

The Turns in the Production of Knowledge Through Interdisciplinary and Transdisciplinary Practices: A Proposal from the Perspective of Latin America

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Abstract: Interdisciplinarity (ID) and transdisciplinarity (TD)—in their definitions and practical characteristics—encapsulate the tensions, demands, and transformations that scientific research is currently undergoing in response to the complexity of scientific problems across various domains. This article aims to contribute to the discussion on how ID and TD research dynamics are implemented in Latin America. By anchoring the analysis in this region, it seeks to recognize and examine developments specific to it, identify commonalities with other regions, and, most importantly, contribute to expanding a fragmented and often unacknowledged community of practice. To distinguish these dynamics, the article proposes an analytical matrix composed of four “turns” that introduce new perspectives on how knowledge is produced. These turns, termed the “ethical-political turn,” the “participatory turn,” the “contextual turn,” and the “dialogical turn,” draw inspiration from contributions in Science, Technology, and Society Studies (STS) and Interdisciplinary and Transdisciplinary Studies (ITS). The matrix is designed to serve as a common and flexible framework, allowing for the application and integration of new dimensions to uncover and analyze situated ID and TD dynamics. Its purpose is to advance a better understanding of how ID and TD dynamics are practically implemented, fostering their recognition, application, and support. To test its application, four research groups from the University of the Republic in Uruguay were selected as case studies to analyze ID and TD dynamics and their implementation. The results demonstrate that the matrix facilitates an understanding of the foundations, challenges, and practices of ID and TD, as expressed through each of the proposed turns and their interrelations. From the perspective of the philosophy of interdisciplinarity, this matrix contributes to an epistemological reflection on the integration of diverse forms of knowledge, the theoretical and methodological challenges involved, and how this process generates a reconfiguration of scientific knowledge that enables a more effective approach to addressing the complexity of contemporary problems. Ultimately, the matrix offers a situated framework that promotes the integration of multiple perspectives in the process of knowledge creation and

recognizes the connections between diverse forms of knowledge to address problems that cannot be satisfactorily tackled by a single discipline or solely by academic actors. This approach aims to deepen the understanding of the transformation of epistemological and methodological practices, providing a more nuanced, complex, and varied image of science that enriches scientific practice.

Keywords: research dynamics, analysis matrix, interdisciplinary, transdisciplinary

Interdisciplinarity and Transdisciplinarity: From Empeiria to Analysis, and Vice Versa

There is a growing consensus that the complexity of the world we live in, and the problems arising in that complex context, demand changes in how we approach them. Problems connected with health, the environment, and intersecting inequalities, among others, have underscored the limitations of knowledge production organized in disciplinary structures and their various value systems and institutional logics. Collaboration efforts that combine multiple perspectives from diverse disciplines and extra-academic stakeholders are instead needed to develop a more thorough understanding of the problems. In Latin America, as in other regions, scientific research today is under increasingly greater tension between advancing the understanding and addressing complex problems, and the demands of diverse stakeholders who situate these problems and expand the strategies and practices of knowledge production (Vienni Baptista et al., 2022a, p. 2).

Interdisciplinarity (ID) and transdisciplinarity (TD) are embedded in that context of multiple complexities and it is there where they grow and develop. The most widely cited definition of interdisciplinarity is provided by the U.S. National Academy of Sciences (2005), namely:

A mode of research . . . that integrates information, data, techniques, tools, perspectives, concepts, and/or theories from two or more disciplines . . . to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single . . . research practice area. (p. 2)

Jahn et al. (2012), in turn, proposed a general definition of transdisciplinarity as:

A critical and self-reflexive research approach that relates societal with scientific problems; it produces new knowledge by integrating different scientific and extra-scientific insights; its aim is to contribute to both societal and scientific progress; integration is the cognitive operation of establishing a novel, hitherto non-existent connection between the distinct

epistemic, social-organizational, and communicative entities that make up the problem context. (2012, p. 9)

While both definitions contribute to a general understanding of ID and TD and their specific characteristics, there is no consensus in academic literature on a single definition. Instead, a heterogeneity and overlap of terms is emerging—alongside contrasting and sometimes controversial discourses—shaped by the contexts in which these approaches are developed, the problems they address, and the characteristics of the epistemic communities promoting them, among other factors. With varying emphases, there is a shared aim to reestablish connections between various knowledges in order to respond to problems that cannot be addressed satisfactorily from a single discipline and with academic stakeholders alone (Menken & Keesstra, 2016; Schmidt, 2022, p. 37; Vienni Baptista et al; 2022b; Vienni Baptista, 2024, pp. 6–7).

In Latin America—the region where the analysis presented here is situated—we can identify different perspectives that contribute to the recognition of research practices designed to integrate diverse forms of knowledge and promote interaction among different stakeholders toward democratizing knowledge. Participatory Action Research (PAR) (Fals Borda, 1979, 1992), science, technology, and development studies (Arocena & Sutz, 2010; Sabato, 1971), postcolonial and decolonizing studies (Castro Gómez & Mendieta, 1998; Escobar, 2014), and, more recently, studies on interdisciplinarity (Hidalgo et al., 2018) and transdisciplinarity (Vienni Baptista, 2016) are some of the conceptual and methodological tools that have analyzed the heterogeneity of practices. Despite their differences, they offer a critical perspective on the hegemonic framework that shapes how scientific knowledge production is conceived and validated in the region (Vienni Baptista et al., 2022a, p. 2). These and other perspectives provide insight into how ID and TD dynamics have unfolded in Latin America.

However, in attempting to identify and study how these processes are carried out, what strategies are employed, and how they are institutionalized, finding collaborative spaces for analysis proves challenging. This prompted a proposal to create the emerging field of “Studies in Inter- and Transdisciplinarity” to explore the research practices and processes furthered and the perceptions of the different academic and extra-academic stakeholders involved (Vienni Baptista & Klein, 2016).

