

NETIM

NEW Tools for Innovation Monitoring



DESIGN OPTIONS PAPER

A novel monitoring tool for S3 policies

Agenzia Regionale per la Tecnologia e l'Innovazione (ARTI Puglia)

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Executive summary

This Design Options Paper has been prepared in the context of the project “New Tools for Innovation Monitoring” (NETIM) financed by the European Union’s H2020 Programme. The overall purpose of the NETIM project was to develop efficacious and easy to implement practices for monitoring the delivery of public policies supporting innovation in SMEs.

NETIM was coordinated by ARTI Puglia, the Apulian Regional Agency for Technology and Innovation (Italy) and implemented together with IFKA, the Public Benefit Non-Profit Ltd. for the Development of Industry (Hungary), and FUNDECYT-PCTEX, the Foundation FUNDECYT Science and Technological Park of Extremadura (Spain).

This paper aims to find an effective mechanism for monitoring policies for innovation and design a tool for collecting systematically information without excessive costs and through procedures easy to implement.

It is targeted at organisations such as innovation agencies, regional and national authorities and similar organisations, involved in monitoring and evaluation of public policies for innovation.

Work on this paper commenced by undertaking peer reviews of good practices on monitoring selected and presented by each partner region; the results of this first step have helped to clearly identify the main criticalities in the monitoring of innovation policies and the requirements for a monitoring tool.

The choice to apply the tool to the specific case of innovation policies implemented under Smart Specialisation Strategies has added additional challenges linked to the needed to take into account the specialisation dimension and to disaggregate the gathered information across Specialisation areas.

The approach in the Design Option papers is based on the following principles:

- Disaggregation of all collected indicators across the different RIS3 priorities, according to a three-tier classification (Priority Areas, Innovation Value Chains, Innovation Fields)
- Use of different indicator sets: input, output, result, transition
- Monitoring based on information mandatorily provided by the participants to public calls and beneficiaries
- Monitoring data collected through questionnaires, at project submission time, at project conclusion and in later follow-up phases.
- Direct surveys, focus groups and other qualitative approaches used for impact evaluation

To test the feasibility of the approach, the tool has been applied, as a pilot exercise, to the Apulia and Extremadura RIS3.

1 Introduction

1.1 Structure of the paper

The paper is intended as a guideline for any innovation agency, department or similar organisation that is involved in the monitoring of innovation policies and intends to improve its ability to collect high quality information directly from the policy beneficiaries, by adopting a structured methodology and simple tools.

Chapter 2 provides a background on the monitoring and evaluation of innovation policies, with a specific focus on highly integrated policies like those encompassed by Smart Specialisation Strategies (S3) and a synthetic description of the good practices already developed by the three agencies of the NETIM consortium.

Chapter 3 is the core chapter of this document, as it contains a discussion on the rationale behind the design of the monitoring tool and provides a thorough description of the proposed approach.

After that, chapter 4 presents the monitoring tool in terms of a general framework (service delivery system), which has three major cornerstones: the actors targeted by the service (target groups), the framework conditions and organisations within which the service is delivered, and the process that make up the service design, implementation and follow-up.

Chapter 5 is devoted to the description of the pilot application of the proposed methodology and tool in the regional contexts of Puglia (Italy) and Extremadura (Spain). Further details about the implementation of the monitoring tool can be obtained by contacting the project partners.

This model or framework is shown graphically in the diagram below.

1.2 The project partners

1.2.1 ARTI – Apulian Regional Agency for Technology and Innovation (Italy)

Established in 2004 by Apulia Region and become fully operative in 2005, the Regional Agency for Technology and Innovation (ARTI), with its versatile and lean organization, is a main tool to realize the specific objectives set in the Apulian Regional Innovation Strategy. These objectives are the following:

- supporting innovation demand
- supporting technological offers produced by public research bodies
- improving connections between supply and demand
- improving human capital in the field of R&I

Therefore, ARTI's activity aims at promoting and satisfying both the demand for innovation expressed by enterprises and local productive systems and the qualification of human resources, its main function being the strengthening of the regional innovation players and of the relationships among them, in order to help and develop the stream of innovation between research and enterprises.

