


I bet you don't look good on the dance floor

*Re-examining the innovation policy dance metaphor
in the case of Colombia*

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ABSTRACT

Innovation heuristics offer guidance on how to navigate through the complex dynamics of innovation governance. However, further discussion is needed on the premises of such analytical tools to inquire on their implications on innovation policy and practice. This paper builds on the innovation policy dance metaphor to better grasp the ever-changing interplays (or dance) between innovation practice (I), policy (P) and theory (T). We critically assess the basic underlying assumptions of this metaphor, by examining the extent to which its heuristic pretensions are relevant in the Latin American context. To do so, we explore three illustrative cases in Colombia, shedding light on some crosscutting opportunities and gaps for the dancing metaphor across different innovation I-P-T situations. Some derived lessons suggest that dancing occurs *within* and/or *between* different governance levels, where variables such as *politics* shape the innovation I-P-T interplay and *time* defines first and second order learning pathways.

Keywords: Innovation Policy; Governance; Innovation Heuristics; Interactive Learning; Colombia.

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INTRODUCTION

The systems approach on innovation policy has been widely accepted since the mid-1980s as a comprehensive explanation on the role of governments in fostering the production and diffusion of knowledge and innovations in a given set of institutional and network configurations (Freeman, 1987; Lundvall, 1992; Nelson, 1993; Edquist, 1997). While the explanations offered by the innovation systems approach are originally based on empirical cases in the global north, Latin American scholars have long expanded the theoretical scope of the systemic perspective by up-taking lessons from the region and its own contextual features (Crespi & Dutrénit, 2014; Dutrénit & Sutz, 2014; Arocena & Sutz, 2020).

A core assumption of the systems approach is the interactive nature of innovation processes, leading to the interplay between multiple interdependent actors. Common heuristics to grasp such interactions have been provided by the multiple 'Helixes' approaches (Triple, Quadruple, Quintuple), which address the dynamics of innovation from the point of view of the different interfaces found in university-industry-government-public-environment interactions (De Oliveira Monteiro & Carayannis, 2017). However, these broad categories tend to overlook the micro-dynamics of science, technology and innovation processes, and offer a rather static illustration of the interrelations within innovation systems (Centeno, 2021).

Kuhlmann, Shapira, & Smits (2010) provide an alternative heuristic to account for the ever-changing dynamics in innovation systems. They focus on the interplay between innovation practice (I), policy (P) and theory (T) as 'dancing partners' that shape the governance of innovation in a given system. This metaphor suggests that multiple governance/ 'dancing' configurations appear depending on the rhythm of the music played and the actors playing the music, the type of dance floor hosting the dance, among others. Nevertheless, since this metaphor is mainly based on the traditional innovation systems literature, it might also fall short in grasping the differentiated dynamics of innovation systems in Latin America.

We believe that analytical potential of the metaphor may nurture from additional insights from the Latin American context, in order to further explore the opportunities and failures for the governance of innovation in emerging economies (Kuhlmann & Ordóñez-Matamoros, 2017). This is so as the conceptual foundations of the metaphor are deeply rooted in scholar traditions in the global north, where innovation systems are highly institutionalized, unlike the ever-changing Latin American innovation systems. In this con-

text, we believe that the innovation policy dance is often an unstructured set of moves with a high degree of improvisation and even conflict, rather than a well synchronized waltz.

Innovation heuristics define the problems to be addressed as well as the type of solutions thereof, which in turn is shaped by the values and interests that underlie innovation heuristics (Arocena & Sutz, 2020). In this regard, more attention is needed on their basic underlying assumptions, especially since metaphors have the potential to shape the reality of innovation policymaking and the acritical uptake of them might be problematic for the role of governments within innovation systems.

This paper critically assesses the underlying assumptions of the dancing metaphor as depicted by Kuhlmann, Shapira, and Smits (2010), by examining the relevance of its heuristic ambition in the Latin American context. We do so by exploring three illustrative cases in Colombia: i) the interplay between the national systems for STI and competitiveness, ii) the funding of subnational STI with mining royalties' income and iii) the implementation of projects of social appropriation of STI. These allow us to derive crosscutting lessons on the gaps of the metaphor that need further conceptual development.

We shed light on some particular features of the dance metaphor for the Latin American context. Some of our guiding questions are: Who is playing the music in innovation governance? What do we know about the beat of the music and the relationships between the dancers? To what extent the dance excludes grassroot innovation movements crucial for innovation policy? To what extent innovation practice is eclipsed by 'business as usual' dynamics according to which industrial actors can capture the dance?

The reminder of the paper is as follows: after this introduction, section 1 goes over the innovation policy dance metaphor; section 2 describes the three cases, focusing on the dynamics of the innovation practice, theory and policy interplay for each. Subsections 2 offer some crosscutting lessons learned from the cases; and then we conclude with some avenues of research for strengthening innovation policy heuristics.

I. EXPLORING THE BALLROOM: THE INNOVATION POLICY DANCE METAPHOR

The dance metaphor can be traced back to the early criticisms to the linear approach on the interaction between science and technology. By distinguishing their attitudes towards literature, Derek de Solla Price (1965) argued that scientific knowledge does not automatically translate into technology because the knowledge published is typically aimed at specific scientific peer groups. In this vein, he regarded science and technology as a differentiated pair of dancers or as independent but interlinked cumulative bodies of search, which often dance to the common rhythm of instrumentalities, i.e. accidental craft innovations in laboratories leading to technological change (de Solla Price, 1984a; 1984b). The author stressed the need for further inquiry on the rhythm and movements of both dancers in order to acquire a better understanding of the history of technology (de Solla Price, 1965).

