

Dialogues for the generation of indicators of STI in Costa Rica

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Abstract

This paper systematizes the experience of the dialogue process for the generations of indicators of STI in Costa Rica and rescues the perspective of a series of actors playing an important role in the process. It starts from a theoretical framework that enables to better understand the dialogue process and from a methodology that allows identifying the lessons learned and the challenges for the dialogue to have better results. Moreover, the paper enables to view that the objective of generating indicators has been achieved, but there is much more to be done before the system provides better results regarding the generation of STI policies.

1. Introduction

The generation of official indicators of science, technology and innovation (STI) began in Costa Rica in 2008, because a solicitude of extra funding for STI by the Ministry of Science and Technology (MICITT) to the Ministry of Finance. From these conversations it result clear that there were no official indicators useful to know the situation of the country and the magnitude of the effort to reach the goals in STI. Nor even the goals were completely clear, because the Plan of Development proposed by the Government, only mentioned de goal of reaching 1% of R&D with respect to GDP.

The original goal was to measure R&D. But later it was decided to generate a more complete set of indicators. During the first phase, the dialogue was organized in top-down initiative, but increasingly incorporating more communities.

After some months, MICITT designed a decree-law signed by the president and by the ministry (the Decree 34278-MICIT of January 11, 2008), creating a National Commission for the generation of indicators of STI, with persons from the main state and private organizations. There was also created a technical committee with representatives of the same agencies and organizations. The technical committee designed a set of indicators to be calculated and discussed the methodology to generate the indicators.

Six versions of the National Indicators Report of Science, Technology and Innovation had been published by 2016 in with data from different sectors. In the middle of the process to generate the indicators for each year, the process of dialogue has continued, with the purpose of discussing about new indicators and revision of methodologies, but also for the analysis of the results and to consider opportunities for policies or for strategies of the different stakeholders.

This document enables to identify the importance of the dialogue process in the creation of indicators and it takes into account the impact of the interactions among the different actors in the system. Key elements to improve the dialogue are identified.

From the methodological perspective, the research proposal is developed as a case study through semi-structured interviews and open questions. The structure of this document is organized in an introductory section, general aspects about the dialogue processes of science, technology and innovation, the research design and the presentation of the case. Finally, the discussion of the evidence from the main findings and some conclusions are exposed.

2. Theoretical approach of the Dialogue Processes of Science, Technology and Innovation (STI)

This section explores the development of recent approaches for the design of policies for STI. The point of departure is the Innovation Systems Approach. This approach recognizes a high level of complexity and the participation of varied group of actors (Edquist, 1997; Lundvall, 1992; Nelson, 1993). In fact, innovation is understood as an interactive search that is constantly evolving and in which science and technology play an important role (Smits, Khulmann and Teubal, 2010).

The Development of STI Policies is a creative process. It is important the existence of a specific institutional context where changes and variations can impact the appropriate identification of strategies and the capacity of actors to adapt the instruments to change realities (Crespi and Dutrénit, 2013; Edquist, 2014). It is required a wide range of policies expressed in a wide array of instruments specific to each context and oriented to a holistic vision (Chaminade and Edquist, 2010). It is important to set an explicit objective that develops a mechanism of dialogue on the ideas and the definition of cooperation channels.

Interactions among different actors are relevant. The triple helix model is useful to understand the transformations in the production of scientific and technological knowledge occurred in the latest decades and to comprehend how the organizations establish strategies to adapt to those changes through the dynamics of coupling (Etzwitz and Leydersdorff, 1995; Izasa, 2006). The close link among these actors has promoted different types of initiatives generating an increasing interest on the researchers in Latin America (Sutz, 1998; Ibarra-Colado, 2006; Pérez-Bustos et al, 2012, Piñon, 2004)). As Sutz's states (1995), the innovative processes are developed at an institutional level in which "the capability of institutional learning and the institutional influence on the learning processes of other actors" (Sutz 1995, p. 22).

The organizations that intervene in the learning processes could become in real institutionalized networks of social interaction (Arocena y Sutz, 2004). Alzugaray, Mederos and Sutz (2013) indicate that knowledge as well as innovation should establish ways of explicit and direct collaboration that allow the social inclusion with a view to set up a democratic system and guarantee the representation for all the involved actors (Edwards et al., 2004).

Moreover, it is clear that the organizations should not be seen as expert networks when referring to the discussion about dialogues of STI polices. It is crucial to establish more inclusive STI communities to identify the non-codified knowledge or the one that comes from experience (Lam, 1999). Designing and implementing dialogue of politics can promote the creation of communities of innovation. The will of the actors is closely linked to their institutional interest and it enhances

operative structures needed for the establishment of successful processes including the social inclusion objective cited in the most recent debates about the impact of STI policies (Gras, 2012).

Innovation does not occur in isolation since it is an intrinsic dynamic of social and cultural activity in which the actors take defined positions (Alzugaray, Mederos y Sutz, 2013). It is important to take into account that the establishment of dialogues for innovation policy impacts the environment beyond the area of substantive action of the institutions; this strengthens the democratic ideal through the deliberative practice (Badallo, 2008). More inclusive dialogues, as Delgado (2009) states, foster more reflexive political processes. Considering the political perspective of the community of actors, the pluralism of opinions contributes to the construction of citizenship when enabling the necessary mechanisms for new actors to become part of processes of knowledge production moving from a traditional community of experts to an environment of co-production of knowledge (Palacio Sierra, 2011).

“The dialogue is a process of real interaction through which human beings listen to each other so deeply and respectfully that they can change through what they learn. In a dialogue, every single participant makes an effort to introduce others’ concerns to oneself perspective, even when there is a persistent disagreement. None of the participants give up their own identity, however each of them recognizes how strong the human claims of others are and as a consequence they behave differently towards others” (Cuentas y Linares Méndez, 2013).

