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Situated expertise in integration and implementation processes in Latin America

Bianca Vienni-Baptista¹ , María Goñi Mazzitelli², María Haydeé García Bravo³, Inta Rivas Fauré⁴, Daniel Felipe Marín-Vanegas⁵  & Cecilia Hidalgo⁶

Several environmental, political, social and institutional factors have resulted in the heterogeneous and adaptive integration of knowledge, actors and methodologies in Latin America. Despite poor recognition and even a lack of research conditions, experiences involving different societal actors and types of collaboration have developed across the region. These experiences form a collection of integration and implementation processes not yet fully systematised in a way that serves other cases. This paper aims to contribute to the discussion of how expertise is defined in integration and implementation processes in Latin America. To re-signify collaborative practices in the region, a critical perspective is applied, and a heuristic framework is built that comprehends the 'situated' and relational dimensions of expertise. This framework is tested to study five cases from Argentina, Chile, Colombia, Mexico and Uruguay related to territorial planning, gender and knowledge, coastal management and the provision of climate services. These concepts are compared on the basis of the three dimensions comprising the framework—context, actors and methods—and the intersections among them. Applying a qualitative methodology and auto-ethnography, we identified the main features of situated expertise in Latin America, that is, engaging marginalised societal actors, fostering greater participation, acknowledging power imbalances, managing conflicts and contradicting perspectives, and directing an ethical-political engagement in the research process. As a result, *situated expertise* encompasses not only the situatedness of practices and processes, but also their political (and potentially transformative) dimensions in tracing power imbalances. This paper then argues that this situated aspect of expertise is relevant for conducting more context-sensitive integration and implementation processes in Latin America, thus contributing to the ethical-political dimension on how expertise is defined, embodied and enacted in vulnerable contexts.

¹ Transdisciplinarity Lab, Department of Environmental Systems Science, Swiss Federal Institute of Technology, Universitätstrasse 16-CHN K76.28092, Zürich, Switzerland. ² Comisión Sectorial de Investigación Científica, Universidad de la República, Montevideo, Uruguay. ³ Centro de Investigaciones Interdisciplinarias en Ciencias y Humanidades, Universidad Nacional Autónoma de México, Mexico City, Mexico. ⁴ Vicerrectoría de Investigación y Desarrollo, Universidad de Chile, Santiago, Chile. ⁵ Facultad de Arquitectura, Sede Medellín, Universidad Nacional de Colombia, Medellín, Colombia. ⁶ Instituto de Ciencias Antropológicas, Facultad de Filosofía y Letras, Universidad de Buenos Aires, Buenos Aires, Argentina. ✉email: bianca.vienni@usys.ethz.ch

Introduction

Several environmental, political, social and institutional factors have resulted in the heterogeneous and adaptive integration of knowledge, actors and methodologies in Latin America, all of which aim to address complex regional issues. In spite of poor recognition and even a lack of research conditions, projects involving different societal actors have developed across the region. These experiences compose a collection of understandings and expertise ranging across several integration and implementation processes (Bammer, 2005). In the Latin American context, expertise comprises a plurality of skills and capabilities aimed at engaging with a multiplicity of marginalised and vulnerable societal actors (Hidalgo et al., 2018; Mitlin et al., 2020).

However, integration and implementation processes have not been fully systematised to serve as input for new research projects in Latin America. Some authors have claimed that it is necessary to further analyse and contextualise developed strategies to target complex problems (Lawrence, 2017) and provide useful insights and tools for initiatives in the region (Vienni Baptista, 2016), particularly when expertise is “reinvented” every time (Bammer et al., 2020).

The complexity of research and political conditions in Latin America requires an awareness of conflicts and contradicting perspectives on knowledge to avoid reproducing an idealised view of co-production processes (Phillips et al., 2018). For this reason, we ground our study in the concept of *ecologies of knowledges*, which implies a contextual, heterogeneous understanding of knowledge production that is developed hand-in-hand with societal actors searching for a solution to urgent and specific problems (Santos et al., 2018; Santos and Meneses, 2009). Such knowledge entails the greater participation of different societal and scientific actors and, therefore, requires a higher level of social responsibility, including ethical and political engagement from all societal actors involved in the research process.

This paper aims to contribute to the discussion on how expertise is defined and systematised in integration and implementation processes in Latin America. Hence, our guiding questions are (i) Which practices constitute expertise in Latin American collaborative research settings? and (ii) How can they be systematised to serve future research projects?

We apply a critical perspective and build a heuristic framework that comprehends the “situated” and relational (Grundmann, 2017) dimensions of what constitutes expertise (Collins and Evans, 2007) in the Latin American context. This framework allows scientific and societal actors involved in research processes to identify and systematise their expertise and reflect on or manage marginalised perspectives, power imbalances, multiple interests and motivations. Users of the framework can re-signify their collaborative practices and expertise by considering marginalised perspectives and power relationships that are not always integrated in the research process, and therefore deemed invisible. To our knowledge, this is the first framework that systematises relevant features of expertise in the Latin American region.

We tested this framework and studied five cases in different cultural, socio-political and environmental settings in Argentina, Chile, Colombia, Mexico and Uruguay that involve integration and implementation processes (Bammer et al., 2020). These cases represent complex real-world problems related to territorial planning, gender and knowledge, coastal management and the provision of climate services. We compared them using the framework’s three dimensions—context, actors and methods—and the intersections among them (Eisenhardt, 1991). By applying a qualitative methodology and auto-ethnography, we identified the main features of *situated expertise* as a grounded term (Haraway, 1988) that takes into consideration the situatedness of practices and processes, and also their political (potentially transformative)

dimensions in tracing power imbalances. We argue that this situated aspect of expertise is relevant for conducting more context-sensitive integration and implementation processes in Latin America, and therefore contributes to re-signifying them. Mapping these practices and consolidating them as expertise helps pursue common goals towards improved integration and implementation processes in the continent, as well as their social meaning and accountability (Bammer, 2008; Nowotny, 2003). Situated expertise strives to contribute to rethinking the ethical-political dimension of expertise and how it is defined, embodied and enacted (Felt, 2009; Schmidt and Neuburger, 2017).

This paper is organised as follows. First, we present the rationale and concept of expertise from a Latin American perspective, together with the main dimensions of analysis. Then, we propose a framework to examine expertise in five Latin American case studies. After explaining our methodology, we focus on the results, providing details on how we applied the tool in each case study and elaborating on the intersections among them. Lastly, we briefly discuss the findings in light of this rationale and draw conclusions that open some lines for future research.

Theoretical background

Several conceptual and methodological tools have analysed the heterogeneous approaches which aim to address problems related to social and productive development in Latin America, such as participatory action research (Fals Borda, 1972, 1979), the theology and philosophy of liberation (Alves, 1969; Dussel, 1972, 1977; Gutiérrez, 1971), popular education (Freire, 1968), the decolonising critique of modernity (Mignolo, 1995; Quijano, 2000; Quijano and Wallerstein, 1992; Streck, 2020; Zavala, 2013), science, technology and development studies (Arocena and Sutz, 2010; Herrera, 1995; Sabato, 1971), postcolonial and decolonising studies (Castro Gómez and Mendieta, 1998; Escobar, 2014), feminist epistemologies (Blazquez Graf et al., 2010; Gargallo, 2007) and, most recently, studies of interdisciplinarity (García, 1986, 2006; González Casanova, 1996, 2004; Hidalgo et al., 2018; Quijano, 1992) and transdisciplinarity (Vienni Baptista, 2016).

