

The Latin American University and the SDG´s: A contribution to the construction of Transformative Innovation

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Abstract: Innovation has generated expectations as a crucial factor in the generation of value and competitiveness for organizations and as a means for nations to achieve growth, wellbeing and development. However, its results seem contradictory: although there has been evidence of an increase in the competitiveness of innovative companies and in the economic growth of certain developing countries, the major problems faced by the global society show worrying signs of persistence and, even, aggravation. In this context, the concept of transformative innovation, which seeks to direct the emphasis of innovation towards the construction of social welfare and human development, emerges as an alternative to competitive innovation. On the other hand, it is well known that innovation occurs in a systemic context; the university, as a fundamental actor within this system, is called to play a decisive role in redirecting innovation towards transformation, considering the commitment that this institution has to society by its very nature. The aim of this paper is to contribute to the understanding of the relationship between the Latin American university and the new paradigm of transformative innovation, in the achievement of the Sustainable Development Goals (SDG´s), with the goal of proposing recommendations so that the transition between paradigms of innovation are led from within the university. For this purpose, an exploratory research study with an interdisciplinary approach was conducted. The study included a systematic review of the literature, a bibliometric analysis, and the consultation of experts of Transformative Innovation Policy Consortium (TIPC) led by the Science Policy Research Unit (SPRU) of the University of Sussex, England, in the framework of a research process carried out in Medellín, Colombia. Main results point to the implementation of teaching, research and extension processes, with a transformative approach; that is, processes in which the principles of the theory of transitions, as well as those of the Sustainable Development Goals (SDG´s), are incorporated into the mission of the university, without neglecting the needs of the market, but focusing on the development of innovations of a transformative nature, such as social innovation, inclusive innovation, innovation at the bottom, innovation under the radar or frugal innovation. These types of innovation contribute to the transformations of the socio-economic, cultural, political, cognitive and environmental

conditions of the marginal communities, excluded from the lucrative markets. Likewise, they permit contributing to the achievement of the Sustainable Development Goals of humanity from the spaces where knowledge is generated.

Keywords: Transformative innovation, sustainable development Goals, SDG's, university, Latin America, SPRU.

1. Introduction

In developing countries, innovation has not brought the benefits promised by the paradigm adopted by developed nations (Crivits et al. 2014). On the contrary, it has generated inequality, exclusion, unemployment and environmental imbalances, favoring the affluent classes and segregating more and more the communities of low purchasing power, leaving many impoverished countries with greater social, economic and environmental problems. In this sense, it has been mentioned that the generation of wealth, development and well-being through innovation does not work in certain areas and that only through the achievement of a *different type of innovation* can the integral development so longed for be generated (Hernández 2013; Rui 2013; Sonne 2012; Altenburg and Lundvall 2009; Fressoli, Dias, and Thomas 2014; Srinivas 2014).

The University, as part of the innovation systems, represents an institution capable of leading this transition between innovation paradigms and has a preponderant role because it is in these centers where knowledge, science and technology are normally generated. necessary to achieve the answers to the problems of humanity. It is, from this new paradigm, that the third mission of the university must be conceived and implemented, without neglecting the needs found in the dynamics of the market, its scope of solution, but focusing on the development of inclusive innovations that contribute to the improvement of the socio-economic, cultural, political, cognitive and environmental conditions of the marginal communities excluded from the lucrative markets.

The aim of this paper is to contribute to the understanding of the relationship between the Latin American university and the new paradigm of transformative innovation, in the achievement of the Sustainable Development Goals (SDG's), with the goal of proposing recommendations so that the transition between paradigms of innovation are led from within the university. The above to propose recommendations that address the shortcomings that the current model of competitive innovation has left in developing countries, specifically in Latin America, as well as the relationship of the new paradigm of transformative innovation and the university as part of the National Innovation Systems.

In the first instance, the concept of a university is contextualized as an organization in which it is not only transmitted, but also generates knowledge, science, technology and innovation and, additionally, contributes to the National Innovation Systems. Subsequently, the emergence of a new paradigm of these processes is examined: the transformative innovation (IT) that tends to respond to the social, economic, political and environmental challenges of today's world, challenges that competitive innovation has been unable to solve. The process carried out in the framework of the TIPC Consortium (STI Policy Factory) and the role of actors of the National Innovation System in Colombia, to generate a vision and approach of the National Science and Innovation Policy (Libro Verde 2030) is defined below. Verde 2030), which allows to align these processes with

the achievement of the Sustainable Development Goals, contributing to the construction of the same from the study of the role of the university in this type of dynamics.

