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# Reassessing the LIS approach to traditional knowledge: Learning from Xochimilco, Mexico City

Andrew Cox, Jorge Martins and Gibran Rivera Gonzalez

## Abstract

*Purpose*

To understand the nature of traditional knowledge by examining how it is used and reinvented in the context of Xochimilco, in Mexico City.

*Design/methodology/approach*

The paper is based on field site visits and focus group interviews.

*Findings*

Traditional knowledge was being reinvented in two contrasting ways. One was based on heritage tourism drawing on syncretism between Aztec and Spanish culture in the formation of Xochimilco. The other was agro-ecological focussed on traditional farming practices on the chinampas, their productivity, ability to sustain biodiversity and their link to social justice. There were some common elements, such as a passionate concern with retaining a valued past in the face of growing threat.

*Research limitations/implications*

Traditional knowledge is often seen as a static heritage, under threat. But it also has the potential to be a fertile source of strong identities and sustainable practices.

*Originality/value*

The paper helps to conceptualise the dynamic character of traditional knowledge.

## Introduction

Indigenous knowledge has become of increasing interest to Library and Information Studies (LIS). An important strand of work, primarily from North America and Australasia, has sought to re-evaluate the practices of libraries and archives in the handling of material originally created by or about indigenous peoples (Callison et al., 2016). This literature explores the complex issues around describing, accessing and ownership of Traditional Cultural Expressions (TCEs) respecting Indigenous Cultural and Intellectual Property Rights (IPR) (Nakata, 2013; Janke, 2018). Traditional knowledge is of very high value to local people but it is vulnerable because it is intangible, often only recorded orally or bound up in material practices. It is also vulnerable because ownership is typically collective and until recently had limited legal protection. It can be misused in multiple ways, such as through the appropriation of indigenous crafts or traditional names as brand names (Janke, 2018). Traditional material in libraries, archives or museums was often collected in ways that would not now be deemed acceptable, certainly without consent. Past descriptions could be in inappropriate language. It is hard to organise and manage such knowledge within systems based on the assumption of western knowledge as the norm or using classification systems rooted in structures of Western thought. The assumption that anyone should have access to everything does not respect traditional mechanisms for sharing knowledge or the treatment of many objects as sacred. Hence protocols like the Aboriginal and Torres Strait Islander Library Resource Network protocol are types of cultural protocol to assist in the sensitive handling of traditional material (https://atsilirn.aiatsis.gov.au/protocols.php).

Another strand of LIS literature evaluates knowledge management methods developed in Western corporations for the task of preserving and sharing indigenous knowledge about agricultural techniques and crops, usually in the African context. Such literature reveals that indigenous knowledge is under threat because (i) it is often seen by local farmers themselves as less effective than scientific practices, but also (ii) because it is not written down, (iii) it is shared in restricted ways, (iv) the lack of IPR protection, and (v) the disappearance of the culture and practices within which it was developed (Lwoga et al., 2011; Dweba and Mearns, 2011). Equally there are many barriers to simple adoption of external forms of knowledge, such as "scientific" farming methods, by local farmers (Lwoga et al., 2011). The conclusion seems to be that Knowledge Management techniques could be applied but with caution, since they assume particular types of organisational context and often focus on technology (Lwoga, 2010).

LIS is not the only field to seek to reflect on the nature of indigenous knowledge and how it should be "managed". For example, in environmental studies, a number of authors have used the term Traditional Ecological Knowledge (TEK) to describe indigenous knowledge about the environment. Usher (2000), for example, defines TEK as constituted of four elements:

1. Factual knowledge about the environment, such as classification and naming of flora and fauna and of places;
2. Knowledge of the past and current use/management of the environment, such as crop rotation, pest management etc.;
3. Value statements about how the land should be used;
4. A wider cosmology within which all such knowledge sits.

Houde (2007) also emphasises the aspect of cultural identity tied to TEK. This work resonates with Grenersen et al. (2016) suggestion that features of a landscape could be documentation for an indigenous society.

It could be objected that this very definition of TEK is based on an external, etic perspective because it privileges knowledge that bears on the environment, whereas presumably for indigenous peoples themselves the wider cosmology is prior, as it encompasses all forms of their knowledge. Further, writers such as Nyamnjoh (2012), Falola (2017) and Chilisa (2017), writing from a decolonising perspective, see such knowledge as having a completely different epistemic basis from Western scientific knowledge, whereas often writers about TEK focus purely on factual knowledge of local farming conditions based on experience, trial and error and observation (Ramisch et al. 2006). Nevertheless, the concept of traditional knowledge is a useful starting point for thinking about the contribution of local knowledge to contemporary environmental management. Alternative terms such as local knowledge, folk wisdom or vernacular knowledge have been used to label these forms of knowledge. Nyamnjoh (2012) suggests the term "endogenous knowledge" wishing to imply its dynamism and negotiability. However, traditional knowledge (TK) is the term adopted in this paper.

