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Toolkit for completing the GO→SPIN surveys: Guidelines for the preparation of the inventory of SETI operational policy instruments; inventory of the SETI legal instruments; and inventory of SETI institutional ecosystem

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Toolkit for completing the GO→SPIN surveys: Guidelines for the preparation of the inventory of SETI operational policy instruments; inventory of the SETI legal instruments; and inventory of SETI institutional ecosystem¹

Guillermo A. Lemarchand

Abstract: We present a brief description of the GO→SPIN theoretical framework in terms of three main analytical units (i.e. SETI ecosystem, SETI legal framework and SETI operational policy instruments). After giving some examples of different policy instruments associated with each individual analytical unit, we present the guidelines to complete the survey's templates for the construction of the national inventories of (a) SETI operational policy instruments; (b) SETI legal framework; and (c) SETI institutional ecosystem.

1. INTRODUCTION

UNESCO's Global Observatory of Science, Technology and Innovation Policy Instruments (GO→SPIN) is a programme designed to expose —through the rigorous application of an assessment lens— usable insights about science, engineering, technology and innovation (SETI) policies and their context. This programme is helping UNESCO Member States to create local capacity for analysing SETI evidence-based policies to detect gaps and introduce reforms and upgrades to their national innovation systems and its governance. It promotes building capacity to monitor and evaluate the policy performance, through a structural analysis (covering the explicit policy, the SETI national ecosystem, the legal framework and operational policy instruments), because such analysis points to implicit policies and gaps, and situates the performance of each individual national policy. In this way, the scope of standard SETI assessment can be widened, to consider country-specific contexts, as well as emerging knowledge of technological advances that contribute to sustainable development. While complementing efforts to promote evidence based SETI policymaking as well as efforts to evaluate policy performance, GO→SPIN offers a good baseline for the promotion of national scientific and technological foresight studies.

SETI policy priorities must be intricately linked to national objectives and visions, which are embedded within broader development strategies and trajectories. A SETI policy framework with a transformational focus aimed at sustainable development can support shared objectives such as the SDGs and other national and global priorities, as well as other UN commitments and Recommendations. For instance, GO→SPIN is contributing for monitoring the implementation of the recent UNESCO's *Recommendation on Science and Scientific Researchers*².

¹ This working paper is an abridge version of Lemarchand (2014). Here we use the last versions of UNESCO's GO→SPIN surveys which follow the new templates designed in 2018 for the GO→SPIN on-line platform (URL: <https://gospin.unesco.org/>).

² https://en.unesco.org/themes/ethics-science-and-technology/recommendation_science

SETI policies are implemented through various operational instruments with different features and focus which are often combined in “policy mixes” requiring coordination, consistency, and coherence across government. Differences in the levels of maturity of countries’ National Innovation Systems (NIS) require different SETI policies and instruments.

Nevertheless, the lack of, or weaknesses in data, information, indicators, and capabilities to formulate, analyse and monitor SETI policies and instruments continue to be a major challenge in many countries. Consequently, the objective of GO→SPIN programme is to fill these gaps.

Science, engineering, technology, and innovation (SETI) are becoming increasingly important for socio- economic and sustainable development. During the past 60 years, both developed and developing countries have recognized this fact by increasing the number of SETI government bodies, establishing new SETI legal frameworks, and implementing a diverse set of new SETI policy instruments. This has driven investment in scientific research, technological development, and innovation (STI), led to an increase in the number of scientists and engineers and fostered exponential growth in the number of new scientific articles and patents worldwide (UNESCO 2015).

The information economy is one of the key concepts invented to explain structural changes to the modern economy (Godin 2008). The infrastructure to manage SETI information has been largely considered the core resource of national competitiveness in research and innovation (Neelamegham and Tocatlian 1985). With the globalization of SETI information infrastructure has come a need to implement comprehensive strategies to connect, share and trade both domestic and foreign information at the national level (Lee and Kim 2009).

The formulation of adequate SETI policies is critical to tackling contemporary challenges that include mitigating the consequences of global climate change; exploring new energy sources; generating innovation to foster social inclusion; promoting the sustainable management and conservation of freshwater, terrestrial resources and biodiversity; disaster resilience; and fostering the eradication of extreme poverty and hunger. These policies also need to be designed to achieve the different dimensions of the Sustainable Development Goals (SDGs).

The GO→SPIN methodological approach has been recently included by the United Nations Inter-Agency Task Team (IATT) on STI for SDGs Roadmaps, as one of the tools used to understand the relation between STI and the achievement of SDGs targets, and to consolidate –among different UN agencies– a shared framework and common language across these different professional communities that are rooted in public, private, academic, civil society and international organizations (UN Technology Facilitation Mechanism 2020).

2. BETTER WAYS OF MEASURING EVIDENCE-BASED POLICIES

SETI policy debates are not yet dominated by a thoughtful, evidence-based analysis of the likely merits of different investment options and policy decisions. The latter are strongly influenced by past practice or data trends that may be out of date (Husbands Fealing et al. 2011). The evolution of new policies has been accompanied by more difficult challenges related to planning and evaluating these policies; this indicates a need to improve the theoretical frameworks for policy formulation (Steinmueller 2010).

Unfortunately, a number of factors prevent countries from reaching most of the objectives established by their own development plans: the lack of reliable information on SETI

national potentialities; difficulties in coordinating the various SETI stakeholders; an absence of mechanisms for promoting a strong interaction between the supply and demand sectors in SETI, and; the absence of any explicit industrialization policy promoting endogenous innovation.

These difficulties mostly appear in small economies. For example, Flanagan et al. (2011) have explored the ways in which innovation policy studies treat actors, instruments, institutions, and interactions, in order to arrive at a more useful conceptualization of the policy mix for innovation. They stress the need for a genuinely dynamic view of policy formulation and policy interaction. They conclude that 'despite the importance attached to "strategic policy intelligence" in recent innovation policy analysis, little empirical attention has been devoted to actual processes of policy learning.' In developing and exploiting technological opportunities, institutional competencies – namely, the governance of SETI decision-making bodies – are just as important as the SETI incentive instruments they promote (Pavitt 1996). Path dependency emerges, as the cost of institutional changes to SETI is often higher than that of accommodating new instruments and policies in existing structures (Van der Meulen 1998). For this reason, the design, analysis and monitoring of any national SETI policy will strongly depend on the adequate mapping of: the structure of the SETI governing bodies; the SETI national legal framework and; of the implicit and explicit operational SETI policy instruments which are implemented (Herrera, 1971; 1972; Sagasti and Aráoz, 1976).

3. WHY TALK ABOUT SETI POLICIES?

The term 'science policy' was coined following the seminal publication of Vannevar Bush's "Science, the Endless Frontier: A Report to the President" (1945), which laid the foundations for the first social contract for science. By 1950, UNESCO had initiated the first systematic studies on science policies in a dozen developed countries. Originally, this term referred to public policies related to scientific and technological research, experimental development, scientific and technological services, and innovation. Science policy as a discipline evolved over the coming decades. Today, it is possible to distinguish specific operational policy instruments according to the different needs established by science policies, engineering policies, technology policies and innovation policies.

As these four distinct types of public policies require different skills, major universities around the world have recently introduced specific postgraduate programmes targeting each of the four types of policy:

Science policy: relates to those policies needed to: promote scientific research, determine and select scientific objectives and goals consistent with national plans or strategies, exercise judgment in fixing norms to govern the ways and means by which science is developed, transferred and applied; gather, organize and deploy resources required to pursue the selective objectives and; monitor and evaluate the results obtained from applying the policy. The following are therefore among the most important questions dealt with by policy-makers in the field of science policy: (a) establishing and strengthening government structures and mechanisms for planning, budgeting, co-ordinating, managing and promoting scientific research; (b) gathering, processing and analysing basic data concerning the national scientific potential, including data on ongoing research, monitoring national scientific development and ensuring the smooth growth of the institutional infrastructure for scientific research; (c) maintaining a proper balance between the various

types of research (fundamental, applied, experimental development), supporting the development of a creative national scientific community and setting standards for the status of scientific researchers in conformity with their responsibilities and rights; (d) optimizing human, financial, institutional and informational resources to achieve the objectives established by the national SETI policy; (e) assessing and promoting productivity, relevance, quality effectiveness of national research and scientific and technological services in various sectors of performance (higher education, government institutions, business enterprise, private non-profit) and removing organizational and managerial difficulties encountered in the execution of scientific research; (f) initiating appropriate legislative action in relation to the impact on the individual, society as a whole or the natural environment of the application of discoveries and inventions; evaluating the economic profitability and social utility (or harmful effects) of the said discoveries and inventions. Although the aforementioned list is not exhaustive, it indicates the key areas for which government policymakers are primarily responsible. Each individual issue requires the design of a particular operational policy instrument.

