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ORIGINAL ARTICLE

Integration of knowledge systems in urban farming initiatives: insight from Taipei Garden City

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Abstract

There is growing interest globally in the potential of urban farming to respond to a breadth of urban sustainability challenges. Yet it is also recognised that the policy and implementation of this nature-based strategy is influenced by an underlying science–policy–practice community. The aim of this paper is to understand how different actors and knowledges come together to form a science–policy–practice community for a citywide urban farming initiative—Taipei Garden City. The result shows that the science–policy–practice community was formed in a dynamic 'top-down' and 'bottom-up' process. This allows long-term public–private partnership to be developed and enables different knowledges and experiences to co-exist in policies and practices. This study argues that in-between spaces and actors, who can cut across different fora, are vital to make urban farming interventions happen. Nonetheless, we also question the extent to which embodied and experiential knowledge is sufficient to support environmentally and socially appropriate outcomes for attaining urban sustainability.

Keywords Urban farming · Epistemic communities · Communities of practice · Green infrastructure · Urban green spaces · Nature-based solutions

Introduction and overarching context

There is significant global interest in how innovation and experimentation in neighbourhood-level nature-based solutions may enable sustainability transitions in cities (Dennis et al. 2016; Frantzeskaki et al. 2020; Kabisch et al. 2016). This field of enquiry is supported by concomitant interest in the politics of how knowledge and expertise drive the implementation of urban sustainability interventions (Frantzeskaki et al. 2020; Romero-Lankao et al. 2018). Similarly, international agenda-setting organisations such as ICLEI (2017), Future Earth (Future Earth Urban 2019) and the Biophilic Cities Network (2020) increasingly advocate science–policy–practice coalitions and public participation in support of upscaling and learning both within and between cities. Broader initiatives such as the Edmonton Declaration (2018) encourage measures such as the creation of chief scientist positions within cities. Yet amidst this enthusiasm, there remains a need for more attention to how place context shapes urban transitions in specific localities (Wolfram and Frantzeskaki 2016); and to critically interrogate how different knowledge systems compete to shape the governance and deployment of urban sustainability initiatives across space (Hughes et al. 2019).

Taking nature-based solutions, and in particular urban farming, as a point of departure, the purpose of this paper is, therefore, to explore how academic, policy and practice actors compete and cooperate to make claims of expertise in shaping a vision for a sustainable city through green spaces. To do so, we analyse a city-wide network of urban farming actions which form one set of nature-based solutions interventions—the Taipei Garden City Project in Taiwan.

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Nature-based solutions and urban farming

Nature-based solutions (NbS) refer to actions to protect, sustainably manage and restore natural or modified ecosystems in a way that addresses societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits (Cohen-Shacham et al 2016). For the purposes of this paper, we focus on one type of NbS intervention, urban farming, which increases accessible urban green spaces while connecting them with various ecosystem services (Russo et al. 2017; Fischer et al. 2019). In addition to providing stable and affordable food resources, which is often highlighted in emerging economy nations (Schwab et al. 2018), urban farming in wealthier countries tends to emphasise a range of benefits including mitigation of surface runoff, reduction of urban heat island effect, enhancement of biodiversity, alleviation of urban poverty and inequality, improvement of social cohesion, and enhancement of community resilience (Säumel et al. 2019; Nyman 2019). Urban farming often makes use of underutilised lands, including school grounds, playgrounds, roadsides, riversides, vacant building lots, roof-tops and existing park and greenspaces (Eigenbrod and Gruda 2015; Hajzeri and Kwadwo 2019; Middle et al. 2014). This allows the reintroduction of nature and associated benefits to built environments, where available spaces for parks and green spaces are limited, and brings local communities in contact with nature without the need of a radical and prolonged process to acquire lands or to change zoning/building codes (Middle et al. 2014). COVID-19 has illustrated the role of urban farms and/or edible gardens in providing supplementary food resources, improving mental health through accessible green spaces, and fostering social resilience through collective gardening practices (McCunn 2020; Zheng 2020).

Given our overarching interest in the knowledge politics of urban sustainability initiatives, it is notable that scholarly, policy and practice interest in nature-based solutions for cities is growing (Escobedo et al. 2019; Frantzeskaki et al. 2020). It is hence an opportune moment to understand whose knowledges and interpretations of NbS and related concepts such as urban farming carry the most power in driving forwards specific NbS initiatives for urban sustainability. The Taipei Garden City Programme in Taipei provides a specific city-wide urban farming action through which to explore this question.

Taipei Garden City

Our focus is an Asian city with a relatively mature urban farming policy sustained over several years in Taipei, Taiwan. Taipei has several characteristics which make it a valuable case for conceptualising the politics of knowledge in NbS for cities more widely. Taipei has seen relatively rapid development and constant regeneration over recent decades, reflecting dense development and competition for land which characterises a number of urbanising locations in Asia (Moser 2020). Environmentally, Taipei represents the kind of urban form and societal relationships with green spaces in cities at lower latitudes which is very different to temperate climates (Song et al. 2017), yet remains underrepresented in the literature on NbS for urban sustainability (Kendal et al. 2020). Politically, Taiwan also stands as an example of a relatively new democracy (Martial Law ended in 1987), with the emergence of a breadth of channels in recent years to enable civil society participation in the planning and governance of public space (Hou 2020). Urban farming initiatives in Taipei, as a form of NbS, hence happen against a backdrop of dense development, competition for land use, and nascent forms of civil society participation that may characterise many growing economy locations globally in which urban dwellers will experience NbS interventions as part of transitions to sustainability.

In the past decade, a series of vibrant local movements have advocated increasing greenery within the built environment of Taipei City (Hou 2020). Through this process, public–private partnerships came to take on a prominent role in shaping Taipei's greenspace policies, such as *Taipei Beautiful, Open Green* and *Taipei Garden City*. Several tracts of small and vacant land were temporarily converted into edible gardens and gained great popularity under the earlier *Taipei Beautiful* policy. This catalysed a local movement for promoting urban farming and the subsequent establishment of a local community known as the *Farming Urbanism Network (FUN)*. FUN has become a key actor lobbying Taipei City Government to adopt policies for urban farming.

Against this background, urban farming in Taipei was upscaled by FUN to a city level through the Taipei Garden City Programme (田園城市), which was in 2015 endorsed and enacted by the city government as a priority policy initiative. This subsequently led to the lifting of two bans on the use of government-owned lands. The specific land acquisition scheme for temporary use of government-owned lands enables fast implementation of small-scale and non-commercial types of gardens across neighbourhoods, without a need to amend land use plans. Four types of edible gardens have been established or incorporated from previous projects such as community gardens, rooftop gardens, school gardens, and allotments (Fig. 1). The number of garden city sites has increased from 292 in 2015 to 733 in 2020, including 102 community gardens, 76 rooftop gardens, 284 school ground gardens, 253 school rooftop gardens, and 18 allotments as of February 2020 (PSLO 2020). Because allotments were established long before the programme and often located in the city outskirts, our study focuses on community, rooftop and school gardens.

At the government level, Taipei Garden City is characterised by enhanced cooperation between different sectors. Although the Parks and Streetlights Office has been designated as the principal authority for managing the programme, three government agencies—parks and streetlights office, economic development department and education department oversee implementation through integrating the programme into their own mandates and professional networks (Fig. 2). More than ten governmental sectors, such as urban development, environmental protection, social affairs, and health, are also involved in supporting policy implementation. The existence of champions in the government, and coordination by the former deputy mayor, played a critical role in effective inter-departmental cooperation, particularly at the initial stage of the programme.

As shown in Fig. 2, the programme engages urban farming initiators in policy and implementation, by including them on the advisory board for city government and in the steering group for community gardens. The involvement in the administrative system of wardens' offices, social welfare systems such as public hospitals and social housing, and school systems allows gardens to respond to social issues such as an ageing society, lack of housing for young people, environmental education of children, and patient well-being. There is hence scope for practitioners to interpret the characteristics of a garden to meet the needs of the people engaging with their site.

Conceptual framework

The main conceptual contribution of our paper is to bring together two different ways in which scholars have tried to understand how experts influence policy and practice. These are the idea of epistemic communities, which looks at how experts from science seek to influence policy, and the idea of communities of practice, which looks more at how experts whose knowledge comes through experience and practice try to influence policy. By bringing these two ideas together, we aim to understand, in an environmental context, how experts holding different types of knowledge can compete or work together to shape policy and practice (Fig. 3).