In debates rather familiar from LIS contexts, a body of literature in agricultural and ecological studies has emerged reflecting attempts to integrate TEK and scientific knowledge, as different knowledge cultures, both to increase knowledge and to empower local people (Tsouvalis et al., 2000). A number of models of participatory design and transdisciplinarity have been adopted (Lacombe et al. 2018, Hill et al. 2012). Emerging from this experimentation is an understanding of the challenges of working across such boundaries, including the inherently local, situated nature of TEK, differences of perception at the boundaries between knowledge cultures, but also issues arising from the asymmetry of power between scientists and local people (Briggs, 2013; Ramisch, 2014). Briggs suggests there is a need for a greater emphasis on understanding indigenous ways of knowing,

rather than knowledge content. It appears that part of the solution is a joint learning process, in which cognitive dissonances can be identified and jointly overcome (Ramisch, 2014).

What is clear is that historically indigenous or traditional knowledge has been held in abjection. It has often been seen as at odds with scientific knowledge, which itself claims to be universal and objective (Usher, 2000). TK in contrast is stereotypically considered to be oral or even embodied, somewhat unified and homogenous, tied in a holistic way to religious or mystical beliefs, embedded in traditional social relations and power structures, and for these reasons not very dynamic or responsive to change. Indeed, it has often been painted as "inferior, invalid, mythological, archaic, irrational and non-scientific" (Narchi and Canabal, 2015:92). Furthermore, because part of the myth of colonialism is to portray indigenous cultures as dying, traditional knowledge has often been presented as in decay or doomed, particularly as it is tied to indigenous languages.

Traditional knowledge often seems to be under threat by forces of globalisation and modernisation but to see it as dying is ironic in the context of climate change, as it becomes clear that it may be exploitative forms of agriculture based on science and technology that may actually be "doomed". Without romanticising its value or present it in dualistic opposition to scientific knowledge, TK seems to offer a potential reservoir of proven, highly productive and sustainable ways of managing the natural environment. Furthermore, TK may not be how it is stereotypically portrayed nor necessarily at odds with many forms of science. It may also be more dynamic than it is often presented (Ramirez-Meza et al., 2017). Ultimately TK is a resource for hearing the voices of the poor and marginalised (Agarwal, 2002). As a reservoir of wisdom, rooted in human values, it has potential to be reclaimed and reinvented in different progressive ways.

In this context, the aim of this paper is to reflect on the nature and management of traditional knowledge from an LIS perspective. More specifically, it seeks to chart the nature of traditional knowledge in a specific context and explore how it is used and shared in practice. As material for this investigation, data is taken from a study of two co-operatives in Xochimilco, Mexico City.

## Xochimilco and chinampas agriculture

The setting for this study is the borough of Xochimilco on the southern edge of Mexico City. The area contains some of the last remnants of lakes that once occupied much of the Valley of Mexico. Historically the Aztec capital, Tenochtitlan, was built here and a population of perhaps quarter of a million people were sustained by a highly productive form of agriculture based on chinampas, small, rectangular plots of land reclaimed from the lake. Chinampas are made by building up mud scooped from the lakebed. They are typically 2.5-10 metres wide by 100 metres long (Torres Lima et al. 1994; Robles, 2019). A good sense of the landscape can be gleaned from the photographs in Government of Mexico City (2017). Because of the fertility of the mud and the way that water is filtered up into the reclaimed land from the surrounding water channels, this is a highly productive form of agriculture (Narchi and Canabal, 2015, 2017; Torres-Lima et al., 1994). Indeed a sense of abundance is central to the identity of Xochimilco (Canabal, 1997). Contrary to one image of TEK being the basis only of extensive land management in an essentially rural context, this traditional practice supports intensive cultivation and city life, yet in a sustainable way (Merlin-Uribe et al., 2013). Not only are the chinampas highly productive, but the lacustrine agriculture benefits the environment. Government of Mexico City (2017: 13) reports claims that the lakes may reduce temperatures in the city by as much as 2 degrees Celcius.

Despite their apparent value they are not fully surveyed and mapped, making it hard to establish their precise economic value (Narchi and Canabal, 2015). The recent history of the area is hard to recover too (Lopez, 2006).

Recognition of the value of this system of agriculture in the literature reflects the tradition of agro-ecology in Mexican agrarian studies (Astier et al., 2017). Agro-ecology combines a study of ecology and traditional farming methods, and has evolved as an alternative to the notion of modernisation of farming based on mechanisation and chemical fertilizers. It places value on the knowledge of small scale, indigenous farmers. It also has strong political overtones and links to social movements. Gliessman (2012:151) describes it as "grounded in knowledge systems that integrate science and research, practice and experience, and the need for social change and brings justice and equity to our food systems." Agroecotourism is an emerging form of tourism linked to agro-ecology (Duffy et al. 2017).

In addition to a productive agricultural zone, Xochimilco has become a popular mass tourist destination. Trips on the brightly coloured boats (*trajineras*) are accompanied by eating and music. Most visitors are from Mexico (Bride et al., 2008).