Despite their differences, these conceptual tools share common ground, as they provide a critical perspective on the hegemonic setting that shapes *how* scientific knowledge production is conceived and validated in the region. This critical perspective has modelled epistemic and methodological alternatives for knowledge production, and for improving populations’ quality of life and wellbeing, particularly marginalised groups. To avoid reproducing an idealised view of co-production processes (Phillips et al., 2018), we ground our study in the concept of *ecologies of knowledges* (Santos, 2007, 2019). Thus, we have built a multidimensional theoretical corpus that allows us to acknowledge the different forms of expertise and tensions at play in the region.

To build this theoretical corpus, we conducted a textual narrative synthesis of expertise literature (Xiao and Watson, 2019; see section “Approach: comparative case study”). Based on the findings from this type of literature review, we constructed three dimensions of analysis that characterise the multiple ways to engage in knowledge production and expertise: (i) the context in which projects are embedded, (ii) the (inter-)relations among different societal actors and (iii) the methods put into practice. These dimensions constitute the foundations for the framework we elaborate on in the next section.

The first dimension is *context*, that is, the terrain where problems are located (Funtowicz and Ravetz, 1993; Longino, 1997; Nowotny et al., 2001; Polk, 2015; Regeer and Bunders, 2009; Rip, 2002, 2010) and approached collaboratively by different societal actors (Felt, 2009; Jasanoff, 2004). Following Nowotny et al.

(2001), we understand the context as an *agora*, which is a domain of primary knowledge production in itself. The agora is receptive to the repertoire of knowledges and demands from multiple scientific and societal actors. Hence, in this scenario, the knowledge that is produced is “socially robust” (Nowotny, et al., 2001).

Like an agora (Gibbons, 2000; Gibbons et al., 1994), context provides the arena where knowledge is produced and implemented (Funtowicz and Ravetz, 1993; Leyva et al., 2008; Regeer and Bunders, 2009). It is a dynamic space where problems, actors and methods converge (Hess, 2011). This interaction fosters a learning scenario that facilitates the integration of multiple perspectives and contributions from different scientific and societal actors (Grundmann, 2017; Harding, 1998). Thus, acknowledging that these actors are not merely qualified informants allows a plurality of knowledges, norms and visions that transcend disciplinary boundaries to converge in the context (Fals Borda, 1979; Harding, 2003; Hirsch Hadorn et al., 2008, 2010; Jasanoff, 2004; Santos et al., 2019).

Context is “co-constituted and emergent in practices rather than an external, exogenous structure, constraining from the outside” (Phillips and Napan, 2016, p. 828). Therefore, context is never entirely given, as different dynamics are bound to different temporalities (historical, present/urgent and future). Under this logic, context becomes a transformative space that addresses (different) future scenarios and historical conditions, creating a “community of practice” (Knorr Cetina, 1981; Regeer and Bunders, 2009; Wenger, 1998, 2010). This results in an opportunity not only to co-produce knowledge (Hirsch Hadorn et al., 2006; Pohl and Hirsch Hadorn, 2007; Polk, 2015) but also to strengthen its potential to transform, re-appropriate and enhance artistic creations, imagery, oral traditions, multi-sensorial components and subjectivities (Hess, 2007, 2008; Santos et al., 2009; Tapia, 2016; Vessuri, 2002).

The second dimension, *actors*, implies the re-definition of the role of scientific and societal actors (Hess, 2007, 2011; Jasanoff, 2004; Nowotny et al., 2001; Regeer and Bunders, 2009). From a feminist epistemology, it is essential to observe the relationship between the person who knows and what is known (Harding, 1996, 2010; Longino, 1993, 1997). This approach discusses objectivity as a patriarchal tool of control, that assumes that the social world is something that can be externally observed and emotionally detached from our consciousness (Blazquez Graf et al., 2010; Longino, 1993). In this sense, a horizontal and non-hierarchical process may instead lead to *hybrid knowledges* (Vessuri, 2004). These are defined as knowledge systems (both local and empirical) that enrich modern science by integrating significant elements of other knowledges (Vessuri, 2006). In this collective means of knowledge production (Fals Borda, 1979), the interests of different societal actors are integrated to achieve common goals (Hidalgo, 2016). This includes assuming responsibilities towards marginalised groups (Mitlin et al., 2020) and negotiating differences in types and degrees of participation (Phillips et al., 2018; Tengö et al., 2017). A “reflexive sensitivity to emergence” pays “attention not just to processual matters, but also to the socio-culturally and temporally contingent content of the voices articulated in spaces” of co-production (Phillips and Napan, 2016, p. 840).

Therefore, the concept of *situated knowledge* proposed by Haraway (1988) is useful for our analysis, as it highlights the relevance of knowledge derived from the location and features of the knowing subject (Leyva et al., 2008; Tauginiené et al., 2020). To explain the perspective of situated knowledge, Haraway (1988) applies a visualisation metaphor, an extremely powerful image in the rhetoric of science. To observe from “nowhere” (from an angle that is never explicit) constitutes the illusion of a neutral, universal science. The situatedness proposed by Haraway (1988) does not correspond to a topology of fixed locations, but of a

relational nature. This makes it possible to obtain epistemological advances from peripheral, marginalised or bottom-up perspectives. In Latin America, the role social movements and activists play has been relevant in the field of political action and simultaneously in continuous interaction with academia (as shown in our study), particularly relating to experiences in participatory action research (Fals Borda, 1967, 1979, 1988; Freire, 1982) and anti-colonial theoretical frameworks (Dussel, 1977; Fals Borda, 1979; Leyva et al., 2018; Santos et al., 2009; Santos et al., 2009).

Based on previous studies (Vienni Baptista et al., 2020a), we identify three types of societal actors in our analysis: (i) those from the public sector, (ii) those from the private sector and (iii) those of civil society. The (inter-)relations among these societal actors are driven by different objectives, partly mediated by the problems addressed by the research projects and their network, and by each actor’s commitments to their practices, methods and institutions (Tengö et al., 2017).

The third dimension of analysis implies the choice and adaptation of *methods* for knowledge production developed by different societal actors (Escobar, 2014; Fals Borda, 1987, 2007; Santos, 2017). This dimension also comprises the integration and implementation of the new (co-)produced knowledge (Santos et al., 2019). With integration, we understand the convergence and synthesis of different knowledges, perspectives, insights, interests, conflicts and collaborative approaches towards a problem and its potential solutions, allowing for diversity and the fostering of mutual respect and accessibility to knowledge (Klein, 2021; Pohl et al., 2021).

This dimension seeks not to produce a rigid, pre-established prescription of how to carry out research, but rather to identify methods that are malleable and based on contextualised needs for knowledge generation (Funtowicz and Ravetz, 1993; Nowotny et al., 2001). As we will show, to overcome challenges such as institutional fragmentation, power imbalances and knowledge asymmetries, the cases under study applied reflective and critical methods that allow the modification and adaptation of the research process to integrate new knowledge(s) (Escobar, 2014; Santos et al., 2009, 2019; Vessuri, 2004).