The processes of dialogue can harbor conflicts resulting from positions and interests different from the actors. Asymmetric locations in the communicative interaction resulting from relationships of power or unequal distributions of resources among the participants could also generate conflicts. The relationship of power among the different actors is present in the dialogue. Within the common space of interaction, one of the actors could influence asymmetrically others’ decisions. In the Weberian sense, this differential influence occurs when imposing will against any kind of resilience or when the rest of the actors obey a mandate. When referring to dialogue, leaderships and the asymmetry of knowledge also become factors of power affecting the relationships among the participant actors. The eventual presence of leaders in some processes can cause/resolve conflicts throughout it (Goñi *et al*, 2015). The institutional significance and anchoring of each actor define its situation of power in dialogues and then, its capacity of interference in the process (Weber, 2002: 43). In the study of dialogues, the possible sources of conflict as well as the relative power of each of the actors should be taken into account.

Characteristics of dialogue in STI

According to Goñi *et al* (2015), any dialogue of STI communities is a process that gets unique characteristics in terms of: the objectives of the dialogue process (for what and for Whom?); the duration (on time, short term- less than a year-, medium/long term- over a year-), temporal continuity (continuous or discontinuous); the scope (global policies, sectorial policies, regional policies of STI); those who are promoting it (government agencies: national, estate, local, academic community, business community, civil society); the presence or absence of an institutional framework where it is conducted (it can accompany the “lifecycle of the policy”

looking for fostering its development and consolidation, it can occur outside of the environment of the public policy giving it contributions and alternatives, or emerge from its critique); the combinations of communities that is present in the process being able to classify its heterogeneity in high, medium or low; the methodology being developed (promoting participative processes of wide scope or specific consultations, or creation of consensus); the products (binding or non-binding outcomes for the development of STI policies).

Taking this combination of characteristics into account, Goñi *et al* (2015) distinguish some types of dialogue processes namely: a) Reactive dialogues: emerge in response of a concrete policy/action; they get organized looking for modifying/insist/correct the context of a policy. b) Proactive dialogues: they seek the construction of new policies and actions and their objective is to develop discussions to design collectively a product relatively concrete, that means, to create alternatives to the existing policies. c) Dialogues to detect demands that help to orient STI policies are of an exploratory nature and they seek to provide evidence for possible paths of action for policies based on topics, situations and neglected problems. d) Dialogues to create non-expert opinions related to concrete issues that are object of the STI policies (for example, citizens' judgements).

3. Methodological framework

The qualitative approach of research is used in this study, because with this approach is possible to explore deeply the phenomenon being studied according to an inductive process and an analysis process of reality that considers multiple subjective realities (Hernández, 2010).

In order to analyze the case study, the construction of the design incorporates elements of the analytic-inductive method of social investigation. In other words, the researcher can use a technique that goes from specific to general allowing the researcher to make generalizations based on what it is observed.

There are some specific elements for the conceptual approach of the experience of dialogue that emerges from its conformation and that is established from the theoretical component:

i. Being aligned with what Álvarez *et al.* (2016) suggest, the dialogues of STI policies are characterized by being articulated processes that facilitates the concentration of actors, they are based on levels of interaction and cohesion that promotes besides the establishment of common language and the discovery of shared interests, the transfer of knowledge and the promotion of learning dynamics.

ii. A key element for the consolidation and success of the dialogues in the STI policies is the trust established among the involved actors (Nupia and Martínez, 2015). Therefore, the creation of trust foundations should be the main objective from the first stages when exploring and involving new actors. As we believe, this aspect should be visible to the resolution of any conflict in the respective guidelines and, at the same time, they should be part of the strategies directed to legitimize the dialogue among actors, in particular those who become part of it at a later time or those who participate at specific moments.

iii. Due to the above, in the case of the MICITT on its role of governmental organization competent on STI issues, it is expected to identify within this actor the basic elements of legitimacy and credibility that guarantee its leadership. Goñi (2015) states that leadership may affect the relationships among the participant actors. However, Nupia and Martínez (2015) and Dutrénit (2016) go deeper in this idea when affirming that leaderships are necessary to indicate the pathway clearly and they even help to monitor the correct implementation of the dialogue process in determined contexts.

iv. Another assumption is the establishment of an assessment process. It is considered that one crucial component of dialogue is the transparency and the constant review of criteria that dominates the discussions. Thus, the assessments may contribute to improve the design and the effectiveness of dialogue and guarantee democracy inside of it in general (Nupia and Martínez, 2015).

An array of variables that were later utilized for making a guide of questions were identified in order to achieve the objective of dialogue described as an interactive process derived from the interinstitutional articulation, a task that is done for the first time since the creation of the Indicators Commission of Science, Technology and Innovation. Although in this type of research design does not exist a fixed instrument for collecting data, the identification of variables of interest helped to plan relevant questions, a key factor that aimed the systematization of the experience without underestimating its empirical base.

It started from a revision of relevant documents, from the institutional basis that has been shaped for the creation of science, technology and innovation indicators as well as from the products of the process identifying each of the relevant aspects that provide evidence to the process of dialogue.

During the months of May and April 2016, eight interviews were made to key actors that belong to the Commission generating participation of the process of dialogue in this space as a result. Finally, once the information was gathered, the recording transcriptions and the use of variables-descriptors to obtain a better homogeneity in the analysis of data took place.

4. Dialogues to generate STI Indicators in Costa Rica

The process of dialogue is the result of the interinstitutional articulation formalized on 2008 when it was published the official Decree 34278-MICIT that establishes the Indicators Commission of Science, Technology and Innovation providing a space for discussion that meets all the main public Institutions, the academic representatives and the private sector with expertise in science, technology and innovation in the country.