In line with the national and European policies, the Agency concurs to the sustainable growth of Apulia, by promoting a network of relationships and exchanges among those involved in the creation and use of new knowledge and new technologies and by stimulating and encouraging innovative behaviours in the region.

Over the years, ARTI has gained a strong expertise in the field of monitoring and evaluation of policies for innovation, even joining international projects and numerous groups with national and international experts on the specific theme of monitoring and evaluation, and represents a reference point of the regional government on this theme (ARTI and Apulia Region join the Seville Platform and the S3 Pilot Monitoring Group).

Since 2014, ARTI supported the Apulian Region in the definition and implementation of the monitoring system for Regional Smart Specialisation Strategy contributing both to the definition of suitable indicators, adequate monitoring tools and data-collection system implementation.

1.2.2 FUNDECYT-PCTEX (Spain)

The Foundation FUNDECYT Science and Technological Park of Extremadura (FUNDECYT-PCTEX) is a non-profit organisation based in Extremadura (Spain) with the aim of contributing to the social and economic exploitation of science and technology in the region, fostering innovative entrepreneurship, supporting and promoting scientific and technological development and a better use of research and innovation outcomes.

As the Science and Technological Park of Extremadura, FUNDECYT-PCTEX offers the spaces and the necessary services to facilitate the exchange of knowledge, science and technology in the region, hosting more than 50 innovative companies in its facilities and supporting regional entrepreneurs and SMEs. With this aim of fostering entrepreneurship and SMEs competitiveness, FUNDECYT-PCTEX supports entrepreneurs and enterprises for business idea development, consolidation and validation, business development and innovation, participation in European projects, and the search of partners and funding. Moreover, FUNDECYT-PCTEX fosters regional RDi activities by connecting and coordinating the exchange of knowledge among entrepreneurs, scientists, and social and institutional agents, and also by providing consultancy services to regional bodies (access to technology, IPR, subcontracting of RDi activities, etc.).

FUNDECYT-PCTEX, playing the role of a Development and Innovation Agency, provides technical assistance to the Regional Government of Extremadura for the design and implementation of policies, such as the Smart Specialisation Strategy (RIS3) or the Digital Agenda of Extremadura, and works in close relation with enterprises, the University of Extremadura, R&D centres and other regional stakeholders to foster innovation.

Since 2014, FUNDECYT-PCTEX has worked as Technical Office of the Smart Specialisation Strategy of Extremadura (RIS3 Extremadura), collaborating with the Regional Government in the alignment of ERDF and ESF Operative Programmes with the RIS3, elaborating the Implementation Plan for 2014-2015, and in activities related to the set up of the strategy in the region. For 2016-2020 FUNDECYT-PCTEX will develop tasks regarding strategy consolidation, implementing an efficient monitoring and evaluation system for the actions included in the RIS3 Extremadura, and their alignment with the actions of the Regional Plan for Research, Development and Innovation.

1.2.3 IFKA (Hungary)

IFKA Public Benefit Non-Profit Ltd. for the Development of the Industry is the auxiliary organization (government agency) for the Ministry for National Economy (Hungary). For over 25 years, IFKA's extensive network of connections has promoted liaisons between the supply and demand sides of the economy in the fields of education, improving job opportunities, research and innovation. IFKA is strategic partner to the Hungarian Enterprise Europe Network, dealing with technology transfer between stakeholders, and to the Hungarian Association of Innovation.

IFKA is a strategic partner to the Hungarian Association of Innovation as member of the Science, Technology and Innovation Assessment Department and sponsored the István Harsányi Award as well as the Business Plan Competition. As part of the Hungarian Government now IFKA is designing an overarching approach on how to connect formal education into the needs of the labour market in support of enhancing entrepreneurial spirit. Due to its expertise, IFKA has been actively contributing to the finalization of the RIS3 Regional Smart Specialisation Strategy of the Central Hungary Region as well. Moreover, IFKA has been deeply involved in the programming of the Economic Development and Innovation Operational Programme of Hungary in support of the Ministry for National Economy, the largest Hungarian OP with a total budget of more than 8 billion 0 € that is managed by the Ministry as Managing Authority.

