

How can industry learn? Interactive frameworks for innovation and knowledge transfer between university and industry

JC Spender

Today we honor Professor Millar – and she has asked us to talk to one of her passions - the relationship between industry and the university. Changes in science and technology, and globalization, mean we academics must contribute to moving the country's economy and workforce forward – especially when taxpayers are paying our salaries.

The puzzle is to know the university's role and how best to create and implement innovation policy.

What problem should innovation policy solve? For many, it boils down to ensuring a flow of technological information - especially from the university research labs into industry. In practice, the flow back, about industry's and the nation's needs, is equally important. We look for policies to improve these communication structures, networks and capabilities.

Because of my technology and business background, I was once Chairman of a university company tasked with commercializing the knowledge being generated in our laboratories. I attended conferences on what we called T-squared – TT, as in technology transfer. We had our own journal and professional association. Even so institutionalized we made little impact and, with the greatest respect to my colleagues then and now, I think this because we mis-specified the issues.

Our dominant model is that things work better when the people in the university and those in industry speak the same language. We think of these communication problems as caused by a difference of cultures - along the lines of CP Snow's 1959 Rede Lecture. His focus was the gulf between the two cultures of the liberal arts and the natural sciences. Likewise, for us in the T-squared business, the gulf between science and profit makes it seem scientists are from Venus and managers from Mars.

Thomas Jefferson, no mean innovator himself, argued the price of freedom is eternal vigilance – a way of saying that innovation arises from what is being experienced but not explained. Here I move away from a theory of innovation as driven by logical thought, hypothesis testing and rational deduction from what is already known. This is the story we tell students about how science works - even though we know it is incorrect.

On the contrary, to understand science's development we must pay close attention to the process of induction from what is being experienced, which takes us back to Jefferson and to Francis Bacon's *Novum Organum*. Likewise Thomas Kuhn suggested anomalies drive breakthrough science, while 'normal science' is like tidying up after the circus leaves town.

The new discipline of knowledge management – all that stuff about tacit knowledge and intangible assets – gives us a better appreciation of the relationship between thought and practice. The convention is that best practice should be driven by rational thought. Knowledge management is less sure and prioritizes effective practice over rigorous analysis. We feel the shadow of Wittgenstein and his maxim that if we want to understand meaning, to make sense of our world, we should look to our practice.

What does this mean for innovation policy?

I suggest radical innovation is more likely to emerge from entrepreneurial alertness and explorative practice than from sitting there like Rodin's *Thinker*, holding your head and coming up with hypotheses to test. Following my friends Loet Leydesdorff & Henry Etzkowitz and their metaphor of the Triple Helix, which my colleagues will talk about later, we can look to DNA and the double helix. Watson, Crick and Wilkins - and Rosalind Franklin too, so carefully written out of the history - spent years exploring models of what they were seeing in the lab before they hit on the double helix idea. Likewise Kekulé reported he dreamed the benzene ring.

I don't want to mystify these Eureka moments. On the contrary I want to stress the investment in collaborative practice that provoked these insights. Keith Sawyer's entertaining new book *Group Genius: The Creative Power of Collaboration* shows our invention stories are typically embedded in

networks of collaborative practice - on many individuals immersing themselves in the practicalities of the phenomena to prime their insights.

What is this to do with the difficulties of knowledge transfer?

If we pay attention to these practical or tacit dimensions of our knowledge, we see it develops in chunks whose outlines are nothing to do with the names of the different planets. On the contrary they are more like ant-hills, untidy spoil grounds from the day-to-day practices that constitute that particular community. The differing ant-hills of industry and university are occupied by different communities of practice whose collaborative activities lead them to develop different languages – each specific to their practice. Long-line tuna fishermen communicate in a language that has little to do with the language of fly-fishing. Diamond cutters have their own language, as do neurosurgeons and economists. Each language is bound into its community's practices.

You see where I am going with this. Industry and the university are simply labels we use for the language-games these communities develop to capture and develop their different domains of exploratory practice. Innovation goes on in both, all the time, as must if they are to survive in a changing world.

