



Logics and Enablers of Transformative Innovation Policies


The case of the Colombian Appropriation of Science and Technology Policy

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ABSTRACT

In this work, we seek to answer the question, what are the main logics and enablers underlying the implementation of TIP policies in countries of the Global South? We address this question using the *Path-transformative heuristic* (Pinzón-Camargo *et al.*, 2020; Pinzón-Camargo, 2022). This heuristic combines two approaches, path dependency and institutional entrepreneurship theories, to explain the processes, decisions, and actions carried by actors in building an alternative path and how they face internal and external pressures that could support or damage their processes. Using an illustrative case based on the Colombian Social Appropriation of Science, Technology and Innovation policy, we examine in-depth interviews and secondary data on the underlying logics and enablers of innovation policies with transformative potential. This work allows us to identify six underlying logics in three of the four phases of the Path-transformative heuristic and six enablers extended through all the transformative pathway. Those elements bring a starting point to unfold and better understand TIP in the Global South.

Keywords: Transformative Innovation Policy; Path-transformative heuristic; Transformative innovation enablers; Transformative innovation logics; Colombia; Global South.

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INTRODUCTION

Recent debates on science, technology and innovation (STI) policy are moving rapidly towards new frames that are concerned with societal and environmental challenges and the needed transformative change in these realms. Particularly, since Schot and Steinmueller (2018) distinguished transformative innovation policy (TIP) as a new frame, it has quickly pervaded policymaking circles.

Transformative innovation encompasses a broad set of practices that adopt a direct approach on development (Arocena & Sutz, 2017) and that intend to foster major long-term changes in sociotechnical systems, i.e. transformations in broader institutions, practices, infrastructures, networks, among other elements that sustain those realms where society and technology are embedded (Geels *et al.*, 2004). This means that transformative innovations aim at transforming unsustainable production patterns, but also incentivizing the necessary cultural and behavioural changes (Steward, 2008; Weber & Rohracher, 2012). In other words, transformative innovation aims at producing radical paradigm/systemic transformations in broad societal functions and realms: transportation, agro-food, sanitation, energy, among others (Geels, Elzen, & Green, 2004; Steward, 2008), which have deepened unsustainable industrial patterns leading to environmental degradation and societal inequalities (Kanger & Schot, 2019).

Under this frame, transformative innovation policy (TIP) is "a set of public actions and instruments, through which governments mediate and mobilise resources towards more sustainable and inclusive sociotechnical systems via the promotion of knowledge and innovation production, diffusion and use with a long-term perspective" (Ordóñez-Matamoros *et al.*, 2021, p. 119). Here, innovations seek to introduce changes at the level of broad societal functions or sociotechnical systems (Geels, Elzen, & Green, 2004; Steward, 2008). This implies new rationales for governmental intervention that go beyond market and systemic failures (Woolthuis *et al.*, 2005) to include transformational failures that governments should address to boost transitions (Weber & Rohracher, 2012; Schot & Steinmueller, 2018).

This particular policy frame is acquiring a prominent popularity within scholar and policy circles in the Global South, with an active diffusion and impulse given by global partnerships, e.g. the Transformative Innovation Policy Consortium –TIPC– composed by innovation policy agencies from Colombia, Finland, Mexico, Norway, South Africa and Sweden, and coordinated by the Science Research Policy Unit –SPRU– at the University

of Sussex in the United Kingdom and its sister project Deep Transitions coordinated by SPRU and the Centre for Global Challenges of University of Utrecht. However, the growing fondness of governments towards the explicit implementation of this approach contrasts with its actual viability, especially in the Global South.

For instance, in the case of Colombia, a transformative STI policy approach was adopted by the national STI governmental agency in *El Libro Verde 2030* in 2018, a policy document that explicitly orients STI policy towards the achievement of the Sustainable Development Goals. Nevertheless, the implementation of this policy approach in Colombia has not gotten sufficient support, among other things because of political reasons.

In this vein, it is possible to identify at least three reasons that arguably explains why an explicit TIP has not been implemented in Colombia.

First, *El Libro Verde 2030* was launched during the final months of the government 2014-2018, and the last administration 2018-2022 was not clear about this frame in its governmental program. Furthermore, there has not been a visible support to this policy document by governmental agencies in other sectors different from STI. Part of the problem is perhaps that *El Libro Verde 2030* depicts a rather normative narrative with no clear implementation plan. A recently elected new government for the period 2022-2026 seems more attuned with the TIP discourse, but it is still too early to conclude about real change.

Second, the sort of systemic transformations proposed by this policy frame are difficult to achieve in a country whose economy relies heavily on incumbent regimes based on extractive industries (e.g. mining, monoculture plantations, extensive stock farming), with path-dependence dynamics sustained by political elites that inhibit transformative change at the regime and system level. In other words, pretending to foster systemic transformations on a top-down basis seems to be less viable in political terms than steering bottom-up transformations at the local level. In this respect, although the new government claims it will diversify the economy to be less dependent on extractive sectors based on oil, coal and gas, the real substitution will heavily depend on its ability to mobilise sufficient political support in an adverse context, where the war in Ukraine has led the economy to benefit from raising prices and pressing social demands needing government subsidies funded by such royalties. Even in the context of the new government narratives, knowledge, science and technology is not part of the equation where tourism, another extractive activity, is seen as the chosen sector to substitute the funding necessary currently originating from the mining sector.