Epistemic communities and communities of practice

Epistemic communities are concerned with how groups of experts act to influence policy and practice with formal scholarly knowledge. With roots in international relations (Haas 1992), epistemic communities have more recently been explored for environmental issues in urban spaces (Finewood 2016; Finewood et al. 2019; Mabon et al. 2019).

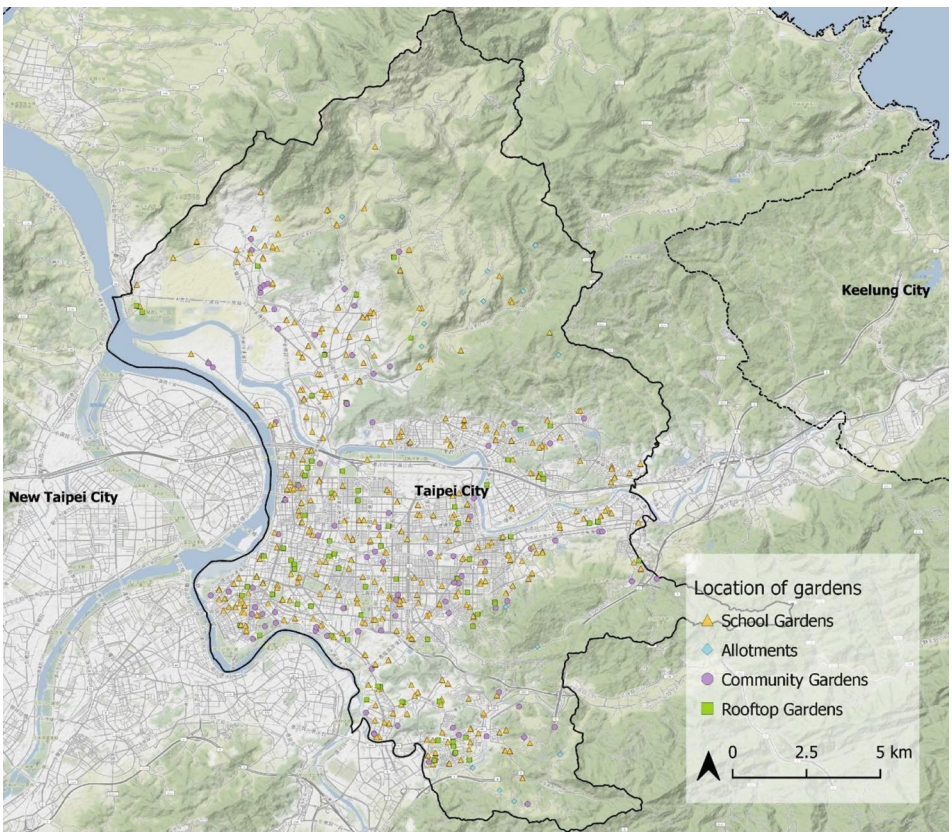

Fig. 1 The location and the types of gardens in the Taipei Garden City programme

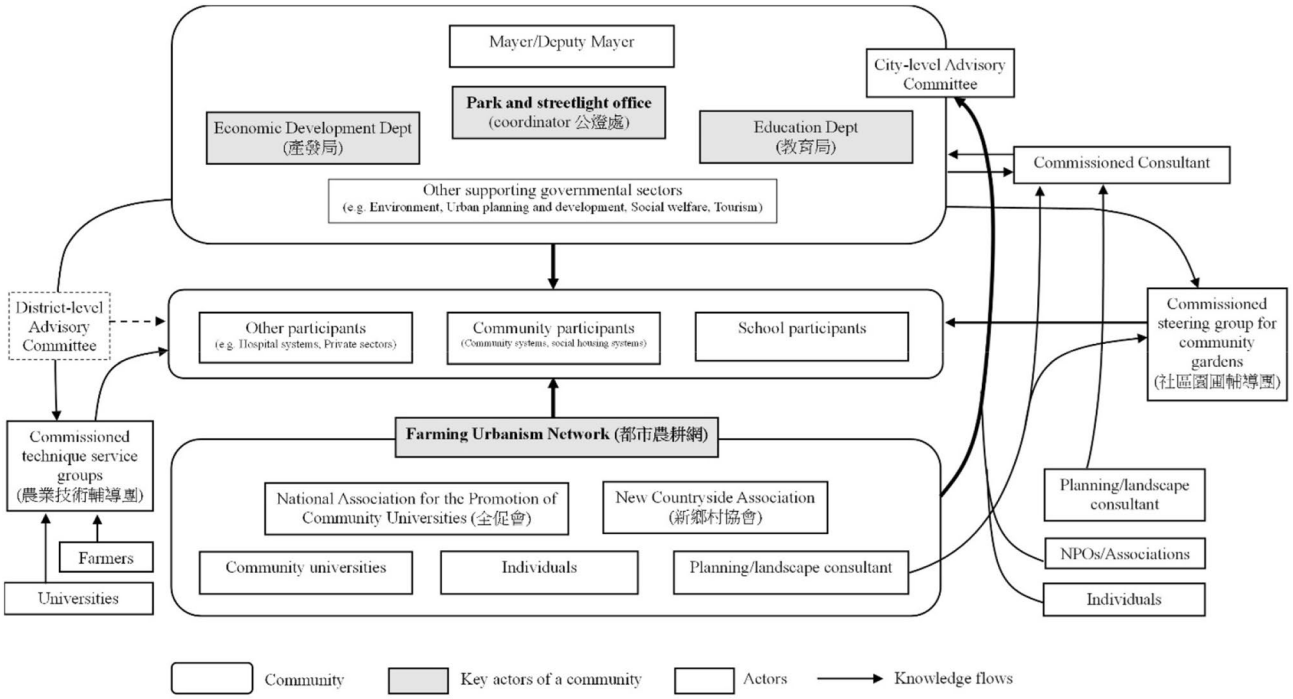

Fig. 2 Communities and actors of Taipei Garden City programme

Members of an epistemic community share four characteristics: (a) shared notions of validity, meaning community members use common methodological standards to judge what constitutes 'valid' knowledge (Dunlop 2014); (b) shared causal beliefs, whereby members have a common interpretation of the formal academic knowledge behind an environmental problem which they find convincing (Gough and Shackley 2001); (c) shared normative beliefs, meaning members have similar values and motivations guiding their actions (Mabon et al. 2019); and (d) a common policy enterprise, where members' beliefs and expertise lead them to make detailed policy proposals (Lovell and Mackenzie 2011). Epistemic communities create consensus which can come to be understood as the accepted 'reality', closely linked to the practice of science (Bromley 2012), communicating their needs and desires through both normative approaches and technologies themselves (Finewood et al. 2019).

Nonetheless, Lovell (2015) argues epistemic communities are just one kind of community which may shape an environmental debate and influence policy and practice. Dennis and James (2017) identify the key actors in communities driving forward nature-based approaches to sustainability as local residents, community groups and schools, rather than technical 'experts'. Dobson and Dempsey (2019: 4) are thus critical of the idea that epistemic communities alone spread knowledge, arguing that

> "understandings of 'what works' may have few connections with the academic evidence base. Practitioners seldom have the privileges or time to access academic research, while policymakers are more often informed by 'grey' literature […] and by the practice-based knowledge."

A second understanding of expertise is thus a community of practice. A community of practice can be understood as a group of people who share a concern, a set of problems, or a passion about a subject matter, and deepen their knowledge and expertise by interacting on an ongoing basis. The idea has origins in organisational studies (Wenger 1998), but also more recent applications in environmental contexts to understand how the science–policy interface may be extended to practice (Iyalomhe et al. 2013). Similar to an epistemic community, members of a community of practice share common characteristics. First is joint enterprise, which is a shared pool of knowledge that community members draw on to identify themes to be advanced by the community, and a shared vigour in learning about a particular endeavour such as gardening (Bendt et al. 2013). Second is the presence of community—that is, cohesive relationships and interactions among members, where learning about a practice such as urban farming leads to increasing levels of participation (Tidball and Krasny 2011). Third is shared practice, in other words routine activities, and common procedures or 'know-how.' Barthel et al. (2014) explain that participation and

reification in this shared practice leads to continuous social learning, and creates objects/artefacts/metaphors which last longer than the practices themselves. For practice, Harper and Afonso (2016) add that community of practice members may have a common interest, but can have different motivations and attach different meanings to their practice.