Industry and university are gross terms that tell us little. They hide the significant differences of practice and thought between, say, radiological engineering and food processing, or labor economics and literary criticism. Thus it is never useful to talk of innovation in the abstract, distanced from the practices of a specific community. Nor is it useful to suggest the university is a place of innovation and industry is not. Each simply innovates differently. The idea that industry produces wealth while government and universities consume it is both naive and unhelpful. We should be more honest about what is only a division of social and economic labor.

The impulse behind this division of labor, mirroring what Adam Smith regarded as the source of the nation's wealth, is the relationship between language and practice, especially when it comes to searching for and capturing innovation. You might think I am being too academic here - but the bottom line is that we know it is specialization that drives the learning that produces the valuable knowledge we want to transfer.

Where do we get the idea that managers, researchers and bureaucrats should speak the same language - and that would facilitate the flow of knowledge and innovation?

We have no empirical evidence for this – rather it flows from our assumptions about the nature of the knowledge to be transferred. Some of you may dismiss my chunky ant-hill model in the name of good science, saying the science applied in industry is the same science as in the research lab, and that all government talk about it must also be grounded on the same ‘good’ science. This is a positivist dream of objective scientific truth standing apart from our subjectivity and practice, and it blinds us to a different way of thinking.

My point is that as long as we continue to think of knowledge this way, we shall never get to grips with either innovation or the transfer of any knowledge that might promote innovation.

All useful knowledge, and I stress useful, whether scientific, managerial, or economic, is embedded in and captive to a specific milieu of practice. It is Bridgman’s ‘operationalism’ all over again. No useful knowledge can stand apart from the practices from which it springs and which it is capable of shaping. This is not a social constructionist story as much as a Kuhnian one. Knowledge management helps us see Kuhnian paradigms are also domains of practice. Knowledge can never be separated from the practitioners who make it useful. What is captured in language will not be useful without relevant prior practice.

How then should we think about knowledge transfer between the strands of the Triple Helix?

Let’s take artistic innovation as an example, such as the Rembrandt School’s. 17th century Dutch print-making was shaped by Lucas van Leyden who, over a century before Rembrandt’s print-making, met and took much from Albrecht Durer. Similarly, by the time Rembrandt moved to Amsterdam in the winter of 1631, Anthony Van Dyck, who left for London in 1632, was experimenting with the innovative dynamism in portraiture that Rembrandt then took up and made the hall-mark of his work and that of his school.

What is the process here? To talk of Rembrandt is to distinguish innovation from imitation. Artists have their own agenda, each uniquely reflecting the changing political and economic situation in

which they work. Learning from each other is not imitating, it is to harness something they find in the other's work to their own agenda. Thus Picasso's *Demoiselles d'Avignon* is not African Art, but would not have been possible without it.

Likewise to speak of knowledge flow within the Triple Helix is to mis-specify. What we see is that innovation in one context somehow facilitates or provokes innovation in another.

Knowledge flow is a metaphor and we sometimes forget metaphors can confuse as well as illuminate. Knowledge does not flow. We need a more relevant metaphor. We have one in Niklas Luhmann's notion of 'irritation'. He argued social, psychological and technological systems are autonomous but affect each other through 'irritations'. Thus we might say Picasso found African art irritating – creatively speaking - and dealing with this irritation led him to produce the response that changed 20th century European art, just as Semmelweis was 'irritated' by child-bed fever, or Jonas Salk by polio's spread. Likewise we might argue Steve Jobs was irritated by the way music was being delivered.

Can national policy promote the irritations that lead to economic, technological, and cultural innovations? Yes and no, perhaps, but here we are really talking about the university's place in society.

In Rembrandt's time the university was a place to gather the accumulating knowledge then being gathered by those involved in discovery abroad, for instance, in the *VOC* or what we English call the Dutch East India Company, which also happens to have been the first modern commercial organization and an astoundingly important Dutch economic innovation.

