Why is Knowledge Translation Important? Grounding the Conversation

Michael Gibbons

Preamble

It is the burden of my remarks to argue that Knowledge Translation describes an engagement process.

You may think that engagement is a somewhat unusual term to apply to KT activities, perhaps because so much of the theoretical analyses and practical applications of KT are dominated by the rather mechanical language of transfer. In knowledge transfer, the image is one of moving items of knowledge or pieces of information between different domains, whether they be those of pure and applied science, applied science and the industry, or, moving closer to home, the transfer of the knowledge being generated in the bio-sciences to improving human well being at the point of delivery via a matrix of institutions comprising universities, health research institutes, health delivery systems and policy makers.

The image of transfer is, however, deeply flawed because it operates not only subliminally but also heuristically in the construction of models concerned mainly with the efficiency or effectiveness of moving knowledge between one domain and another without noting that the knowledge will need to change in the process of being transferred. It is true that the subject of our meeting is entitled knowledge translation. This metaphor retains the idea of transfer but acknowledges, if only tacitly, that in the translation process the relevant knowledge might need to be adapted in some way.

In what follows I will try to indicate just how that might take place. I will develop a framework that tries to go beyond the images of both transfer and translation by offering a different one that, in my view, captures more accurately the nature of what we intend by the phrase “knowledge translation”. It will be the burden of my argument to demonstrate we need to shift the metaphor from knowledge transfer, and move beyond that of translation to what I shall call knowledge exchange.

This shift of metaphor would seem to fit well with the overall aim of this conference. If I read the conference literature correctly, we are not here merely to transfer knowledge in the sense of best practice between one another but to generate knowledge relevant to our field through a process of interaction. I will try to show that knowledge exchange describes a process of engagement that applies both to concrete instances of knowledge exchange and to the task that we are meant to participate in be during the next few days. In this, my presentation will draw upon some earlier work that colleagues and I have done on Mode 2 forms of knowledge production.

Before beginning, and at the request of the conference organisers, I will outline briefly some of characteristics of Mode 2 forms of knowledge production and how they differs from the more conventional Mode 1 forms.

1. The New Production of Knowledge

Both *The New Production of Knowledge* and *Re-Thinking Science* were written as reflective essays rather than empirical studies. Their purpose was as much to address the need to invent a new language of research as to offer a detailed analysis of the trends which had already been identified by numerous authors. In the first book, *The New Production of Knowledge,* the notion of ‘Mode 2’ knowledge production was introduced – and contrasted with ‘Mode 1’ research, the model which applies to knowledge production in science as conventionally practised.

In contrast, ‘Mode 2’ knowledge production has a number of distinguishing characteristics: the context of application, transdisciplinarity, heterogeneity, reflexivity, and modified forms of quality control.

1. ‘Mode 2’ knowledge is generated within the context of application. This is different from the conventional process of application by which ‘pure’ science, generated in theoretical/experimental environments, is ‘applied; 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 uses are defined.

2. Mode 2 knowledge production is trans-disciplinary, by which is meant the mobilisation of a range of theoretical perspectives and practical methodologies to solve problems. But, unlike inter- or multi-disciplinarity, it is not necessarily derived from pre-existing disciplines nor does it always contribute to the formation of new disciplines. The creative act lies just as much in the capacity to mobilise and manage these perspectives and methodologies, their ‘external’ orchestration so-to-speak, as in the development of new theories or conceptualisations or the refinement of research methods, the ‘internal’ dynamics of scientific creativity. In other words ‘Mode 2’ knowledge, in this trans-disciplinary form, is embodied in the expertise of individual researchers and research teams as much as, or possibly more than, it is encoded in conventional research products such as journal articles or even patents.

3. In Mode 2 there is a greater diversity of the sites at which knowledge is produced and, an associated phenomenon, ae growing heterogeneity in the types of knowledge production. The first phenomenon, it can be argued, is not especially new. Research communities have always been

‘virtual’ communities that cross national (and cultural) boundaries. But their dynamics have been transformed. Once interaction within these communities was limited by the constraints both physical (the ability to meet) and technical (letters and telephones); now as a result of advances in information and communication technologies interaction is unconstrained - and instantaneous. The orderly hierarchies imposed by these ‘old’ technologies of interaction may have been eroded by this communicative free-for-all. This shift has been intensified by the second phenomenon, the fact that these research communities now have open frontiers which has allowed many new kinds of ‘knowledge’ organisation - such as think-tanks, management consultants, activist groups - to join the research game.