Linking epistemic communities and communities of practice

As concepts, epistemic communities and communities of practice are not mutually exclusive. For instance, Iyalomhe et al. (2013) use a communities of practice approach primarily to understand the science–policy interface, whereas Gough and Shackley (2001) view epistemic communities as involving 'experts' from policy and non-governmental spheres as well as research and academia. Yet whereas epistemic communities' thinking places emphasis on academic/techno-scientific knowledge, or at least 'expertise' (especially given the emphasis on common causal beliefs and shared notions of validity), communities of practice models engage with a broader range of actors and knowledge systems and place more emphasis on outcomes.

In any case, one of these approaches alone may be insufficient to make sense of the politics of knowledge of urban sustainability in a situation where actors drawing on both techno-scientific knowledge and experiential knowledge have a part to play. Lo and Chen (2019) argue that the 'community' may require both elite/expert learning *and* wider societal participation at different points in time when linking knowledge, policy and practice. Raco et al. (2010) also observe that academics may choose to influence practice

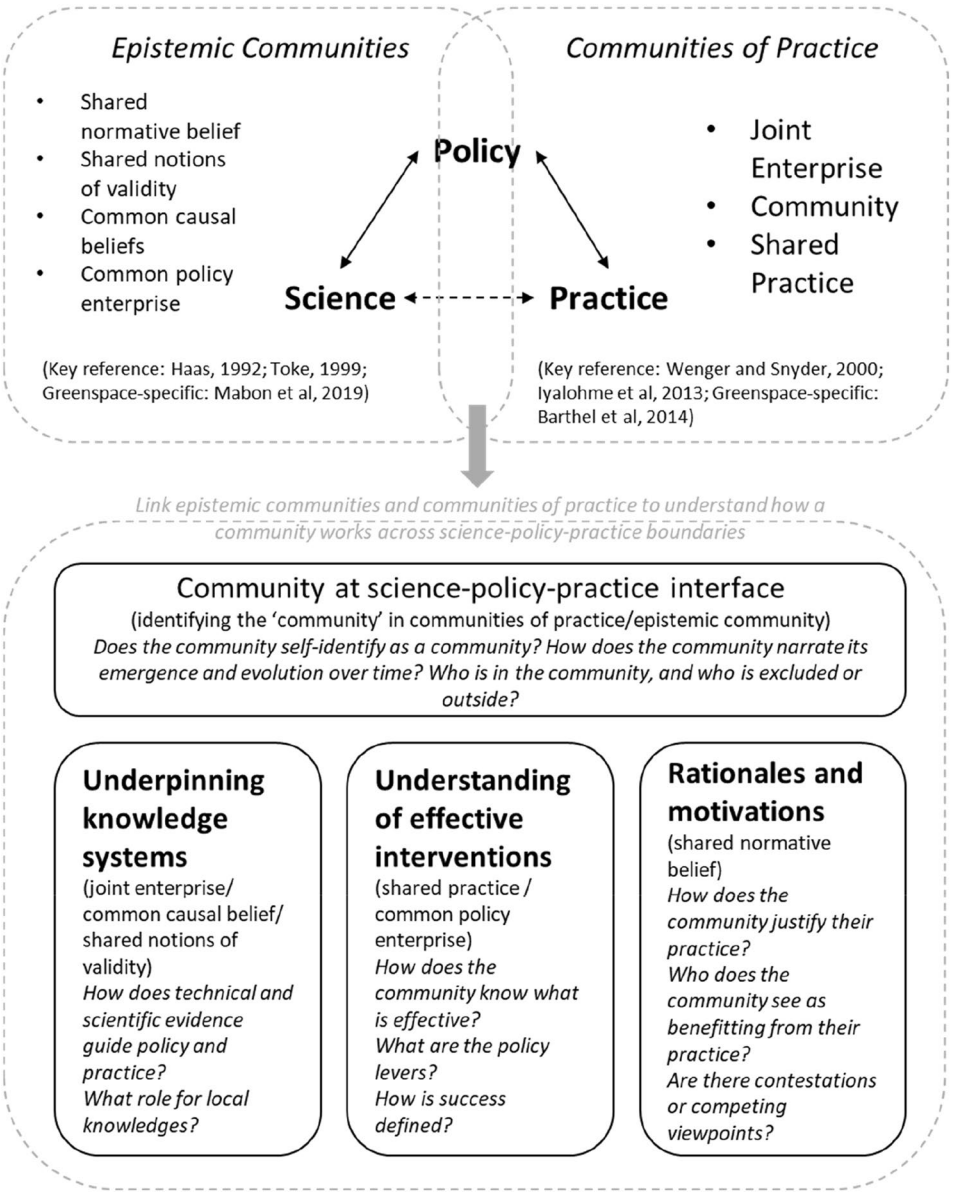

Fig. 3 Conceptual framework for assessing science–policy–practice community

directly, for example by working directly with communities rather than through policy. It may thus be the case that it is through interaction between science–policy, policy–practice, and indeed science-practice, that communities effectively move towards urban sustainability. Linking elements of epistemic communities and communities of practice may hence give a more nuanced understanding of how communities drive practice at the science–policy–practice interface. We, therefore, propose a four-point conceptual framework that links the insights from both epistemic communities and communities of practice literatures.

The first element is *community*, reflecting the 'community' element of communities of practice and the overall idea of an epistemic community. In addition to the presence of cohesive relations, interactions and participation that define 'community' (Barthel et al. 2014), key points to assess are (a) whether the community self-identifies as a community; (b) how the community narrates its emergence and evolution over time, noting that epistemic communities and communities of practice are not static (Dunlop 2012; Lo and Chen 2019); and (c) who is 'in' the community and who is excluded or outside, bearing in mind that the presence of community means others must be outside or excluded (Bendt et al. 2013).

The second community characteristic is *complementary underpinning knowledge systems*, encompassing both the common causal belief and shared notions of validity from epistemic communities; and joint enterprise from communities of practice. Whilst epistemic communities working at the science–policy interface tend to favour 'science' as a base for their endeavour (Gough and Shackley 2001), local, tacit and experiential knowledges have been demonstrated to be critical in a greenspace context (Dobson and Dempsey 2019). Elements to assess are thus: (a) how techno-scientific knowledge is used to guide policy and practice within the community; (b) what the roles are for local, traditional and experiential knowledge systems in informing practice; and (c) how these different knowledge systems are weighed up and co-exist.

The third community characteristic is *shared understanding of effective interventions*. This reflects the common policy enterprise of epistemic communities and the shared practice of communities of practice. Elements to evaluate are (a) a shared understanding within the community of 'what works' (Dobson and Dempsey 2019) (or 'what would work') when it comes to practical interventions; (b) what the policy actions and levers are to make this happen, given the detailed policy recommendations that Lovell and MacKenzie (2011) see as arising from the community's beliefs; and (c) how 'success' is defined by the community.

Fourth and final is the presence of *common rationales and motivations*, based on the shared normative belief of epistemic communities. Questions to address here include (a) how the science–policy–practice community justifies their practice; (b) who this community sees as the beneficiaries of their activities; (c) whether different academia-policy–practice community members have different rationales which are able to coalesce around common practical courses of action (Harper and Afonso 2016); and (d) whether there may in fact be contestations underneath the impression of consensus or even competing communities seeking influence for the same issue in the same locality (Finewood 2016; Lovell 2015).

Methods

As the overall aim of this paper is to make sense of how academic, policy and practice actors compete and cooperate to make claims of expertise in shaping a vision for an NbS initiative, a qualitative methodology was deemed appropriate as it allowed us to go into analytical depth on how different people position themselves as experts for urban gardens in Taipei, and to explore whose knowledge is valued within policy and governance processes and why (see Appendix 1 for a fuller justification of our methodological approach). To answer this question, we, therefore, focused on the language and argumentation different people used within the policy and governance processes for urban gardens in Taipei, rather than on the natural science characteristics of the green spaces themselves.

