SHAPING THE FUTURE OF THE BRAZILIAN NATIONAL COUNCIL FOR SCIENTIFIC AND TECHNOLOGICAL DEVELOPMENT

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Abstract

The paper highlights the insights, the combination of methodological approaches and both results and impacts from a future-oriented process applied by the National Council for Scientific and Technological Development (CNPq). As an Agency of the Ministry of Science, Technology, Innovation and Communication (MSTIC) its mission is to foster scientific and technological research, boost the formation of Brazilian researchers, and collaborate with policy-making government efforts.

Between 2011 and 2015 CNPq developed a strategic plan 2025. It outlined seven critical dimensions for action from a Science, Technology and Innovation (STI) funding agency perspective: Innovation, Internationalisation, Social Commitment, Monitoring and Evaluation, Interaction and Integration with Partners, Management Model, and STI Transversality. Beyond designing a strategic roadmap with long term objectives and indicators, a number of projects were selected, which lead to a portfolio of priority projects and an associated operational plan 2015-2025.

Currently, the Agency is revising its strategic plan 2015-2025 and associated portfolio of priority projects. The aim is to design a future vision not only to re-position the Agency in the Brazilian STI System, but also in comparison to other funding agencies globally. Also, to revisit the work done previously in order to refine its strategic positioning and necessary actions to actively shape it. Finally, to define priority projects to be implemented to move towards such desired future. All these should be ready in due time to serve as both an evaluation framework for the current National Government planning budget period (2016-2019), and for shaping the next one (2020-2023).

The process employed is a combination of structured scenario building with Causal Layered Analysis (CLA). It also used text mining and data visualisation techniques to help characterise and contextualise the seven dimensions that structure the ways in which CNPq operates, based on evidence. A new layer of analysis has been added to the CLA process to understand how STI actors behave in the mentioned 7 dimensions in each of the developed scenarios.

Moreover, a Futures Literacy exercise was developed in order to bring to the fore assumptions used to think about the future within the Agency. Also, to develop a more disruptive vision and identify strategic questions worth probing by decision makers.

The results were combined both to develop a future vision for CNPq and to identify priority criteria for developing and selecting projects to be implemented in order to move the agency towards a plausible desired future.

As for impacts, the defined vision and prioritisation criteria will be used between July and December 2018 to revisit the CNPq Strategic Plan 2025 and to identify gaps in its existing project portfolio. Also, to establish a framework for assessing current projects and programmes towards its desired future vision. Finally, to identify change requirements for the next national planning budget period.

1. Introduction

Historically, the following temporal milestones stand out regarding CNPq's performance. In 1951 the National Research Council was created directly linked to the Presidency of the republic. Its objective was to institutionalise a national state support for research and development in all knowledge areas. In practice, its foundation was linked to the importance of atomic energy in the perspective of science and its political-military bias. Hence, the objective was to reinforce the need for a body responsible for shaping policies in this sector, aiming at the defence of national interests and the internal development and use of nuclear energy.

The role of the institution would change in the following decades. In 1964 CNPq began to act as a formulator of national Science and Technology (S&T) policy, together with other government agencies. In 1975, it was expanded and became the coordinator of the National System for Scientific and Technological Development (SNDCT). At the time, CNPq changed qualitatively, thus becoming the body responsible for S&T policy in Brazil. A national development plan (PND) was developed containing a chapter on S&T. The details of this chapter led to a key document, the Basic Plan for Scientific and Technological Development (PBDCT), which was under direct responsibility of CNPq (LOPES, 2001).

At that time, CNPq created the Scientific and Technological Council (CCT). This was an advisory body with the function of giving an opinion on issues relevant to the country's scientific and technological development. More specifically, the CCT also had to cooperate with CNPq in the preparation of the PBDCT and in monitoring its implementation.

In September 1980, as a result of the III National Development Plan (PND), the III Basic Plan for Scientific and Technological Development (PBDCT) was approved. Since the PBDCT III did not spell out programs and associated projects and activities, it was necessary to further carry out this task. To this end, CNPq began to dedicate itself to the elaboration of what was named of Programmed Actions, thus further detailing key actions stemming from the III PBDCT (LOPES, 2001).

As responsible for coordinating Actions in S&T, CNPq also elaborated the Evaluation & Perspectives 1982. This was *"a document that had as objective to make a critical analysis of the state in which the Brazilian science was and to present perspectives for its development In the next years"* (CAGNIN, 1997).

With the creation of the Ministry of Science and Technology (MCT) in 1985, CNPq loses the role of coordinator of the SNDCT. It then became an Agency for the promotion of research and training of human resources, linked to this Ministry.

Throughout its 67 years, the role of CNPq for the Brazilian scientific and technological capacity is undeniable. A critical analysis of its actions shows a positive balance of its contributions to the formation of the national scientific base and to the construction of an intellectual heritage, which have been essential to boost the country's cultural, technological and economic development.

As for the planning efforts of the institution, it can be said that the different experiences over the years have been more focused on the planning and evaluation of the national scientific and technological policy, rather than on its own strategic planning. Hence, the process of organisational planning and management, including the elaboration, the development and the

monitoring of an Institutional Plan, has not been at the core of CNPq's efforts (LOPES & ROCHA NETO, 2016).

However, the 1990s represent an important turning point in the history of CNPq planning. In 1995, considering the need to improve and modernise its internal management efforts, CNPq began a strategic planning effort. This resulted in the reformulation of the institutional mission, which would change to *"promote scientific and technological development and carry out research necessary for the social, economic and cultural progress of the country"*. Also, it led to the elaboration of an Institutional Plan, where priority goals were established. Nevertheless, several of these goals were not fully achieved (LOPES, 2001).

Another important historical fact occurred in 1999, when the new Minister of Science and Technology accumulated the position of president of CNPq. Although he spent little time in the institution, he established a new statute, a new regiment and a new organisational structure. Through these new arrangements the CNPQ's Superintendence of Planning was extinct. In this new context, the goals and operations established in the Strategic Plan were discontinued.

As a new effort, at the end of 2011 another strategic planning process was undertaken. At that moment, the institutional mission and vision were changed again and the main directions for CNPq's future were defined, in a temporal perspective until 2025. In the years that followed, from 2012 to 2015, the Institutional Strategic Map and an Action Plan were deployed at the Tactical and Operational levels, culminating in the definition of a Portfolio of Projects to be executed over a period of four years. Although a few of these projects were executed, those projects of greater complexity and with real possibilities to leverage institutional change were not tackled.