Engineering policy: the role of engineers in public policy can be seen as a two-fold endeavour: (1) to help create public policy related to the utilization of technology to solve public problems as well as monitor and ensure compliance with such policies; and (2) to use engineering knowledge to assist in the construction of policy directives to help solve social problems. In many cases, the development and implementation of such regulations and laws requires both a technical understanding of the functioning of these artefacts and an understanding of how this technology interacts with social and natural systems and would benefit from the involvement of a technical expert. The issues addressed by engineering policies are vast and global in nature and include water conservation, energy, transportation, communication, food production, habitat protection, disaster risk reduction, technology assessment and the deterioration of infrastructure systems. These issues need to be addressed while respecting the rights and meeting the needs and desires of a growing world population [for a detailed list of issues and challenges addressed by engineering policies, see UNESCO (2010)].

Technology policy: the fundamental premise of technological policies is that it is possible for governments to implement public policies to improve social welfare by influencing the rate and direction of technological change. The conventional entry point for economic analysis is to identify the conditions needed for such influence to be superior to the outcome of ordinary market competition. These conditions, in turn, direct further examination of the feasibility and methods for such intervention, including the question of whether government intervention is necessary to improve social welfare. Succinctly stated, government intervention would be necessary if profit-seeking actors underperformed or performed poorly in producing or exchanging technological knowledge from the perspective of social welfare.

Innovation policy: innovation policy can be characterized in various ways, such as by distinguishing between 'supply-side' and 'demand-side' policy, or between 'mission-oriented' and 'diffusion oriented' policy. Policy instruments include financial instruments (e.g. R&D tax credits, export incentives, soft loans, etc.) and regulatory instruments such as laws and binding regulations (e.g. the use of safety equipment for children in cars). Innovation policy encompasses many types of innovation. Innovation may be characterized, inter alia, by: the type of innovation – technological (product and process) or non-technological (organizational and marketing); the mode of innovation – novel innovator

(strategic and intermittent), technology modifier and technology adopters and; the socio-economic impact– incremental, disruptive or radical. The effectiveness of innovation policies requires a sufficiently stable framework, institutions, and policies. Stability and predictability are particularly important for risky activities with a long-term horizon such as R&D and innovation. Excessive instability may inhibit innovation by increasing uncertainty for innovators. It may lessen the effectiveness of policy instruments by weakening the incentives they provide. In addition, it reduces opportunities for learning and developing evidence- based policy practices. Whereas there are manifold sources of unwarranted discontinuities, political instability, and fiscal problems –often related to policy cycles– are a common cause. In an increasingly complex innovation landscape, developing effective governance requires better co-ordination at, and among, the local, regional, national, and international levels.

SETI projects normally occur within a larger temporal framework administered by an organization or a government policy-making body. The early stages of a new SETI policy usually appear as successive expansions of the group of agents and stakeholders whose endorsement is needed to launch the initiative, whereas the latter stages focus on programme management, with feedback as to its success or failure at the policy level (Marburger 2011). Consequently, in order to provide an accurate landscape of the SETI policies and policy instruments in a specific national context, it is imperative to understand the long-term evolution of the SETI organizational chart, SETI infrastructure and legal framework (i.e. explicit policies), as well as the type of funding mechanisms implemented. The latter dimensions must be contrasted with detailed analyses of the long-term behaviour of political, educational, economic, productive, and social macro variables (i.e. implicit policies).

It is impossible to describe the current status of SETI without accurate data. Moreover, these data should be presented in such a way as to allow decision-makers and experts to estimate whether the status of SETI meets societal needs or expectations. Policymakers benefit from additional policy tools to assist them in deciding about budget allocations or in the design of new SETI policy instruments, especially if these are real-time tools or new innovative prospective methodologies. Recent empirical studies show the relevance and long-term impact of appropriate SETI information services on SETI policies designed to improve national competitiveness (Lee and Kim 2009).

It is also important to note the availability of a large group of public and private databases. These can be most useful tools for evaluating the performance of the SETI policies and providing adequate technology intelligence studies. There are robust, accessible systems designed to make rapid analyses and apply mathematical models to identify critical points or levers triggered by policy changes that can directly affect the performance of innovation activities. For example, Zucker and Darby (2011) present a comprehensive survey of all available databases that may be used to analyse the impact of SETI policies.

4. POLICY INSTRUMENTS: LEVERS FOR IMPLEMENTING DECISIONS

A policy may remain a mere rhetorical statement if no means are provided for its implementation or to realize its potential effect. To do this, a few things may be needed, which we will incorporate under the term of policy instrument. A policy instrument constitutes the set of ways and means used when putting a given policy into practice. It can

be considered as the vehicle through which those in charge of formulating and implementing policies actualize their capability to influence decisions taken by others.

The study of public policy instruments in national settings has contributed significantly to the understanding of policy, political systems and relations between State and citizen. Research on policy implementation usually focuses principally on the effects of a specific instrument, within a wider reflection on whether the correct instrument has been chosen for the purpose. As far as new governance models are concerned, the search for suitable instruments is above all governed by pragmatism (Kassim and Le Gales 2010).

SETI operational policy instruments are the levers by which the organizational structure ultimately implements the decisions on a day-to-day basis and attempts to produce the desired effect on the variables the policy has set out to influence. Throughout the analysis of an instrument's effectiveness, it is important to bear in mind the 'actors' or key decision-makers who are directly involved in the design and use of a policy instrument. An instrument does not act on its own accord. Rather, it responds to the will of the policymakers and decision-makers using it.

The challenge for SETI policy instruments can be interpreted as a problem of transformation, namely the question of choosing the best policy instrument to reach the set target. A policy instrument attempts to make individuals and institutions take decisions following the rationality dictated by the collective objectives established by those in power. It is the connecting link between the purpose expressed in a policy and the effect that is sought in practice. An SETI policy instrument includes, as a significant component, the manipulation of SETI variables.

One of the first and more relevant studies on SETI policy instruments was conducted in the 1970s by the International Development Research Centre (IDRC). The principal objective of the study was to devise ways and means of understanding how a country's investment in S&T could be most effectively related to its objectives for industrial development. Sagasti and Aráoz (1976) developed an interesting methodological framework for making a survey and analysing the policy instruments of ten countries in Latin America, the Middle East, Southern Europe, and Asia.

Since 2011, UNESCO's GO→SPIN programme has adapted and expanded the theoretical framework of Sagasti and Aráoz (1976), in order to implement a systematic surveys in Africa, Arab States, Asia and the Pacific and in Latin America and the Caribbean. The information in the present country profile has been organized according to this methodological approach. Figure 1 presents the basic analytical units around which the surveys are organized.

All national SETI policies be they implicit or explicit (Herrera 1971, 1972), attempt to harness a country's creative potential to its socio-economic, environmental, and cultural objectives. An explicit SETI policy is a statement by a high-level government official or institution, such as a ministry or the planning secretariat, that deals with activities related to STI. The policy expresses a purpose (effects according to SETI variables) and may set objectives, define desired outcomes, and establish quantitative goals. Policies also contain criteria for choosing from among several alternatives to guide decision-makers as to how SETI works. SETI policies might also be formulated by representatives of the private sector. Several factors impinge on the efficiency of SETI governance, namely, the extent to which policy processes have the greatest effect with a given use of resources. It must be

acknowledged that overall efficiency is not easily defined and measured in a multi-objective, multi-actor world.