Later on, Arie Rip (1992) praised the illustrative character of this metaphor, but warned about the risks of approaching science and technology as separated processes, rather than as part of the same continuum. By highlighting the social embeddedness of science and technology, Rip argued that the division of labour between science and technology is subject to permanent mutual adaptations in their 'dancing' as they are driven to anticipate each other's steps. This dancing is not pre-given, but rather shaped by specific historical circumstances, and the multiple configurations of relations between science and technology are usually changing, meaning that "the dancehalls themselves change" (Rip, 1992, p. 233).

Kuhlmann (2007) builds on the metaphor to explore the governance of innovation as a process shaped by the interaction between innovation practice (I), policy (P) and theory (T). For him, these are "partners on a dancing floor, moving to the varying music and forming different configurations" (p. 11), as represented in Figure 1. For instance, sometimes "practice and policy, argue and negotiate about the dance and music while the third, theory – not always, but often and to an increasing extent –, provides the other two partners with arguments and sometimes also with new music" (p. 5).

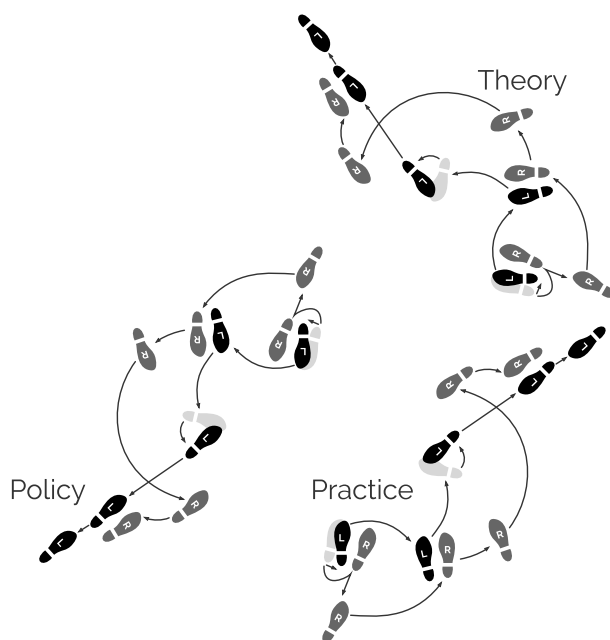


Figure 1. Innovation policy dance metaphor. Source: Kuhlmann (2007).

As this one, there can be multiple configurations of interactions between I-P-T in which any of them can be the leading force, and these multiple modes of interplay are usually determined by the direction of learning processes. Kuhlmann, Shapira, and Smits (2010) highlight the following possible interactions: first, in the case of innovation Practice-Policy interaction, there is learning when, for instance, policy lessons derived from evaluations are translated into policy change (*learning by using*) or when policymakers receive direct feedback from actors on the field (*learning by interacting*). Furthermore, innovation practice is also shaped by policy when innovators and entrepreneurs learn from policy instruments (*learning by using*).

Second, in the interaction between innovation Policy-Theory, on the one hand, researchers learn and produce new ideas and theories based on the empirical insights that the policy process offers, whether it is by observing such processes (*learning by searching*) or participating on them (*learning by interacting*). On the other hand, policymakers often use theories as framings for policy design (*formal learning*) or receive the support of researchers as consultants in the policy process (*learning by interacting*).

Third, regarding the innovation Theory-Practice interface, there is a similar situation in which theory learns from practice by observing the experience of innovation as a living lab (*learning by searching*) and as a source of empirical insights (*learning by interacting*). Furthermore, innovation practice is driven by the frameworks offered by theory (*formal*

learning), as well as the inputs that researchers and academics can offer to practitioners (*learning by interacting*).

Therefore, an underlying assumption of this approach is that "the three dancers observe each other, and react on the partners' movements: They copy, comment, complement, counter-act, neglect, and thereby learn" (Kuhlmann, 2007, p. 11; Kuhlmann, Shapira, & Smits, 2010). Depending on the extent to which institutional arrangements are transformed, Kuhlmann, Shapira, and Smits (2010) distinguish between first-order and second-order learning, following Argyris and Schön (1978). While first-order learning entails strategic adaptations to a given set of institutions that maintain organizational performance and dancing patterns, second-order learning implies a transformation of institutions, strategies and visions, and, therefore, the melody of the dancing by introducing new modes of governance. In other words, second order learning involves institutional change and first order learning does not. Furthermore, the authors suggest that "external changes (new 'music fashions') could imply new roles of dancers on the floor, or even the appearance or (temporary) farewell of an actor" (Kuhlmann, Shapira, & Smits, 2010, p. 8).

Furthermore, Kuhlmann, Shapira, and Smits (2010) argue that the underlying rationales and instruments of innovation policy is the result of interactive learning between stakeholders taking part in the I-P-T dancing floor. Interactive learning processes are therefore at the core of the different dancing configurations that might take place. Such learning process often takes place in 'fora' for debates, which provide I-P-T with a dancing floor. Such fora are "institutionalized spaces specifically designed for deliberation or other interaction between heterogeneous actors with the purpose of informing and conditioning the form and direction of strategic social choices in the governance of science and technology" (Kuhlmann, 2007, p. 16). In this context, Kuhlmann (2007) also sheds light on strategic intelligence as a set analytical tools and sources of information that offer insights for strategic decision making.

The dancing metaphor provides relevant elements that synthetize the complex underlying dynamics of the governance of innovation. Nevertheless, we believe that the use of this heuristic must be cautious in order to avoid the oversimplification of the innovation policy process. Moreover, we believe that the early uses of the dancing metaphor in the field of science and technology studies (Rip, 1992; de Solla Price, 1965) offer some relevant insights beyond the dynamics of the dancing partners, including the role of the rhythm of the music and the dance floor that are yet to be further developed in the analysis of the governance of innovation.

