories.	(Ostrom E, 1999) cited by (Kitson A et al., 2008)
Mechanism(s)	Actions, processes, techniques by which phenomena under study within a model operate to achieve their result. Mechanism usually carries the burden of explanation in a model hence the term "explanatory mechanism."	(Van de Ven AH et al., 1999)

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By way of illustrating the similarities and differences between the above terms and how we might try to create greater clarity, an illustrative sample of conceptual frameworks, theories, models and mechanisms related to KT are outlined. The sample begins with Rogers' work and then moves to three illustrative empirical studies that have constructed multidimensional conceptual frameworks. We then link between these broad conceptual frameworks and more grounded methodological approaches that are still based on multidimensionality and complexity , in particular, Pawson and Tilley's (1997) work on realistic evaluation.

Pawson and Tilley's (1997) work has introduced a renewed interest in the use of theories to inform and guide evaluation research and studies in the area of KT research. Indeed, Greenhalgh et al's (2004) work on developing a conceptual map of the diffusion of innovations in health service settings used this methodology (realist synthesis) to review the literature on the subject.

The final three models outlined are illustrative of the trends that are taking place in the KT community – overviews of testable interventions that have a theoretical base to them, and a classic knowledge-to-action model which argues that the basis for the process is evidenced in the literature on the theory of planned action.

It is not the authors' intention to produce a comprehensive overview of the range of examples of the conceptual frameworks, theories, models and methods that could be used. The sample is purposeful in that it shows the interconnectedness and the development of certain ideas. Most especially, it acknowledges that the KT research community is dealing with multidimensional factors, complexity and mechanisms embedded in processes and context that influence outcomes.

3.2 A Sampling of Conceptual Frameworks, Theories and Models that inform KT

3.2.1 Diffusion of Innovations: Rogers, 1995

First developed in the early 1950s, using research in rural sociology, Evert Rogers Theory of Diffusion of Innovations (1995) continues to be influential in shaping our understanding of the uptake of new ideas and in structuring our research endeavours. Based on the broader principles of communication theory, Rogers proposed four main elements that influence the spread of new ideas: the characteristics of the innovation itself; the channels of communication; the time it takes individuals to accept new ideas; and characteristics of the social system itself – notably how the social system's structure affects diffusion, the elements of the structure, norms, the role of opinion leaders and change agents within the system and whether the decisions around the innovation are voluntary or imposed.

The theory could be represented in the following way:

SI = f (I, C, T, SS) where

SI = successful implemetation;
I = characteristics of the innovation (relative advantage, compatibility, complexity, trailability, observability);
C = communication channels (mass media versus interpersonal, and the impact of other characteristics such as education, social class, background etc on individuals' ability to communicate effectively together);
T = time (defined as the individual's progress through the innovation process – awareness, persuasion, decision, implementation and adoption – key stages that have been identified); and finally,
SS = social system (which relate to the wider contextual issues).

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Aspects of the theory that have become most popular include the description of the characteristics of the innovation, the individual's progress through the innovation process and the role of the change agents/ opinion leader within the social system.

3.2.2 The Management of Innovations: Van de Ven et al., 1999 and 2000

Van de Ven and colleagues (1999; 2000) followed a number of naturally occurring innovations over a 10-year period across a range of organisations – public, private and voluntary. Although they did not refer to their high level analysis as a conceptual framework – they called their synthesis steps towards an overarching theory or meta-theory of innovation processes.

They found that the core elements across all organisations were linked to the nature of the ideas (the innovation being introduced); the people (or actors in the system at every level); the transactions (the multiple relationships, contacts and networks that were produced in order to get the idea into the system); the context into which the idea was being introduced; the perceived and actual outcomes (or results) of the innovation and the process by which this all happened.

These elements could be constructed into an equation:

SI = f (O, D, C) where

SI = successful implementation of an innovation;
O = the organisational context and level within the organisation at which the innovation is introduced;
D = the development theory that best reflects the way in which the people engage with the innovation and with each other; and
C = the contingencies i.e. those elements around contextual variables, the alignment between actors of their shared understanding of processes and outcomes, characteristics of the innovation and resource implications.

Their research summarised a number of key concepts of innovation:

- A complex process – not linear, predictable but multidimensional, non-linear and chaotic; has to span the whole organisation – from the top to the bottom to the top again;
- A developmental process – embracing three distinct theories of development – historical (i.e. relating to theories of development where there is a predictable path of development, growth and maturation); functional (i.e. theories of social development that do not presume a necessary sequence of events yet do imply standards by which change can be judged, in particular relating to the expected outcomes); and emergent process (i.e. specifying the processes that drive development but leaving both the path and the function open to random events that influence the outcomes);
- Sensitive to time, space and characteristics of the innovation;
- Contingent factors that influence the sort of development theory include: institutional context and tradition of adherence to 'rules' and traditions; level of agreement on processes and outcomes shared by participants; level of novelty and complexity of the innovation; level of resource intensity of the innovation.

The conceptual framework provides a number of working hypotheses, for example: successful implementation of a new idea (an innovation) is a function of the characteristics of the idea (C); the way that individuals (C) respond to the new idea; the types of relationships/transactions that transpire (D); the nature of the context (O) and the way in which expected outcomes (C) guide the change process.