The importance of Xochimilco is recognised by its designation as both a World Heritage site and an Important Global Agricultural Heritage System (IGAHS). It offers a unique resource for sustainability in Mexico City, as a highly complex and productive economic system, offering food security and viable livelihoods; a form of cultivation that supports significant biodiversity and is aesthetically beautiful; and as a foundation of equitable social networks and a cultural resource.

Canabal's (1997) book captures the culture of Xochimilco: It is already based on a cultural fusion. For example, the many local fiestas represent syncretism of Catholicism and pre-hispanic practices. This is not a static culture. Chinampas agriculture has evolved in significant ways. For example, after the conquest by the Spanish there was the introduction of European crops and animals to be reared alongside endemic species (Canabal, 1996). In the more recent past, Ramirez-Meza et al. (2017) chart the evolution of Amaranth production in the Xochimilco area. Far from a static body of traditional practices, how amaranth is produced and sold has evolved without losing its "traditional essence". Thus while embedded in a rich local culture, such TEK should not be seen as necessarily static.

Although designated a World Heritage site in 1987 the threats to this unique ecology, agricultural system and culture have been widely discussed (Narchi and Canabal, 2015, 2017; Torres-Lima, 1994; Wirth, 2003; Onofre, 2005). They include:

1. Gradual reclamation of the original lake system and urbanisation, ever since the arrival of the Spanish and accelerating in the Twentieth century. The area under lake has fallen from 400 square kilometres in pre-hispanic times to just 25 by 2000 (Wirth, 2003). Yet the population of Xochimilco has risen from about 50,000 in 1950 to 370,000 in 1980 (Torres-Lima, 1994).
2. The diversion of aquifers supplying the lake to the supply fresh water to Mexico City from the 1910s leading to falling water levels.
3. Deforestation of the upland areas supplying water to the lakes.
4. Replacement of water from natural aquifers by raw, later treated sewage, leading to loss of water quality.
5. Pollution from chemical fertilizers adopted by some chinampas farmers.
6. Abandonment of chinampas, with people moving to work in Mexico City.
7. Ill-considered tourist or conservation initiatives that ignore the cultural aspects of the landscape and the interconnectedness of the local economy.
8. Mass tourism introducing further pollution.
9. Illegal settlements, which occupy land and often discharge sewage directly to the canals.

These threats are well understood in the literature and are also recognised by local people (Narchi and Canabal, 2017). Underlying these problems is the failure of governments to enforce protections of the area and active exploitation of its water sources. Yet while chinamperos have often been presented as passive victims of such processes, Canabal (1996) gives a stronger sense in which it has been collective local resistance that has held these forces in check allowing at least a partial survival of chinampas culture. Also, the proximity of the city, while clearly a threat, also offers benefits such as a strong market for produce, and many chinamperos combine work on their land with employment in the city (Torres-Lima, 1994).

Threats to chinampas agriculture are also threats to traditional knowledge. New forms of technologized or chemical based farming treat TK as ineffective. Fundamental changes in farming conditions threaten to render the content of TK irrelevant and potentially undermine ways of knowing. Abandonment implies a break in knowledge sharing between family members; while the break up of community feeling undermines knowledge sharing at this level.

As well as calling for further state protection, various initiatives have sought to protect the area. Another type of initiative is the work described by Bride et al. (2008) to focus ecological concerns around the salamander, the axolotl, as a “Flagship species” and rallying point for environmental concerns. Unique to the area and with almost magical properties of regeneration of interest to science, yet vulnerable and threatened by pollution and other often non endemic species, the axolotl symbolises both the uniqueness and threatened character of Xochimilco. Bride et al. (2008) recognise the problems of using this since in the role of rallying point as amphibians they are not particularly attractive or dynamic nor are they of economic value in themselves. The project trained boatmen in understanding, so that they passed on this knowledge to tourists and also encouraged the production of more souvenirs featuring the axolotl.

## Methodology

The design of the study was exploratory. The researchers did not come with pre-conceived ideas or solutions. We took an interpretivist stance, seeking to understand alternative worldviews through a direct encounter with participants in a naturalistic setting. The main data was collected in four visits during April 2019. Two on site focus group interviews were conducted by Rivera. Two more were conducted by all three authors. The latter consisted of a tour led by a group of participants representing the co-ops, Puente de Urrutia and Chinampayolo. Rivera chose the two groups on the basis of extensive experience of working with SMEs in Mexico City through courses for them run by his University Department. Each tour lasted around 4 hours. The approach was somewhat analogous to the “walk with” interview, where moving through familiar environments serendipitous encounters prompt observations and conversations that add insights that would not be gained from a traditional sit down interview in an office (Kusenbach, 2003). Both groups routinely did undertake tours as part of their activities. Therefore, we can see what the researchers experienced as reflecting actual practices of the two groups and therefore a relevant self presentation. In addition to the tours we met some of the group members in other contexts such as at an event run by the Culture secretariat of Mexico City where they were presenting to other SMEs and we participated in a tree planting expedition with Chinampayolo. The two initial interviews and discussions during the tours were recorded, transcribed and translated. Extensive field notes were made and photos taken to document what we encountered. This data was analysed collectively by the three authors to produce the account that follows.

