

POLICY  
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# Technology Transfer Policy in Colombia - Recent developments

Case study contribution to the OECD TIP Knowledge  
Transfer and Policies project

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**Technology Transfer Policy in Colombia - Recent  
developments: Case study contribution to the OECD TIP  
Knowledge Transfer and Policies project**

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## Executive summary

Technology transfer policy in Colombia began in 1992, when a cooperation program to strengthen relations between universities and the business sector was launched through the implementation of units responsible for managing the transfer process, called Research Transfer Offices. Technology transfer was later established as one of the main functions of the Administrative Department of Science, Technology and Innovation (COLCIENCIAS). Thereafter, each administration has included technology transfer as an objective of the national government plan. This case study focusses on two recent instruments of technology transfer policy in the country: Regional Technology Transfer Offices (TTO) and new programmes to support spin-offs.

COLCIENCIAS issued a public call in 2013 with the objective of building institutional capabilities to connect the developments of the universities with industry, in order to achieve a systematic process of transferring research results and overcoming weaknesses. As a result of the public call, six regional TTOs were created or strengthened. This program has been subject to two evaluation studies, in 2014 and 2017, which are summarized in this report.

Additionally, COLCIENCIAS has been part of the increasing efforts to create spin-offs in Colombia. In 2015, 36 Colombian universities worked together with the leadership of COLCIENCIAS, Corporación Ruta N Medellín and Corporación Tecnova UEE to jointly develop the project called “Guide for the Implementation of spin-off in Colombia”. Its main objective was to generate and strengthen capabilities in Colombian universities for the implementation spin-offs (Colciencias; Corporación Ruta N Medellín; Corporación Tecnova UEE, 2016).

As a complement to the guide, a diagnostic tool was also developed to assess the technology readiness level of a project and to identify whether it is possible to develop a spin-off as a transfer mechanism for its research results. A national invitation to submit spin-off proposals was then launched with the objective of strengthening the capabilities of Colombian universities for the effective implementation of the spin-off technology transfer mechanism through pre-feasibility and training for a constitution of technology-based companies. The invitation to submit spin-off proposals was open until February 2017, in which 7 proposals were selected.

In parallel, legal impediments were found for some universities and researchers to create spin-offs and benefit from them. On July 6th, Law 1838 of 2017 was enacted which empowers universities, both public and private, to create spin-offs, with the active participation of researchers who can receive incentives through the exploitation of their intellectual property.

Following the description of these technology transfer strategies in Colombia (support for TTOs and spin-offs), and the analyses of their results, this report also discusses their complementarity and their interactions with other policies. Both strategies can support each other. TTOs can identify potential spin-offs, so that universities and technology business incubators can verify their viability and implement them. Likewise, these technology transfer policies are related to other policies implemented by COLCIENCIAS, such as the recognition of STI National System Actors, STI tax benefits and the STI Royalties Fund.

Finally, taking in consideration the results of supporting TTOs and spin-offs and their complementarity and relation with other policies, the following conclusions emerge:

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- The focus on a market pull orientation is strategic in order to meet the needs of the productive sector.
  - The effectiveness of spin-offs can improve with better coordination, by articulating the results of TTOs with technology business incubators. The recognition process of STI National System Actors designed by COLCIENCIAS creates a framework that stimulates specialization among actors related to technology transfer.
  - However, technology transfer strategies require permanent and major financing sources, considering their recent creation and that their sustainability requires a medium to long-term approach. This is the reason why technology transfer strategies have been introduced in the tax benefits program and in the guidelines to present projects to the STI Royalties Funds.

## 1. Background

In Colombia, the Science, Technology and Innovation Administrative Agency – COLCIENCIAS created in 1968 as National Council for Science and Technology, is responsible for designing and implementing the Science, Technology and Innovation (STI) policy, in accordance with national plans and development programs.

The history of the technology transfer system began in 1992. Although a consolidated system was not yet in place, the term was already being used. In this year, a cooperation program to strengthen relations between universities and the business sector was developed, through the implementation of units responsible for managing the transfer process called Research Transfer Offices. In addition, in 1994 the first technology business incubator called Corporación Innovar was created, which emerged as a pilot program in Bogotá and then expanded throughout the national territory (Salazar & Varios Autores, 2013).

Then, the National STI Policy 2000-2002, approved by the National Council of Economic and Social Policy (CONPES 3080) (Consejo Nacional de Política Económica y Social, 2000), assigned COLCIENCIAS the mandate to strengthen networks to achieve greater articulation between the government, industry and the academic sector.

In 2007, COLCIENCIAS, the Colombian Training Entity (SENA) and the universities created the “High Level Training Program in Strategic Innovation Management”, as a response to the guidelines of the “National Science, Technology and Innovation Policy”, and as an initiative to close the university-business-state gap and promote the competitiveness of companies in the global market. As part of the strategy of dissemination and development of this program, a series of alliances were made with the Chambers of Commerce and with the Colombian Association of Micro, Small and Medium Companies (ACOPI), which trained an important group of people around the country.

In addition, the University-Company-State Committees (CUEE, for its Spanish name) were created as regional institutions to coordinate universities and companies of the productive sector (Salazar & Varios Autores, 2013). The Ministry of National Education and COLCIENCIAS supported the creation of eight CUEE in the country (Ramírez & García, 2010). However, these alliances were insufficient, thus new mechanisms and instruments of innovation emerged, also known as hybrid organizations that play the role of intermediaries such as technology business incubators, TTOs and venture capital companies (Olaya, Mirabent, & Duarte, 2014).

In 2009, COLCIENCIAS became the STI Administrative Department and the STI National System was consolidated. With this milestone, COLCIENCIAS became the lead agency in these issues for the country. This Law gave COLCIENCIAS the function to “oversee the generation, transfer, adaptation and improvement of scientific knowledge, technological development and innovation in the production of goods and services for regional, national and international markets”.