The three-dimensional nature of the framework relates to the developmental theories and models used by Van de Ven and his team to explain the

different routes that many of the innovations tookand to explain the interplay between the levels of activity across the organisation and how this was affected by a number of the contingency factors.

3.2.3 Integrating Framework for Managing Knowledge across Boundaries: (Carlile PR, 2004)

The second conceptual framework to represent comes from the disciplines of knowledge management and organisational science. Carlile's (2004) hypothesis was that innovation can be observed at the intersections between different specialist domains and in particular how new knowledge migrates across these boundaries. Carlile (2004) offers an analytic description of the varying circumstances possible at different knowledge boundaries and describes the possible processes involved in managing the knowledge and the boundaries. He argues that paying closer attention to boundary management will integrate three different theoretical approaches, namely information-processing (knowledge transfer), interpretative processes (knowledge translation) and political processes (knowledge transformation).

The type of boundary – syntactic, semantic and pragmatic, relates to the behaviours and actions required to manage the type of knowledge being introduced. For example, at the syntactic/information processing boundary, knowledge is transferred between sender and receiver and the same meaning is understood by both. This is contingent upon stable relations prevailing between sender and receiver where a common language or lexicon is in operation. Given the technological aetiology of this approach (roots in a mathematical model of Shannon and Weaver 1948), it means that information processing concepts are used in managing boundaries in product development, organisation design, and on technologically-based approaches to knowledge management where the primary focus has been on the storage and retrieval of information.

When novelty occurs, problems arise because the common lexicon no longer is sufficient to represent differences and dependencies. When such confusion occurs the next level comes into operation, namely the need to create processes that help create shared meanings between actors. Common language therefore gives way to the quest for common meaning as contexts become more complex. When situations arise where shared meanings cannot be reached, the final stage is arrived at – the pragmatic or political boundary where the knowledge is transformed to serve multiple purposes and multiple negotiations are transacted in order to reach a common goal.

For Carlile (2004), a summary equation of the conceptual framework could be represented in the following way:

SI = f (K, B, A/C) where

K = knowledge being managed across specialist domains;
B = boundaries across which knowledge has to travel; and
A/C = ability and capability of individuals and teams to manage knowledge at the boundaries.
Carlile's (2004) thesis resonates with some of the earliest conceptualizations about the nature of knowledge utilization, namely the instrumental, conceptual and persuasive ways of using it (Weiss 1979, Estabrooks 1999, Estabrooks et al., 2006).

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3.2.4 Promoting Action on Research Implementation in Health Services: Kitson et al (Kitson A et al., 1998); Rycroft-Malone et al (Rycroft-Malone J et al., 2002); Kitson et al (Kitson A et al., 2008).

The PARiHS Framework (Promoting Action on Research Implementation in Health Services) was first developed by Kitson et al in 1998. It is based on a series of empirical research projects that looked at how evidence–based guidelines were implemented into practice. Within the PARiHS framework, successful implementation is represented as a function of the nature and type of evidence (E), the qualities of the context (C) in which the evidence is being introduced, and the way the process is facilitated (F):
SI = f (E, C, F).

Detailed descriptions exist in the literature on the development and empirical evaluation of the PARiHS framework. The framework has been refined through two phases of research and development and is currently in its third or current phase. (The unique characteristic of the PARiHS framework was that it proposed a three-dimensional framework within which to interpret successful implementation, arguing that elements could be located on a continuum of "high" to "low" evidence and context). The main features and assumptions of the framework are:

1. Evidence (E) encompasses codified and non-codified sources of knowledge, including research evidence, clinical experience including professional craft knowledge, patient preferences and experiences, and local information.

2. Melding and implementing such evidence in practice involves negotiation and developing a shared understanding about the benefits, disbenefits, risks, and advantages of the new over the old. This is a dialectical process that requires careful management and choreography, and one that is not done in isolation; in other words, it is a team effort.

3. Some contexts (C) are more conducive to the successful implementation of evidence into practice than others. These include contexts that have transformational leaders, features of learning organisations, and appropriate monitoring, evaluative, and feedback mechanisms.

4. There is an emphasis on the need for appropriate facilitation (F) to improve the likelihood of success. The type of facilitation, and the role and skill of the facilitator that is required is determined by the "state of preparedness" of an individual or team, in terms of their acceptance and understanding of evidence, the receptivity of their place of work or context in terms of the resources, culture and values, leadership style, and evaluation activity. Facilitators work with individuals and teams to enhance the process of implementation.

The set of characteristics that have been identified in each of the frameworks as the contingencies are those factors that can be manipulated or managed in some way. They are what Van de Ven et al., (1999 and 2000) have termed explanatory mechanisms and what Pawson and Tilley (1997) describe as the mechanisms within their realistic evaluation framework. Whether the 'mechanism' is a set of factors, an integrated intervention, a programme or a planned set of actions, the impact on the conceptual framework can be observed within the dimensions of the other two co-ordinates or constants – the organisational layers and the type of knowledge being assimilated or learning that is being experienced or both.

