

## Exploring local innovation as a key process in the transformation of institutions for the new millennium

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**ENG Abstract:** The incompatibility between energy and environmental policies is marking the history of the public administration of natural resources in the new millennium, particularly in the Latin American region. This article, contrasting the objectives of energy policies with those of environmental policies, suggests that innovation in governance should consider articulations, in a polycentric multilevel context of local-global impact. At the conceptual methodological level, this paper presents the "multilevel governance" approach, the "strategic management of technological niches" model, and the "governance innovation" concept for the implementation of such synergies. This article concludes by exploring the integration between government sectors, technological niches, and local ecological knowledge as a key coalition to advance in the intersectoral articulation of the aforementioned public policies.

**Keywords:** Institutional innovation, energy policies, environmental governance, local development.

**Summary:** Introduction. Innovation in environmental governance. 3. Political contradictions and environmental conflicts. 4. Exploring technology, local ecological knowledge, and innovation. 5. Conclusions. 6. Bibliography.

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## 1.Introduction

Increasingly, experts, activists, institutions, etc. are confirming the planetary limit of the "Anthropocene" period, which points to a future scarcity of certain natural resources that may pose threats to human survival (Rockström et al., 2009; Bettini and Karaliotas, 2013). Likewise, we are witnessing a globalized world where the technological paradigms of new technologies impose the challenge of a multidimensional understanding of these structural changes in the social scenario (Geels 2011, 2012). We are at a moment of historical significance, the development of which imposes on public administration the challenge of reflecting on the capacity to socially and substantially optimize public resources in favor of low carbon initiatives, transforming the energy sector and incorporating the knowledge of local territorial processes.

Much of the current literature on innovation in environmental governance uses a neo-institutionalist approach that studies governance as a process related to new instruments of environmental policy, particularly those dedicated to the evaluation of design, control, enforcement, and monitoring schemes of pollutant gas emission schemes, as well as to the measurement of scarcity and price elasticity of natural resources (Jordan and Turnpenny, 2015; Jordan et al., 2013). Another part of the literature, giving particular attention to environmental justice and the study of environmental conflicts, reflects governance as a site of political debate where irreconcilable tensions about ways of conceiving and managing natural resources are perceived (Castro, 2017; Martin et al., 2014; Dietz, 2014; Dietz and Engels, 2017). So far, few studies analyze institutional innovation in governance from a bottom-up perspective, which enables the institutional articulation of intersectoral policies based on innovative ideas arising from the interaction between technological niches and the territorial practices of local actors. Energy nationalism is not a new state strategy, but in the period between 2005 and 2015, it underwent a significant transformation, as the market for energy products experienced an unprecedented rise (Wilson, 2015). During the year 2000, the world demand for minerals and other energy resources grew strongly in the Latin American region, in the case of energy it increased by 58%, and in the case of steel, it increased by 60% (Wilson, 2013). In this period, Venezuela nationalized hydrocarbons between 2005 and 2007, Bolivia during 2006, and Ecuador in 2010, in all cases, this decision doubled the national budget (Sabaini et al., 2015). Between 2010 and 2013 Bolivia, Venezuela, and Ecuador observed an increase in Gross Domestic Product (GDP) due to fiscal resources exceeding 12%; more than 70% of this growth arose in the energy sector (Sabaini et al., 2015). One of the major crossroads of environmental governance in these countries is related to making a balance between economic growth, the longed-for social redistribution, and at the same time, respect for the traditions and well-being of the communities (Dietz, 2014; Dietz and Engels, 2017). In these countries, social mobilization against large-scale extractive projects has shown that civil society puts the defense of life above productive activities that may put it at risk (Ararat et al, 2013; Soto and Urán, 2013; Svampa, 2012).