The National Development Plan 2010-2014 (Departamento Nacional de Planeación - DNP, 2011) established technology transfer as one of the central enablers for innovation and proposed establishing mechanisms to transfer and adapt the scientific and innovative developments that are being generated in the country. An overhead policy was implemented to finance the creation and co-financing of technology transfer offices and the training in innovation and research management skills. Financing was provided through competitive call for projects.

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The National Development Plan 2014-2018 (Departamento Nacional de Planeación - DNP, 2015) defined that it was necessary “to improve the quality and impact of research and the transfer through the STI”, as well as “promote scientific, technological and innovation development as an engine of business growth and entrepreneurship”. Finally, Decree 849 of 2016 (Presidencia de la República, 2016), assigned to COLCIENCIAS, as one of its functions, the “design and implementation of plans, programs and projects focused on the technology transfer and that allows its application by the productive sectors” and was consolidated the policy of technology transfer.

Also in 2016, the National Productive Development Policy (PDP) was established to define the responsibilities of each STI National System Actor and the coordination between them, and to promote sustained increases in productivity that will result in greater growth of the Colombian economy in the long term. This policy is defined as a set of sectoral and cross-cutting instruments to resolve market failures, as well as governance and articulation problems, that inhibit the growth of productivity or obstruct the processes of sophistication of the Colombian productive system. In this context, technology transfer is considered as a critical line of action to solve the market and government failures that limit the development of the determinants of productivity required for the country to improve its levels of productivity, diversification and sophistication.

## 2. Recent policy developments

Two of the most important policy developments in recent years were the creation of regional Technology Transfer Offices (TTO) and policies to support spin-offs. The National Development Plan 2010-2014 (Departamento Nacional de Planeación - DNP, 2011) and the National Development Plan 2014-2018 (Departamento Nacional de Planeación - DNP, 2015), included both instruments for the promotion of technology transfer in Colombia.

On the one hand, the development of regional TTOs was promoted through the call 621 of 2013. This call created and strengthened some TTO, through the construction of an institutional capability for the identification of needs in the companies and the connection with the developments of the universities, in order to achieve a more systematic process of technology transfer. The call's objective was "to shape a bank of eligible proposals for the creation or strengthening of research transfer offices, formulated by alliances between universities, research centres, technological development centres and companies, which are provided with the organizations participation with experience in management of the intellectual property, thinking about how to strengthen the institutional skills of a sustainable way to impel the transfer of knowledge and technology towards the companies and the society" (Colciencias, 2013).

The call was directed to the regional level with the help of the CUEE, resulting in six proposals financed for one year (Colciencias, 2013). The Colombian regions benefited by the call were: Bogotá D.C, Medellín, Bucaramanga and Barranquilla.

In addition to financing, the call offered its beneficiaries special activities such as training and methodological guidance by an expert entity, who visited each of the TTOs, to assist on the creation of its operational plan and the creation of its strategy of five-year sustainability, as well as an international technology mission to Switzerland. Some of these aids were given with the support of the Superintendence of Industry and Commerce (SIC), within the framework of the Colombo-Swiss Agreement called "COLIPRI", for the strengthening of the results transfer system (Inventta, 2013).

On the other hand, the creation of Technology-based companies from research projects in universities (spin-offs) opened several calls focused on:

- providing resources as seed capital for the maturation of technology-based projects,
- supporting and structuring business plans resulting from research and technological development activities,
- designing strategies to support technology-based entrepreneurship projects
- contributing to the reduction of the failure rate of this type of projects due to technical or commercial deficiencies.

Since 2010, COLCIENCIAS has opened the following calls in order to articulate the different players of the innovation ecosystem at national level.

- **Call 523-2011:** Its purpose was to "Provide seed capital and complementary resources for the maturation of technology-based projects". It was divided in two phases. The first phase was carried out in 2011 resulting in the financing of 107 projects. The second one was carried out in 2013, giving continuity to 70 projects presented in Phase I. The amount financed for these projects was USD 3.522.097.



- **Call 642-2011:** Its purpose was to “Support the transformation of scientific or technological knowledge and technological development initiatives in progress, in their transition to concrete value proposals that can be used socially or economically by the country”. The call financed 45 projects for USD 3.341.659.
- **Call 560-2013:** Its purpose was to “To form a bank of eligible projects to support the development and consolidation of business ideas that seek the creation of companies or technology-based business units”. The call financed 58 projects for USD 1.357.209.

Additionally, COLCIENCIAS has been part of a new national initiative for the creation of spin-offs in Colombia since 2013. This initiative seeks to strengthen and streamline the capabilities and resources of universities for the implementation of spin-offs through the development and implementation of a Guide for the Implementation of spin-off in Colombia, including set of sequential actions that must be performed so that institutions can strengthen their internal management processes for the development of spin-off from the strategic, legal and financial components.

Below is a detailed description of these instruments:

## 2.1. Regional Technology Transfer Offices (TTOs)

Regional Technology Transfer Offices are a recent strategy in the national agenda. COLCIENCIAS issued a public call in 2013 with the objective of building an institutional capability and connecting the developments of the universities, in order to achieve a systematic process of transferring research results and overcoming weaknesses. As a result of the public call, six Technology Transfer Offices were created or strengthened. These were:

### 2.1.1. *CienTech TTO*<sup>1</sup>

CienTech was the result of an alliance that emerged within the framework of the Regional Competitiveness Commission, at the Committee of innovation, quality and R&D in the Atlantic region. Different stakeholders identified the need to develop joint strategies, promotion, dissemination and technology transfer, as driving factors of science and technology.

The university-industry relationship is its priority. Therefore, the objectives and actions of its plan are developed around this intermediation, seeking to contribute to increase the levels of science, technology and innovation, to the growth of companies and therefore to the socio-economic development of the region. The office had achieved 2 licensees in the Health sector, 25 technological requests identified, 24 patent applications and 11 technical cooperation agreements signed.