This study hence conducted document review and in-depth interviews with stakeholders for data collection. Official documents reviewed include documentation relating to policy, reports and meeting presentations of the Taipei Garden City Programme (Appendix 2). Information from in-depth interviews was derived from two research projects, of which one focuses on governance of edible landscapes and the other on policy formation, governance, and garden management in relation to food, water, and energy. The former included four interviewees covering a school garden, a community university, a warden, and a FUN member. These interviews applied semi-structured questions, and were conducted in 2018. The latter set of interviews were conducted between late 2019 and early 2020 with eight interviewees ranging from academics, government officers, practitioners (those who initiated or advised on the programme), and site managers of community gardens and rooftop gardens. Interviewees from academia and government were recruited based on how important their role was in forming the programme. Garden managers were selected from exemplar gardens, which were promoted by the city governments. The interview questions were non-structured, but focused on policy formation and actors' associated resource use and consumption. A full overview of interviewees is included in Appendix 3.

Whilst the two sets of interviews were originally collected for different projects with slightly differing purposes, both drew on the same target set of respondents (i.e. academics, policy-makers and practitioners involved in urban farming within Taipei), and had a common interest in respondents' engagement with and understanding of the science–policy–practice interface for urban farming in Taipei. Accordingly, these two datasets were able to give a fuller understanding of the formation of a community spanning the science–policy–practice interface by giving insight into a wider range of respondents. The size of the interview sample reflects the relatively small number of key actors who drive the programme forward and play a role in shaping the science–policy–practice interface. The recruited respondents are able to talk in-depth and hence produce appropriate data relevant to understanding the knowledge politics of the Taipei Garden City programme, and, therefore, is reflective of focused purposive sampling.

Furthermore, an analytical approach was selected which would allow the policy documentation and interviews to be analysed against a common set of themes, to draw insights relating to a common overarching research question out of multiple sources of data. Accordingly, data were analysed through qualitative content analysis (Cho and Lee 2014). Under this approach, data (in this case interview transcripts and documents) are read for pre-determined themes relating to the overall research question the analysis aims to answer. Data were analysed for insights relevant to each of the categories and sub-categories identified in the conceptual framework developed in Fig. 3. Extracts in the data which helped to explain or understand the themes and sub-themes were noted and synthesised, and are reported according to this analytical structure in "Results". A qualitative analytical approach of this nature is considered appropriate for situations where researchers wish to test existing theory or understand existing data in a new context, and where there may be several different sources and types of data (Cho and Lee 2014).

Within qualitative research, the rigour of the research is a more important indicator of the quality of the work than the language of validity and representativeness that is associated with quantitative research (Teel et al. 2019). Appendix 1 illustrates how we have sought to follow the principles of rigour in qualitative research as laid out by Meyrick (2006), and hence how we believe our methods and analytical approach are appropriate for the research question.

Results

In this section, we analyse the science–policy–practice community for urban farming in Taipei following the four-part framework we developed in "Conceptual framework". After looking at how the community defines itself and has shaped its identity over time, we then assess the underpinning knowledge systems on which the community draws. We then explore what shared understandings the community has of 'what works' and why before assessing the existence of common rationales and motivations.

Defining Taipei's science–policy–practice community for urban farming

We first assess the existence of a science–policy–practice community for urban farming in Taipei. Section "Taipei Garden City" described the governance structure of Taipei Garden City, and the relations between key actors. The aim of this sub-section is thus to explore if there is a community of experts which seeks to drive this policy process forwards, and if so, who they are. Figure 2 illustrates that there is a clear community of actors who work to influence policy and practice for urban farming in Taipei, and specifically the Taipei Garden City programme. The local initiator—FUN—involves self-identifying individuals and communities who work towards upscaling urban farming policy at the city level. As well as defining itself as a community of expertise, FUN as a key node in the science–policy–practice community for urban farming in Taipei reflects characteristics of a community of practice, through a common interest in urban farming, and also an epistemic community, through a common policy enterprise of engaging with broader spatial planning actions in Taipei with a shared aim of emphasising ecological dimensions and community engagement. Recognition of FUN as a node of expertise is evidenced through the fact that all candidates for the Taipei mayoral election in 2014 bought into FUN's policy appeals (NGO:TP01; Prac:TP05). FUN members and stakeholders demonstrate a common policy enterprise through the holding of workshops and meetings, which serve as an interface between academia, government and practitioners to provide opinions and recommendations to governments. These meetings are held by actors of FUN as an organisation and are attended by external actors in government. This illustrates how the group is recognised as an authoritative actor in urban farming in Taipei.

To understand how the broader science–policy–practice community of academics, NGOs, community organisations and consultants shown in Fig. 2 came to be influential for urban farming in Taipei, we look into recent history. Taipei's prior open- and green space policies, such as Taipei Beautiful and Open Green in the 2000s and 2010s, supported societal participation in the physical transformation of Taipei's open spaces through use of derelict/vacant lands for greening. This resulted in small farming or gardening activities being organised between individuals and institutions with interest in urban greenspace, including university professors,

students, landscape consultants, and NGOs (NGO:TP01; Gov:TP07). These actions helped to build cohesion between disparate communities undertaking urban greening and formed FUN, which as above has become a key node in the community of actors influencing urban farming in Taipei. Around the same time, the community university system and the training programme of youth community planners (NGO:TP01; Prac:TP05; Gov:TP07) built connectivity and instilled a common knowledge base and shared sense of purpose between different urban greenspace practitioners and policy influencers within Taipei. As such, a combination of top-down policy initiatives and grassroots urban greenspace movements acted to enable disparate actors to gain shared practical knowledge and experience of urban greening in Taipei, and to form a common identity of urban farming community in the city (NGO:TP01; Gov:TP07). Regular progress meetings between government sectors and advisors from FUN and other stakeholders illustrate that this history has created a clearly defined and recognised community of urban farming 'experts' in Taipei, who are able to exert influence over local government policy processes for urban farming in Taipei. However, as we now discuss, subtle differences exist in the knowledge systems on which community members draw.

Underpinning knowledge systems

We now look at how knowledge is shared among community members, and which knowledge systems are valued. In terms of formal knowledge sharing, Taipei City Government coordinates departments and agencies to provide urban farming training programs, covering farming techniques, technology, landscape design, plant and flower aesthetics, nutrition and health, and local culture and history. Training and education are largely top-down, although subsidies are also provided to give garden managers the autonomy to organise classes and invite external teachers, mostly from existing urban farming networks or through personal connections (GM:TP08; GM:TP12). In programmes run by the Department of Economic Development, attendance at training classes can be compulsory for volunteer gardeners, and wardens may be obliged to arrange classes and invited lectures (GM:TP12).

Training organizations and affiliated greening centres or classrooms are the spatial nodes for distributing the skills, techniques and knowledge of urban farming. In each case, these third sector organisations have networks of urban farming experts and practitioners to introduce ideas and techniques to communities. However, respondents suggested different parts of government compete with each other and do not necessarily recognise each other's training, or trust the qualifications of a trainee who has taken a course run through a different department (NGO:TP01). It is also worth noting that online platforms play an important role in sharing knowledge, and also in reinforcing the science–policy–practice community's claims to be a source of expertise on urban farming in Taipei. FUN set up an online platform at an early stage of urban farming in Taipei to share information, develop policy appeals, and organise events (NGO:TP01). Taipei City Government later set up the Farm City Online Banking Platform, which provides a constantly updated inventory of available sites for gardening, information regarding regulations, and learning opportunities (Gov:TP06). Again illustrating how the science–policy–practice community for urban farming in Taipei is recognised as a source of expertise by the city government and is able to integrate its knowledge into policy and practice, eLearning resources are increasingly created with collaboration with the Department of Civil Service Development (e.g. Taipei e-campus) and FUN members.

Underpinning the development of technical guidance and training in Taipei are insights from international 'best practices', in particular Seoul (Korea) and Seattle (USA) (Gov:TP07; Gov:TP06; NGO:TP01). These cases are arguably selected not through social, environmental, or climatic similarity, but through the preference of government departments and personal experiences and connections of key members in the science–policy–practice community. In particular, an existing academic network between Taiwan and the USA enabled the importing of 'best practices' from Seattle and Seoul via sharing with FUN and the city government. Actors spatially distant from Taipei (i.e. academics working outside of Taipei and indeed Taiwan) can thus engage from overseas or in international epistemic communities to shape the direction and visions of urban policies within the city.