Boaventura de Sousa Santos (2017) indicates that it is essential to move from an understanding of knowledge-as-regulation to knowledge-as-emancipation, allowing for broader ecologies of knowledges committed to non-extractivist methodologies (Santos et al., 2009). These methodologies are “grounded in subject-subject relations rather than on subject-object relations” (Santos et al., 2019, p. x). This allows power imbalances to be openly addressed in the research process as a means to overcome them and to empower societal actors that have soft or silenced voices in research processes. Non-extractivist methods disentangle traditional roles assigned to scientific actors when producing knowledge, and modify the inter-relations among all societal actors by means of attentive and productive listening (Guzmán-Valenzuela and Gómez, 2019). “It consists of the design and validation of practices of struggle and resistance carried out in accordance with the premises of the epistemologies of the South” (Santos et al., 2019, p. 65).

When a pluralist epistemology, or ecologies of knowledges (Santos et al., 2009, 2019), is adopted, it is fundamental to keep an open mind and stay methodologically flexible. This may eventually change the course of events, as a sensitive and empathic attitude is required to truly build solidarity based on shared goals. Such attitude, along with pragmatism and resilience, have also been highlighted in recent studies (Duncan et al., 2020).

These three dimensions of analysis are not isolated. On the contrary, they must be considered as inter-related, which constitutes our fourth element: the intersections among dimensions. Based on these elements, we developed a heuristic framework detailed in the next section.

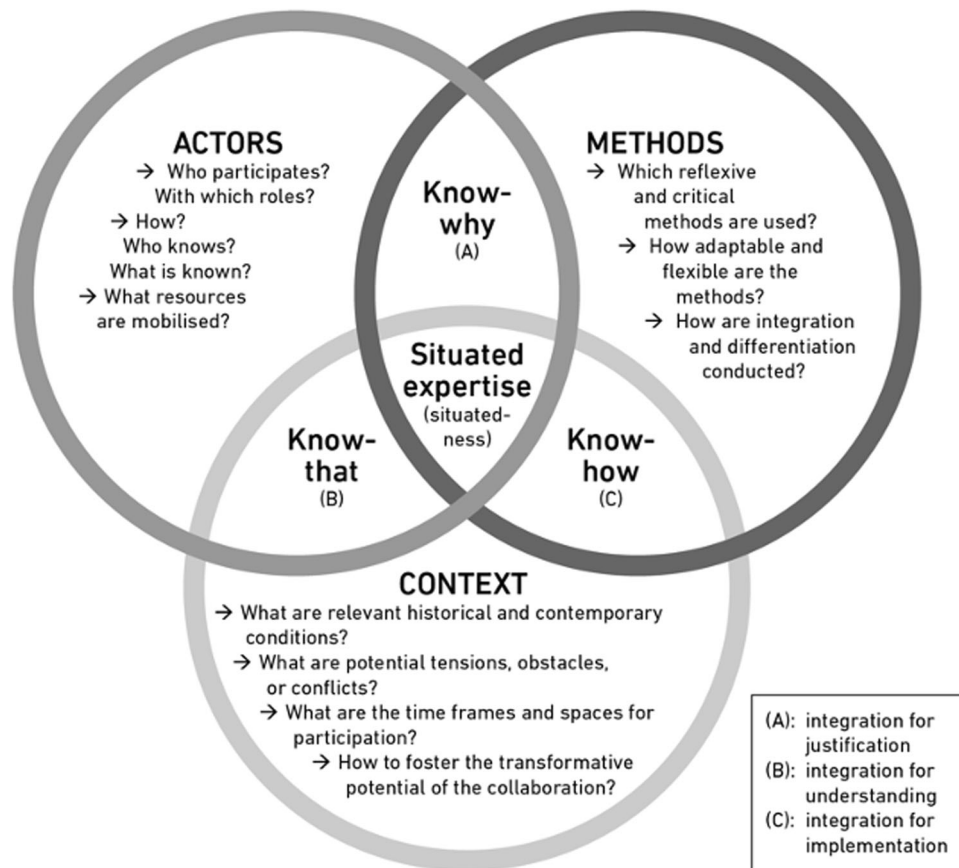


Fig. 1 Heuristic framework for situating expertise in vulnerable contexts. The framework entails three dimensions (context, actors and methods), their categories and three spheres (know-why, know-that; and know-how) together with their three areas of articulation: (A) integration for justification, (B) integration for understanding; and (C) integration for implementation.

Heuristic framework for situating expertise

We elaborate here on a heuristic framework to study and systematise *situated* (i.e., the act of being situated) expertise (Clarke et al., 2015; Collins and Evans, 2007) in integration and implementation processes in Latin America. This framework entails three dimensions (context, actors and methods), their categories and three spheres at the intersections of the three domains (Fig. 1).

Heuristics are cognitive procedures that can be expressed as rules for one's reasoning (Chow, 2015, p. 1000). The framework allows scientific and societal actors involved in research processes to identify and systematise their expertise, while recognising marginalised perspectives, interests and motivations that are usually kept silent. By reflecting on the questions the framework offers, actors may overcome power imbalances in integration and implementation processes.

Our framework seeks to re-signify research practices by (i) determining what was left behind and needs to be taken into account in the following research phases; (ii) bringing the implicit to the explicit, considering the tacit knowledge of integration and implementation processes (Pearce and Ejderyan, 2020); and (iii) managing the tensions of the dialogic process related to knowing-that, knowing-why and knowing-how (Mitchell et al., 2015; Mitlin et al., 2020).

Building on Bammer et al. (2020), this framework's spheres cover skills for tackling complex problems: (a) know-why, (b) know-that; and (c) know-how, each representing a type of expertise in integration and implementation processes:

- Knowing-why* refers to the aims, motivations and commitments that societal actors have and pursue in a project. It includes the (inter-)relations between different actors and the power imbalances that they need to overcome to fulfil common research aims.
- Knowing-that* involves understanding the implications of managing complex social problems in specific contexts. It relates to interconnections with other problems and aspects of a problem, such as the cultural, historical, economic or political. "Know-that expertise requires appreciating that worldviews frame what investigators see, what priorities they set, how they talk and how they act" (Bammer et al., 2020, p. 6).
- Knowing-how* implies the recognition and selection of methods or processes to use in a particular context, along with skills and competences to handle potential conflicting interests or aligning motivations and sentiments (Bammer et al., 2020).

These spheres are inseparable in practice and show the intersections among the three dimensions. These intersections refer to forms of cultural meaning that underpin social relations in integration and implementation processes. They show how the dimensions and categories are partially connected in a simultaneous holding together and keeping apart, while reproducing parameters of belonging and identity (Edwards, 2000; Strathern, 2007). These intersecting and overlapping forms of sociality shape the situatedness of expertise.

Table 1 Dimensions, categories, and prompts of the heuristic framework.