Governments use a wide variety of instruments and methods to operationalize broad policy decisions. As in other policy domains, the choice of specific instruments will be guided by the overall SETI policy objectives, the nature of local conditions, priorities and challenges (including the political context, governance and institutional framework, etc.), as well as the level of maturity of the country's research and innovation ecosystem.



Figure 1: GO→SPIN Analytical Units

5. SETI OPERATIONAL POLICY INSTRUMENTS

A concern with the means employed by governments to reach SETI policy goals fits within a more general concern for SETI policy formulation and design. The basic demands are: How do governments approach public problems, how do they select means for addressing them, and how do those means conform to evaluate standards appropriate for assessing public policy. Usually, the formulation process of the policy design approach is the least analytically developed stage in traditional policy making process models. Thus, an important component for the assessment of SETI policies implementation is by knowing where the instruments of government typically come from (conceptually and practically) and what decision processes are involved in the refinement and appraisal.

Throughout the analysis of an instrument, it is important to keep in mind the actors or key decision-makers who are directly involved in the design and use of a policy instrument. An instrument does not act on its own accord. Rather, it responds to the will of the policymakers and decision-makers using it.

The question of the tools and instruments used by governments to influence their surrounding contextual factors (economy, society, education, poverty, environment, sustainable development) and the application of research and innovation results to address solutions and strategies to solve those issues, has received increased academic attention over the past decades.

In this section we will analyse the third group of policy instruments: the so called *SETI operational policy instruments*, which are the levers, or actual means, through which the national research and innovation ecosystem ultimately implements the decisions on a day to day basis and attempts to influence the behaviour of the various stakeholders targeted by the policy.

There are different types of operational policy instruments according to different objectives and goals which are expressed within a given SETI policy. There are also different types of mechanisms that governments can use to obtain similar results and there are also different instruments according to the different stages of the innovation process (see Figure 2).

Policy instruments are usually categorized along different dimensions. These taxonomies can help in the selection of instruments and be of use for classifying and analysing diverse sets of policy mix. In the Table 1 we show different examples of operational policy instruments according to different policy objectives and goals, beneficiaries, allocation mechanisms, etc. The GO→SPIN methodological approach analyses each individual operational policy instrument using 25 different standardized fields (see Appendix 1). Within the UNESCO's GO→SPIN online platform there are around 1,200 examples of operational policy instruments which are in place in around 75 developing countries around the world. Each individual operational policy instrument in the GO→SPIN online platform has been linked to the corresponding SDGs target.

According to Cirera and Maloney (2017), for countries with a less-developed national research and innovation system, SETI policies should focus primarily on areas such as developing human resources (including fostering managerial and organizational capabilities, as well as STEM skills), improving basic SETI infrastructure (e.g. machinery upgrading, testing/standards, ICTs), and strengthening general framework conditions (ensuring for example a sufficient level of competition and intellectual property rights).

At later stages of development, other SETI policy objectives become more prominent including investing in more advanced research and technological capabilities, strengthening links between actors in the demand and supply sides (e.g. industry/academia), fostering greater absorptive capacity in firms, and addressing other systemic barriers to innovation.

Finally, in a more mature stage, the emphasis can shift to promoting the development of more advanced technologies, fostering more collaborative research and innovation efforts across all actors, and promoting an innovation culture throughout the private and public sectors as a whole.

In the Appendix 1, we provide instructions on how to complete the corresponding GO→SPIN survey template for SETI operational policy instruments and we provide some examples taken from the GO→SPIN online platform.

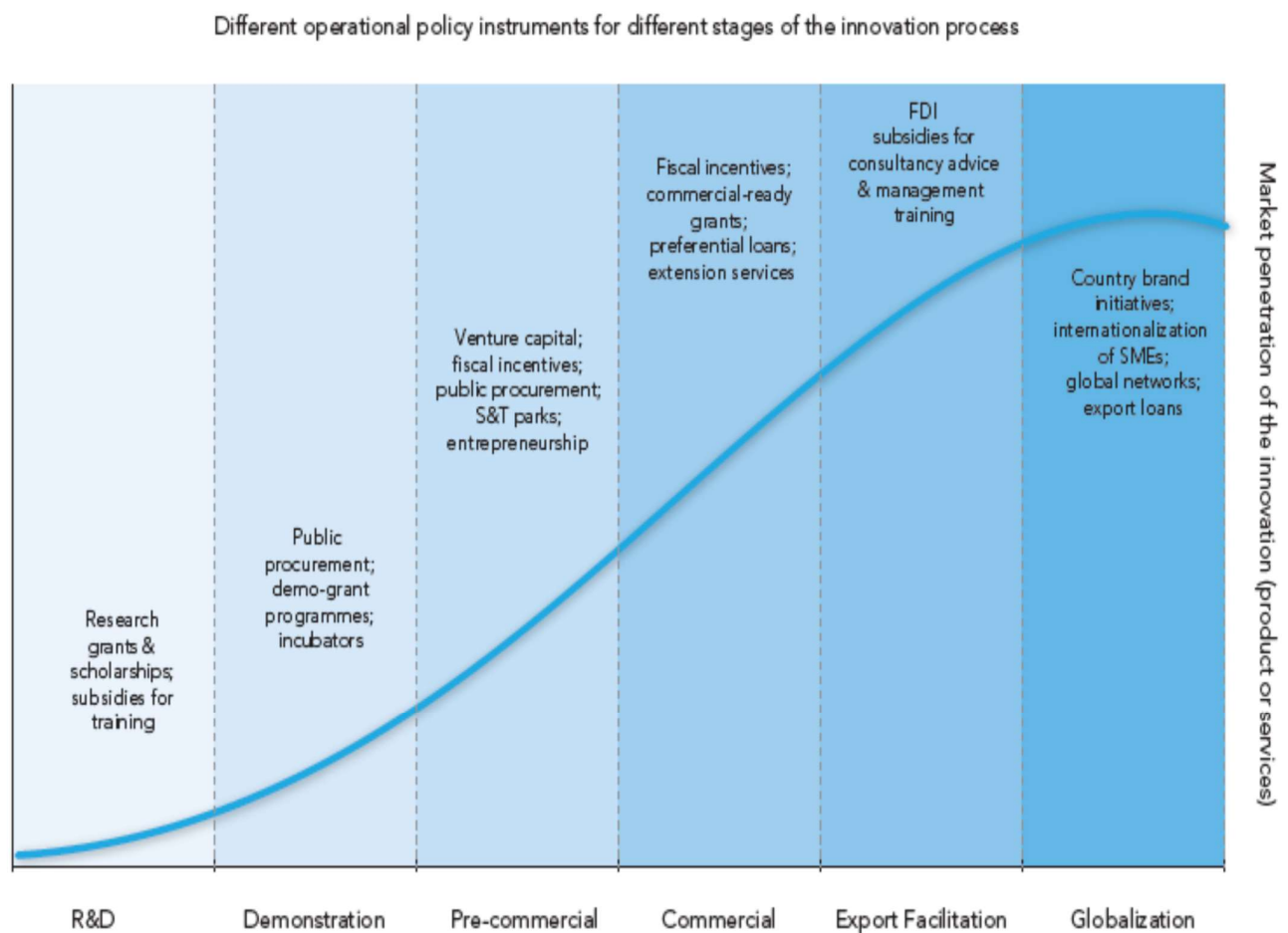


Figure 2: Examples of different operational policy instruments that are usually applied for the different stages of the innovation process