Clearly the content of the data could be affected by the circumstances under which it was collected. Collective interviews do not necessarily capture a sense of the diversity within a group that would

have arisen from individual interviews. The nature of the visit by Cox and Martins, as foreigners, might well have affected what was presented to them in the tour based interviews. We do not present our results as the full or only truth about the two co-ops. We hope by supplying quite a detailed account of each trip the reader can form their own view of the usefulness of our analysis.

The research was approved by University of Sheffield ethics processes, but we were very conscious of the need to develop a contextually appropriate approach to ethics. Given the positionality of two of the authors as researchers from the global North, we endeavoured to be reflexive about how power structures played out in the research. Research by investigators from the global North in the global South is beset by many practical and ethical issues (Smith, 2012; Chilisa, 2012). We recognised the danger of reproducing hidden assumptions, stereotypes and unconscious biases. Indeed our purpose was precisely to challenge such deeply engrained assumptions, since we sought to question approaches to knowledge that deprecate and diminish traditional knowledge. The research was premised on respect for local beliefs and values. Coming from a very different cultural context we sought to approach the study with humility and in a non-judgemental way and driven by an open-minded willingness to learn. We had respect for myths and rituals. We were hesitant to judge statements through our own cultural assumptions. We came as visitors, interested to learn and sought to present ourselves in that light. Indeed we came away inspired by the energy and sincerity with which participants shared their views.

Part of our explicit contract with the research subjects was that they be invited to visit Sheffield in return, paid for by the project. Only one was able to come but this proved productive in deepening further our understanding of their philosophy. The visit also helped reinforce a sense of the resonances between their experiences and our own, however different the context. Seeing freshly our own city through their eyes prompted a realisation of the resonance of issues of sustainability locally.

Perhaps the most immediate issues were fundamental ones of understanding given the very different cultural context from which the first two authors came, and of language barriers. We had prepared ourselves through a literature review. The Xochimilco experience has been written about extensively in both English and Spanish. This was very useful, but also gave us pause to think about why this was the case – Smith (2012) comments that many indigenous communities see them as the most researched populations in the world. Raising this issue with participants, they felt previous projects had exploited them, by learning but not giving anything back. Where there was a local benefit, projects often brought money in divisive ways into communities. We agreed that it was appropriate to pay the participants for the tour they gave us, more or less on the same conditions as other tourists or eco-tourists. As a long term benefit we hope to help the groups explore and strengthen relations with other stakeholders, through an analysis of knowledge flows. The groups' willingness to participate in proposed follow on projects suggests that they recognise this to be an appropriate reward for participation. Participants were themselves concerned with IPR around chinampas knowledge. Given that we were bringing an LIS rather than agricultural perspective, this was not a major issue, we would argue.

Martins speaks some Spanish; Cox does not – therefore his questions had to be translated. Although this was a limitation which we should take very seriously, we would also argue that it had some benefits in terms of forcing the group of researchers to make explicit their understanding of what they saw. The method of encountering participants in their place of living and working, over a fairly extended period (as opposed to in a simple sit-down interview) on terms defined by participants themselves was effective, we believe, in helping to overcome some of these barriers of understanding. We had extensive discussions about the meaning of what we saw. In many ways, it

was a very material encounter. We got our hands dirty. Nevertheless, we would acknowledge that there may be many gaps in understanding and this paper represents an initial attempt to feel our way to understanding. A continuing concern was that all three authors are male, and we feel this could have limited our access to experiences of gender and issues of intersectionality. Nevertheless, we did try and self-consciously reflect on the data with a concern to consider issues of equality, diversity and inclusion.

## Findings

To capture a sense of how the past was being reclaimed in different ways by the two groups we will describe the two guided visits we undertook, supplemented by quotes from the interviews.

### Puente de Urrutia

The presentation of this visit framed it as heritage tourism. Thus when we arrived at the embarkation point one of the guides was dressed in traditional costume, the elements of which she later explained. The boat we were ferried in was one of the "traditional" trajineras used for the mass tourist, with a colourfully painted roof panel and given a woman's name. The boat man (*remeros*) used a pole to propel the boat quietly along the canals.

During the tour most of the heritage reference points were pre-Columbian. The tour started with one of the guides recounting a foundation story from Aztec mythology: The story of the priestess Coatlicue who becomes pregnant with a god while sweeping a temple. The point of telling the story was to illustrate how the parallel with the biblical virgin birth had helped the syncretism of Aztec and Spanish cultures. Another important story (that the guide illustrated from a popular history magazine) was the way that the local church (San Bernardino de Siena) had been built on the site of an Aztec temple reusing its material. This again symbolised the persistence of pre-conquest beliefs and practices and their syncretism with Christian beliefs.

Emphasis was given to the way the landscape was located between prominent mountains that were visible on the horizon and that were important reference points in Aztec cosmology. Some of the chinampas' own layout was said to mirror that of the heavenly constellations as they were perceived in pre-hispanic civilisation.