Currently, based on the low level of execution of the existing project portfolio and the premise that environmental changes occur in an accelerated way, CNPq decided to review its tactical and operational plans. A foresight study has been carried out for CNPq aiming to identify future scenarios, within a time horizon up to 2035, thus entailing the next four national budgeting periods. The aim is to define a normative desired scenario or a future vision. It is intended that this scenario will serve as a basis for the revision of the institution's strategic plan and its projects portfolio previously elaborated.
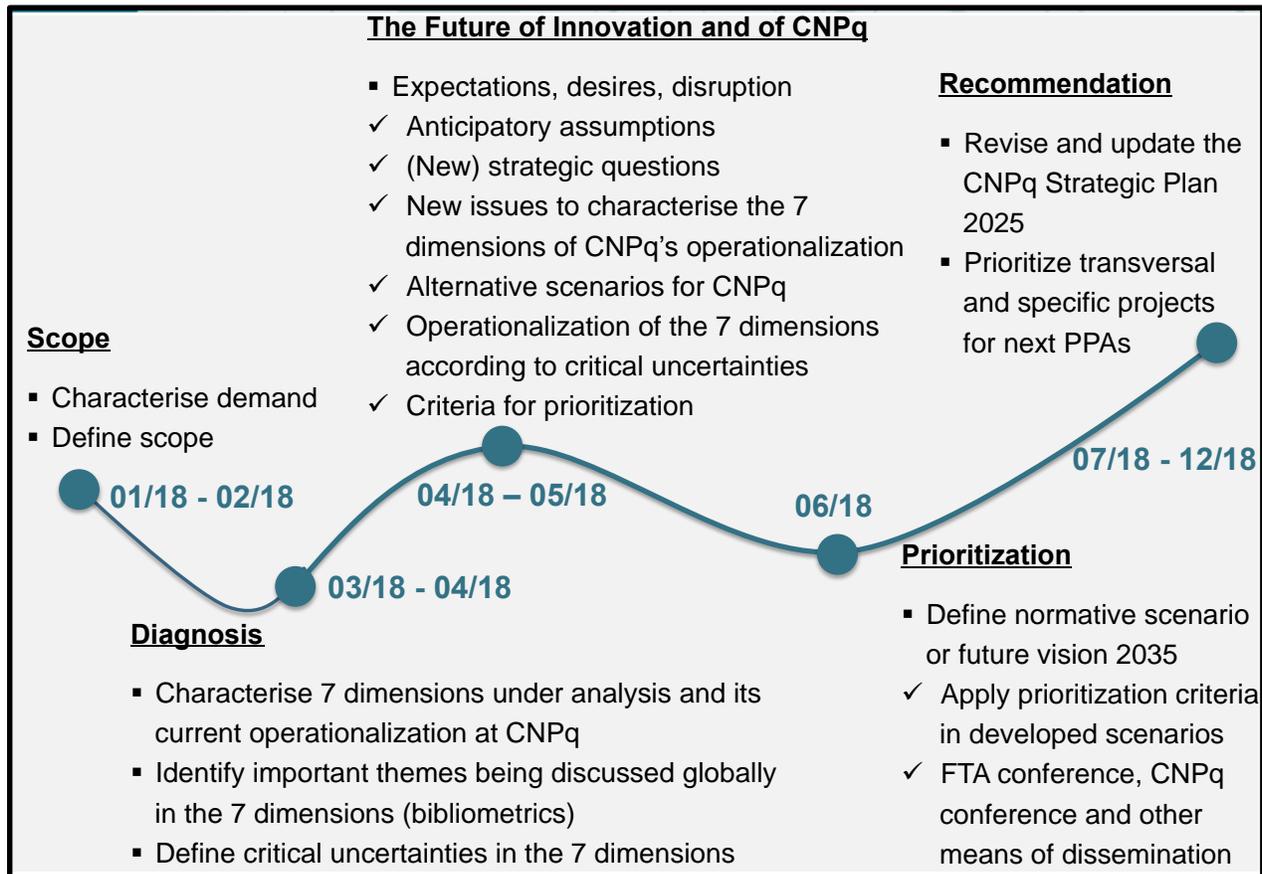
In this context, section 2 describes the process and results attained in defining a normative scenario or future vision for CNPq. Section 3 discuss implications for CNPq and next steps in terms of revising its current project portfolio. Finally, section 4 outlines the paper conclusions.

2. The future of CNPq

The combination of methods employed to think CNPq in the future included a mix of structured scenario building with Causal Layered Analysis. It also used text mining and data visualisation techniques to help characterise and contextualise the seven dimensions that structure the ways in which CNPq operates, based on evidence. These dimensions or themes are considered to be more relevant to guide the strategic reconfiguration of CNPq. Also, these were based on the CNPq stakeholders perceptions (*e.g.* police makers, researchers, managers of research and technology centers, NGOs leaders, etc.) and have been defined in a previous strategic planning exercise developed in 2011 involving almost forty thousand people (CGEE, 2011). The seven dimensions are: Innovation, Social Commitment, Internationalisation, Monitoring and Evaluation, Interaction and Integration with Partners, Management Model, and STI Transversality. The

methodological approach comprises four steps: i) performing a diagnosis; ii) identifying assumptions used to think about the future and key questions worth probing; iii) building alternative futures (scenarios); and iv) visioning or normative scenario development. These are outlined in the overall methodological approach depicted in Figure 1 below.

Figure 1: Methodological Approach

The Future of Innovation and of CNPq

- Expectations, desires, disruption
- ✓ Anticipatory assumptions
- ✓ (New) strategic questions
- ✓ New issues to characterise the 7 dimensions of CNPq's operationalization
- ✓ Alternative scenarios for CNPq
- ✓ Operationalization of the 7 dimensions according to critical uncertainties
- ✓ Criteria for prioritization

Recommendation

- Revise and update the CNPq Strategic Plan 2025
- Prioritize transversal and specific projects for next PPAs

Scope

- Characterise demand
- Define scope

01/18 - 02/18

04/18 – 05/18

06/18

07/18 - 12/18

03/18 - 04/18

Diagnosis

- Characterise 7 dimensions under analysis and its current operationalization at CNPq
- Identify important themes being discussed globally in the 7 dimensions (bibliometrics)
- Define critical uncertainties in the 7 dimensions

Prioritization

- Define normative scenario or future vision 2035
- ✓ Apply prioritization criteria in developed scenarios
- ✓ FTA conference, CNPq conference and other means of dissemination

2.1. Methodological approach Step 1 – Diagnosis

Initially, an internal exercise with CNPq staff took place through focus groups to discuss each of the seven dimensions. The aim was twofold. First, to understand how CNPq evolved historically in terms of fostering scientific and technological research, in forming Brazilian researchers, in leveraging innovation capacity, and in contributing to the shaping of STI policy in Brazil. Second, to bring to the fore how the Agency currently operates in each of the seven dimensions, as well as to identify up to three key uncertainties in each of these dimensions. The identified uncertainties were critical to shape the two workshops organised later on Step 2 (Futures Literacy) and Step 3 (Scenario Building). These uncertainties were:

- **Innovation:** institutional arrangements; indicators; and formation of human resources for innovation efforts.

- **Management Models:** models to foster and operationalize STI research; criteria to assess projects, programmes and policies; sources of financing including ways to allocate funding; size, profile, skills and competences required; and organisational structure.

- **Social Commitment:** fostering of social technologies; social and environmental impacts of STI (responsible research and innovation); and public engagement in defining STI priorities.

- **Internationalisation of both STI and the Agency:** regulatory and normative environment; financial resources for international cooperation; and diversification of actors for STI (firms, NGOs, citizens, etc.).

- **Monitoring and Evaluation:** monitoring and evaluation models for fostering STI; monitoring and evaluation infrastructure; and monitoring and evaluation instruments to measure institutional performance.

- **Interaction and integration with partners:** ways and means for interacting and integrating (networks?); work processes and practices (flexible?); and strategic intelligence and influence in the collaboration with partners.

- **Transversality:** mechanisms to support transversal and interdisciplinary research and institutions; information and communication technologies (ICTs) support to transversality; human resources formation for transversality.

In parallel to the work of the seven focus groups, one per dimension, a desk research analysis was undertaken. On the one hand, the aim was to identify key trends and weak signals worth bringing to the debate. On the other hand, a benchmarking study of key funding agencies such as the National Science Foundation and the European Science Foundation, as well as those operating in countries such as the UK, Singapore, China, Germany, South Korea, Sweden and Japan was developed aiming to both understand how CNPq should position itself in the future and also to reflect upon new ways by which the Agency can fulfil its mission. Key messages which were later used to shape further discussions both internally at CNPq and externally in the two workshops (futures literacy and scenario building) can be highlighted as depicted in Table 1 below.

Also in parallel to both the work of the focus groups and the desk research analysis, a bibliometric investigation was employed to identify how the seven dimensions used to structure the way of thinking and working of CNPq was viewed globally. The basis for this research was the Scopus database of scientific articles.

A number of queries[1] were defined and tested in order to search and select papers related to STI and funding agencies. After a number of feedback loops, the final list of keywords used were defined. Applying these keywords led to a database of relevant papers. This was considered the original database or the departing point for further investigation with all potential papers of interest for a funding agency and the dimensions used by CNPq for its operationalization. The original database was organised according to specific attributes such as authors, country of authors, scientific or knowledge area, abstract, keywords and paper title.

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[1] This search was done through the InsightData tool developed by Center for Strategic Studies and Management (CGEE).