These processes of openness—towards the integration of different forms of knowledge, the participation of diverse stakeholders—and the transformations they entail take place within science and technology systems, particularly in public universities, which are the main knowledge-producing institutions in the region (Arocena, 2014). The longstanding commitment of public universities to society, implemented through their outreach function and the reformist tradition of Latin American universities (Tünnermann, 2008), has served as a foundational platform from which to recast their practices and

modes of interacting with their surroundings, amid growing inequality and multiple exclusion processes. This has shaped a distinctive profile by proposing new roles and relationships between the academic community and society as a whole.

This article provides a matrix for analyzing ID and TD processes by describing certain dimensions that can be considered central and serve as guidelines for examining such processes and practices in Latin America. Four research groups from Uruguay's University of the Republic, each with distinct ID and TD research processes, were selected to apply the matrix. This design, which can be used as a heuristic tool, can be developed and applied in at least two senses. It can enhance the understanding of the strategies, multiple trajectories, and features deployed in ID and TD processes conducted to address different problems that require the integration of various knowledges. And it can also be used epistemologically (including by considering philosophical aspects) to analyze the contribution of ID and TD to the expansion of conceptual and methodological frameworks that enable a situated understanding of these processes from a Latin American context.

This proposal joins other contributions emerging from the region, under *Estudios Sobre Interdisciplina y Transdisciplina (ESIT)*, that seek to reflect on how ID and TD are developed, toward recognizing the epistemic changes these processes entail and adding to the global discussion on the subject (Crespo, et al., 2024; Hidalgo et al., 2018; Vienni Baptista et al., 2022a).

The Idea of "Turns" and the Importance of Imagining Our Narratives

Working in the framework of ID and TD does not necessarily entail developing a single pathway that leads to the "success" of such processes. These are in a sense experimental (Felt et al., 2016), given that addressing diverse complex problems and working to produce socially relevant knowledge are efforts that serve as blueprints for creating different designs that often take the form of a cyclical process, in contrast to the idea of linearity in processes, aiming instead to establish an interactive, integrative, and multicentric model.

The notion of "turn" seeks to represent a paradigmatic shift that integrates both external and internal impulses within universities, ultimately proposing that science is not a "view from nowhere." On the contrary, scientific knowledge, like all forms of knowledge, is partial, fallible, and highly contextual. Within this framework, addressing complex problems requires the integration of diverse forms of knowledge to develop more efficient and democratic solutions.

The shifts proposed by "Studies in Inter- and Transdisciplinarity" can be understood as a departure from traditional knowledge production practices,

particularly those associated with disciplinary approaches, “Mode 1” knowledge, or “normal science” (Funtowicz & Ravetz, 1993; Gibbons et al., 1994). In this way, the idea of a turn introduces new dynamics in knowledge production, prioritizing the articulation of multiple ways of knowing, while emphasizing the relevance of specific contexts.

With the aim of identifying some of the central dimensions in the development of ID and TD, and to deepen the understanding of the dynamics driving these processes while connecting theory and practice, four “turns” are distinguished: the ethical-political turn, the participatory turn, the contextual turn, and the dialogical turn. Each contributes dimensions that help characterize the shifts and new dynamics introduced by ID and TD. While these dimensions can be analyzed separately, their joint identification represents the potential and strength of the matrix proposed and its application for analysis.

This approach moves from the general—encouraging a rethinking of the principles, methods, and purposes of scientific inquiry—toward the specific strategies and practices that guide the design and implementation of ID and TD. Hence, the relevance of their interrelation, offering insights to identify characteristics specific. Combined, they enable a more in-depth analysis of the dynamics of both processes, thereby contributing to a growing body of studies. Designed as a prototype, this contribution seeks to uncover ways to unpack these different interpretations of ID and TD and to enhance their development.

The Ethical-Political Turn: Social, Academic, and Political Motivations

Producing knowledge in different ways—from and toward other horizons of meaning—that problematize and transform traditional research practices requires stakeholders to engage in a continuous process of reflection and self-reflection. This raises fundamental questions: Who defines research problems? With whom do we think? What experiences and forms of knowledge are integrated into these processes? How do we conduct research? What concrete practices are implemented? For what purpose and for whom is knowledge produced? To whom is research useful? These questions shape the motivations that guide and drive the ethical-political turn in research design.

Following Weber (1998/1991), the ethics of responsibility implies that researchers must commit to the reality they analyze, particularly to those with whom they have built a network of trust, even when their political perspectives do not necessarily align. Added to this is the responsibility toward the problem itself and the actors involved, ultimately seeking to challenge the fiction of knowledge universality. Thus, this turn necessitates the construction and reinforcement of a trust-based space, enabling participants in these processes to actively engage in transforming reality through collaboration across differences, while recognizing new forms of knowledge to address various challenges.

Within this shift, three motivations can be identified—social, academic, and political—which operate in an interrelated manner, shaping the practices that drive researchers to design and implement ID and TD processes.

A social motivation arises from pressing problems in the immediate context and the engagement with various extra-academic stakeholders who demand solutions. Researchers' proximity to these contexts enhances their receptiveness to such demands, which may be explicit or more difficult to identify and often unfold across multiple dimensions. Given their complexity, addressing these issues requires a commitment to connecting capacities and an active responsibility in seeking solutions.

From this perspective, the role of researchers is redefined as active agents in identifying and responding to the needs of social sectors that lack direct representation in shaping research priorities. This role extends beyond the mere generation of knowledge, requiring researchers to navigate and interweave institutional structures through which, ideally, problems can be addressed effectively.

Interwoven with the social dimension is an academic motivation. Problems originating in extra-academic contexts enter the academic sphere, shaping research agendas, generating new questions, and fostering diverse methodological approaches. This process creates an enabling environment—driven by a growing normative demand for ID and TD—for the integration of diverse disciplinary perspectives and the participation of extra-academic stakeholders. To achieve this, research designs must be adapted to incorporate multiple epistemological and methodological perspectives (Fals Borda, 1992/1980, p.71; Hoffmann et al., 2019, p. 37).