On the other hand, the productive industries of the sector project their growth based on greater price stability, lower costs related to taxes and tariffs, and an increase in their storage funds (Günther and Mildner, 2013). In the last two decades, the political economy has been questioning the management of common goods, showing the long-term limitations of classical management that sought to maximize resource productivity only in the present generation (The Core, 2017). Intergovernmental institutions play a central role in the distribution of functions between governments and private institutions, but also in the management of environmental conflicts where capital accumulation and ecological degradation are opposed (Jenkins, 2017). Different authors have shown the need for the transformation of institutional structures to respond to the failure to overcome problems related to a permanent distribution of resources and benefits among their appropriators (Ostrom, 2009; Gibson, McKean, and Ostrom, 2000). Some international organizations and networks identify the disarticulation between different policy sectors as a central obstacle to achieving global environmental climate change goals (Beisheim, 2015; Jordan and Turnpenny, 2015). This paper assumes that new institutional policies should structure partnerships with local mechanisms from a perspective of multilevel socio-technological evolution, which will contribute to the compatibility between energy and environmental policies. The central hypothesis of this article is to show why and how institutions, from a bottom-up governance approach, should promote mechanisms of amalgamation between the knowledge of technological niches and local experts as a key to innovation in governance. This amalgamation represents a pioneering channel in the generation of new processes for the use, exploitation, and administration of natural resources, which can contribute to the redefinition of institutional patterns for the sustainable management of these resources. This article is structured in four parts. The first part introduces the field of environmental governance and presents concepts that facilitate the understanding of innovation processes related to it. The second part highlights the duality between energy policies and environmental policies, showing why institutions should promote innovation mechanisms in governance. The last part shows how local innovation promotes, in an inter-scale manner, symbiotic relationships between different government representatives and knowledge of technological niches and local experts. Thus, this text concludes by showing how symbiotic relationships between different actors can constitute innovative mechanisms that contribute to the redefinition of institutional patterns for more sustainable resource management

in the new millennium. Methodologically, this text draws on the advances of the research project "Innovation

in governance in Latin America", which uses contributions and tools from the social sciences, mainly from political science in the fields of political ecology, neoinstitutionalism, and the MLP multilevel perspective approach. The Grounded Theory method was used in the review of the state of the art of the secondary sources. This method aims to establish premises and hypotheses that contribute to the solution of the central problem of the research (Glaser and Anselm, 1998). This method facilitates the establishment of categories and their analytical tracing in scientific secondary sources. The inductive character of this method broadens the margin of interpretation of the problem, facilitating the differentiated and alternated use of variables and categories (Titscher, 1998; Kelle, 1991).

## 2. Innovation in environmental governance

In recent decades, the institutional exercise of governance has broadened from an initial institutionalist approach that promoted coherence between national government policies and those of international and supranational governments (Brunnengraeber, 2006), to a "reflexive type of control" focused on facilitating joint problem-solving (Jessop, 2002). This type of environmental governance is often criticized for being reduced to a top-down approach based on a commitment to continuous dialogue, participatory consensus, concerted action, or common benefits, from a perspective that does not delve into the pragmatic difficulty of dissuading deep tensions between different actors with ambivalent interests (Castro, 2007). This vision of governance often assumes a naïve, unpolitical view of how to effectively encourage regulatory procedures. In this context, contemporary research in this field has identified some challenges related to the need to implement methods, mechanisms, and models dedicated to studying the costs and gains of environmental conflicts in an intersectoral, intercalary, and polycentric manner (Jordan et al., 2013).

Governance studied from the MLP approach represents a process of transformation oriented to promote new patterns in political and institutional structures, from a bottom-up perspective, which combines a micro level of processes built by new technologies, to a macro and medium level, where cultural patterns, markets, infrastructure, and regulatory spheres are found (Brunnengraeber, 2006; Geels and Schot, 2007; Geels, 2011; Voss and Simons, 2014; Jordan and Huitema, 2014). This approach shapes the political reality by considering an intercalary relationship of poly-centric coordination in the collective control of resources, in which traditional hierarchical forms do not prevail (Jordan et al., 2018; Jordan et al., 2013); local participation processes occupy a central place and with the help of technological niches promote socio-technological innovation processes, in which alliances between different actors can be structured.