Therefore, in addition to the new idea/new piece of knowledge/new piece of evidence/new innovation that is coming into the system there is another set of novelties – the processes by which the new knowledge is assimilated. This may be termed a

programme or an intervention from a research point of view. The more interesting question however, is what is it called by the actors within the system? Do they perceive it as something outside of their daily working practices, and if so, how do they develop the confidence and skills to manage it?

From a research/KT point of view this is an important question because if the programme is the construction of the activity to enable the change to happen, who is the architect of the programme? Can the programme be constructed outside of the context into which it is being implemented by actors who have not been involved in constructing the script? What impact does this have on researchers who are trying to construct interventions/ programmes without the intimate knowledge of the contextual and boundary issues of the transfer of knowledge?

Methodologically these dilemmas are reflected most accurately in the description by Pawson et al., (1997) description of realistic evaluation, a methodology for investigating complex programmatic interventions. This is a cross over between a conceptual framework and a methodology and is outlined here to stimulate discussion.

3.2.5 Realistic evaluation/review and synthesis as methodological bridges between conceptual frameworks, theories and methodology of KT. Pawson and Tilley (1997)

The roots of realistic evaluation can be found in philosophy (realism) and have been applied in the social scientific world in particular. The approach is explanatory rather than judgemental. The realist approach to evaluation can be summarised by the following questions:

What works? For whom? In what circumstances? In what respects? How?

The first steps in the realist approach are to make explicit the programme theory i.e. the underlying assumptions about how an intervention is meant to work and what impact it is expected to have. (An important question to ask here is who is responsible for doing this – the researcher, the people who are introducing the programme or both parties together?). The next step is to look for empirical evidence to populate this theoretical framework, searching for supporting and contradicting evidence and modifying the programme theory as one goes along.

The result of a realist review is to focus on explaining the relationship between three key elements:
C = the context into which I, the intervention, is applied; M, the mechanisms by which it works in order to produce the desired outcomes (O). Programs have successful outcomes (O) only if they introduce appropriate ideas and opportunities (M) to groups in the appropriate social and cultural context (C). This can be represented in the following formula: C+M=O. Realistic evaluation is about hypothesising and testing such CMO configurations.

The interventions being tested are described by Pawson et al (1997) as complex service interventions (CSIs), characterised in the following ways:

- They are theories which implicitly or explicitly postulate that if programme A is delivered B will happen.
- They achieve their effect by active input from individuals. Individuals are the key agents and can alter their behaviour according to the local circumstances/conditions. Active programmes only work through stakeholder reasoning and knowledge and personal choices. They make decisions that influence outcomes.

- The theories being tested traverse policy, political, professional and patient (user) boundaries. Successful CSIs depend on the cumulative success of the entire sequence of these mechanisms as the programme unfolds (or the deliberate alteration/ adaption of actions to steer the programme in the desired direction).
- The 'implementation chains' are non-linear and can go in various directions.
- They are fragile, embedded in multiple social systems and have to take account of context. Variables include political timing, organisational culture, organisational leadership, resource allocation, staffing levels, capabilities, interpersonal relationships, competing local priorities and competing influences.
- They mutate and migrate across boundaries, and are taken up by other groups.
- They are open systems and feedback on themselves. As they are implemented they change conditions.

This dynamic interaction described in the conceptual frameworks and represented in the methodological approaches of the authors' work, as well as summarised in the methodological representation of realistic evaluation and review, is something to be considered in the development of KT science.

In the next set of theories and models described, there is more focus on particular aspects of KT rather that an attempt to conceptualise the whole picture. The question raised for this Forum is to what extent does KT research need the boundaries of emerging dynamic conceptual frameworks to guide the research endeavour?

3.2.6 Diffusion of Innovations in Service Organisations : Greenhalgh et al (2004)

Greenhalgh et al's (2004) representation of the conceptual map of innovations in service organisations stands at an interesting intersection between the conceptual frameworks described earlier and the specific theories and models described in the next sections. Their comprehensive review used a realist synthesis and review approach, and outlined eight key dimensions that were thought to influence the successful implementation of innovations into practice. These eight dimensions comprised: the characteristics of the innovation; the diffusion-dissemination process; the outer context; the linkage process; system antecedents; system readiness; adoption/assimilation and the implementation process itself.

Their 'conceptual map' was descriptive rather than explanatory or interpretative, and they did not speculate on the range of dynamic interactions that could take place at the intersections or boundaries of each of these set of characteristics. What they did do however, (and implicit in this was the hypothesising and developing of theories to be tested), was to produce a set of topic areas for further research based on a clear set of design characteristics. The characteristics for next generation research on diffusion/dissemination/implementation of health service innovations included:

- Theory driven – defined as exploring hypothetical links between an intervention/programme and a defined outcome. The role of the researcher is to refine their understanding of the mechanisms by which determinants produce, or fail to produce, the outcome of interest.;
- Process, rather than looking at the programme as an end in itself.;
- Ecological i.e. having to take account of the programme in the wider contextual setting.;
- Use of common definitions, measures, tools.;

• Collaborative and co-ordinated – prioritise and study research questions across multiple programmes in a variety of contexts rather than small isolated teams doing their own thing.;

• Multidisciplinary and multi-method – recognise the inherent limitations of the experimental approach to researching open systems and embrace a broad range of research methods.;

• Attention to detail – includes rich descriptions of context and process and use technology to collect and store data sets that can be used for future reference.;

• Participatory – because of the reciprocal interactions between context and programme success, researchers need to engage on-the-ground service providers as partners in the research process. Locally- owned and -driven programmes were thought to produce more useful research questions and data, and were thought to be more valued by practitioners and policy makers.