2. Innovation and the university

Innovation, seen from the spheres of academic knowledge, commits the contemporary University as a fundamental actor in the generation of innovation capacities; this is why it constitutes a key institution of the National Innovation Systems (SNI), which are being consolidated in the countries of the region. For example, in Colombia, the SNI began to be strengthened at the beginning of the 1990s, with the support of a policy proposed by the national government that inserts universities in the field of innovative development, but which "privileges productive organizations" of goods and services as a focus of the processes of transformation of scientific and technological knowledge into economic wealth, social welfare and human development "(Robledo, 2007, p.2).

Although the processes of generating innovation capacities have not been consolidated in the developing countries, with the consequent positioning of them, it is also true that systematic efforts are being made to strengthen these processes. However, despite the efforts being made, innovation has not brought with it the benefits promised by the adopted paradigm of the developed nations (Crivits et al. 2014). On the contrary, it has generated inequality, exclusion, unemployment and environmental imbalances, favoring some sectors and increasingly segregating communities with low purchasing power, leaving many impoverished countries with greater social, economic and environmental problems. In this sense, it has been mentioned that the generation of wealth, development and well-being through innovation does not work in certain areas and that only through the achievement of innovation with a different meaning can the integral development so longed for be generated (Hernández 2013; Rui 2013; Sonne 2012; Altenburg and Lundvall 2009; Fressoli, Dias, and Thomas 2014; Srinivas 2014).

From the above it follows that the innovation that transforms (Transformative Innovation IT) is generated from a different conception of the direction and intention of these processes. This paradigmatic change arises from the need for a new framework of science, technology and innovation (STI), which meets the real and urgent needs of humanity. In this regard, Schot y Steinmueller (2016) mention the need for this new paradigm, since the world is changing profoundly. Fressoli, Dias, et al. (2014) also mention that the current economic development model is not oriented towards sustainability, so that a large part of scientific policies does not focus on this problem either. This implies the resolution of major problems of humanity that generate new challenges for STI policies and that must be aligned with the achievement of the Sustainable Development Goals (SDG) of humanity (ONU 2015).

3. The world situation

In 2015, after monitoring the fulfillment of the Millennium Development Goals, a new 2030 Agenda for Sustainable Development was created and the seventeen Sustainable Development Goals (SDG's) were postulated, incorporating into the Agenda the fight for the reduction of climate change within the framework of a new, more global and inclusive agenda (United Nations 2016). However, it is necessary to recognize that achieving the SDG's in 15 years represents a challenge that must generate articulation and alignment, directionality and intentionality, in all spheres of humanity.



Fig. 1 Sustainable Development Goals (SDG´s) (UN 2017)

From this global context, the emergence of a paradigm shift in terms of STI is evident. In order to respond to this prevailing need, it is proposed what has been called the third framework for Innovation Policy (Science, Technology and Innovation), which will allow a world in transition to contribute to the achievement of the SDG´s. As well as the generation of public policies at the world level, that allow articulating the initiatives, actors and infrastructure of STI to consolidate those processes, critical for the conservation of life and human species. The third framework for STI is being studied by the Scientific Policy Research Unit (SPRU) of the University of Sussex in England, based on the discussions held at the OECD between the months of June and July 2016 in Paris and Seoul and is based on academic work on transformative innovation policies. This proposal manifests the need to design policies for an innovation that allows a transformative change (Schot and Steinmueller 2016).

The third STI framework states the need to change the conception of innovation in the aforementioned terms, since under frame two, innovation is part of the causes and not of the solution of the problems faced by humanity. In large part, this happens because the policy of innovation stimulates industrial activities, economic growth and consumption, which has been part of the generation of environmental problems, social tensions, inequality, increasing the social gap, among others. That is why, from a change in the public policies of STI, it could contribute to the construction of a transformative change through the mobilization of the STI (SPRU 2016) .

It is well known that R&D and innovation occurs with the leverage of the National Innovation Systems; the university, as an active part of them, is called to play an important role in the generation of inclusive innovation (Arber et al. 2014; Hernández 2013; Robledo 2007). In this regard, Thomas, Bortz, y Garrido (2015) emphasize that the systems focused on transformative innovation are those that include problems linked to poverty and, in this sense, a more fluid articulation with social policies is essential, as demanders of innovations and makers of innovation policies, which allow generating virtuous circles of knowledge, innovation and lower inequality.