It starts from a brief reference to the structure of the Commission and the annual presentation of the National Report of Indicators and it continues with characterizing the process of dialogue that it originates. This distinction is appropriate since it enables a detailed assessment of the process not only in its formal structure, but also in its operative scheme which leads to identify objective

conclusions and contributions that can work as elements for substantial improvements in the planning of its organizational design and the role of decision making in regards to subsequent measurement processes.

At first, the Indicators Commission of Science, Technology and Innovation works as a formal structure that gathers the group of institutions involved in the process of measurement of the STI indicators; this is a recognized platform that enjoys legal status given by the Decree that creates it. On the other hand, the measurement is a process that has different stages, an identification stage of the sector characterization being studied each year, one part of methodological application that shows a population framework and its respective sample, the process of enterprises and institutions consultation and subsequently the systematization and the publication of collected data.

4.1 The motivation of dialogue

The creation of National Indicators of science, technology and innovation emerge as a necessity, but also as an opportunity to face the future challenges. Meneses (2016), who is the Conare representative before the Commission in 2015, indicates that this necessity comes up, as a desire to know the current situation and the behaviors or tendencies before diverse events or adoption of policies in order to modify or promote desired situations. According to Umaña (2016), who has represented the INEC since the Commission started, it was not known exactly what the contribution of the STI investment to the GDP was; nor it was not clear, at the international level, the position that the country had in regards to the investment levels and the adoption of policies in this matter. Therefore, the MICIT came to fulfill a space that was not totally satisfied when incorporating this political and institutional effort.

Cruz (2016), the Minister of MICITT during the Chinchilla Miranda Administration 2010-2014, states that the discussion about the creation of a National System of Science, Technology and Innovation appeared in the seventies and it came up from the necessity of having a system that encouraged activities of research and development, capital goods and science and technology goods. In addition, he indicates that another important factor that determined this necessity was the interest of strengthening the interaction among Estate, Private Sector and Academia. Cruz (2016) believes that the Decree 34278-MICIT provides greater support to the interactions and the findings and recommendations can get deeper, thus in this way the process can improve constantly.

Since the Commission creation, their participants have been conscious of the necessity in evolving by giving priority to attract more actors and participants so that there is better and greater interaction. Vargas (2016), MICIT Indicators manager and a key figure in the process of measurement, states that this is a national evolutionary process that enables the country to use the present time appropriately and “draw the line” in the innovation topic; even though it does not always happen in the time required.

Flores (2016), Minister of Science, Technology and Innovation during the Arias Sanchez administration 2006-2010, was the head in charge of enabling the Commission to start with the duties and she participated actively in the first work stage of the Commission. Since she was directly in charge, Flores (2016) remembers that during the first stages of the process, different members of the Chambers (corporate organization) of the public sector were invited such as the Chamber of Industry of Costa Rica; also the formation of the Commission with key people who understood the importance of the indicators elaboration was reinforced. Fervoy (2016) who is the representative of CAMTIC designated by UCCAEP (Costa Rican Union of Chambers and Associated Private Business Sector, affirms that the sectorial participation was the key since the beginning. From his point of view, the multisectorial approach has enriched the process of perspectives diversity, completing the private-public representation.

Meneses (2016) expresses that during the early preparation stage, the discussion process was built with the invitation to belong to a group that made decisions on how to measure scientific and technological activities and with the responsibility awareness that every party has in relation to the data about the particular situation in Costa Rica. Thus, it started also with the central stages of the dialogue process in order to create a Technical Committee, among them are: to determine who the actors were, to understand their individual nature of the topic and to implement a process that takes all of that into account. The Indicators Technical Committee of Science, technology and Innovation is also a mechanism of consulting and agreement among the public, private and academic sector, besides, its duties are defined by the Decree 34278-MICIT and it has highly qualified technical representatives in each institution that encompasses the Commission. All of those institutions are directly related with the processes pertaining to calculating indicators just as in the case of CINPE, a National University Institution in charge of working as a link with the companies consulted through the establishment of a Cooperation Agreement, and in charge of facilitating the data collecting and elaborating the indicators calculation.

Porras (2016), who is part of the Intellectual Property Area of the Ministry of Foreign Trade (COMEX) and the representative of this institution in the Commission, expresses that this is how the structure that later aimed the discussion of agendas and specific issues was consolidated, for example, selecting the sectors to study in each measurement. In other words, the creation of the organizational structure of the Indicators Commission of Science, Technology and Innovation and the Technical Committee enabled the coordination among the sectors of the country related with the production of Science, Technology and Innovation Indicators in order to establish policies that guide the scientific and technological sector in strategic areas of the country.

Therefore, the study dialogue is created in a context characterized by the concern of the SIT condition in Costa Rica, the sector political ambiguity and the growing concern in regards of the new economic scenario and future challenges. However, it is important to mention that many of the interviewed actors believe that the institutional space of the Commission has become an appropriate scenario to extent the debate by incorporating discussions about topics that are not part of the work agenda of the Commission, although they are related to discussion about STI.

Hence, more than a consultative forum, the interaction among the actors that are part of the Commission has led to a proactive dialogue that we know today.

4.2 The path to an Economy based on knowledge

The discussion about measuring the scientific, technological and innovation activities in Costa Rica is not a foreign process to the international changes. On the contrary, the increasing concern about knowing the efforts of the institutions and firms in this path responds to the world economy transformation and its evolution to an Economy based on knowledge.

For the group of actors involved in the Commission, it is clear that the innovation is a strategic tool for development when considering that a country that does not innovate is in risk of getting stuck. Besides, it shows the necessity of adapting to changing markets. In a context of markets that are rapidly becoming more globalized, the change capacity should be intrinsic to any organization and productive system (Fervoy, 2016).

Umaña (2016) indicates that measuring is important because the local economies move in a global market. In the case of Costa Rica, the need to compete with other nations has positioned a debate that was not clear before. In order to compete, the country needs to know how to monitor the scientific, technological and innovation activities, that is developing methodologies to identify who conducts these activities and what sectors they are located in. Thus, it is possible to invest resources, policies and guidelines in a more targeted manner.