The call to focus on the theoretical underpinnings of KT and to define discrete programmes or interventions around particular theories has been heard by many KT research teams. Three pieces of work are outlined as illustrative of the current trend in theory development and testing. These are Wensing et al's (2005) review of theories of behaviour change, Grol et al's (2005) model of behaviour change and Graham et al's (2007) knowledge-to-action model.

3.2.7 Factors in Theories in Behaviour Change: Wensing et al (2005)

This team reviewed theories of behaviour change that could help identify a broader range of factors that influence the successful uptake of new knowledge into practice. In methodological terms, the focus was on specific (potentially measurable) 'mediators' (defined as intermediate factors which influence/change the effect of an intervention on the final outcome p10) or 'modifiers' (defined as variables that affect the direction, strength of the relationship between independent or predictor variables and a dependent or criterion variable p12) of the effects of KT interventions (not located within any particular overarching conceptual framework). The review took a transdisciplinary approach including theories and research from psychology, sociology, economics education and management. Through a process of review and synthesis, the team produced a list of 30 factors spanning four levels of the organisation (see table 5)

Out of this review, Wensing et al (2005) recommend that developers of implementation strategies e.g. professional bodies, managers, policy makers consider the relevance of the above factors in their design of such strategies. They also recommend that evaluators and researchers of implementation processes consider the inclusion of these theory-based factors in studies. However, what the review did not choose to do was to speculate on the interdependencies between the factors and the levels within their implicit framework. For example, if the intervention was based on enabling workers at local level to take more control of their ability to problem solve and innovate, what would the relevant consistent theories be at individual, group, organisational and economic structure level? One can easily speculate how 'families' of theories could be bunched together to look at the intervention across the whole system.

Also, another question that was not fully addressed was the role of the KT researcher in helping to design and implement the intervention at local level. However, the researchers suggest that 'mediators' can be used for setting objectives and 'moderators' can be used to tailor KT interventions to specific sub-groups or individuals. Such terms (mediators and moderators) are similar in meaning to what Van de Ven et al (2000) and Pawson and Tilley (1997) call 'mechanisms'. However, the particular meaning and use to which these elements are put to will also be dependant upon the particular methodology being used.

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Table 5: Theories of Behaviour Change that could Influence KT

Level within the organisation	Factor	Underlying theories
individual	Information behaviour; knowledge; beliefs about consequences; attitudes; beliefs about capabilities; behavioural regulation; skills; perceived social norms; motivation; emotion	Motivation for learning; planned behaviour; coping theory; social cognitive; cognitive theory on learning; adopter characteristics; innovation chars; stages of change.
Professional groups	Objectives; group composition; change agents; relationships; education and legal	Team cognition and team processes; leadership; social network; prof.dev.
Health care organisation	Clinical protocols; flexible delivery systems; training of professionals; customer relations; climate of openness; Constancy of purpose; organisation intelligence; size of teams	Specification; flexibility; continuous improvement; external communications; internal communications; leadership strategies; technical knowledge; organisation size
Economic structures	Positive incentives; financial risk sharing; transition costs; purchaser-provider relations; competition intensity; priority on societal agenda	Rewards and sanctions; budget capitation; cost improvement; licensing rights; market maturation.

3.2.8 Ten Stage Model for Planning Change : Grol and Wensing (2005)

One publication that moved some way to operationalising the Wensing et al (2005) review was the description of a ten-stage model for planning change outlined by Grol and Wensing (2005). Previous versions of this model were published by Grol (1992). It derives from theories of behaviour and planned action. According to Grol and Wensing (2005), successful implementation of an innovation is the ability to identify all potential interacting determining factors that have a positive or negative effect on the uptake or adoption of an innovation, and to describe factor characteristics, in terms of their antecedent implicit and explicit theories, through which single or multiple theories can be tested to evaluate their impact/effectiveness on change.

In arguing for a more systematic use of theories in planning and evaluating interventions in clinical practice, they outlined seven principles – acknowledge the complexity; establish commitment from the 'target group' i.e. the group of people in the system who were responsible for actually implementing the innovation; review attributes of the innovation and link to values and level of local autonomy; plan staged approach to change ; link measures and strategies for change to the results of the problem analysis; recommend the evaluative approach with feedback to change the plan and ensure that the implementation plan is linked to the wider strategies of the organisation.

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From these broad principles, a ten-stage model is described:

Orientation: 1. Awareness of innovation; 2. Interest and involvement

Insight: 3. Understanding; 4. Insight into own routine

Acceptance: 5. Positive attitude; 6. Decision to change

Change: 7. Actual adoption/trying out; 8. Confirmation of value

Maintenance: 9. New practice integrated into routines; 10. New practice embedded into organisation

The model is a combination of a participatory and planned approach (bottom-up and top-down). The model suggests the importance of planning, but it also recognizes the importance of involving stakeholders and the non-linear patterns of change resulting from this.