For some decades now, movements and organizations have been brewing in different parts of the world, in which innovations of this type are being developed, which are called grassroot innovation (Smith et al. 2016). This innovation is developed through different processes of innovation in public institutions, universities, and R & D centers, as well as from the innovation departments of companies that have traditionally networked with formally organized research institutions (Smith et al. 2016). The university, as part of the innovation systems, represents an institution capable of leading this transition between innovation paradigms and has a preponderant role because it is in these centers where knowledge, science and technology are normally generated. necessary to achieve the answers to the problems of humanity

Finally, it is necessary to point out that this paradigm arises from the prevailing need to make a structural change that permeates institutions in developing countries and that reverses, in some way, the negative effects that competitive innovation has left in these countries that, Many times, they become the scenario not only of poverty, but of abandonment, misery and deprivation, all together with the waste and environmental pollution that the (economic) development processes have left under the paradigm of competitive innovation.

4. Methodology

In Colombia, the Administrative Department of Science, Technology and Innovation (STI), Colciencias, is the governing body of the STI processes, as established in Law 1286 of 2009 and Decree 849 of 2016, the Administrative Department of Science, Technology and Innovation, Colciencias (Colciencias 2018c). Among the functions of Colciencias are its functions are (Colciencias 2018a):

1. Formulate and promote the short, medium and long-term policies of the State in STI, for the training of human and infrastructure capacities, the insertion and international cooperation and the social appropriation of the STI to consolidate a society whose competitiveness is based on knowledge, technological development and innovation.
2. Adopt, according to the Law of the National Development Plan, national policies for scientific, technological and innovation development, as fundamental axes of social and productive development of the country.
3. To base and favor the projection and strategic insertion of Colombia in the dynamics of the international system that incorporate knowledge and innovation as a basis for its social and economic development, within the framework of a global knowledge society.
4. Ensure the consolidation, strengthening and articulation of the National System of Science, Technology and Innovation - NSSTI with the entities and the actors thereof, in close coordination with the National Competitiveness System.
5. Promote, articulate and project the organizational management schemes of the STI, in the regions, departments and municipalities of the country to enhance their own development and harmonize the generation of policies.
6. Define and guide priority thematic and operational lines of the National System of Science, Technology and Innovation NSSTI, for which it may modify, suppress or merge

the National Programs of STI; create new structures on different areas of knowledge; define your name, composition and functions; dictate the rules for their organization and design the guidelines for their incorporation into the plans of the entities linked to their implementation.

7. Design, articulate and stimulate policies and instruments for private investment, domestic or international, in STI.

8. To coordinate, with the support of the National Planning Department -DNP, in coordination with the other national entities that execute the STI policy, the resources and their destination in the budget programming process based on the National Development Plan and the policy of CTel.

9. Coordinate the National System of Science, Technology and Innovation (NSSTI) for which it will have the Councils of the National Science and Technology Programs, the Departmental Councils of Science, Technology and Innovation and the Science, Technology and Innovation Advisory Council.

In order to generate a different STI policy and respond to the country's commitment to achieving the SDG's, Colciencias joins the Transformative Innovation Policy Consortium (TIPC), coordinated by the Science Policy Research Unit (SPRU) at the University of Sussex in the UK, and with the participation of innovation ministries and funding agencies from Finland (National Research Council), Mexico (National Council of Science and Technology of Mexico - CONACYT), Norway (Research Council of Norway), South Africa (The South African National Research Foundation - NRF) and Sweden (Swedish Governmental Agency for Innovation Systems - VINNOVA). Additional, associated TIP initiatives include projects in China, Panama and Brazil (TIPC 2018).

The TIPC gives guidelines to a new STI policy framework whose objective is to contribute to the achievement of the global challenges summarized in the SDG's proposed by the UN (Colciencias 2018c). Since 2016, a different methodological approach has been developed, from the STI Policy Unit of Colciencias, to propose this new STI policy, in which several processes were carried out: TIPC; Mentoring Network; Conversations; Citizen consultation SDG'S; Interviews and scientific and technological capacities (Colciencias 2018b). In the present article we present results of the participation of the researchers in the Mentoring Network, that is, a process called "Factoría de Política Pública de Ciencia, Tecnología e Innovación para la Transformación" (Factory of Public Policy of Science, Technology and Innovation for the Transformation hereinafter "Factory") whose objective was to co-create a STI regional public policy for the transformation by analyzing the role of higher education institutions (HEI's) in Medellín, Colombia.