4. Mode 2 knowledge is that it is highly reflexive. The research process can no longer be characterised as an ‘objective’ investigation of the natural (or social) world. Instead, it has become a dialogic process, an intense (and perhaps endless) ‘conversation’ between research actors and research subjects - to such an extent that the basic vocabulary of research (who, whom, what, how) is in danger of losing its significance. As a result traditional notions of accountability as being a form of external review of mature research concepts and projects have had to be radically revised. The consequences (predictable and unintended) of new knowledge could not be regarded as being ‘outside’ the research process because problem-solving environments influence topic-choice and research-design as well end-uses.

5. Mode 2 exhibits novel forms of quality control are emerging - for a number of reasons. First, in ‘Mode 2’ knowledge scientific ‘peers’ can no longer be reliably identified, because there is no longer a stable taxonomy of codified disciplines from which ‘peers’ can be drawn.

> Secondly, reductionist forms of quality control can not easily be applied to much more broadly framed research questions; the research 'game' is being joined by more and more players - not simply a wider and more eclectic range of 'producers' but also orchestrators, brokers, disseminators, users. Thirdly, and most disturbingly, clear and unchallengeable criteria to determine quality may no longer be available. Instead we must learn to live with multiple definitions of quality, which seriously complicates (even compromises) the processes of discrimination, prioritisation and selectivity on which policy-makers and funding agencies increasingly rely.

2. The emergence of a Mode 2 society

In our second book, *Re-thinking Science*, we returned to the idea of Mode 2 but this time we tried to identify the major political, social and institutional changes that had been taking place in society more generally over the past twenty years or so. Some of these changes, it seemed to us, supported the idea that Mode 2 forms of knowledge production reflected, and were reflected in, the characteristics of an emerging Mode 2 society. Let me describe briefly some of the relevant characteristics of a Mode 2 society. This will help to clarify the need for a completely different approach to knowledge transfer or translation.

Beginning in the twilight of the Cold War, if not before, the relative institutional separation between societies' major institutions had begun to breakdown:-

1. In publicly-funded research with the privatisation of the system of government research establishments.

2. As government gradually moved its priorities to the maintenance of international competitiveness and the enhancement of the quality of life, many long-established

industries were de-nationalised and, in many countries, firms which had been dependent upon government for R&D support were forced to find these resources internally.

3. In universities, too, the massification of higher education moved universities into a market place for students but this was accompanied by the introduction of a culture of accountability and a mounting social demand for “value for money” which soon reached into the heart of the research process.

4. The research councils themselves, created initially to support basic research in the universities were transformed into instruments for attaining economic and social priorities through an increased use of programme and project funding. These trends are observable in virtually every country in the world, though the timing and rates of change have varied with historical circumstances.

5. In virtually every country, promoting knowledge transfer between science and society became a central element of policy.

The upshot of this decade’s long series of changes is by now evident. The once clear lines of demarcation between government, industry and the universities, between science of the universities and the technology of industry, between basic research, applied research and product development, between careers in academe and those in industry seem no longer to apply. Instead, there is movement across established categories, greater permeability of institutional boundaries, greater blurring of professional identities, greater diversity of career patterns. In sum, the major institutions of society have been transgressed as institutions have crossed onto one another’s terrain.

In this, science has been both invading (the outcome of its familiar one way communication with society), but also, and less familiar, invaded by countless demands from the side of society. These changes were not primarily the result of the policies of impecunious governments, of greedy industrialist trying to take over the universities, or of a disgruntled citizenry disappointed by the performance of science, though some elements of each can be discerned in their histories. Quite the contrary, it is because institutional leaders, industrial managers, and people generally understand very well the importance of science that they respond to the growing complexity of the contemporary world by wanting to draw the research capabilities of universities into their interests and concerns. Given these pressures, it is hardly surprising that some scientists now participate in more open and complex systems of knowledge production.

In brief, society and science have *both* become transgressive; that is, each has invaded the other's domain, and the lines demarcating the one from the other have all but disappeared. In other words, we have to deal with both a new kind of society - a Mode 2 society - and a new kind of research - Mode 2 knowledge production - that are linked in a process of co-evolution. As will become clear, this development is not without its impact on the relationship between society and its knowledge producing institutions and, *a fortiori*, on the nature of knowledge exchange itself.