Table 1: Examples of SETI operational policy instruments

Programmes and Objectives	Policy instruments	Strategic Objectives	Beneficiaries	Mechanisms for allocating funding
Scientific research and technological development	Competitive grants	Promote the endogenous production of new scientific knowledge in the exact and natural sciences. Promote regional networking.	Research groups at national universities and national research centres associated with similar research groups from other countries in the region, within formal partnership agreements	Competitive grants selected on a peer review basis; national research groups must be associated with similar groups from countries in the region which provide matching funding
Promotion of science education	Public subsidies for projects establishing science laboratories at public secondary schools	Improve scientific knowledge; methodological approach and critical thinking for secondary school pupils	Public secondary schools in less developed parts of the country	Public subsidies to mount new science cabinets and laboratories and new posts for science professors
Promotion of gender equality in research and innovation	Scholarships	Promote the participation of women in high-tech research and innovation	Young women enrolled in a PhD programme in basic and engineering sciences	Scholarships of up to four years and small grants for participation in international conferences
Protection of indigenous knowledge	Intellectual property rights, public law-national legislation, and public subsidies	Protection of traditional knowledge to confer exclusive ownership and rights on local communities when the object of protection is a product or domesticated animal, cultivated plant or any micro-organism, or a design or an object of a functional or aesthetic nature, including any element of handicrafts, the act prohibits third parties from making, using, stocking, offering for sale, selling, commercializing, importing, exporting, or identifying the active substances for commercialization, without consent	A local traditional practitioner, a local community or its representative may apply to register traditional knowledge	Public subsidies and tax exemptions to defend the Intellectual property rights of holders of indigenous and traditional knowledge
Attraction and reinvestment of foreign direct investment	Public financing Tax incentives	Strategies vary from country to country, examples being: (a) an Industrial policy based on attracting export-oriented industries; (b) promotion of structural change; (c) capacity-building to improve competitiveness, focusing on sectors or market niches; (d) internationalization of enterprises, and promotion of innovation; (e) prioritizing the generation of higher-tech goods and services (f) attracting selective FDI oriented towards ICTs, biotechnology, nanotechnology, and financial services; (g) improving the business climate by refining legislation and simplifying formalities to facilitate corporate operations.	National Infrastructure (buildings, technology corridors, technological cities) and training of labour and professionals for the industry in question SMEs with export capacity	Soft-loans, tax incentives, grants For specific periods: tax discounts, exemptions, preferential rates, rebates on machinery and equipment

	Attracting R&D firms		Endogenous entrepreneurs High-tech emerging sectors: biotechnology, nanotechnology, new materials, ICTs.	The same tax incentives plus special competitive funding
	Other services	Structural change within a large country offers more opportunities for the domestic market, small and medium-sized countries generally focus on schemes conducive to the development of exports	Strengthening exports of industries and services considered to have strong potential in the country	Creation of a "one-stop shop" with representatives from different ministries/agencies to deal with problems concerning programmes, public regulations and post investment services
Technological development	Fiscal credit programme	Assistance in executing R&D	Physical or juridical persons who own enterprises producing goods and services	Subsidies through fiscal credit certificates obtained via public competition; up to 50% of the total cost of the project
	Loans for modernization Projects	Technological adaptation and improvements to products and processes with a low level of technical and economic risk	Enterprises with R&D department or groups; collaboration groups, and technical linkage units underwritten by the enterprise	Special compulsorily repayable loans allocated on an open window basis. Up to 80% of the total cost of the project, with a maximum of \$...in three years
	Loans to enterprises	To finance projects for the development of new production processes, products, and modifications thereto	Enterprises, without any restriction on size or sector; no finance provided for projects with a rate of return of less than 12%	Compulsorily repayable loans allocated on an open window basis. Up to 80% of the total cost of the project, with a maximum of \$...
Promotion of the technological services market (research institutes and business research centres)	Subsidies for projects to develop business plans	Finance for business development projects based on R&D	Micro-, small and medium-sized enterprises whose projects are executed by technical linkage units	Subsidies allocated on an open window basis. Up to 50% of the total project cost, with a maximum of \$..., for up to one year
	Loans to institutions	To promote the establishment and strengthening of structures for the provision of technological services to R&D enterprises and institutions	Public or private institutions providing services to the private productive sector; projects may be presented on an individual or associated basis	Obligatorily repayable subsidies allocated on an open window basis, up to a maximum of \$...
Training and technical assistance	Subsidies for training and retraining projects	Subsidies to support activities for training and retraining human resources in new technologies	Micro-, small and medium-sized enterprises whose projects are executed by technical linkage units	Subsidies allocated on an open window basis. Up to a maximum of 50% of the total cost of the project, or \$... for up to six months
	Subsidies for project Formulation	Support for the formulation of R&D projects, technology transfer or technical assistance	Micro-, small and medium-sized enterprises whose projects are executed by technical linkage units	Subsidies allocated on an open window basis. Up to a maximum of 50% of the total cost of the project, or \$... for up to six months
Technological advisory assistance programmes and those strengthening the performance of	Technological advisory assistance programme	Support for the formulation of R&D projects, technology transfer or technical assistance	Micro-, small and medium-sized enterprises producing	Subsidies allocated on an open window basis to individuals or groups, with a maximum of

technical small and medium-sized enterprises			goods and services which incorporate technological added value	50% of the total cost of the project, or \$... and a maximum of \$... per participating enterprise
Popularization and social appropriation of science	Competitive grants	Support for the organization of national exhibitions and science fairs	Science museums, educational institutions at primary, secondary and tertiary levels	Subsidies allocated on a competitive basis

6. SETI LEGAL INSTRUMENTS

The so-called legal framework can also be considered as a legal instrument. This embodies the policy, or parts thereof, in the form of a law, decree or regulation. Formal agreements, contracts and international STI cooperation treaties may also be included in this category. A legal instrument goes one step beyond a policy by stipulating obligations, rights, rewards, and penalties. There are large number of examples of legal instruments which were implemented to foster policy interventions for achieving different goals.

Among them we find, among others, legal instruments for the creation of national research labs, universities, national research councils, Ministries of S&T, R&D Funds, Innovation Funds; for the regulation and organization of the national innovation system; for the regulation of the imports/exports of high-tech products, or, tax incentives for the promotion of innovation within the private sector; regulate foreign direct investments promoting the establishment of new high-tech enterprises; regulate the protection of the national biodiversity and to establish norms on how foreign companies exploit the active substances available within each national territory (new rules for the protection of indigenous knowledge); to foster R&D activities within the private sector and the creation of technological funds associated with the most strategic sectors of the economy (energy, mining, agriculture, industry, communication, fishing, tourism, etc.); to establish regulations and decrees for the implementation of new national policies, creation of new funding mechanisms, import/export tariffs; to setup bilateral, regional and international agreements on SETI activities; to establish contracts on technology transfer; to regulate the protection of the national biodiversity and to establish norms on how foreign companies exploit the active substances available within each national territory (new rules for the protection of indigenous knowledge).

In some cases, it is possible to estimate the impact that specific legal instruments can generate in each country. Figure 3 shows the evolution of the gross expenditure on R&D (GERD) as a percentage of the GDP in the State of Israel (1960–2013). In this graph the military expenditures on R&D are not included. Within the figure we also represented a list of the main legal instruments ordered by their corresponding enactment dates. It is shown that after the implementation of the Law for the Encouragement of Industrial Research and Development (1984) the GERD in the country – as a percentage of the GDP – grew approximately 300%.

The UNESCO GO→SPIN online platform has developed a friendly template offering direct access to the entire SETI legal framework, description and the full text of laws, acts, decrees, and agreements adopted by each country. In the Appendix 2, we present the guidelines to complete the national inventory of SETI legal instruments.