Dimensions	Categories	Description
Context	What are the relevant historical and contemporary conditions?	The contextual and spatial conditions in which the problem is situated (Funtowicz and Ravetz, 1993; Knorr Cetina, 1981). This is the agora in which learning scenarios, communication strategies and leadership take place (Nowotny et al., 2001).
	What are potential tensions, obstacles or conflicts?	Conflicts and diverging features in relation to the problem (Phillips et al., 2018) and/or power imbalances among societal actors (Schmidt and Neuburger, 2017; Tengö et al., 2014).
	What are the timeframes and spaces for participation?	Co-constituent and emergent timeframes that arise from practices, together with the sociocultural and temporal articulations of participation (Felt, 2009; Phillips et al., 2018).
	How is it possible to foster the transformative potential of the collaboration?	This category encompasses (i) postcolonial and decolonising approaches (Castro Gómez and Mendieta, 1998; Escobar, 2014; Streck, 2021); (ii) critical and emancipating perspectives (Dussel, 1972; Fals Borda, 1972; Santos, 2017); (iii) feminist epistemologies (Haraway, 1988); (iv) transformative learning or teaching (Cranton, 2002; Freire, 1968); and (v) future studies (Schauppenlehner-Kloyber and Penker, 2015).
Actors	Who participates and in which roles?	Societal actors from (i) the public sector, (ii) the private sector, (iii) civil society or (iv) who are not included in the previous categories (marginalised or vulnerable communities) (Vienni Baptista et al., 2020a). - Roles of societal actors who “enact” the problem (Hess, 2007). - (Inter-)relations among different societal actors.
	How?	Relationships built between the person “who knows” and “what is known” (Harding, 2003) when defining the problem (delimitation, priorities, contributions and engagement of each actor, commitment to what is at stake) (Phillips et al., 2018); degrees of participation (Leyva and Speed, 2015; Phillips and Napan, 2016); and listening skills (Moreno-Cely et al., 2021).
	What resources are mobilised by/among actors?	Contributions such as narratives, dialogues, perspectives and different experiential, practical, scientific, cultural, territorial and socio-political knowledge, artistic creations, imagery, oral traditions, multi-sensorial components, subjectivities and transgenerational knowledges and memories (past, present, future; Hill et al., 2012).
Methods	Which reflexive and critical methods are used?	Focus on three questions: (i) for whom is such knowledge produced?; (ii) for what reasons and purposes is it produced?; and (iii) how is it generated? (Escobar, 2014; Santos et al., 2009, 2019; Vessuri, 2004).
	How adaptable and flexible are the methods used?	Degree of adaptability and malleability to unforeseen, multidimensional problems (Funtowicz and Ravetz, 1993).
	How are integration and differentiation conducted?	There are three phases in the integration process: (i) integration for understanding, (ii) integration for justification and (iii) integration for implementation.

In turn, the spheres represent three areas of articulation (A, B and C in Fig. 1) that refer to the emergent relational features of expertise:

- A. Integration for justification refers to the expertise required to integrate actors’ insights to justify the relevance and legitimacy of the chosen pathway (methodology) to solve a problem.
- B. Integration for understanding is posed by context-actor relationships. It addresses the expertise required to understand and explain different epistemic frameworks and types of knowledges.
- C. Integration for implementation is represented by the relationship between the context and the methods. It refers to the expertise required for allowing teams to implement solutions through appropriate methods, and is based on the agreements of how to perform the integration process.

The framework aims at tracing and systematising expertise developed in projects or programmes in vulnerable contexts, such as those identified in Latin America. Scientific and societal actors may use this framework to analyse, reflect on and systematise their research practices when addressing complex problems, and to strengthen and legitimise knowledge (co-)production processes in conflictive contexts. Prompts and questions for each category (Table 1) can guide an ex-ante or ex-post analysis in relation to the three main dimensions.

Methodology

Approach: comparative case study. The methodological approach consisted of a detailed analysis of the five case studies as unique social units (Yin, 2014). At least one of the authors was involved in the design and/or development of one case study either as a researcher or practitioner, and contributed specific expertise. We developed a critical approach to these experiences as Latin American interdisciplinary and transdisciplinary researchers/practitioners.

The value of the selected cases lies in the following criteria (Stake, 1995): (i) completed and on-going projects; (ii) a wide range of societal actors involved in the research process; (iii) participatory methodological and/or theoretical approaches; and (iv) different types of integration and implementation processes. Thus, it is assumed that from the five cases, it is possible to access a better understanding of the conceptualisation of expertise and how these processes are enacted in Latin America (Eisenhardt, 1989, 1991).

To answer our research questions and build the heuristic framework, we applied a qualitative methodology (Flick, 2007a, 2007b). In the data collection phase (Flick, 2014), we conducted a textual narrative synthesis of expertise literature (Xiao and Watson, 2019). This method allowed us to organise the studies into homogeneous sub-groups under the three dimensions (context, actors and methods) that underpin the concept of expertise. We considered Latin American schools of thought but

also compared the studies with those from European and North American authors. We followed Streck (2021, p. 41) in understanding that comparison is a scientific method that establishes “relations among relations [...] requiring openness for different and eventually divergent perspectives”. After removing duplicates, we made an initial selection based on titles and abstracts. Six researchers performed assessments of 73 scientific articles.

We then complemented this dataset with three main types of documents obtained from the case studies: (i) grey literature produced by each case study; (ii) each project’s internal documents, including reflections that have driven the projects’ working plans; and (iii) scientific articles elaborated on by these projects. Six researchers simultaneously systematised 90 documents following the dimensions and categories of analysis (see Table 1).

To analyse these documents, we developed a qualitative content analysis (following Mayring, 2000; Schreier, 2014). Hence, our analysis resulted from individual and collective learning processes based on systematic self-reflection on the contextualised experiences of the five case studies and a scholarly discussion of the concept of expertise (Pohl et al., 2010). We conducted a self-reflexive process as interdisciplinary and transdisciplinary researchers and practitioners investigating their own collaborative practices. We combined an auto-ethnographic approach (Anderson, 2006) with grounded theory (Strauss and Corbin, 1998) to study the main features of Latin American knowledge production processes in each case. We had weekly meetings for two years to characterise, analyse and compare the case studies. This allowed us to establish a common language in the team and understand similarities and differences among practices, meanings, beliefs and representations in all five cases in an emerging process (Mendizábal, 2007). As a result, we refined the categories (Table 1) and elaborated on the guiding questions that are used as prompts for each dimension.

This second phase of analysis was complemented with data from semi-structured interviews (24 in total), focus groups (9 in total) and participant observations (11 in total; Flick, 2007a) conducted in the case studies’ settings. The analytical process was achieved through several iterative phases of coding and induction (Charmaz, 2014). After testing the framework in the five cases, we identified specific features of situated expertise in Latin American integration and implementation processes (see section “Results”).

Setting: the five cases. In what follows, we briefly characterise (in alphabetical order) each of the case studies.

The Argentinian case was a multinational collaborative research network entitled “Towards usable climate science—Informing sustainable decisions and provision of climate services to the agriculture and water sectors of south-eastern South America”. The network included participants from Argentina, Brazil, Paraguay and the USA, and was funded by the Inter-American Institute for Global Change Research (2012–2018). The project aimed at designing, implementing and disseminating climate services to improve decision-making strategies for the agriculture and water sectors of south-eastern South America, both at an individual and organisational level. It combined research on climate science with research to improve the ways in which climate information and knowledge are analysed, assessed, synthesised, communicated and merged with the needs, procedures and decision protocols of climate-sensitive social sectors.