Finally, the implementation of this approach in Colombia has been limited by the dissonance between explicit and implicit STI policies, i.e. when STI policies enacted in formal policy documents, laws, executive decrees, among others, are incoherent with implicit STI policies that express the actual demand of society for knowledge, as well as the role and value that people ascribe to knowledge to address societal challenges (Herrera, 1973). In this particular case, while *El Libro Verde 2030* was enacted as an explicit STI policy that intends to implement global development agendas on a systemic basis focusing on societal and environmental transformations based on people's needs at the local level, implicit STI policies focus on economic growth and competitiveness.

This example makes us ask about what are the main logics and enablers underlying the implementation of TIP policies in countries in the Global South. This overarching question leads to making a first step to explore those elements based on an illustrative case from Colombia. In this vein, the illustrative case we study aims to bring insights from the Colombian case as building blocks for further discussions about the logic and enablers of TIP policies in the Global South. Therefore, we are not looking to extrapolate results from an illustrative case for all Global South.

The study of the possible logic and enablers underlying the TIP policies requires changing the field of analysis. This change means moving from a normative stance towards a positive analysis of STI policies designed intentionally with a transformative ambition unattached to the multilevel perspective (Geels, 2002) and TIP conceptualisations (Schot & Steinmuller, 2018; Gosh *et al.*, 2021). This sort of policy has been thought of with transformative intentions and implemented for a while now to produce the societal and environmental transformations needed by communities at the local level.

We analyse the case of the Colombian Social Appropriation of Science, Technology, and Innovation policy (hereinafter SASTI-policy). This policy shows, we claim, a long trajectory and transformation in its objectives and policy instruments, thanks to key roles played by institutional entrepreneurs. Hence, while in the early 1990's it was mainly a policy focussed on fostering scientific knowledge diffusion in a vertical relationship between academia and society, at the beginning of the XXI century, its directionality was changed by key actors and events. This change entailed a different meaning of this policy at the national level and the development of new policy instruments to address societal and environmental challenges at the local level. Examples of these instruments are: i) *A Ciencia Cierta* and ii) *Ideas para el Cambio*, a couple of programs implemented in the frame of our main case study analysis, the SASTI-policy.

We approach this case using an interpretative heuristic: the Path-transformative heuristic (Pinzón-Camargo, Ordoñez-Matamoros, & Kuhlmann, 2020). It allows us to inquire on the role of institutional entrepreneurs in shaping innovation policies with transformative potential, in a broader context of interactions between innovation policy, theory and practice (Kuhlmann, Smits & Shapira, 2010; Kuhlmann & Ordóñez-Matamoros, 2017). With this, we contribute to the reflection on the third innovation policy frame identified by Schot & Steinmueller (2018), from the perspective of a country from the Global South. This enables us to identify the peculiarities of this type of policies and to forecast their implications in this particular context.

The reminder of the paper is as follows: after this introduction, section 2 presents the main tenets of the path-transformative heuristic, which offer the conceptual elements to analyse the Social Appropriation of Science, Technology and Innovation Policy (herein-after SASTI-policy) case. Section 3 defines the methodological and heuristic approach, where the SASTI policy is briefly described, and section 4 presents the results of the analysis, the path-transformative heuristic is used to analyse the SASTI policy case. We discuss these results in section 5, and propose some final reflections in section 6.

I. CONCEPTUAL APPROACH

In order to understand the transformative potential of existing STI policies, as mentioned in the previous section, we are going to follow the *Path-transformative heuristic* developed by Pinzón-Camargo (2022) and Pinzón-Camargo, Ordóñez-Matamoros & Kuhlmann (2020). This heuristic offers a conceptual approach to understanding and unfolding processes of change based on the role of actors, mainly institutional entrepreneurs as agents of change. In this vein, the heuristic, as exploratory strategy (Kuhlmann, Stegmaier, & Konrad, 2019), combines in a layering process two literature branches, Path dependence and Institutional Entrepreneurship.

The path dependence theory, as the first heuristic's layer, is understood as a never-ending process of path dependence, path destruction and path creation (Hirsch & Gillespie, 2001; Martin & Sunley, 2006). This understanding of path dependence differs from the canonical comprehension of the concept developed by David (1985) and Arthur (1989), and it includes the interpretation offered by Garud and Karnøe about path creation (Garud & Karnøe, 2001a; Garud & Karnøe, 2001b; Karnøe & Garud, 2012). The second layer in the path-transformative heuristic is provided by the institutional entrepreneurship theory.

In this case, based on the works by DiMaggio (1988), Battilana, Leca, & Boxenbaum (2009) it is possible to position institutional entrepreneurs as agents who can explain the process of path creation, path destruction and path dependence. In this vein, these actors provide an endogenous explanation to the building paths processes and therefore, processes of institutional change (Pinzón-Camargo 2022). However, it is worth pointing out that these Institutional Entrepreneurs' agencies are distributed and relational (Garud & Karnøe, 2003; Cabero Tapia, 2019; Pinzón-Camargo, 2022), which means that institutional entrepreneurs are not heroes but are part of actors' constellations which work together performing differently roles.