In the same context, Giralt (2016) from the Quality Management Department of the Costa Rican Central Bank, explains that the indicators allow to reveal the investment done in science and technology development at a country level, thus being an important element to define a Policy directive and at the same time, to reinforce and maintain the investment level through the different administrations.

“Something that is not measured does not improve”, that is a phrase used by Fervoy (2016) when he indicates the relevance of the National Indicators of Science, Technology and Innovation. Porrás (2016) thinks that the indicators enable to count with numbers which is a crucial aspect during the decision making.

In this sense, the contribution that the indicators have made to the definition of the National Policy of Science, Technology and Innovation cannot be underestimated. Cruz (2016) highlights the importance of a STI public Policy when she indicates that the country is in transition to an economy based on the innovation components and R+D and the companies experience, in addition to be a differentiated factor, represents a process that has to be identify and utilize for generating guidelines and programs based on the indicators information.

The innovation policy in particular, clearly defines the interaction among academia, companies and public institutions as well as the type of innovation that should be promoted, the financing possibilities and the sectors that require to be greater impacted, considering the most important necessities of the country. According to Vargas (2016), the Innovation Policy is a road map to guide

the efforts made by firms, the academia and the public sector. This is a guiding model for the innovation efforts and its application should be done in an articulated manner among firm, academia and university through the synergy establishment, for example “triple helix.”

On the other hand, the indicators show the necessity to bring the classroom knowledge to the companies and vice versa. “Since firms have knowledge through their experience and guideline, it is important to identify it and analyze its potential” (Cruz, 2016). Porras (2016) agrees with this aspect when she indicates that the competences of new generations that are born with great facility in technology should be considered as well as the opportunities that offer those areas with high added value that could generate the employment that the country needs at this moment. Therefore, “the innovation commitment” mentioned by Vargas (2016) considers that it is necessary to innovate not only to survive, but also to align with the growth and evolution of the world’s economy.

4.3 Towards a definition of a methodology of work

As noted above, promoting the scientific and technological activities and in particular, the innovation investment is a crucial element to obtain sustainable economic development that are more accelerated than the growth obtained through the increase that just occur in the production factors. The innovation facilitates to generate changes and improve products, processes, commercialization systems and organizing ways and all this turns to criteria of distinction with other competitors. At a country level, the indicators creation has become an effective strategy in identifying successful experiences with firms, but also non-covered areas that require a greater stimulus and public support including a better knowledge of persistent necessities and the institutional gaps when channeling collaboration.

Therefore, as Meneses (2016) stated, the indicators aim firstly to know the initial situation from the base line and later the indicators measuring contributes to determine the existence of improving growth and the effectiveness of the different policies in this matter.

Nevertheless, in order to get to this point, it was necessary to take agreements with the objective of establishing a methodology that consolidated the technical and methodological inputs appropriately. It is important to remember that the Decree 34278-MICIT had already assigned the Indicators Technical Committee of Science, Technology and Innovation to propose necessary actions that lead to quality, standardization, privacy of the received inputs, as well as the consultancy to the Planning Board in the field of data and information handling. In this line, Meneses remembers that the creation process of the Indicators Technical Committee was formed to the need to pinpoint positions, methodologies and collaborations of all entities of the country involved in the scientific and technological development. Thus, CINPE of National University became the Research Institute in charge of performing the operational phase of the process through a Cooperation Agreement.

Flores (2016) also points out that, before the first measuring conducted in 2006-2007, there was only overall estimates. Hence, contacting CINPE-UNA to systematizing the data and establishing unified method was very appropriate.

Umaña (2016) explains that during the first phase of the process, the most important aspect was to clarify what was said when talking about innovation, which motivated the conceptual effort that facilitated the origin of dialogue that according to Fervoy (2016), is a dialogue led by MICITT in its quality of lead entity and the CINPE technical support.

The measuring methodology was always quite clear for Vargas (2016). From his point of view, the professionalism of the participating groups and its vision was the key point to understand from the beginning what should be done through the use of international manuals that could guarantee data comparability at the international level. During the first stage, a seminar/workshop was conducted with CINPE researchers where the main concepts and methodological guidelines were clarified. In addition, it was explained the international manual content exemplifying the other countries experience in the STI measuring indicators.

The selected methodology, as Vargas (2016) indicates, uses a sample survey, this probabilistic sample is randomly selected and it represents the population under study. The first sector being measured was the manufacture, energy and telecommunications and the criteria for this selection was the international experiences, namely those cases from countries that have already measured the STI in that sector. Vargas (2016) points out that it was clear that business innovation as well as the R+D should be measured. From his point of view, both should be measured independently since they are really wide and complex.

In 2012, there was an important process improvement through the accumulated experience. The Services Sector integration implied a rearrangement on how innovation should be measured. Vargas (2016) states that although this sector largely contributes to the national economy in regards to production, it is less innovative than the Manufacture sector because of its production nature. Finally, the agricultural sector starts with measurements in 2015, which is justified by the interest of the current government that establishes the rescue of this sector within its policy and the recent experiences that allow to see features of the region innovation measurement in the agricultural activities. According to Vargas (2016), the agricultural production experience in Latin America is particularly different compared to what happens in other countries. Thus, it is necessary to highlight its particular characteristics.

According to Porras (2016), the methodology is related to the technical inputs provided by the CINPE researchers, which is a process open to other actors' feedback and accompanied by an agenda that provides issues being discussed in the Commission meetings and that is constantly updated (Meneses, 2016).

Understanding the Commission methodology of work and its creation from empirical experience derived from the measurement process is a crucial factor to understand why dialogue is considered purposeful, an aspect that will be analyzed in the following section.