The Chilean case encompassed the self-convened constituent councils held in the Universidad de Chile in the midst of the social outburst in 2020. The sessions included cultural elements that converged around the call from Unidad Social, a nation-spanning civil society network, for a new constitution focusing on

public higher education and knowledge co-creation. The subject matter included the experiences and demands of women and sexual dissidents at university, and a critical review of institutional settings. Participants represented different scientific and societal actors, both from academia (scholars, students, alumni and staff) and civil society organisations and trade unions.

The Colombian case focused on the outreach project *Disincronías Territoriales* (Territorial Desynchronies) funded by the Universidad Nacional de Colombia (2019–2020). The town of Santa Elena is located in a rural area that has been drastically modified. Although this territory is suitable for expansion (Acuerdo Municipal, 1999), this process was performed through normative means with limited empirical and contextual evidence (Marín-Vanegas and Serna-Velásquez, 2020). The extension of the city’s tourist activity generated new dynamics of land exploitation, which did not serve the needs and demands of the local population. Thus, to help local actors, rural workers and social groups and organisations design an alternative transdisciplinary urban planning, developing *knowledges’ dialogue for community governance*.

The Mexican case, entitled *Nómades devorantes* (Devouring nomads: Sensory-perceptual experiences of mobile economies) is an ongoing transdisciplinary project developed in Xochimilco (Mexico City). The project aims to investigate how different spaces and activities are configured in the city, and how this is associated with the city’s history. It also focuses on the amphibious connection between land and water, and on the current and future potential of these spaces. Despite constraining conditions such as violence, vulnerability and inequality, it is possible to create and enhance sensory and affective enjoyment, and update links of pleasant coexistence in this setting. Researchers combine teaching, action research and collective artistic creation to work together with the community.

The Uruguayan case addressed the creation of the Centro Interdisciplinario de Manejo Costero Integrado del Cono Sur (Interdisciplinary Centre for Integrated Coastal Management of the Southern Cone; Universidad de la República; Conde et al., 2010). Since 2002, the Centre has promoted an interdisciplinary and transdisciplinary approach to coastal management, generating knowledge, tools and human resources, and connecting coastal populations with decision makers. Its aims are (i) to develop interdisciplinary research and promote synergy between scientific and traditional-local knowledge; (ii) to co-create methodologies and innovative tools for decision-making in the management and planning processes of the coastal system; and (iii) to contribute to public policy development and the institutionalisation of coastal management initiatives in Uruguay (Conde et al., 2010).

Results

We present our results under the three dimensions of analysis—context, actors, and methods—together with the intersections among them.

Context. Both Chile and Mexico are countries that have been particularly struck by the establishment of neoliberal policies, which have affected most dimensions of social life, including politics, culture, workplaces (Drake and Frank, 2004), education (Campos-Martínez et al., 2015; Gandarilla, 2014), housing, healthcare and social welfare (González Casanova 1995; Power and Gaete-Reyes, 2018). A model installed under authoritarian control and imposed by a civic-military dictatorship (Chile; De la Barra, 2011; Drake and Frank, 2004; Moulian, 1997) and by an over 70-year-old one-party regime (Mexico; Favela Gavia, 2008; Meyer, 2013) cast aside broad population sectors from the

socioeconomic and political agenda through the stratification marks of old colonial wounds, including racism, classism and patriarchy (Gandarilla, 2018; Mignolo, 2005). This has resulted in societies with great inequality, a lack of cohesion and social unrest.

Historical and contemporary conditions constitute the first category of this dimension. In both case studies, the asymmetrical distribution of power and resources is permeated by a rich historical context. Xochimilco's strong tradition is an example of where the Mexican rural and urban worlds coexist, which represents the lacustrine past of Mexico City. It is the survival of a remote past of ancient forms of relationship(s) with nature, such as the *chinampas*¹, and, in turn, of innovative technologies that are being implemented, for instance, nano-bubbles to decontaminate the lake². This example shows how the historical context contributes solutions to today's environmental problems. It supports new types of relationships with nature, based on traditional and new technologies. Research practices are re-signified as collaborative encounters valorising the historical and contemporary conditions of the region.

The Chilean and Mexican projects are situated in conflicting societal conditions. In the Chilean case, a socioeconomic crisis (low wages and pensions, high living costs and widespread consumer debt) and massive demonstrations in late 2019 and early 2020 led to rethinking the entire social contract (i.e., a new constitution). This profound discontent manifested in mainstreamed debates whilst we performed our study, was considered a major obstacle for a transdisciplinary approach at the Chilean university. It reflects the second category of this dimension in our framework, namely the tensions, obstacles and conflicts that arise in integration and implementation processes.

In the Mexican case study, we also identified a paradox in Xochimilco's context. On the one hand, it is an extremely popular and heavily promoted tourist destination. On the other, it is a place where over-exploitation degrades the socioecological environment, leading to poverty, violence, desiccation and pollution. A "safety net" created by the indigenous and rural communities has played a key role in protecting these spaces, where the rural and the urban coexist (Peralta, 2011). The safety net is constituted by a series of values from the indigenous communities such as community solidarity, cooperation and reciprocity. These are "the product of a centuries-old tradition that turns it into a narrative of timeless events" (Peralta, 2011, p. 184).

The Mexican case also constituted a platform to elaborate questions on how the city is lived and perceived by different societal actors. In this experimental space, research techniques based on the communities' own symbolic elements (for example, the *chinampas*) give vulnerable and indigenous communities a voice in violent contexts as the Mexican one. The team built a device called "Navío anfíbio para investigaciones nómadas" ("Amphibious nomadic research vessel", NAPIM) to simulate the mobility of the *trajineras*.³ The amphibian condition refers to the *ajolote* (from the Nahuatl *axolotl*; *ambystoma mexicanum*), an endemic species that resembles Mexico by synecdoche. Local actors and visitors share an experience on the boat, which will be offered as a touristic tour in the future. Using photographs and historical images of the place, societal actors weave together the different temporalities, not only own experiences, but also what their parents and grandparents might have told them about the environment. Thus, this lacustric trip represents a temporal journey that connects past, present and future.

As both case studies are ongoing action-research projects (Colectiva MIA, 2020; García-Bravo et al., 2020) and, in the case of Mexico, also of artistic production, the context includes different time layers and tensions. Much of this work focuses on

co-producing a collective framework for these projects, featuring what is included, what is (un)known, what is missing and what is left out, especially regarding the objectives related to the transformation of knowledge production conditions. This process of co-production enriched our heuristic framework. One of the project's researchers lives at the site and has developed collective and creative proposals together with the community. The device with which data are collected and produced is mimetic with the context of the *trajineras*⁴. The outcome of this research will be a collective artistic exhibition, which combines a community analysis of the space and the memories of resistance displayed on it. The exhibition will invite the audience to use their senses to (re-)signify the urban space, and to embed marginalised perspectives in it. The project seeks to be a space for the convergence of different actor's experiences, backgrounds and wisdom to build specific, situated and personalised interpretations of Xochimilco.