This shift challenges traditional categories regarding who produces knowledge and how it is produced. Consequently, ID and TD require adaptability and flexibility, as they unfold within a process marked by uncertainty, tensions, and enriched by multiple forms of learning.

Finally, a political motivation refers to the explicit pursuit of research outcomes with differentiated effects on the problems addressed and the stakeholders involved. This motivation embodies an ethical responsibility, recognizing that academic research must not only advance knowledge but also contribute to transforming pressing societal challenges. As Fals Borda (1979) proposed, this framework emphasizes a “commitment-to-action” for researchers engaged in ID and TD. This commitment manifests on (at least) two levels: a level of awareness and reflectiveness, requiring a critical and situated analysis of the structural conditions that generate and sustain the problems under investigation, and a level of theoretical and conceptual knowledge, enabling researchers to critically engage with existing interpretative frameworks and the methodological tools they employ.

These two dimensions are symbiotic and mutually influence research design and its contextual application. In this sense, drawing on Participatory

Action Research (PAR) (Fals Borda, 1992/1980, p.81), the “reflection-action and action-reflection” principle is reaffirmed as a continuous and reciprocal articulation between knowledge production and praxis.

Together, these three motivations define the ethical-political turn, shaping participatory spaces that are co-produced, relational, diverse, and emergent—never rigid but always negotiable. Following Guerreiro Ramos’s (1959) argument, reflecting on the underlying assumptions of scientific activity reveals that research is embedded in a network of complex relationships that structure the world as perceived by the researcher inhabiting it. Recognizing this leads to the acceptance of an inescapable involvement in the research context and to the formulation of what Guerreiro Ramos terms the “Law of the Researcher’s Commitment.” According to this principle, researchers must consciously commit to their environment by identifying research problems and questions collaboratively with extra-academic stakeholders, developing conceptual and methodological pathways adapted to these challenges and considering the potential applications of the knowledge produced (Guerreiro Ramos, 1959; Naidorf, 2017, p. 3).

Acknowledging and negotiating these ethical-political dimensions and recognizing these motivations as integral to ID and TD dynamics can be particularly challenging for those unaccustomed to critically reflecting on the meaning of their practices. However, incorporating these considerations into each process creates opportunities to forge new—sometimes unexpected—alliances, explore innovative methodological approaches, and, in some cases, bring about transformations in the epistemological and methodological practices of the disciplines involved (Chambers et al., 2022; Tuana, 2013, p.1965).

The Participatory Turn: Types of Participation and New Roles

The participatory turn entails recognizing the need to integrate diverse forms of knowledge, thereby expanding the repertoire of disciplines and stakeholders beyond academia. Making participation a real, non-normative exercise presents several challenges. It requires acknowledging how participation manifests among actors for joint decision-making or responsibility allocation. Within the same process, various types of participation can occur, and a single actor may assume more than one role at specific moments. This diversity means participation is not always singularly defined, allowing for situated narratives of participatory practices in process (Chilvers & Kearne, 2020, p. 8).

To understand the levels of participation within the frameworks of ID and TD, Arnstein’s (1969) citizen participation typology is useful. It conceptualizes participation as a means of redistributing power, enabling traditionally excluded stakeholders to engage in decision-making processes. The eight levels distinguish varying degrees of participation. The first four levels reflect “classical” dynamics of unidirectional communication—from researchers to

stakeholders—where stakeholder opinions are sought without guaranteeing integration. From the fifth to the eighth levels, significant differences in participation dynamics emerge, enabling shared decision-making, granting stakeholders greater authority, and establishing negotiation spaces between participants (Arnstein, 1969).

This turn promotes experimental, reflexive, and responsible participatory practices that must be situated in the context of their application and the characteristics of the actors involved (Chilvers & Kearne, 2020, p.12).

Another challenge lies in reconfiguration of learned roles among different actors—both academic and stakeholders—to enable processes of knowledge integration and the design of new interaction dynamics. In the case of stakeholders—who may come from various domains such as public policy, social organizations, or the productive sector—their involvement in knowledge production processes requires acknowledging the partiality, fallibility, and ubiquity of knowledge, positioning them as “lay experts” (Epstein, 1996, p. 3; Vienni Baptista et al., 2022a, p. 3). With this new role, their participation is legitimized by including them in epistemological and methodological definitions, contributing to defining the problem, providing information, and co-analyzing data (Epstein, 1996, p.335, 336; Nowotny et al., 2001).

As proposed by TD, one of the goals of broadening participation is to build partnerships rather than conduct mere consultations. According to Fricker (2017), involving stakeholders seeks to counteract the dismissal of their perspectives as “less credible,” which leads to unilateral views of the problems addressed and reproduces “epistemic injustice.” Just as the actions of stakeholders can be guided by scientific knowledge, researchers’ actions can be informed by the knowledge contributed by stakeholders. Finally, these actors can identify potential flaws in scientific knowledge and promote the creation of “hybrid knowledge” that includes various perspectives (Vessuri, 2004, p. 186). This does not mean that any conflict between the two types of knowledge is attributable to scientific knowledge. On the contrary, dialogue is necessary to determine which type needs reforming, or if both do.

Researchers also take on different roles, which are gradually reformulated. In this sense, the classification of roles by Pohl et al. (2010), within the TD framework, as reflective scientists, intermediaries, and facilitators, proves useful for identifying the new characteristics they assume. The reflective role involves providing a scientific experience validated as “objective” or “intersubjective” by the relevant discipline after presenting evidence. The intermediary role entails mediating between the different “ways of thinking” brought by the interacting actors. Finally, the facilitator role seeks to assist diverse actors in addressing challenges in ways that foster openness and discussion, triggering a collective learning process. Transitioning between these roles requires skills developed throughout the process, which presents significant challenges.

Within this framework, the metaphor of hybridization also applies to the participating disciplines as they interact with others, reconstituting their identity in a new way through conceptual contact with other disciplines. This does not imply a disappearance of their initial constitution; rather, it reflects a dual identity: being an original input that continues to exist independently while simultaneously transforming through its application and interaction with other disciplinary and conceptual inputs (Follari, 2008, p.73).