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<sup>1</sup> <http://www.cientech.org/>

### **2.1.2. Connect Bogotá TTO<sup>2</sup>**

Connect Technology Transfer Office was created in February of 2014, with the purpose of helping stakeholders and partner organizations with their technology transfer needs in Bogotá and Cundinamarca region. The University of Texas - Austin provided the initial design.

During the first year, Connect has trained more than 400 researchers from different Universities to understand the basics of Technology Transfer. In addition, the Regional Office team has received a significant amount of training from the IC2 Institute of The University of Texas at Austin on many of the complex aspects of technology transfer. The Office had achieved one licensing in the energy-mining sector, has revised 59 technologies, accompanying seven technologies in their negotiations, and closed a licensing on one.

The Office performed SWOT, PESTIL, and DIAMOND analyses to understand the real technology transfer capabilities of its partner organizations, and to identify the best opportunities in the technology transfer market. Based on this information, the Office generated a five year Strategic Plan aligned with Connect's general vision to help build one of the most innovative regions of Latin America. The Office sees a blue ocean opportunity around negotiation and closing deals. However, there is a significant need to help the region developing basic capabilities in technology transfer, and specifically in tech evaluation, market validation, tech valuation, IP generation, startup and spin-off creation. This Office recognized that developing close ties with universities and companies is critical to its success

### **2.1.3. Fuerza Innova TTO<sup>3</sup>**

Fuerza Innova TTO was created to take advantage of the innovative potential of the actors of the Technology System and the Defense and Security Sector and was set to serve as a platform between scientific development and the real sector. This TTO searches for new business opportunities, examines the technical, economic and financial viability, and develops the processes and strategies necessary to transform Science and Technology System into a system that is competitive and financially sustainable.

The first strategic line of Fuerza Innova is carting out actions for developing an innovation management strategy, based on the technological needs of the air force operation. This orientation is framed by the definition of the Science and Technology programs that are a part of the air force operation lines, and supports the adoption of new processes, acquisition of machinery and equipment, parts and pieces, training of personnel and better technological practices required by the air force.

### **2.1.4. Bogotá TTO<sup>4</sup>**

The Universidad Distrital Francisco José de Caldas (the public university of the city of Bogotá) and the Secretariat of Economic Development of the city created and consolidated an office in charge of facilitating the technology transfer by researchers and inventors of Bogotá, thus enabling the visibility, promotion and development of a marketable and profitable product, socially and economically.

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<sup>2</sup> <http://www.connectbogota.org/>

<sup>3</sup> <https://www.fac.mil.co>

<sup>4</sup> <http://otribogota.udistrital.edu.co/>

The office seeks to give innovation a social character and make it inclusive for all sectors and actors involved in the areas of knowledge and economic sectors. The office has advised 36 projects on intellectual property, carried out the protection of six brands, three utility models and two patent applications and have held workshops on different technology transfer issues influencing more than 1 800 researchers.

#### **2.1.5. Tecnova TTO<sup>5</sup>**

TECNNOVA is a nonprofit corporation with over 7 years of experience managing the relationship between Universities, enterprises and the government of the region of Antioquia. It participated in the bid for COLCIENCIAS with the aim of strengthening the regional model. The office known as “Centro Regional de Comercialización de Tecnología CRCT” has the following purposes:

- Articulate needs, challenges and opportunities of companies with the research group’s capabilities, seeking the commercialization of technologies.
- Improve a network of partners and investors for the realization of the best possible license agreements.
- Generate a culture of confidence in the scientific and business community about the technology transfer and commercialization process.
- Working collaboratively with ecosystem partners that support the structuring and strengthening of spin-off and startups.
- Licensing technologies that enhance business development for startups and spin-off.
- Developing IP strategies in articulation with the commercial potential of technologies, seeking to optimize the resources invested in the mechanism of protection.

The Office had achieved 3 licenses in the financial, health and food sectors; more than 350 people sensitized in topics of technology forecast, competitive intelligence, intellectual property, transfer and commercialization of technology; 5 validations for commercialization of proof of concepts and prototyping of technologies and 15 technologies with a business case development.

#### **2.1.6. Estratégica de Oriente TTO<sup>6</sup>**

The Strategic Plan for Science, Technology and Innovation of Santander Region 2020, within its strategic areas has raised the need for the creation of a technology transfer unit, therefore supported the creation of the Technology Transfer Office *Estratégica de Oriente*.

*Estratégica de Oriente* Office promotes, facilitates and boosts the transfer and commercialization of technology among environments of research, business and social; generating benefits for its allied institutions and the society, as well as economic and competitive growth at local, regional and national levels. The Office has obtained four patent applications, 6 collaboration agreements with STI agents and 19 technologies with a marketing plan. It has also built his portfolio and media participation in the regional agenda.

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<sup>5</sup> <http://www.tecnova.org/>

<sup>6</sup> <http://otrieo.org/>

### 2.1.7. Evaluation model of Technology Transfer Offices

COLCIENCIAS has made two evaluations of the regional TTOs programme. These reviews enabled a better understanding of the institutional advances and challenges of the offices, and served as an input to adjust the program's strategies.

#### First TTO review

After the first year of COLCIENCIAS financial support to the Technology Transfer Offices selected by the call, a process of validation of the strategy was carried out by Diana Mora, an external evaluator. An evaluation system was established to review three fundamental axes: Strategic Management, Operational Management and Impact, presented in the following Table.