2. THREE CASES OF ‘THE DANCE’ IN COLOMBIA

In order to assess the assumptions of the dancing metaphor and its relevance for the Latin American context, we analyse the I-P-T interplay by reflecting on secondary sources and research findings on three illustrative cases of STI governance scenarios in Colombia: i) the interplay between the national systems for STI and competitiveness (Pinzón-Camargo & Ordóñez-Matamoros, 2021), ii) the funding of subnational STI with mining royalties' income (Salazar, 2017; Centeno, 2019; 2021) and iii) the implementation of projects of social appropriation of STI (Pinzón-Camargo, 2022; Pinzón-Camargo & Centeno, 2020).

We followed a theoretical sampling approach (Glaser & Strauss, 1967) for the selection of the cases, based on their relevance and illustrative potential. Each case relates to different innovation policy situations, which allows us to draw crosscutting lessons to enrich the dancing metaphor. Rather than empirically detailing each case, we use them as illustrative devices to explore the governance of innovation.

Colombia offers a relevant case scenario given the distinctive features and dynamics of innovation governance in emerging economies in contrast to more developed countries (Dutrénit & Sutz, 2014; Kuhlmann & Ordóñez-Matamoros, 2017). Furthermore, the national innovation system of the country has gone through multiple transformations during recent years, representing an interesting case to inquire on the role of innovation theory, policy and practice in such changes.

In the following paragraphs we briefly describe each case, and characterize the dynamics of the innovation practice, theory and policy interplay for each.

2.1. Case 1: Systems for Competitiveness and for Science, Technology & Innovation

2.1.1. Case description

In Colombia, governance systems for STI, on the one hand, and competitiveness, on the other, have been developing since the 90s. Building on the notion of Innovation Systems, Colombia structured STI governance, organizations, institutions, and policies in the early 90s, similar to other countries in the region (Moncayo Jiménez, 2018). The Colombian National Innovation System (NIS) sought to allow a better relationship between State, Enterprises and Academia, following the Sabato and Botana's Triangle (Salazar, 2013), and it intended to engage them to work together. The NIS was explicitly oriented

towards using STI to achieve higher levels of economic growth to improve societal wellbeing, as defined in Law 1286 of 2009 (Pinzón-Camargo & Ordoñez-Matamoros, 2021).

The NIS was steered by the National Institute of Science, Technology and Innovation (Colciencias), currently the Ministry of STI,¹ and it was organized around the "Program Councils" (Salazar, 2013). The Councils were responsible for policy design and implementation by means of strategies and projects. Although the Councils were integrated by the three main actors of the NIS: State, Industry and Academia, the latter tended to be overrepresented, producing imbalances in their operation (Pinzón-Camargo & Ordoñez-Matamoros, 2021). With the transformation of Colciencias into the Ministry of STI in 2019-2021, the NIS structure was also reshaped, deleting the Program Councils and promoting the inclusion of Civil Society in the State-Industry-Academia interface.

In parallel to the evolution of the NIS in the early 90s, a National Council of Competitiveness was created (1994) with the purpose of fostering joint work between State, Academia, Industry and labour sectors to improve the productivity and competitiveness of the country in the context of an economic liberalization process. This council evolved into the National Administrative System of Competitiveness and Innovation (NASCI) in 2012 (Decree 1500), and it became an umbrella system to harmonize other public-public and public-private coordination schemes, including the NIS. It was steered by the Presidential Council for Competitiveness and Public-Private Management. In contrast with the NIS, the NASCI privileged the Industrial sector participation and implemented technical committees to address public and private issues that could affect national or subnational competitiveness.

Both systems, NIS and NASCI, had local organizational structures represented by the CODECTIs (Departmental Councils of STI) and CRC (Regional Commissions of Competitiveness), respectively.

¹ Colciencias became in the Administrative Department of STI in 2009 by the Law 1286 of that year. In 2021, this administrative department evolved into the Ministry of STI by Law 2162.

2.1.2. Innovation practice, theory and policy

In this case, the objective of increasing Colombia's productivity and competitiveness to achieve social wellbeing can be identified as a single music pattern across two different dance floors: the NIS and NASCI, both hosting similar actors, but with different leading roles. In the first system, the leading dancing partner was Academia, embodying a Theory (T) approach on innovation governance. In the second, the leading actor was Industry, which usually represents innovation Practice (I). In both cases, Policy (P) has been a secondary player, often following the steps of the leading dancing partners in each case, despite setting the organizational scene for the dance floors.

In this context, the existence of two dance floors for the same actors to interact has produced tensions between Theory and Practice as leaders in each one. These tensions are often related to deciding which floor is more attractive for the dancers to push their agendas according to their interests. In this regard, the NASCI (dancing floor A) has gained appeal by becoming an umbrella system that coordinates and encompasses other systems, including the NIS (dancing floor B). This resulted in providing the Industry with a better position for agenda-setting. Such tensions are also reproduced in the subnational structures of these systems. For example, Industry actors often accuse academic actors from being too detached from real world problems, while academia blames the industry for underestimating the role of research and innovation in entrepreneurship.

This has had implications in actors' strategies to better push their interests, moving their agendas from one dancing floor/system to another. Therefore, it may be possible to hypothesize that industry actors have prevailed over academic ones in defining the direction of innovation policy. By making the NASCI (dancing floor A) the core arena for decision making, they have been able to define an innovation policy driven by Practice rather than Theory.

Furthermore, in this case, actors in both dancing floors seem have been stuck in a first-order learning process in the sense that the music followed by the dancers has remained the same in the last 30 years. However, the existence of a single music pattern has not translated into a better alignment between actors within and across systems, deepening the challenge of public-private coordination. Although several organizational changes have been put in place to prevent such misalignment (Pinzón-Camargo & Ordoñez-Matamoros, 2021), tensions remain and spread through different levels, eventually restricting coordination between the national and subnational levels in each system: between the NIS

and the CODECTI and the NASCI and the CRC. The lack of coordination at the national level sends contradictory signals to the local level about how to implement policies and coordinate efforts between actors at the same level and across levels.