Based on the "Niche Strategic Management Model", institutions, with the help of innovative ideas from niches, institutionalize practices that are usually only part of local processes at other system levels such as regional, national, and international (Geels, 2011). If niches manage their innovative ideas or innovation findings successfully, their impact, which starts at the local level, can influence relatively stable regimes and, moreover, achieve systemic changes in the socio-technological landscape. Under this model, the transformations of socio-technological systems have three levels of interaction: the first is the local space of interaction of niches, the second is the institutional influence of socio-technological regimes and the third is the consolidation of changes in the socio-technological landscape (Geels, 2011). Geels differentiates innovation determined by "novelty" (an original creation by any actor in the system) from innovation generated by niches. The latter will have a revolutionary impact if it meets the following two conditions: the first is that the innovation satisfies a latent social need or desire; the second is that it develops a symbiotic relationship with institutions (Voss and Simons, 2014). Niches are protected spaces, in the sense that their actions do not enter the system in the field of political struggle, as is the case with social movements or pressure groups. If niches carry out an extensive and institutionally endorsed innovation, a "symbiotic relationship" develops in which locally emanating innovation is promoted by institutions and can come to replace traditional patterns (Geels and Schot, 2007; Geels, 2012). In this case, the pressure of the niches is based on filling a social gap, if the novel idea is massively adopted, this innovation manages to "align" with other structures in the generation of a socio-technological landscape (Ibidem), which indicates that it manages to cohere the technological, economic and institutional organizational dimensions of society.

Geels exemplifies this transformation by referring to the historical moment when society (in a passive but gradual way) changed from horses as a means of transportation to the use of bicycles and cars, an example that can be replicated in the transition from fixed telephones to mobile or cellular phones. The massification of these inventions (wheels on bicycles, motorcycles and automobiles, or cell phones) was largely due to the development of a "symbiotic relationship" between niches and government institutions (Geels, 2011, 2012). If governments had taxed the use of cycle engines or cell phones at all or had prohibited their massive use, this invention would not have spread successfully. Likewise, if the States had not provided road or telematics infrastructure, these inventions would not have impacted the entire current socio-technological landscape to the point of transforming patterns of interaction. If the innovation is not aligned by the regime in command, the system does not include it massively, since the new invention does not compete with the already established solutions. If these inventions are not sufficiently interesting or attractive to institutions or society, they will become obsolete. Examples of obsolete technologies are public telephone booths, analog television, VHS, etc. (Geels and Schot, 2007). There are also technological innovations that

are promoted by institutions after their invention. Two decades ago, electric cars were considered a luxury and did not impact the socio-technological landscape. Today, political instructions in industrialized countries favor the acquisition of hybrid cars that promote electric technology; therefore, it is expected that in the coming decades, this technological innovation will be appropriated by considerable sectors of the population.

The symbiotic relationship between niches and institutions in the strategic management model of niches is relevant because it manages an interdisciplinary perspective of a multidimensional nature on sustainability and the dynamics of structural change. This perspective of understanding innovation in governance is fundamental in the face of the current institutional challenges of the new millennium since it privileges the local dimension and its influence on the transformation processes of government institutions and the socio-technological landscape. Innovation is not significant policies that become new, but those that develop new patterns in institutional structures. Innovation represents a process that invites us to better identify the social gaps related to the global problem of climate change and, therefore, the challenges of new technological niches.

### 3. Political contradictions and environmental conflicts

Specifically in the Latin American case, authors rescue the alternative processes of territoriality at the local level developed by native populations of indigenous peoples, peasants, and Afro-descendants, whose relationship with nature poses an environment-society interdependence. Sousa and Escobar consider the possibility of "normalizing" values rooted in these pre-capitalist and pre-modern societies of this region of the world, as alternative forms that could definitively renew structural patterns of contemporary societies (Sousa, 2012, 2010; Escobar, 2010). The creation of the Bolivian Plurinational State in 2009 was an icon of this transformation process, as it integrated the values of native communities and their historical experiences at the legal and constitutional levels (Sousa, 2012). The new constitution (2009) was profoundly ambitious, institutionalizing the integration of the political and environmental diversity of the Bolivian reality, granting nature a legal character as a subject of law (Benavides and González, 2016). The political innovation of this State was constitutionally consigned to the national protection of the social function of coca as cultural heritage (Art. 384), mining and metallurgical resources (Art. 369), water resources (Art. 373), forms of energy (Art. 378), biodiversity and renewable natural resources (Art. 380), the Amazon (Art. 390), protected areas (Art. 385), natural forests and forest soils (Art. 386), land and territory (Art. 393) (García, 2010). Likewise, the Plurinational State constitutionally established the autonomy of the different types of territories, the Community Lands of Origin, the different indigenous territories (Chimán, Multiethnic, Original Peasant, Pluri-ethnic, Isiboro-Securé National Park, among others), the Indigenous Original Peasant Territorial Entities and, likewise, autonomy at the departmental, regional and municipal levels (Albó and Romero, 2009). In addition, in 2012, the Framework Law of Mother Earth and Integral Development linked the conception of the social order of indigenous peoples in the political-institutional scheme (Exeni, 2015).

