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When cosmology meets property: indigenous people's innovation and intellectual property

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The protection of traditional knowledge by means of intellectual property rights is one of the major concerns of international organizations. Less attention has been paid to the relationship between systems of indigenous innovation and intellectual property. Using Australia as a case study, the paper argues that indigenous innovation systems are located within a connectionist cosmological framework. The distinctive institutional features of this innovation system are identified. Key is that innovation in systems maintains the health of other systems. The commodity-based nature of intellectual property systems does not suit this kind of innovation. Property rights in land matter to this innovation system far more than intellectual property. Forms of intellectual property based on the right to distinguish one's product in the market will generally be more useful to indigenous innovation than commodity regimes such as the patent system. Voluntary certification systems can probably be harnessed to much greater effect by indigenous business enterprises.

Introduction

'[I]f we have anything to learn from the Noble Savage, it is what to avoid. His virtues are a fable; his happiness is a delusion; his nobility, nonsense'. So said Charles Dickens (1853; see also Orestano, 1987). How widely shared his characterization of tribal cultures would have been is hard to say, but we can be confident that he was not a lone voice. In Australia, official government policies towards indigenous people at the beginning of the 19th century were based on a principle of benevolence (Reynolds, 1972, p.151). According to a House of Commons Select Committee of 1837, the British Empire had a duty in its dealings with 'the untutored and defenceless savage' to provide an opportunity to become a part of 'that civilization, that innocent commerce, that knowledge and that faith with which it has pleased a gracious Providence to bless our own country' (Reynolds, 1972, pp.152–3). The basic assumption then was that the Empire had a great deal to teach, but probably not much to learn from indigenous people.

Colonists arriving in 19th century Australia did so at a time of great economic transformation in the United Kingdom. Before long, colonial economies were being built around processes of natural resource extraction in the agricultural, maritime, mining and pastoral sectors to service the needs of a resource-hungry mother

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country. The Australian bush became the object of radical reshaping through the application of European agricultural and industrial techniques. Many made the journey from England eager to build a fortune on the sheep's back. By 1850, colonial Australia was supplying almost 50% of Britain's wool needs, much of this expansion in wool production being financed by London commercial credit (McMichael, 1984, pp.101–3).

This extractive approach to the land led to an extractive attitude towards indigenous knowledge. Generally speaking, the colonists were interested in indigenous knowledge that helped them to explore the country and exploit its resources. As the journals of explorers like Thomas Mitchell (1792–1855) and Charles Sturt (1795–1869) make clear, Aboriginal guides helped expeditions by leading them to waterholes and food sources.[1] Indigenous knowledge and labour in collecting and then diving for pearl shell along the coastlines of Western Australia provided the start for an industry in which Broome was to become the world centre (Bailey, 2001). The pastoralists who occupied vast tracts of indigenous land came to realize the practical value of indigenous people's knowledge about the land's food and water resources (Goodall, 1996, p.61). This instrumental and extractive approach to indigenous knowledge did not deepen into a respect for the knowledge systems and institutions of indigenous people. Rather, once the colonists had won the frontier conflict, the emphasis was placed on assimilating the survivors (Rowse, 2005).

If now we jump to the beginning of the 21st century, we can see that a remarkable transformation at the level of global governance has taken place with respect to perceptions of the value of indigenous knowledge or traditional knowledge (TK), the more commonly used term in international policy circles. Today, there are several treaties containing standards that recognize the value and importance of TK (see Antons, 2009). Perhaps the best known of these is the Convention on Biological Diversity (1992), which in Article 8(j) requires its member states to 'respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities'. Another example is the United Nations Declaration on the Rights of Indigenous Peoples, adopted by the General Assembly in 2007. It recognizes that indigenous people have broad rights of intellectual property over their cultural heritage, TK and traditional cultural expressions (see Article 31(1)). An even more recent example is the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilisation to the Convention on Biological Diversity (adopted in 2010). The protection of TK has also been linked to the broader obligations to be found in international law, especially human rights obligations (see Gibson, 2005, ch. 8; Oguamanam, 2006). These examples show how, at the level of global governance, an important normative transformation has taken place in attitudes towards TK.

This normative transformation has, in turn, produced a lot of technical work on the relationship between TK and intellectual property rights. Much of this work is being carried out by the World Intellectual Property Organization (WIPO).[2] One of the WIPO's early conclusions was that intellectual property can protect some items of TK, but at some point 'existing IP mechanisms cannot fully respond to the characteristics of certain forms of traditional knowledge, namely, their holistic nature, collective origination and oral transmission and preservation' (WIPO, 2001, p.216). Following on from this, negotiations have been taking place in the WIPO aimed at producing an international instrument to protect TK. There are also negotiations focussing on the protection of traditional cultural expressions as well as genetic

resources. The WIPO established a committee to work on these issues in 2000. It is not a bold prediction to suggest that these negotiations will continue along a long and winding path.

Asking how intellectual property might protect TK presupposes an item of knowledge. The inquiry takes on a juridical bent, one in which lawyers excel as they investigate which intellectual property box offers the best fit or whether, in fact, a new box is needed. A different question lies behind the analysis in this paper: Do intellectual property rights help the innovation systems of Aboriginal people? TK is often said to have a dynamic quality, but there has been little explicit analysis of the features of the indigenous innovation systems that must presumably be responsible for this dynamic quality. Instead, the tendency is to conceive of TK, either explicitly or implicitly, as an existing resource upon which one might draw. Yet, the standard economic justification for intellectual property rights is that such rights encourage investment in the search for new knowledge by allowing the searchers to appropriate privately the social value of the new knowledge they find (Granstrand, 1999, p.56; Greenhalgh and Rogers, 2010, p.32). As mentioned above, there are massive international efforts being made to design intellectual property solutions for the protection of TK. If this were simply about compensating indigenous people for the use of their existing knowledge, then a targeted system of wealth transfers might be the best solution. However, this option is not on the table. Instead, one finds proposals to modify existing systems of intellectual property or to create new standards of protection. The assumption seems to be that intellectual property rights can have positive effects on systems of indigenous innovation. How plausible is this assumption?