**Table 1. Measurement system of the TTOs in its first year of operation**

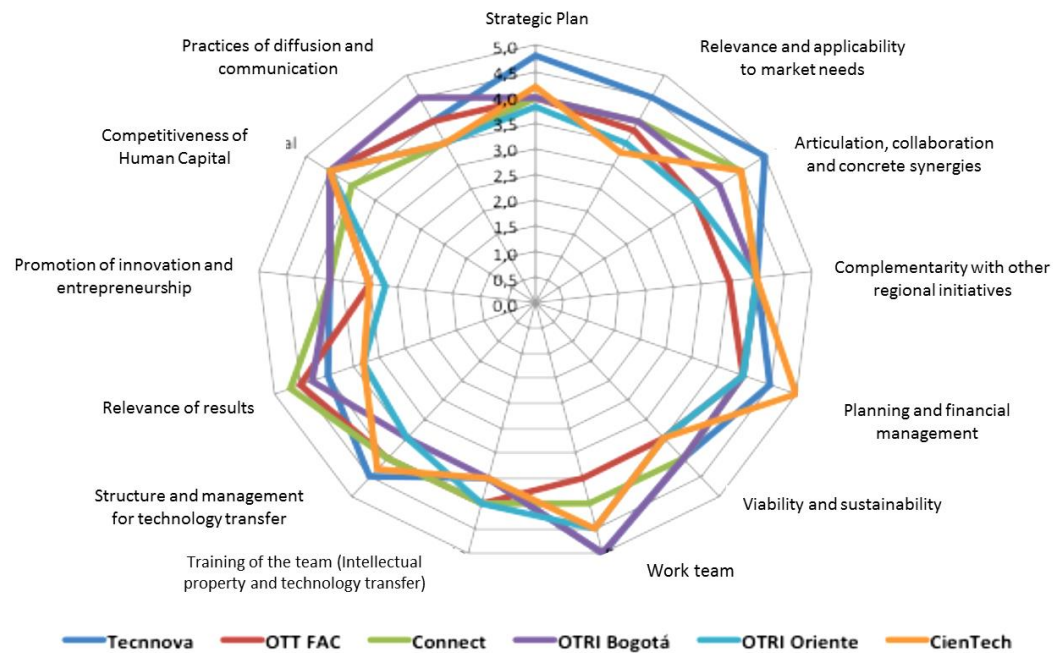
| EVALUATION CRITERIA                              | ASPECT TO EVALUATE                                 | INDICATOR   |
|--|--|---|
| <b>AXIS 1. STRATEGIC MANAGEMENT</b>              |  |   |
| Business model                                   | Strategic plan                                     | <ol style="list-style-type: none"> <li>1. Definition of the business model.</li> <li>2. Design, execution and accomplishment of the strategic plan.</li> <li>3. Clarity in the definition of the objectives directed to the operations of technology transfer, entrepreneurship and intellectual property.</li> <li>4. Accomplishment with activities of the working plan.</li> <li>5. Strategic plan in accordance with STI System.</li> </ol> |
|  | Relevance and applicability to market needs        | <ol style="list-style-type: none"> <li>6. Definition and execution of the marketing plan and the strategic plan.</li> <li>7. Implementation of a system of technological forecasting and competitive intelligence.</li> <li>8. Technology valuation model and technology business plan with high exploitation potential.</li> <li>9. Identification of technological demand.</li> </ol>   |
| Ability to articulate, offer value and synergies | Articulation, collaboration and concrete synergies | <ol style="list-style-type: none"> <li>10. R&amp;D projects in collaboration with other agents.</li> <li>11. Strategic alliances, international TT or IP networks or joint ventures with other organizations aimed at exploiting innovations.</li> </ol>  |
|  | Complementarity with other regional initiatives    | <ol style="list-style-type: none"> <li>12. Proposals with STI Parks, technology business incubators and technology development centers.</li> <li>13. Participation in projects with regional networks.</li> </ol>   |
| <b>AXIS 2. OPERATIONAL MANAGEMENT</b>            |  |   |
| Financial and sustainability Plan                | Planning and financial management                  | <ol style="list-style-type: none"> <li>14. Investment plan and availability of resources.</li> <li>15. Budget.</li> </ol>   |

|                                 |  |   |
|---------------------------------|--|---|
|                                 | Viability and sustainability   | 16. Structure of the sustainability plan (minimum 5 years).<br>17. Management and financing capacity.   |
| Leadership and Operations       | Working team   | 18. Human Capital Competences.<br>19. Dedication of TTO staff.  |
|                                 | Training of the team (Intellectual property and technology transfer) | 20. Design and execution of training plan on Intellectual property and technology transfer.<br>21. Human Talent Management.   |
|                                 | Structure and management for technology transfer                     | 22. Type of organizational structure, functions and organizational guidelines.<br>23. Processes and tools for the identification, presentation, negotiation and commercialization of research results.<br>24. Definition of roles and functions.<br>25. Standardization of policies, procedures and instruments established for the protection of research results. |
| <b>AXIS 3. IMPACT</b>           |  |   |
| Results                         | Relevance of results   | 26. Agreements for the transfer of know-how, confidentiality agreements, R&D contracts, licenses, technical assistance, consultancy or transfer of material.<br>27. Patents, utility models, industrial design, trademarks, copyrights, creative commons with marketing potential.<br>28. Projects with potential development for the creation of spin-off.         |
|                                 | Promotion of innovation and entrepreneurship                         | 29. Definition, standardization and communication of the incentive plan and promotion of innovation.<br>30. Entrepreneurship initiatives of the academic community.<br>31. Activities for the management of investors.  |
|                                 | Competitiveness of Human Capital                                     | 32. Events in technology transfer, Intellectual Property management, entrepreneurship and innovation.<br>33. Training for the development skills in technology transfer and entrepreneurship.   |
| Communication and dissemination | Best Communication and dissemination practices                       | 34. Implementation of a system for managing and promoting technological research results.<br>35. Standardized documents and instructions to formalize and promote the communication between researchers and offices.  |

Source: Based on (Mora, 2015)

The results of this process, after technical visits to the work units, interviews with the members, and detailed reviews of reports and sustainability plans, are summarized in the following measurement chart:

Figure 1. TTOs Global Results



Source: Based on (Mora, 2015)

According to the evaluation, the TTOs showed a high level (70% -84%) and progress (85% -100%) of its strategic, operational and impact management, obtaining a rating between 3.7 and 4.4. This indicates, on average, an score of 80% overall progress in the management of the restructuring processes carried out in its first year of management (Mora, 2015).