Hence, both case studies acknowledge the "heterogeneity and volatility" of different "knowledge environments" (Pedersen, 2016). According to our analysis, the context is closer to "process" than to "environment": it is dynamic and multi-functional (Gibbons, 2000; Gibbons et al., 1994), as well as integrative and relational. These features consolidate the fourth category, that is, their transformative potential. Both case studies have context-sensitive research designs (Agee, 2009; Baum et al., 2006; Estrada, 2010) adapted to the specificities of the context. In the Chilean case, this process supported the discussions around the Constitutional Convention.

The Argentinian case also shows the relevance of the institutional-political context in integration and implementation processes. The project established and sustained a World Meteorological Organization Regional Climate Centre (WMO RCC) for southern South America. This resulted in opportunities for societal actors to actively participate in workshops that delineate the effective provision and societal use of climate services through a close partnership and continuous interaction with the WMO RCC. Such partnerships, absent in the past, strengthened the consolidation of a collaborative network between operational, governmental and scientific communities, and boosted the implementation of 'face-to-face' working spaces that put the knowledge from different participating institutions and users at the centre of attention of the network (Carabajal and Hidalgo, 2022).

In the Chilean case, both scientific and societal actors were summoned. These actors engaged in a socio-political debate and a transdisciplinary exercise (Pohl, 2008) immersed in a popular constituent process, which focused on two major issues: (i) the marginalisation of women and the LGBTQI+ community in academia, and (ii) the challenges for knowledge production and outreach programmes (e.g., collaborative research, community engagement and socially robust knowledge) that are in tension with traditional roles and institutional practices. In this process, the "outside" social world became part of the academic world and vice versa. For the first time since the Chilean democratic period began, societal actors lead the discussions and designed research questions to transform women and the LGBTQI+ roles at the university. The transformative aspect of this co-production process (our fourth category) was achieved by applying a feminist approach that encourages marginalised actors as women to guide the research process.

Actors. Actors, our second dimension of analysis, were configured differently in each case study in relation to the context, the stage of the project and the societal actors' degrees of involvement. This relational-sensitive approach implies an ongoing (re-)

definition of the role of societal actors (Salomone and Gallardo, 2017). For example, in Argentina, actors are called stakeholders because they are restricted to specific users of climate services.

In Colombia and Mexico, inhabitants and tourists play a fundamental role. The latter, called visitors, are also part of the milieu, because in this interaction resides possibilities for transformation and change. In Uruguay, the team developed a strong relationship with societal actors from the public sector and local producers, and citizens living in the coastal area, who participated in several phases of the research process. They redefined the protected coastal areas with subsequent influence on how the national law defined such territories (Conde et al., 2010).

The Argentinian case study is representative of the three categories of analysis. The project involved different profiles of societal actors, disciplines and institutions that shared growing concerns about the socioeconomic impacts of climate variability, climate change and high-impact weather events. These represent the first category of analysis (who?). The initiative had to manage and channel the heterogeneity of the network, where societal actors had multiple perspectives and perceptions of the central problems or questions addressed in the project. In this case, the recent creation of a WMO RCC for southern South America resulted in exciting opportunities for societal actors for the effective provision and societal use of climate services through a close partnership with the RCC.

Societal actors (or stakeholders) involved in this project come from the public sector, such as researchers from different disciplines, members of governmental agencies and a regional institution, and the RCC. Researchers were relevant actors in this case study in that climate services critically depend on their diagnosis of recent conditions and predictions/projections of regional climate. The complexity of the targeted socioecological systems required a rich set of approaches, such as researchers trained in different disciplines, including a handful of doctoral researchers and several graduate and undergraduate students. These early career scholars played a critical role in integrating results and communicating among disciplinary groups, as pointed out by Schmidt and Neuburger (2017). It was not easy for the researchers to step out of purely academic objectives to actively create new knowledge and products capable of informing science-based climate policies. Curiosity-driven researchers had to gain new competences to interpret, assess, and synthesise diagnostic and forecasting climate information on multiple time scales, and to translate climate information into likely socio-ecologic impacts and outcomes.

Despite the commitment of mission-oriented institutions that enhanced the chances of the results, products and services being operationally sustained by different organisations, the articulation of research and applications proved difficult. The second category of our framework focuses on the relationships built between the person “who knows” and “what is known” when defining the problem. In the Argentinian case the heuristic tool allowed us to identify the weak integration of academic and operational communities that was paralleled by a poor integration of multidisciplinary knowledge on climate-related information. The latter could have helped to enhance research practices oriented to support decision-making (governmental and non-governmental). For members of the operational institutions, the network was understood as a means to stop working in isolation (i.e., without articulating efforts and sharing data with similar institutions in the region) in order to reach global standards while still managing to be locally/regionally based and to handle budgetary pressures. Superficial integration of academic and operational communities was paralleled by a poor integration of multidisciplinary knowledge on climate-related information that

could help enhance research oriented to support decision-making (governmental and non-governmental).

The success and actionability of knowledge and services largely depended on identifying key climate-sensitive problems that were to be politically addressed. In the Argentinian case, the societal actors involved agreed on a set of key problems that would allow them to jointly advance step by step, and decided to focus on the issue of drought. In a way, members of mission-oriented institutions acted as mediators between the interests of the climate science community and the diverse needs of the many relevant climate-sensitive sectors.

A deliberate effort was needed to create and sustain mechanisms for an iterative dialogue between scientific and societal actors in the analysed case studies. Without appropriate consideration of these and other design elements, the provision of climate services risked being ineffective and users could lack knowledge that was critical to making informed decisions. Resources, such as the Argentinian RCC, were mobilised to guarantee the feasibility of the co-productive process, which constitutes an example of the framework’s third category (what resources?).

Methods. In the case studies we have analysed, we focused on the application of reflective and critical methods that allowed the creation of a space for dialogue and bidirectional learning (Tengö et al., 2017). This is related to the third dimension of analysis in which we sought open and flexible methods that went through an adaptation process to make them socially robust.

By comparing the five cases, we confirmed that they iterated between a phase of integration and one of differentiation. We identified three phases in the integration process: (i) integration for understanding, (ii) integration for justification and (iii) integration for implementation.

Boundary objects “such as jointly produced maps, pictures or conceptual frameworks” (Tengö et al., 2017, p. 20) were likely used in the integration for understanding phase. The Uruguayan case offers a good example. Social cartographies are tools that promoted the dialogue between different societal actors used by the Centro Interdisciplinario de Manejo Costero Integrado del Cono Sur (Conde and Gómez, 2011). Owing to the problems this centre addresses, maps are frequently used not only to analyse a specific context, but to clearly establish insights on a problem perceived by the different societal actors.

The maps made it possible to address the ethical and political implications of research such as the role and impact of small fisheries in the coastal environment (Conde et al., 2010). In this case, a common language was built among the actors that helped them arrive at a joint framing of the research problem and the strategies needed to demarcate a coastal area with different uses such as touristic, living area, and small commercial activities. Using citizen-panels as main spaces for deliberation, an Advisory Group—with local and scientific actors—systematised the different perspectives and provided baseline information to assess the exclusion/inclusion areas in the coastal zone. In this way, political aspects were embedded into the phase of integration for justification. Moreover, the three phases of the integration process allowed the team to address the sentiments and motivations of the societal actors, seeking to counterbalance the limitations of the dialogue-consensus methods (Díaz-Reviriego et al., 2019; Moreno-Cely et al., 2021).