These constitutional changes conceive decolonial relations of the natural world, promoting the interrelation of ecological, economic, and cultural processes of nature, and with it, a new reformulation of conservation, sustainability, and productivity, a different recognition of the society-nature relationship (Escobar, 2010). However, although Bolivia constitutionally guaranteed nature an essential place in the life of its nations, the State's administration of natural resources has not been very efficient in ensuring greater compliance and implementation of environmental policies; on the contrary, particularly after 2012, government management has facilitated the presence of different large-scale extractive projects. Currently, the Atlas of Environmental Justice refers to 40 environmental conflicts in this country, 14 of them for mining, 7 for fossil fuels and climate justice, 3 related to biomass and territorial conflicts, and 2 for infrastructure and environmental impact (EJ atlas, 2017, Temper, 2015). This evidences the duality between energy policies and environmental policies in Bolivia, showing a typical case of the contradictions that institutions face in contemporary public administration, and in that sense, their challenges in the face of the emergence of innovation mechanisms in intersectoral resource management.

By 2015 Bolivia was the fastest-growing economy in the South American continent, during that year its economic rise was from 2.7% to 4.9% (Sabaini et al., 2015). Between 2003 and 2015 Bolivia's GDP increased from 7% to 82% (Stroebele-Gregor, 2015). With the nationalization of strategic resources, the Bolivian state budget grew from US\$ 677 million in 2005 to US\$ 2.1 billion in 2008, and in 2009 it amounted to US\$ 2.329 billion. In the latter year, Bolivia, for the first time in its history, achieved a surplus; likewise, the figures for social investment were significant: 629 million in 2005, 1,005 million in 2007, and 1,428 million in 2009 (Gandarillas et al. 2008). In addition, with the nationalization, Bolivia began the industrialization of the energy sector through the purchase of the LPG processing plants in Cumao Grande, the gas separation plant in the Chaco, the thermoelectric plants in Chapare, and the metallurgical plants in Huanui, Vito, Corocero and Colas. In parallel, the Bolivian State has also implemented Emapa, a Food Production Support Company managed by the Ministry of Productive Development and Plural Economy, whose purpose is to contribute to food security with sovereignty (García, 2010, 2012). During the last two decades (2007-2017) energy nationalism as a political strategy allowed nation-states to accumulate considerable capital, reduce

poverty and inequality, as well as ameliorate the negative effects of the 2008 global economic crisis. In the Latin American region, energy nationalism has produced a drastic transformation not only due to the increase in income but also because the mechanisms of accumulation of energy market wealth have been used by the political regime for social change, promoting industrialization, technological development, provision of social services, restricting foreign investment for national development, creating subsidies and social funds (Wilson, 2015). Wilson (2015), comparing this nationalism with that defined as the "developmentalist state", asserts that Latin America has been a region that has been a vehicle for political change in a more evident and radical way than in other parts of the planet. The reforms of the governments of Ecuador, Bolivia, and Venezuela established the conditions for using economic rent in projects with a social impact; it should be noted that *de facto*, however, these reforms did not achieve the expected local impact (Svampa, 2012).

The contradiction between capital accumulation and ecological degradation is strongly rooted in the recent experience of these governments. It is undeniable that the activities of the extractive sector imply inter-scale environmental consequences such as, for example, water pollution, impacts on air quality, risks to human health due to emissions of carcinogenic substances, etc. (Zimmerer, 2011). This section does not prioritize either energy or environmental policies but shows the contradictions of values and norms between these policy sectors. A visionary approach to governance should promote institutional innovation through recognition of the importance of the interdependence of certain resources using a program with the technological infrastructure to generate integrated systems that safeguard ecological and cultural heritage, but at the same time recognize the livelihood and welfare needs of rural and urban populations.