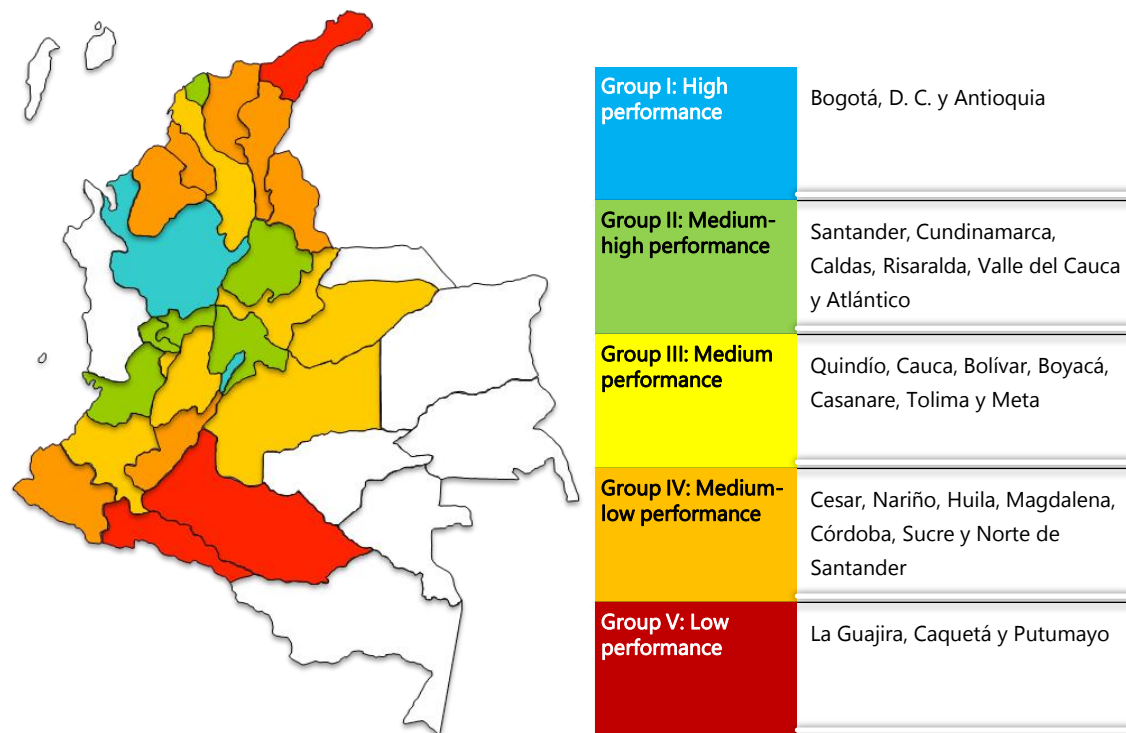
The TTOs evaluated achieved its strategic planning, and its model of organizational and operational structure in the first stage. This allowed institutional continuity to develop in a second stage, and to generate and consolidate successful results.

The most advanced factor presented in the TTOs was operational management, as evidenced by progress in the restructuring processes and in the strengthening of its operations in the first year of management. A second factor of progress was the strategic management, based on the high capability of the offices to articulate the needs of different agents involved in the processes of technology transfer. Finally, the impact factor obtained the lowest rating, which showed the clear need for the office to achieve better recognition and results for the region.

The Regional Innovation Index for Colombia (IDIC) (DNP y OCyT, 2016), based on the methodology of the Global Innovation Index (Cornell, U.; WIPO; INSEAD, 2015), evaluated the capabilities and results of innovation for 25 of Colombia's 32 departments, for the first time in 2016.

According to the good results obtained in the first year evaluation of the TTOs and the IDIC results, COLCIENCIAS continued to support the offices with a regional approach in the regions with the best STI capabilities and results.

**Figure 2. Pillars and performance levels in IDIC 2016**



Source: DNP and OCyT, 2016.

According to this, COLCIENCIAS continued the financial support of a single office for each region for the Groups I and II:

- Group I: High performance
  - Connect in the regions Bogota and Cundinamarca.
  - Tecnova in the regions of Antioquia, Caldas and Risaralda.
- Group II: Medium-high performance
  - Estratégica de Oriente in the region of Santander.
  - CienTech in the region of Atlantic.

The financial support did not continue for the Bogota's University Francisco José de Caldas and Fuerza Innova, because they were not oriented to a specific region.

Valle del Cauca region did not have a regional Technology Transfer Office, in spite of its potential conditions for innovation. For that reason, the Technology Transfer Office was created in 2015, known as Reddi.

Reddi's creation was possible thanks to various sectors that are committed to the growth and consolidation of the ecosystem of Science, Technology and Innovation, such as COLCIENCIAS, Cali Chamber of Commerce, Universidad del Valle, Universidad Icesi, Pontificia Universidad Javeriana Cali, Universidad Autónoma de Occidente and Universidad San Buenaventura of Cali. Although the TTO is recent, it has advanced in its formal creation and has analyzed 37 technologies from sectors such as agroindustry, health, technology, basic sciences, energy and manufacturing.

### Second TTO review

The German expert entity, Steinbeis, conducted a second review commissioned by COLCIENCIAS in 2017. According to this review:

- Colombia has an excellent starting point for a well-functioning, nationwide operating technology transfer system.
- It has many excellent universities, which are already engaged in contract research.
- There is a network of TTOs with a competent and motivated staff.
- In a future, they could and should be strengthened, by being involved in an international innovation policy strategy for the countries of the Pacific Alliance (Mexico, Chile, Perú and Colombia).

The German expert entity issued the following recommendations and COLCIENCIAS designed a working plan.