In this regard, the Mentoring Network was an advisory and accompaniment to eight projects in different Departments of the country, in which the dialogue with government agencies and agents of the STI was promoted at the local level, generating results that are reflected in the guidelines to the formulation of regional policy transformative innovation, which allows generating a critical mass of academics with these foundations that will help consolidate the processes in the country and its regions, taking into account the particularity of each, without neglecting the alignment with the achievement of the SDG's, as well as these projects are generating the foundations of a network of Colombian academics that will help consolidate the foundations of this new policy of STI in the country and its regions (Colciencias and SPRU 2018a).

The process of the "Factory" consisted in an "experiment" that put into debate the role of HEIs in the construction of transformative innovation policies through the training of various agents. The proposal was selected within the framework of the TIPC Consortium and supported to be executed at the Metropolitan Technological Institute of Medellín (ITM) and was called as a "Factory" in an attempt to highlight the collaborative spirit of the experience (Villa et al. 2018)



Fig. 2 Logo Mentoring "Factoría" (Villa et al., 2018).

The organizing team built the methodology and academic content in a collaborative construction space with around 40 attendees from the academic, business, state and civil society, who contributed their knowledge, realities and experiences to the generation of proposals and guidelines for a new STI policy for transformation. There were four face-to-face sessions, in which exhibitions on relevant concepts of transformative public policy were interspersed with games and workshops. Specifically, a public policy analysis of regional STI was carried out from frame three of innovation and a workshop for the co-creation of proposals and recommendations so that the STI policy incorporates elements of a transformative innovation policy (Villa et al. 2018).

5. Results and Discussion

It is noteworthy that there are successful examples of the role of the university in the generation of innovation that transforms; one of them, is the one carried out by the University of the Republic of Uruguay, who was a pioneer in developing Research and Innovations Oriented to Social Inclusion (IIS), from a call issued in 2003 as a response of this university to the deep economic and social crisis suffered by the country in 2002 (Dutrénit 2017). In addition to the above, Uruguay has the fund for inclusive innovation, which is managed by the National Agency for Research and Innovation (ANII) with the aim of supporting applied research projects aimed at generating impact and improvements at the level of social inclusion (ANII 2017).

Another example worthy of mention is the one carried out by the CAF - Latin American Development Bank - in partnership with the Organization of American States (OAS), Microsoft, Western Union, Seattle International Foundation and The Trust for the Americas, who supported in 2016, to the Technological University of Santa Catarina in Mexico, to create the DIA Inclusive Innovation Laboratory, whose objective is to train young people so that they can develop projects that improve their social environment, with the support of a laboratory equipped with tools of high technology such as 3D printers, microprocessors and laser cutters, and financially leveraged by public and private entities (CAF, 2016).

As far as Colombia is concerned, as of the present century, a discreet but firm bet has been evidenced, in terms of innovation themes focused on the social aspect. For example, it refers. This is the case, for example, of the current National Development Plan "Todos por un Nuevo País", proposed under the guidelines of the Organization for Cooperation and Development (OECD) in which it is the need to target the generation of social welfare with public policy to achieve the development and wealth of the nation stipulated (Congreso de la República de Colombia 2014). In the Administrative Department of Science, Technology and Innovation, it is mentioned that innovation must "create value from knowledge by generating positive externalities of an economic and social nature" (Departamento Administrativo de Ciencia, 2016), which has been reflected in some calls of R & D and innovation projects (Colciencias 2016).

As mentioned, it is evident that Higher Education Institutions, as part of society and particularly, of local, regional and national innovation systems, are called to support the generation of these changes for the welfare of the nation, it is for This is important in the construction of propitious scenarios to carry out the analysis of public policy that allows to identify, in a participatory manner, components and instruments of regional public policy oriented to HEIs that enable the third framework to be strengthened and strengthen the management of inclusive innovation in these institutions.