At national level, IFKA also promotes knowledge transfer to industrial actors, collaborating through tenders and international cooperation projects in the development of science and technology-driven sectorial strategies in Hungary, such as the Mid-term Logistics Sector Policy Strategy (2014-2020) accepted by both the Government and the trade.

Hungary represents a wide portfolio of research and innovation strategies addressed to boost the knowledge-based economy in Hungary. The policy framework builds on two mainstream policies, namely the Innovation Strategy (2013-2020) and the Science Policy Strategy (2014-2020):

- The new Innovation Strategy 2013-2020 focuses on three main areas of intervention: knowledge creation, knowledge transfer, and knowledge utilisation. Encouraging smart specialisation, building a sustainable system able to create equal opportunities, providing stable financing conditions, raising public awareness and strengthening the acknowledgment of knowledge and technology, and creating a stable, innovation-friendly economic and regulatory environment – these could all lead to rising levels of R&D intensity in the coming years. The strategy and its implementation are being supplemented by the Strategy of Smart Specialisation (S3), which has been adopted.
- The Science Policy Strategy 2014-2020 aims to enhance the attractiveness of the research environment, increase scientific excellence, and reverse the brain drain.

1.3 Glossary

<p>Additionality</p>	<p>In the context of public policies, additionality is the extent to which the policy intervention provides an extra contribution from the beneficiary side that would not have materialised had the intervention not been introduced. Additionality can take three forms: input, output and behavioural additionality.</p> <ul style="list-style-type: none"> • Input additionality refers to the extra resources invested by the beneficiaries as an effect produced by the public intervention. • Output additionality reflects the increased number of output produced as the result of the intervention. • Behavioural additionality indicates a persistent change of the behaviour and attitude of the target groups, lasting even after the conclusion of the intervention.
<p>Baseline</p>	<p>Refers to the conditions existing before the policy intervention and can (should) be evaluated for all context, result and impact indicators of interest (the baseline for output indicators is obviously zero).</p>
<p>Context indicators</p>	<p>Context indicators refer to macro variables that depict the socio-economic situation of the territory of interest (nation, region) and are often used for benchmarking purposes and for setting up the scope of the public intervention, mainly at strategy or program level.</p> <p>Context indicators do not reveal the effect (or impact) of policies because they are dependent on too many interrelated factors, including external factors that are beyond control of the public sector.</p>
<p>Evaluation</p>	<p>Evaluation is the systematic assessment of an on-going or completed project, programme or policy, concerning its design, implementation and results. It is a process based on the collection and analysis of information that aims at assessing the relevance and fulfilment of objectives, development efficiency, effectiveness, impact and sustainability. Besides that, evaluation provides knowledge for informed decision-making and adaptation and improvement of the interventions.</p>
<p>Impact</p>	<p>The change that can be credibly attributed to an intervention. Same as “effect” of intervention or “contribution to change”.</p>
<p>Impact indicators</p>	<p>Impact indicators measure the extent to which a public intervention has produced the expected changes. In other words, they measure the part of the change that can be reasonably attributed to the intervention. These kind of indicators are measured on the basis of evaluation exercises and deliver information about longer term, more structural changes.</p>
<p>Input indicators</p>	<p>Input indicators provide a measure of the effort that is devoted to pursuing a policy intervention, by keeping track of the resources used/spent, and may refer to the financial, organisational and human-resource dimensions.</p>
<p>Indicator</p>	<p>A variable that provides quantitative or qualitative information on a phenomenon. It normally includes a value and a measurement unit. When designing a monitoring and evaluation system, a complete definition of each indicator should be given, including its baseline and target values, its sources and/or measuring methodology.</p>
<p>Method</p>	<p>Methods are procedures and tools for the systematic collection and analysis of data and information for monitoring and evaluation purposes. A great variety of methods exist and their choice is bound to the nature of the intervention under observation, its phase of realisation and the evaluation purpose.</p>
<p>Monitoring</p>	<p>Monitoring is a systematic and continuous process of collection and analysis of</p>