TABLE 1 – Key Messages	
Key trends	Open innovation, frugal innovation, inclusive innovation, co-creation.
	Crowd sourcing, crow funding, mixed funding (amongst firms or a mix of public-private).
	Big data used to define funding priorities and soft skills to be promoted, to contextualise commerce, to customise solutions.
	Trends and uncertainties such as urbanisation, increased inequality and social division, aging, flexible work and change in nature of work, climate change, increased nationalism, universal basic income, clean and renewable energy with the end of petrol as an energy source, circular economy with 100% reuse or recycling of resources, end of individual privacy and property, singularity, among others.
Key messages from other STI funding agencies globally	Funding of individual researchers, of networks of researchers and research institutions, and of firms operating in the initial phases of the innovation chain (maturity level between 1 or basic research to 6 or prototyping of potential solutions), especially start-ups or young coming stars but also new businesses and even multinationals.
	Funding of basic and applied research which are multidisciplinary and innovative or blue sky or pioneer or adventurous or of excellence, all linked to either solving a specific problem or societal challenge, thus being relevant to society.
	Funding multilateral and international research between researchers, research institutions or firms, as well as research facilities and researchers mobility, with funding going usually to national participants.
	Prioritising funding where there is either a competitive advantage or to deal with a nation-wide need, aiming to advance knowledge and to foster economic growth, society prosperity and well being, as well as ecological sustainability.
	Different forms of assessment and peer review, including internal, national and international boards or panels as well as by researchers, policy and civil society organisations; some of the funding agencies offer peer review services to others and all use evaluation processes continually to assess what is being financed.
	Fostering a culture of experimentation and co-creation of systemic solutions and services together with civil society, as well as inducing new areas with great potential for the future both through open competitive calls and by direct funding of selected projects.

Then specific queries and in-depth investigations[2] were undertaken for each of the seven dimensions in what was named the original database. The criterion used for his analysis was to select papers with relation to 'public policy' since the aim is to support CNPq in its role of shaping STI policy and associated funding mechanisms. Hence, the keyword 'policy' was combined with keywords associated to each of the seven dimensions to create seven smaller databases stemming from the original database.

The criterion 'year of publication' was used to consider only papers published in the last 10 years, between 2008 and 2018. Then the criterion 'citation' was used to help us in exploring those scientific contributions and reflections most relevant from the standpoint of STI funding agencies. The remaining papers for each dimension had their titles and abstracts analysed, and those disconnected from STI policy, funding, instruments, design or implementation were removed from their respective databases.
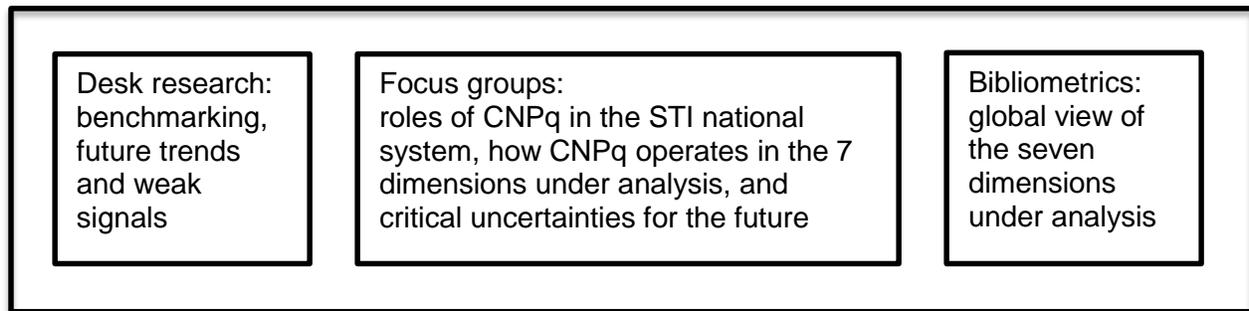
It is important to highlight the main elements that were brought into the discussion of the focus groups for each of the seven dimensions, since these were also used to shape the scenario building workshop to be explained next in section 2.3. The key elements are described in Table 2 below.

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[2] In order to further refine the database of papers to be assessed the tool Insight Net developed by CGEE was used.

TABLE 2 – Key Elements per Dimension	
Innovation	✓ Institutional arrangements: i) partnerships university-industry-government; ii) private funding of research. ✓ New: i) fostering of other modes of innovation (i.e. organisational); ii) knowledge agency instead of STI agency; iii) funding agency operating as the articulator of the STI system and knowledge brokerage.
Management Model	✓ Models to foster and operationalize STI research, criteria to assess projects, programmes and policies, and sources of financing including ways to allocate funding: i) framework for interdisciplinary research funding; ii) project- or challenge-based research; iii) crowd-sourcing; iv) crowd funding; v) democratic and transparent decision making processes; vi) indicators to measure both impact and the institution itself. ✓ Size, profile, skills and competences required: i) formation of leaders; ii) multi- and trans-disciplinary teams; iii) internal and external communication; iv) strategic intelligence for the anticipation of future challenges; v) capacity building and participation in STI fora. ✓ Organisational structure: i) increasing administrative burden for researchers; ii) influence on STI decision making; iii) collective organisation with a focus on long-term strategic planning; vi) cultural change; v) internal mobility. ✓ New: regulatory and normative environment.
Social Commitment	✓ Fostering of social technologies: i) productive inclusion of citizens; ii) reduce social and economic inequalities; iii) participation in R&D fora and decision making bodies. ✓ Social and environmental impacts of STI (responsive research and innovation): i) knowledge translation (translating research outcomes and impacts to society); ii) interactional expertise (dual road research-society); iii) amplify current understanding of mechanisms able to bridge knowledge production and society development as well as societal appropriation of knowledge. ✓ Public engagement in defining STI priorities: i) knowledge brokerage; ii) citizenship science; iii) research needs assessment; iv) education and identity.
Internationalization	✓ Nothing new
Monitoring and Evaluation	✓ Monitoring and evaluation model for fostering STI: i) open access research (i.e. data); ii) crowd authoring. ✓ Monitoring and evaluation instruments to measure institutional performance: i) performance indicators; ii) indicators to measure institutional mission; iii) indicators to measure knowledge advancement; iv) indicators to measure social impact.
Interaction and Integration	✓ Ways and means for interacting and integrating (networks?): i) metadata interoperability.
Transversality	✓ Mechanisms to support transversal and interdisciplinary research and institutions: i) indicators for production and evaluation of transversal knowledge as well as of impacts in shaping STI policy and in the management of STI research. ✓ ICTs support to transversality: i) networked research. ✓ Human resources formation for transversality: i) building a culture of transversality.

In a nutshell, Figure 2 below summarises the methods employed on Step 1 or Diagnosis.

Figure 2: methods employed on step 1 or diagnosis

Desk research: benchmarking, future trends and weak signals	Focus groups: roles of CNPq in the STI national system, how CNPq operates in the 7 dimensions under analysis, and critical uncertainties for the future	Bibliometrics: global view of the seven dimensions under analysis

2.2. Methodological approach Step 2 – Future assumptions and key questions

A Futures Literacy exercise was developed in order to bring to the fore assumptions used to think about the future within the Agency. Also, to develop a more disruptive vision and identify strategic questions worth probing by decision makers and staff alike.

In practice it consists of activities that always involve narratives, collective intelligence and construction of meaning [MILLER, 2007; MILLER 2011]. It is a meta-scientific structure to detect and make sense of the present [MILLER, 2007; MILLER 2011]. The process aims to develop an in-depth understanding about the way we operate in systems that are known, at least partially, as well as those that are unknown. This is how we become able to detect novelty, by using two distinct ways of using the future [MILLER, 2007; MILLER 2011]: (i) use of a model to imagine the future aiming to predict what can happen (predictions and expectations); and (ii) use of a disruptive model whose objective is to reduce or eliminate predictive or normative barriers. By participating in such a process, a form of self-consciousness (meta-cognition), in which anticipation is brought out in a way that the future exists in the present, an amplified understanding of anticipation (models, systems and processes) that can be defined as Futures Literacy [MILLER, 2007; MILLER 2011] is obtained through learning-by-doing [MILLER, 2007; MILLER 2011].