In order to answer this question, one needs to shift the analysis to the level of institutions that support an innovation system. If the incentive effects of intellectual property rights operate at all, they operate upon actors within an institutional setting. If we are to understand the dynamic effects of intellectual property, we have to focus on the institutional system in which actors search and generate new knowledge and not on the abstract qualities of the knowledge that is produced. The generation of useful knowledge and techniques implies a set of institutions working in convergent ways to produce innovation (Mokyr, 2002). A systems perspective on innovation requires one to look more broadly at the institutions that contribute to innovative performance (Nelson, 1992). Once we shift the level of analysis away from TK and the rules of intellectual property to institutions of indigenous innovation, different questions arise. Innovation is often conceptualized in terms of firms developing new products and processes (Greenhalgh and Rogers, 2010, p.4). Does indigenous innovation fit into this kind of standard definition? The ethnobotanical record in Australia provides some examples of indigenous innovation that fit with this standard approach. For example, recorded interviews with Wagiman elders show that the Wagiman people developed products and processes. The leaves of the Ironwood tree, for example, were used as a fish poison, and the roots provided the basis for the production of a glue (Liddy *et al*., 2006, p.39). Similarly, they discovered a method for producing a damper from the seeds of *cycas canalis* (bush palm) that has the qualities of long-term storage and high food energy (Liddy *et al*., 2006, p.34). However, we will see that the most important innovative achievement of indigenous people lies in the innovation of systems to maintain systems, especially ecological systems. This is a form of service innovation, one that would have been hard for colonists to see, let alone understand. The scale of its achievement has only begun to be mapped by scientists in Australia in the last few decades.

A systems approach to innovation also requires one to identify the set of institutions that matter to innovation, as well as the distinctive linkages and interactions among institutional actors that characterize an innovation system. In the context of modern economies, this usually involves an examination of the linkages among firms and their industrial research laboratories, universities and government laboratories, as well as looking at the role of institutions, such as tax and venture capital markets (Nelson, 1992; Hall and Soskice, 2001). The third section of this paper identifies some institutional features of indigenous innovation, but this part of the analysis should be seen as preliminary. Clearly, a full institutional analysis of indigenous innovation is a quest in which a number of disciplines, including ethnobotany, cognitive anthropology and human ecology, play a crucial role (Brush 1993; Sillitoe 1998; Berkes, 2008, pp.22–5). From the discussion of indigenous innovation, the paper moves to considering the role of intellectual property in supporting indigenous innovation. The upshot of this section is that intellectual property rights are likely to make only a modest contribution to indigenous innovation and that the intellectual property systems that matter most are those based on rights to distinguish products in the market as opposed to rights to originate products. The property rights that matter most to indigenous innovation are land rights.[3]

Cosmologies, 'Country' and knowledge

Indigenous Australians have distinct and systematized beliefs about the true nature of the universe. These beliefs continue to exercise a profound influence on Aboriginal social organization, including the organization of indigenous knowledge and innovation systems. The term cosmology does a better job of communicating the idea that these beliefs are thought to be true of the world than the English words 'Dreamtime' or 'Dreaming'. The use of Dreamtime goes back to a mistranslation of a word from the Aranda language that is better translated as 'eternal, uncreated, springing out of itself' (Swain, 1993, p.21). Aranda was one of more than 200 languages that were being spoken in Australia prior to colonization by Europeans, along with many dialects. Dreamtime does not refer to one cosmology, but a number of distinct cosmological schemes. In the broadest terms, these cosmologies deal with a class of eternal events involving ancestral beings that remain present in a place (Morphy, 1991; Swain, 1993; Dussart, 2000).

One of the features of Aboriginal cosmologies is their focus on explaining the origins of the physical features of particular areas of the country (Keen, 2004, p.211). In Dreamtime stories, ancestral beings in either animal or human form will often begin a journey in a specific place and end it in another known place. Along the way, they will, through the exercise of their great powers, transform the landscape to give it the physical features by which it is known today. So, for example, in one Yolngu story, pairs of guwaks, emus and possums leave from Burrwanydji near Donydji station and end up in Djarrakpi, a brackish lake on the Gulf of Carpentaria near Blue Mud Bay (Morphy, 1991, pp.220–2). During the journey, the emus form waterholes using their feet for drills. At Djarrakpi, these beings engineer more topographical transformations. Lengths of string spun by the possums using their fur become gullies, sandbanks and coastal dunes, and these individually become linked to specific clans. The emus, unable to find fresh water, throw their spears into the sea and where these fall, they become, at low tide, fresh-water

springs. Through their geo-magical powers, the ancestors create the topography of an area that clan members come to know as their 'Country'.

Country is an emotional centre of being. It is a place that one knows intimately at many levels, where one has countrymen and rights along with the safety and security that these things bring. It is where one can truly 'sit down' (McKnight, 1999, p.81). Cosmologies and Countries are indissolubly linked. Different groups of ancestors have shaped different areas of land in Australia. Exceptionally powerful totemic beings, such as the rainbow serpent, feature in more than one cosmology, but the stories in which they feature are not the same story. Ancestral beings are, as it were, local rather than universal forces. It follows, for example, that a Lardil person from Mornington Island going to central Australia where the Warlpiri live is not equipped by virtue of Lardil cosmology to understand the forces that shaped Warlpiri Country. So, while cosmologies may have some similarities, they are location specific, functioning as a key to understanding a particular area.

Aboriginal cosmologies do not take the form of an abstract set of truths in the canonical form of a text or set of equations. Rather, they take the form of stories that describe events that have become embodied in Country. There is no need for written records or archives because the land itself holds and displays to the trained knower all the knowledge that matters. The land is a living and signalling embodiment of knowledge. Prior to the arrival of mining and agricultural technologies, the land would have seemed to indigenous people to be the most permanent presence of knowledge that one could imagine. The details of this knowledge are poetically encrypted in Dreamtime stories and transmitted through dance, singing, ritual and story-telling.