In short, instead of conceptualizing participation as a transferring of “control”—from one actor to another or from one discipline to another—the emphasis is placed on mutual learning through continuous dialogue. In this way, the “static” image of the participation—where actors are fixed at specific moments performing a single role—is abandoned for a dynamic (pendular) image in which actors can assume different roles and engage at different moments throughout the process (Felt et al., 2013; Kestra, 2019, p. 118).

The Contextual Turn: Social Usefulness and Mobilization of Knowledge

Complex problems emerge within a specific context and, therefore, their solutions must be sought within that “context of application” (Gibbons et al., 1994, p. 15). Knowledge is always produced through a continuous process of negotiation, taking into account the social, political, economic, environmental, and cultural circumstances in which problems are situated, the actors involved, and those striving to transform them.

In line with Nowotny et al. (2001), context can be understood as an agora, a space of knowledge production in itself, open to a repertoire of knowledges and demands from multiple academic and extra-academic stakeholders. Focusing on contextualization not only entails increasing the number of participants—along with their diversity, experience, and interests—but also designing practices that facilitate their participation, thereby expanding perspectives on both the problems at hand and the new knowledge required to address them. This approach considers the social, economic, and cultural particularities, among other factors, that shape and influence the problems and demands of extra-academic actors. Within the specificities of each context, experiences, objectives, values, and expectations converge, fostering more reflective and open decision-making processes and strengthening both the social utility and robustness of knowledge (Nowotny et al., 2001).

Context is “co-constituted and emergent in practices, rather than an external, exogenous structure constraining from the outside” (Phillips & Napan, 2016, p. 828). Therefore, context is never entirely given, as it integrates dynamics linked to different temporalities—historical, present/urgent, and future. In this scenario, different actors negotiate intersubjective and collective experiences, while knowledge is circulated and tested in an effective collaboration that reshapes perceptions and behaviors, ultimately

redefining the usefulness that such knowledge acquires (Hoffmann et al., 2019).

Utility is not a fixed or univocal category, nor is it determined by a single actor at a specific moment. On the contrary, meanings of utility emerge throughout the process of interaction, evolving through the exchange of knowledge, interests, and expectations. Thus conceived, utility remains a dynamic and continuously evolving category (Vaccarezza, 2009).

Interwoven with that utility, the notion of “knowledge mobilization” provides a framework for understanding the implementation of new knowledge through reciprocal and complementary flows, enriching the concept of the social utility of knowledge (Naidorf, 2014, p. 15). In line with this requirement, ID and TD aim to create knowledge ready for use by the stakeholders for whom it is intended. This entails going beyond the traditional dissemination stage and finding pathways that link knowledge production with the concrete use of that knowledge. Thus, knowledge mobilization involves a series of strategies and actions in the workings of the process that are never linear and rather involve a negotiation regarding meanings, frames, and definitions. The new knowledge and its utility combine with the context—as a space of implication—requiring continuous effort to foster a sense of shared ownership among the different actors (Chambers et al., 2022, p. 12).

The Dialogical Turn: Integration of Knowledge

Facilitating interaction among diverse stakeholders, integrating knowledge and experiences within specific contexts, and considering the characteristics of the participants necessarily require a tailored design that fosters dialogue and continuous learning.

As a methodological principle, dialogue seeks to establish and design a shared space where stakeholders can dissent, agree, and reach consensus, constructing a type of knowledge that—working across disciplinary boundaries—challenges the identity of disciplinary practices and aligns with democratic forms of participation (Funtowicz & Ravetz, 1993, p. 25–26; Phillips, 2011; O’Rourke & Crowley, 2012).

The notion of a “community of practice” (Wenger, 1998) becomes a valuable concept for understanding the network created and sustained through interaction, dialogue, and exchange among stakeholders. Within these communities, theoretical and conceptual complementarity emerges for problem-solving, daily practices are transferred and shared, and methods are developed to integrate knowledge and navigate agreements and disagreements, openings, and disconnections.

Following Hoffmann et al. (2017a), three levels of integration can be identified within the framework of these communities: epistemic integration, which combines and interrelates different types of scientific and practical

knowledge with the aim of generating new and useful insights that go beyond the individual outcomes of research projects; social-organizational integration, which ensures that the interests, perspectives, and expectations of the stakeholders are acknowledged and harmonized; and communicational integration, which involves the development of a shared language that facilitates effective communication among all participants (Hoffmann et al., 2017a, p. 3).

Through the pursuit of these different types of integration, communities enable the development of a shared repertoire of resources that are strengthened over time, trust, and sustained interaction among participants. It is important to note that integration is influenced by the objectives to be achieved, the questions to be addressed, the desired outcomes, the stakeholders involved, their participation, and the roles and responsibilities assumed within the community (Hoffmann et al., 2017b, p. 10; Keestra, 2019; Klein, 2012). This process is inherently unique, flexible, and highly experimental.

Two central elements emerge within the framework of these communities: the skills developed by stakeholders to address the recurring challenges of integration and the methods designed to facilitate these processes. Regarding the necessary skills, Hoffman et al. (2017a) identifies several characteristics within these processes. While social skills help foster strong relationships among participants, communication skills stimulate the flow of information and the exchange of knowledge, and cognitive skills enhance understanding of the theoretical and methodological challenges surrounding interaction and research questions. As these skills are cultivated, new solidarity-based and reciprocal relationships are woven among stakeholders, with attention to both the processes and the sociocultural and temporally contingent spaces in which they occur.

Regarding the methods, their combination and construction are key to facilitating interaction among stakeholders and integrating their knowledge. This design must incorporate process flexibility, participant iteration, and sensitivity to their interests, making it highly reflective in nature (Hoffman et al., 2017b). Within the framework of these communities, the challenge lies in “weaving”—as described by Tengö et al. (2014, p. 4)—the outcomes of diverse knowledge systems while preserving their unique contributions. In this context, the previously identified skills are essential for “facilitating” this intricate interplay of knowledge and experiences.