The departing assumption is that being able to make decisions that embrace complexity and treat uncertainty as a resource rather than a threat demands capacity to use the future as a means to expand the understanding of the present. Building such capacity requires that anticipation is brought out into the open in a way that the future exists in the present. It then becomes clear that human consciousness, in its process of search and choice, uses a number of anticipatory systems to imagine and use the future in decision-making. An applied anticipatory systems approach to use the future, therefore, enables policy and decision-makers and individuals alike an expanded capability to question and create anticipatory hypothesis that base their choices [CAGNIN, 2014; MILLER, 2007; MILLER 2011]. Futures Literacy offers such capacity [CAGNIN, 2018; MILLER, 2007; MILLER 2011].

The process reveals and questions the anticipatory assumptions, explicit or implicit, which we use to think about the future. Participants of such process are involved in a simulation that develops their capacity to make strategic decisions in contexts of ambiguity by exploring the potential of the present [CAGNIN et al., 2013; MILLER, 2007; MILLER 2011]. In this way, diversity and complexity become sources of inspiration, and we become better at embracing the precious heterogeneity of the world as well as at respecting the spontaneous creativity of freedom and serendipity [MILLER, 2007; MILLER 2011].

The methodology follows a learning curve in three phases. The aim is to engage the collective intelligence of participants to make explicit the anticipatory assumptions that shape our decision processes. Ultimately, Futures Literacy is a systematic approach to improve our anticipatory systems [MILLER, 2007; MILLER 2011; CAGNIN et al, 2013]. Decision-makers able to use the future will become more conscious of the expectations and values that shape not only theirs, but also their community's vision of the future. Also, they will be better able to design processes of collective intelligence that use the future to identify opportunities in the contemporary world, shaped by complexity, fluidity and spontaneity. Finally, by expanding what we imagine to be the future helps us to amplify our appreciation about the potential of the present [MILLER, 2007; MILLER 2011].

In practical terms, participants were divided in groups of five people each, totalizing five groups (total of 25 members). In the first phase participants made explicit their expectations or predictions, what they believe shall happen in the defined time horizon, as well as their desires or values, what they would like to see happening in this timeframe. In the second phase we left behind expected or desired futures to experiment a discontinued or alternative model that should be proposed aiming to alter the conditions of change, those which are consensual in determined time and space. The idea was to enable a practical experimentation of our anticipatory assumptions in shaping imagined futures and the potential to address the creative challenge to invent futures based on new or different paradigms. Finally, in the third phase, the aim was to examine how certain anticipatory assumptions influence our understanding of the present and how certain images of the future can bring meaning to different aspects of the present. In this last phase the challenge was to think about new questions, such as those that could have been considered unimportant or incomprehensible if the participants had not engaged in imagining the future using different anticipatory assumptions. In practice, one tries to identify new questions and investigate different solutions based on the expanded understanding of the object under analysis.

To enable and facilitate making tacit knowledge explicit and, therefore, to reveal the collective anticipatory assumptions in the first phase, the research used the Causal Layered Analysis (CLA) method [Inayatullah, 1998; 2013]. Here participants had to introduce their ideas to others in a group and collectively shape a narrative using the four categories of the CLA method: (i) headlines or common sense (litany); (ii) nature or attribute of systems (systems/social); (iii) points of view of specific actors (worldviews); and (iv) myth or metaphor that captures the spirit or central idea of each scenario and that connects to the other layers of the analysis.

However, a new layer of analysis was added to the CLA process to understand how specific STI actors, including funding agencies, behave in the mentioned seven dimensions that mould the ways in which CNPq operates in each of the developed scenarios. With this in mind, the question used to drive the first phase was: **what is the future of innovation in 2035?**

The objective of CLA is not to predict the future, but rather to open the present and the past to create alternative futures. It departs from the premise that individuals, organisations and civilisations see the world from different points of view (horizontal and vertically). Hence, there are different levels of reality and forms of 'knowing'. Critical when applying the method is the vertical movement between the four layers, which enables the integration of analysis and synthesis. The horizontal movement enables the integration of discourses, of different ways of 'knowing' and different worldviews, thus increasing the richness of analysis. It is important to highlight that no layer should be privileged. The results are differences that can be captured in diverse scenarios, each representing different ways of 'knowing'.

In the second phase, participants were given a reframing model developed for the purpose [CAGNIN et al, 2013]. This model is called of "learning intensive society" [Miller, 20012-2018] and it changes the conditions of change with the aim of questioning and stimulating the development of new anticipatory assumptions, thus reframing the challenge of the roles a funding agency plays in its National STI System and globally. In order to go about working with the reframing model provided, participants in each group defined different and specific characters (e.g. robot, film or book character, funding agency, ministry, singer or artist, fisherman, children, etc.) and described how such character would live, work, establish relationships, have leisure, amongst other descriptive elements in the learning intensive society. This exercise enabled participants to describe a rich scenario for the disruptive future model provided. Also, participants had to think about the audience and formats of an exhibit that would communicate the ways in which their imaginary funding agency would function. The exhibit would celebrate the 200th birthday of CNPq and of STI activities in Brazil (currently CNPq has celebrated its 67th birthday). Participants were required to think about a STI museum in the future. Hence, each group developed an imaginary prototype of such exhibit and a narrative to describe it both in terms of historical content (i.e. timeline) and sensorial emotion.

Finally, in the third phase the world café method [Brown and Isaacs, 2005] was used to enable participants both to identify new questions and, in a second moment, to address these trying both to find and criticise solutions in a process of due diligence. Nine questions were highlighted for an in-depth discussion, which enabled participants to both invent new ways of improving the existing system and to transform it by inventing new configurations or disruptive systems that would be better placed to foster alternative pathways for CNPq in the future. The aim was to better understand how CNPq would become operational in the future thinking in terms of the dimensions that mould its actions today. The questions were: (i) what is your vision for CNPq in the future?, (ii) in this future, what are the roles of the Agency both with regards to the internationalization of STI and of itself?, (iii) what about its roles regarding the transversality of STI and its interaction and integration with partners?, (iv) what about its roles regarding innovation and social commitment?, (v) finally, what about its own management model as well as its approach to monitoring and evaluation its activities and performance?

In terms of main results of the second methodological step, the main assumptions participants from CNPq use to think about the future of the Agency are:

- **Phase 1 – Trends (predictions) and Expectations (desires):**
  - ✓ CNPq looses its capacity to direct and induce Science, and its budget is reduced even further, thus leading the Agency to become a simple executer of policies decided at Ministerial level, which leads to a peripheral knowledge production in Brazil especially in comparison to other countries.
  - ✓ CNPq ceases to exist or becomes minimal in terms of physical infrastructure and personnel working in the 'cloud' and in articulation with other actors across the world via decentralised networks, and its functions are increasingly undertaken by artificial intelligence.
  - ✓ Technology advancements increases life expectancy to over 200 years and an expanding aging population globally, but at the same time only those in advanced economies will be able to seize its benefits while emerging economies will have to bare with increasing social exclusion and the ability to produce commodities alone, as well as will suffer greater intervention from advanced economies in their political and decision making processes.

✓ Technology advancements lead to greater social divide and social inequality, as well as increased environmental degradation and lack of social participation in decision making processes.

✓ Increased radicalisation of ideologies, including in politics and leadership, lead to greater nationalism, protectionism and authoritarian governments worldwide, with an increased centralisation of research funding through government and firms, as well as overall control of society, which strengthens the power of monopolies.

✓ Post-democracy or plutocracy with big corporations become the centre of the world and their increased power, both economic and political, drives society individualistic values, mercantilist behaviours and consumer ways of living, with research funding being directed to private interests alone.