> *"In the case of the Xochimilcas they were the archaeo-astronomers who dedicated themselves to understanding the movement of the heavens. They studied that closely, that is why it is said that many of our channels were built in the image and likeness of some constellations."*

It was also explained to us that in Aztec times Xochimilco had been a separate tribe but conquered by the Mexicas, the name Xochimilcans gave to the people in Tenochtitlan. Its productivity arose partly from the need to grow enough food while also paying tribute to their conquerors, we were told. So Xochimilco retained some uniqueness in relation to Aztec civilisation and there was continuity in its symbolisation of resistance.

Xochimilco had also won special rights through hiding Hernan Cortes when he had had to fly from Tenochtitlan at one point in the conquest. Land ownership was protected and foreigners could only stay there for a few days. This protection had helped preserve its unique character and continuity with indigenous culture, we were told.

These examples illustrate how the trip was framed largely through references to pre-hispanic culture and its survival during the encounter with the Spanish. Another notable event, however, was the pact between the two great revolutionary leaders, Francisco Villa and Emiliano Zapata signed when

they met with their armies prior to occupying Mexico City itself. Thus in various ways Xochimilco had a special place within national history, often as a focus of resistance.

The first stop of the tour was a chinampas that was in the process of being reclaimed, though it still had some drainage problems. The traditional crop of maize had just been planted. Many of the key local rituals are tied to maize and the choice of crop reflected this. The guide described the chinampas as

> *"The most complex agricultural system in the world. Because despite being in one of the most populated megalopolises in the world our chinamperos system still works. Yes, indeed, I want to acknowledge it: it is in danger. But […] there is a way to rescue it, but this has to be done with manual work. The chinamperos system is a cutting-edge technology that we have inherited, so to say."*

Interestingly she stressed the centrality of manual labour to this work with the land.

> *"This system has to be as manual as possible so that it is as healthy as possible."*

We then stepped across to a second chinampa which had been more fully restored and it was pointed out how green it was because of the way humidity was transpired from the surrounding canals. This chinampa was mostly a large grassed area rather than under cultivation for produce.

> *Yes we observe that today there is very little sown in the chinampas. But in the end if this is preserved it acts as a filter, and air-purifier. It works like a lung. Even if we do not sow we are still generating environmental benefits.*

The wider value of the chinampas was emphasised:

> *We are rescuing Xochimilco. We are not only helping the chinampas, Xochimilco, but the whole world, because Xochimilco is a small green dot on our planet. It's a small lung.*

Our tour paused and we were invited to ask questions of the guides and one of the guide's father whose idea it had been to reclaim the chinampas. The tour guide said that she was learning the indigenous language of Nahuatl because she felt so much of the culture was tied to this pre-hispanic language.

Then a young woman and boy wearing pre-hispanic traditional costumes conducted a traditional ceremony, with the group standing in a circle and being blessed with incense (*copal*). The young woman danced; the boy blew on a shell. Explaining the ceremony the young woman was keen to emphasise that she was an educated person, with a degree and asked us to respect her beliefs.

> *On this land, sacred chinampas, we welcome those who are foreigners, we welcome the Mexicans. Please take good care of our traditions, do not be ashamed of them. The fact that you want to preserve a tradition does not mean that you are illiterate: I have a degree, I have a degree in administration, furthermore I am a physical anthropologist. I do Olympic gymnastics. I am a very cultured person, this does not mean that one can not continue growing as a person. Certainly there is no reason to be ashamed of tradition. We must do everything with respect and we must transmit it to other generations and to people who come to accompany us from other places.*

We were told that on the chinampas evidence of ancient ritual was often being found, but people were afraid to talk about it in case their land was taken away from them.

While we were travelling to the next chinampa we were told of some extraordinary aspects of the natural ecology of Xochimilco. There was a giant frog that had been seen a number of times and there was a phenomena when the fish come and float on the surface of their own accord. These stories reinforced the sense that Xochimilco was a magical place.

The ecological threat from introduction of alien species such as waterlilies was acknowledged. At the last chinampas we were shown the aquariums where axolotl were being bred for release back into the wild. The guide commented that efforts by locals to protect them had been much more effective than those of scientists. There was also a shop selling local handcrafts and craft food produce and above it a restaurant.

## Chinamapayolo

The visit to Chinamapayolo was very different. The meeting point was not a tourist embarkation point, just a ramp behind a wire fence at the back of a football pitch. Members of the co-op were dressed in working clothes and we were ferried through the canals in an unadorned flat-bottomed boat with an outboard motor (on a later trip the team from Chinamapayolo struggled using the pole to navigate a similar boat).

The first stopping point was a large chinampa where a system of production was described based around supporting 5 cows to produce milk and cheese. It was acknowledged that rearing cows to produce cheese was not a traditional practice. We were shown several buildings which were being constructed from traditional materials. We were told that Chinampayolo's objective was to achieve independence or self-sufficiency from the wider economic system. They had markets in the city among eco-conscious young women (often foreigners) and young families and also some 5 star restaurants. Their objective was to reach these markets directly, cutting out intermediaries, to control prices. They saw the need to build a community of consumers in parallel with their community of producers. They sought an academic partner to develop certification which would define products produced sustainability under a very specific chinampas regime and help them differentiate their products in the market place. They rejected labelling their products merely as organic since the chinampas systems was much more demanding.