3.2.9 The Knowledge-to-Action Model: Graham et al (2005)

Graham et al (2005) are very clear that the model is based on planned action theories. The planned (prescriptive) change model is a 'set of logically interrelated concepts' that:

- Explain in a systematic way the means by which planned change occurs.
- Predict how various forces within an environment will react in specified change situations.
- Help planners or change agents control variables that increase or decrease the likelihood of occurrence of change. They identify a set of six principles underlying the model and seven sequential steps:

Principles	Steps of the Knowledge-to-Action Model
1. Nature of the evidence/knowledge	1. Identify problem – identify, review, select relevant, appropriate knowledge
2. Attributes of change/innovation	2. Adapt knowledge to local context
3. Who the audience is	3. Assess barriers to knowledge use
4. Organisational context	4. Select, tailor and implement the intervention
5. Organisational resources and suppor for proposed change	5. Monitor knowledge use
6. Implementation related factors	6. Evaluate outcomes
	7. Sustain knowledge use

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As a proposed intervention with a clear theoretical base, the K-to-A Model could be used as a programme intervention to test its efficacy. However, what it does not pick up is the multidimensional and dynamic nature of the context, relationships and interactions going on at every one of the steps. Somehow the logic of the analytical problem-solving and planning process has to be connected to the chaotic, random, serendipitous way change tends to happen in practice. This is the challenge to the research as much as to the people on the ground who have to make the change happen.

Graham et al's (2005) model has similar characteristics to many of the problem-solving and quality improvement cycles described in the literature. They would seem to be tools or models embedded in a bigger, more complex picture that requires more theoretical and conceptual development before we can adequately and accurately describe what is really happening and then try to influence it positively.

Questions emerging from this high level illustrative review of a range of conceptual frameworks, theories and models include:

1. How do we define the boundaries of the intervention? Is it a theory, and hypothesis to be tested, a model?

2. Who develops the intervention and who 'owns' it? Should it be created by researchers and given to practitioners? Should it be created by practitioners and researchers evaluate the process and outcomes? Should the intervention be co-created and co-owned by the researchers and the practitioners?

3. What level of feedback, alteration, change is acceptable to the intervention within the research process?

4. What scientific methods are best suited to the study of complex interventions?

5. How do we construct the boundaries around the discipline of KT – conceptually, theoretically and methodologically – in order to speed up the process of getting knowledge into practice?

6. Do we have to come to agreement on the above factors/issues before we can agree on working definitions of key terms within the discipline?

3.3 The Emerging Research Agenda

How do we make sense of the richness and diversity of the science of KT? The earlier sections describe the range of issues that need to be considered and the next table attempts to pull together the key elements of the discussion so far and to summarise them in a series of sections within which are posed a set of illustrative questions. The classification is relatively straightforward – potential research questions are divided into theoretical, policy and methodological (design, exploratory, intervention and evaluative).

There are, no doubt, many other ways that the data could be organised. The most useful and meaningful approach, together with a rationale for the prioritisation, rejection, aggregation, and selection of topics will be negotiated at the KT08 Forum. The same criticism could be levelled at the list as in the previous outline of conceptual frameworks, namely that of selection bias. This exercise is but the first iteration of what is hoped will be a much more inclusive process.

Section 3: Ways of Framing the Issues

Table 6: The Emerging KT Research Agenda

Type of Research Question	Research Question	Source(s)
Theoretical		
• World view	How does the wider discourse of Mode 1 and Mode 2 science influence the theoretical and methodological assumptions of the KT discipline?	(Kitson and Bisby, 2008)
• Conceptual frameworks	How has the evolution and critical discourse around research evidence influenced its uptake and use? How can healthcare learn from other disciplines (engineering science) in order to improve its core processes?	(Grimshaw J, 2007)
• Definitions	How do we construct a set of working definitions for key terms in KT?	(Grol R et al., 2008)
• Theories (use of)	How do you develop and test theoretical models for dissemination and implementation processes?	(Graham I et al., 2006)
• Knowledge synthesis	How do you identify the knowledge base for KT research and practice?	(National Institutes of Health, 2006)
• Boundaries	To what extent does KT research need the boundaries of emerging conceptual frameworks to guide the research endeavour?	(Grimshaw J, 2007) (Kitson and Bisby, 2008)

Section 3: Ways of Framing the Issues

Table 6: The Emerging KT Research Agenda

Type of Research Question	Research Question	Source(s)
Policy		
• Role of funders	What is the role of the funding agency in: • Synthesising knowledge • Training researchers in KT methods • Acting as knowledge brokers • Improving evaluation methods of effective studies at funding level?	(Tetroe JM et al., 2008)
• Commercialization How to accelerate KT	How do you increase the generalisability/transferability of research findings in order to accelerate the movement of knowledge?	(Kitson and Bisby, 2008)
• Common theories/frameworks	How can you examine the conceptual frameworks and theories of innovation that apply to commercialisation of knowledge and the application of knowledge to practice?	
• Impact of technology	What can technology and technology transfer teach KT?	
• Roles within the commercial sector	What roles and models have worked in the commercial sector and what could we learn for the health/public sector?	
• Transfer of learning	What methods in terms of fostering receptor competency, improving research approaches and tools, improving metrics and improving training of researchers could be transferred from commercialisation to KT?	