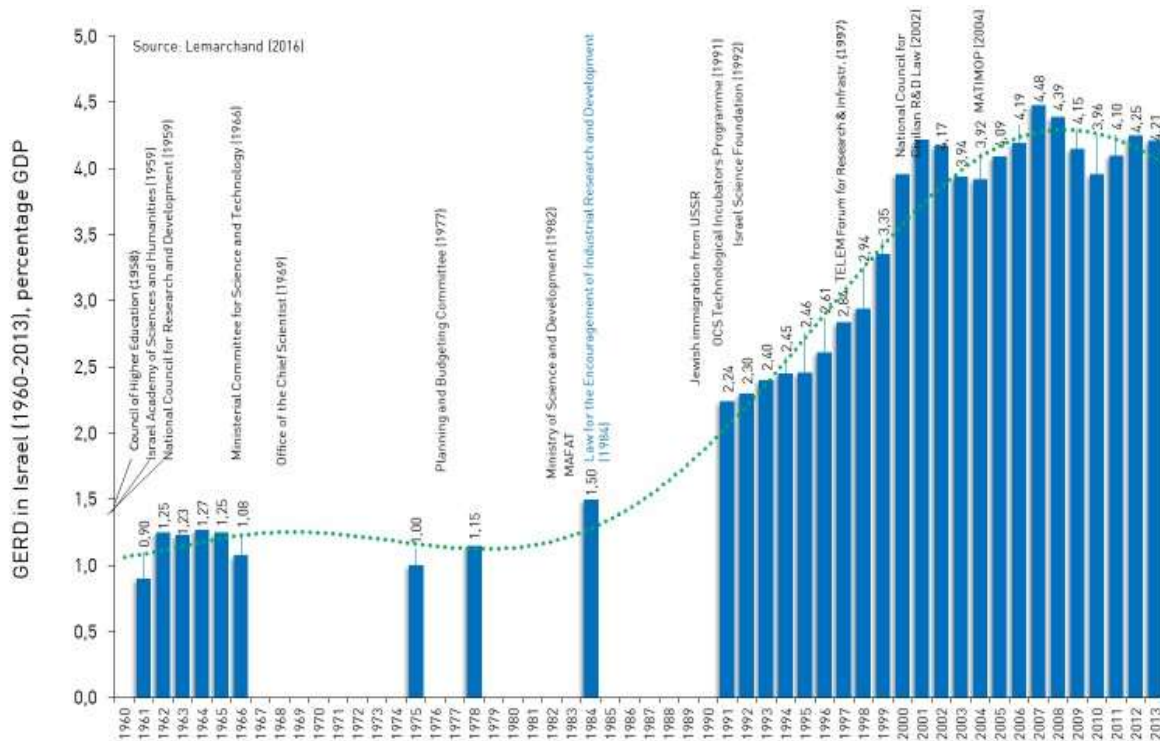


Figure 3: Evolution of the GERD (1960-2013) in Israel and the enactment of the most important legal instruments. It is shown that after the implementation of the Law for the Encouragement of Industrial Research and Development (1984) the GERD in the country as a percentage of the GDP grew approximately 300%. Source: Lemarchand (2016).

7. SETI INSTITUTIONAL ECOSYSTEM

The GO→SPIN methodological approach analyses the SETI institutional ecosystem, in different levels, according the distribution of responsibilities in the implementation of a given policy. Under the term 'organizational structure,' it is possible to distinguish at least five different levels: (1) policy planning level (policy design); (2) promotional level (i.e. funding, regulation and co-ordination of R&D, innovation and scientific and technological services); (3) implementation level (execution of R&D and innovation activities); (4) scientific and technological services level and; (5) assessment or evaluation level.

Policy-planning level: Includes policy planning, budgeting, decision-making, inter-ministerial co-ordination. The responsibility for the formulation of SETI policies generally rests with a special government department, ministry, or statutory body, in some cases assisted by national councils of research and innovation. SETI policy formulation normally includes the preparation of the national development plan or strategy relating to SETI; it also includes the annual preparation of the functional state budget for SETI activities (mainly research, innovation, and scientific and technological services). The decision-making function usually falls to the government, or to a committee of ministers more specifically concerned with SETI; it mainly involves the approval of the national SETI plan (or strategy), as well as the assignment of funding mechanisms. The inter-ministerial co-ordination takes place during the formulation of policies and preparation of plans and

budgets then at the various stages of the implementation of these policy documents, once approved by the government.

Promotional level: the promotion, financing and co-ordination of research, innovation, and scientific and technological services in the various sectors of the economy and in society. The functions performed at this level begin with the policy decisions taken by the government and continue with the various government departments or ministries through traditional budgetary procedures along administrative budget lines or through programme budget procedures, as applied to the so-called management by objectives. Several funding mechanisms and SETI operational policy instruments of various kinds have been implemented over the years (i.e. research funds, innovation funds, sectorial funds, tax-incentives; competitive grants, scholarships, etc.). Most countries apply a combination of operational policy instruments to handle the financing of research, innovation, and scientific and technological services according to well-defined programmes. The latter can be achieved either by responding to requests for the funding of specific projects submitted by external institutions, laboratories, research units, individual research scientists and high-tech enterprises, or by providing incentives for innovation, or by selectively entrusting the external bodies mentioned above with the execution of specific projects called for by certain development objectives according to the national SETI plan or strategy (normative method). At this particular level, several countries have special institutions (i.e. national research councils) which promote the advancement of scientific research and technological development with a view to improving the quantity and quality of new scientific knowledge to expand the country's potentialities, particularly through support for post-graduate education and research at universities and polytechnics.

Implementation level: this operational level concerns the actual performance of scientific research, technological development, and innovation activities in the public and business enterprise sectors.

Scientific and technological services (STS) level: this represents a mixed group, including the institutions in charge of: (a) SETI information and documentation, (b) museums of science and technology, botanical and zoological parks and other SETI collections (anthropological, archaeological, geological, etc.), (c) general purpose data collections: all the activities comprising the routine systematic collection of data in all fields of SETI, such as topographical, geological and hydrological surveys, routine astronomical, meteorological and seismological observations, surveying of soils and plants, fish and wildlife resources, atmosphere and water testing, monitoring of radioactivity, UV and CO₂ levels, prospecting and related activities designed to locate and identify oil and mineral resources, gathering of information on human, social, economic and cultural phenomena, usually for the purpose of compiling routine statistics; testing, standardization, metrology and quality control, activities related to patents and licenses, as well as the production of scientific publications.

Assessment or evaluation level: this consists in government sectors and institutions monitoring the implementation of policy goals and measuring the societal impact of those policies. Their function also encompasses the conduct of an ongoing survey of a country's SETI potential at the level of research, innovation, and scientific and technological service units, including ongoing research results and their practical application.

The GO→SPIN methodological approach introduced a normalized way of encoding the different types of organization and their functions. By representing each national SETI organizational chart and by using the same set of coding tools (Lemarchand 2010), it will be possible in future to associate these charts and tools with specific topological metrics to identify patterns in the ecosystem performance. The latter will be useful for defining a new set of SETI policy indicators able to reveal the level of complexity and functionality of each STI organizational chart.

Since its purpose is to guide decisions about the future that must be taken now, a SETI watch cannot seek to identify future developments in research and innovation activities independently of past and current developments, or independently of the material and human resources devoted to them. The prerequisites for any future is: knowledge of the present, knowledge of the current trends observed in a real world composed of different nations and institutions and knowledge of the strength and weaknesses of the national SETI ecosystem in which the decisions informed have to be taken.

In the Appendix 3, we present the guidelines to complete the GO→SPIN institutional ecosystem survey. The template has 24 different fields to be completed. A survey of individual Ministries, Secretaries, Agencies, Higher Education Institutions (public and private), Research Centres (governmental, business enterprise and private non-profit), scientific and technological services organizations is require to complete the information of the national research and innovation ecosystem.