The second chinampa visited on the tour had belonged to one of the co-op members' family. He was currently reclaiming it: redredging the canal (by scooping material to build up the land in the traditional way), restoring the health of the water and growing crops for seed. The improvements in water quality were already creating favourable conditions for the return of axolotl. The group were cutting a new channel in the centre of the chinampa to create a water reservoir. We were shown a tub being used to compost material based on using the microbes from a cow's stomach. Another innovation was a sawdust toilet. The banks of the chinampas had had to be reinforced with rock in wire mesh because of attacks on the roots of the trees protecting the banks by carp (a non-endemic fish species which had been introduced into the system). The threat to endemic species from species that had been introduced from elsewhere was often mentioned as an issue.

> *Well in productive terms we are doing things already, that is very evident; the incorporation of biofertilizers, the reproduction of microbiology, of mineral broths. These practices did not exist before in the Chinampas, rather they have been incorporated recently into the productive system. That is, there are new problems and issues that did not exist before. In the social aspect, in terms of the*

*community organisation, to re-weave all this that has been broken, in terms of neighbours, community, that is a very strong challenge. I think there is where innovation is needed, we need to incorporate new elements that, perhaps, we have not been able to find.*

The third chinampa was rather different, more of a recreational area for the co-op. It contained a construction for a type of traditional sauna. On the fourth chinampa, the chapin system was explained to us. This is a traditional practice which uses fertile mud drawn from the bottom of the water channels to germinate plants, apparently with amazingly productive results.

This visit ended with a conversation around a table. Much of the discussion was about the deep sense of identity and well-being they felt from the chinampas:

*"I think it is the love we have for the land because, I do not feel it is a job, I could be there all day and do not feel it as I am making an effort, I feel myself a part of the chinampa. It is not like being pressured when you are outside of your chinampa, when time is pressurising you to be on one place and then another, everything is more like being in a hurry, everything already has a deadline. You see people who start infecting you with their stress and you get into that rhythm, and when you get to your chinampa again, you disconnect yourself again from that noise, from that rush of the city life."*

*"I feel myself to be a part of the chinampa."*

*"The chinampa for me is identity, it's my story, it's my family, it's my past, it's a pride to be chinamperos, especially because the chinamperos is a person who has a very precise, very deep understanding of the whole environment, how it works, that is a chinamperos. It is a pride to be chinamperos, few people have that knowledge of the environment."*

Thus part of the pride is linked to knowledge. This knowledge is tied to a particular, embodied experience of land was central to the chinamperos identity:

*"It is the love you have for the land, for the traditions, for the family. Once you have these dialogues with the land, well, it is something that you only understand by talking to the land, I could not explain it to you. […] There is no theory that can explain this. […] And that dialogue is without words. It's more about actions."*

Chinamapolo had five leaders drawing on differing expertise of the leadership group: one each for production, distribution, conservation, agroecotourism and education. They had an active education programme (*Escuela Chinampera*) to make people in Mexico City more aware of the chinampas and their potential.

*"We have to produce, to sow, to transform, to sell but also to make people aware."*

Chinampayolo were a very dynamic group rediscovering, reinventing and resharing knowledge in a number of contexts:

- reclaiming traditional knowledge practices, e.g. through engaging with older members of the community;

- sharing knowledge with partners such as other co-ops and with university researchers to design appropriate biotechnologies and develop environmental certification for their produce;
- building knowledge networks of ecologically aware customer communities;
- negotiating with entities competing for use of Xochilmilco, especially representatives of the mass tourist industry;
- educating the public about the chinampas and promoting agroecotourism;
- communicating knowledge to policy makers to enable them to understand how to provide conditions for chinampas life to flourish.

A central task for the leadership team was managing these complex relations with differing stakeholders, who themselves had a very different knowledge base and in the context of power structures. Some of the relations were somewhat conflictual, e.g. they had been struggling to gain access to the green market to sell their food because of resistance from traditional sellers.

## Analysis and discussion

In this account of co-ops from Xochimilco, rather than dying, invalid or archaic traditional knowledge seems to be a source of energy and inspiration, albeit developing in very different directions in the two cases.

The tour by Puente de Urrutia was firmly located in a notion of heritage tourism. The unique character of Xochimilco as a place was framed primarily through historical and archaeological references points, mostly pre-hispanic. Important aspects of the narrative were the richness of pre-hispanic cosmology and beliefs and their resilience in the face of western culture (as represented by Catholicism). The co-op were trying to revive respect for traditional rituals. Xochimilco was presented as having a special place in history, before and during the conquest but also in the 1910 revolution: in both cases as a point of resistance. Thus historical/archaeological knowledge were combined with folk memory. There was an emphasis on the uniqueness of the place, reinforced by some of the remarkable, even inexplicable aspects of the local ecology, which were often presented as beyond scientific explanation. This distance from science was emphasised by the focus on religious beliefs and ritual.