Figure 1 depicts the path-transformative heuristic developed by Pinzon-Camargo (2022). It illustrates a process divided in four phases. Those phases are the Preformation phase, the Formation phase, the Creation phase, and the Development phase. The first one is focused on describing the dominant setting and the contextual conditions where the Institutional Entrepreneurs are embedded; the qualities and features of the Institutional Entrepreneurs; and the conditions that produced the critical juncture that boost the formation phase. The second phase describes the vision of change championed by the institutional entrepreneurs, the enabling conditions, strategies, and self-reinforcing mechanisms that support a niche building process. The creation phase draws attention to two activities. The first activity is to identify the practices that support introducing a change regarding the dominant setting identified in the first phase. The second one is to unveil the possible pressures that could undermine or stock institutional entrepreneurs' efforts to build the path-transformative process. Finally, the last phase tries to capture those endeavours by the institutional entrepreneurs to consolidate the new path, besides possible factors that contribute to or challenge such a consolidation process.

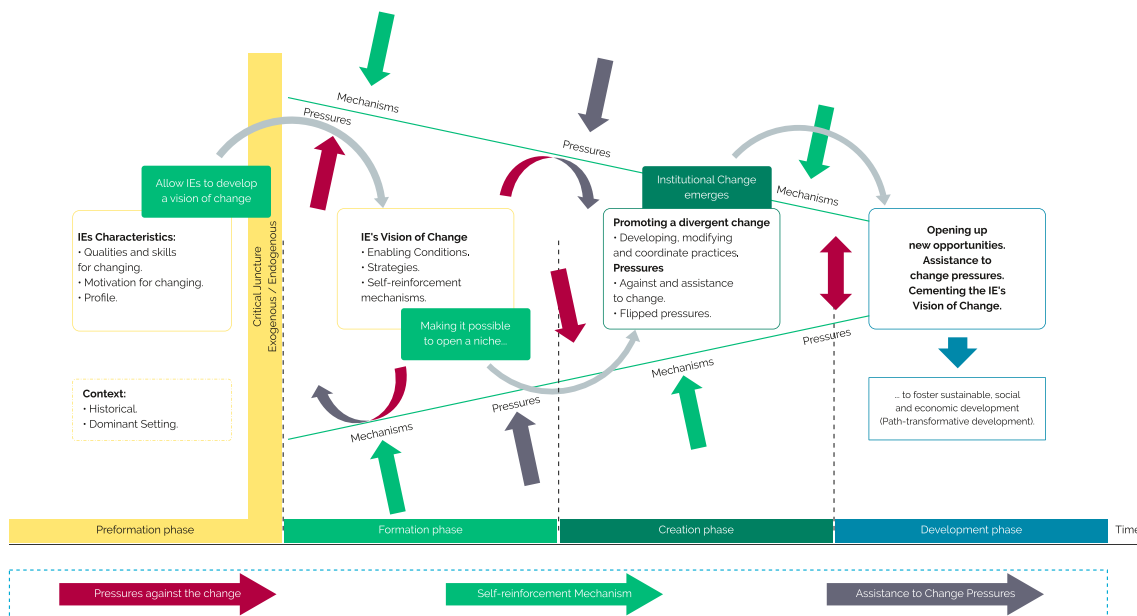


Figure 1. The Path-transformative heuristic. Source: Pinzón-Camargo (2022).

Based on Figure 1, Pinzón-Camargo (2022) develops a set of crucial concepts to follow the set of phases in the path-transformative heuristic. Table 1 introduces the concepts and their definitions.

Table 1. Main concepts to consider in a Path-Transformative Process.

Concept	Definition
Institutional entrepreneur	IEs are 'agents who initiate, and actively participate in the implementation of, changes that diverge from existing institutions, independent of whether the initial intent was to change the institutional environment and whether the changes were successfully implemented.' (Battilana, J., Leca, B., & Boxenbaum, E; 2009 p. 69).
Critical juncture	These events can be both exogenous but also created by actors. In the case of exogenous events, they can be used by the actors to support their actions.
Increasing returns	Like critical junctures, the increasing returns can be produced and used strategically by the actors. They also emerge from 'contingencies' that actors can manage to reinforce their path creation process.
Actors' strategies	It is a set of actions and behaviours made by IEs to support their vision of change and the introduction of the divergent change or to consolidate their Path-transformative process.
Vision of change	It is the set of narratives that combine the past, present, and future to support mobilizing skills and strategies from the IEs and their allies.
Practices development	They include old practices aligned with the new path's institutional logic and new practices. They are part of the niche that the IEs build by implementing their skills and strategies.
Lock-in	It is a state of temporary stabilization that allows both positive and negative outcomes based on the process of critical revision and mindful deviation done by the IEs.

Source: Pinzón-Camargo (2022, p. 208).

2. MATERIALS AND METHODS

As we mentioned in the former section, this study aims to understand the main enablers, and underlying logics of innovation policies with transformative potential. In this vein, we decided to follow the Yin (2018) case study methodology to build an illustrative study case that brings insights into the transformative potential of innovation policies in the Global South. Following that purpose, the Social Appropriation of Science, Technology and Innovation Policy was chosen. It is a policy led by the Ministry of Science, Technology and Innovation of Colombia. This case was studied in previous work by the authors (Ordóñez-Matamoros, G. *et al.*, 2021) as an illustrative example to understand what a Transformative Innovation Policy (TIP) could look like in practice. Although the case is the same, the analysis in this exercise takes distance from the first one in two senses. First, the amount of data (interviews and secondary information) is richer and deeply studied. Second, and more relevant, this work studies the case to understand in depth the underlying logics and enablers of innovation policies with transformative potential.