The challenges of governance raised so far are of great importance, especially considering a historical past where for centuries state bureaucracies developed highly specialized administrative apparatuses, whose missions, visions, and objectives did not have the obligation to articulate their sectoral policies (Weber, 1958). Historically in Latin America, the management of non-renewable natural resources was concessioned as if it were a private good, subjecting it mainly to privatization processes (Gibson, McKean, and Ostrom, 2000). The administration of the territory and its resources was based on uniform, abstract, and impersonal conceptions and processes, deploying, in a homogeneous manner, specialized administrative processes throughout the national territory (Vandergeest and Peluso, 1995; Sack, 1983). This idea of resource administration instituted specialized units to manage each sector, establishing policies and institutions for specific purposes. Sectoral policies have a certain autonomy with respect to other sectoral policy units, and they preferably communicate with central organizations in the pursuit of their objectives (Weber, 1958). This paper seeks to show how this perspective of public administration must be urgently reevaluated and redefined through innovation processes rooted at the local level.

#### **4. Exploring technology, local ecological knowledge, and innovation**

Current recommendations for energy policies and climate change policies overlook the strategic local-global linkage resulting from the feedback between technology and policy (Schmidt and Sewerin, 2017). Particularly, technological innovation has been understood in isolation or independently of sectoral policies (Schmidt and Sewerin, 2017), as well as territorial practices and local ecological knowledge. Only about twenty years ago, ecological and environmental studies studied forests or moorlands as isolated ecosystems; today, the phenomenon of climate change and technological advances have allowed us to begin to manage these resources from an ecosystemic interdependence. In the literature on environmental justice and environmental conflicts, technological investment is usually seen as an advantageous instrument for extractive or infrastructure projects and not necessarily positive for local populations. Mining technology is often seen as a trigger for the contamination of water, soil, and air, scarcity or alteration of the productive cycle of food plants, and fragmentation of communities, among other consequences (Jenkins, 2017). This approach is considered by some as reductionist because it overlooks the possibilities of the contribution of technological knowledge to local territories (Schmidt and Sewerin, 2017). Technology has made it possible to demonstrate through satellite models that 80 percent of the biodiversity of the planet is found in indigenous territories (Sobrevilla, 2008).

This indicates that the local practices and values of indigenous populations have contributed to the conservation of forests, biodiversity, and other globally relevant resources. Sustainable management of forests and moorlands, etc., is intimately related not only to the maintenance of the planet's biodiversity (Parrotta et al., 2012) but also to global food security (Vira et al. 2015) and to the reduction of carbon emissions worldwide (Baccini et al., 2012). Technological innovations can create linkages not only between energy policy and environmental policy but also in the management of ecosystem services, conservation, and sustainability of common resources and public resources in general. For example, much of the developing world lacks an integrated system for monitoring the state of their ecosystems in real-time (Sierra et al., 2017). Monitoring ecosystem functions and services is a policy challenge that has currently been instituted in a few countries. In the United States, there is NEON (National Ecological Observation Network), a program that uses scientific infrastructure that uses technological instruments to detect and respond not only to the main disturbances of ecosystems (Sierra et al., 2017), but also to a more efficient management of resources. In Europe, the Integrated Carbon Observing System Research Infrastructure (ICOSRI)



integrates observations of the atmosphere, ecosystems, and oceanic greenhouse gases. ICOS currently has more than 100 sites, 30 of them atmospheric and about 70 in 12 European countries. Meanwhile, the NEON observatory collects high-quality data from 81 field sites (47 terrestrial and 34 aquatic) in the United States (including Alaska, Hawaii, and Puerto Rico) (NEON, 2017). These integrated systems provide a picture of what is happening to the state of ecosystem transformation using four distinct technological tools, using standardized collection methods across sites and including sensor measurements, airborne and satellite remote sensing, and other in situ instruments through field sampling. The comprehensive technological observation of data by NEON and ICOS is useful for research, policymaking, and the general public, as these infrastructure programs make information accessible at scales unprecedented in previous generations. Data from these platforms are freely available allowing their users to address scientific questions (NEON, 2017), but could also potentially facilitate accountability mechanisms. Integrated systems represent a technological advance that serves to contrast information about a given territory, facilitating resource planning and management (Mukul, 2017).

These integrated monitoring systems can be an effective and relevant tool for policy formulation and intersectoral articulation. The States of developing countries have not yet strategically and institutionally incorporated the importance of this type of integrated system (Sierra et al., 2017). Through them, government institutions could have a correlated estimate not only of the state of their ecosystems but also of the management of resources, the productive, environmental, and local impact of activities on a large scale and determine territories, data that could be equated with other administrative data (Sierra et al., 2017).