In contrast, the Chinampayolo tour was animated by a combination of the rediscovery of highly productive traditional farming techniques, supplemented with some scientific methods, that was also sensitive to the conservation of native species in the environment and with a concern that produce be distributed in a fair and sustainable way. Traditional farming techniques were highly valued but there was a willingness to innovate too in terms of crops and techniques, where they were shown to be sustainable within the wider ecology. There was a strong concern that the natural environment be conserved. The sense that traditional agricultural techniques worked harmoniously with a rich ecology of nature, opened up the possibility for agroecotourism. The group recognised that the distribution of produce also needed to be managed outside existing capitalist structures. They were keen to find markets among people who shared their values, and also sought certification, specifically for products grown in chinampas conditions. Participatory guarantee systems are growing in Mexico (Nelson et al 2016). There was also a strong sense of the need for the whole enterprise to be built from a base in a strong sense of community and linked to a concern social justice. Emerging from the data is a strong identity implicated with a specific notion of wellbeing linked to a feeling of

- continuity with previous and future generations;
- connection to the land and value placed on its physical demands and temporal rhythms;

- direct access to self-produced, high quality food;
- co-operative social relations in a fair marketplace offering a sense of social justice.

Here traditional knowledge is clearly much more than knowledge content, but about ways of knowing wrapped up with a set of values.

Whereas Puente de Urrutia tended to reject science as a reference point, many aspects of the chinampas ecosystem and farming practices were presented as of interest to science by Chinampayolo. Several new scientific based production practices were referred to favourably. However, science and academia as a whole was viewed with some scepticism for being quite narrow and for exploiting local people by winning money from the government but without always producing very helpful results to local people.

In contrast to Puente de Urrutia, historical events or myths were rarely if ever referred to, though there was a strong focus both on past practical wisdom and its potential for future sustainability. Rather than giving emphasis to the place, Xochimilco, as such, more often the reference point was the chinampas as a unique environment with its associated life style. Chinampayolo literally means "the heart of the chinampas". Much emphasis was given to the chinamperos identity: to having roots among the people who had been successfully farming here for hundreds of years. The chinampas were referred to as "monuments" (by both groups). But Chinampayolo's link was to a mundane history of working the land, rather than the dazzling, exotic highlights of Aztec history. Yet this too had a mystical element articulated through the sense of identity and lifestyle tied up with the identity of the chinamperos.

There was also an excited sense both of rediscovery of the value of traditional techniques and a willingness to innovate in terms of products, processes and market strategies, including agroecotourism. They were outward looking and keen to engage other organisations such as scientists e.g. to gain certification, with consumer communities, with local government as well as with the public, through their educational programme.

Particularly with Chinampayolo, there was a sense of organisational ambidexterity in terms of both exploiting the productivity of established practices of the past and wishing to explore more innovative approaches to production and distribution (O'Reilly and Tushman, 2004).

Thus there were many contrasts in emphasis in the accounts, see Table 1 below.

| | **Puente de Urrutia** | **Chinampayolo** |
|---|---|---|
| Main approach | Heritage tourism | Agro-ecology |
| Sources of knowledge | Folk memory, archaeology and history | Folk memory, scientific discovery |
| Central focus | Aztec cosmology | Traditional farming practices |
| Place making | Xochimilco as a unique place | The chinampas as a unique form of production and life style |
| The past | Pre-hispanic culture, major historical events | Wisdom of the chinamperos |
| Relation to scientific knowledge | Beyond scientific understanding | Of great interest to science |
| Indigenous language | Language revival | *Not mentioned* |
| Crops | Traditional crops: maize | Innovation in crops and produce |

| | | |
|---|---|---|
| Ideology | Traditional myths and ritual | Anti capitalist, ecology, sustainability |
| Symbols | Traditional punt, traditional costumes | Punt with outboard motor, work clothes |
| Type of cultural sustainability (Soini and Birkeland, 2014) | Cultural heritage | Economic viability |

Table 1 Two differing reclamations of traditional knowledge

The strength of the Puente de Urrutia approach is the appeal to a fascination with pre-hispanic culture. It is interesting that Xochimilco's heritage status was confirmed at the same time as that of the historic centre of Mexico City. Recognition of the importance of indigenous language is important in this perspective. Chinampayolo's appeal is to growing ecological concerns among the public and in potential markets, as well as to the rise of foodie culture – though distancing itself from the elitist overtones of this through its concern with social justice. The attempt to develop a system outside capitalist social relations is a strength but also a vulnerability.

On the surface the two accounts are entirely different (we have presented them in Table 1 as a dualism) yet there was some significant common ground.

Both accounts "reclaim" the past but simultaneously reimagine it. As a rich reservoir, traditional knowledge offers diverse potential to reinvent place in different, powerful ways. Both accounts also reclaim the past through a place making process, and there were certainly common reference points, though mentioned with differing emphasis. Both referred to the chinampas concept, for example, but it was much more central to Chinampayolo. The chinampas was being rescued more as a tourist destination by Puente de Urrutia, whereas for Chinampayolo it was as a living and productive form of agriculture. In both cases, though in differing ways, forms in the landscape were documentation for how the community belongs to that landscape (Grenersen, 2016). In both cases the past was a reservoir for resistance, be that to conquest by western culture and religion or capitalist market relations. Both sought to construct a unique local identity.