5. Evidence discussion

Before suggesting some improving elements that strengthen the process of dialogue and the Commission actors participation, this section explores the main findings of the study.

5.1 The proactive dialogue as a previous community condition

Following the classification of Goñi et al. (2015), it is stated that, according to the developed methodology, dialogue for generating an Indicators system of Science, technology and innovation in Costa Rica represents a participative process oriented in the consensus creation and the lines legitimization that MICITT wanted to promote. The resulting products have worked as the STI policy development input, but not directly in a binding manner.

It is clear that it is a proactive dialogue (Goñi et al., 2015) in the meantime it fosters the creation of new actions and policies. The process was generated in particular to develop an indicators system of science, technology and innovation in Costa Rica, which is seeing as a specific product with a high level of complexity though. The final objective for having an indicators system is to have inputs for creating policies alternative to existing ones. Once the first stage of the indicators system generation is completed, the process of dialogue in the Commission continues in order to create new updated rounds of indicators. Therefore, this is a long term process that even though has not been completely constant, it is taken back year after year to discuss the type of indicators needed to be generated, the sectors in study and the results indicators. A governmental office, MICITT, has coordinated the process, however actors from different areas have participated. After the first stage of discussions, it was created an institutional framework that sets the rules of the game on the participant actors, the process purpose and the achievements.

Nevertheless, we should be more critical when analyzing the proactive scope of dialogue and its relation with a dialogue Community establishment in the country. Although the experience has been enriched with different actors that are part of it, it should not be forgotten the operative viability of the discussions, the follow up of objectives and the political context in which proposals may arise in order to strengthen the Indicators National Subsystem of Science, Technology and Innovation of Costa Rica.

Starting from the approach elaborated by Goñi et al. (2015) and the reflections derived from this case study, there are a series of elements that are important to include in the concept analysis of the proactive dialogue:

- ✓ Actors availability

The evidence found identifies the existence of a purposeful dialogue not only in its formal process of development, but also in the diversity of organizations that are part of it. Thus, the actor's inclusion from the public sector, the private area and the academia has impacted positively in the proposal of innovative actions due to the richness of the approaches and competences. The array of actors share some characteristics such as the source of spheres of competence linked directly or indirectly to dialogue, which allows the integration to get developed in a general knowledge

framework. Nonetheless, there is no a common knowledge basis on the individuals that represent the specific organizations, which is a fact that influences its ability to own the space and interact with other participants with empathy.

On the other hand, the actors refer to their participations in the process according to their contributions. Even in the cases where interaction has not been easy, it is possible to state that the original motivation is one of the main components. Likewise, the permanence of the actors in the dialogue is discussed since many consider that it is a decisive factor to reach an articulated space with effective incidence. On the contrary, the absence or departure of specific actors is considered an element that affects negatively the group performance.

✓ Formal structure of the proactive dialogue

All the above is related to the characteristics of the formal structure of dialogue that in some specific cases limits the actors' integration. At this level of analysis, although the indicators system structure of science, technology and innovation in Costa Rica has promoted the actors' inclusion through recognizing their institutional competences, it shows weaknesses in regards to identifying strategies that enable to integrate the different approaches and organizations perspectives about specific topics. Although the purpose is not to unify positions, there should be clear mechanisms to set up consensus that contribute to foster the character of the purposeful dialogue.

On the other hand, the discussion stage is conceived as a close structure that does not provide actors with informal spaces to debate new ideas. In other words, although the rigorousness of the interaction method does not make significant asymmetries in the actors ability to discuss new actions or proposals, it limits expansion of non-planned spaces in which it is possible to generate methods of parallel discussions. That means that the actors ability to impact the context beyond the limits of formal dialogue structure is reduce and it has negative effects in mechanisms that are used to articulate among them. The continuity of ideas is subject to the development of formal meetings and its distance in time affects the argumentative quality, the analytic creep and the follow up of debate valuable planning.

✓ Institutional environment

The institutional environment is determined by the political context in which the dialogue process is developed. Because it is led by a public institution, its guidelines are conditioned by the political mandate. Accordingly, the immediate needs that the dialogue seeks to understand are subject to the priority establishment identified by the ongoing administration. As a result, the agendas setting can affect the development of central issues due to the threat of lack of financial and technical resources that support the completion of activities when there are changes in the Central Government.

In addition, the alternatives construction has to deal with the regulatory terms of the country being subject to the time periods and current intentionality for the approval of specific work plans.

Besides, it is important to question if the actions that are really performed at a long term have a higher level of articulation with other sectorial policies.

✓ Impartiality of instruments

In relation to the information above, it is to be noted the objectivity of the dialogue reports. The questions is whether the instruments that the actors used are neutrally integrated to the Indicators National Subsystem of Science, Technology and Innovation or whether they represent the collective interest of the actors involved. In this specific case, it emphasizes that the experience of the indicators construction is the phase where dialogue is more active because of the national interest that guides the periodic generation of indicators. Thus, there is an analytic framework that provides confidence to the actors that allows not only horizontal discussions, but also spaces to assess the viability of alternatives; it also enables to make adjustments previous to the final publication. The transparency in which this process is conducted guarantees the technical objectivity and a procedure oriented to visible results at a short term.

5.2 A dialogue enriched by the diversity of actors

The Indicators National Subsystem of Science, Technology and Innovation is a political effort that had the responsibility since its foundation, to consolidate an appropriate environment for technological innovation and its incorporation in the productive processes of the country (Flores, 2008). Since then, the actors' agreement has enabled the publication of seven national reports.

However, this interinstitutional effort among public sector, academia and industry, besides obtaining the production of reliable data in STI area comparable to an internal and international level, should also consider, within its positive balance, the consolidation of an expert work team that has held the attention of the Indicators Commission and other institution representatives, as well as chambers, public and private universities, and organizations linked to STI and firms through a participative dynamic. The STI indicators is a transversal issue in the economy, being measurement a process that has been built up and improved from the contributions made by this entities and the particular experience of people who make up dialogue. Today, it is possible to identify a structure that enables discussion on topics such as the definition of sectors being measured in the following stages (Porrás, 2016).