3. Transaction spaces: the "how" of it all

Let me summarize our progress so far. In a Mode 2 society and Mode 2 forms of knowledge production, research, as we have already suggested, is increasingly carried out in the context of application. In that context, science and society are both drawn into an engagement process that is characterized by knowledge exchange rather than knowledge transfer or even knowledge translation.

We are now ready to approach the hub of the argument:

- that knowledge exchange is not an automatic process;
- that it needs to be facilitated;
- that this requires a degress of awareness of what is taking place within the exchange process itself;
- which can only be generated through participation in the production of knowledge itself.

In this, boundary objects are essential.

Boundary Objects
In the process of knowledge exchange a way must be found to allow experts and others, each of whom may inhabit different social worlds, to interact effectively in transforming an issue or problem into a set of common activities some of which may require more research or a shift in research direction. In this, boundary objects and their associated transaction spaces are key entities if cooperation is to be established, consensus generated and knowledge produced.

<u>Example 1</u> The notion of a boundary object is simple enough and can be elucidated using a very mundane example. Consider a man and a woman walking in Hyde Park, in London on a Sunday morning. Socially, it is still very awkward for the man to approach the woman, or vice-versa, with the aim of striking up a conversation. It is not impossible, but it is awkward and, because the intent of the "first move" is ambiguous, defensive mechanisms can be expected to be brought into play. However, if both parties happen to be walking their dogs, then, of course, a conversation might originate, around the "dogs", while other issues remain in the background, for the time being. In this example, the dogs constitute a simple boundary object. A neutral entity around which information can be exchanged and which helps to create the conditions of the possibility of a dialogue on other, more serious matters, in due course. Boundary objects assist in the constitution of a "spaces" where debate can begin and relevant information exchanged.

In the case of knowledge production, boundary objects are typically:-

concepts or an ideas which refers to scientific objects which both inhabit several intersecting social worlds and satisfy the informational requirements of each of them;

objects which are both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites;

are weakly structured in common use, and become strongly structured in individual site use;

have different meanings in different social worlds but having a structure is common enough to more than one world to make them recognisable, a means of translation (between one social world and another)." (Star, S.L., *et al.* (1989), p. 393)

<u>Example 2</u> The importance of a boundary object can be seen in evolution of the Human Genome Mapping Project HGMP) analysed by Dr Brian Balmer. (Balmer, 1996) To begin, it should be recalled that the aim of the Human Genome Mapping Project was to draw up a catalogue of the entire genetic make-up of the human genome.

This project did not come about without controversy. Proponents of the project claimed that it would provide a valuable resource for science and medical treatments, while opponents have challenged its wisdom in terms of cost, strategy, ethics and the ultimate utility of its results.

Balmer has shown that the emergence of HGMP was not the outcome of any single factor. More specifically, the project did not follow the typical model of national research programmes typically cobbled together in a conspiracy between bureaucrats and the scientific establishment. The fact that a mapping project emerged at all has to be understood not in terms of bureaucratic politics but as the outcome of a complex *process of negotiation* in which a large number of interested parties were involved. It is the case that in this instance some actors and institutions played a large part, while others were less important. The point is that no one single person, group or organisation was in control dictating the pace and direction of advance. Indeed, the UK policies of "selectivity and concentration", and "value for money" only provided guidelines for a co-ordination with the agendas of the Medical Research Council (MRC) and the gene mapping community and their spokespeople.

As Balmer describes the process, the human genome mapping project came to act as a boundary object. The project constituted a social and a political entity that was able to align the goals and agendas of separate working groups. Alignment was achieved over a period of time as groups and their agendas where shuffled into and out of the policy arena, or altogether marginalised. As a consequence, money flowed from the state to scientists, and gene mapping, under the auspices of a concerted organised programme, came to be supported.

The emergence of boundary objects can thus be crucial in the generation of the social spaces that lie at the heart of the conduct of research in the context of application. Still, something is necessary to align diverse, and often divergent interests if work is to get started, but it is not a planned process. At each stage of the development of a project, the contingency of events and the opportunism of the actors cannot not be ignored. Scientists (Brenner and Bodmer, in this case) may have had some degree of control; but the government, together with the civil servants of the Advisory Council for Science and Technology (ACOST), and Medical Research Council (MRC) administrators may also have been able to influence events.