Both groups were passionate about retaining an inheritance from the past that was under threat, but retained great value and power locally, and which offered something to the wider world too.

Both groups were primarily of young, educated people who after a period of disconnection were returning to the land. This may be a critical aspect of the situation because the break seems to potentially lead to a much deeper reinvention of knowledge.

Both groups also felt a sense of threat and pressure, the danger of something fragile and precious that could easily be lost, and both identified the same main threats as being:

- A lost generation who had left the chinampas and were disconnected from traditional knowledge.
- Pollution from farming based on chemical fertilizers.
- Uncontrolled mass tourism.
- Conflict produced by monetising social relations.
- Non-native species such as lilies and carp undermining endemic ecology.

So, notwithstanding the dualism suggested by Table 1, we can propose that the two approaches are not mutually exclusive, rather both are creative and progressive responses to the commonly perceived problems of Xochimilco. Nor are we suggesting from the limited data that these are the only two such accounts that might be in circulation. Both are complex constructions actively created

through the process of telling. Original interviews with Puente de Urrutia differ far less from Chinampayolo than the impression given by the tour, suggesting strong underlying shared values.

Both narratives have their own strengths and challenges, but there is logical reason to believe they can have common resonances. A focus on either pre-hispanic culture or the productive chinampas seems more plausible than some other preservation strategies, such as the use of axolotls as a flagship species (Bride et al., 2008). While a unique creature worthy of conservation, the axolotl in the wild is virtually invisible offering little of symbolic value beyond the human threat to natural diversity. The chinampas concept in contrast inherently integrates conservation with production, and local identities. Certainly in the Chinampayolo narrative it also has a strong social justice element, which is an important aspect of Latin American thinking about sustainability (Vanhulst and Zaccai, 2014).

## Conclusion

The chinampas farming system is highly productive and has proved resilient and successfully been adapted to a changing environment over centuries. Our analysis resonates with Gliessman's (2015: 152) reflection on the nature agro-ecology, that "Food systems must be people centred, knowledge intensive, and place based." While traditional knowledge is under threat, it seems it is also a rich resource from which can be reclaimed multiple local narratives of sustainability. The two versions of the story recounted here illustrate this fertility and dynamism; and also a potential for multiple voices to emerge from traditional knowledge. Such reinvention has to be grounded in ecological, social, economic and cultural roots. This context is a particularly rich area of research because we encounter dynamic groups reinventing TK from the bottom up, rather than initiatives driven by development agencies or scientists as typically investigated in previous studies in environmental science. The diversity within TK becomes clear.

To date, LIS engagement with these forms of knowledge has been somewhat limited. We have thought about how to describe, organise, digitise and offer access to TCEs, in respectful ways. There has been some work on promoting the sharing of traditional agricultural knowledge, mostly in Africa. Most usefully, there has been some work exploring the sense in which features in a landscape can be documentation for the identity of an indigenous people. Our research points to the way that traditional knowledge takes many forms other than that usually labelled "indigenous". There is clearly a need for LIS to engage further with other literatures that have already begun to theorise traditional knowledge and how it can be shared. There are many interesting questions for LIS to explore here. We need to understand much better how knowledge flows within the co-ops, especially between generations. Also of interest are the encounters with other knowledge cultures in the interactions with the wider world. Previous work in environmental science has focussed on the relation between farmers and scientists purely to raise productivity. A broader perspective demands analysis of the relation between co-ops and each other, with stakeholders such as development partners, with customers, and with policy makers. These encounters happen at the boundaries between knowledge cultures, but are shaped by the complex power structures within which these relations unfold. Into this mix we need a strongly reflective layer of work exploring the positionality of the researcher, especially the male researcher, to query issues of power within the research relationship itself.

A further area of study will be thinking about what kind of thing can be learned from this case for other contexts, because traditional knowledge is inherently local. Attempts to transfer the chinampas system as a productive form of agriculture to other contexts have been unsuccessful, probably because the lack of the wider cultural understanding that supports it (Chapin 1988). What

can be learned across contexts may be more about processes of knowledge sharing and place making than anything specific about chinampas agriculture. In practical terms, projects that brought together different local communities to explore how they relate to TK as a living resource could help strengthen the use that is made of it and how TK is explained to local stakeholders. One route to do this could be in developing the notion of a protocols in new directions. This idea has already been taken up to help libraries, archives and museums to understand how to engage respectfully with indigenous people and their TCEs (Callison et al., 2016). It has also been used in the sphere of protection of IPR (Jukic and Collings, 2013) and more recently data stewardship (Kukutai and Taylor, 2016). Project work directly with local communities co-designing new types and formats of protocol to assist in interaction with different stakeholders could be very useful in many contexts.

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