This case comprises a period between the early 1990s and 2021. In addition, the period was considered regarding the emergence of the idea of the social appropriation of Science, Technology, and Innovation in public policies in Colombia and its last advances. Before describing the policy and the data collected, it is worth pointing out why this country and this policy. Colombia was considered as an illustrative example of a country in the Global South with several complexities. In the first place, it is striving to find new path-transformative processes after more than 60 years of an internal armed conflict between Colombian state forces, paramilitary and guerrillas. In the second place, this country has been acknowledged as one of the most unequal countries worldwide, with problems of poverty both in urban and rural areas. In third place, Colombia shows a high dependency on extractive and other non-sustainable industries that have caused environmental damage, requiring Innovation Policies with a Transformative Potential that addresses such challenges. Finally, this country faces weak democratic institutions, high levels of corruption and an incipient sense of public good, which characterises many countries in the Global South.

These complexities have led to the necessity to find alternatives to transform the futures of Colombian society, like in most of the countries in the Global South. In this sense, SASTI-policy was identified as an effort of experimentation to build new development pathways in Colombia. This policy supported the study of the challenges associated with the operationalization of Innovation Policies with Transformative Potential in the Global

South. After the second part of the XXI century, the trajectory of this policy was changed by Institutional Entrepreneurs towards attending to the needs of local communities by using Science, Technology, and Innovation directly and involving different types of knowledge (Andrade-Sastoque & Balanzó 2017; Balanzó, Andrade-Sastoque *et al.*, 2021; Pinzón-Camargo, 2022). The objective of this policy was operationalized by two programs implemented since 2012, these programs were *Ideas para el Cambio* and *A Ciencia Cierta*. These programs used public calls that invite local communities and researchers to work jointly to address communities' needs or reinforce their path-transformative processes. Applications selected from these public calls receive funding and technical support to implement solutions co-created (Balanzó, Nupia, & Centeno, 2020) between the different actors involved.

The analysis in this study comprises a set of data constituted by three different sources. First, it includes seventeen interviews done in 2019 with current and former policy advisors at the Ministry of Science, Technology and Innovation (Before 2020 known as Colciencias) who intervened in the SASTI-policy and with actors from entities who have been working jointly with the Ministry. Second, it considers policy documents, official reports from the Ministry, proceedings from events and information from the Ministry and the Programs *Ideas para el Cambio* and *A Ciencia Cierta* websites. Finally, secondary information like news from local newspapers, videos, journal articles, book chapters, and dissertations that discuss directly or indirectly the case were studied. The data considered in this study were processed using the software, Atlas.Ti and following the categories described in the Path-transformative heuristic. Findings from the previous analysis were discussed between the authors and with other researchers in different forums.

3. RESULTS

The use of the Path-transformative heuristic leads to identifying the four phases that comprise a path-transformative process in the Colombian case, in particular in the SASTI policy. The results will be presented according to each of the four phases.

The Preformation phase

The Preformation phase began in 1994 in the frame of the *Science, Education and Development Mission* (Better known in Colombia as *Misión de Sabios*). It was a meeting called by the President of Colombia to discuss the role that knowledge could play in

Science and Education in the country's development process. Well-known researchers from different fields took part in such a meeting and delivered a blueprint about the role that should play the topics that convened the meeting (Daza-Caicedo & Lozano-Borda, 2013). In this frame, the notion of Social Appropriation of Science and Technology emerged in the public agenda (ColciCase-IT1, 2019; Daza-Caicedo & Lozano-Borda, 2013). This notion was developed to address the need of diffusing or spreading scientific and technical knowledge to society (Aldana Valdes *et al.*, 1996; Daza-Caicedo & Lozano-Borda, 2013). However, it is worth mentioning that efforts in science divulgation were present at that moment (COLCIENCIAS, 2005).

The Social Appropriation of Science and Technology was embedded in a dominant setting featured by four elements. The first one was a market liberalisation process triggered by the President between 1990 and 1994. Second, the role of Science, Technology, and Innovation (hereinafter Innovation) was understood under an indirect approach to development (Arocena & Sutz, 2017). Third, Innovation was understood under a linear mode of production. It also entailed that Innovation was considered a driver to foster industrial productivity and, therefore, increase economic competitiveness. Finally, this period was featured by a vertical relationship between the knowledge producers (Academia, Industry and Government) and the knowledge consumers (Citizens). These four elements supported a process of path dependency of the role assigned to Innovation in Colombia (Pinzón-Camargo & Ordóñez-Matamoros, 2021).

Discussions about the meaning and scope of the notion of Social Appropriation of Science and Technology increased their intensity between 2005 and 2010. The critical juncture was bordered by the enacting of two critical policy documents. The first one was the draft of the Policy of Social Appropriation of Innovation in 2005 that never was formally issued but it acquired certain legitimacy. Five years later, the second document was enacted, the National Strategy of Social Appropriation of Innovation. This critical juncture was built by the Science, Communication and Culture Division in Colciencias (hereinafter, Division). This Division was in charge of science divulgation activities since the early 1990s, and it was boosted after the *Mision de Sabios*. In this case, this Division embodied the role of institutional entrepreneur.