✓ Social and ecological tipping points, such as lack of water in many countries, wastelands of litter and massive migration, lead to greater awareness of the need for social engagement and participation not only in decision making processes, but also in the development and application of Science, Technology and Knowledge, including through new funding participatory mechanisms with a focus on technologies for life – in other words, Science for Society (Citizen Science) and for a healing or regenerative environment, which ultimately leads to new clean and renewable limitless energy for all.

✓ Society becomes more organised, inclusive and democratic within a participatory governance system as well as interconnected via an open ICT system that fosters wide citizens' dialogue and through which STI actors can share information, jointly identify societal needs and use the same data and databases for individual and collective work, and research funding becomes directed to societal interests and needs, even if resulting solutions do not lead to market potential exploitation, such as neglected diseases and end of hunger.

✓ Societal values become collaboration, solidarity, mutual respect, integration and sharing of knowledge, resources and both tangible and intangible goods, with life becoming self-sustaining and circular within interconnected neighbourhoods, and with more responsible and less corrupt politicians and leadership since they must do social welfare work for life when caught in wrongdoing.

✓ CNPq becomes an agency whose mission is to strengthen human potential and intellectual capital as well as to articulate and coordinate STI stakeholders, using technology advancements in the benefit of society and for enabling universal access to both accumulated and frontier knowledge, as well as for devising funding mechanisms able to direct research and innovation for the public good, for increased quality of life in intrinsic connection to and harmony with nature, and ultimately fostering greater social participation in setting research, innovation and associated policy priorities for the future in collaboration.

▪ **Phase 2 – Disruptive Future (learning intensive society):**

✓ In terms of culture, this would be a playful and non-reproductive society, in which relationships would be free, and ethics and commitment to one another based on bottom-up interactions would be key values. People can chose who and how they want to be or look like and this changes continually. Connection with nature, with local and community gardens and both native and recovered forests, is part of

everyone's life. Money is no longer required and what society value is every individual unique contribution to other individuals or groups of people.

✓ Every person is part of a single family and relationships and interactions are cornerstones of society and the way it functions. A single-family locus is no longer the norm and relationships are based on empathy, taste and are specific to a moment in time. Children are both collective and attached to their biological families and nature, and are required to be self-responsible for their lives at a very early age.

✓ Health-wise individuals can substitute any of their body parts according to taste and functions required, rather than aesthetics. Life is expanded and we are able to change any of our body parts, although we are not immortal. Hospitals still exist but are humanist and animalist since animals and humans interact for their mutual health improvement.

✓ This would be a post-work society, of free time in which every individual adds value based on its unique contribution to systemic, interconnected and integrated solutions with attached emotions to daily problems on a multicultural and multi diverse society, in which everyone is interconnected emotionally and mentally with mindfulness regardless of the physical space (city or country) in which they live. Robots and Artificial Intelligence (AI) are responsible for carrying out all jobs and work related tasks.

✓ Regarding education the important is to learn by doing in idleness and a variety of school formats still exist to help one to develop socio-emotional skills and to learn to learn and to unlearn. Accumulated knowledge is always available, anywhere and anytime. Seamless connection to the cloud or matrix enables one to learn as he or she was participating at the very moment history was (past) or could be (potential future) unfolding; it is history at the making, continually. Leadership is volatile and according to the project at hand, and global decisions are collective.

✓ Time is controlled mentally with support of technology, and we can travel to the past and into the future to learn from mistakes and to avoid new ones, as well as to experience old and new emotions. There is no traffic and mobility is fluid within and across neighbourhoods, cities, regions and states. Energy is limitless, clean and renewable. Food is organic, nutritious, healthy, delicious and local, produced on land, urban farms and in laboratories as well as at home via 3D printers, and there is no hunger since we are able to produce anywhere in the planet, including deserts.

✓ A STI funding agency, if it still exists, is therefore fostering limitless creativity, post-science and new forms of life, technical-scientific solutions to new problems that we are currently unable to imagine. Hence, funding mechanisms are unclear but these should definitely foster spaces for dialogue and for both individual and collective creativity. The target audience is all humanity. The key value is everyone's free time and both learning and contributing to society in their leisure. This happens since Science is produced through daily interactions, all captured and put for common use via big data and AI.

▪ **Phase 3 – Key Strategic Questions:**

✓ How can we jointly re-think our role in society and build mechanisms to better understand society expectations, desires and challenges? How can such

understanding bring us closer and enable us to build a real partnership with society?

✓ How to identify and train leaders and ways in which all CNPq staff can influence decision making processes both internally and externally in order to define priorities for STI funding and policy and, therefore, influence positively the National STI System? How can we build and train our internal teams to become multi and transciplinary and, therefore, able to understand society needs and challenges as well as foster required mechanisms and arrangements able to ameliorate these?

✓ How can we transform our workplace and embed flexibility in the way we operate, including our physical space, our meetings, projects, etc? How can we transform our key processes of: i) defining STI funding structures, processes and mechanisms; ii) inducing priority research and innovation in Brazil; iii) building our internal memory in order to learn from the past and think the future differently; iv) developing our ICT systems in an integrated fashion and with open and transparent access to all; and v) developing our human resources and building required skills to become key players nationally and internationally?

✓ How can we organise ourselves internally and collectively to change CNPq and guarantee that whoever the government promotes to become the agency president has to follow a jointly defined long-term strategy with an associated tactical and operational plan?

✓ How can we collectively change our culture of bureaucracy, hierarchy and centralisation and foster internal mobility? How can we foster social technologies and innovative solutions that transcend their technical aspects alone to embed more systemically our emotions, health, and all that make us humans?

Finally, based in the main new questions that were raised at the end of the workshop and that served as a backbone for the discussion of a future vision for CNPq and how it becomes operational in the seven dimensions under analysis, it is important to highlight the following outcomes:

▪ **Vision:**

✓ CNPq is a flexible and dynamic agency with capillarity, fluidity and capacity to adapt to different demands, which makes it relevant in its role of advising the National STI System;

✓ CNPq defines and adopts its own agenda to create programmes and projects developed in and by the Agency;

✓ STI promotion continues its institutional mission, based on a new model that considers: i) the development of research networks; (ii) adequate mechanisms to support multidisciplinary and cross-cutting projects and programmes; iii) shared databases, which facilitates the transversal operationalization of inducing STI research and innovation, as well as the articulation and integration with different partners;

✓ CNPq adopts effective mechanisms to stimulate the diffusion and appropriation of the knowledge generated in the research it promotes;

✓ CNPq has fewer personnel, which is better qualified, with more space nationally to perform their work, with increased managerial capacity and with greater internal mobility and interaction.

▪ **Internationalisation of STI and of CNPq:**

✓ Currently, STI is already internationalised. However CNPq and Brazil do not participate in such process effectively, let alone in the definition of an international agenda of what research shall be promoted. Therefore, CNPq now operates as equal to other funding agencies globally in shaping STI;

✓ CNPq open branches abroad, creates advanced support mechanisms, expands the use of foreign consultants in the evaluation of projects and programmes based on learning provided by the INCTs (National Institutes of Science and Technology) Programme;

✓ CNPq with increased staff participation in international relevant fora;

✓ CNPq stimulates networks, international cooperation, multidimensional, multinational and collaborative research groups, all based on an shared infrastructure, including laboratories, telescopes or environments such as Antarctica;

✓ CNPq establishes parameters for counterpart collaboration, for reciprocity and for transfer of technology;

✓ New actors in the most up-to-date scientific committee, with mutual participation in the definition of objectives and associated projects;

✓ Definition of and participation in own international fund for scientific and technological developments in order to finance international cooperation projects.

▪ **Interaction and Integration with Partners:**

✓ Integration and interaction occur more equitably and more fairly with other agencies or institutions;

✓ Integration with partners is institutionalised in CNPq through clear and formalised organisational processes, beyond permanent seminars with the participation of potential partners;

✓ Identification of new partners, sharing of databases, networking of teams and interaction with national and international agencies;

✓ Managers trained to articulate partnerships within the scope of the National STI System, establishing protocols for partnerships with different entities, aiming at collective solutions to problems or social challenges detected;

✓ Strategic intelligence in prospecting of partnerships and in capturing funding or budgetary resources.