Nonetheless, whilst technical knowledge, academic argumentation and international expertise are integral to urban farming in Taipei, the on-site skills and local and experiential knowledge of practitioners and citizen farmers cannot be ignored. Respondents suggested that practitioners and promoters of alternative and natural farming methods retain substantial visibility in Garden City sites (GM:TP08; GM:TP09). Permaculture and organic techniques have long been introduced by key individuals who are active in teaching urban farming as well as in Taipei's community colleges (Ac:TP02; Prac:TP04). Moreover, local and experiential knowledges from other localities are imported to Taipei and appropriated into urban farming (GM:TP08; GM:TP09; GM:TP12). Many older urban farmers moved to Taipei from the countryside and still have memories and skills of farming and cultivation from rural areas. Some will even bring seeds or plants back to Taipei from their hometown, and in other communities, people from overseas will contribute expertise and seeds—as one warden narrated:

> *There is an experienced volunteer from Vietnam, helping with growing seedlings. We have Vietnamese cori-*

ander and Japanese okra, which were secretly brought by her from her overseas business trips. It is tastier though. (GM:TP12)
Gardens connect cooking, countryside experiences, and society experiences from the original family. In this aspect, Taipei city has built a good foundation for community empowerment/development. We wish to see gardens with Taipei community characteristics. These years we also use a few community development methods to train people and foster community youth planners, so that they can go back to their community for help. (NGO:TP01)

Community gardens in Taipei may hence act as sites where traditional and experiential knowledges around plants, farming practices and even cooking from a breadth of localities may come together. Respondents also indicated edible gardens were supported by the sharing of experience from more experienced and capable community members and leaders, supplemented with information gleaned from the internet. Nonetheless, as NGO:TP01 puts it:

most of the gardens are stereotypes…I wish they can grow with a wide variety of (local) features…but it takes time to happen *(NGO:TP01).*

What TP01 is arguing is that although a diversity of experiential knowledge is somehow a quality of Taipei itself, because many gardens have been implemented rapidly to meet policy targets, the gardens have not been able to develop in a way that reflects specific socio-environmental characteristics of a locality and takes different and diverse experiential knowledge systems into account. Nonetheless, community universities have played an important role in linking in situ skills and traditional and experiential knowledges with more formalised understandings of urban farming. For instance, Wenshan Community University has an education programme to link food-farming education, community development, and self-sustaining food provision under the concept of climate change and food security (Ac:TP02). As the community university system is established on a district basis, a respondent suggested that it has a good potential to lead community-based training and/or farming activities for further localisation of the programme (NGO:TP01). Yet the role of community universities is to date not clear or well defined in the programme.

As such, the urban farming science–policy–practice community in Taipei emerges through a convergence of knowledges and practices across different locations and scales. These include academics with international case studies and experience; sharing of technical knowledge from influential individuals whose knowledge derives from long-term practice of urban greenspaces; information dissemination by government-led internet platforms; and the adoption of in situ techniques on the gardens themselves grounded in traditional and experiential knowledge from both Taiwan and overseas. Knowledge of urban farming is continuously enforced by learning and doing, driven through daily experience of geographical linkages between old hometowns and Taipei, the gardens themselves, and influences from international benchmark cities.

Understanding of effective interventions

We now turn our attention to the science–policy–practice community's understanding of what constitutes an effective urban farming intervention. Respondents had different views on which specific aspects of urban farming required intervention, and of the grounds on which interventions could be considered successful. These include specific land acquisition schemes to release public-owned lands for gardening; systematic training to provide farmers with basic understanding; and aligning farming activities with broader policy objectives.

Many of us have no basic technology of farming. Through this little garden '小田園' programme, which provides systematic training, we follow the steps guided by teachers for soil amelioration, paying attention to garden ecosystem.…so this is not bad. (GM:TP11)
The Education Bureau has the best achievement so far. They implement gardens both on the ground and on the rooftop of schools, so they have the largest number of gardens. (Gov:TP06)
Da-an Silver Hair Rooftop Farm (大安銀髮農園) *of the elderly centre is nice too. It develops public-private partnership and has solar panel and water recycling system. Because it is owned by the Department of Social Welfare, their garden is integrated with elderly care [...] If we can't even find 50 characteristic gardens from this programme, this policy is meaningless. (NGO:TP01)*

Notable here are the breadth of factors raised, and the different measures respondents use to assess the success or otherwise of interventions. For GM:TP11, a school teacher, the fact that gardeners are provided with skills is essential for the practice and thus a critical precursor for success. TP01 from an NGO defines a 'successful' urban farm as one which reflects local environments and social–cultural characteristics, such as using soil containing local bacteria, introducing stream water for irrigation, elevating planting plots for the elderly, and connecting to life experiences. Government sectors meanwhile tend to use the sheer number of gardens deployed as an indicator of success (Gov:TP06; Gov:TP07).

Yet more than policies and interventions themselves, it is the *individuals* driving urban farming in Taipei forwards

who are considered bearers of 'success'. For instance, the existence of a champion (former Vice-Mayor) in the Taipei City Government and the lifting of two bans by Mayor Ko Wen-je was repeatedly mentioned by interviewees as key to success for coordinating different sectors in promoting and implementing the programme at the first stage (e.g. NGO:TP01; Gov:TP07; Prac:TC04). One respondent felt that a city-level advisory committee was useful for bringing concerns to the deputy mayor and helping them to be resolved (Gov:TP07).

However, whilst discrete interventions and the strategies driving them were seen as effective, it was argued that the visions, aims and values of policies for developing urban farming policy into the future were not clear or consistent (NGO:TP01). Respondents provided further explanation for why there was no clear vision for the effective upscaling of urban farming into the future:

> *The most challenging area is firstly land acquisition. Most of the garden lands are government owned, so the lands can be reclaimed for construction. Also, the production from the garden cannot be sold for profit, as it is controlled by a national law for the use of a public land (Gov:TP07*) (see also reporting of Shih (2020) on struggles to retain urban land for farming)
> *We wish to improve the environment and the city government could have provided budget, but the (landowner) Ministry of National Defence impeded the opportunities. They don't want to see us being good and successful, as it will make land reclamation for development difficult (GM:TP08).*

Moreover, many gardens are created to meet specific policy requirements, and not because local community members want them (GM:TP12). As a result, some gardens are created quickly, in a way that fails to address local environmental and societal characteristics (NGO:TP01). Without opening the chance for involving wider local communities, maintenance of gardens can be challenging. This is particularly true for school gardens, which have been rapidly installed for underpinning 'food-farming education'. Although both land and budget are available for this type of garden, the maintenance when students are out of classes is problematic.

> *I have suggested the headteacher of [name] primary school opens to volunteers from the local community to maintain the garden. However, (he didn't take the suggestion) because of a safety concern… Our schools actually have many horticultural mums (mothers of students), who are keen to plant vegetables there, but the school does not allow it (GM:TP11).*

The temporal precarity of land availability, and the creation of gardens in response to policy requirements rather than community desirability, may indicate the limited ability of the science–policy–practice community to be able to shape widespread and long-lasting changes beyond interventions at specific time-bound sites across the city.

In sum, the science–policy–practice community's vision of success may rely on the support of key individuals within the city government, and remains at the mercy of wider land use and urban development actions. This may limit the ability of the community to influence a 'garden city' vision beyond discrete time-bound sites when in competition with other interests and actors. Underpinning this are divergent understandings of how to attain successful interventions across space in the present.