If there is one thing that unites indigenous systems of knowledge, it is the principle that most, or all, knowledge that is part of a group's system can be traced back to the acts of powerful ancestors in the Dreamtime. Dreamtime stories are the threads that connect different parts of an indigenous knowledge system. One can, for example, give independent descriptions of a group's botanical taxonomies, but the ultimate origins of these taxonomies lie in the names and classifications that ancestral spirits created, along with the landscape and the animals and plants in it. Indigenous knowledge systems are said to be holistic, but this term probably does not quite capture Australian indigenous knowledge systems. A Dreamtime cosmology helps individuals make connections between different parts or objects of a knowledge system, so that a place, a painting, an object, a word and a ceremony can all be connected to the Dreamtime, and relations among these things established by virtue of this central node.

Aboriginal knowledge systems are perhaps better described as connectionist systems. Connectionism is an approach within the cognitive sciences that draws on the interactions of units in a network to create models that explain functions of the mind, such as memory, learning and calculation (Bechtel and Abrahamsen, 2002). The use of connectionism here does not follow exactly the sense in which it is used to model processes of cognition. Rather, connectionism is used to characterize an attribute of the social networks that underpin the performance of indigenous knowledge networks. These social networks are qualitatively different by virtue of the types of units that make up these networks. An example of the way in which indigenous social networks are distinctively enlarged is to be found in the community of Ngaringman-speaking and Nagaliwurru-speaking people in the Northern Territory (Rose, 1987). The social identity of members of the community is, in part,

constructed by reference to connections to other species, such as flying foxes. Some individuals are 'countrymen' of flying foxes, meaning that they are close kin. When a flying fox person dies, flying foxes become a food taboo until other flying fox people lift the taboo.

Indigenous people are born into social systems that, from the very beginning, multiply the number of connections which make up their world. The kinship system links them to their own Country, along with the Countries of other groups, their ancestors and the events associated with those ancestors. Aboriginal societies are sometimes described as kinship societies because no individual of a given tribe is left out of a kinship calculation (McKnight, 1999, p.33; Keen, 2004, p.174). In practical terms, it may mean that an individual using this classification system can work out a kin relationship to a language group of more than 500 people (Edwards, 2004, p.58). These kinship systems are open systems in the sense that they can be used to integrate strangers who, through being addressed by a kinship term, find themselves knowingly or unknowingly beginning a journey of integration into a kinship and marriage system. In this connectionist world, plants, animals, rocks, rivers and other things have multi-dimensional natures. A tree may have utilitarian functions, such as providing shelter and being a source of medicine, but it may also be linked to a person by virtue of a kinship relation because it features in an ancestral story on that person's mother's side, leading that person to say that 'this tree is my mother' (Keen, 1994, p.107). From this kinship connection, there may flow a set of rights and obligations with respect to a tree species. A very large range of things can function as a totem, including plants, animals, wind, rain, thunder, fire, mist, tools, food, as well as parts of the human body (Stanner, 1979, pp.106, 127–9).

We can see, even from this brief description, that individuals are immersed in a social network which stretches well beyond the conventional understanding of a social network because the units of the network include plants and animals and the land itself. Connectionism refers to the fact that TK systems are part of social networks that are characterized by a variety in the types of units in the network, as well as a density of connections among those units. The density of connection comes about because communication with the non-human members of the network is seen as possible. Indigenous cosmology, kinship systems and totems operate together to create a complex web of relations that, for the most part, remains opaque to outsiders.

These distinctive cosmological systems have a bearing on the values and preferences of indigenous people. On those occasions when studies of the cultural values and preferences of Aboriginal people have been carried out using techniques such as choice experiments, they reveal preferences different from those of non-indigenous Australians on matters such as the use and protection of rivers (Zander and Stratton, 2010). Understanding how these preferences and values play out when it comes to the exploitation of indigenous knowledge remains poorly understood. Economic models of self-interested firm behaviour operating under assumptions of profit maximization probably have limited relevance to a world of preferences woven together by a cosmological connectionism. For the moment at least, we do not know what those preferences are because there has not been widespread engagement of Aboriginal groups with the intellectual property system.

A related point emerging from fieldwork is that working out preferences will be difficult. Indigenous knowledge systems are rooted in Country, and essentially it is only those with links to Country that can speak about the uses of knowledge from

that Country. Indigenous leaders in Australia have, in effect, very little representative power to speak on behalf of indigenous people. Certainly, when it comes to uses of knowledge, it would be unthinkable for an indigenous leader from, say, the Gulf Country in Australia's North to make observations about the uses of knowledge that emanate from the Central Desert Country. Indigenous knowledge systems in Australia are hierarchical within Country, but they are the subject of highly decentred governance across Australia, with groups of Countries linked by clans having their own systems for the governance of knowledge.

Indigenous innovation

The previous section showed the primacy of the cosmological framework to an understanding of indigenous institutions. In the light of this cosmological framework, this section identifies some key features of indigenous innovation in Australia. Indigenous innovation is place-based innovation. It takes place in Country. Indigenous people do not travel to distant laboratories to conduct experiments. Their Country is their laboratory. It is the place where they observe and interact with the plants and animals to which they are cosmologically linked in some way. It follows that if settler societies such as Australia want to support indigenous systems of innovation, they have to confront the issue of land rights for indigenous people. Yet, this is precisely the issue that settler states have struggled to face. Progress on land rights in Australia has been painfully slow. When, in 1992, the High Court of Australia declared that native title was a part of the Australian common law, the response of politicians was to promise 'bucket loads of extinguishment' of that title.[4] One of the features of the international discussions of TK and intellectual property is the way in which states have conceptually partitioned the intellectual property issues from land rights issues. International organizations, such as the WIPO and the World Trade Organization, focus on intellectual property issues raised by TK, but stay silent about traditional land rights. Of course, this is exactly what the member states of these international organizations want, but this is a partition that makes no sense to indigenous people. Their knowledge systems are rooted in land. To protect the former, one must recognize rights to the latter.