Finally, the actors/dancers have also been the same for several years. Despite the NIS's intention to include civil society actors (Decree 1666 of 2021), further efforts are needed in practice. So far, organizational change proposals by the Ministry of STI only re-label actors from the Academia (i.e. Researchers) as part of the civil society, and it remains unclear how other actors, different from Industry and Academia, will be included effectively in the NIS.

2.2. Case 2: The Science, Technology & Innovation Fund

2.2.1. Case description

Investment on STI in Colombia has been historically low. Evidence of this is that R&D funding has never reached the 1% of the GDP, despite the multiple promises of governments in that regard. In 2011 the national government proposed the creation of a specific fund for STI, which allocated 10% of the national income from mining royalties to STI projects at the subnational level. This occurred in the context of a broader constitutional reform inspired by the experience of other countries in managing their royalties' profit (e.g. Norway), and intended to redistribute this income across the 33 subnational entities² of the country, since the concentration of it in those territories where extractive industries operate have proven to be inefficient and resulted even in the waste and misappropriation of resources.

The OCAD was created as a board to approve projects and allocate resources, composed by five representatives of the national government, six subnational governments and six public and private universities, each group entitled to one vote for decision-making. The creation of such governance structures for the decentralization of STI funding had, however, ambivalent results, raising questions regarding its efficiency: the resources available were not being used to a full extent and, in some cases, there was misappropriation of resources that inhibited the fund's overall goal to strengthen STI capacity at the regional level (Centeno, 2019). This raised a broad debate on the governance of regional STI and the institutional arrangement involved (Salazar, 2017), which can be further described by means of the 'dancing metaphor', as follows.

² Including Bogotá, the capital district.

2.2.2. Innovation practice, theory and policy

The interplay between practice, theory and policy can better explain the tensions regarding the fund's inability to enhance the performance of the regions in STI and its subsequent reform in 2017/2018, which illustrates second-order learning with significant institutional transformations. We illustrate this in a couple of 'dancing' or governance situations.

The first 'dancing' scenario is the transition to a competitive allocation of resources. At the beginning, those regions with the higher the population and poverty levels received a greater amount of resources, assuming that STI was most needed in those regions with more critical developmental challenges (theory). However, STI capabilities (and practices) defined a region's ability to submit robust proposals to get resources allocated, which was not the case of the regions with the highest poverty levels. As a consequence, those with the strongest capabilities were able to submit better proposals and, therefore, had a better chance of receiving funding, resulting in a sort of Mathew effect, i.e. those with more capabilities/resources have stronger capabilities to further attract funding at the expense of those with less capabilities who get allocated less (Merton, 1968).

Furthermore, since each of the 33 regions of the country had a fixed allocation according to the above-mentioned criteria and that they had the autonomy to set their own priorities, there was a fragmentation of the (policy) instrument in 33 mini-funds instead of a single one as intended, limiting the system's ability to mobilize resources towards broad national goals (Salazar, 2017). This fragmentation, among other design features, suggest that there is no 'music' being played to guide the I-P-T interplay.

The 2017/2018 reform insisted on the idea of one single fund by transforming the allocation mechanism by means of public, open and competitive calls for proposals. Now, actors of each region must compete for resources according to previously defined priorities by the CODECTIs. Under this mechanism, the Ministry of STI leads planification processes across regions in order to support the definition of priorities. The result is a biennial plan that includes the public calls that will be organized during that period, as well as the aggregated priorities defined by each region so that actors can submit proposals according to them. Although this transformation privileges meritocracy and scientific robustness of the proposals, it tends to deepen the capacity-based Mathew effect between regions. Furthermore, subnational governments were not sympathetic of this reform, since it limited their autonomy in using the resources, while being subject to the directives of the

national government. Innovation policy as defined by the national level and practice embodied by local actors may exhibit competing interests in this case.

The second 'dancing' configuration shows a diverse landscape of actors interacting and developing STI activities. Under the initial fund, only subnational governments could submit project proposals and, if approved by the OCAD, only *public* organizations could be designated as project executor, such as subnational governments and public universities. This led to a situation in which subnational governments negotiated their odds for executing the funding in their own jurisdictions, being the scientific quality, relevance and merit of the projects secondary criteria. Furthermore, it was argued that subnational governments did not have the expertise to be responsible for the implementation of STI projects, and public universities had a strong position in the execution of the resources (Centeno, 2021).

The subsequent 2017/2018 reform allowed any organization in the national STI system, whether *public* or *private*, to submit and implement projects. This represented a milestone for the opening of the system, allowing a more diverse set of actors to implement projects including firms, research centers, private universities, and civil society organizations (Centeno, Delgadillo, & Roa, 2020).

Overall, the 2017/2018 reform depicts second-order learning with institutional transformations, which in this case took more than 5 years to uptake early lessons from 2012-2013 on the form of strategic intelligence (Kuhlmann, 2007). This is a consequence of political negotiations and the constitutional status of this policy instrument. This reform, however, proved effective for the execution of resources, as the more diverse participation of actors increased the amount of proposals submitted and public calls allowed to group multiple projects in one single package for discussion and approval (Centeno, Delgadillo, & Roa, 2020). The allocation of resources transformed from a discretionary procedure-based approach in which the OCAD played a central role, to a peer-review-based one, involving experts that would judge the merit of the proposals according to a scoring system. Therefore, role of the OCAD as a 'forum' for debate seems now to be expendable since it was stripped of its primary function. The CODECTI's are expected to be the main fora for debate, although these are often limited to budgetary rather than strategic policy discussions.