Regarding the second phase, integration for justification, in most of the analysed cases it was essential to co-produce knowledge that, despite its availability, at times or under different perspectives had not been recognised as a valid element (Tengö et al., 2017) in the research process. These other sources added

new formats, which in turn contributed to transforming the basis of pre-existing methods with a non-extractivist orientation (Santos, 2017). The consolidation of shared meeting spaces in all cases proved relevant to establish more symmetric relationships between the different societal actors. In these spaces, dialogue and listening skills were put into practice, using differences between perspectives as means to agree on future decisions and to develop strategies for building new knowledge. These spaces took on different forms: assemblies, open councils (as in the Chilean case), meetings (as in the Colombian and Argentinian cases), workshops (as in the Uruguayan case) or community artistic interventions (as in the Mexican case).

In the third phase, integration for implementation, the methods used in the analysed case studies were not entirely new, yet their implementation was. Thus, we identified a set of methods with different objectives depending on the stage of the process in which they were applied. The aim of this set of methods was to build a collaborative setting shared by the societal and scientific actors participating. For example, some methods were initially used to identify and define the issues to be addressed, that is, individual interviews and focus groups (Brinckmann, 2014; Kamberelis and Dimitriadis, 2014), as exemplified in the Argentinian and Uruguayan cases; participant observation (Lins-Ribeiro, 1989) of outreach activities shown in the Mexican case; interactive workshops; dialogue methods (MacDonald et al., 2009); systematic literature reviews (Jahan et al., 2016); logical framework development through problem trees (Chevallier, 2016), as used in the Colombian case; situational mapping (Clarke, 2005); and conflict and actor analyses, among others.

In the Colombian case study, the first phase of the research process consisted of collecting data from local accounts, anecdotes and publications (integration for understanding). This was a means to identify problematic events (from the last 20 years) in relation to the ecological parks and development policies that were developed against inhabitants' interests (Marín-Vanegas and Serna-Velásquez, 2020). Thus, by bringing this information into the second phase of the research process, participatory techniques were developed, including problem trees or issue maps (Chevallier, 2016), social mapping and cartographies (Kathirvel and Kumar, 2012), focus groups and workshops. Based on these sources, the academic team designed a technique considering the situatedness of the problem, named a *bimodal problem tree*. It addresses not only the identified problem but also all possible solutions to it by codifying the more challenging elements foreseen by the community. A specific implementation of this methodology was developed as a variant of the commonly known problem tree or issue map (Chevallier, 2016).

Ultimately, these reported features show how all five analysed cases addressed their project's context in the methodology implementation. This is related to a know-how on situating particular methods to address specific research problems from a relational approach. We propose the term *situated expertise* to refer to integration and implementation processes as a skillset for addressing today's complex problems in Latin American contexts.

Intersection spheres. The spheres (know-that, know-how and know-why) constitute three intersections of the framework's dimensions (context, actors and methods).

Knowing-that involved aspects of a problem. Some of the difficulties in our case studies arose due to efforts to establish a set of mutually agreed-upon definitions and languages. In the Argentinian case, the degree of conceptualisation could either facilitate or impede the understanding between scientific and societal actors. However, the research network formed by natural

and social scientists, professionals working in governmental institutions and NGOs helped to overcome such difficulties and to develop collaborative skills necessary to develop transdisciplinary research to improve the way in which climate information was communicated and used.

When the theoretical formulation did not integrate contributions from societal actors, misunderstandings rendered the knowledge necessary to make informed decisions useless and ineffective, as in the Colombian case. When applying the heuristic framework, the team made a great effort to make those tensions explicit in the process of integration for understanding (know-that).

Knowing-how implied specific skills and competences to manage potential conflicting interests, such as time dedicated to the research process. In all five cases, this sphere related to the degree of commitment to the project itself, its financing and how it was distributed, that is, the level of political training and degrees of active involvement. The challenge was to produce situated data meaningful to all actors by sharing researchers' responsibilities towards marginalised groups (Mitlin et al., 2020), in accordance with the demands to decolonise and democratise academia (Leyva and Speed, 2015; Santos et al., 2019).

In the Colombian case, the rural area was drastically modified without local actor involvement. Participation was weakened due to lack of interest. This was caused by unfulfilled promises in previous projects that returned nothing to the community, thus marginalising societal actors (know-why). These were perceived as a source of information and legitimation for receiving funding. Knowledge dialogues for community territorial governance, helped local societal actors, rural workers, social organisations, and scientific actors to build a common understanding of the problem (know-that). The know-how (i.e., context-specific interactive workshops, cartographies, social mapping, problem trees and actor analyses) constituted a means to interconnect the problem with the sentiments and motivations of diverse local communities.

Knowing-why referred to the aims, motivations and commitments that societal actors have and pursued in the project. In all five cases, this sphere included the tensions derived from the roles played by the different scientific and societal actors and the power imbalances that they needed to overcome to fulfil common research aims. Relevant issues were who leads the process, how and at what moment, and the social distancing within the institution, university or research centre (as illustrated in the Chilean and Mexican cases). In the case studies analysed here, different expectations were generated among scientific and societal actors and, on occasion, divergences with respect to the objectives. In some cases, scientific actors found it difficult to move beyond purely academic goals to actively create new knowledge, as in the case of Argentina.

By systematising the different tensions, contradictions (dis-sents), and agreements that arose in the interaction among scientific and societal actors the heuristic framework made it possible to change power dynamics and its impact, as in the Chilean case. As this is an on-going research initiative, this change was accompanied by the construction of a space of trust between actors, which helped establish an integration process and communication of knowledge and resources (Moreno-Cely et al., 2021; Vienni Baptista et al., 2020b). The know-why is the predominant sphere in this case and iteratively shapes the problem (know-that) as the research process progresses. This is of great importance for overcoming the state of uncertainty and conflict derived from the 'social unrest'. Through the systematisation of the discussions, both for the action-research project and for the repository built by Unidad Social (a conglomerate of social and trade union movements at the national level), the

impact of the integration process of situated and transformative knowledge was increased, serving as input for academy and public policies, and directly affecting those societal actors who co-produced it.

In the Argentinian case, the team acknowledged that scientific actors do not have all the answers (Mitlin et al., 2020) and some might be tentative or approximate where complementarity helps generate a co-production process (Santos, 2010; Santos et al., 2019). In this sense, the situated nature of the expertise became relevant due to the principle of incompleteness. Following this principle, the team promoted epistemological debates between the different actors involved, which helped overcome inherited ignorance (Santos et al., 2009, 2017) in relation to services for the provision of climate services.

In our analysis, context-sensitive methodological designs (know-how) were put into practice to establish spaces for dialogue to promote symmetric relationships between different actors (know-why). In these spaces, the main aim was to recognise tensions and to (co-)produce strategies for greater or better understanding. The significance of different roles also encompassed scientific actors learnt how to collaborate with societal actors (Leyva and Speed, 2015) to overcome power imbalances. In the Mexican case, participatory teaching, action research and collective artistic creation constituted means to question traditional research models by allowing a shared learning process.

Conclusions

In this paper, we propose a heuristic framework to identify and systematise specific expertise developed in projects in vulnerable Latin American contexts. The analysed case studies showed a diverse set of experiences that generated integration and implementation processes between scientific and societal actors, pointing to a co-creation of alternative joint solutions to urgent matters in the Latin American context.