As we saw in the previous section, this placed-based innovation is integrated with a connectionist cosmological scheme in which knowledge is generated as part of a web of relations, relations that include ancestors and totemic entities. As one might expect of an ancient culture that innovates under conditions of cosmological connectionism, many rules and restrictions concerning the use of knowledge have evolved (for an example, see Morphy, 1991, p.89). Indigenous systems of governance for knowledge and innovation do not really accommodate the concept of unrestricted public domain rights that characterize some intellectual property systems. The expiry of patent and copyright terms sees information enter the public domain for use by competitors. Within indigenous knowledge systems, those with custodial rights over land, plants or animals and the knowledge related to those things do not hold those rights for a limited time. Potentially, this does set up a problem of access to vital resources, and so others are given use rights over resources held by primary custodians (for examples, see Keen, 2004, ch.9). Kinship relations will be a determining factor in the kind of use rights a given individual can gain. In essence, intellectual property systems and indigenous governance systems solve access problems to resources in different ways. Intellectual property

systems, with some exceptions, such as trade secrets and trademarks, make protection time sensitive, while indigenous systems place the emphasis on use rights. In the former, exclusivity of use is offset by limiting the duration of exclusivity, while in the latter case, perpetual rights are offset by granting use rights to others.

Another feature of indigenous innovation is the strong presence of uncodified knowledge. The information theoretic perspective on innovation draws a distinction between codified and uncodifed information, with the latter being best transferred by means of personal communication (Mandeville, 1996, p.50). A subset of uncodified information may also be uncodifiable and therefore capable of being transmitted only through personal teaching. Some knowledge, Polanyi (1958, p.53) argues, cannot be specified by means of rules and can only be passed on through relationships of close learning, such as master and apprentice. This form of personal knowledge depends on tradition: 'A society which wants to preserve a fund of personal knowledge must submit to tradition' (Polanyi, 1958, p.53).

A good example of the role of personal knowledge in indigenous innovation is to be found in techniques of fire management. In Arnhem Land, there are areas of land that have been in the hands of traditional custodians for many decades, allowing those custodians to use a traditional system of fire management (Yibarbuk *et al*., 2001). In outline, this system is based on a seasonally-based method of burning. Burning begins in the early dry season and first targets the higher parts of Country, where the moisture content of the grass has fallen. This moisture content acts as a natural control upon the extent of the burn. Burning continues throughout the dry season, moving into lower areas and reaching a peak in the coolest months of the dry season. As groups move about on their Countries carrying out burning, a mosaic pattern of burnt and unburnt patches develops. The essence of the method is to produce a large number of smaller, cooler fires that pose less risk for people and Country.

Achieving a 'cool burn' that causes minimal damage to trees and insect life, but at the same time stimulates grasses into growth, requires an intimate knowledge of how to manage the fire, as well as a judgement about exactly the right time and conditions under which to burn so as to produce the right level of re-growth. During the course of the fieldwork, we participated in an indigenous fire workshop in which the method was explained and demonstrated by indigenous experts.[5] It soon became clear that a great deal of experience is required to use the method safely and to produce the right results. Even an experienced elder can, on occasions, get it wrong, choosing a wrong time to burn with the result that the Country does not regenerate optimally because the burn has been too severe. Standing in the bush watching an indigenous man calmly and deliberately start a series of fires that culminate in a racing wall of flame makes one realize how much depends on accurate judgement about exactly when to start the fire so that it will run and stop in a predictable way. The mosaic method of burning requires supervision by masters of the method. It is not a matter of just strolling into the bush and randomly setting bits of it alight. During our work in the Gulf Country, we were told of incidents in which Aboriginal youths would, without supervision, set fire to Country. Not surprisingly, these kinds of incidents caused great concern among senior people because the youths were doing something that was dangerous to themselves and others.

The ecological value of this traditional technique has slowly been scientifically realized. Its use helps to avoid the highly destructive large-scale fires typical of late

season fires in Northern Australia (Russell-Smith *et al*., 2009). One study of an indigenous estate in north-central Arnhem Land, on which this traditional method of burning had been used more or less continuously up to the present, showed that the method promoted ecological integrity, as measured by a number of indicators, such as biodiversity, the presence of rare native fauna and threatened fire-sensitive vegetation types (Yibarbuk *et al*., 2001).

Another feature of indigenous innovation is the form of its expression. It is hard to avoid the pull of a technological artefact view of innovation, in which it is new material technologies that come to represent the innovative achievements of a society. If we look at the technological products of Aboriginal people prior to colonization, they consist largely of the wooden and stone tools and hunting implements that one might expect of hunter–gatherer societies (Keen, 2004, ch.3). But, different theories of innovation illuminate different dimensions of a society's achievements in innovation. The information theoretic perspective locates innovation in collective processes of generating information to reduce uncertainty (Mandeville, 1996, p.49). A society may choose to invest its resources in information that expresses itself in services and processes rather than technological artefacts. It may also place the emphasis on the symbolic manipulation of information, meaning (among other things) that more time is devoted to the coding and transmission of information through story-telling, dance, ritual, art and other forms of symbolic manipulation. For Aboriginal people, there is an overriding sense of cosmologically derived duty to maintain a 'healthy Country'. Many of their limited resources were devoted to generating knowledge and techniques to this end. Healthy Country would, at least in the eyes of indigenous people, represent their greatest innovative achievement.