Section 3: Ways of Framing the Issues

Table 6: The Emerging KT Research Agenda

Type of Research Question	Research Question	Source(s)
Methodology: Design		
• Methods	How do you develop standardised and comprehensive ways of reporting exclusion, participant rates and representativeness of both participants and settings?	(Glasgow RE et al., 2003)
	How do you improve the fidelity of implementation efforts, including the identification of components of implementation that will enable fidelity to be assessed meaningfully?	(National Institutes of Health, 2006)
	How do you encourage innovation in intervention design and standardisation in reporting on process and on outcome measures at both individual and setting level?	(Glasgow RE et al., 2003)
	What sort of designs work best for studies of innovation: • cross-over • sequential programs • replications • multiple baselines • RCTs?	
• Outcome measures	How do you develop outcome measures that accurately assess the success of an approach to move evidence into practice?	(National Institutes of Health, 2006)
• Measures for barriers/ facilitators to dissemination and implementation	How do we develop robust methods to assess what are the barriers and facilitators to dissemination and implementation?	
• Use of routine data to monitor performance	Can you use routine data to monitor changes to practice and the introduction of new practices in a reliable and valid way?	(Grimshaw J, 2007) (Grol R et al., 2008)

Section 3: Ways of Framing the Issues

Table 6: The Emerging KT Research Agenda

Type of Research Question	Research Question	Source(s)
Methodology: Exploratory		
• Key characteristics of innovation	How do you investigate ways to enhance reach, adoption, implementation and maintenance of innovations?	(Glasgow RE et al., 2003)
	What are the factors that influence the creation, packaging, transmission and reception of valid health research knowledge, ranging from psychological and social cultural factors affecting individuals (consumers, caregivers, and practitioners), other stakeholders, to the whole system?	(National Institutes of Health, 2006)
	How do innovations arise and in what circumstances?	(Greenhalgh T et al., 2004)
	What mix of factors produce adoptable innovations?	
	What is the impact of a 'top-down' innovation versus a 'bottom-up' innovation?	
	What is a 'bad' innovation and how do you stop it spreading?	
• Sustainability	How do you maintain/sustain an innovation both a) within the research design and b) within the system where it is being introduced?	
	How do you achieve sustained change in "normal care delivery"?	(Glasgow RE et al., 2003)
	What are the long term effects and sustainability of initially successful interventions?	
• Different types of health information	How do you test the effectiveness of prevention, early detection, diagnostic interventions as well as treatment and clinical interventions?	(Grol R et al., 2008)
• Different dissemination strategies for different contexts	How do you test the utility of alternative dissemination strategies for service delivery systems targeting rural, minority and/or other underserved populations?	(National Institutes of Health, 2006)

Section 3: Ways of Framing the Issues

Table 6: The Emerging KT Research Agenda

Type of Research Question	Research Question	Source(s)
Methodology: Exploratory (continued)		
• Defining the target audience for the innovation	How do you successfully determine the target audience(s) for an innovation and how does this influence the way the evidence is 'packaged' for them?	(Grimshaw J, 2007)
• Knowledge management	What are the best ways to retrieve evaluate and manage knowledge?	
	What is the role of knowledge management networks across organisational boundaries in increasing the spread of innovation?	(Greenhalgh T et al., 2004)
• Knowledge to action gap	How do we identify the knowledge-to-action gaps in the health care system?	(Grimshaw J, 2007)
• Personal motivation	What mechanisms enable professionals to move from being resistant to new ideas to embracing them and which will lead them to feel more motivated and satisfied with their work?	(Grol R et al., 2008)
• Individual/team performance	What factors influence the difference in individual performance at local level?	(Greenhalgh T et al., 2004)
• Identifying clinical problems and areas for innovation	How do you identify and address the needs of specific groups of patients and what is their role in determining the type/shape of the innovation/improvements being introduced?	(Glasgow RE et al., 2003; National Institutes of Health, 2006)
• Improving the uptake of evidence	What are the conditions that encourage clinicians to use safe, scientifically credible evidence in their everyday practice?	
• Access to evidence at the point of care	What are the most effective ways of providing practitioners with access to the most up-to-date evidence at the point of care?	

Section 3: Ways of Framing the Issues

Table 6: The Emerging KT Research Agenda

Type of Research Question	Research Question	Source(s)
Methodology: Exploratory (continued)		
• Teamwork	What mechanisms help to enable groups of professionals to work effectively as teams to introduce new ideas into practice?	
• Context	What are the mechanisms that create a culture of change and continuous improvement in a ward or practice setting?	
• Characteristics of adopters /adoption	What is the role of professional associations in increasing innovations?	(Greenhalgh T et al., 2004)
	What are the unintended negative effects of 'external push' when a system is not 'ready' for an innovation?	
	How are innovations 'internalized' into the organisational culture?	
	What impact does restructuring have on the ability of organisations to innovate?	(Glasgow RE et al., 2003; National Institutes of Health, 2006)
	Why and how do people reject an innovation after adopting it? Is this linked to sustainability?	
	Do the actors within the system perceive the intervention as something outside their daily work practices? And if so, how do they develop the confidence and skill to manage the new information?	
	Who and what are product champions?	
	What is the role of champions and what is the nature and extent of their social networks?	
	Who and what are opinion leaders?	
	What is their impact in groups?	
	Who are the boundary spanners and what do they do?	
	What is the nature of their role and what is their impact on groups?	
• Dissemination and social influence	What impact does context have on the successful implementation of interventions (studies of specific care delivery settings e.g. primary care, schools, community settings)?	