In sum, the genesis of HMPG was more an *orchestration process*, that attempted to make use of the resources available than a planned strategic, networking exercise. Nonetheless it led to the emergence of the HGMP in the United Kingdom.

Using a beautiful metaphor Balmer concluded that:-
"the process was rather like having an orchestra where all the players are vying to be the conductor, but with no one fully in control *and every one ready to improvise*." (italics mine)

The boundary object - the genome mapping project itself - allowed some sort of melody to be heard. In this case, *one can observe how the social, economic and scientific strands were woven into the project and how important it was to have something to command the allegiance of diverse interests in order for the project to be carried forward.*

These are the key element of boundary objects: something to command the allegiance of diverse interests; and willingness by participants not to compromise but to improvise.

Boundary objects are necessary because they increase the probability that a transaction space will be generated. What, then, is a transaction space?

Transaction spaces and trading zones
Of course, not every boundary object will generate an effective transaction space but when they do these "spaces" provide an important framework in which still tentative, and as yet inadequately institutionalised, interactions can take place. However, these interactions are more than random encounters. To the extent that they do develop into genuine transaction spaces they have some of the essential features that Peter Galison has described for the 'trading zones' he came across when analysing the history of nuclear physics in the twentieth

century (Galison, 1997). My point is that if trading is important in the highly structured, hierarchical framework of physics, then, surely, it is not outrageous to suggest that it may be a typical phenomena in all knowledge production generally and knowledge exchange more specifically.

In Galison’s work, we are made to encounter *within the disciplinary structure* of one sub-field the fascinating exchanges and intense collaborations between three sub-cultures of the nuclear physics community – theoreticians, experimentalists and engineers (those who build the machines used in nuclear physics). These traditions remained intact, preserved inside the collaboration, while the co-ordination of exchange took place around the production of the two competing instrument cultures of ‘image’ (taking pictures) and ‘logic’(counting events), which ultimately fused.

Taking his lead from anthropological theories, Galison observed how the often apparently independent exchanges between the various sub-cultures of physics can be compared to the incomplete and partial relations that are established when different tribes come together for trading purposes.

Nothing in the notion of trade presupposes some universal notion of a neutral currency. Quite the opposite: much of the academic interest in the category of trade is that things can be co-ordinated (what goes with what, for what purposes) without reference to some external gauge. Each tribe may bring to this interaction and take away from it completely different objects as well as the meanings attached to them. An object which may have a highly symbolic or even sacred value for one tribe may represent an entirely banal or utilitarian object for another. Nevertheless, interaction and trade is possible and actually takes place – to the obvious benefit of all because, if this were not so, dialogue would have ceased.

Importantly, trading may give rise to the emergence of *contact languages*, not unlike like the 'pidgin language' that has grown up in Louisiana, as a means of local communication. These languages are inevitably incomplete and truncated but they are developed to the degree necessary to work.

Why trading is so important? Thinking of his problem in physics, Galison's insight was that physicists and engineers were not engaging in translating knowledge from one sub-culture to another as they pieced together their microwave circuits, nor were they producing "neutral" observation sentences, as the philosophers contended they should. Rather, *they were working out a powerful, locally understood language to co-ordinate their actions.* Despite obvious limitations, some kind of understanding and exchange does occur in such situations.

For Galison, then, the crucial question was not:

How do "different scientific communities which seem to pass like ships in the night still manage to communicate?" After all, specialisation is meant to inhibit be a serious any interdisciplinary exchange of information. It was rather "how, given the extraordinary diversity of participants in this case in physics – cryogenic engineers, radio chemists, algebraic topologists, prototype tinkerers, computer wizards, quantum field theorists – they speak to one another at all… And the picture ……. is one of different areas changing over time with complex border zones
that sometimes vanish, coalesce, and even burgeon into quasi-autonomous regions in their own right." (Galison, *op. cit.* p. 63).

The idea of transaction spaces, as developed here, is an extension and generalisation of the concept of a trading zone beyond interaction amongst scientific sub-cultures to wider exchanges that take place across both the disciplinary and institutional boundaries that form the KT environment. The idea of "transaction" or "trading" implies, first, that all partners bring something that can be exchanged or negotiated and, second, that they also have the resources (scientific as well as material) to be able to take something from other participants. Of course, the meanings attributed to exchanged objects may differ greatly for different participants. But the success of these exchanges depends upon each participant bringing something that is considered valuable by someone else – whatever that value might be. Participants usually will return to their 'home base' with their gains, thereby re-enforcing, in typical Mode 2 fashion, the links and exchanges that have already occurred by sharing with others.