▪ **Transversality:**

✓ Mechanisms to encourage multidisciplinary research, based on social problems and challenges to be addressed;

✓ ICTs at CNPq (databases, information systems, platforms, etc.) help define strategies for detecting socio-economic problems and for the articulation with

national and international actors, as well as for helping the Agency to identify, monitor and evaluate cross-cutting projects;

✓ Capacitation and instrumentalization of CNPq staff to enable the treatment of multi and trans-disciplinary demands.

- **Innovation:**

    ✓ Promotion of innovation, with a focus on the citizen and in social well-being;

    ✓ CNPq's own budget allows the institution to define and prioritise actions to support innovation;

    ✓ CNPq intensifies training actions to form human resources for innovation and to stimulate innovation habitats (technology poles, parks, incubators, etc.);

    ✓ Innovation indicators are used in different stages of projects' assessment and to evaluate research programmes.

- **Social Commitment:**

    ✓ Increased transparency of the Agency's actions, decisions and results;

    ✓ CNPq adopts principles of Responsible Research and Innovation in the execution of its funding programmes;

    ✓ STI promotion and funding based on socio-economic demands;

    ✓ CNPq boost the promotion of social technologies, emphasising the need for productive inclusion;

    ✓ Ability to connect scientific and non-scientific knowledge in the construction of effective solutions to social problems.

- **Management Models:**

    ✓ The hierarchical structure of CNPq has been revised and the institution now works connecting and optimising competences, and focusing on projects rather than based in isolated structures and demands, which allows effectiveness with a reduced number of staff;

    ✓ Channels for listening and for permanent dialogue with the Society are in place and subsidize the institution's decision making process and operational management;

    ✓ The institution adopts a decentralized and democratic management model, through which the technical staff participates in decision making processes and in the elective process of the Direction, which is aware of the long-term strategic planning of the institution and commits itself to its execution, monitoring and evaluation;

    ✓ The CNPq staff performance evaluation system (360º) is used effectively to identify potential leadership in the institution;

    ✓ Work processes and organisational structures are defined based on the institution's strategic plan;

    ✓ Workers mobility (internal and external) programme established with formal and transparent criteria;

✓ The institutional communication strategy strengthens its internal interaction and its relationship with Society.

▪ **Monitoring and Evaluation:**

✓ Focus on results and objectives, rather than the accountability of supported research projects alone;

✓ As a knowledge agency, CNPq has a long-term planning, with well defined projects, all of which are executed, monitored and evaluated continually;

✓ CNPq implements tools for monitoring and evaluating institutional performance;

✓ CNPq has effective instruments and indicators for evaluating the impacts (economic, social and cultural) of the projects it supports;

✓ The expertise of technical staff is effectively used in evaluation processes of STI funding and promotion, as well as in shaping public policies;

✓ CNPq adopts a new model for monitoring and evaluating STI funding and promotion, incorporating an information system that enables data crossing according to a wide range of variables and the customised assembly of technical reports, among other features;

✓ CNPq has in place an information system to support the execution and monitoring of its strategic plan, available within a situation room whereby the strategy review meetings take place.

The above results were used as an input both for the scenario building workshop, described next in section 2.3., and for the visioning process detailed in section 2.4.

2.3. Methodological approach Step 3 – Alternative futures

Scenario building is one of the main methods used in foresight. It is about multiple or alternative futures, built from intuitive logic using quantitative data, evidence-based information, and/or qualitative rich descriptions of possible futures [van Duijne and Bishop, 2018]. These often are plausible, sometimes surprising, but in some cases the aim is for disruption and to look at what is implausible, impossible, unlikely and improbable. In any case, the objective is to generate a meaningful conversation about the future relying on a mix of evidence, intuition and imagination.

According to van Duijne and Bishop (2018) scenarios build upon influential and uncertain drivers of change, and a storyline is then created from this starting point, using insights of trends and the outcomes of the STEEPV analysis [Loveridge, 2002]. Scenarios are, therefore, narrative descriptions between today and alternative futures.

In this context, the scenario building process applied used a structured process based on quadrants. The variables used to define the structure of the scenario building process was defined in various meetings between CGEE and the Planning Advisory Group of CNPq. These were: governance (nationalism vs. globalisation) and production of knowledge, goods and services (inclusive, open and sustainable vs. excluding, centraliser and proprietary). Figure 3 depicts the structure used to define the four scenarios.

Figure 3: Scenario Structure
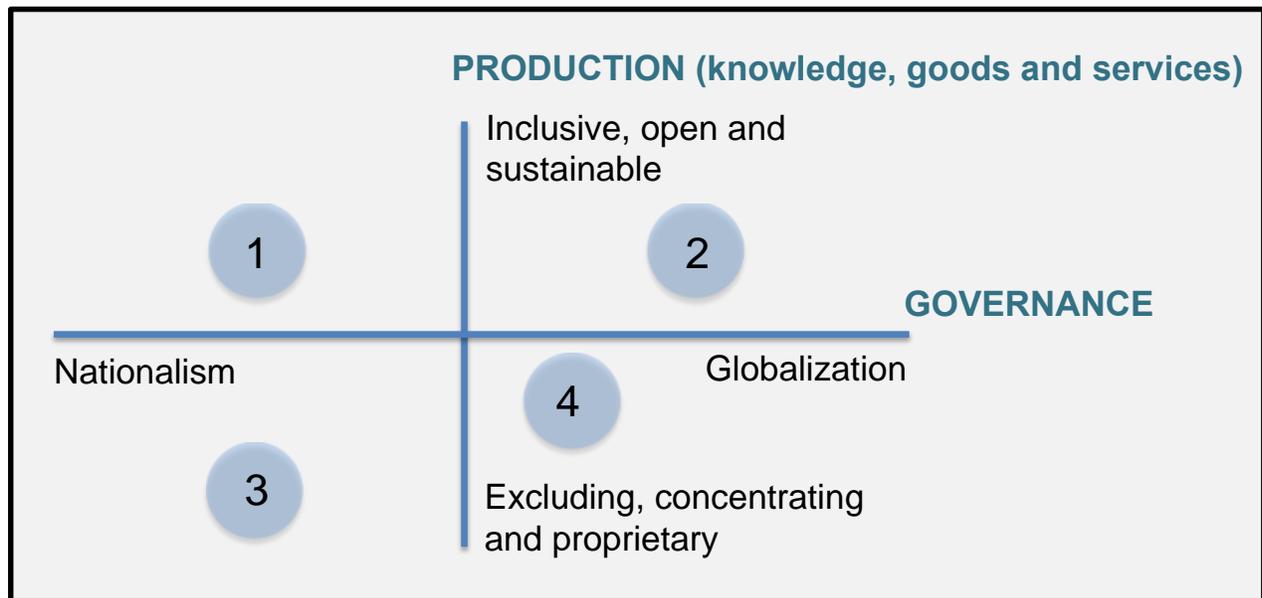
It is important to highlight that for the two-day scenario building workshop there were 24 participants being 12 from CNPq and 12 representing different institutions of the National STI System. Four groups were created, each containing 6 participants of which 3 were from CNPq and 3 not. Initially, each group developed a snapshot of the future looking at 2035 and using the STEEPV approach for describing each system in the future.

In the second stage, groups had to design important milestones or landmarks between today and 2035 for each of the STEEPV systems. Do to so, these were defined as the next national planning budget periods: 2019, 2023, 2027, 2031 and 2035. Beyond defining markers for the STEEPV systems, participants also had to define the roles of CNPq in fostering innovation and in relation to other STI actors between today and 2035 using the previously defined periods. To facilitate this discussion, we used a model of innovation according to the following description:

- Between 0-3: initial phase of research in which there is high risks and uncertainties in relation to which innovation than can emerge;

- Between 3-6: intermediary phase in which potential innovations are prototyped and inventions are commercialised;

- Between 6-9: final phase in which innovations are disseminated and adopted, as well as gain market scale.