Rationales and motivations

Our final area of consideration is the rationales and motivations of the Taipei urban farming science–policy–practice community. The community seems to have a shared rationale of promoting urban farming for the benefit of Taipei society as a whole, emphasising social connectivity and connection with social welfare and an ageing population (Taipei City Government 2019). Key persons within the academia and policy elements of the community tended to become involved through personal connections they already held within Taipei, which in turn shaped the nature of urban farming in the city. For example, one respondent—who lives and works in the USA—was invited by a contact from National Taiwan University (and also the head of an NGO promoting urban farming) to share insights from Seattle at a conference. As the respondent also drew on personal connections to introduce experiences from Seoul to Taipei, some of the ideas applied in Seattle and Seoul were taken as a prototype for the Taipei Garden City programme (Ac:TP03; Gov:TP07). Another key community member (NGO:TP01) was inspired by Taiwan's pro-democracy 'Sunflower Movement' in 2014, which drew heavily on online platforms for organisation and mobilisation, and decided to create an internet platform for an urban farming network. Many key actors later in the programme had worked together to share information both physically and online prior to the establishment of FUN. They formed a policy appeal, which was brought to candidates for the Taipei Mayor position (Ko Wen-je) in 2013. Following Ko's appointment as Mayor and the adoption of the appeal in his policy white paper, district wardens and schools were encouraged to implement urban farming initiatives with support from the district office and schools. In some cases, gardens were not established out of desire, rather they were seen as a compulsory activity designed to meet the policy commitment of the Mayor (GM:TP12; NGO:TP01).

The establishment and sustenance of Taipei's urban farming science–policy–practice community hence relies

heavily on personal motivation, networks and convictions (GM:TP10). Across interviews and policy documentation, the perceived beneficiaries of the gardens are variously reported as young people, with budget for schools and youth start-up programmes; communities, who benefit from societal interaction and associated social capital opportunities; and hospital patients and school pupils via respective rooftop gardens. Respondents narrate the multiple benefits thus:

> *Vegetables grown in the garden cannot be sold according [to] the regulation, so vegetables are either eaten by the gardeners or donated to disadvantaged groups, social welfare institutes, and the elderly in the local community through the programme called 'the elderly meal sharing (老人共餐) (GM:TP09)*
> *Although the number of the garden is increasing, the economic value enhancing food security is low. In some less active community gardens, you can see they only enjoy growing. Vegetables are not necessarily to be harvested. (Prac:TP04)*

Reflecting underpinning scholarship, practitioners themselves note that the benefits of Taipei's edible gardens extend beyond food security. Indeed, the precarity of the gardens' existence is a source of anxiety and in some cases causes further distress for people suffering mental health problems who fear that the gardens they value may suddenly be removed from them (GM:TP08).

Gardens are hence spaces for realising the science–policy–practice community's vision of wider benefit to society through urban farming, and reflecting key members' own visions for local justice and democracy. Yet as illustrated earlier, competing visions and narratives exist to that promoted by this core community. One such contestation is over urban farming versus naturalisation or biodiversity conservation, and not wanting to turn all earth grounds into middle-class playgrounds:

> *The society of wildness is promoting the naturalisation of parks, so they felt that growing vegetables in cities is conflicting to their principles. Yet, we had reached the agreement between NPOs—if park naturalisation is positive to Taipei's biodiversity, community gardens won't enter parks; because what we aim for is to revitalise hard-paved and small urban grounds, not to turn all earth grounds into the middle-classes' playgrounds. (NGO:TP01)*

An additional point to note is that whilst the science–policy–practice community operates on a shared knowledge system, there arguably remains a need to empirically verify some of the claims made about the environmental 'benefit' brought by the urban gardens. Although academia has been involved in the initiatives, policy-making for urban farming in Taipei tends to be supported by technical guidance and case studies, rather than empirical observation-based scientific 'evidence.' The principal policy documents supporting urban farming—Taipei Garden City Promotion and Implementation Plans (2015–2018; 2019–2022) do include scientific terminology, such as climate change, mitigation of urban heat island effect, increasing biodiversity, and public health. Taipei City Government has also recently commissioned research, such as on runoff retention and carbon storage (PWD 2019), to support its claims of the benefits of urban farming. Yet aside from these post hoc confirmations of project benefits, it is not clear to what extent policy decisions and implementation are guided by independent rigorous evidence from an early stage. Systematic assessment on-site to verify claims to environmental benefits from Taipei's edible gardens is especially lacking.

In sum, the science–policy–practice community appears driven by a strong rationale to provide a 'better' quality of life for people in Taipei, through the vehicle of urban farming and the virtual and physical spaces associated with it. But competing visions of urban nature exist from those outside the core urban farming community and key policy actors, and questions remain over the depth and rigour of the 'science' underpinning the community's vision.

Discussion

We now discuss how our results contribute to the literature. We identify four main novel findings, which we summarise in Table 1. Each of these findings connects to one of the four pillars of a science–policy–practice community that we developed in our conceptual framework. Specifically, (a) online spaces are as important as physical spaces for a science–policy–practice community to exert tangible change; (b) knowledge developed in different geographical locations is able to co-exist within a single community to drive action; (c) for the science–policy–practice community to be successful, they need to be able to control the physical environment as well as the policy-making space; and (d) common rationales and motivations alone may not be enough to enable urban transitions in the face of physical environmental realities.

Presence of a self-identifying and self-sustaining community

We first said that a science–policy–practice community needs to identify itself as a community, and needs to be able to sustain itself. The Taipei Garden City programme illustrates that online spaces may be as critical to the science–policy–practice community forming an identity and sustaining itself as activity in physical spaces within Taipei. In particular, the Farming Urbanism Network (FUN) Taiwan

Table 1 Main conceptual contributions of this study for each characteristics of a science–policy–practice community

Characteristic	Key issues in existing research	Contributions from our study
1. Presence of a self-defining and self-sustaining community	What gives a community a sense of identity? (Dunlop 2012; Bendt et al. 2013) What spaces does the community operate in? (Finewood 2016; Dobson and Dempsey 2019; Lo and Chen 2019)	• Both physical and online spaces are important sites for forming and sustaining the community's sense of identity • Influence in both policy committees and 'on the ground' in the physical environment is important for a community to assert identity and credibility
2. Common underpinning knowledge systems	How are international experiences 'provincialised'? (Chang et al. 2020) How are local and experiential knowledges valued alongside techno-scientific knowledge? (Dunlop 2014)	• Knowledges and experiences from different geographical locations are negotiated and localised in an ad-hoc way when implementing interventions in the environment • Rather than a single shared knowledge system, communities draw on multiple knowledge systems which are able to co-exist in support of common goals
3. Shared understanding of effective interventions	Does the community consider interventions to be most effective at the policy (Lovell and MacKenzie 2011) or practice (Dobson and Dempsey 2019) level? Does the community have a shared sense of 'reality'? (Bromley 2012)	• Agreement within a community on what constitutes an effective policy intervention does not translate into agreement on how the intervention should be realised in practice • Shared understanding of effective interventions and 'what works' is insufficient to enable upscaling and widespread change of the physical environment without support from land use and planning legislation
4. Common rationales and motivations	What is the evidence base or justification underpinning the community's normative stance? (Haas 1992) Within what appears to be a single community, are there sub-communities or different factions competing for influence, with different rationales? (Lovell 2015; Finewood et al. 2019)	• Even within techno-scientific knowledge, different disciplinary factions may be over-represented or compete for influence in policy-making • Against the physical realities of the environment in which urban sustainability transitions happen, a shared normative belief alone may be insufficient to enact sustainability transitions if it is not supported by a robust evidence base

co-working space (https://beta.hackfoldr.org/Taipei-Urban-Agri/) is intended to act as a vital repository of knowledge to create the joint enterprise (Bendt et al. 2013) and shared notions of validity (Dunlop 2012) that FUN relies on. The city government also uses the Farm City Online Banking Platform to maintain an inventory of vacant land and Facebook as a platform for arranging training events which then happen in the 'real world'. These online spaces are important to enable the community to energise urban farming actions at physical locations across Taipei. Research to date has largely focused on the operation of epistemic communities and communities of practice in physical spaces such as urban planning committees (Finewood 2016; Mabon et al. 2019) and in urban farms themselves (Dobson and Dempsey 2019). However, the Taipei Garden City case illustrates the increasing importance of attention to online spaces as sites through which communities spanning the science–policy–practice interface are able to build their claims to authority and motivate practical action.