The literature identifies various “integration methods” (Bergmann et al., 2012), methods originally derived from a monodisciplinary context that require adjustments to fit within an ID and TD environment. Methodological creativity and innovation are essential prerequisites for the success of integrative research (Bergmann et al., 2012, p. 80). In this context, the process of employing different methods to address the same problem constitutes a form of triangulation. These methods include the definition of concepts and theoretical frameworks, which foster shared understanding across disciplinary

boundaries; the formulation of research questions, where problems are translated into researchable objects; the design of evaluation processes, which merge multiple criteria from diverse perspectives into new procedures; and the development and application of models that link theoretical and empirical descriptions, among others.

A particularly useful tool in this framework is the concept of “boundary objects” (Leigh Star & Griesemer, 1989), designed to facilitate dialogue among stakeholders and promote knowledge integration. Represented through maps, images, diagrams, databases, technologies, and other formats, these objects help identify the knowledge contributed by each actor without requiring significant effort to translate or transform concepts. They also serve to identify tensions in stakeholders’ perspectives and enable potential areas of agreement. By incorporating these tools at various stages of the research process, the aim is to foster situated learning and the co-creation of new knowledge, which is ultimately reflected in a new shared object.

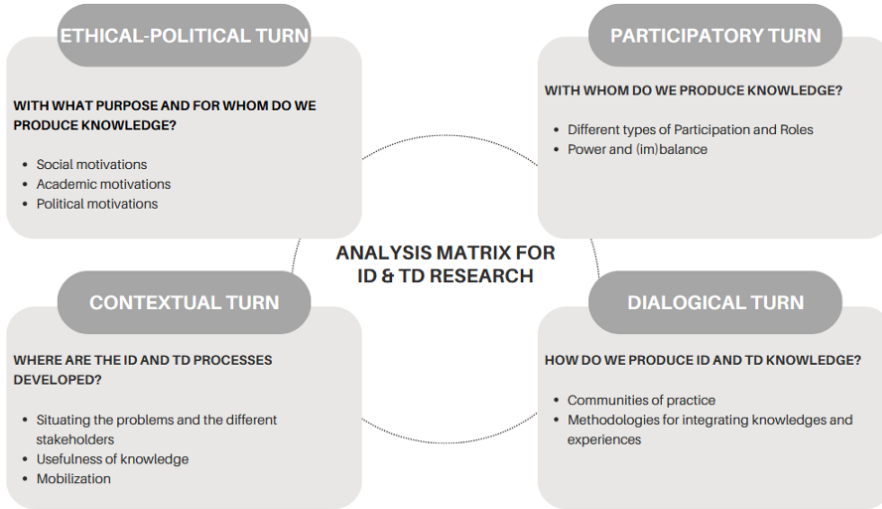
Within the framework of this community, it is crucial to address power-knowledge asymmetries between researchers and stakeholders, understood as the capacities of an individual or group to constrain the options of another, potentially suppressing or distorting evidence (Tengö et al., 2014, pp. 6–7). These asymmetries may be explicit, implicit, or invisible, and can manifest as dynamic, relational, multidimensional, or context-dependent phenomena, shaped by the circumstances and interests of those involved. Making these asymmetries explicit necessitates critical reflection on the assumptions and expectations surrounding participation, as well as on the roles and responsibilities assigned to each stakeholder (Phillips et al., 2018, p. 9).

Under this turn, the dimensions of preceding frameworks converge into a dynamic and reflective process, where participants mutually influence one another and collaboratively construct meaning. Stakeholders must be prepared to adjust their perceptions and engage in a situated process of mutual learning, finding ways to navigate and address any tensions that arise. Dialogue, as the guiding principle of these knowledge production processes, embraces divergence and controversy in the issues at hand, fosters symmetry in exchanges, and encourages a plurality of perspectives for problem-solving. The knowledge and experience contributed by each stakeholder are revisited and rediscovered, enriched by the collective value of co-produced knowledge.

Figure 1 shows how the analysis matrix is composed, with the four turns described above and the dimensions identified in each turn.

The matrix aims to facilitate the recognition and analysis of ID and TD practices, particularly in vulnerable contexts and in addressing the complex, multifaceted problems present in Latin America. This design seeks to create situated approaches that, through their application, adaptation, and continuous transformation, contribute to expand the ESIT community—often fragmented and unacknowledged—and foster dialogue with analyses from

Figure 1. Analysis Matrix for ID and TD Research



different regions. Each turn and dimension gains full meaning in relation to the others, providing an open orientation that remains receptive to further enrichment.

Through its development and application, the matrix seeks to establish a common space for exchange and reflection, to strengthen and legitimize these processes in contexts where these practices continue to experience heterogeneous institutionalization (Vienni Baptista & Klein, 2022).

Methodology

With the aim of putting ID and TD practices and the lessons learned into dialogue, the matrix design was applied to four research groups of the University of the Republic, Uruguay. The four groups were: Dalavuelta; Hacklab; Interdisciplinary Research Group for Actions against Inequalities in Rural Areas (IADR); and the Co-Innovation Group for Development. For their selection, certain cross-cutting criteria were applied to identify common characteristics among them. These four groups address different social problems, namely: improving accessibility and quality of life for people with disabilities; designing production models that are environmentally sustainable and sensitive to the needs of family producers; and transforming gender inequalities in trade unions. In addressing these problems, the groups seek to produce potentially applicable knowledge. All four work with different extra-academic stakeholders, promoting methodological strategies to integrate their knowledge and

experiences, at different moments and with varying degrees of participation. Finally, all groups include researchers from different disciplines and, among other objectives, aim to develop an interdisciplinary perspective that enables them to identify new dimensions in the problems addressed.