The critical juncture was featured by intense discussions fostered by the Division around relationships between Innovation and society. Those discussions were boosted by several activities promoted by the Division in the period of the critical juncture (Daza-Caicedo & Lozano-Borda, 2013). They revolved around two approaches that aimed to address

the relationship between Innovation and society. The first approach was represented by *deficit models* of innovation divulgation, and the second one was shaped by "strong" approaches of scientific knowledge appropriation (De Greiff & Maldonado, 2011).¹

The Formation Phase

As institutional entrepreneur, the Division has seven features that strengthen its role. First, it had a distributed leadership among its members (ColciCase-IT1, 2019). This distributed leadership was helpful to deal with the job instability that features the public sector in Colombia. Second, the Division was shaped by members with a background or a strong relationship with Science and Technology Studies (STS). This quality contributed to defining the Division directionality. Third, the Division was constituted by heterogeneous members. Therefore, it gave them the flexibility to attend different work areas (ColciCase-IT1, 2019). Two qualities (fourth and fifth) that also distinguish this institutional entrepreneur are its opportunities tracking and strategic analysis capabilities. These features allowed the Division to:

"advantage spaces or opportunities to involve political and conceptually the topic. For example, in 2015, the linking of social appropriation to the sectorial guide, which is the guide to finance projects from the Science, Technology and Innovation fund" (ColciCase-IT1, 2019).

The sixth and seventh Division's qualities are linked with the Division recursion talent and second order-learning (Rip, 1992; Kuhlmann, Shapira, & Smits, 2010).² These characteristics were reflected in the members' capacity to overcome challenges in working with communities in remote areas in Colombia (ColciCase-IT2, 2019) and designing and implementing policy tools to develop the Policy and the Strategy of Social Appropriation. The last characteristic of this Division as an Institutional Entrepreneur has been its resilience. This quality, along with its distributed leadership, has contributed to navigating the Colombian political and policy instability and building trust and credibility with local communities in the country.

¹ In this context, deficit models can be described as the relationship between knowledge producers and consumers mentioned in the previous paragraph. In contrast, the "strong" approaches acknowledge the capacity of knowledge production of any actor (consumer, citizen, researcher, policymaker, among others) and the necessity of fostering horizontal spaces of co-production of knowledge between them (COLCIENCIAS, 2010; De Greiff & Maldonado, 2011).

² Following Rip (1992) and Kuhlmann, Shapira, & Smits (2010), learning processes can be divided into first-order and second-order. Those categories can be defined as follows: "Whereas first-order learning focusses on improving a particular path without considering any change, in a second-order process, new understandings, objectives, actors and interplays could appear" (Pinzón-Camargo & Ordoñez-Matamoros, 2021, p. 154).

As mentioned, the Strategy of Social Appropriation entailed the vision of change introduced by the institutional entrepreneur. This vision of change emerged from the discussions around the alternatives to build bridges between innovation and society in the critical juncture at the path-transformative phase. The vision of change was featured by the stream of the "strong" approach to scientific knowledge appropriation. This stream acknowledges innovative capabilities in all of society and not only in the scientific community. In that sense, it considers that knowledge production can emerge from co-production processes between different actors and that those processes could address daily problems (Jasanoff, 2004) (COLCIENCIAS, 2010; ColciCase-IT1, 2019).

The Division implemented several strategies and self-reinforcing mechanisms to build a policy niche³ and, therefore, align and develop new practices to support the introduction of divergent change.⁴ Some of the strategies implemented by the Division are described in Table 2. In this table, the programmes Ideas para el Cambio and A Ciencia Cierta (hereinafter, the programmes) appear repeatedly, showing the centrality to foster the Path-transformative process.

Besides the strategies described in Table 2, the institutional entrepreneur used self-reinforcing mechanisms to strengthen the Path-transformative process. Some examples of those mechanisms were the institutional density (Pierson, 2000) and financial investments. The first set of mechanisms can be illustrated by enacting policy documents and anchoring critical elements of those into others. From a managerial perspective, the anchoring strategy produced financial and political arrangements between Entities that kept sustainability to the vision. For example, some of the public calls from the programmes have received funding from other National Entities like the Ministry of Information and Communication Technologies or the National Service of Learning (SENA by its acronym in Spanish). The second set of mechanisms have emerged from significant agreements between COLCIENCIAS and multilateral banks (ColciCase-IT1, 2019; ColciCase-IT2, 2019).

³ Policy niches are very similar to socio-technical niches but in the context of policy's formulation and implementation. They are protected spaces where vision's change led practices to divert the trajectory of the mainstream of policy. These niches provide conditions to experiment inside the public sector, and in implementation policy spaces which can derive into deep socio-technical transformations. Examples of these policy niches are known as "public policy pilots".

⁴ These practices and the divergent change will be described below as part of the development phase.

Table 2. Strategies implemented by the Division to foster the Path-transformative process.