The academy has taken an active part in the dialogues to implement the 2030 Agenda in Colombia (PNUD Colombia, 2016). However, at both the national and regional levels, there are no clear policies regarding the role that HEIs can play as key actors of the Innovation Systems in the ITC policy oriented to Framework 3. For this reason, this case study is in an exploration stage. By identifying components and instruments of regional public policy oriented to HEIs with transforming potential, the management of inclusive innovation in these institutions can be strengthened; additionally, it will be possible to generate a process of evaluation of the three framework in the region (Schot 2015) and specifically in Higher Education Institutions as an active part of the National Innovation Systems.

The general objective of the "Factory" process was to contribute to the construction of inclusive innovation policies for the regional HEIs, based on a process of participatory construction of a regional public policy on STI aligned with the third framework. For this purpose, the involved parties were trained in the conceptual and theoretical principles, as well as in the methodological aspects and the practical criteria applicable to the STI public policies of Marco 3, identifying in a participatory manner, both at the local, regional level, national and international, components and instruments of regional public policy oriented to HEIs, which have the potential to strengthen inclusive innovation in these institutions. Subsequently, specific actions were proposed, appropriate to regional institutions, so that the components and instruments of transformative innovation policy (inclusive in this case) identified as priorities could be implemented. Results of the process are reported on "Orientaciones para la formulación de políticas regionales de innovación transformativa en Colombia" (Colciencias & SPRU, 2018b, p 47-50).



Fig. 3 Book “Orientaciones para la formulación de políticas regionales de innovación transformativa en Colombia” (Colciencias and SPRU 2018b).

Among the most outstanding results, it was observed that the theme was of interest for the participants due to its novelty and for placing the focus of innovation in the construction of a better society. Additionally, this space argued about the importance of creating incentives for scientific, economic, political and social production focused on transformative innovation. It was identified the existence of advanced processes in this type of policy, but that came from the base of the pyramid; The need to incorporate civil society in these initiatives was also evident, for which it is necessary to generate other strategies, methodologies and ways of convening them, with a clearer and colloquial language, in which they feel included and can freely express their opinions.

In general, there was a consensus on the need to implement changes in education policy, such as, for example, the revision of educational models, the education evaluation system and the focus of the curriculum based on the innovation framework. There was also talk of including transformative policy concepts in the national, regional, departmental, municipal and HEI development plans. In particular, in the case of universities, it is recommended that framework 3 be included as part of the mission processes.

All of the above must be leveraged by creating a culture of transformative innovation that permeates the productive apparatus and encourage this culture at all levels of education. For example, in research, it was proposed to incentivize processes directed towards the three framework, that allow understanding the phenomenon and that the results of these investigations be widely disseminated in the local context. In extension, it was suggested to stimulate Spin-off as an organization capable of aligning competitiveness and sustainable development. Finally, in the social field there was agreement on the importance of identifying new spaces in which organized civil society actors can participate actively in these processes, generating diverse strategies such as laboratories of transformative innovation in which the communities of base can experience.

Conclusions

The need for transformative changes at the structural level in terms of the policy that will allow building a transformative innovation and the importance of involving the university in these policies is ratified. As a first result it is concluded that the territory and the regions are fundamental actors to carry out the necessary transformations, since the vision of the problems that exist in the same environment create an adequate environment to reach consensual and effective solutions. This requires a real articulation between NSSTI actors and an active role of researchers, students, representatives of civil society and citizens in general. This transformation at the regional level is essential to lay the foundations of a policy aimed at solving problems at the local level, but with a global approach and defined orientation, direction and intention.

To the extent that the process was carried out, it was evident that the university is a fundamental actor in the generation of transformative innovation since from these academic spaces it is possible to implement teaching, research and extension around the transformative approach, that is, processes in which the principles of the theory of transitions, as well as those of the Sustainable Development Goals (SDG's), are incorporated into the mission of the university, without neglecting the needs of the market, but focusing on the development of innovations of a transformative nature, such as social innovation, including innovation, innovation at the bottom, innovation under the radar or frugal innovation. These types of innovation contribute to the transformations of the socio-economic, cultural, political, cognitive and environmental conditions of the marginal communities, excluded from the lucrative markets. Likewise, they allow contributing to the achievement of the Sustainable Development Goals of humanity from the spaces where knowledge is generated.

It is, from this new paradigm, that the third mission of the university must be conceived and implemented, without neglecting the needs found in the dynamics of the market, its scope of solution, but focusing on the development of inclusive innovations that contribute to the improvement of the socio-economic, cultural, political, cognitive and environmental conditions of the marginal and excluded communities of the lucrative markets.

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