Government, Academia and Private sector are conscious of the importance of consolidating these interactions. Therefore, the state representation has been growing through the participation of organizations related to R+D or those that have specific criteria of technology and science among their duties and competences and that got integrated it thereafter. It is also taken into account in universities, the vice-rectory of research and research centers, in particular those of applied character that promote innovative projects, whereas the business sector participates through chambers and specific entities. Most of these organizations are aware of the needs that the

country has in some issues and they have been involved in the measuring process before publishing the Decree 34278-MICITT in 2008.

The measuring bet of STI activities, as Vargas (2008) defines it, is currently the main experience in political dialogues for science, technology and innovation that have been done in Costa Rica. Nowadays, the participating actors know clearly their role and they are engaged with their performance of duties in the Indicators Technical Committee of Science, Technology and Innovation.

INEC plays an important role at the beginning of the process. Its participation, as the regulatory entity of the national statistic system, is crucial to support the sample selection, to follow up unresolved problems and to attend technical questions of the cases. On the other hand, chambers such as Costa Rican Union Chambers and Associations of Private Enterprise (Uccaep), Costa Rican Chamber of Communication and Information Technologies (Camtic) and Costa Rican Chamber of Industry, perform internal communication processes to inform about the relevance of the process to their members and to seek for support to measure the innovation in their firms.

The calculation of indicators, specifically the business sector indicators, is performed on the one hand by CINPE-UNA using the information provided by the firms as the basis, and on the other hand by the MICITT that collects information from the academic sector, the estate entities, non-governmental organizations and international organizations of the country. Once the indicators information in charts and graphics is systematized, MICITT, the entity in charge, convenes a meeting to analyze the results and discuss the main findings¹. The participation of entities like BCCR or Comex is linked to its experience in the generation of monitoring indicators and its objective is to evaluate the measurement results as well as to review deeply the drafting of reports. These interventions are done through specialized comments. Fervoy (2016) states that these meetings use a specific methodology. In addition, during their performance, the recording of minutes and audio of the session is conducted too.

Based on the exchange of perspectives, the Technical Committee should recommend a consensus decision about the report publication. In terms of the actors' agreement, there have not been major disagreements to date².

One positive aspect of the participation of institutions in the Technical Committee, for the consulted actors, is the representativeness which enriches the point of views and enables to perform a better job. It means that the high representation of people from different disciplines and different organizations enhances the discussions and the analysis of proposals for changes and

¹. There are also extraordinary sessions that show planning in methodology changes, indicators scope or problems with collecting data .

². In some cases, there have been some differences in the time that every institution takes to finish their remaining tasks, due to the disagreement of resources in the provision and availability of information of the firms, which data base is controlled by the MICITT.

improvements. The technical visions of the organizations are essential in the Indicators' final reports and they also contribute in some high level decision-making.

Nevertheless, the process also has weaknesses that can affect future measurements. According to Giralt (2016), the meetings are convened with very short notice to assess the Final Reports and it affects the quality of the revision. Generally, the reaction time is too short and it is not possible to engage in a profound reading that enables to evaluate the variables in study carefully. In addition, the organizations do not participate in all sessions and, in some cases, the people in charge of their representation can vary according to the internal guidelines. Although there is convening power to these meetings, the lack of key actors or the incorporation of institutional representatives without knowledge about previous discussions have negative effects upon fluid dialogue since, as discussed more fully below, the levelling of new people in terms of dialogue threatens to cause an involution of the process.

5.3 Leadership and its impact in the interaction among actors

According to Vargas (2016) the measurement of the National Indicators of Science, Technology and Innovation there is a shared and variable leadership. Porras (2016) agrees with this idea when indicating that the MICITT keeps a natural leadership because of its competence in the field, meanwhile the CINPE-UNA provides its technical leadership to the measuring process. However, other organizations like Comex is one of the entities that has made a greater bet for the design of a Public Policy of Science, Technology and Innovation in Costa Rica. From the perspective of the private sector, the institutional organization like CAMTIC has provided clarity to the measurement, a fact that has turned it into a key actor in the process.

The leadership of MICITT is recognized by its full range of actors due to its responsibility of being leader in the field and because it promotes a better quality of information and reflects the importance of the science and technological investment at a public as well as the private level. Nonetheless, MICITT has to face also important political risks that have compromised its leadership in certain periods since the Creation of the National Subsystem of Science, Technology and Innovation. Among the threats that can hinder the quality of this leadership are the administration changes in the Central Government, the entry of new leaders with a different vision and budget adjustments. In specific conditions though, these threats can also become strategic opportunities to improve the dialogue through the opening of new spaces for discussions or, as Fervoy (2016) states, through changes in the coordination that allow to move from informative work sessions to participative, open and consensus sessions. Precisely, Fervoy (2016) mentions that the sessions of the Technical Committee were formal and hierarchic at the beginning and they lacked the necessary mechanisms to expand participation. However, he indicates that the subsequent changes in the coordination influenced the improvements of communication and dialogue exchange.

5.4 Risks of formal mechanisms

The hierarchical structure that Fervoy (2006) states has effects on the proactivity and will of the participating actors in the dialogue. Although it is necessary to have mechanisms recognized at an institutional level that facilitate the meetings, the excessive formality of the work sessions reduce the creative potential and the invention of the meeting attendees. As it is shown in theory, the agreement of ideas and the definition of channels of cooperation to fulfill joint agendas is a crucial requirement of any of dialogue of STI policy that has the objective of consolidating Communities. Therefore, these processes must occur naturally, in a space of horizontal exchange that does not coerce the actors' participation or, even more important, that does not decrease their main motivation.