Section 3: Ways of Framing the Issues

Table 6: The Emerging KT Research Agenda

Type of Research Question	Research Question	Source(s)
Methodology: Interventions		
	How do you test the effectiveness of individual and systemic dissemination strategies focusing on outcomes related to the direct outcomes of the strategies (new knowledge, maintenance of knowledge, attitudes about the dissemination strategies, use of knowledge in the practice decision-making)?	(Greenhalgh T et al., 2004)
	By what processes are particular innovations implemented and sustained in particular contexts and how can these be enhanced?	
	Is there a difference in outcomes when an innovation is constructed independent of the context and actors who have to implement it?	
	What difference does it make to the success of a new intervention being introduced by a research team if they have involved the local actors in all the stages in the process?	
Methodology: Evaluation		
• Cost effectiveness	How do you devise more cost-effectiveness studies and other economic evaluations that are of interest to programme administrators and policy makers?	(Glasgow RE et al., 2003; Grimshaw J, 2007; Grol R et al., 2008)
• Use of financial incentives/ economic principles	How can the use of financial incentives and economic principles be used to increase innovations in practice and improve quality of care?	

Section 3: Ways of Framing the Issues

3.4 Where do we go from here?

It has not been difficult to construct a large list of potential research questions. Yet despite this ease, we have to recognise that we still do not have common definitions as we are at an early stage of formulating and refining key concepts and constructs. Theoretical work within the discipline is distinct from testing theory-based interventions. We need to work out how we manage complexity and the multidimensional nature of the discipline (which is probably no different to levels of complexity and multidimensionality in other disciplines e.g. theoretical physics). How we identify those areas requiring immediate attention will be the focus of the Forum discussions. How can funders identify those areas that can be productively and effectively funded and move from the large laundry list or wish list of topics to something more focused and tangible? This debate cannot be pre-empted and indeed it requires the whole Forum to participate in a refining and prioritising process.

By using the range of conceptual frameworks that already exist, we should consider starting to populate them with relevant groups of theories within clearly delineated models which could then become the hypotheses to be tested through specific interventions. We should consider the underlying methodologies most suited to this discipline and embrace the necessary requirements of interdisciplinary working in a collaborative way. We could then set ourselves the task of creating a series of integrated KT research programmes, adequately funded, that would contribute to the advancement of knowledge translation research and practice.

If this does feel like the way forward, then the next big question is around whom the stakeholders ought to be and how they are involved.

Section 4: Who are the stakeholders and how should they be involved?

What does all this mean to Forum participants and to others who will read the background paper and the Forum proceedings?

The premises or tentative positions we have arrived at in this paper include:

- Society is changing in terms of the way K is understood, used, transmitted.
- This has influenced the way R has to be conducted.
- KT is one of the consequences of this change.
- KT development has reached a point where it needs to agree a common language/lexicon, agreed definitions and sketch out the various conceptual frameworks that will create the boundaries around different research enterprises within KT.
- We must agree how to prioritise the evolving research agenda and how to support the funding agencies to be able to create more sensitive evaluative criteria.
- We need method(s) for identifying key stakeholders and creating and building upon existing investment, incentive, reward, capacity building processes.
- While some countries/organisations have moved far on these issues they require co-ordinated international effort, because of the rapid pace of societal change, and the growing need for healthcare research to demonstrate a positive, measurable and attributable impact on patient care.

Indeed, one of the emerging questions and challenges is how to create different dissemination strategies for different contexts, in particular in underserved or disadvantaged populations. Our focus has been on KT as it is practiced in nations with well-developed public and health systems, but we must note there is both an enormous opportunity to apply effective KT practice to less-entrenched systems in emerging economies, and a challenge to apply knowledge acquired in wealthy nations to health systems in lower and middle-income countries (Madon T et al, 2007)

We need therefore to work out how we involve key stakeholders in these transformations.

What are the transforming ways to engage the following groups?

- Politicians/government agencies
- Funders/research organisations
- Academic organisations (the traditional knowledge generators)
- Policy workers
- Research community
- Users of the knowledge
- Underserved, disadvantaged populations

We have chosen to itemise these stakeholder issues as a way of encouraging discussion at the Forum. The level and type of involvement resides at the heart of the Mode 1/Mode 2 deliberations of the earlier sections and also transcends the conceptual and methodological discussions of Section 3.

Section 5: What do we need to do?

In order to focus discussion, we have constructed a series of propositions that can be tested throughout the Forum. The propositions have emerged from the arguments presented in the paper and our intention is for participants to reflect on and debate these propositions.