2.3. Case 3: Projects of Social Appropriation of Science, Technology & Innovation

2.3.1. Case description

Colciencias began to implement the National Strategy of Social Appropriation of Science, Technology and Innovation in 2012, after a long process and several debates around the notion of Social Appropriation of Knowledge by the Academia. This Strategy allowed to design and implement two policy programs named *A Ciencia Cierta* (ACC) and *Ideas para el Cambio* (IPC)³ by Colciencias. The first program (ACC) was designed to strengthen ongoing initiatives fostered by local organizations, where the communities use innovation to attend to their socio-economic challenges. The second program (IPC) encouraged local communities to identify their needs under a set of general challenges defined by Colciencias. At the same time, Colciencias invited solvers (researchers, academia, and advisors, among others) to present possible solutions to the community's needs. In this way, Colciencias aimed at building, strengthening, and boosting relationships between Academia and Local communities. Therefore, scientific, ancestral, traditional, and other possible types of knowledge were convened to co-create solutions to local needs. This process was named *knowledge dialogue*, aiming at a horizontal acknowledgement of these knowledges (Pinzón-Camargo, 2022).

ACC and IPC evolved in an experimental process of mutual learning and improvement based on public calls for proposals (Pinzón-Camargo & Centeno, 2020; Pinzón-Camargo, 2022). These public calls for proposals defined general rules for different variables. First, they defined the actors who could take part in the process. Second, the type of relationships and features associated with the actors involved in these public calls for proposals. Third, the conditions to invest the financial resources provided by Colciencias. Since 2012, IPC and ACC have supported around 155 projects in 29 departments of 32 in Colombia. In a general overview, these programs have been focused on attending unmet basic needs in Colombia's rural areas (Daza-Caicedo *et al.*, 2020a, 2020b).

³ For more detail, check: <https://acienciacierta.minciencias.gov.co/> and <https://ideasparaelcambio.minciencias.gov.co/>

2.3.2. Innovation practice, theory and policy

This case unfolds a contrasting situation regarding the two dance floors in competence discussed in case 1. This case provides a dance process assembled on dance floors that work as layers overlapped between them. The first dance depicts a co-evolutive process where debates about the notion of social appropriation by Theory (Academia) gave the dance fundamentals to Policy (Colciencias). On this first dance floor, Practice was missing but considered a further dancer in the second layer/dance floor. In turn, based on the learning from Theory, Policy developed the dance steps. It improved them through an experimental process followed in designing and implementing ACC and IP and affecting how Practice (local communities) understood the dance. These elements illustrate second-order learning in this dance.

We suggest that the second dance floor emerged into the first one, or it overlapped. Policy led the dance on the second dance floor, triggering a process of *collibration* (Jessop, 2012) between Theory and Practice by the terms of reference designed to lunch both ACC and IPC. The terms of reference worked as a musical score that defined the different interplays between the dancers but gave enough space for improvising new steps. These new steps are linked to second-order learning that features this dance. It produces deep changes allowing new activities like processes of knowledge co-production between Theory and Practice.

The music played resonates with the notion of social appropriation introduced on the first dance floor. In this vein, the music in this dance entailed the intention of bringing different types of knowledge (i.e., Scientific with ancestral or traditional knowledge) to produce their acknowledgement and valuation between different epistemic communities and, based on that, build and co-produce solutions to local communities and their needs.

CROSSCUTTING DISCUSSION: THE INTERPLAYS AND PATTERNS OF THE DANCE

The above presented cases offer relevant lessons regarding the governance of innovation from the point of view of the dancing metaphor, specifically regarding 1) the type of learning that takes place according to each governance or dancing situation, 2) the type of dance floors and music involved, as well as 3) the performance of each dancer or component of the governance of innovation: theory, policy and practice. Table 1 below synthesizes the key elements of the cases, unveiling different types of coupling processes between the dancers from the three cases described above.

First, regarding the type of learning, we find different learning attitudes that highlights the relevance of time and policy change in innovation governance. For instance, first-order learning can prevail as a consequence of lock-in situations that reflect path-dependency dynamics (case 1). There is practice-policy learning in case 2 (by using and interacting), revealing that second-order learning often depends on institutional frameworks and political dynamics that allow to translate policy learning into effective policy change. This in turn relates to time-spans and actors' ability or will to translate policy lessons into strategic intelligence that facilitate its uptake for decision making and policy change. Case 3 shows formal second-order learning, facilitated by actors that play a role in theory and policy.

A second element that draws attention is the possibility of identifying more than one dance floor in the same case. While in case 1, there is a competition between the dance floors led by different dancers at the same level, in case 2 there are tensions between dance floors at different governance levels. Moreover, in case 3 a multiplicity of floors emerges as an overlapped process that allows different types of dances at different levels. Dancing floors are determined by 'fora' for debates which in case 2, for instance, also change as a consequence of institutional transformations resulting from second-order learning. In case 1, competing dance floors showcase competing forums that respond to the organizational features of each dance floor.

A third element relates to the type of music being played. Following Rip's (1992) early reflections on the metaphor for the case of science and technology, dancing patterns and dancehalls are not pre-given and change over time according to contextual circumstances. So is the case of the music involved, which typically expresses embedded policy goals that set the guiding directions of the dancers, and that must not be taken for granted for analytical purposes. Case 2 leads to considering the possibility of dancing without music when policy instruments are implemented with no clear policy objectives or fragmented ones. As part of the implications of such a situation, there is a risk of misalignment between actors and inefficient coupling processes between dancers. In this vein, music and its meaning emerge as a crucial variable in unfolding the dance. As in case 1, the existence of the same music in two different dancefloors may suggest redundant policy objectives across differentiated arenas. Furthermore, the fact that the same music can be played for long periods of time is symptomatic of the lack of second-order learning (case 1).