As I have already indicated Mode 2 knowledge production and Mode 2 society are linked through a process of co-evolution. Co-evolution in this context implies that from the side of science new research practices are emerging in part as a response from the side of society, to new questions which society wants to be taken seriously; but also, in part, from a greater understanding on the side of society of the importance of research in delivering solutions to problems of many different kinds. The notion of a transaction space makes the evolutionary aspect of the process more specific, because transaction spaces become visible as the sites where the first tenuous interactions between society and science take place. They are spaces (both symbolically and very concretely) where potential participants can decide what might be exchanged or traded and also establish the lines of communication necessary to sustain discussion of potential to the point where constraints become visible.
In summary, as Galison notes, a "trading zone is an intermediate domain in which procedures could be coordinated locally even where broader meanings clashed…..The work that goes into creating, contesting, and sustaining local coordination is at the core of how local knowledge becomes widely accepted."

In other words, rather than depicting the movement **across** boundaries as one of translation (from one theory to another, from theory to experiment, from military to civilian science, or indeed from medical research into clinical practice) it may be more useful to think in terms of work **at** boundaries, "where local languages grow, and sometimes die in the interstices between sub-cultures". As we have seen, under the prevailing view the language of knowledge translation is largely about moving knowledge across boundaries.

As may already be becoming evident, the twin notions of transaction spaces and boundary objects can be used to underpin a new notion of engagement and a new language for knowledge exchange.

The notion of a transaction space shifts the metaphor from translation across boundaries to dialogue – to exchange**- at** boundaries. This shift underscores precisely that it is dialogue at the boundary that makes it possible to access knowledge held by others and to appropriate it by promoting the search for a common language within which to formulate a problem or issue. As Galison has argued, common languages, when and if they occur, provide the "evidence" that some sort of common understanding has been achieved. By contrast, simply moving information "packages" across boundaries leaves too much unsaid and, not surprisingly, it is often the case that such translations are not successful.

In sum, the "how" of knowledge exchange, then, is about generating boundary objects and managing them in the context of transaction spaces. Developing expertise to work at the boundaries is a challenge for those who would develop KT into a flourishing research and practical activity.

4. Concluding Summary

1. What are the implications of what I have said for the development of KT as an emergent discipline?

Despite the obvious complexity of KT, much progress can be made by the simple expedient of replacing the metaphor of knowledge transfer with that of knowledge exchange. In knowledge transfer, the accent tends to be on establishing formal linkages between individuals or institutions. In contrast, knowledge exchange evokes engagement processes that are at the heart of Mode 2 knowledge production. By and large knowledge producers – all those who hold specialist knowledge of some kind - are individuals who believe that they possess important, perhaps the only important, knowledge pertinent to a particular issue. However, they tend to be in “send” rather than “receive” mode, to borrow a phrase from you email toolbar.

As a consequence, communication tends to be one way, the very opposite of what is required. As has been argued reverse communication is crucially important but I don’t underestimate the difficulties of engaging experts effective dialogue.

Many of the models set forth for our consideration in “Speeding the Spread” deal with transfer more than exchange. But, these flows presume the existence of an already functioning boundary objects and trading zones without which these models will simply not work. As KT researchers, we need to take a step back and immerse ourselves in the various exchanges that take place at boundaries in order to get a feel for the conversations that must be enabled in transaction spaces. Model building can come later.

2. In knowledge exchange, boundary work is essential.

Effective boundary work at the interfaces between research, application, delivery and policy is a matter of developing new languages. A real challenge for KT workers is to set themselves up as facilitators of boundary work and the management of transaction spaces. This is an engagement task of a high order and to be effective the only way is to wade in and consent to learn.

3. Why is KT important to the policy agenda?

KT is important because policy agenda itself is moving, albeit somewhat slowly, from static, economics-based models to more dynamic, interactive "political" models. Though both governments and scientists resist the notion, the real issue to be addressed today is the politics of science, rather than the economic impact of scientific and technological research.