It would also have been an achievement largely lost on the colonists arriving in 1788. Soon after the fleet anchored in Botany Bay, an officer demonstrated the power of the pistol to a group of Aboriginal people by firing at a bark target. Watkin Tench, an officer on one of the ships, wrote an account of the incident, reporting the need 'to convince them of the superiority we possessed' (Tench, 1798, ch.VIII). The evidence of Aboriginal people's innovation would have been seen, but not recognized by the colonizers. Its most obvious presence was the fine-grained habitat produced by traditional methods of fire management (Russell-Smith *et al*., 2003). By 1848, the explorer Mitchell reported a dramatic change to the landscape around Sydney:

> The omission of the annual periodical burning by natives, of the grass and young saplings, has already produced in the open forest lands nearest to Sydney, thick forests of young trees, where, formerly, a man might gallop without impediment, and see whole miles before him. Kangaroos are no longer to be seen there; the grass is choked by underwood; neither are there natives to burn the grass, nor is fire longer desirable there among the fences of the settler. (Mitchell, 1848, ch.X)

The innovation output of indigenous societies is best understood at the level of systems maintenance, where the systems being maintained are interlocking ecological systems and subsystems. Innovation in terms of new technological artefacts has been less of a cultural priority for Aboriginal people.

One other aspect of indigenous innovation needs to be mentioned. Some areas of innovation, such as biotechnology and information technology, are said to have a high degree of cumulativeness (Scotchmer, 2004, p.127). In cumulative innovation, invention X depends on invention Y as an input. In a general sense, all innovation

is cumulative since no inventor invents every single input that contributes to his invention. Models of cumulative innovation operate with a narrow sense of the cumulative, looking at the sharing of rents between the first and second innovators and how intellectual property rights affect the incentive setting (Scotchmer, 1991). This has limited relevance to innovation in the indigenous setting, where it is better to think in terms of cycles of innovation dependence. In a cycle of innovation dependence, the use of one technique at one point in time allows for the more efficient or innovative use of other techniques. For example, the use of fire regimes to improve the quality and quantity of plant life offers women who are often involved in the gathering of plants for food and medicines more opportunities to improve the use of those plants. Along similar lines, there is clear evidence that fire regimes also increase the efficiency of small game hunting (Bird *et al*., 2008). In a cycle of innovation dependence, one technique or set of techniques acts as part of a set of complex conditions that help to promote other forms of innovation. The use of fire is not a direct input into the harvesting of a new plant, but it is part of a set of causal conditions that helped to promote its growth. Some sense of this complex conditionality, of which the apparently simple act (to outside observers) of setting fire to the bush is a part, can be glimpsed from the following statement:

> The secret of fire in our traditional knowledge is that it is a thing that brings the land alive again. When we do burning the whole land comes alive again - it is reborn. But it is not a thing for people to play with unless they understand the nature of fire. . . . [T]he fire-drive is itself regarded as a sacred and very serious act, often first enacted by the major creative beings for that area (Yibarbuk cited in Langton, 2000, pp.7–8).

Summing up, we can see that indigenous innovation has at least the following features. It is a place-based form of innovation depending critically on land rights for the innovators. The innovative process is deeply integrated into a cosmological connectionist scheme in which all innovation has threads leading back to ancestors. The diffusion of innovation is dependent upon use rights rather than time-limited forms of protection. The innovation system depends on the transmission of non-codified personal knowledge. While many rules surround the use of knowledge, much of this knowledge has to be learnt through personal training rather than rules. Putting it starkly, robots could not be programmed through rules to run this place-based innovation system. The goals and expression of innovation have less to do with products and everything to do with services to Country. Resources are devoted to innovation in systems maintenance, rather than the generation of technological artefacts. This systems maintenance means that indigenous innovators operate in cycles of innovation dependence. There is a time for burning Country so that the efficiency of other techniques and practices can be improved upon.

Intellectual property and indigenous innovation

Through successive waves of land rights activism, indigenous Australians have managed to regain control over more and more of their land. In 2008, indigenous owned or controlled land amounted to a little over 17% of the area of Australia (Steering Committee for the Review of Government Service Provision, 2009, ch.8, p.18). As more and more indigenous groups find ways to return to their Country, they have an opportunity to engage in place-based innovation. The systems of indigenous innovation that are being developed on Country are a mix of old and

new ways of working. The cosmological framework and the duties to Country that it imposes remain invariant, but obviously, there are new tools and new networks to help in the execution of these duties – helicopters to reach the remotest areas to carry out burning, software and data management technologies to help organize the detailed observational knowledge of Country and networks with scientists and research institutions. Quietly, some indigenous communities in Australia's North are building new capabilities with which to drive their innovation system.

What role then for intellectual property rights in systems of indigenous innovation? These days, intellectual property rights are made up of highly differentiated and complex systems – copyright, database protection, designs, geographical indications, integrated circuits protection, plant variety protection, patents, trademarks and trade secrets. It might appear as if there are many options for the development of strategies to support indigenous innovation, especially if one adds to this the use of contract to help regulate the commercial exploitation of indigenous knowledge. Detailed rule-based analyses of the various individual intellectual property rights systems show that some systems, especially copyright, have some utility for the protection of traditional knowledge (Janke and Quiggin, 2005). The benefits of using conventional intellectual property rights mechanisms to protect TK are always context dependent and have to be organically constructed, but they should not be overlooked (Taubman, 2005, p.534).

But our question here is whether these systems will do much to support indigenous innovation. As we have seen, much of indigenous innovation takes place at the systems level where systems of fire burning are used to promote the optimal operation of other systems. The use of these systems demands specialist knowledge and training in skills, the value of which is hard for outsiders to see and understand, let alone appropriate. For example, it was not until the 1970s, almost 200 years after colonization, that the value of traditional burning began to be scientifically discussed.[6] The information that flows through indigenous systems is perhaps the stickiest of 'sticky information' (von Hippel, 1994). Intellectual property rights have little relevance to innovators who seek to innovate at the level of systems rather than commodities. Many intellectual property rights are essentially commodity regimes that grant rights over a single commodity, such as a plant variety, a work of art or an invention. Moreover, Aboriginal people do not need the incentive effects of Western intellectual property rights systems to carry out place-based innovation. Their cosmologies bind them in duty to their Countries and to place-based innovation.