In succeeding centuries, following Bacon's critique of Aristotle, the European university became a place of intellectual innovation and the pursuit of knowledge for knowledge's sake. The core innovation was what we call the scientific method. Later that method was applied to industry and commerce via Scientific Management, and to government also, and it transformed our world.

My argument is what we confusingly label 'knowledge transfer' is actually more a process of creative irritation. The metaphor we need is less one of transporting knowledge from one place to another,

like a food aid program, than of laying out a supermarket of new knowledge and having people in to both become irritated and to seek relief for their irritations – just as Picasso’s colleagues collected and observed African art, and a generation earlier artists like Van Gogh found Japanese art crucially irritating.

The real issue here is education, in the broadest sense. Irritation happens when our consciousness gets raised and we become aware that things could be otherwise. We experience but cannot explain, and that is when we start to have innovative insights. As Pasteur remarked, luck favors the prepared mind and immersion in practice is that preparation. It applies as much to university professors as it does to industrialists, bureaucrats, or ourselves as we go about our every-day lives.

The problem with our ant-hill language-games is that they shut out the rest of the world, we become over-focused and parochial; groupthink rules. Again, this is as true in the university as it is in industry or government - and it is even more the case when we get stressed, with no time for our families or ourselves, with no time to smell the roses.

What is to be done? Behind Triple Helix policy questions lie political questions about public goods and their management. We live in an age in which many nations’ public goods and infrastructures are disregarded and abused. In the US our bridges fall down and we are told the least government is the best, that people must be self-reliant, driven by self-interest, and so forth. Yet the most transforming technological event of our times, the Internet, is more or less an American public good.

I think this the Triple Helix’s real challenge, to cope with an explosion of knowledge in a political environment that increasingly regards education – of the individual or the firm - as a personal responsibility. This is abandonment rather than policy, of course, which is why the social place of the university has become problematic once more, as it was in the 1920s. We cannot address this by remaking the university as a research service to industry, nor is it merely about training young people for today’s work. We need a new Information Age identity.

The specialization and division of labor which produced our society came at a great cost, of course, and the communication problems within the triple helix are merely a symptom of this. We created a

Tower of Babel. Given growing specialization, we move into in an Age of Specialized Ignorance as much as into an Age of Information.

One implication is that the university needs to become an efficient portal onto the world's knowledge, a search engine that can handle meaning as efficiently as Google handles data. This is an update of the university's role in Rembrandt's time. But the university also needs the intellectual apartness that enables it to innovate in ways that are as de-contextualized, critical, and seemingly useless as modern art, post-modern feminism and the recent proof of Fermat's Last Theorem, for therein lie the most profound innovations.

It was only in the 19th century, with the rise of industry and the involvement of local business, that the university was transformed from a monastic retreat for a book-loving intellectual elite into today's instrument of mass education. The model was the 17th century military and professional school and the specialization it implied. Yet the paradox of such a division of labor is it requires a mode of coordination if wealth is to result. In short, today's university confronts the balkanization that must follow the rise of the professions in a socio-economy that has adopted market forces as its primary coordinative mode. Disaster seems inevitable – as the rigor versus relevance debates warn us.

I have no idea of how the university's role should be changed, of how we might adjust our educational policies and public goods management to overcome the downside to specialization which, we know, leads to our knowing a great deal about very little, that ivory-tower-ness of which ordinary folk accuse us.

But I am certain of one thing; the problems within the Triple Helix that are Professor Millar's charge for us today are symptoms of an age of specialized ignorance. By this I mean we are increasingly interconnected – economically, physically, politically and linguistically - there is more to know, and so more chance of being found ignorant.

It is as if we are moving to a world of seven degrees of separation from a Medieval world of five degrees - in which you were related to almost everybody you knew. Likewise in Rembrandt's time it

was possible for the well-read Amsterdammer to know almost everything that what known. Now we academics seldom know even the boundaries of our own specialization.

I am not sure we all see it this way, but I suspect the knowledge challenge in our Age of Ignorance may be as important as that of global warming. So I think Professor Millar directs us correctly to think more carefully than we have done up to now about knowledge growth, education and innovation.