Finally, Table 1 offers a set of roles the dancers could perform. Those roles could be: i) a single-lead dancer, ii) a shared-lead dancer, iii) a following dancer, iv) a missing dancer, and v) a dancer who unwillingly takes part in the dance. Beyond mentioning the roles, questions appear around the rationalities that could explain, support, and encourage the performance of each of the roles. We argue that those questions resonate with the politics between the dancers. In this line, dancers' politics and music are key variables for further operationalizing the dance metaphor.

Table 1. Main dance elements from the cases.

Case	Learning process	Dance floor	Music	Dancers Performance		
				Theory	Practice	Policy
Case 1: Systems	First-order	Dance floor 1: Competitiveness	Innovation for competitiveness	Low participation in leading the dance	It has been leading the dance	It has followed the Practice
		Dance floor 2: STI	Innovation for competitiveness	It has been the dance leader	Low participation in leading the dance	It has followed the Theory
Case 2: Royalties	Second-order (I-P learning by using and interacting)	Dance floor 1: National level	No clear music/ Fragmented policy goals	Linear approach on innovation funding	Practice at the regional level up taken for policy change	Often leading the dance because of power relations
		Dance floor 2: Regional level	Own regional challenges	Often affected by theories underlying national policy guidelines	Capacity based, providing inputs for policy learning	Risk of fragmentation and competing with national policy
Case 3: Social Appropriation	Second-order (T-P formal learning)	Dance floor 1: Social Appropriation Strategy	Social Appropriation of knowledge	It led the dance	It was missing in this floor	It was followed by Theory
		Dance floor 2: ACC and IPC		It shared the leading with Practice	It shared the leading with Theory	Sometimes accepts to be guided by Theory or Practice

The lessons derived from the cases reveal that the *time* dimension matters in the dance. In long-term processes, it is possible to note switches between second-order learning and first-order learning, the type of 'fora' for debate, and the music being played. Cases 1 and 2 illustrate this situation, where dancers without previous contact got involved in second-order learning at the beginning of the dance. However, after a long time, they got familiar and switched to a first-order learning process. The permanence of music over long periods of time may express stability or institutionalization of policy goals, or conflicting path-dependence situations that only allow first-order learning.

Furthermore, the cases illustrate the *multilevel* nature of the policy dance, showing (mis)alignment patterns at different levels, *within* or *between* the 'dancers': policy, theory, and practice. On the one hand, we often see tensions *within* the policy domain across different levels, in which coordination issues as well as competencies to define policy goals limit the normal development of the dance. On the other hand, misalignment *between* policy goals at the national level and innovation practice at the local level may suggest implementation gaps that can be attributed to the underlying theory of the intended policies.

Interactions between and within innovation policy, theory and practice across different governance levels remarks the *role* of politics in shaping such interplays and learning processes. Policy-related actors, whether governmental or not, are more often in a position to define the rhythms of the dance by setting binding policy goals to which actors and other elements of the system have to respond to at the regional/local level. In case 1, Practice/Industry actors gained a better position for decision making across dancing floors, while in case 2 political positions alternated between subnational governments (in decision making) and universities (during project implementation). This suggests that hierarchical governance structures might shape power relations between actors, facilitating or restraining different types of learning, specially over long periods of time.

An interesting feature of the dance relates to the changing roles of actors across the theory, policy, and practice realms. Kuhlmann and Ordóñez-Matamoros (2017) associate specific groups of actors to each component of the innovation dance: innovators and entrepreneurs in Practice, innovation scholars in Theory, and government agencies in Policy. However, some of the above presented cases show that this type of actors can move from one realm to another, or even belong to multiple realms at the same time. In other words, the *performative* character of actors in the innovation dancefloor entails that they can easily change their dancing stance –from theory to practice to policy– or embody different dancers at the same time. In other words, there is not a strict correspondence between the actors in the Sabato's triangle (academia, State, industry) and the innovation dancing metaphor (theory, policy, practice).

For example, in case 2, policy actors (Departments) and Theory actors (Universities) performed the role of Practice implementing the royalties' resources through projects of STI. In turn, in case 3, the Policy was performed by actors with a strong academic profile giving the impression that Academia was performing the Policy's role as a dancer. These cases unveil the complexity and imbrication of the dancers once they must or are invited to dance. Therefore, it must not be assumed that Policy, Theory or Practice has a clear set of profiles of actors that could fit within these categories.

This implies that the dancers in the governance of innovation are complex settings which include but are not limited to actors: they encompass a broader set of interconnected elements such as institutions, practices, ideology, and strategies, among other factors that shape them as practice fields. As Kuhlmann & Ordóñez-Matamoros (2017) acknowledge, heterogeneity is a central feature of each component of the I-P-T interface, and tensions are part of the landscape involving opposing expectations, beliefs, paradigms, interests, power struggles, and multiple sets of resources, capabilities, and strategies. This is what actually may distinguish the dancing metaphor from other actor-based heuristics such as the Triple-Helix model or the Sabato Triangle.

Figure 2 depicts the above-described crosscutting lessons. It provides an illustration of how dancing partners often cross the border of I-P-T realms, while reflecting on domains at different levels and dancefloors with differentiated scopes.