In the third and final stage, participants had to describe within developed narratives between today and 2035, the ways in which CNPq operates in the seven dimensions that frame its organisation.

The resulting four scenarios can be summarised as follows and according to Figure 4:

- **Scenario 1: *Fantasy Island***

  ✓ Strong but not authoritarian Brazilian State, secular and citizen-centered;

- ✓ Free society with human rights and individual freedoms guaranteed, and with deep connections to historical and cultural roots;
- ✓ Traditional knowledge and emotional skills (softskills) are worth more than diplomas;
- ✓ National development based on national technologies with a tendency towards a low carbon economy;
- ✓ Diversification of the energy matrix, with greater participation of renewable energies such as wind and solar;
- ✓ Agricultural production with less agrochemicals, more greenhouses and with traditional knowledge incorporated;
- ✓ Evidence-based public policies;
- ✓ CNPq is shareholder in a number of start-ups;
- ✓ CNPq physical infrastructure no longer exists and almost all its work is done remotely;
- ✓ CNPq enables the participation of researchers in the prospecting of demands and in collaborative planning;
- ✓ Restructuring of the National STI System, with the end of overlaps between research and innovation funding institutions (*i.e.* CAPES, FINEP, BNDES and CNPq);
- ✓ R&I promotion and funding gives more importance to patents than to scientific production;
- ✓ A private STI fund is in operation;
- ✓ Integration of CNPq databases (*e.g.* Lattes, Carlos Chagas, Sucupira);
- ✓ Implementation of multidisciplinary teams at CNPq focused on problem solving;
- ✓ Strong social commitment with research focusing on cooperativism and family economy;
- ✓ Participation of the Third Sector in setting R&I priorities;
- ✓ Broad transversality and new areas of knowledge;
- ✓ Development of a partnership with INPI that allows the use of university researchers in the previous analysis of patent;
- ✓ Institutionalization of a new democratized and shared management model at CNPq;
- ✓ STI observatory at CNPq supporting constant monitoring and evaluation processes.

- ▪ **Scenario 2: *Elysium***
  - ✓ Production of inclusive and democratised knowledge as a founding principle;
  - ✓ Production with respect to social demands and full access to generated knowledge;

✓ Production of goods and services are massified, distributed and standardised, so that access is universal and its circulation is available for the majority;

✓ Stimulus to both productive and social technology based on interdisciplinary knowledge;

✓ First Science Nobel given to a Brazilian researcher;

✓ Institutions remain strong and fulfilling their original role (Classical State);

✓ Economic policy for development and sustainability with a non-subordinate relationship with developed economies since peripheral countries have equal positions in the international scenario;

✓ Tolerance and respect for human rights;

✓ Production of knowledge focusing on its economic and social relevance;

✓ Citizens participation in the most important and relevant discussions of Society;

✓ Wide access to quality education and healthcare;

✓ CNPq has a strong relationship with the productive sector, sharing information and knowledge;

✓ CNPq hosts a STI Observatory: generates, prospects, receives, captures, processes, analyses, organises and connects data and information, which serves as a resource for the National STI System actors, civil society and the international community, as well as connects key players to develop strategic actions at the national and international levels;

✓ CNPq is the IBGE (National Statistics Office) of data, and IPEA (Applied Economics Research Centre) of knowledge.

▪ **Scenario 3:** *Giant in Chains*

✓ Society with individualistic values and little solidarity;

✓ Centralising State with an isolationist discourse;

✓ Closed economy, with market reserve and protectionism;

✓ Production focused on the domestic market;

✓ Reinforced frontiers to contain the intensification of migration from automation and Industry 4.0;

✓ Very unequal Society with very strict social classes;

✓ Low technology transfer capacity and poor quality education leading to low potential for innovation and hardening of intellectual property rights regime;

✓ Loosening environmental criteria and increasing pressure for natural resources, generating more predatory forms of resources exploitation;

✓ The mission and the way by which CNPq operates is practically the same as of today;

✓ The CNPq budget trajectory has been constant, with very discrete episodes of growth in moments of country economic growth, without recomposition at historical levels;

- ✓ CNPq institutional mission is reviewed due to the current economic crisis (2035) and CNPq is still disputing space for action with similar institutions in Brazil;

- ✓ The reduced CNPq budget generates the need for planning and for prioritisation of actions (just like in 2018);

- ✓ Unstable and conflicting internal environment at CNPq, with a skeptical technical staff in relation to the current management model (2035), very much alike 2018.

- ▪ **Scenario 4: Life as it is**

  - ✓ The world is dominated by large corporations and conglomerates, with strong economic blocs and large unemployment rate;

  - ✓ Conglomerates define governments and how they should rule, with a dispute between liberalism and protectionism;

  - ✓ Proprietary knowledge as exchange currency, and intensification of intellectual property rights regime of conglomerates instead of countries;

  - ✓ Ministry of STI no longer exists;

  - ✓ Non-academic actors are stronger in the National STI System;

  - ✓ CNPq has a new funding model in place focused on partnerships and budget flexibility;

  - ✓ CNPq has more of an advisory role, like a councellor, and less of an executor of STI fundig and promotion, thus working closer to the Presidency of Brazil as used to be in its origin until the creation of the STI Ministry. Hence, all Brazilian Ministries have a STI policy centre embedded in its structure also responsible for promoting STI, thus leaving CNPq with the role of coordinator of these various efforts;

  - ✓ CNPq staff is reduced, but all with a broad strategic vision and knowledge of the national and international context in which they operate;

  - ✓ The management and governance model of CNPq is decentralised and shared with other actors;

  - ✓ The CNPq's agenda is strongly influenced by the interests of large international conglomerates, which contribute with large amounts of money for its operationalisation;

  - ✓ Tranversality becomes a reality at CNPq as it is the overcoming of the compartmentalised logic of its development;

  - ✓ Social commitment with the incorporation of ethical and social imperatives, both Brazilian and foreign.

Figure 4: resulting scenarios

Form of Production of goods, services and knowledge		Global Governance (globalized x nacionalized)
1 Nationalized, Open, Includent, Sustainable State: strong, laïc, centered on citizens. Not autoritharian Free Society with garantee of human rights strong nacional culture individual liberty Evidence-based public policy focus on traditional knowledge and softskills economic development based on national technology tendency to a low-carbon economy diversification of energy matrix Agriculture production with less fertilezers Scenário FANTASY ISLAND	**2** Open, Includent, sustainable Globalized manufacturing production Classic form of Nacional State with strong institution Better distribution of power in the global scenario. Less dependency Tendency to green economy. Higher respect to nature and natural resources Values - mutual tolerance and human rights respect knowledg as focus for solve economic and social problems social participation in pivotal decisions Acces for education and health in a good quality Tendency to green economy. Higher respect to nature and natural resources Observatory of knowledge, Research and development SCENÁRIO ELYSIUM	
3 nationalized, excludent and closed centralizing State with isolacionist discourse Society with individual values and few solidarity Higher inequality and straight social classes Closed Economy and protectionism Domestic market-led economy Growing migrations and reffugees as a result of Advanced Manufacturing. Low innovation capacity Predatory exploitation of natural resources scenario CHAINED GIANT	**4** Globalized, and excludent World economy dominated by Corporations, conglomerades The National System of ST have more participation of extra-Academy actors Conglomerates defines governments in international and national levels Propriety knowledge as currency, stronger propriety rights but linked to corporations not Nations There is no more Ministry of Science and Technology scenario THE LIFE AS IT REALLY IS	
Form of Production of goods, services and knowledge		

2.4. Methodological approach Step 4 – Visioning or normative scenario

The results of the Futures Literacy and scenario building workshops were five scenarios: i) disruptive vision for CNPq with descriptions of the seven dimensions of interest for the institution (result from the Futures Literacy exercise); ii) scenario 'Fantasy Island'; iii) scenario 'Elysium'; iv) scenario 'Giant in Chains' and v) scenario 'Life as it is' – the last four scenarios developed at the scenario building workshop.