Much of the land controlled by Aboriginal people is characterized by ecological intactness and high biodiversity value (Altman *et al*., 2007, p.24). The practical problem facing indigenous communities is that their innovation takes the form of services to Country that have clear public good benefits in terms of biodiversity, environmental and climate values that are difficult to turn into income streams. Biological diversity, for example, has an economic value. Importantly, it is the stock of biodiversity that is the source of this value rather than individual plants (Swanson and Johnston, 1999, p.65). Maintaining this stock is precisely the area of innovation in which indigenous systems excel. However, patent and plant variety protection allows for the extraction of economic value only from a particular product that meets the criteria of these systems (for example, the criteria of patentability for an invention). The commodity-based orientation of intellectual property systems does not suit those who seek to innovate in systems that can be used to impact upon the

function of ecological systems. If market-based solutions to public good problems cannot be found, then the standard move is to argue that government must pay for the provision of these goods. This means government making income transfers to indigenous people for providing environmental services. This, of course, means that government must be willing to meet the fiscal and political cost of making these transfers.

In the remainder of this section, I want to suggest that some intellectual property rights systems may be able to, albeit indirectly, help indigenous people capture some of the value generated by their services to Country. It needs to be emphasized that this role of intellectual property rights is likely to achieve only modest income effects for some indigenous people, but modest gains for those in the poorest income sector may, nevertheless, be significant.

Intellectual property rights can be divided into those that confer rights over a product (for example, patents and plant variety protection) and those that confer rights to distinguish a product in commerce (for example, trademarks and geographical indications). One way in which indigenous people might take advantage of the biodiversity that their systems help to maintain and generate is to go down the path of patent commodification of plants and their genetic resources. As we will see in a moment, the payoffs of this strategy are very uncertain, while the costs are not. A better option is to base a strategy around the rights to distinguish a product. The rise of ethical consumerism offers the possibility of linking products and services of indigenous innovation with consumers who are willing to pay a premium for these services and products.

Turning first to the use of intellectual property as a commodity regime, during the course of the fieldwork, we did come across one case where a community had applied for a patent on a plant-based product, another case where it was being contemplated and a third case where the possibility of patenting had been investigated, but not taken up. There may be more cases since we did not talk to every indigenous community in Australia, but we can be confident that we are dealing with a small number of cases because of the expense and complexity of using the patent system.

The case where a patent had been applied for involved claims over compounds extracted from plants of the *Barringtonia* species, the two applicants being Griffith University and Jarlmadangah Buru Aboriginal Corporation.[7] One of the interesting features of the use of the patent system by Aboriginal people is the way in which the territorial nature of the patent system interacts with the Country-based nature of indigenous innovation. As the patent specification makes clear, several *Barringtonia* species are to be found in Northern Australia, and these and other species have a long history of use in traditional medicine by indigenous people. The effect of a grant of a patent is to create a set of exclusive exploitation rights for the owners of the patent in the territory of the granting office. In the case of a patent over the compounds from the *Barringtonia* tree, the two applicants own the patent rights in the Australian territory. The Jarlmadangah Buru community is located south east of Derby in the Kimberley region. But, as we have noted, the traditional uses of *Barringtonia* plants extend all over Northern Australia. The point is not that the grant of the patent would interfere in these traditional uses by other groups. It would not. The patent claims are over the compounds with analgesic properties derived from the plant and the use of these compounds in methods of treatment. Traditional methods of using the plant that, for example, involve the use of the leaves of the tree, are not affected.

What is obviously affected is the capacity of other indigenous groups to patent the same compounds. Under patent system rules, there are no prizes for finishing second. Why does this matter? Earlier in this paper, indigenous governance systems for innovation were described as decentred across Countries. Four species of *Barringtonia* occur in Northern Queensland, and it is certain that such a medicinally useful plant is known to indigenous groups there. Aside from their practical uses, plants also play a role in totemic identities and as moiety names (Keen, 2004, p.137). Under a Country-based system of governance, different groups in different parts of the Australian territory could co-evolve with the same species or different species of the same plant. The use rights of an indigenous group based in, for example, the Kimberly, did not interfere with the use rights of a group based in Northern Queensland. Although patent claims do not interfere in traditional uses, one right, namely that of ownership rights in a class of compounds derived from trees of the *Barringtonia* species, is now held exclusively by the Jarlmadangah Burru community and Griffith University. The claims are Markush claims, a specialized form of chemical claiming over a class with millions of possible members. The possibility of other indigenous groups being able to utilize this new use right over a traditional resource has been lost. The patent system does not allow for independent co-extensive ownership of a resource.

In this particular case, this has turned out not to matter because this patent has thus far not generated commercial returns.[8] Not surprisingly, the global financial crisis has affected risky venture capital enterprises such as this one. The Jarlmadangah Burru community have had to pay their share of the patent fees, something that they described to us as being a burden on the community. With pharmaceutical compounds, the main markets are Europe, Japan and the US. Obtaining national patents in these countries is expensive. Interestingly, our interviews suggested that if the patent had led to commercial success, there might have been some questions asked by other indigenous communities in the Kimberley about how the Jarlmadangah Burru community was able to claim monopoly rights in the compounds derived from the widespread *Barringtonia* trees. Senior people from Jarlmadangah had obviously given some thought to this because, when we asked them about the possible reaction of other communities to any commercial success they might have had, they suggested that one option might have been to involve these other communities in the tree plantations that would have been needed for the purposes of extracting the compounds. Of course, the reality is that had the compound been successful, the patent would have been sold to a multinational pharmaceutical company, which would probably have used its chemical facilities to develop a synthetic version of the naturally occurring compound. The biggest beneficiary of this patenting strategy to date would appear to be Australia's patent office. It advertises the Jarlmadangah patent as part of its Dreamshields public relations campaign featuring Aboriginal people and patent success stories.[9]

I am not suggesting that the patent path will always be the wrong path in the context of indigenous innovation. There is strong evidence of successful drug discovery through the ethnobotanical path (ten Kate and Laird, 1999, p.61; Sampath, 2005, pp.23–6). What has to be kept in mind are not the success stories, but the chances of success, given the global nature of the pharmaceutical industry and its complex business agendas. The global pharmaceutical industry has, for a long time operated with a blockbuster business model in which individual firms are highly dependent on a very few successful molecules for most of their profits

(Temin, 1979). The chances of any one indigenous group striking it lucky under this business model are very slim. With cost estimates of bringing new drugs to market ranging from $US800 to $US1.7 billion (Food and Drug Administration, 2004, p.3), there has been a worldwide downward trend in the number of drug and biologic submissions to drug regulatory authorities since 2000.