**Table 2 Recommendation and COLCIENCIAS Work Plan**

| No. | RECOMMENDATION   | WORKING PLAN   |
|-----|--|--|
| 1   | TTO must seek for closer institutional relation and interaction with business member associations.   | COLCIENCIAS has designed a program for closing technological gaps partnering with the Innovation agency iNNpulsa and the business association of Colombia – ANDI. This implies designing and implementing technological studies and roadmaps in which TTO will have a main role. |
| 2   | Learning targets and selected topics useful for consultants working in the domain of technology transfer.  | Training to the needs identified in the diagnosis of the offices.  |
| 3   | Change approach from a top-down to a demand orientated bottom-up approach.   | Performance agreements between each TTO and COLCIENCIAS will include a Market Pull process that take into account the technological needs of companies.  |
| 4   | TTO should not work with employed staff only, but also with external freelance experts who can/should act on behalf of them.   | This represents an opportunity to improve cost in the offices. Performance agreements between each TTO and COLCIENCIAS will encourage sharing resources among them and managing supplier's relations.  |
| 5   | It should be complemented with hands-on experience by interacting with regional industry and sector experts.   | New calls and meeting with the business community, across the generation of spaces of dialogue. This with the support of the chambers of commerce and the ANDI.  |
| 6   | In order to improve the market penetration (i.e. access to the demand) the following recommendations were made:<br><br>A pro-active program for company diagnostics, personal interaction. <ul style="list-style-type: none"> <li>• Events for SMEs.</li> <li>• Social Media, homepage,</li> </ul> | In order to improve the market penetration, COLCIENCIAS will promote a connection between companies benefited from its innovation management programs and TTO.   |



| No. | RECOMMENDATION  | WORKING PLAN  |
|-----|---|---|
|     | mailings, phone contacts (e.g. for after care).   |   |
| 7   | Technology transfer has to be understood as a process to solve technological problems of industry instead of limiting it to mere “licensing”. | Performance agreements between each TTO and COLCIENCIAS will consider as deliverables agreements of co-development agreements, services of technological extension, technology business plans, collaboration agreements and consultancies in intellectual property. |

Source: (Steinbeis, 2017).

### 2.1.8. National Network of Regional Technology Transfer Offices

COLCIENCIAS has also promoted a National Network of Regional Technology Transfer Offices in order to work together, participate in international networks, establish connections and share resources. The advantages of networking are:

- More visibility and a common branding.
- Certain resources and services that are not relevant for each TTO could be centralized in the network.
- Political lobbying would be more efficient.
- Individual features and competition would still be possible.
- Share costs and take advantage of economies of scale.

The main targets of this National Network of Regional TTO are strengthening capabilities, exchanging knowledge, and offering services with high value in technology transfer. A Memorandum of Understanding among the five Regional Technology Transfer Offices for mutual, coordinated and active cooperation was signed in July 2017 with the common objective of streamlining the transfer system.

In addition, the network has initiated several programs to carry out “market pull” processes that take into account the technological needs of companies. One of them is the pilot project for tech transfer accelerator in clusters. The project aims at creating capabilities across the country to accelerate the technology transfer processes, based on a methodology designed for the white protein cluster in the Valle del Cauca region. This policy tool will enhance the coordination between government agencies and will be focused on regional clusters and Technology Transfer Offices.

## 2.2. Technology-based Companies (spin-offs)<sup>7</sup>

The Political Constitution of Colombia, under the principle of university autonomy, developed by Law 30 of 1992, assigned Colombian universities the important role of being a factor of scientific, cultural, economic and political development at national and regional levels. This mandate was understood and assumed by Colombian universities, which has resulted in increased resources for Research, Experimental Development and Innovation (R&D&I), creation of technology transfer units/offices, venture capital, programs to

<sup>7</sup> <http://www.spinoffcolombia.org/>

support entrepreneurs, among others. Within this framework, the term “Technology Based Company or Spin-off” was used to identify a specific technology transfer mechanism by which the university gives life to a company capable of carrying out the transfer process.

However, the possibility to create spin-offs from autonomous public universities was unclear in Colombian legislation. For this reason, the national forum “Can public universities create spin-offs?” was held at the University of Antioquia in early 2012. The main objective of this meeting, which was attended by some of the main public universities of the country and representatives from COLCIENCIAS and the Ministry of National Education, was to explore the legal constraints for the creation of spin-offs at public universities, and how to address them.

In 2013, a management group was set up to analyze the forum conclusions. It was composed of the Universidad de Antioquia, Universidad Nacional de Colombia, Universidad Industrial de Santander, Universidad del Valle, Universidad Tecnológica de Pereira, Universidad de Caldas and Universidad del Atlántico. It received the support of COLCIENCIAS and Tecnova UEE. This exercise led to the following results:

- A detailed study on the spin-off topic, both nationally and internationally.
- A more detailed picture of the challenges; especially of the regulatory barriers in Colombia, in front of which several legal and institutional alternatives were proposed.
- The formulation of a bill that was subsequently submitted to the Congress of the Republic of Colombia (which will be discussed in more detail in section 2.2.3 Spin-off Law).

In 2015, 36 Colombian universities worked together with the leadership of COLCIENCIAS, Corporación Ruta N Medellín and Corporación Tecnova UEE to jointly develop the project called “Guide for the Implementation of Spin-offs in Colombia”. Its main objective was to generate and strengthen capabilities in Colombian universities for the creation of spin-offs (Colciencias; Corporación Ruta N Medellín; Corporación Tecnova UEE, 2016). As a complement to the guide, a diagnostic tool was also developed to assess the technology readiness level, to identify whether it is possible to select spin-offs as a transfer mechanism for its research results.

Participating universities contributed to the development of this collaborative work, whose co-creation methodology was based on three thematic workshops: strategic, legal and financial, in which each entity designated some delegates who supported the definition and construction of the contents of this study. The contents were reviewed, validated and complemented jointly by the leading entities, under the guidance of national and international advisers.

### ***2.2.1. Pilot Project***

Once the first versions of the “Guide for the Implementation of Spin-off in Colombia”, the diagnostic tool and the definition of spin-off for Colombia were developed, it was necessary to review if the guide was aligned with the existing spin-offs or those in consolidation process in the country.