Moreover, existing research has indicated that actions happening on-site at communal gardens themselves, and usually actions of local citizens or non-academic actors, are important in driving urban farming initiatives forwards when compared to top-down policy directives (Dennis and James 2017; Dobson and Dempsey 2019). The formation process of urban farming initiatives in Taipei partially reflects this point. Enthusiastic individuals from practitioners, NPOs, students and non-academic actors play a critical role in shaping the movement and the practice in an earlier stage. However, what is distinctive about Taipei compared to what has been seen in the literature before is the enabling environment created by policies, such as the Taipei Beautiful Programme and Open Green, for the greening of temporarily available urban spaces as well as previous policies and activities developed to empower local communities. These created the context for the development of the Taipei Garden City programme. Contra to what has been observed in existing research, 'formal' decision-making spaces such as city government committees, meetings, forums and press conferences (and, indeed, websites and social media hosted by Taipei City Government) still retain a key role in enabling the proliferation of urban farming in Taipei, and the ability of community members to exert influence in these spaces. Reflecting the assertion of Lo and Chen (2019) that an academia-policy–practice 'community' may require both elite/expert learning and wider societal participation at different points in time, the Taipei Garden City case indicates that to be effective, the community may require membership and composition that enables it to move between online spaces, discrete farm sites, and formal decision-making spaces.

Underpinning knowledge systems

We then said that a science–policy–practice community needs a shared understanding of the knowledge systems it can use to guide its action. What is notable about the science–policy–practice community in Taipei is that knowledge developed in different locations is able to co-exist to drive practical action. Networks such as FUN are an important vehicle for bringing scientific knowledge into policy processes, as they act as a bridge spanning science and practice. The Taipei Garden City policy is informed by knowledges and best practices drawn from cities and urban farm sites overseas, brought back to Taiwan by academics and practitioners with international experience and 'provincialised' (Chang et al. 2020) through incorporation into policy and practice guidelines within Taipei City. However, scholarly knowledge of the Taipei Garden City programme is heavily supported by the embodied skills and knowledge held by urban farming NGOs and practitioners, including knowledge of cultivation practices developed elsewhere in Taiwan or even overseas. It is through classes at community universities, training programmes run by governments, advisory committee and community service groups, invited lectures of each garden across Taipei and through in situ practices at specific garden sites that scholarly knowledge is combined and negotiated in relation to urban farming practitioners' own experiential knowledges.

Local and embodied knowledges, therefore, have a prominent role on the formation of Taipei Garden City sites themselves (and the flexibility for these to be incorporated into 'formal' training courses). In the case of Taipei Garden City, 'non-scientific' knowledges are, therefore, not discounted by the community in the way Dunlop (2014) and Nesbitt et al. (2019) suggest in previous research. In formal policy-making spaces (committee rooms, press conferences, forums) too, the knowledge and identities of non-academics carry significant weight in driving Taipei Garden City forwards. This observation supports Dobson and Dempsey's (2019) assertion that practice-based knowledge may take precedence over academic knowledge when it comes to engagement with governmental policy-making. Rather than a 'joint enterprise' where all members of the community draw on the same knowledge system (Bendt et al. 2013), what we instead have are different types of knowledge which co-exist and are drawn on selectively by the community depending on the space and context.

Understanding of effective interventions

The third element of a science–policy–practice community that we identified was their common understanding of what an effective intervention looks like. In Taipei, we see there is good shared understanding within the urban gardens

science–policy–practice community of 'what works.' However, what we also saw was that for these interventions to be effective, this community needs to be able to transform the physical environment in a systematic way. There is ample evidence of engagement with key figures in municipal government via, for example, proposing policy appeals, conducting governmental projects, and sitting in an advisory committee to make the city-wide policy recommendations that Lovell and Mackenzie (2011) see as a critical venture of an epistemic community. We also see the in situ skills which give an understanding of 'what works' at the level of individual gardens and community colleges (Dobson and Dempsey 2019). However, the distinct place-specific characteristics of individual gardens are not necessarily reflected in the policy recommendations made by the science–policy–practice community. There may be disagreement within the community on the 'reality' of urban farming and the best way forwards (counter to Bromley's (2012) characterisation of an epistemic community) and dissensus or even competing sub-communities seeking influence for the same issue in the same locality (Finewood 2016; Lovell 2015). Put simply, whilst there might be shared ideas within the community of 'what works' in theory and policy, there may be less capability or agreement on how this translates into physical transformation of the environment.

Indeed, the science–policy–practice community has been less effective at making long-term impacts on urban planning and land use. Our findings show that the precarity of land and the temporary nature of the programme is a critical limiting factor on the long-term sustainability and up-scaling of urban farming in Taipei. Limited government-owned land is temporarily given over to urban farming, and is under constant threat of being re-called for new construction. Possibility for linking site-specific grassroots actions with city-wide planning is, therefore, limited. The Taipei Garden City case offers a new slant on existing research into the links between urban greenspace, land development, financialisation and social justice in public space (e.g. Anguelovski et al. 2019), in that as temporary greening of the urban environment increases the instability of its functions and benefits, it is unlikely to be a driver for increasing land prices and rents. Although the Taipei Garden City programme appears widely appreciated by the public, conflicting views and interests are increasingly apparent between gardeners and the government sectors across space, in that the current mechanism to determine land use, which ultimately determines the fate of spaces in the city, remains driven from the top down. Urban farming has to happen in a specific, physical location—yet in Taipei, these spaces become sites for competing claims to land use and for broader contested visions over how open spaces in the city ought to be used and to whose benefit. These broader development pressures hint at the limitations of a science–policy–practice community to be able to enact widespread physical transformation of the urban environment beyond the social structural actions the Taipei Garden City programme facilitates.

Rationales and motivations

The fourth and final characteristic of a science–policy–practice community we picked out was the presence of shared rationales and motivations. However, our findings question whether common rationales and motivations within a science–policy–practice community are in reality sufficient to support sustainable urban transitions in the face of physical environmental realities. There is no doubt that those driving urban farming in Taipei share a common rhetoric of acting to create benefits for the wider society in Taipei. Yet, where the shared rationales and motivations of the urban farming science–policy–practice community in Taipei differ from those identified in the epistemic community literature in particular (Haas 1992; Mabon et al. 2019) is that they are not necessarily underpinned by an empirical evidence base grounded in shared notions of 'valid knowledge'. As outlined in "Underpinning knowledge systems", the science–policy–practice community in Taipei has had success in influencing policy-making with techniques and case studies; and frequently justifies the success of urban farming through reference to exemplars (e.g. the Da'an Silver Hair Rooftop Farm, Happiness Farm at Fujian Neighbourhood, Colourful Garden at Dexing Park) which were created before the initiation of the programme and hence have had more time to grow and develop distinctive characteristics.

Policy documents at city level (Taipei City Government 2017; undated), hence, refer to social connectivity, climate change, health and wellbeing, ecosystem enhancement, and food-farming education. However, this rhetoric is arguably not fully underpinned by empirical observation-based evidence gleaned from gardens within the programme. This again hints at a disconnect between the social structural effectiveness of the community, and its more limited ability to enact systematic physical transformation of the urban environment. Indeed, reinforcing Lovell's (2015) argument of multiple communities seeking to influence policy debates with their knowledge, it was suggested that the motivation to promote societal benefit via urban farming in Taipei might conflict with the biodiversity conservation motivations of alternative science–policy–practice communities seeking influence in the same policy spaces if gardens are created in existing parks or greenspaces. Furthermore, echoing Finewood et al. (2019), urban farming in Taipei reminds us that 'science' or 'academia' are not homogeneous entities, and that different epistemological and methodological bases within academia may compete for (or be absent from) influencing policy. In Taipei, the 'academic' voices exerting influence over the urban farming sphere tend to come from backgrounds in landscape architecture or urban planning,

providing 'practical evidence' in the form of case studies and propositions. Yet state-of-the-art literature globally advocates the need for site-appropriate ecological and technical knowledge to accompany rhetoric of social benefit if nature-based interventions towards sustainability are to be effective (Keeler et al. 2019). Reflecting our previous points about how the community's social structural activities physically transform the urban environment, one may well question the extent to which a 'common enterprise' of scholarly, embodied and experiential knowledges (Bendt et al. 2013) is sufficient to support environmental sustainability given the ecological complexities of an urban ecosystem.