More generally, the evidence shows that private returns to most patentees are low, and that a small number of large companies benefit disproportionately from the system (Moir, 2009). Even if the Jarlmadangah community ultimately succeeds with its patent, one could not conclude that the patent system is useful for indigenous communities. The evidence about who really profits from the system simply does not warrant such a conclusion. Moreover, communities that are sensitive to interference in their decisions to exploit resources might be reluctant to embrace a system that gives the power to extract royalties over genetic resources that are widely dispersed. The rules of the patent system have been strongly shaped by capitalist modes of production that fit a 'winner-take-all society' (Frank and Cook, 1995). They do not sit particularly well with decentred systems of indigenous governance that allow for the co-extensive use and development of resources. Since Aboriginal people have been present in Australia for thousands of years, one would expect many examples of co-extensive use of plants of the same species. The example of *Barringtonia* is not an isolated one. A native Australian lemon grass species that grows throughout the Northern Territory and which has a long history of use in traditional medicinal treatment has recently been found to contain chemical ingredients accounting for therapeutic efficacy in the treatment of headaches and inflammation (Grice *et al*., 2009).

The right to distinguish products through the use of signs probably has broader application to the products and services of indigenous innovation than exclusive rights of exploitation over products themselves. The cost of trademark protection is less of a barrier than the cost of applying for a patent over an invention. Trademark applications, unlike the drafting of patent specifications, do not require scientific expertise. There also appears to be a better normative fit between trademark protection and the decentred nature of indigenous knowledge systems. Staying with the example of the *Barringtonia* tree, any of the indigenous groups with traditional links to this tree could use it to develop products for the botanical medicines market and develop a promotion strategy around their own trademarks. Trademarks allow for the possibility of a number of indigenous business enterprises to flourish around a resource, as opposed to patents, where the winning group gains all the patent rents from the resource.

Trademarks are part of a much broader world in which regulation occurs by means of communication through signs. It is a world in which private third parties have devised certification and labelling systems that use signs to provide information to consumers about the standards and processes that lie behind the product. Was the product produced sustainably? Did the producer receive a fair return? Organizations such as the Forest Stewardship Council (FSC), the Marine Stewardship Council and Fairtrade Labelling Organizations International (FLO) run systems to inform consumers about these kinds of questions, thereby allowing them to use different choice criteria from a market in which this information is absent (Schneiberg and Bartley, 2008, p.45). This information allows values to mingle with price. Entrepreneurs, such as those involved in fairtrade, have used these systems in innovative ways to align markets with consumer preferences and a willingness to pay (Hutchens, 2009). Markets are seeing the emergence of the 'ethical shopper' (Young and Welford, 2002).

The potential of this world of voluntary certification for indigenous innovation remains largely unexplored. In Australia, there has been experience with a national certification scheme in the arts sector and regional schemes that have grown since this national scheme stopped operating in 2002 (Zografos, 2010, pp.120–32). One possible inference from the failure of the national scheme is that it might be better to think big and move to working out how a global system might be adapted to local indigenous contexts (Drahos, 2007, p.403). The application of these certification systems to indigenous innovation involving biological materials has been neglected. Patents claim a disproportionate part of the analysis when, for reasons already given, they are not likely to reward much indigenous innovation. Patents also have a narrowing effect on our perception of indigenous innovation. Innovation is reduced to the hunt for the next blockbuster molecule or gene. Yet, the range of indigenous innovation is much greater than the plants with which indigenous people have co-evolved. As we saw earlier, indigenous people devote resources and skills to the maintenance and improvement of healthy Country, meaning that innovation takes place across and within ecological systems. Government policy is increasingly recognizing the comparative advantage of indigenous people in being able to provide a range of environmental and resource management services (Commonwealth of Australia, 2011, p.8). Their management of Country through techniques of fire has an application in emerging carbon offset markets. The US energy company, ConocoPhilips, for example, is paying traditional owners in West Arnhem Land about Aus$1 million a year to carry out methods of burning that, in the first year, are estimated to have reduced greenhouse gas emission by about 256,000 tonnes.[10]

Voluntary certification systems may be able to play a role in supporting indigenous business enterprises that produce services and products through methods of traditional innovation. One recent study, which focussed on bush foods, Aboriginal tourism and handicrafts and art, concluded there was a case in Australia for the development of an indigenous fairtrade certification system (Spencer and Hardie, 2011). There may also be a case for the use of geographical indications (GIs), although European GI models could not simply be transported to the very different contexts of indigenous business enterprises. A GI system can have a lock-in effect when it comes to traditional methods of production, acting as an incentive against innovation (van Caenegem, 2003. p.717). From the point of view of designing systems that are appropriate for the place-based nature of indigenous innovation, voluntary certification systems have some clear advantages over patents and plant variety rights. The adaptation of patent and plant variety rights to local context is constrained by a country's membership of intellectual property treaties and organizations such as the World Trade Organization. In contrast, designers of voluntary certification systems have much more flexibility over the principles that will drive the system. For any global system, such as the one run by the FLO or the FSC, there will always be a balance to manage between its principles and the diversity of the local contexts in which those principles have to function. During the fieldwork, we interviewed indigenous people in the Kimberley and Central Australia who were involved in the bush food industry. Our impression was of small family groups operating on the basis of wild harvest, having to survive all the dramas and costs of small business in remote locations, along with large-scale problems, such as prolonged drought. There are many obstacles for indigenous people to overcome in making money from bush foods (Cleary, 2009; Cunningham *et al*., 2009). Finding ways to monetize their services to Country independently of government payments

is an even bigger challenge. Devising voluntary certification systems for contexts such as these will not be easy, but perhaps they will be more useful for indigenous business enterprises than patents or plant variety rights. Scale is needed to take advantage of patents and plant variety rights. These two systems also require the disclosure of some information. Voluntary certification systems give much more scope for trade secret protection to operate, a form of protection with which indigenous people are more comfortable.