The pilot project launched by COLCIENCIAS, Corporación Ruta N Medellín and Corporación Tecnova UEE started with an invitation to submit spin-off proposals by the universities that were working on the project Guide for the Implementation of Spin-off in

Colombia. The goal was to select 8 projects, in order to review their strategic plan. The projects selected should meet three requirements:

- To be a business project from the university.
- To be a business project that translates the knowledge generated in universities into commercial products and services.
- Have a first market approach.

In addition to the fulfillment of the three previous requirements, other factors considered were the development technology level, innovation level, market segmentation, product life cycle, market expansion projection and work team experience. (Colciencias; Corporación Ruta N Medellín; Corporación Tecnova UEE, 2016).

9 of 12 submitted projects were chosen by COLCIENCIAS, Corporación Ruta N Medellín and Corporación Tecnova UEE:

- Universidad Javeriana. “Bioallpa”: It offers the development, production and commercialization of bio-inputs that have the capacity to accelerate the degradation of organic matter, making organic composting processes more efficient, as well as promoting plant growth.
- Universidad de Medellín. “Green Bio Vitroplants”: It offers the development of the protocol for the production of oil palm vitroplants (*Elaeisguinnensis* Jacq.) by somatic embryogenesis.
- Universidad Tecnológica de Pereira. “Dicolabs Instruments”: It offers the design, creation and construction of electronic equipment to demonstrate the concepts, equations and laws of basic physics that are studied in schools and universities.
- Universidad de Antioquia. “Medication Mixing Center”: It offers the provision of pharmaceutical services and activities, procedures and technical, scientific and administrative interventions related to single dose drugs (master blends).
- Universidad de Caldas. “Telehealth”: It offers the development and commercialization of software for telemedicine, commercialization of professional training programs, diagnosis and treatment of medical specialties.
- Universidad Industrial de Santander. “Chicamocha Magic”: It offers the production and marketing of cosmetic products derived from natural extracts (massage oils, insect repellent air freshener, antibacterial gel, mouthwash and liquid soap).
- Universidad del Valle. “EBT Energy Reserve”: It offers the production of Bacterial Cellulose with commercial applications in medical and pharmaceutical treatments.
- Universidad Militar Nueva Granada. “Colombia Biocontrol”: It offers biological controllers (mites) that serve to carry out biological control to the pests that affect the flower crops.
- Universidad Pontificia Bolivariana. “Bionanocell”: It offers a prototype that allows to measure the energy of the soil, in order to evaluate the state of its nutrients and therefore determine if it is suitable or not for crops.

Lessons learned from the pilot project were:

1. The evaluation and selection project processes required validations through visits to universities to know:
  - The work team of the spin-off.
  - The actual capability of laboratories and facilities.
  - The support of certifications of equipment and laboratories in the cases that are required.
  - The way in which spin-off costs are administered from the university.
2. From a financial point of view, some projects were viable; however, there are costs, specifically related to the administration assumed by the university, that are not presented in the financial projections. Therefore, it is necessary to review this aspect in detail and ask the universities to show these hidden costs as they lead to errors in the selection of projects.
3. Projects in the bio-, agro- and health sectors require longer incubation times and high investments (on average USD 68 600), as they require laboratory and product tests and the fulfillment of health and administrative regulations, among other procedures that take between one to three years.
4. The creation of a spin-off only with the participation of the university should be the last option, because the initial process requires knowledge and approach to the market from practical realities. This component is not yet in the dynamics of universities and it is necessary a partner who has experience in this subject.
5. Linking of researchers to spin-off must be negotiated from the moment in which the researcher's work plan for the university is established, because their work plans are annual and rigid to be modified.
6. The processes of identification, formulation, revision and start-up of university spin-off are not short-term, since this transfer mechanism is more complex than traditional mechanisms such as licensing or extension technical services. The complexity arises due to the need to involve, on one hand, a new venture or business opportunity and on the other, results of research processes. On average, incubation times are between 3 and 5 years, depending on the area of knowledge to which the technology to be exploited belongs (Colciencias; Corporación Ruta N Medellín; Corporación Tecnova UEE, 2017).

### ***2.2.2. Spin-off Strategy Execution***

A national invitation to submit spin-off proposals was then launched with the objective of strengthening the capabilities of Colombian universities for the effective implementation of spin-offs through pre-feasibility and training for technology-based companies. The invitation to submit spin-off proposals was open until February 2017, in which 7 proposals were selected:

1. Universidad Católica de Manizales. “Telemetry, control and early warnings through a system for measuring the water consumption of residential users”: The project consists of developing a prototype that measures the consumption of water by residential and industrial users in almost real time, in addition to control the water lines or pipes that go to the residences or industries through a remote system

that is connected to the network. This project minimizes errors during the measurement of water consumption and can detect the location of leaks, fraud or altered counters.

2. Universidad Tecnológica de Pereira. “Movy TIC”: The project focuses on generating a set of solutions aimed at strengthening urban mobility, creating more intelligent and environmentally conscious cities.
3. Universidad CES. “In-vitro Toxicity Uni”<sup>10</sup>: The project generates a specialized unit in the in vitro toxicological evaluation of finished products, raw materials and environmental contaminants, to meet the needs of the pharmaceutical, food, biomaterials, cosmetics, cleaning products, mining, agricultural, chemical and environmental sectors.
4. Universidad de Antioquia. “Factory for the production of pharmaceutical therapeutics and pharmacological treatments”<sup>11</sup>: The project consists in the manufacture of antivenomic therapeutics to counteract the poisoning in humans and animals caused by different venomous species located in different zones worldwide.
5. Universidad CES. “Hola Dr”<sup>12</sup>: It is a model of pediatric care through a mobile application to improve the care of their patients and the lives of their families. It allows extending the consultation scheme and accompanying families 24 hours a day, 7 days a week and following up.
6. Universidad de Medellín. “Sicrif”<sup>13</sup>. Financial Risk Quantification System, based on historical data on deposits and outlays, applies statistical models and the methodology of value at risk to arrive at a reliable measurement of liquidity risk for different scenarios over a defined time horizon and classified by the different lines of business that the entity manages.
7. Universidad Piloto de Colombia. “Sustainability Forum”<sup>14</sup>: The project facilitates the design and implementation of action plans for sustainable development, through group tools and techniques that improve economic performance, the reputation of organizations and indicators of socio-economic and environmental impact in the regions.