For the application of the analysis matrix, each research group was used as a case study under a qualitative methodology design (Flick, 2014; Yin, 1994). It should be noted that, as case studies, they cannot be generalized for statistical purposes but only for theoretical propositions, given that the objective is to expand and generalize theories (analytical generalization) rather than quantify frequencies (statistical generalization). Each specific experience involves, contains, and constructs its own work dynamics, rhythm, language, connections among stakeholders, spaces for knowledge integration, expectations, tensions, and lessons learned. Therefore, it is assumed that these cases provide a better understanding of the dynamics that ID and TD processes bring to knowledge production in Latin America.

To develop the analysis, four research projects—one per group—were selected from those conducted during the 2017–2019 period. Table 1 presents the selected projects, their timeframe, their objectives/problems, and the academic and extra-academic stakeholders who participated.

Based on the proposed matrix, the questions formulated within each turn, and the identified characteristics, the dimensions that guided data collection and analysis were: (i) the motivations guiding the design of ID and TD processes, (ii) the broadening of participation of various stakeholders and the adoption of new roles, (iii) the contextualization of the proposed design and dynamics, and (iv) the dynamics of negotiation and production of new knowledge.

The data gathering stage (Flick, 2014) involved conducting semi-structured interviews with researchers (a total of 36), participating in meetings between researchers and extra-academic stakeholders (a total of 30), and reviewing a total of 130 documents, including research projects, scientific and dissemination articles produced by the projects, research theses connected with the projects, and other informational materials (newsletters, videos, etc.) distributed in various formats (electronic and paper-based).

The proposed qualitative content analysis (in line with Mayring, 2000; Schreier, 2014) emerged from individual and collective learning processes based on systematic self-reflection on contextualized experiences. Finally, the analysis proposed in the matrix's application—through the turns and the characteristics they provide—aims to contribute to the recognition of these practices and their effects.

Table 1. Project Name, Timeframe, Objectives, and Academic and Extra-Academic Stakeholders Involved in the Projects

	RESEARCH GROUPS			
	Dalavuelta	Hacklab	IADR	Co-Innovation
Project Name	Research Applied to Interdisciplinary Spaces for the Inclusion of People with Physical Disabilities	Prosthetic or Orthotic Components and 3D Printing for Inclusion Purposes	Inequalities in the Participation of Male and Female Rural Workers in Uruguay: Toward an Organizational Innovation	Building Resilience to Climate Change and Variability among Small-Scale Producers in Vulnerable Situations
Timeframe	2016–2019	2016–2019	2016–2019	2017–2019
Objective/ Problem	Furthering the inclusion of people with physical disabilities through the generation of affordable and potentially mass-produced technical mobility aids.	Researching and developing solutions for specific problems faced by amputees and their reinsertion into the labor market using 3D printing technology.	Contributing to the strengthening of labor organizations by furthering equitable participation of male and female rural workers in trade unions through a diagnosis and the co-drafting of trade union organization proposals.	Reducing vulnerability and enhancing resilience to climate change and variability among small-scale livestock farms in highly drought-sensitive landscape units in the Basaltic Slope and Eastern Sierras regions.
Academic and Extra-Academic Stakeholders	Academic Stakeholders: Mechanical Engineering, Physiotherapy, Occupational Therapy, Industrial Development and Design. Extra-Academic Stakeholders: Association for the Recovery of People with Disabilities (APRI), Casa Gardel, Ministry of Social Development - National Disability Program (MIDES-Pronadis).	Academic Stakeholders: Industrial Design, Physiotherapy Extra-Academic Stakeholders: State Insurance Bank (BSE).	Academic Stakeholders: Sociology, Psychology, Agronomy, and Geography. Extra-Academic Stakeholders: Rural workers' unions (SUTTA, UNATRA).	Academic Stakeholders: Agronomy (various areas of specialization). Extra-Academic Stakeholders: Family farmers, Ministry of Livestock, Agriculture, and Fishery (MGAP), National Institute of Agriculture and Livestock Research (INIA), National Colonization Institute (INC).

Note. Table prepared by the author (2024) based on material provided by the research groups.

Relevance Reflection

The exercise of applying the matrix to concrete research experiences of these four groups yielded the following reflections and analysis.

Ethical-Political Turn

Even with different starting points, disciplines, frameworks, and problems addressed, common aspects can be identified across the four groups that led them to design and implement ID and TD research processes. These aspects are reflected in the social, academic, and political motivations that guide and distinguish these processes, highlighting a situated reflection on the knowledge being produced.

Through diverse pathways, the social motivation drives the fostering of spaces of proximity to the immediate context and to various extra-academic stakeholders, helping to uncover different problems. With both recent and longstanding connections, the groups are responsive to the demands of extra-academic stakeholders that can be met, or at least advanced, collaboratively. Thus, the recognition of specific problems—for instance, mobility issues in the case of Dalavuelta and gender inequalities in participation in the case of IADR—and their impacts on the well-being, rights, and quality of life of different groups triggers a reflection on and a responsibility to contribute to their resolution.

The academic motivation, in interrelation with the social motivation, reflects an incorporation of these identified contextual problems into their research agendas, with the aim of producing new knowledge. This reflects a persistent effort to bridge the gap between the knowledge generated by academia and the problems faced by extra-academic stakeholders. Within this framework, new questions are formulated, addressing previously unexplored dimensions—for example, in the case of Co-Innovation, explicitly linking social, health, and productive aspects. Furthermore, integrating these extra-academic stakeholders and transitioning through interdisciplinarity requires modifications in research designs to encompass all the perspectives involved.

Finally, the political motivation focuses—right from the beginning of any process—on emphasizing the social relevance of the knowledge and innovations produced, with the aim not only of advancing understanding but also of ensuring that such knowledge is utilized by the broader group of extra-academic stakeholders to contribute to problem-solving.

Each motivation can be seen as a space for reciprocal questions that permeate ID and TD practices. Together they build a conscious commitment-to-action that alters traditional academic culture and prompts discussions regarding not only the guiding principles of each field or discipline, but

also the role of research in the social context in which it is conducted. In an interrelated way, all three motivations reveal the particular characteristics within the framework of this ethical-political shift, presenting an openness that can be recognized as a hallmark of ID and TD processes, where dynamics remain receptive to contexts, stakeholders, and knowledge.