There are different criteria regarding the official character of the meeting of the Technical Committee. Vargas (2016), the MICITT representative, considers that the sessions are not formal, while the representatives of the other organizations think that they are. Nevertheless, beyond the nature of the meetings, what is worrisome is their frequency and follow-ups because, although there is more knowledge about the process, the meetings are performed more gradually every time. Umaña (2016) affirms that the meetings were performed every two month at the beginning, but now it is every two years.

Asked by the existence of an agenda of activities, Fervoy (2016) explains that there is a calendar to follow. As he states "it is like the cycle of the design of research, analysis and publication of indicators." Following this calendar enables to meet the ongoing needs.

Regarding the monitoring, he declares that the meeting minutes are shared. There is a record of what was done and what will be done. The issues are raised in cycles in the sessions, which helps the actor to remember details of the previous session and enables a better and continuously evolving dynamic.

Porras (2016) adds that there are no pending tasks for the following meeting in general, which contradicts at some point what has been raised before. This observation is supported by Morales (2016) of BCCR, who argues that there is no continuity upon what was agreed in the previous meetings nor a web site or document repository to be consulted.

In this regard, the actors consulted suggest to incorporate interactive mechanisms to socialize the information effectively as well as to convene meetings regularly to even discuss agendas with limited issues. From their point of view, these meeting could work, among other benefits, to discuss the introduction of improvements in dialogue and follow up the indicators' results evaluating its utility and usage by the actors. Some of the dialogue actors are also interested in determining how firms use the reports, whether they are used to improve some aspects of the productive process or they are taken as a reference in decision-making about the investments strategies or the development of training programs in universities. Giralt (2016) indicates that once having in mind what the report was used for, it is possible to work on the feasibility of proposals that improve the process.

5.5 Management of capacities

As mentioned in the section of actors availability, the capacities management is very relevant. According to what Sutz (1995) states, it is clear that the learning processes are a main component of interaction. For the author, this is a determinant factor in designing successful STI policies because it involves the channels establishment for knowledge exchange that facilitates the generation of collaboration bridges.

This general approach can be applied specifically to the dialogue experiences since the capacities management, besides facilitating the actors learning, strengthens confidence in order to promote a proactive articulation and a democratic dialogue.

However, one of the greater weaknesses in this process is the lack of mechanisms for the capacities management of the participating actors, which refutes one of the assumptions exposed at the beginning.

It is concluded that when new actors participate for the first time or they get incorporated to the Technical Committee later or if the organization changes the representative, it hinders the dialogue efficiency since the person is not aware of the current state of discussions and the points agreed in the agenda.

Morales (2016) underlines that the persons that participate in the meetings for the first times are generally lost and they do not have appropriate trust channels to raise doubts. The Technical Committee lacks of institutional mechanisms for the creation of capacities and it has not been made efforts to develop formal trainings or spaces that contribute the updates of knowledge. According to Vargas (2016), the capacities issues has not been suggested internally to the Technical Committee in such a way that it can be identify as a necessity. The learning process has not been autodidactic in most of the cases, and it emerges mainly from the actors' interest in learning more about the issues addressed. Moreover, the fact that every organization contributes from their specificity restricts the participation to the technical contribution.

Nevertheless, the actors are clearly aware that this is a fundamental issue. Fervoy (2016) comments that the internal of the Technical Committee, lacks of instruments and mechanisms to level the experiences and knowledge of people who belong to the group; this makes persons with less experience feel uncomfortable to express their opinions. In addition, the irregular attendance of some of the actors despite the efforts of convening to meetings, affects the communication strategy and the established links' quality. The occasional attendance of some entities makes difficult to organize seminars or workshops since it has jumped to the conclusion that these spaces could be disapproved by the persons involved or could not be interesting enough for the Technical Committee's participants.

Therefore, there is occasion for discussing the quality of dialogue and the proactive character since according to Goñi et al. (2015), one characteristic of dialogues is that they facilitate the exchange among the actors while learning. It is also argued the guarantee of representation for all the involved actors mentioned by Edwards et al. (2004), because the barrier to learning of actors that

are recently incorporated are against the humanist values recognized in a democratic process of dialogue based on high levels of opening and access to information.

5.6 Gaps in self-assessment

Although there is a feedback process among the participants of the Technical Committee, which is a key factor in the permanence of the measuring process, there is a lack of mechanisms of institutional evaluation that allows learning the evolution and the current state of dialogue.

The suggestions of the actors are addressed in the meetings and the persons in charge pay attention to their comments. However, there is no a significant follows up since the planned agenda has to be fulfilled in each session.

Umaña (2016) indicates that the technical feedback provides more concrete results when the actors are exposed to the methodologies, results, new techniques, new instruments or modifications of processes giving space to discussion and feedback. These consulting spaces create greater affinity among actors where it is shared the world's perspectives. Moreover, this is possible only through the continuance of some actors in the group which gives place to discussions outside the established space for feedback and as a result sporadic collaborations (Fervoy, 2016).

On the other hand, some actors consider that the dialogue assessment is not explicit enough as the group action, but they think that it happens parallel with the process when this is constantly modified by the same normal processes of the dynamic.

Nevertheless, there is very little assessment made in Costa Rica. There is no evaluation in the impact or the results achieved in the STI measuring process in the country. One reason of this issue is that there are no actors that can make the assessment and not enough budgets.

6. Institutional process of dialogue and generation of policies for STI

The process of dialogue has given the stakeholders better understanding on the needs in STI. Discussion and exchange of opinions opened opportunities to MICITT to interact with other actors in the system, both for specific programs and projects and for new national policies.

6.1 Definition of the set of indicators

The process of dialogue gave as a result an agreement on the set of indicators to be measured. The Technical Committee defined in workshops different aspects, beginning with the purpose to generate indicators, and continuing with the specific topics to study. The result was a list of variables to study and the respective indicators, using as a parameter the Oslo Manual and the Bogota Manual on indicator of CTI. The methodological approach is also based in these manuals.