The figures include figures related to payments for compensation policies for socio-environmental damages. Today, governance in the new millennium should transcend the compartmentalized logic with which resources have been managed and with which socio-environmental conflicts have been responded to. Developing more stable and sustainable societies in the new millennium implies planning governance actions that include multi-criteria valuation scales of natural resources capable of linking technological innovation to territorial dynamics and forms of appropriation of local space (Sato, 2014, 2016). Academic approaches using practical knowledge such as Traditional Ecological Knowledge (TEK) and Integrated Local Environmental Knowledge (ILEK) can improve the formulation of policies and other mechanisms aimed at resource sustainability by linking local knowledge to these global systems and mechanisms (Gómez-Baggethun et al., 2013; Sato, 2014). The TEK and ILEK approaches, from an interdisciplinary perspective, incorporate challenges of the Paris Agreement related to promoting non-market approaches present in Article 6, paragraph 8, which reads as follows:

*"Parties recognize the importance of having integrated, holistic, and balanced non-market approaches to help them implement their nationally determined contributions, in the context of sustainable development and poverty eradication and in a coordinated and effective manner, including through mitigation, adaptation, finance, technology transfer, and capacity-building, as appropriate" (UNFCCC, 2015).*

Likewise, the challenges of integrating forms of local knowledge, Article 7, paragraph 5:

*"The Parties recognize that adaptation should be undertaken through a country-driven, gender-responsive, participatory, and fully transparent approach, taking into consideration vulnerable groups, communities, and ecosystems and that it should be based on and informed by the best available scientific information and, where appropriate, traditional knowledge, Indigenous peoples' knowledge, and local knowledge systems, with a view to integrating adaptation into relevant socio-economic and environmental policies and actions, where appropriate" (UNFCCC, 2015).*

In addition to these academic approaches and agreements, there are institutional projects of global organizations such as the Intergovernmental North-Scientific Platform on Biodiversity and Ecosystem Services (IPBES), the Intergovernmental Panel on Climate Change (IPCC), the International Union for Conservation of Nature (IUCN), the United Nations Educational, Scientific and Cultural Organization (UNESCO), among others, which link global sustainability to a greater awareness of the environment Indigenous knowledge and the rights of local communities, based on international legal frameworks such as the Convention on Biological Diversity (CBD), which in its preamble:

*"recognizes the close and traditional dependence of many Indigenous and local communities ... on biological resources, and the desirability of sharing equitably the benefits of the use of traditional knowledge, innovations and the sustainable use of its components" (In Senent Des Frutos, 2005: 165).*

This legislative, institutional, and scientific framework pursues innovative governance mechanisms that provide relevant knowledge on how to close the gap between local knowledge and scientific knowledge,

expressing new values, norms, and worldviews of resource management and sustainability in the new millennium (Löfmarck and Lidskog, 2017). These organizations could activate global mechanisms that facilitate a transformation of shared values in this regard (Löfmarck and Lidskog, 2017), advocating for an interscalar and polycentric impact (Jordan et al., 2017) that values the ecological and cultural heritage of local knowledge (Sato, 2014, 2016). There are specific "knowledge institutions" arising from local territorial practices that, in essence, are similar to each other; but their impact is commonly approached from a micro-level perspective (Turnhout et al., 2016), however, this ecological knowledge could be known as an expression of universal knowledge that starts at the local level and can be scaled up to national and international levels (Löfmarck and Lidskog, 2017; Lee, 2016).

In recent decades, several government regulations in Latin American countries have recognized the territorial rights of Indigenous peoples, leading to national and international lawsuits in favor of land restitution and recognition of their original rights (Gilbert, 2006). Still, Indigenous knowledge of forests and biodiversity is generally dismissed in Western science and policy circles as "unqualified, partial or 'not scientific enough' knowledge" (Diver, 2017: 4). More work is needed to communicate and reconcile such different values, norms, and worldviews (Van der Hel, 2016).