Participatory Turn

In the effort to promote an interdisciplinary process and expand participation toward different perspectives, all groups found themselves in an “incipient” stage. Although they recognized the relevance of these approaches, the lack of experience and, in most cases, the limited time of each project may have restricted their depth. In some groups, the composition of disciplines was broader—such as in Dalavuelta and Hacklab—while in others, it was narrower—such as in IADR and the Co-Innovation group.

To broaden the participation of various extra-academic stakeholders, necessary to strengthen the knowledge produced, promote its mobilization, and ensure its contextual anchoring, all groups engaged in an active “search” to identify who should be invited to join the process. Strategies varied, depending on existing relationships or the need to build new ones. For example, Dalavuelta and Hacklab conducted “institution mapping”—through interviews and visits—to identify the profiles of stakeholders, their objectives, the scope of their actions, the types of activities they engaged in, and the organizational and economic vulnerabilities they faced, which could impact their active participation at different stages. In contrast, the Co-Innovation group already had established connections with some stakeholders but still needed to extend invitations to participate and commit to the process. The invitations were accompanied by presentations on the project, its objectives, and the characteristics of the co-innovation approach.

It is essential to highlight that the various extra-academic stakeholders adopted different types of participation throughout each analyzed process. However, a common aspect among all groups was the effort to build and enable spaces—through diverse designs—that allowed those directly experiencing the addressed problems to engage in direct and/or associative participation. This effort posed multiple challenges, as these stakeholders often face vulnerabilities—social, economic, health-related, among others. This highlights the importance of situating the context’s characteristics where these processes took place to design feasible strategies, primarily by the researchers.

Regarding the roles adopted by the stakeholders, certain common strategies emerged in how the groups identified and defined problems, enabling them to begin reconfiguring traditional roles. The development of each process itself became a learning space where strategies were tested and practiced. In promoting an interdisciplinary perspective, researchers adopted different

roles—reflective, intermediary, and facilitator—with the aim of fostering dialogue and integrating diverse knowledge. For instance, coordinators from two distinct disciplines organized internal seminars to recognize different contributions, identify points of intersection, and convened collective spaces where problems were presented and addressed from various disciplinary perspectives.

In the case of extra-academic stakeholder participation, jointly identifying and defining the problem served to clarify their roles within each process. As a common strategy, all groups initially began by building and systematizing diverse datasets, which enabled a better understanding of the problems, the identification of different dimensions, and, consequently, joint decisions on how to address them. In this framework, extra-academic stakeholders were not only “qualified informants” facilitating better problem definition but also “translators” of different dimensions, “interlocutors” with other stakeholders, “gatherers” of information, and co-analyzers of systematized data. Their role was never linear and, in many cases, served to highlight latent problems that had not yet been identified. For instance, as illustrated by IADR, a question raised by a rural salaried worker (“Where are the women in rural unions?”) served as a catalyst for a deeper analysis of gender inequalities and the intersection of diverse perspectives.

This shared problem definition required researchers to transform their roles as well. They had to step out of their “comfort zone” and navigate boundaries between disciplines to fill the “gaps” in knowledge production. Mediating between disciplinary contributions became essential to construct previously absent understandings. A clear example is the design of technical aids—such as those developed by Dalavuelta and Hacklab—for improving mobility for people with disabilities. Knowledge from various disciplines—engineering, occupational health, and industrial design—was integrated, recognizing extra-academic contributions, to design prototypes effectively usable by the intended population. These new roles, adopted by all stakeholders, did not emerge automatically or harmoniously. Rather, they required a deliberate and continuous effort, often marked by tensions. This dynamic eventually led to understanding, facilitated by creating spaces and mechanisms for dialogue.

Contextual Turn

Following the characteristics analyzed in the preceding turns and within the framework of the redefinition of context as a space where problems, actors, and knowledge production intersect, researchers had to modify their engagement with the immediate context of action. As the research teams highlight, broadening participation also required recognizing how extra-academic actors identified problems and contributed to context-specific solutions. That is, problems, stakeholder participation, and the various outcomes intersect across multiple dimensions, each of which has effects throughout the entire process.

Usefulness is not a fixed category; rather, like the ID and TD processes, it unfolds through different phases and is built collaboratively. The ongoing transaction between actors characterizes these dynamics, and this is reflected in the final product. In the case of Dalavuelta and Hacklab, some of the designs—such as electric couplings and 3D-printed prosthetics—were not initially the most “visible” options in the list of assistive technologies available to people with disabilities. However, throughout their development, the process itself helped reveal their advantages and potential applications for improving mobility and accessibility.

At IADR, the final outcome—a booklet addressing gender inequalities—gained greater significance following the direct request of rural salaried workers: “How do you plan to close the project? Are you just going to deliver information?” The collaborative construction of the booklet—including discussions on what topics to cover, which data to incorporate, the language to use, and the visual elements—ensured that the final product met the expectations of all involved.

For the Co-Innovation group, the “co-innovation stories” created for each farm documented the different trajectories of each producer throughout the process. These were compiled into an accessible document, outlining the various stages, supporting the evidence generated, systematizing methods and proposed redesigns, and illustrating how producers strengthened their capacity for planned action.

The mobilization of results and ensuring their real-world use by extra-academic actors aligned with the initial motivations of each process. This also entailed a learning process for all participants, especially for extra-academic actors, who, as they co-produced new knowledge, gradually appropriated it through practice. For Dalavuelta and Hacklab, the openness of assistive technologies meant that they could be made more accessible—not only in terms of economic costs but also regarding the materials used in their fabrication. Additionally, ensuring replicability was key, taking into account what could be produced within each specific context. The assistive technologies designed by both groups remained “open,” meaning their designs were made publicly available to be replicated and further improved for better usability.

Meanwhile, at IADR and within the Co-Innovation group, the booklet and the “co-innovation stories” not only recognized partners as direct users of these materials but also enabled them to transfer these products to other spaces—such as public policy discussions—thereby enhancing their impact on problem transformation.