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APPENDIX 1:

Instructions to complete the
survey of SETI operational
policy instruments

Field	Description on how to fill each field
1. Title of the instrument	Provide the official title of the instrument
2. Keywords	Provide 3 to 5 keywords that describe the instrument
3. Overview	Provide a short description of the scope and goals of the instrument. The text should have a maximum of 250 words
4. Objectives of the STI plan related with the instrument	Provide a list of objectives and goals – taken from the STI national policy or plan – which are related with the expected results generated by the instrument.
5. Other instrument objectives and goals	Provide a list of objectives and goals of the instrument, which were not included above (in the previous field 4) and which are specific for the instrument.
6. Starting date	Provide the year when the operations of the instrument started. YEAR
7. GO→SPIN standardized classification for objectives and goals of the instrument	<p>Select one or more items from the following list. Please indicate the corresponding letter(s) for each individual item(s)</p> <ul style="list-style-type: none"> a. Strengthening the production of new endogenous scientific knowledge b. Strengthening the infrastructure of research laboratories in the public and private sectors c. Human resources for research, innovation, and strategic planning. Capacity building, education and training of specialized human capital for (1) the production of new scientific knowledge, (2) development of new technologies, (3) promotion of innovation within the productive and services systems and (4) management of the knowledge society. d. Strengthening gender equality for research and innovation e. Strengthening the social appropriation of scientific knowledge and new technologies f. Development of strategic technological areas and new niche products and services with high- added value. Promotion and development of innovation in the production of goods and services. Promotion of start-ups in areas of high technology

Field	Description on how to fill each field
	<ul style="list-style-type: none"> g. Strengthening programmes on science education at all levels (from primary school to postgraduate) h. Promotion of the development of green technologies and social-inclusion technologies i. Promotion of indigenous knowledge systems j. Research and innovation eco-system: strengthening co-ordination, networking and integration processes which promote synergies among the different actors of the national scientific technological and productive innovation system (i.e. government, university, and productive sectors) k. Strengthening the quality of technology foresight studies to: Assess the potential of high-value markets, develop business plans for high-tech companies, construct and analyse long-term scenarios and provide consulting services and strategic intelligence l. Strengthening regional and international co-operation, networking, and promotion of STI activities m. Awards in science, technology, and innovation
8. Sectoral and horizontal approach of the instrument	<p>Select one item from the following list by indicating the corresponding letter associated with it</p> <ul style="list-style-type: none"> a. Sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector, or a specific issue b. Horizontal: the benefits go to all the disciplines, areas, and sectors
9. STI Supply and Demand Sides	<p>Select one item from the following list by indicating the corresponding letter associated with it</p> <ul style="list-style-type: none"> a. Fostering STI's supply side (Academic Sector, government R&D centres, etc.) b. Fostering STI's demand side (business-enterprise and other productive sectors, etc.) c. Fostering the link between STI's demand and supply sides
10. One and Two-digit field of science and technology classification	<p>Select one or more items from the following list. Please indicate the corresponding number (s) for each individual item (s)</p> <p>0. All fields</p> <p>1. Natural sciences</p> <ul style="list-style-type: none"> 1.1 Mathematics 1.2 Computer and information sciences 1.3 Physical sciences 1.4 Chemical sciences 1.5 Earth and related environmental sciences 1.6 Biological sciences 1.7 Other natural sciences

Field	Description on how to fill each field
	<p>2. Engineering and technology</p> <p>2.1 Civil engineering</p> <p>2.2 Electrical engineering, electronic engineering, information engineering</p> <p>2.3 Mechanical engineering</p> <p>2.4 Chemical engineering</p> <p>2.5 Materials engineering</p> <p>2.6 Medical engineering</p> <p>2.7 Environmental engineering</p> <p>2.8 Environmental biotechnology</p> <p>2.9 Industrial biotechnology</p> <p>2.10 Nanotechnology</p> <p>2.11 Other engineering and technologies</p> <p>3. Medical and health sciences</p> <p>3.1 Basic medicine</p> <p>3.2 Clinical medicine</p> <p>3.3 Health sciences</p> <p>3.4 Medical biotechnology</p> <p>3.5 Other medical science</p> <p>4. Agricultural and veterinary sciences</p> <p>4.1 Agriculture, forestry, and fisheries</p> <p>4.2 Animal and dairy science</p> <p>4.3 Veterinary science</p> <p>4.4 Agricultural biotechnology</p> <p>4.5 Other agricultural sciences</p> <p>5. Social sciences</p> <p>5.1 Psychology and cognitive sciences</p> <p>5.2 Economics and business</p> <p>5.3 Education</p> <p>5.4 Sociology</p> <p>5.5 Law</p> <p>5.6 Political science</p> <p>5.7 Social and economic geography</p> <p>5.8 Media and communications</p> <p>5.9 Other social sciences</p> <p>6. Humanities and the arts</p> <p>6.1 History and archaeology</p> <p>6.2 Languages and literature</p> <p>6.3 Philosophy, ethics, and religion</p> <p>6.4 Arts (arts, history of arts, performing arts, music)</p> <p>6.5 Other humanities</p>
11. One Digit Socio-Economic Objective Classification	<p>Select one or more items from the following list. Please indicate the corresponding number (s) for each individual item (s)</p> <p>1. Exploration and Exploitation of the Earth</p> <p>2. Environment</p> <p>3. Exploration and Exploitation of Space</p> <p>4. Transport, telecommunication, and other infrastructures</p>

Field	Description on how to fill each field
	<ul style="list-style-type: none"> 5. Energy 6. Industrial production and technology 7. Health 8. Agriculture 9. Education 10. Culture, recreation, religion, and mass media 11. Political and social systems, structures, and processes 12. General advancement of knowledge 13. Defence
12. Mode of support / Type of Mechanism	<p>Select one or more items from the following list. Please indicate the corresponding letter(s) for each individual item(s)</p> <ul style="list-style-type: none"> a. Grants (grant funds) b. Donations (individuals, companies) c. Loans d. Creation of, and support for, technological poles and centres of excellence e. Tax incentives f. Technical assistance g. Scholarships h. Credit incentives and venture capital i. Trust funds j. Information services k. Others, specify
13. Conditions to apply for the instrument	<p>Policy instruments will always have conditions to access its services or funding. Usually these conditions are specified within the application forms to the instrument. Each condition should be clearly stated, and all conditions should be listed.</p>
14. Target groups / Beneficiaries	<p>Select one or more items from the following list. Please indicate the corresponding number(s) for each individual item(s)</p> <ul style="list-style-type: none"> 1. Individual researchers or professionals, PhD holders, higher-education teachers 2. Research groups 3. Technical and support staff for STI activities 4. Graduate students 5. Undergraduate students 6. Universities, colleges, tertiary education institutions (public or private) 7. Secondary and primary schools (public or private) 8. Institutes and other research centres (public or private) 9. Technical training centres (public or private) 10. Business/enterprises (public or private) at different categories (corporations, SMEs, etc) 11. R&D non-profit organizations (public or private) 12. Foundations (public or private) 13. R&D Professional Associations

Field	Description on how to fill each field
	14. Ad hoc associations 15. Co-operatives related with STI
15. Selection Criteria	This field describes how requests to access the instrument will be evaluated. It can include information on who will evaluate submissions, the time frame for awarding funds, the evaluation methodology (percentage weight of different criteria, such as innovation, experience of the submitting team/institution, sustainability, relevance to a national strategy...) etc.
16. Eligible costs	Describe the amount of funding available to each applicant and what costs the instrument will and/or will not fund. You can indicate, for instance: the maximum amount of funds disbursed, the maximum percentage contribution (the fund will contribute to 80% of project costs), the type of activities that can or cannot be funded (scholarships, travel, administration costs, investment in machinery...).
17. Source of funding	Select one or more items from the following list. Please indicate the corresponding number(s) for each individual item(s) <ol style="list-style-type: none"> 1. None 2. Business enterprise sector 3. Government sector 4. Higher education sector 5. Private non-profit sector 6. Rest of the world business 7. Rest of the world government sector 8. Rest of the world higher education sector 9. Rest of the world private non-profit sector 10. International organizations 11. Other, specify
18. Mode of disbursement of financial resources	Describes how the funds will be made available to successful applicants to the instrument. It can include the timing of the resources, the details of access to a credit facility, due diligence steps before disbursement etc.
19. Annual budget	The total annual budget assigned for the instrument in local and other specified currencies.
Annual Budget in local currency	Insert the annual budget in local currency, for example: xxx,xxx,xxx.xx - name of the local currency
Annual budget in US\$ current	xxx,xxx,xxx.xx
Annual budget in US\$ constant	xxx,xxx,xxx.xx