Since knowledge formation is a dynamic process and depends on its formation, validation, and adaptation to changing circumstances both locally and (increasingly) globally (Van der Hel, 2016), new relationships between native peoples and researchers are needed to co-produce knowledge (Berkes, 2009, 2012). Such relationships require mutual trust and respect so that both parties are more open to other types of knowledge and knowledge formation processes. Considering, for example, which understanding the value of biodiversity, among other resources, implies recognizing the interdependence between species, humans, and major natural cycles (Nunes and Van den Berg, 2001). If certain indigenous communities have conserved biodiversity in the territories they have inhabited, how can we appropriate these dynamics of local territorial appropriation, and how can new technologies facilitate this intercultural dialogue? For example, the intergenerational use of resources considers the historical agrarian time of the original communities.

This axiomatic transformation of the understanding of natural resources and their large-scale administration requires the democratization of environmental justice that implies the recognition of intangible ecological and cultural heritage and the development of participatory and regulatory processes to safeguard it (Martin et al., 2014). Latin American governments should explore the management of their forests, wastelands, and biodiversity based on the recognition of the strategic ecological and cultural value of these assets, promoting international mechanisms and lobbies for their legal and legitimate recognition.

From our point of view, we believe that it is worthwhile to analyze this perspective of local innovation as a way of transforming institutions in Latin America. In this sense, we are aware that there are still no cases where local innovation cases of niches and local experts have facilitated a symbiotic relationship that promotes the transformation of institutional patterns in natural resource management. This article does not conclude by verifying the practical conditions in which local innovation or symbiotic relationships between government institutions, local experts, and niches have taken place, but rather proposes, in a horizon of change in progress, spaces where institutions could focus on developing synergies between two sectors that until now have been opposed, that of environmental policies and energy policies.

The north of governance transformation in developing countries could be related to innovation mechanisms that promote local solutions through alternative mechanisms. This proposal emphasizes technological niches as the privileged spaces for implementing this axiomatic transformation, where governance can be aligned with sustainable resource management and where local community processes can establish pluralistic access to the use and distribution of natural resources and their benefits for both current and future generations.

## 5. Conclusions

Governance in the new millennium should transcend the compartmentalized logic with which it has managed resources and responded to socio-environmental conflicts. Developing more stable and sustainable societies in the new millennium implies planning governance actions that include multi-criteria valuation scales of natural resources capable of linking technological innovation to territorial dynamics and the values of appropriation of local space (Sato, 2014, 2016). Academic approaches that use practical knowledge from Traditional Ecological Knowledge (TEK) and Integrated Local Environmental Knowledge (ILEK) can improve the formulation of policies and other mechanisms aimed at resource sustainability.

The circulation of knowledge across multiple levels of governance can create opportunities to develop new methodologies and ways of governing climate change. Science can develop channels of communication between local-level narratives, connecting with national and global narratives. Local innovation through local ecological knowledge can be a key to rescuing and recreating other ways of understanding institutional management by reconciling different values, norms, and worldviews about nature, resources, and territory.

Since knowledge formation is a dynamic process and depends on its formation, validation, and adaptation to changing circumstances at both local and (increasingly) global levels (Sato, 2014, 2016), new

relationships between native peoples and researchers are needed to co-produce innovative knowledge capable of responding to contemporary challenges. Innovation represents a concept that allows a better understanding of the gaps in multilateral governance with respect to the global problem of climate change, particularly from the local level. Innovation does not mean policies that become new, but those that develop new patterns in institutional structures.

This paper shows that new institutional policies should structure innovative alliances and mechanisms to dissuade tensions between energy and environmental policies while maintaining socio-technological evolution. Latin American countries in the midst of their contradictions between economic growth and sustainability could propose new governance schemes based on synergies between the governmental sector with technology and local actors as a key coalition to advance in the intersectoral articulation of policies related to the public administration of resources. In this sense, the amalgamation between the knowledge of technological niches and local experts can be a channel that generates new processes for the use, exploitation, and administration of natural resources, which can contribute to the redefinition of institutional patterns for the sustainable management of these resources.

A visionary approach to governance should promote institutional innovation through recognition of the importance of the interdependence of certain resources to enhance their common use in safeguarding the ecological and cultural heritage of humankind. Through the use of integrated systems and other technological instruments, government institutions could have a correlated estimate not only of the state of their ecosystems but also of resource management, productive, environmental, and local impact of activities in specific territories and on a large scale, data that could be equated with other administrative data such as figures related to payments for compensation policies for socio-environmental damage.

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