Dialogical Turn

The forming of different spaces—“exchange groups,” “interpretative focal groups,” and “workshops”—served to establish “communities of practice” that

situated the interaction and integration of knowledges among the different stakeholders. A strategy deployed by all the groups involved establishing these communities in the territory of the extra-academic stakeholders.

This approach sought to ensure that participants did not feel “detached” from the process, while also furthering their comfort and reducing asymmetries. By striving to connect previously unrelated experiences and knowledges, each community enabled the circulation of ideas and perceptions that stakeholders brought with them. With no pre-established formula and employing various methods, these spaces created opportunities—at different stages—for the integration of knowledges and experiences.

It should be noted that within these communities there were also tensions among the interacting stakeholders. For instance, making tacit knowledge explicit—knowledge that extra-academic stakeholders brought with them as a result of navigating various problems and their own practices—was one such challenge. Similarly, disciplinary knowledge could sometimes feel foreign to extra-academic stakeholders. Thus, within each community, different strategies—such as establishing a common language—were developed to create a space for exchange and negotiation. These efforts sought to reduce potential power-knowledge asymmetries among stakeholders, which, even unintentionally, could lead to some participants adopting a less active role in the shared effort of knowledge production.

Taking this into account, and with the goal of furthering the circulation of knowledge, the groups built spaces of trust—“favorable environments”—for all stakeholders to feel comfortable in. The social-interactive dimension that permeated each community was key for fostering trust, promoting collaboration, and strengthening the credibility of the knowledge produced. To facilitate interaction and integration within these communities, the methodological designs deployed can be viewed as catalysts for situated and shared learning. While these designs were given different names—“innovation circuit,” “user-centered methodology,” “feminist methodology,” and “co-innovation approach”—they had a common denominator: guiding the way in which stakeholder relations were established and creating different spaces for knowledge and experience integration. In this framework, the “boundary objects” applied enabled the convergence of interests, knowledges, and experiences. These objects can be seen, for example, in “technical aids,” “maps,” “interview fragments,” and “problem trees,” as these were elements that facilitated a heuristic analysis of the problems, expanding the limits of the knowledge that had been constructed until then.

Through these objects and within the framework of the designed methodologies, the aim was for the community to engage in collaborative data analysis and ultimately arrive at knowledge consensually constructed among the stakeholders, facilitating its application. The knowledge produced in these spaces emphasized partiality, localization, and the multiplicity of

voices, perspectives, realities, and meanings. Partiality—and not universality—is a condition of enunciation, whereby statements are made from the lived experiences of people and their engagement with problems, rather than from “nowhere.”

Future Prospects

The development of ID and TD practices across various domains is a necessary response to the growing demand for research to integrate into different social spheres and address the complex problems of today. However, much remains to be learned about how these dynamics unfold, in order to strengthen their support systems and allow them to reach their full potential.

Working within the framework of an ID and TD process is not something that happens automatically, nor is there a single pathway to its “success.” In a sense, these processes are experimental, as tackling different problems provides a framework for creating diverse, often cyclical designs. Collective experimentation introduces novel forms of participation and organization that generate expressions or formulations of problems that might otherwise remain unidentified.

The analysis proposed here, using the matrix as a tool to identify and characterize different dynamics through the turns and dimensions that compose them, seeks to contribute new epistemological, methodological, and ethical-political questions to research processes. By identifying the four turns and their characteristics, the aim is to build a tool to analyze how these dynamics are put into practice, addressing the complexities and nuances inherent in this type of research. Its design and implementation strive to deepen the understanding of what ID and TD processes are and do, rather than focusing solely on what they should be, thereby situating their development within the Latin American context.

The matrix provides a multidimensional and context-sensitive approach to practice, functioning as an enabling tool for generating locally valid and socially robust knowledge about ID and TD dynamics with transformative potential. It synthesizes multiple orientations reflecting ID and TD dynamics across various levels—personal motivations, relationships among actors, and connections to the context—while addressing a recurring theme in the many definitions of ID and TD: how complex problems are solved and questions are answered that cannot be satisfactorily addressed using singular methods and approaches. Its design and application aim to contribute to the political and practical efforts of ID and TD by facilitating their translation, circulation, and construction as a dynamic and constantly evolving field that, at times, results in the transformation of epistemological and methodological practices among the disciplines and actors involved.

Each turn poses a central question that guides the characteristics of the dimensions to be examined and analyzed: Why do we address problems, and for whom is this new knowledge useful? Who participates in these processes? How do contexts influence them, and how are they approached (methods)? The interrelations among these turns and dimensions operate as a heuristic framework that can be expressed as a rule for systematic analysis while recognizing perspectives, interests, and motivations that are often silenced.

The proposed matrix, based on applied results and analysis, offers the possibility of application to new cases and contexts, as well as its potential to be included in the repertoire of other tools focused on the analysis of ID and TD. In this sense, it is vital to continue exploring and problematizing the forms that interactions among different actors and the integration of knowledge take, unraveling the complexities of these dynamics and facilitating smoother practices between disciplines and diverse actors.

This proposal aims to contribute to the philosophy of interdisciplinarity, with the objective of expanding the understanding and analysis of knowledge integration and the varied methodologies that facilitate these processes. As an epistemic practice, ID and TD require a reconfiguration of the research process, necessitating the development of new conceptual and methodological structures by the actors involved to advance toward a meaningful integration of diverse knowledge forms. In turn, this implies recognizing the interdependence between knowledge production and the social and political context in which it takes place.

This framework seeks to support this cognitive endeavor and create more context-sensitive approaches in Latin America, drawing from the legacy of critical social thought whose central feature is an interdisciplinary approach to analyzing regional problems and trends, resignifying these practices. Incorporating a regional perspective could help identify failed strategies and successful ones with greater precision, thereby avoiding the need to “reinvent the wheel” with every new attempt. This approach would contribute to strengthening the collective knowledge base, ensuring that ID and TD research in Latin America continues to evolve in a way that is contextually relevant and epistemically robust.

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