Field	Description on how to fill each field
Indicate the year at which is taken the constant US\$	Enter the year for the US\$ constant amount entered. For instance, for 2010 constant US\$, enter "2010".
Annual budget in international \$ PPP current	xxx,xxx,xxx.xx
Annual budget in international \$ PPP constant	xxx,xxx,xxx.xx
Indicate the year at which is taken the constant international \$ PPP	Enter the year for constant international \$ PPP amount entered. For instance, for 2010 constant international \$ PPP, enter "2010".
20. Geographical coverage	<p>Select one or more items from the following list. Please indicate the corresponding number(s) for each individual item(s)</p> <ol style="list-style-type: none"> 1. Provincial or State 2. National 3. Regional (several countries)
21. Relation with SDGs targets	This field will be completed by UNESCO
22. Results, outcomes, and evidence of success	Indicate known results, outcomes, and evidence of success of the instrument. For instance: the number of applications received and selected, the number of beneficiaries, amounts disbursed, the effects of the instrument on the number of researchers hired by the private sector, the number of international conferences organised, prizes or patents awarded, or more detailed evidence such as Metric tons of carbon capture for a carbon capture financing fund, or any other relevant measurement or assessment employed to evaluate the impact of the instrument. If possible, provide a URL where the study of the impact of the instrument is described in detail.
23. Relevant links	Provide a URL with a direct link to the instrument's information website or the website form which you sourced the most information on the instrument.
24. Source	Provide the official source where the information on the instrument was taken (e.g. name of the institution and link)
25. Date when the form was completed	YEAR / MONTH / DAY

APPENDIX 2:

Instructions to complete the
survey of SETI legal policy
instruments

Field	Description on how to fill each field
1. Title of the legal instrument	Provide the official title of the legal instrument
2. Type of legal instrument	<p>Select one item from the following list by indicating the corresponding letter associated with it</p> <ul style="list-style-type: none"> a. National laws and acts b. National Decrees c. National Regulations or other policies d. International agreements/treaties
3. Enactment date	YEAR / MONTH/ DAY
4. Short description	Provide a short description of the scope and goals of the legal instrument. The text should have a maximum of 250 words
5. Theme of legal instrument	<p>Select one or more items from the following list. Please indicate the corresponding number (s) for each individual item (s)</p> <ul style="list-style-type: none"> 1. Regulations for the National Research and Innovation System 2. Regulations on Open Science 3. Tax Incentives for Innovation 4. Regulations of the Higher Education System 5. Regulations on Bioethics and Ethics of Science and Technology 6. Regulations to ensuring responsible research and innovation 7. Regulations on STI personnel 8. Regulations on research labs safety/security 9. Regulations on nuclear, chemical, and other dangerous substances 10. Regulations on STI gender equality 11. Regulations on inclusive and green technologies 12. Regulations on Indigenous Knowledge Systems 13. Intellectual Property Rights 14. Other, provide description
6. One Digit Socio-Economic Objective Classification	<p>Select one or more items from the following list. Please indicate the corresponding number (s) for each individual item (s)</p> <ul style="list-style-type: none"> 1. Exploration and Exploitation of the Earth 2. Environment 3. Exploration and Exploitation of Space 4. Transport, telecommunication, and other infrastructures 5. Energy 6. Industrial production and technology 7. Health

Field	Description on how to fill each field
	8. Agriculture 9. Education 10. Culture, recreation, religion, and mass media 11. Political and social systems, structures, and processes 12. General advancement of knowledge 13. Defence
7. Access to the full text of the legal instrument	Provide a URL link to the complete text of the legal instrument or submit a PDF file with the complete text to UNESCO
8. Relation with SDGs targets	This field will be completed by UNESCO
9. Source	Provide the official source where the information was taken (e.g. National Parliament Gazette, Parliament on-line database, etc). If it is possible provide a URL to the source.
10. Date when this form was completed	YEAR/ MONTH/ DAY

APPENDIX 3:

Instructions to complete the
inventory of the SETI
institutional ecosystem

Field	Description on how to fill each field
1. Name of the institution/organization	Insert the complete name of the institution. Do not use acronyms
2. Address	Insert the full address including postal codes, name of the city and name of the country
3. Name of the director/ contact officer	FAMILY NAME, FIRST NAME
4. Email address of the director/ contact officer	Insert email address
5. Telephone	Insert the full number including international codes and area codes
6. Website	Insert the complete URL
7. Name of the Ministry or other mother institution	If the institution is linked to a mother institution or Ministry, please specify this here.
8. Type of institution	<p>Select one item from the following list by indicating the corresponding number associated with it</p> <ol style="list-style-type: none"> 1. Government and public Institutions 2. Business-enterprise sector 3. Non-profit sector institutions 4. Higher education institutions
9. Function	<p>Select one or more items from the following list. Please indicate the corresponding number(s) for each individual item(s)</p> <ol style="list-style-type: none"> 1. Policy planning 2. Promotion and funding 3. Research and Development 4. Innovation 5. Scientific and Technological services 6. Policy evaluation
10. Mandate	Describe what the official purpose of the institution is and how the legitimacy to perform this purpose was granted to the institution. Less than 100 words.
11. Historical notes	Describe the history of the institution, including how it was created, notable figures, key moments, major changes etc.

Field	Description on how to fill each field
	Less than 250 words. A link to a more detailed historical description might be included here.
12. Brief description of the main activities	Describe the principal activities of the institution. Less than 100 words.
13. One and Two-digit field of science and technology classification	<p>Indicate the field of science and technology activity performed by the institution according to the following classification. Select one or more items from the following list. Please indicate the corresponding number(s) for each individual item(s)</p> <p>0. All fields</p> <p>1.Natural sciences</p> <p>1.1 Mathematics</p> <p>1.2 Computer and information sciences</p> <p>1.3 Physical sciences</p> <p>1.4 Chemical sciences</p> <p>1.5 Earth and related environmental sciences</p> <p>1.6 Biological sciences</p> <p>1.7 Other natural sciences</p> <p>2. Engineering and technology</p> <p>2.1 Civil engineering</p> <p>2.2 Electrical engineering, electronic engineering, information engineering</p> <p>2.3 Mechanical engineering</p> <p>2.4 Chemical engineering</p> <p>2.5 Materials engineering</p> <p>2.6 Medical engineering</p> <p>2.7 Environmental engineering</p> <p>2.8 Environmental biotechnology</p> <p>2.9 Industrial biotechnology</p> <p>2.10 Nanotechnology</p> <p>2.11 Other engineering and technologies</p> <p>3. Medical and health sciences</p> <p>3.1 Basic medicine</p> <p>3.2 Clinical medicine</p> <p>3.3 Health sciences</p> <p>3.4 Medical biotechnology</p> <p>3.5 Other medical science</p> <p>4. Agricultural and veterinary sciences</p> <p>4.1 Agriculture, forestry, and fisheries</p> <p>4.2 Animal and dairy science</p> <p>4.3 Veterinary science</p> <p>4.4 Agricultural biotechnology</p> <p>4.5 Other agricultural sciences</p> <p>5. Social sciences</p> <p>5.1 Psychology and cognitive sciences</p> <p>5.2 Economics and business</p> <p>5.3 Education</p>