The aforementioned projects were improved by using the Diagnostic Tool and Guide for the Implementation of spin-off in Colombia and on June 15 of 2017, the launching event was held for these 7 spin-offs which were renamed:

- Universidad Católica de Manizales, SIOTICTECH.
- Universidad Tecnológica de Pereira, spin-off BIT DATA.
- Universidad CES spin-off, UT In-vitro Toxicity Unit.
- Universidad de Antioquia, spin-off Tech Life Saving (TLS).
- Universidad CES, spin-off Hola Dr.
- Universidad de Medellín, spin-off FAKTOR BUREAU.
- Universidad Piloto de Colombia, Sostenible Action spin-off.

### *2.2.3. Spin-off Law*

In parallel to the work described above, legal impediments were found for some universities and researchers to create spin-offs. For that reason, in 2015, a bill was presented to promote science, technology and innovation through the creation of technology-based companies (spin-offs). The bill was approved by the Congress. A public hearing was also held, in which the universities of the country and the entities that are part of the Community of Practice were invited, including COLCIENCIAS. Finally, on July 6th, Law 1838 of 2017 was enacted, empowering universities, both public and private, to create spin-offs, with the active participation of researchers who can receive incentives through the exploitation of their intellectual creations.

### 3. Discussion

The previous description of technology transfer strategies in Colombia, regarding support for TTOs and spin-offs, and the analyses of their results, are also useful to review their complementarity and their interactions with other policies.

Both strategies can support each other. Regional TTOs, through the identification of technology transfer needs and opportunities, can identify potential spin-offs, so that universities and technology business incubators can verify their viability and implement them. One of the successful cases that has achieved endorsement by both strategies was the spin off “Hola Dr.” from Universidad CES discussed above. The TTO helped in the definition of intellectual property, license or commercialization conditions, financing of ownership of intellectual property rights, royalties and the implementation of the spin-off strategy.

Likewise, these policy instruments to support technology transfer are related to other policies implemented by COLCIENCIAS, such as the recognition of STI National System Actors, STI tax benefits and STI Royalties Fund.

With regard to the recognition of STI National System Actors, it is necessary to mention the National Policy of Actors of STI National System (2017), which aims to promote the excellence of the main actors that are part of the STI National System. This policy entails a process of accreditation or recognition of those actors by COLCIENCIAS, with three purposes:

- Address legal requirements, according to which COLCIENCIAS must recognize certain actors, enabling them to access tax benefits for investments in STI (Articles 158-1 and 256 of the Law 1819 of 2016) (Congreso de la República, 2016).
- Facilitate their participation in the calls and programs of the National Government.
- Deepen the information available on STI National System Actors, their results, dynamics and interactions, through the systematic and periodic reporting of such information, in order to consolidate information and indicators for the design of instruments and public policies of their own for each of them.

The typology of actors related to technology transfer include TTOs, technology business incubators and STI Parks, which once they meet a series of requirements, must be submitted to COLCIENCIAS to be recognized as a STI National System Actor. All this means that there are actors within the ecosystem that work to generate products of technology transfer (such as spin-offs) to allow the maturation and growth of the STI National System. The recognition seeks to reach the conditions for a coordinated action among them as their strategic focus is differentiated.

On the other hand, tax benefits encourage investment in research, development and innovation, promote the competitiveness of companies and the development of high-impact research for the country. With the regulations created around this program, TTOs or technology business incubators can participate in the projects presented by companies as co-executors. That is, they participate directly in the fulfillment of the objectives and results proposed for the project or as a technical supervisor whose objective is to guide, support and ensure compliance with the scientific, technical and budgetary commitments of the project, for which they must be recognized as a STI National System Actor. Additionally, the companies will be able to cover costs associated with the technology readiness,

activities of protection and commercialization as a specialized service performed by the TTO within the projects. This guarantees the complementarity between the different instruments for STI National System Actors.

Finally, it is worth mentioning that the policies discussed in this report interact with ongoing efforts to improve the efficiency of the STI Royalties Fund, which was created in 2011 as a fund that assigned 10% of the resources received by Colombia from the exploitation of non-renewable natural resources (mainly oil and gas). This fund is then used to finance STI regional projects. When a region wants to make use of the STI Royalty Fund, it is necessary for it to formulate a project in one of the topics related to STI (basic research, applied research, technological development, innovation, technology transfer, among others).

For the formulation of these projects, COLCIENCIAS has created different tools for its support. One of them is the Guide No 2 of STI Programs and Projects. This document identifies the different types of STI projects and activities that can be financed (DNP y Colciencias, 2015). The Guide identifies as a type of projects the creation and strengthening of TTOs and spin-offs, including the financing of prototype development, valuation, proofs of concept, intellectual property protection expenses, scientific personnel and equipment, materials and supplies.

In addition, in 2017 a pilot project was launched to for the creation of spin-offs in the sector of Information and Communication Technologies (ICT) (Colciencias; MinTIC; Corporación Ruta N Medellín; Corporación Tecnova UEE, 2018). The objective of the call is to strengthen and boost ICT spin-offs in order to increase the innovation and competitiveness of the country's ICT sector. The results obtained from this sectorial pilot will help to generate a comprehensive instrument for technology transfer taking into account the capacities and needs of other economic sectors.

Finally, taking in consideration the results of supporting Regional TTOs and spin-offs, as well as their complementarity and interactions with other policies, it is possible to conclude:

- Focus on a market pull orientation is strategic in order to attend the needs of the productive sector.
- The effectiveness of spin-offs can improve with major coordination by articulating the results of TTOs with business incubators.
- Technology transfer strategies require permanent and major financing sources, considering that their sustainability requires a medium to long-term approach.



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