Limitations

Our paper aims to contribute to theory on how different knowledge systems compete for influence within one aspect of urban sustainability transitions, rather than to generalise across cases and populations. Nonetheless, it is still a single case study, and future research may wish to assess how different knowledge communities exert influence over policy in different social, cultural and political contexts, either through new empirical research or synthesis and comparison of existing research. Moreover, we have focused in this paper on the relationships between different stakeholders and actors, and how these influence policy and practice. Although this has in part engaged with how the science–policy–practice community's interventions have shaped urban farming in Taipei, we have not assessed the 'success' or otherwise of the community in producing and upscaling a network of urban gardens. Again, further research may wish to quantitatively or qualitatively evaluate the transformation that urban gardens in Taipei have had on the environment (e.g. weight of food produced, amount of rainfall retained) and also on communities (e.g. indicators of social capital and community connectivity). Doing so would also help to supplement the scientific evidence base for urban gardens that we suggest in "Rationales and motivations" is lacking somewhat in the city at present.

Conclusion

As a networked city-wide action of site-specific urban farming projects driven forward by an association of science, policy and practice actors, the Taipei Garden City programme offers value in theorising the politics of knowledge for urban sustainability in a dense city characterised by rapid development and renewal, a subtropical climate and ecosystem, and nascent political forms with drives towards civil society participation.

Extant research on epistemic communities in particular has paid limited attention to the spaces through which the urban expertise asserts its authority and influences policy and practice. Yet our findings illustrate how working in hybrid digital-material spaces (Zook and Graham 2018) is critical to the ability of a science–policy–practice community—in our case the Farming Urbanism Network—to shape an urban farming agenda by galvanising city-wide action and establishing their credibility. Contrary to both the shared notions of validity and the joint enterprise ideas of epistemic communities and communities of practice (Bendt et al. 2013; Dunlop 2012), Taipei Garden City also illustrates the possibility for a coalition of actors to allow multiple knowledges, emerging from multiple sites, to coexist to drive forwards an urban farming agenda. Nonetheless, Taipei Garden City also indicates the limitations of a science–policy–practice community in enacting urban transitions to more socially and environmentally sustainable practices. Despite the vibrancy of FUN, urban farming in Taipei ultimately remains at the mercy of urban development decisions, available champions in government, and the place-specific capabilities of community-level actors to maintain garden sites. These remind us of the materiality of nature-based interventions; and that a science–policy–practice community may be just one of multiple interest groups competing for influence in particular spaces (Lovell 2015).

We finish with two questions for further research. One is for deeper enquiry into the gradation between 'bottom-up' and 'top-down' urban sustainability initiatives. Much work to date—including our own—has tended to divide the governance of nature-based approaches into either city-wide strategic initiatives guided by policy and technical expertise, or discrete community-level projects driven forwards by in situ knowledge and practice. However, Taipei Garden City shows that some of these bottom-up projects may in fact be encouraged by empowerment policies driven by municipal government actions, and that high-level policy initiatives may be underpinned by local movements and guided by practitioners with the right connections into formal decision-making spheres. Subsequent research may wish to investigate the kinds of initiatives, and the spaces they operate in, which sit in-between 'top-down' and 'bottom-up.' The second area where we recommend further research is to understand better what might happen when knowledge and skills gained from experience conflict with scientific knowledge derived from rigorous empirical observation. In Taipei Garden City, these different knowledge systems appear for now able to flow in the same direction. Yet, questions may be asked about the rigour of the evidence base on which the claims to multiple social and environmental benefits from edible gardens in Taipei rest. Subsequent research, not only in Taipei but in other localities, may hence wish to assess whether practice communities' site-specific knowledges are able to integrate with techno-scientific city-wide understandings of greenspace functions—and what may happen if these knowledge systems come into conflict with one another.

Appendix 1: Steps taken to ensure rigour within qualitative research design, following principles of Meyrick (2006)

Research stage	Indicators of rigour	How we sought to maintain rigour in this study
Researcher epistemological/theoretical stance	State epistemological and theoretical stance of researcher	Section Conceptual framework lays out the epistemological and theoretical tradition to which this research speaks, with reference to existing theoretical and empirical research. We speak in particular to scholarship from science and technology studies, human geography and political science, which treats knowledge as plural, contested, and shaped by societal context. Accordingly, our epistemological standpoint is not to seek objective 'truth', but rather to build on existing work by looking at the manner in which different groups make claim to authority over the urban environment. This focus on whose knowledge is valued in policy-making, and why, shapes what we focus on when analysing the data
Methods	Make aims and objectives of research and research question clear	The objective and core concern of the paper is stated in "Introduction and overarching context": to make sense of how academic, policy and practice actors compete and cooperate to make claims to expertise in shaping a vision for a sustainable city through green spaces. Recent academic and policy literature is cited in "Introduction and overarching context" to justify why this is a timely and relevant question. In line with our epistemological standpoint, we believe that a qualitative research design is important to gain analytical depth on the language and argumentation used by key actors to assert themselves as experts in urban gardening
Sampling	Ensure there is sufficient detail about sampling techniques, and establish the rationale and theory behind them	The materials sampled—both for interviews and documentary analysis—are listed in Tables 1 and 2 in "Methods" to give a full inventory of the data on which the paper is based. Sampling was purposive and followed 'snowball' techniques (Bryman 2014). A focused sampling approach of this nature was deemed appropriate given the relatively small and specialised nature of the Taipei urban gardening community, and enabled the researchers to ensure respondents were targeted who could address the overarching research question in depth whilst offering a breadth of professional backgrounds. A purposive sample and single case study of this nature is considered appropriate for a study where the aim is to contribute to theory, rather than to generalise to a population (Yin 1984)
Data collection	Detail about how data were collected; description of context; illustrating analytic framework	Detail about how interviewees were recruited and why are provided in "Methods". The conceptual and analytical framework for the study is set out in "Conceptual framework", along with the specific information that the researchers sought to extract from the data based on questions identified in existing scholarship. Description of the specific Taipei context is provided in "Conceptual framework"
Analysis	Illustrate steps taken from data to conclusions—interview technique, detail of analytical process, include all cases, triangulation	Description of the specific approach used to analyse the interview data—qualitative content analysis—is outlined in "Methods", and the reason for its use and propriety for the data is stated. Specifically, as it allows data to be analysed in terms of fit to the research question the study seeks to address, and is appropriate for research that spans more than one data source (Cho and Lee 2014). To show the progression of the analytical process, the four components of the analytical framework set out in "Conceptual framework" are used to structure both the reporting of Findings ("Results") and the Discussion ("Discussion"). Policy documents and research reports (see Table 1) were analysed through the same process to support triangulation of findings
Results and conclusions	Demonstrate how data shaped conclusions; cross-reference between conclusions and data	To provide an audit trail of how the data shaped conclusions and to cross-reference between data and conclusions, direct quotes from the interviews and policy documents are included in "Results" to evidence the points being made. In the Discussion ("Discussion"), links are made between the observations from the empirical research (with reference to appropriate interview numbers or documents) and what has been found in existing scholarship, to illustrate how our findings and evidence fit with our underpinning epistemological and theoretical framework

Appendix 2: Official documents reviewed by this study

Type	Publication date	Name of the documents
Policy	Updated on 24 July 2017	Taipei Garden City Promotion and Implementation Plan (2015–2018)
Policy	Undated	Taipei Garden City Promotion and Implementation Plan (2019–2022)
Meeting report	23 Nov 2015	Meeting Record of Garden City Promotion and Implementation Result
Meeting presentation	07 Nov 2018	Taipei Garden City Promotion Plan and Outcome Sharing
Meeting presentation	09 July 2019	Taipei Garden City Programme: 2nd Panel Meeting at a City Government Level
Meeting presentation	27 Feb 2020	Taipei Garden City Programme Panel Meeting
Pamphlet	Dec 2017	Garden City Taipei 2017
Research report	Dec 2019	Effects of Domestic Garden on Climate Change Mitigation and Environmental Co-benefits
Website	Not applicable	The Farm City Online Banking Platform (田園銀行網路平台). (https://farmcity.taipei/)

Appendix 3: Types and codes of interviewees

Type of stakeholders	Code of interviewees	Year of interview
NGO	NGO:TP01	2018; 2019
Academic/NGO	Ac:TP02	2018
Academic	Ac:TP03	2020
Practitioner	Prac:TP04	2019
Practitioner/NGO	Prac:TP05	2019
Government	Gov:TP06	2019
Government/NGO	Gov:TP07	2020
Garden manager	GM:TP08	2019
Garden manager	GM:TP09	2019
Garden manager	GM:TP10	2019
Garden manager	GM:TP11	2018
Garden manager	GM:TP12	2018

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