Field	Description on how to fill each field
	5.4 Sociology 5.5 Law 5.6 Political science 5.7 Social and economic geography 5.8 Media and communications 5.9 Other social sciences 6. Humanities and the arts 6.1 History and archaeology 6.2 Languages and literature 6.3 Philosophy, ethics, and religion 6.4 Arts (arts, history of arts, performing arts, music) 6.5 Other humanities
14. One Digit Socio-Economic Objective Classification	<p>Indicate the socio-economic activity performed by the institution according to the following classification. Select one or more items from the following list. Please indicate the corresponding number (s) for each individual item (s)</p> <ol style="list-style-type: none"> 1. Exploration and Exploitation of the Earth 2. Environment 3. Exploration and Exploitation of Space 4. Transport, telecommunication, and other infrastructures 5. Energy 6. Industrial production and technology 7. Health 8. Agriculture 9. Education 10. Culture, recreation, religion, and mass media 11. Political and social systems, structures, and processes 12. General advancement of knowledge 13. Defence
15. International Standard Industrial Classification (ISIC) of all economic activities	<p>ONLY for business enterprise organizations indicate the main ISIC activity performed by the institution according to the following classification. Select one or more items from the following list. Please indicate the corresponding letter (s) for each individual item (s) in blue. The two-digit categories are presented here for an easy identification of which are the main company activities.</p> <p>00 no activity</p> <p>A - Agriculture, forestry, and fishing</p> <p>01 - Crop and animal production, hunting and related service activities</p> <p>02 - Forestry and logging</p> <p>03 - Fishing and aquaculture</p> <p>B - Mining and quarrying</p> <p>05 - Mining of coal and lignite</p>

Field	Description on how to fill each field
	06 - Extraction of crude petroleum and natural gas 07 - Mining of metal ores 08 - Other mining and quarrying 09 - Mining support service activities C - Manufacturing 10 - Manufacture of food products 11 - Manufacture of beverages 12 - Manufacture of tobacco products 13 - Manufacture of textiles 14 - Manufacture of wearing apparel 15 - Manufacture of leather and related products 16 - Manufacture of wood and of products of wood and cork, except furniture, manufacture of articles of straw and plaiting materials 17 - Manufacture of paper and paper products 18 - Printing and reproduction of recorded media 19 - Manufacture of coke and refined petroleum products 20 - Manufacture of chemicals and chemical products 21 - Manufacture of basic pharmaceutical products and pharmaceutical preparations 22 - Manufacture of rubber and plastics products 23 - Manufacture of other non-metallic mineral products 24 - Manufacture of basic metals 25 - Manufacture of fabricated metal products, except machinery and equipment 26 - Manufacture of computer, electronic and optical products 27 - Manufacture of electrical equipment 28 - Manufacture of machinery and equipment 29 - Manufacture of motor vehicles, trailers, and semi-trailers 30 - Manufacture of other transport equipment 31 - Manufacture of furniture 32 - Other manufacturing 33 - Repair and installation of machinery and equipment D - Electricity, gas, steam, and air conditioning supply 35 - Electricity, gas, steam, and air conditioning supply E - Water supply, sewerage, waste management and remediation activities 36 - Water collection, treatment, and supply 37 - Sewerage 38 - Waste collection, treatment and disposal activities, materials recovery 39 - Remediation activities and other waste management services F - Construction 41 - Construction of buildings 42 - Civil engineering 43 - Specialized construction activities

Field	Description on how to fill each field
	<p>G - Wholesale and retail trade, repair of motor vehicles and motorcycles</p> <p>45 - Wholesale and retail trade and repair of motor vehicles and motorcycles</p> <p>46 - Wholesale trade, except of motor vehicles and motorcycles</p> <p>47 - Retail trade, except of motor vehicles and motorcycles</p> <p>H - Transportation and storage</p> <p>49 - Land transport and transport via pipelines</p> <p>50 - Water transport</p> <p>51 - Air transport</p> <p>52 - Warehousing and support activities for transportation</p> <p>53 - Postal and courier activities</p> <p>I - Accommodation and food service activities</p> <p>55 - Accommodation</p> <p>56 - Food and beverage service activities</p> <p>J - Information and communication</p> <p>58 - Publishing activities</p> <p>59 - Motion picture, video and television programme production, sound recording and music publishing activities</p> <p>60 - Programming and broadcasting activities</p> <p>61 - Telecommunications</p> <p>62 - Computer programming, consultancy, and related activities</p> <p>63 - Information service activities</p> <p>K - Financial and insurance activities</p> <p>64 - Financial service activities, except insurance and pension funding</p> <p>65 - Insurance, reinsurance, and pension funding, except compulsory social security</p> <p>66 - Activities auxiliary to financial service and insurance activities</p> <p>L - Real estate activities</p> <p>68 - Real estate activities</p> <p>M - Professional, scientific, and technical activities</p> <p>69 - Legal and accounting activities</p> <p>70 - Activities of head offices, management consultancy activities</p> <p>71 - Architectural and engineering activities, technical testing, and analysis</p> <p>72 - Scientific research and development</p> <p>73 - Advertising and market research</p> <p>74 - Other professional, scientific, and technical activities</p> <p>75 - Veterinary activities</p> <p>N - Administrative and support service activities</p> <p>77 - Rental and leasing activities</p> <p>78 - Employment activities</p> <p>79 - Travel agency, tour operator, reservation service and related activities</p> <p>80 - Security and investigation activities</p>

Field	Description on how to fill each field
	<p>81 - Services to buildings and landscape activities</p> <p>82 - Office administrative, office support and other business support activities</p> <p>O - Public administration and defence, compulsory social security</p> <p>84 - Public administration and defence, compulsory social security</p> <p>P – Education</p> <p>85 - Education</p> <p>Q - Human health and social work activities</p> <p>86 - Human health activities</p> <p>87 - Residential care activities</p> <p>88 - Social work activities without accommodation</p> <p>R - Arts, entertainment, and recreation</p> <p>90 - Creative, arts and entertainment activities</p> <p>91 - Libraries, archives, museums, and other cultural activities</p> <p>92 - Gambling and betting activities</p> <p>93 - Sports activities and amusement and recreation activities</p> <p>S - Other service activities</p> <p>94 - Activities of membership organizations</p> <p>95 - Repair of computers and personal and household goods</p> <p>96 - Other personal service activities</p> <p>T - Activities of households as employers, undifferentiated goods- and services-producing activities of households for own use</p> <p>97 - Activities of households as employers of domestic personnel</p> <p>98 - Undifferentiated goods- and services-producing activities of private households for own use</p> <p>U - Activities of extraterritorial organizations and bodies</p> <p>99 - Activities of extraterritorial organizations and bodies</p>
16. Total number of researchers (head counts)	Please insert just the “number” of head counts: xxx Researchers are professionals engaged in the conception or creation of new knowledge. They conduct research and improve or develop concepts, theories, models, techniques instrumentation, software, or operational methods.
17. Total number of women researchers (head counts)	Please insert just the “number” of head counts: xxx Women researchers are professionals engaged in the conception or creation of new knowledge. They conduct research and improve or develop concepts, theories, models, techniques instrumentation, software, or operational methods.
18. Total number of technicians or	Please insert just the “number” of head counts: xxx

Field	Description on how to fill each field
equivalent staff (head counts)	Technicians and equivalent staff are persons whose main tasks require technical knowledge and experience in one or more fields of engineering, the physical and life sciences, or the social sciences, humanities, and the arts. They participate in R&D by performing scientific and technical tasks involving the application of concepts and operational methods and the use of research equipment, normally under the supervision of researchers
19. Total number of women technicians or equivalent staff (head counts)	Please insert just the “number” of head counts: xxx Women Technicians and equivalent staff are women whose main tasks require technical knowledge and experience in one or more fields of engineering, the physical and life sciences, or the social sciences, humanities, and the arts. They participate in R&D by performing scientific and technical tasks involving the application of concepts and operational methods and the use of research equipment, normally under the supervision of researchers.
20. Total number of other supporting staff (head counts)	Please insert just the “number” of head counts: xxx Other supporting staff includes skilled and unskilled craftsmen, and administrative, secretarial, and clerical staff participating in R&D projects or directly associated with such projects.
21. Total number of women supporting staff (head counts)	Please insert just the “number” of head counts: xxx Other women supporting staff includes skilled and unskilled craftswomen, and administrative, secretarial, and clerical staff participating in R&D projects or directly associated with such projects.
22. Last annual budget of the institution in US\$	Please insert the budget in equivalent US\$ current expressed in numbers like: US\$ xxx,xxx,xx
23. Source	Provide the official source where the information on the instrument was taken (e.g. name of the institution and link)
24. Date when the form was completed	YEAR / MONTH / DAY