Co-creation processes raised questions on ontological, epistemological and ethical-political dimensions of the research process, as addressed in the situatedness condition of such expertise. The situated expertise accounted for multiple challenges in the analysed cases. Specifically, (i) generating expertise to approach local ontologies and epistemologies; (ii) fostering an openness to interculturality and socio-political issues, particularly as there is a great deal of wealth in the knowledge of local populations; and (iii) systematising and documenting traditional knowledge and continuous negotiation and translation work.

As discussed in this paper, *context* acquires a renewed validity in Latin American settings, not only as the space where problems are located but also where their approach is jointly defined by the various actor and method intersections (Gibbons et al., 1994). By applying the heuristic framework, the analysis of these five case studies shows the material and immaterial dimensions of context, such as how actors engaged in—and dynamically transformed—it, and in which collaborations it was situated. We argue that a context-sensitive approach is necessary to promote latent—and particularly difficult—networking processes between scientific and societal actors. Under these circumstances, determining priorities and what language and concepts to use becomes a challenge, as actors find themselves constrained by “academic neoliberalism” (e.g., competition over grants) and by epistemic models often sprung in the Global North (Santos et al., 2019).

In relation to the second dimension, the *actors*, our analysis shows that the approach to complex problems benefits from greater collaboration between societal and scientific actors (Funtowicz and Ravetz, 1993; Hoffmann et al., 2017; Nowotny et al., 2001). Tensions and contradictions in this type of research

initiative were made visible when applying our framework. These were derived from multiple factors: accessibility to resources, capacities to manage agendas, co-authorship, modes of dissemination, and power and status imbalances due to gender, age, ethnicity or political ideology (Leyva and Speed, 2015; Mitlin et al., 2020).

The choice and even the invention of *methods* (Lury and Wakeford, 2012), our third dimension, is key to understanding a problem and, later, to implementing its solution (Escobar, 2014; Fals Borda, 1979, 1987, 2007; Santos et al., 2017). As Phillips and Napan (2016, p. 833) stated, it is important to recognise the conditions in which the implementation of these co-creation methodologies occur in “socio-political conjunctures and organizational contexts”. Our framework seeks to address the ethical and political aspects of expertise, as it questions the traditional research models that may be adapted to each context, the unforeseen events that may emerge (e.g., socio-political aspects) and the demands of the scientific and societal actors involved in the research process.

Thus, the proposed heuristic framework offers a multi-dimensional, context-sensitive approach to practice and an enabling tool when the aim is to generate locally valid—and socially robust—knowledge with transformative potential. Discrepancies between different practices (and actors) are at the centre of the responses to the questions that the framework includes. Differences can help consolidate collaborative and co-production processes (Regeer and Bunders, 2009), as some of the analysed cases showed. They can constructively be used to move the discussion on research integration and implementation processes forward by examining how different research practices and expertise are developed in low-income countries and intercultural contexts.

Our framework identified the main features of *situated expertise* in Latin America, specifically engaging marginalised societal actors, fostering greater participation, acknowledging power imbalances, managing conflicts and contradicting perspectives, and aiming at ethical and political engagement in the research process. The framework highlights the intersections of situated expertise: (i) know(ing)-what problem and in what context we are facing it; (ii) know(ing)-how we would solve this problem (chosen context-sensitive method); and (iii) know(ing)-why we need to tackle the problem and solve it in a certain way and not in another. We argue that more context-sensitive approaches are necessary in Latin America to re-signify these practices. Our framework could be applied in future projects and programmes to add nuances to the concept of expertise in Latin America.

Data availability

The datasets analysed during the current study are not currently available because they belong to different research institutions in five different countries and were generated under regulations determined by each funding agency. These can be available from the corresponding author on reasonable request.

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Notes

- 1 From the Nahuatl *chinamitl*, meaning ‘hedge’ or ‘fence of canes’. A small area of land, it is the name given to the ancient Mesoamerican method of agriculture and territorial expansion that, using a kind of raft made of logs and poles covered with earth, served to grow flowers and vegetables, making Tenochtitlan a floating city.
- 2 Created by the Ecological Restoration Laboratory of the Institute of Biology of the Universidad Nacional Autónoma de México (UNAM, Mexico).

- 3 These are small, flat-bottom boats pushed by a long pole that transport vegetables, flowers and people. They were used throughout the Mexican basin and are still used today in the lake areas of Xochimilco, Tláhuac and Chalco
- 4 These are small, flat-bottom boats pushed by a long pole that transport vegetables, flowers and people. They were used throughout the Mexican basin and are still used today in the lake areas of Xochimilco, Tláhuac and Chalco.

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Competing interests

The authors declare no competing interests.

Ethical approval

URUGUAY: The case studied for this paper was entitled: “La producción de conocimiento científico interdisciplinario en la Universidad de la República: modalidades, prácticas e identidades”. The project ran between 2017–2019. Committee that approved the research: Comisión Sectorial de Investigación Científica, Universidad de la República, Uruguay; The committee that approved the research confirmed that all research was performed in accordance with relevant guidelines/regulations; Research was performed in accordance with the ethical requirements established by the Committee cited above.

MEXICO: The project studied for this paper is entitled “Nómades devorantes. Experiencias sensor/perceptuales de las economías móviles”. It began in 2018 (on-going) and is located in Xochimilco, Mexico City. Committee that approved the research: Universidad Nacional Autónoma de México and Universidad Nacional (Costa Rica); All research was performed in accordance with relevant guidelines/regulations from these two universities; Research was performed in accordance with the ethical requirements established by the Committee cited above.

ARGENTINA: The project studied for this paper was entitled: “Towards usable climate science—Informing sustainable decisions and provision of climate services to the agriculture and water sectors of the south-eastern South America”—IAI-CRN3035. It was

developed between 2013–2019 in Argentina, Brazil and Paraguay. Committee that approved the research: Interamerican Institute for Global Change Research (IAI) supported by the US National Science Foundation (Grant GEO-1128040).

The committee that approved the research confirmed that all research was performed in accordance with relevant guidelines/regulations; Research was performed in accordance with the ethical requirements established by the Committee cited above.

CHILE: The case studied for this paper was entitled “Cabildos autoconvocados constituyentes”. The project began in 2019 to date and is located in Santiago, Chile. Nevertheless, it has no funding for the case study analysis.

Committee that approved the research: No Committee approved of it. It was based on the voluntary participation of scientific and societal actors.

COLOMBIA: The case study is entitled “Disincronías territoriales: diálogo de saberes para la gobernanza comunitaria en el corregimiento de Santa Elena (Municipio de Medellín)”. The project was developed between 2018 and 2019 and was located in Medellín, Colombia.

Committee that approved the research: Universidad Nacional de Colombia, “Convocatoria Nacional de Extensión solidaria 2018: regiones y comunidades sostenibles” (Modalidad 1); The committee that approved the research confirmed that all research was performed in accordance with relevant guidelines/regulations; Research was performed in accordance with the ethical requirements established by the Committee cited above.

Informed consent

Informed consent was obtained from all participants and/or their legal guardians in the five case studies.

Additional information

Correspondence and requests for materials should be addressed to Bianca Vienni-Baptista.

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