Strategy	Example
Discursive Capability	The Division decided to name the Strategy of Social Appropriation of Innovation as "Strategy" to have a smooth and fast enacting process in 2010. Content-wise, the Strategy looks like a Policy. However, junctural situations like the beginning of a new presidential period and the traditional change of all persons in strategic positions, besides the complexity of negotiations with other entities that entail a policy, explain this strategic decision (ColciCase-IT10, 2019).
Looking for allies	Besides spreading the vision of change by policy documents and official presentations to researchers and policymakers, it was necessary to involve communities from cities and rural areas in the programmes: "So there was an intentional, a very intentional communication process in generating that facility and that confidence in the public so that they wanted to reach this type of experience. Moreover, from that, either it was the failure, or it was the triumph of the two instruments because we did it badly and we scared them, or we did it well, and we generated what we wanted with those instruments; And so, that was the story of the two. So that is why colours, texts, images, names and everything are special and different." (ColciCase-IT2, 2019). The process like building an allies' network to support the critical juncture or spreading the Division's vision of change is similar to what has been described by classical STI European and Latinamerican studies relied on activities like (Callon et al., 1982; Thomas et al., 2019): Forums (COLCIENCIAS, Universidad EAFIT, 2011; ColciCase-IT1, 2019); Agreements with international entities like the Interamerican Development Bank and the World Bank (ColciCase-IT1, 2019), and actors involved in each of the activities launched by the Division, like the sponsors, beneficiaries and other actors involved in the programmes (ColciCase-IT1, 2019). "This group has been characterised by looking for others to work with, not designing from here only, but seeking alliances with others who are already working, entities, and to be able to work better." (ColciCase-IT1, 2019). The opportunities tracking and strategic analysis example described below also depict the Institutional Entrepreneur efforts to involve other areas and instruments inside MinCiencias. The process of involving other areas inside MinCiencias has required periodical meetings to explain what the Division does (ColciCase-IT3, 2019; ColciCase-IT2, 2019) in a sort of continuous pedagogic process.
Motivating by Example	The results of the programmes are published on the two websites designed for those programs ^{1, 2} . Besides texts describing the projects supported by MinCiencias, those websites include videos with the community's testimonies. The institutional entrepreneur used these results to motivate other entities to follow their path (ColciCase-IT1, 2019; ColciCase-IT5(Part1), 2019).
Showing results	Besides using the results from the programmes to motivate other actors, the visibility and exposure that they brought for Colciencias contributed to standing the Strategy (Pinzón-Camargo, 2019).
Anchoring	To spread the vision of change and build the policy niche, the Institutional Entrepreneur anchored the Policy and Strategy of Social Appropriation of Innovation to: the Innovation Law of 2009; in critical methodologies for the Innovation sector like the model of research team measuring (ColciCase-IT1, 2019); in policy documents like National Development Plans (ColciCase-IT1, 2019); or international studies from entities like the OECD (OECD, 2017). In general, the Division was aware about anchoring the Policy and Strategy in strategic documents to keep sustainability to the Path-transformative process. "In this sector, in Colciencias, it is very important to be in the policy documents, because if you are there, then there may be resources, there may be implementation when you are not, it is an issue that can go unnoticed." (ColciCase-IT1, 2019).

Source: Own elaboration based on Pinzón-Camargo (2022). The definition of each strategy can be found in Pinzón-Camargo (2022).

The implementation of this set of strategies and self-reinforcement mechanisms by the Institutional Entrepreneur produced two results. The first result was the possibility to develop and spread its vision of change. The second result was built and shielded the policy niche where the practices that nurtured the change were developed or aligned to the vision of change. The analysis of this last set of results draws attention to the creation phase in the Path-transformative heuristic.

⁵ A *Ciencia Cierta*, see: <https://acienciacierta.minciencias.gov.co/>

⁶ *Ideas para el Cambio*, see: <https://ideasparaelcambio.minciencias.gov.co/>

The Creation Phase

In this case, the divergent change introduced by the institutional entrepreneurs boosted the development and alignment of four sets of practices that have their expressions in two levels, as Table 3 shows. The first level is named National. It entails the political process that the institutional entrepreneur has had to manage with its peers inside MinCiencias and the public and private stakeholders that traditionally have access to this entity. In this point, it is worth pointing out that the institutional entrepreneurship work is mainly a political process (Leca, Battilana, & Boxenbaum, 2008; Tracey, Philips, & Jarvis, 2011; Pinzón-Camargo, 2022). The second level could be named Local. It comprises the work deployed by the institutional entrepreneur with local communities and academia to attend to the local communities' needs by using Innovation. The institutional entrepreneur has channelized this work supported in the programmes. Those programmes have been implemented since 2012 using public calls. In total, it has launched six public calls under the frame of Ideas para el Cambio programme and five from A Ciencia Cierta.

Table 3. Examples of Practices identified in this case.

Practice	Example	
	National Level	Local Level
Organisational	MinCiencias have had to learn to work with local communities and citizens. It meant developing communicative skills and changing administrative procedures to attend to the needs of these communities. It also entailed the process of involving non-research partners to deploy the public calls at the local level.	Local Communities and academia learnt how to work together. Academia learnt how to apply their scientific knowledge to co-produce solutions to the community needs. The community discovered in academia a partner to overcome their challenges.
Technical	They must develop methodologies and policy devices to support the technical and organizationally programmes. One of these devices was the figure of Godparents. This figure is the name assigned to researchers who decided to support the projects without financial compensation and following a set of principles to interact with the communities defined by MinCiencias (COLCIENCIAS, 2015). By the time, the Godparents figure became a recurrent practice in all the public calls. Besides, they introduce experimental approaches as part of improving the public calls (ColCiCase-IT5(Part2), 2020).	Local communities learnt or improved the use of ITC technologies to get in touch with the Ministry and other actors involved in the programs and make reports required by MinCiencias (ColCiCase-IT2, 2019).
Managerial	Financial and legal procedures were developed and aligned inside MinCiencias to report the financial payments and legally bind agreements with local communities and researchers. Two examples can illustrate these practices. First, a legal producer's alignment was using a traditional instrument in MinCiencias, the public calls, to make agreements with local communities and not with research groups as it used to be the practice. Second, it was necessary to adapt reporting procedures to accept payments from using non-traditional systems of transport. "It was like sitting down with them to explain the nature of the project, to show them how people lived a little and what the realities that were in the territory were like so that they understood the adjustments we had to make there, internally, right. For example, the legalisation thing was crazy because, in the first version with the World Bank, they asked us to even RUT and invoice the donkey on which we went up. I mean, it was like: "no sir, there is no, I mean, they are indigenous, they do not have a RUT, sometimes they do not have an ID card". So, it was like making them understand those processes, to negotiate, for example, that a cash receipt would be worth me like this, or little things that sometimes became a super problem and that could stop the project or the strengthening process." (ColCiCase-IT12, 2019).	The programmes contributed to developing accountant and management practices (ColCiCase-IT17, 2020).
Social	The institutional entrepreneur introduced the role of innovation to attend directly to the local communities and citizens needs, including environmental, social, and economic needs, as a policy objective.	The programme's public calls objectives show the intention of addressing environmental, social, and economic practices. Videos and actors' testimonies from the programs' websites show, for example, the reinforcing of agroecological practices. The work by Pinzón-Camargo (2022) studies in-depth those practices based on three cases from the programmes.