It is this shift from the economics of science to the politics of science that will underpin the growing importance of KT in the knowledge production process. *In future, the problem will be less trying to work out, or even increase, the economic impact of investments in science than in trying to devise robust methods through which policies can be developed, improved and implemented in ways that will help governments reach a diverse set of social goals rather*. Energy, global warming, and an increasing array of medical treatments, for example, are going to be at the heart of government policy for the foreseeable future and the thrust of policy development will be much more focussed on the specifics of research direction than on the broader aim of economic impact.

"In short, academic and policy discourses on science and technology will move away from polarised questions of "yes or no?", "how much?" or "how fast?" about research and its funding; to more nuanced deliberations over "which direction?", "says who?" and why?" This latter is the way of research in a Mode 2 society and, if I am correct in my analysis, KT and knowledge exchange will become a central activity, "lying at the heart of the new, and more realistic, approach to navigating among contending **directions** of scientific and technological progress." (A Stirling, SPRU, private communication, 2008).

In sum, engagement is never an automatic process. Boundary work needs to be facilitated and managed, and to do this specific knowledge and skills are required. Developing the knowledge and skills to manage exchange at the boundaries: now there's an agenda, I would say <u>*the*</u> *agenda for the next generation of KT!*

Concluding unscientific postscript

I would like to close now with a little parable that hopefully you will remember as we labour this week to improve our understanding of KT. In this story, I will be speaking mainly from my experience as an academic but those of you who aren't academics may have already found out that this story has a much wider applicability.

To begin, I have an ageing aunt – now ninety-two to be precise. She lives alone and according craves human contact. She is very deaf, so tends to shout when she speaks. As a result when we go to visit here she immediately goes on "transmit" regaling us with stories of the Great War which of course are not her memories but memories of her parents telling her about the Great War. In the process we are partially deafened. Understandably, my wife, Gillian, is somewhat impatient with the constant repetition of the same of stories time, after time, after time.

One evening after a day of visiting my aunt, Gillian was talking to my daughter telling her how difficult she finds communicating with this person who seems to live in a world of her own. At one point she exclaimed, "Your father is wonderful he sits there all day and patiently listening while she shouts her memories at him". "Mother", my daughter interrupted, "will you never learn?" Father is an academic. He is certainly hearing her but he is definitely not listening!" Alas, the wisdom of children. They always find you out! In my defence, I do wonder if "not listening" is part of the human condition rather than merely an academic affectation.

Are we here today basically on "transmit": hearing the various presentations but definitely not listening? To really listen it helps to have some common interest to hold our attention; think of that dog in Hyde Park. To begin to listen effectively we need to find boundary objects. I wonder, too, what transaction spaces and trading zones we might evoke at our respective boundaries during our short stay together in this beautiful place? Let's give it a try, shall we?

Thank you and good luck!

Appendix 1

What are the implications of this shift from transfer to exchange change for policy makers?

To give you just one example with which I am familiar, consider the attempt that was made a few years back to refine the linear model of technology transfer and replace it with a range of evolutionary models which at the very least capture more precisely the nature of knowledge production and its role in the innovation process. I once tried to introduce such models into the policy world of UK science and technology policy. The attempt failed miserably. Why? Well, it seems that the notion of an evolutionary approach to knowledge transfer was defeated by the policy makers because they found it too difficult either to generate appropriate policies or to convince ministers that evolutionary models were a more accurate description of how science and technology develop and therefore a better basis for designing policy. On the contrary, it was far easier to sell investments in science to cabinet, so the ministers themselves argued, on the assumption of easy trouble-free knowledge transfer from research into application. In brief, the linear model was easier for politicians to grasp and, as well, held out the prospect of straightforward methods of post-hoc evaluation of the effectiveness of the resources allocated in enhancing industrial innovation.

Policy makers often seem to be looking for quick fixes, perhaps because ministers demand them. But for KT to advance as an area of inquiry it must be able to draw on the experiences of policy makers. They are genuine knowledge holders and they have much to communicate that academics seldom consider.

I have discussed above the role of intersecting social worlds in effective knowledge exchange as an engagement process. If there is an interface where work at boundaries needs to be done it is that between researchers and policy makers. We often say that policy makers don’t understand research. This is sometimes true. By contrast, we seldom heard it said that researchers don’t understand policy makers. Yet, in my experience that is universally the case! This law is known in the literature as Gibbons’ second law of science policy!

Appendix 2

What can I usefully be said of KT in the developing world?