The study is done annually, but in a different sector each year. There are three studies on the manufacture sector, two on the service sector and one on the agricultural sector. After defining the indicators to be measured, the equipment develops a detailed questionnaire. INEC provides

the survey, guarantying statistical representativeness, and CINPE-UNA applied the questionnaire to the firms, while MICIT applied the respective survey to the public and academic organizations.

There is now a set of indicators for several year since 2006. Thanks to that, there have been several important impacts in the generation of policies for CTI and in the coordination among different actors of the system. But there are still some weakness of the systmen a new challenges for the process of dialogue.

6.2 Use of the indicators for the generation of policies for CTI

The indicators of STI in Costa Rica give information on the behaviours of firms, state organizations and the academic sector. The information has been key for papalell processes of dialogue and for the decision making in the diffetent sectors. Some years ago, the only goal in the government plans related with STI was to increase R+D to 1% with respect to GDP. But today, there is an explicit plan for STI, with several challenges and strategies, most of them based in the system of indicators.

Private-public interactios

A set of indicators shows the situation of interactions between the publica and the private sectors. Its is clear the need to strenghten the system of innovation with more efficient interactions. The indicators gives information on the interactions between universities and firms, and between other actors in the system. The indicators shows that most of the R+D in the country is done by academic and state organizations, but with poor interactions with firms. This informations has been useful to promote discussion on effective instruments to promote better interactions. Besides, the indicators shows that firms invest in another kind of innovation activities, and not only in R+D. The conclusion is that some instruments promoting interactions in these other activities will be also very useful.

The use of funding

One conclusion of the analysis of the indicators was that only a small amount of the funding to promote innovation was really used. From the discussion of this phenomenon some changes in the rules for funding where introduced by MICITT and CONICITT. After that, there has been increasing demand of the funds by firms. Besides, another indicators show that most of the funding for innovation activities in firms comes from their profits. Only a very small percentage of funding is coming from the banking system. These opened the discussion on the need of new instruments to finance innovation, including changes to the rules of existing funds.

Attraction of foreign direct investment in R+D

Costa Rica has been successful to attract FDI in different sectors. The indicators of STI showed that in spite of that, only few multinational firms are investing high amounts in R+D in the country.

Because of that, the Government considered the opportunity to negotiate with these firms in order to increase investment in R+D in Costa Rica. Some of them are recently increasing R+D and promoting new kind of interactions with universities and other firms, in order to reach this goal. A clear example is the case of INTEL, that move out the manufacturing processes from Costa Rica, but is at the moment investment increasing amounts in R+D and contracting a lot of people to do that in the country.

Programs for knowledge management

Bullón (2016) argues that the indicators on STI were important as an input for the generation of new programs of knowledge transfer, through a public-private dialogue. Even so, he argues that it still needs the support by the parliament for new projects that need new laws. Bullón also argues that MICITT is promoting new programs together with other public organizations, specially the Ministry of Industry and the Ministry of Trade. The presence of participants from these organizations in the committee for the generation of indicators facilitates the dialogue for joint programs.

6. Conclusions

According to the classification of Goñi et al. (2015), dialogue as a means of generating an indicators system of STI in Costa Rica, can be classified as proactive while promoting the construction of new policies and actions. The process was generated with the specific purpose of developing an indicators system of science, technology and innovation in Costa Rica displayed as a concrete product but with a high level of complexity. The final objective of having an indicators system is to obtain inputs to create alternative policies. However, it is also underlined the purpose of opening spaces for discussions among different key actors in the STI field, which enables to have a better understanding of the problematic realities of the country and to open spaces for generating new policies as well as spaces for interaction among the actors.

There are some factors hindering the possibility to better results in terms of STI policies. There is a constant uncertainty regarding the budget in order to continue with the effort to generate indicators. Although there has been some stability, the MICITT representatives in charge of coordinating the efforts have to struggle every year to guarantee that the budget is channeled to the project. Another problem is the lack of continuity of some representatives since the organizations change them and this can unbalance the level of knowledge needed to have a deeper and more profound dialogue. It is necessary to have more extended periods to analyze the indicators generated before the socialization workshops and discussions. It is also important to generate more parallel spaces for the explicit discussions about STI policies. In general, the efforts that the MICITT makes in this line are quite separated from the efforts to generate indicators. The people participating in the dialogue for policies few times know the indicators. It is necessary to rethink about the spaces of exchange to open a more prepared participation of the actors in order

to generate, for example, previous inputs about the discussion lines in which each actor wants to examine in depth and about the scope of the dialogue process.

The fact that the effort has been institutionalized even with a legal decree has generated important space for continuity. There have been already some indicators reports with tangible results of great relevance. Moreover, an explicit culture of innovations and more interested in issues about STI has been created. Firms as well as the academic actors and public and private entities have become part of the process and they provide necessary information to generate indicators although it is not mandatory to do it. There is also an indicators system that works as a base for deep discussions regarding the reality of STI and that gives space to design new policies.

A significant weakness is the lack of mechanisms for the management of capacities in the participating actors in the dialogue process. Another essential challenge is to consolidate the system to identify policies and actions of the different actors that strengthen the innovation national system. The discussions of the Technical Committee of the innovation system should go beyond to wider spaces of generating policies. The MICITT has the parallel challenge of linking its public consultations regarding policies to the efforts to generate indicators.

It is relevant to have spaces of dialogue with clear and well-defined objectives and that have been generating throughout the time rules of the game that enable to take advantage of the experience of each participant. It is underlined the fact of having serious technical feedback based on the international experience. However, it is important to keep innovating in the methodology of the process to generate better conditions and better impacts on dialogues regarding STI policies and actions.

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