The Development Phase

The last phase in the Path-transformative heuristic depicts a situation where the process fostered by the Institutional Entrepreneurs arrives at the consolidation stage. To achieve the Path-transformative process' consolidation, the institutional entrepreneur has continued implementing its strategies. The following are some examples of those strategies.

- The Institutional Entrepreneur remains showing results based on the programmes;
- It is looking for new allies like SPRU;
- It is anchoring the Strategy of Social Appropriation to critical sectorial documents like the Green Book (COLCIENCIAS, 2018);
- It is using its discursive capability to adapt its interests to appealing narratives like *social innovation*, *public innovation*, or *transformative innovation*.

All efforts to sustain its vision of change have had in the last two years two remarkable advances. The first one emerged from the new organisational transformation in COLCIENCIAS. This entity became the Ministry of Science, Technology and Innovation (MinCiencias) in 2019. In that transformation, it was settled the Vice ministry of Talent and Social Appropriation. Second, a new policy of Social Appropriation of Knowledge in 2021 was enacted. Both advances can be understood as part of the self-reinforcing mechanism of increasing the institutional density (Pierson, 2000).

To sum up, the above elements consider that despite the institutional entrepreneur efforts to foster its Path-transformative process, it is still far to be considered a consolidated process.

4. DISCUSSION

In the following do we show which are the operating logics and enablers of the transformative pathway in the analysed case, in particular in the preformation and formation phases of our heuristic. In the first place, we identified six logics underlying the path-transformative process studied in the preformation, formation, and creation phases. Those logics are: i) technological determinism; ii) knowledge-dialogue -typically framed in the

innovation systems approach (ISA)-; iii) technological facilitation; iv) mentorship; v) legality; and vi) visual representation and circulation logics.

On the second place, the enablers are extended through all the transformative-pathway heuristic. We identified at least 6 enablers, namely: i) legitimacy inception of transformation; ii) discursive force; iii) policy-niche inner force; iv) migration of critical policy content; v) public deployment; and vi) sustained vision-oriented of change.

Underlying Logics

A remarkable underlying logic of the transformative path deployed by SASTI-Policy in the preformation phase, is that innovation is considered a driver to foster industrial productivity and competitiveness. It affirms the linear mode of production of knowledge, also known as technology-push or market pull and reinvents the hierarchical and highly criticised mode of relationship between knowledge producers and knowledge consumers attached to the old-fashion paradigm of technological determinism (Feenberg, 1992).

In the formation phase, three underlying logics emerged based on the role performance by the institutional entrepreneur. Those logics contributed to breaking the dominant technological determinism logic from the previous phase. The three logics are: i) mutual learning between academia, communities and citizens at national and local levels (multiactor models: Sabato's triangle, Etzkowitz's triple helix model, ISA etc.) based on the idea of a non-hierarchical processes of knowledge-dialogue; ii) in technical terms, the ITC technologies play a relevant role contributing to building the path-transformative process of transformation pathway, which can be named technological facilitation logic; and iii) in social terms, the mentorship dynamics built up around the figure of Godparents, which can be named as a mentorship logic. These logics are key to trigger the creation phase of a transformative pathway.

Formation and creation phases shared common underlying logics. For instance, the knowledge-dialogue logic based on mutual learning was operating in both phases. In managerial terms at these phases at the national level, we also recognise the logic of legality. This means that transformation can acquire momentum laying on formal state mechanisms such as binding contracts with communities and researchers. Without this, any possible transformation could happen. Finally, visual representation is the last recognisable logic in these two phases. Audio-visual representation on web pages and other communicative pieces, as well as "real-people" testimonies of life transformation configure a public perception that "things are going well". An innovation policy such as SASTI-Policy,

and its implementation requires social circulation: transformations on "communities" does not exist if there is not social understanding and appropriation that transformations are ongoing.

Enablers

In the preformation phase there are at least 3 enablers that trigger transformations: i) when the high-level officials focus in STI and coven high level and prestigious scientist, science gain social and political importance. The 1994 Mision de Sabios' interactions enabled discussion on the role of knowledge and the need to spread scientific knowledge in all the levels of the society; ii) giving rise to the notion of Social Appropriation of Science and Technology, a very catchy name, enough catchy to produce a giant snowball that pervaded a very important amount of social and economic sectors until nowadays. Even enough, iii) to be part since then of the public agenda. These three enablers can be named together as legitimacy inception of transformation.