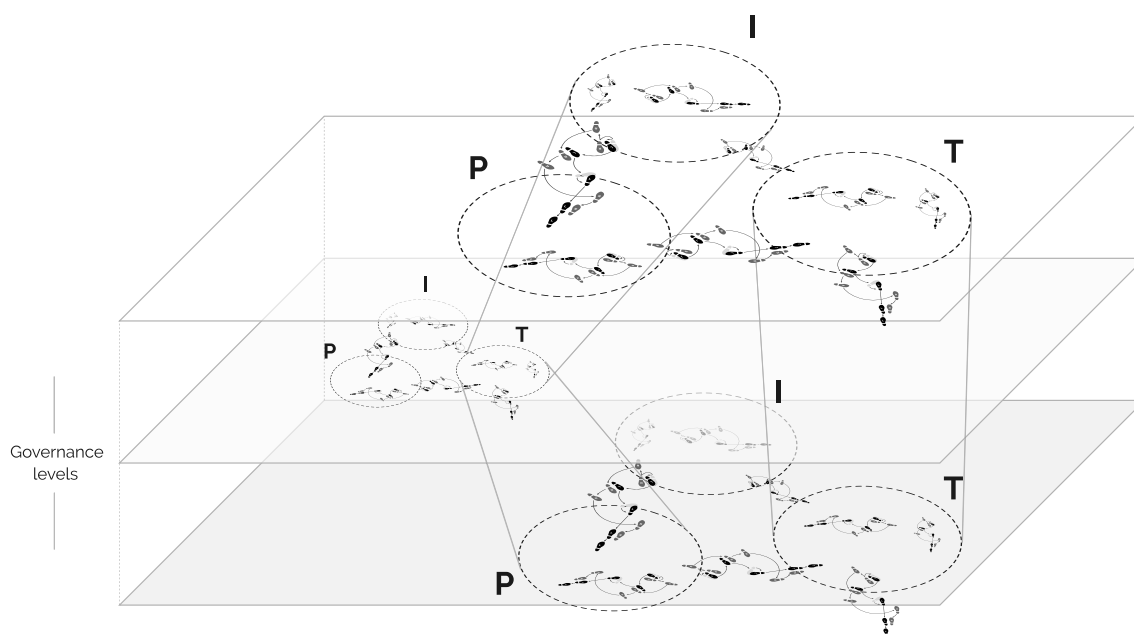


Figure 2. The multilevel and performative dynamics of the innovation policy dance.

It is necessary to shed light on the idea of understanding Theory, Policy, and Practice as practice fields to have more interpretative flexibility to operationalize the metaphor. This understanding of Theory, Policy, and Practice is not new. It resonates with Rip's (1992) ideas about the embeddedness of and imbrication between Science and Technology, which are part of a same continuum. In this sense, further analysis is needed on the imbrications between fields or dancers, avoiding aseptic assumption about the policy dance, and better reflecting the entangled relationship between science and society (Bauchspies, Croissant & Restivo, 2006).

CONCLUDING REMARKS

Using metaphors for explaining or making sense of reality has advantages like simplifying the social complexity. However, aspects could be hidden and crucial in making sense of such reality in this simplification process. In the dance metaphor, the idea that dancers represent the theory, practice and policy seem to leave aside the discussion around the kind of actors that dancers could represent.

In this paper we aimed at critically assessing the basic underlying assumptions of the dancing metaphor, by examining the extent to which its heuristic pretensions are relevant for the Colombian context. While operationalizing the metaphor in three illustrative cases in Colombia, we observe unsynchronized dancing patterns often led by, as argued by de Solla Price (1984a; 1984b), the rhythm of instrumentalities which lead to accidental policy learning and change.

This re-examination of the innovation dance metaphor stresses that the I-P-T interplays is rather unstructured given the emergence of variables that define what happens on the dancefloor. While the dancing metaphor remains useful in the case of Colombia, further considerations need to be highlighted in order to provide a more contextualised explanation of innovation governance dynamics in this context. Unlike innovation systems in the Global North, innovation systems in Latin America, and in this case in Colombia, tend to be contested and ever changing. These are arenas of debate and conflict in which politics play a central role in the definition of policies and institutional arrangements. Therefore, innovation systems in this context evolve in less structured ways, giving space for different types of interactions to take place.

The lessons learned suggest that we need to further advance in detailing the dance metaphor drawing attention on the elements and variables found in the cases. We suggest advancing in the operationalization of variables such as politics, multilevel interactions, time, and the performative nature of actors in the innovation policy dance to better grasp the governance of innovation in Latin America and other emerging economies, considering their often-contested institutional contexts.

REFERENCES

- Argyris, C., & Schön, D. (1978). *Organizational Learning: A Theory of Action Perspective*. Reading: Addison-Wesley Publishing Company.
- Arocena, R., & Sutz, J. (2020). The need for new theoretical conceptualizations on National Systems of Innovation, based on the experience of Latin America. *Economics of Innovation and New Technology*, 29(7), 814-829. <https://doi.org/10.1080/10438599.2020.1719640>
- Bauchspies, W.K., Croissant, J. y Restivo, S.P. (2006). *Science, technology, and society: a sociological approach*. Blackwell Pub., Malden, MA.
- Centeno, J. P. (2019). La "territorialización" de la ciencia: una reflexión crítica de los seis años de funcionamiento del Fondo de Ciencia, Tecnología e Innovación, del Sistema General de Regalías. In C. Soto (Ed.), *Seguimiento y análisis de políticas públicas en Colombia. 2018* (p. 89-113). Bogotá: Universidad Externado de Colombia. <https://publicaciones.uexternado.edu.co/pageflip/acceso-abierto/pdf/seguiimiento-y-analisis-de-politicas-publicas-en-colombia-uext.pdf>
- Centeno, J. P. (2021). Operational Innovation Policies in Emerging Economies: A Social Network Analysis of the Royalties Fund for Innovation in Colombia. In G. Ordóñez-Matamoros, L. A. Orozco, J. H. Sierra-González, I. Bortagaray, & J. Garcías-Estévez (Eds.), *Policy and Governance of Science, Technology, and Innovation. Palgrave Studies in Democracy, Innovation, and Entrepreneurship for Growth* (p. 193-232). Palgrave Macmillan. https://doi.org/10.1007/978-3-030-80832-7_6
- Centeno, J. P., Delgadillo, S., & Roa, M. P. (2020). Ciencia, tecnología e innovación durante el primer año del gobierno Duque: análisis y seguimiento a sus principales hitos. *Seguimiento y Análisis de Políticas Públicas. Anuario 2020* (p. 65-81). Bogotá: Universidad Externado de Colombia <https://publicaciones.uexternado.edu.co/media/anuario2020.pdf#page=65>
- Crespi, G., & Dutrénit, G. Eds. (2014). *Science, Technology and Innovation Policies for Development. The Latin American Experience*. Switzerland: Springer.
- De Oliveira Monteiro, S. P., & Carayannis, E. G. Eds. (2017). *The Quadruple Innovation Helix Nexus. A Smart Growth Model. Quantitative Empirical Validation and Operationalization for OECD Countries*. Palgrave Macmillan.
- de Solla Price, D. J. (1965). Is Technology Historically Independent of Science? A Study in Statistical Historiography. *Technology and Culture*, 6(4), 553-568. <https://doi.org/10.2307/3101749>