In the developing world, higher education policy has been much influenced, dare I say, by The New Production of Knowledge. This has been the case particularly in Africa. At least one university that I know has completely reconfigured is management and academic structures to accommodate what they regard as the essential characteristics of a Mode 2 institution. As you might imagine, this was a massive undertaking. Yet, even here, Mode 2 has been interpreted largely as applied science rather than a distinctive mode of knowledge production in its own right. To the extent that Mode 2 is seen in terms of applied science the notion of KT as an engagement process has not, penetrated very far.

Still, if there is an environment where knowledge exchange, rather than transfer, should be embraced it is Africa. The very multiplicity of its indigenous languages demands it. If there is a continent where there are a large number of separate social worlds exist, it seems, almost in parallel universes and where boundary objects and trading zones are needed, it is Africa.

Yet, most universities in the developing world are still entranced by American models with their offices of technology transfer, professional staff and extensive patent profiles. Though all universities are looking for their “Gatorade”, not many technology transfer offices make much money. As David Ward has pointed out more than once, and leaving aside research income which is meant to be a self balancing item, over ninety percent of the external income generated by universities in the USA comes from private philanthropy and that that level of generosity toward universities, we know, is a distinctive American phenomenon. But as will be obvious from what I have said, much more than money is required to generate the communicative environment that underpins effective KT.

How to break this attachment to American models? Well, if money is the objective there are many more efficient ways to generate it that through the complex processes of technology transfer. For example, there is a growing demand in both the developed and developing world for continuing professional development. In the future, it seems to me that all universities in particular are going to be called upon to upgrade on a continuing basis the knowledge bases of their former graduates. This will require that universities determine what their graduates have learned since leaving the university and taking them forward from there. How do you do that? How do find out what a graduate has learned since graduation in order to take them on further. This is a knowledge exchange process of a high order and I fear it is not one that universities are at all equipped to deal with. Continuous professional development would constitute new terrain for KT. It is pregnant with possibilities for our field particularly in the domain medicine and health care but I would suggest that this be a subject for another day.

Appendix 3

Technology Transfer between Universities and Industry

This point can be illustrated by reflecting on the mechanisms which are currently in place to render more efficient the translation of scientific discoveries from universities to industry. Working, silo-like, with the discipline-based structures of science and scholarship, it is often presumed that the knowledge produced by universities is in some way primary. For example, scientific discoveries are commonly regarded as essential ingredients for successful technological innovation and not infrequently universities have assumed that they are the prime source of many of these ideas. Accordingly, we tend to think it important to move this knowledge *across* boundaries, between one institutional culture and another. This language is perpetuated at several levels: with regard to cognitive boundaries in the translation from pure to applied science, to institutional boundaries in the translation from universities to industry and from medical research to clinical practice, and so forth. Given the prevalence of the idea of translating knowledge across boundaries, it is perhaps not surprising to find many universities and government agencies have put in place administrative structures – technology transfer offices, innovation incubators, science parks, etc. - to help with the translation of knowledge across boundaries. And perhaps I have already said enough to indicate why these arrangements so often seem to be ineffective.

Appendix 4

KT as an integral part of a research project

An effective KT strategy, or as I prefer to call it, knowledge exchange strategy, should be viewed not as an opportunity for researchers to indulge in rhetorical flourishes about the health benefits from research but as a research project in its own right; perhaps as important as the substantive research agenda being put forward for support in any application for funding.

We know that knowledge exchange is far from being an automatic process yet in applications for research funding the protocols linking knowledge production to effective exchange with the institutions of wider society is typically developed hardly at all. This continues despite mounting evidence, for example in the USA, of the lack lustre impact on average medical well-being of the American population of massive increases in research funding. I am not really surprised by this eventuality because on the research applications that I am ritually asked to review, knowledge transfer always comes after the knowledge has been generated. It never it is part of the generation process itself. As I stated at the outset: knowledge exchange is an engagement process and requires that it be an integral elements of the research design. Heresy, I know!

Nonetheless, I would argue that policymakers should make a serious effort to ensure that every request for a grant in medical science should carry a well worked strategy as part of the research plan; perhaps by identifying the boundary objects that will enable research to flow effectively to the points of delivery. But this cannot be done after the research is done. As I have tried to demonstrate it can only happen effectively if it is embedded in the research process from its inception. This is what contextualisation of research means and, if I am correct in my analysis, this is the only type of research that will be adequately funded in the emerging Mode 2 society.