Additionally, between the preformation and formation phase, new conceptualisations and discussions on Social Appropriation of Science emerged. Apparently mirroring the old STS debate about the need to deepen the constructive character of the sociology of science exposed by David Bloor (1976), in 2000's in Colombia the notion of "deficit" in social knowledge circulation appeared as a way to point out the importance of making "strong appropriation of science" (De Greiff & Maldonado, 2011). This is, to stimulate a flatter micro-power dynamics in knowledge production, circulation and uses. In particular, when scientists have to work together with or for communities. This enabler can be name as discursive force.

In the "formation phase" the "who" and the "where" are very important as enablers. As it was explained pages above the Division in Colciencias was constituted by people with an STS background or a strong relationship with STSer's. A heterogeneous group of officials facilitated work flexibility and the inscription of the idea to make another science: more local, pertinent and critic. This facilitates action in politics, in particular, officials who were very committed with communities, tracked opportunities and make strategic analysis in their benefit. This deserves more research, specially to explore the "corpopolitics of knowledge" of the officials who conducts the innovation policy in the global south (Grosfoguel, 2011; Tlostanova, 2019).

Related to the latter, recursion of talent, second order-learning, resilience, and the capacity to to act strategically are very significant enablers (Rip, 1992; Kuhlmann, Shapira, & Smits, 2010). The transformative pathway in the formation phase requires a focus on people and what they interpret about their learnings, how they change their behaviour and how to stand and face adversities, in particular working with communities to gain trust and legitimacy. This enabler can be named as policy niche inner force.

Strategising on policy documents is also an important enabler. Anchoring critical elements of one document into others as well as keeping a low profile of them in the hierarchy structure of them permits the sustainability of the group of officials involved in the division which institutionalise the policy niche. This enabler can be named as migration of critical policy content.

At the creation phase, as well as in the logics section at the national, regional and local level the multiactor interaction producing learnings is a transformative enabler itself. However, at this stage, the IE action supported on policy instruments implemented during a period of a decade, launched periodically is the most important enabler of transformation. This enabler can be name as public deployment.

Finally, at the development phase, the vision of change and the formulation of a policy itself are important enablers. Officials' efforts to sustain a particular vision of change contributes to make possible a new policy. Both, vision, and policy constitute at the same time a self-reinforcing mechanism of increasing institutional density (Pierson, 2000), but determinant at the last stage of a transformative pathway in TIP in the south. This enabler can be named as sustained vision-oriented of change.

The positive turn of our analysis shows some logics and enablers based on the Colombian case. Those elements constitute a starting point to explain how can be set a set of public actions for mobilising resources towards more sustainable sociotechnical systems via the governmental promotion of knowledge (Ordóñez-Matamoros *et al.*, 2021), with or without an underlying transition or mission-oriented's ambition for TIP in the Global South. Policy experiments for localising SDGs (Boni *et al.*, 2021) and transformative outcomes (Gosh *et al.*, 2020) are both normative and explicit ways based on action-research of inquiring TIP in the south. We make a call to complement this type of TIP's research in the south, in particular, for the understanding of what is beyond of the last stage of our heuristic, this is the vision of change as an enabler of transformation.

CRITICAL REFLECTIONS

As the paper is focused on logics and enablers of TIP in the Global South, in the following we draw the attention on a few recognisable limitations proper to the Path-transformative process consolidation in such a context, both political and institutional, based on the Colombian case.

The first relevant context limiting the potential role of the TIP initiatives refers to when the first STI Minister's credibility as researcher was strongly contested after she assumed her position. This situation undermined the political position of the Ministry as a whole, including its peers' trust (academia, industry, public sector and society) and specially the SASTI plans due to her personal commitment to it. This animated a discussion on the possibility for her to leaving her position, which resulted in less attention giving to such policy.

Secondly, the Law that supported the organisational transformation of COLCIENCIAS from an Administrative Department to become a Ministry was demanded, the organisation came to a stall waiting for a new Law to enable its full operation. Under this frame, the advance in terms of the Viceministry of Talent and Social Appropriation was not safe, even till today that there is a hubbub caused to the turn from a right-wing to left-wing government.

Thirdly, the new policy of social appropriation received several criticisms. On the one hand, it does not solve the conceptual definition of the notion of Social Appropriation of Innovation that worked as an enabling condition to foster the Path-transformative process, issue that was brought since the formation phase until today. Finally, the policy was launch with a lack of enforcement because it was enacted by a resolution that is one of the weakest legal instruments in public policy in Colombia.

Finally, in conclusion, we want to highlight the following two points. First, further research from not only normative but positive stances is necessary to have a better understanding of TIP policies in the Global South. This endeavour entails opening a broad research agenda entailing fields like the role of politics in TIP policies, the path-transformative process of TIP policies, visions of change and actors' motivations, the transformative logics in transformative-paths, among other elements that contribute to an in-depth understanding and building of transformative policies from and by the Global South. Second, and hoping to continue working in this stream of knowledge, we convene and reflect on the importance of digging into i) futures change vision; ii) logic, enablers but overall, on barriers; and iii)

in general, on all those innovation policies aiming sociotechnical transformations looking for social and environmental justice detached to MLP theory and action-research. This proposal arguably can shed light on how policy-makers and officials in the global south have dealt with setting transition, social transformations or environmental sensitivity in innovation policy. A better understanding of TIP lies in other theoretical referents; even those based on different kinds of knowledges or local theory are helpful for this matter.

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