- de Solla Price, D. J. (1984a). Notes Towards a Philosophy of the Science/Technology Interaction. In R. Laudan (Ed.), *The Nature of Technological Knowledge. Are Models of Scientific Change Relevant?* (Vol. Sociology of the Sciences Monographs, p. 105-114). Dordrecht: Springer. https://doi.org/10.1007/978-94-015-7699-4_6
- de Solla Price, D. J. (1984b). The science/technology relationship, the craft of experimental science, and policy for the improvement of high technology innovation. *Research Policy*, 13(1), 3-20. [https://doi.org/10.1016/0048-7333\(84\)90003-9](https://doi.org/10.1016/0048-7333(84)90003-9)
- Dutrénit, G., & Sutz, J. Eds. (2014). *National Innovation Systems, Social Inclusion and Development. The Latin American Experience*. Northampton: Edward Elgar.
- Edquist, C. (1997). *Systems of Innovation. Technologies, Institutions and Organizations*. London: Frances Pinter.
- Freeman, C. (1987). *Technology and Economic Performance: Lessons from Japan*. London: Frances Pinter.
- Glaser, B., & Strauss, A. (1967). *The Discovery of Grounded Theory: Strategies for Qualitative Research*. Chicago: Aldine.
- Jessop, B. (2012). Social imaginaries, structuration, learning, and collibration: their role and limitations in governing complexity. *Zarządzanie Publiczne*, 19(1), 71-83.
- Kuhlmann, S. (2007). Governance of innovation: Practice, policy, and theory as dancing partners. *Address delivered upon the acceptance of the Chair Foundations of Science, Technology and Society*. Enschede: Faculty Management and Governance, University of Twente.
- Kuhlmann, S., & Ordóñez-Matamoros, G. (2017). *Research Handbook on Innovation Governance for Emerging Economies. Towards Better Models*. Edward Elgar Publishing Ltd.
- Kuhlmann, S., Shapira, P., & Smits, R. (2010). Introduction. Systemic Perspective: The Innovation Policy Dance. In R. Smits, S. Kuhlmann, & P. Shapira (Eds.), *The Theory and Practice of Innovation Policy. An International Research Handbook* (p. 1-22). Cheltenham, UK: Edward Elgar.
- Lundvall, B.-Å. (1992). *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*. London: Frances Pinter.
- Merton, R. K. (1968). The Matthew effect in science: the reward and communication systems of science considered. *Science*, 159, 56-63.
- Moncayo Jiménez, E. (2018). Las políticas regionales de ciencia, tecnología e innovación en Colombia: surgimiento, evolución y balance de la situación actual. *Opera*, 23, 185-208. <https://doi.org/10.18601/16578651.n23.11>
- Nelson, R. (1993). *National innovation systems: a comparative analysis*. Oxford: Oxford University Press.
- Pinzón-Camargo, M. A. (2022). *Navigating Inclusive Innovation: The role of Institutional Entrepreneurs in Inclusive Innovation Initiatives*. Enschede: University of Twente. <https://doi.org/10.3990/1.9789036553360>

- Pinzón-Camargo, M. A., & Centeno, J. P. (2020). Políticas de innovación inclusiva y tensiones en torno a su implementación y evaluación en Colombia: el caso de 'A Ciencia Cierta'. *Opera*, 28, 139-167. <https://doi.org/10.18601/16578651.n28.07>
- Pinzón-Camargo, M. A., & Ordóñez-Matamoros, G. (2021). A Study of Innovation Policies and Governance Structures in Emerging Economies Under the Path-Dependence Framework. The Case of Colombia. In G. Ordóñez-Matamoros, L. A. Orozco, J. H. Sierra-González, I. Bortagaray & J. Garcías-Estévez (Eds.), *Policy and Governance of Science, Technology, and Innovation. Palgrave Studies in Democracy, Innovation, and Entrepreneurship for Growth* (p. 147-190). Palgrave Macmillan.
- Rip, A. (1992). Science and Technology As Dancing Partners. In P. Kroes, & M. Bakker (Eds.), *Technological Development and Science in the Industrial Age. New Perspectives on the Science-Technology Relationship* (Vol. Boston Studies in the Philosophy of Science, p. 231-270). Dordrecht: Springer. https://doi.org/10.1007/978-94-015-8010-6_10
- Salazar, M. (2013). Gobernabilidad del SNCyT: El papel de los consejos de programas nacionales de ciencia y tecnología. In M. Salazar, M. Lozano-Borda, L. Fog & F. Sagasti (Eds.), *Colciencias cuarenta años: Entre la legitimidad, la normatividad y la práctica* (p. 588-633). Observatorio de Ciencia y Tecnología (OCyT).
- Salazar, M. (2017). The Colombian system of science, technology and innovation in transition: how governance is being affected. In S. Kuhlmann & G. Ordóñez-Matamoros, *Research Handbook on Innovation Governance for Emerging Economies. Towards Better Models* (p. 232-264). Cheltenham, UK: Edward Elgar.