Proposition 1

The public's and society's expectations of researchers and their role in generating new knowledge have changed from being perceived as passive recipients of KT to expecting to become active partners in each step of the research/knowledge generating process.

Proposition 2

One consequence of this is the way that research is developed, conducted, rewarded, assessed and implemented is changing. Institutions that are closely connected to knowledge production will have to change accordingly or lose their influence and ultimately their funding and resources (i.e. universities, funding agencies, policy organisations, provider services).

Proposition 3

Researchers need to acquire KT sensitivity, understanding, appreciation and skills. This means a gradual move from legitimate 'end of grant' activities to a much greater emphasis on appropriate KT approaches. The consequences are: more funding, explicit acknowledgement of KT as a legitimate part of the research process, more training and support, broader research teams and change in funding and evaluative criteria.

Proposition 4

In order to accelerate KT research, urgent attention needs to be paid to agreement on:

- Working/operational definitions that reflect the scope and boundaries of the domain of KT
- Broad conceptual frameworks and how they inform theory, methodology and method
- How to conceive, develop and run complex multidisciplinary research programmes that focus as much on process as outcomes.

Proposition 5

An international, interdisciplinary, collaborative research agenda can be created with priorities and preferences built into it, properly funded and with the right infrastructure in order to speed up the spread of K into practice. Research will span curiosity driven, theoretical research in KT as well as integrated applied practice-based research.

Proposition 6

All health researchers...from the molecular biologist to the sociologist...need training in how to contextualise KT for their particular type of research. As a researcher, what is it that I produce that might be of use to others? Who are the users? How do I reach them? How do I provide the information in the most useful way? How will I know if I am communicating effectively? As a researcher, a key class of user is my research peers, and I can start developing my KT expertise by communicating and sharing/collaborating better with them in order to accelerate the pace of discovery. How do I learn to do this more effectively?

Proposition 7

More effort/investment in evaluation and research on better evaluation methodologies needs to be made in order to learn if KT programs, structures, frameworks and theories are working and if not, why not.

The purpose of the conference is to test these propositions and to build a conceptual framework and research agenda, articulating emerging processes for future refinement and use.

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Appendix 1

Commercialization as a special case of KT

Commercialisation as a special case of KT

Partners, Pathways and Mechanisms are prototypic and well-recognised

- Tends to emphasize linear conceptual model from discovery to marketplace
- Enamoured of technological clusters

Money (or expectation thereof) a major motivation

- Culture of IP protection, patents and exclusivity
- Strong financial incentive for researchers and institution
- Scientific misconduct in underlying science more common
- Infrequently, generates income stream for university
- Large legal component

Vastly more expensive and high-risk

- Failure frequently due to limitations of technology and understanding of human physiology
- Acquiring funding is a large part of the activity in this area, and inability to do so at the right time a common cause of failure
- Time scale very much longer (~20 yrs) for drug development
- Scope is usually multinational

Recognised as desirable national and local priority

- Strongly influenced by government policy changes: e.g. Bayh-Dole Act in USA, national patent protection and corresponding multinational pharmaceutical investment
- Resources available from granting agencies
- Resources in form of special programs and fiscal advantages, directly from governments
- Resources available from universities
- Technology Transfer Offices
- Venture capital funds, sometimes
- University-financed spin-outs
- Centres for technology development/company
- Incubators

Plentiful but conditional resources available from users (industry)

Greater recognition as a valid researcher activity

- By peers
- By university admin
- By policy-makers

Frequently, lack of attention to broader societal costs/benefits of commercialization

- Engenders greater debate about academic freedom and the mission of universities
- Seldom accompanied by system-wide assessment of cost-benefit
- Often vulnerable to attack by social commentators (think GMOs, stem cell technologies, me-too drugs)

Burdened by significant regulatory obligations

- Active lobbying and advocacy within government

Areas of similarity with all Health KT

Both a product of Mode 2 approach to science, both undergoing paradigmatic shifts as conventional models seen as ineffective (e.g. "open innovation", patent pools, precompetitive research funding programs)

Both "contact sports": rely on knowledge brokers
Uncertainty about what works, and why

New technologies are enabling and accelerating new forms of innovation

A challenge to find resources to bridge research-implementation gaps

Often, insufficient attention to social and cultural contexts of innovation

Knowledge producers and users inhabit organizations with different missions and cultures

Receptor organizations may not exist locally, or lack capacity to absorb innovation

Inadequate numbers of appropriately skilled personnel

Academic research agenda needs to be driven to a greater extent by user demand

HRFAs struggling to define emerging role

- Who are the peers?
- What are the evaluation criteria?
- Where does our responsibility end?

Areas for a common research agenda

How to accelerate KT?

- Increasing generalisability of research findings
- Increasing access to research findings
- Improving interpretation of research findings
- More upstream engagement with users of research knowledge

Examination of conceptual frameworks and theories of innovation

Understanding implications of new technologies and ways of collaborating

Training and support for knowledge brokers and other intermediaries (e.g. Spin-off company managers)

Fostering receptor capacity to adopt and employ innovations

Improving research approaches and tools

Improving metrics and evaluation methodologies

Improved training of researchers to understand obligations and mechanisms