To assess all these scenarios, aiming point to define a plausible and normative desired future vision, three criteria were defined: i) **Probability** (of scenario descriptions to occur); ii) **CNPq Influence** (on scenario descriptions to occur); and iii) **Strengthening of CNPq** (in case scenario descriptions do occur).

The final result is a narrative of CNPq in 2035, as described in Table 3 below.

TABLE 3 – CNPq in 2035
In 2035 CNPq has become a **Knowledge Agency** able to influence the strategic dimensions of the National STI Policy. This new focus will came from a long pathway expanding its view of science, technology and innovation in a sense that drives a sustainable development.
The Agency came to understand that highly probable events and characteristics of the future sociotechnical regime will impact the work, the mission and the role of CNPq. The acceleration of robotics and artificial intelligence and its penetration in the daily work of institutions and families, has changed the nature of work, its organization and how income distribution is done. Either in a radical globalisation or in a new era of nationalism and closing-doors world the mission of CNPq would be adapted to a continual changing society.
The progress of science and its growing importance for markets and production will maintain innovation at the heart of competition among corporations, nations and economic blocks for a long time. Brazilian biodiversity and traditional knowledge is a central competitive advantage that has to be studied in depth to promote its sustainable and well-planed use.
CNPq should arrive at 2035 with a competent and well-structured technical staff organized in multidisciplinary areas that are able to reflect about the national and international context and contribute to the conception, implementation

and evaluation of STI funding activities and instruments. This staff will be well connected to other institutions and research groups, and exchange programs will be widely spread. The direction of the Agency will enable it to assume the role of and responsibility for developing STI national strategic plans and other long-term documents that shall direct investments in STI. As a consequence, policies will be complementary rather than silo-based. The participation of technical staff is incorporated in each space of decision making, which has become more democratic and transparent.

Concerning the seven dimensions defined, CNPq's international insertion has been a result of its efforts to participate in relevant global fora. Cooperation with Latin-American nations have enabled CNPq to participate in a equal footing to similar agencies in highly-developed countries in global strategic decisions concerning the definition of priority STI investments and associated funding mechanisms. This investment in cooperation and regional representation of soft power in Latin America has contributed to an international and democratized STI cooperation globally to be achieved. The established practice of sharing scientific infrastructures had a strategic role in this direction.

Regarding the integration and articulation with partners, new societal actors and instruments of CNPq´s partnership instrument have become more dynamic and enabled a wide dialogue with society in terms of identifying challenges to be tackled and possible avenues to be pursued. Innovation remains a driver of competitiveness and global power, and CNPq has been able to establish mechanisms both to guide innovation through S&T and to invest in new firms such as rising stars, start ups and new configurations that have become common place in 2035. Scientific projects are inter- and multidisciplinary, both in its conception and implementation, and funding has become mission-oriented. This means that the Agency fosters STI and demands projects that contribute to solve and clarify relevant challenges of the State and Society. In this regard, much of policy investments between 2018 and 2035 were driven to supply social demands of infrastructure such as housing and sanitation, which leveraged a change in understanding of how STI can contribute to social challenges nationally. This has put increasing demand for new researches of new sustainable, useful and economically effectiveness projects.

With respect to internal dimensions such as management model, and approach to monitoring and evaluation, these have evolved to enable the Agency to establish open, transparent an continual communication channels both internally and with society. Thus, a balance between cultivating its own institutional memory and being open to society and global actors has contributed to the effective implementation of long-term and strategic plans. To this end, continual evaluation and feedback mechanisms to monitoring STI policy and related instruments, as well as the processes and results achieved by CNPq have put in motion a dynamic ecosystem for innovation in Brazil and serves as an important instruments for social control, thus enhancing all the public-policy cycle of life.

Finally, advancements in ICT have been key in the identification and organization of societal challenges, particularly through big data and artificial intelligence. However, the most important development to enable CNPq to achieve its current status was a significant State decision to define its budgetary resources as falling between 1% and 3% of GDP, depending on annual growth. Innovation indicators and an intensification of the formation on human resources have also contributed significantly to enable this vision come true.

3. Next steps and discussion

The developed Scenarios Study allows CNPq, among other aspects, to broaden its mental models, Identify some important trends and possible trend ruptures, as well as identify threats and opportunities for the National STI System, and improve processes and methodologies of Science and Technolog Management.

The normative scenario (the defined vision for 2035) will serve as a basis for the revision of the current portfolio of CNPq projects, defined in 2015. This activity consists refining existing strategic projects and including new ones. Ultimately, such revision has been the central motivation for work done so far of Scenarios Building.

In an era characterized by constant world changes, where STI assumes a strategic role in the pursuit of desired socioeconomic development, Brazilian society has CNPq as a unique entity for the training of innovative researchers and for financing both research projects and those targeted at developing technology and boosting innovation.

An updated portfolio of projects, aligned with a strategic vision of the future, is therefore fundamental for CNPq to maintain its effectiveness and innovative capacity to act in the fulfillment of its mission. This is key for an Agency that "*participates actively in the formulation of policies that guide the National System of Science, Technology and Innovation (SNCTI), articulating public-private partnerships, and promoting collaboration between companies and S&T institutions*"; and also has as competence *"the knowledge of the instruments that will enable the decisions made by the political actors"* [MCTIC, 2016].

A well-defined action plan, with clear projects, internally and externally agreed upon, with the establishment of deadlines and responsible, will add much value to CNPq's management process, reinforcing its institutionality and competence, and minimizing its vulnerability to a growing instability in the country's economic and political contexts.

It should be noted, however, that the implementation of strategies has been a challenge for organisations, whether is it in the public sector or in the private sector, especially when the plans impose alignments between short-, medium- and long-term horizons, such as is the case here.

In this context, the sustainability of a systemic process of strategic planning and management requires the observation and intensification of several managerial assumptions, of which the following stand out: adopting an institutional measure that neutralizes the perverse 'continuity solution', through the probable ones changes in direction, over time. Also, commitment of all managerial levels with the Plan; adoption of computerized tool for execution and monitoring of the Strategy, customized for the institution; permanent and adequate development of technical and behavioral skills, to meet the challenges established in the Plan.

In a way, all these assumptions are closely interrelated, since their results are interdependent, and thus contribute greatly to the alignment of the organization with its Strategic Plan [CNPq, 2014].

4. Conclusions

The scenarios developed for the CNPq is an exercise that cannot end in itself. These indicate different possibilities for the seven strategic dimensions that define its model of action, against the backdrop of the imagined Social, Technological, Economic, Environmental, Political and Cultural (society values) Systems. More importantly, the developed scenarios and defined future vision are capable of addressing strategic issues that are currently critical for CNPq. Hence, these provide an important subsidy to support the Agency's heads in the formulation of future-oriented long-term strategies, in the elaboration of associated plans, as well as in the projects to be deployed.

Nevertheless, in addition to the risks inherent to each of the uncertainties and trends highlighted in the scenarios built, one cannot ignore those concerning the decision-making and political will. Ultimately, this can either contribute to boost the future of the Agency in a collective manner, or the lack of action may invalidate the effort of rebuilding institutional capacities due to its widespread contribution from the tactical and operational levels of the Agency.

These risks bring with them intrinsic uncertainties about the constitution and strengthening of an internal planning system that is capable of linking actions with medium- to long-term objectives and guidelines. Also, regarding the conducting of a process of construction of strategic projects via mobilization of the people who work in the Agency. This is important to highlight due to the

historical evolution of planning within the Agency and its inability, so far, to generate an important contribution to institutional change.

In this context, it is much welcomed the institution's commitment to go a step further and use the results of the scenario building and visioning processes both to re-think what the Agency wants to be in the future and how to operationalize this vision through a portfolio of projects to be implemented and revised along the next four national planning budgeting periods up to 2035. Ultimately, the results of this exercise will establish a framework for CNPq to assess its current projects and programmes towards its desired future vision

5. Acknowledgements

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