One possibility worth considering is that an organization (like the FLO) that runs a global system might help interested indigenous groups develop a set of standards for indigenous business enterprises which utilize indigenous knowledge systems. It is probably time to discuss the possibility of standards dedicated to the goal of helping indigenous people maintain their knowledge systems. Locating such a discussion within an established fairtrade system has some advantages (see Spencer and Hardie, 2011, p.41). Three are worth mentioning. First, there is an obvious advantage for indigenous businesses in being able to gain access to an established global brand. The costs of building consumer recognition and goodwill have been met. Secondly, organizations like the FLO have a great deal of experience in the running of complex multi-stakeholder processes from which standards are eventually agreed. Obtaining agreement on standards will not be easy, and experienced hands are required to assist the process. Thirdly, the FLO also has experience with the financial models that underpin the use of its certification system and so is in the best position to devise something that is financially feasible for indigenous businesses. Given the small-scale nature of indigenous business enterprises in Australia, this is crucial.

Market-based systems of certification have their problems (Schneiberg and Bartley, 2008, p.45). For example, consumers may become confused by a proliferation of certifiers and standards. In the indigenous context, the prospect of audits and certification may be seen as too intrusive by some indigenous people. However, these systems are voluntary. Moreover, in today's marketplace, escaping regulation of one kind or another is virtually impossible. Modern-day markets are constituted through regulatory standards, such as food standards, consumer safety standards, labelling standards and countless others. Regulation is pervasive and inescapable. The virtue of fairtrade systems is that their basic value – fairness – is not inconsistent with what indigenous people everywhere have fought for. At least in this respect, fairtrade systems have a comparative advantage over intellectual property systems.

Conclusion

In the end, the single most important property right for indigenous innovation is property in Country. Starting from a position of complete dispossession by colonists, Aboriginal people have been able to regain control of some of their lands, especially in Northern Australia. Now, some indigenous communities that have the benefit of great leadership are beginning to explore how systems of indigenous innovation can take advantage of intellectual property rights systems. The incentive function of intellectual property rights is not especially important in the case of indigenous innovation. Their innovation and knowledge systems are part of cosmological schemes in which innovating to preserve the health of Country is seen as part of what it is to lead a proper life. Some of the services and skills that indigenous people have relate to the provision of public goods, such as the preservation of biodiversity. Government funding and regulation will continue to play a part in

ensuring an adequate supply of these goods. The usefulness of intellectual property rights to indigenous people lies in being able to capture some of the economic value of this innovation. Systems that grant rights of exploitation over products, such as patents and plant variety rights, will probably be less useful than systems that provide rights to distinguish products and services. Voluntary certification systems hold the most promise. They have the design flexibility to accommodate the scale and situation of indigenous business enterprise in Australia. At the same time, they offer a pathway to an array of markets in which shoppers are prepared to pay a premium for products that represent values and practices with which these shoppers identify. Somewhat paradoxically, global markets with global brands may make some contribution to maintaining local indigenous knowledge and innovation.

Notes

1. Their journals are available online at http://gutenberg.net.au/explorers.html#explorerlist [accessed May 2011].
2. The WIPO's work, as well as draft text aimed at protecting TK, traditional cultural expressions/folklore and genetic resources, can be found at http://www.wipo.int/tk/en/igc/index.html [accessed May 2011].
3. For the purposes of developing the analysis, I refer to some of the fieldwork that I conducted with my colleague Luigi Palombi as part of a three-year project funded by the Australian Research Council that examined the relationship between TK, intellectual property and biodiversity (Peter Drahos and Luigi Palombi, *The Sustainable use of Australia's Biodiversity: Transfer of Traditional Knowledge and Intellectual Property*, Australian Research Council project DP0880606, 2008–10). During the course of the project, we interviewed members of indigenous communities in Western Australia, Northern Territory, Queensland and South Australia. The full results of this study will be reported in a monograph. Here, I draw on some of the interview data for the purposes of illustrating the analysis that I develop.
4. The decision is Mabo *v* Queensland (No. 2) (Mabo case) [1992] HCA 23; 175 CLR 1. The phrase was uttered by the then Deputy Prime Minister, Tim Fischer, in an ABC interview in 1998.
5. The Indigenous Fire Workshop Program, 12–16 July 2010. The workshop was hosted by the Chuulangun community, which is based at Chuulangun on the upper Wenlock River, Northern Queensland.
6. This was pointed out to us by Professor Russell-Smith. It is also interesting to note the comment in Mitchell's journal about how little was understood of the importance of regular burning of Country (see Mitchell, 1848, ch.X).
7. Patent title: *Novel Analgesic Compounds, Extracts Containing Same and Methods of Preparation*, International Application Number PCT/AU2004/001660. The patent application and its patent family status can be viewed at http://www.patentlens.net by searching using the international application number.
8. This was the position at the end of 2010.
9. See http://www.ipaustralia.gov.au/resources/dream_shield.shtml [accessed May 2011].
10. See West Arnhem Fire Management Agreement 2006, discussed in http://proactnetwork.org/proactwebsite/media/download/CCA_DRR_reports/casestudies/em.report.case_8.pdf.

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