	information about the implementation of an intervention, providing a timely information about its state of progress and the level of achievement of the expected results. Monitoring allows well-timed adjustments of the intervention, ensures accountability and provides the basis for evaluation and learning.
Outcome indicators	Same as “result indicators”.
Output indicators	Output indicators describe the direct products of a policy, program or action. Output indicators do not provide any information about the way in which the outputs produced by the intervention are contributing to the desired outcome. Their role is instead to monitor the actual implementation of the intervention, thus measuring its performance and efficiency. Output indicators are typically monitored at the action and programme level, every six months or so.
Results	The aspects of reality that motivate the policy action and are expected to be modified by the intervention.
Result indicator	An indicator describing a specific aspect of a result, that is a variable that the intervention aims to change. Result indicators do not exclusively measure the effects of the intervention, but also the influence of external factors, as well as two other aspects, namely spill-overs and additionality. Output indicators are typically monitored at the policy and program level, on a yearly base.
Spill-over	Spill-over effects are secondary effects of the intervention that deploy in a context that can be far in time and space from the targeted one. An example is the flowing of intervention impacts to groups outside the target groups.

2 Background: monitoring and evaluation systems for innovation policies

2.1 Monitoring, evaluation and indicators

The key concepts of monitoring and evaluation are well established and form an integral part of the conceptual toolkit of anyone dealing with the design and management of policy actions and programmes. As a matter of fact, monitoring and evaluation systems are organic to sound policy design, meaning that a condition for a public policy to be well designed is that the method for assessing its effects and impacts are clearly established.

In other terms:

The starting point in designing any public intervention is to identify a problem to be addressed. [...] It is part of this process to also define the direction of the desired change and sometimes the desired situation that should be arrived at (target). A public intervention often will aim at more than one result. [...]

The intended result is the specific dimension of well-being and progress for people that motivates policy action, i.e. what is intended to be changed, with the contribution of the interventions designed. [...]

Once a result has been chosen it must be represented by appropriate measures. This can be done by identifying one or more result indicators. [...]

Selecting clear result indicators facilitates understanding of the problem and the policy need and will facilitate a later judgement about whether or not objectives have been met. In this context it is useful to set targets for result indicators.

Having identified needs and a desired result does not yet mean that the public intervention has been fully designed. Different factors can drive the intended result towards or away from the desired change. A policymaker must analyse such factors and decide which ones will be the object of public policy. In other words, an intervention with a certain intervention logic must be established. [...] The specific activity of programmes leads to outputs.¹

In order to be able to observe the changes in the values of output and result indicators, one has to set up a monitoring system, that is a structured methodology and management systems that allows to collect data according to a definite scheme and time plan. Monitoring basically allows to understand:

- if intended outputs (products) are delivered according to the established plans;
- if the result indicators move in the desired direction.

However, there is a basic difference between output and result indicators: while the variation of the former is a direct effect of the action/policy/strategy under observation, the changes of result indicators can *also* depend on other factors, external to the said action, policy or strategy.

So we can say that the change in a given result indicator is made up by two terms:

- the contribution (effect) of the intervention = its impact;
- the contribution of external factors.

¹ The Programming Period 2014-2020 - Guidance Document on Monitoring and Evaluation - Concepts and Recommendations. 2015 (Underlining by the authors of the present DOP)

The purpose of an impact evaluation system is that of assessing the entity of the first term, the intervention's impact.

To disentangle the effects of the intervention from the contribution of other factors and to understand the functioning of a programme is a task for impact evaluation. Two distinctive questions are to be answered:

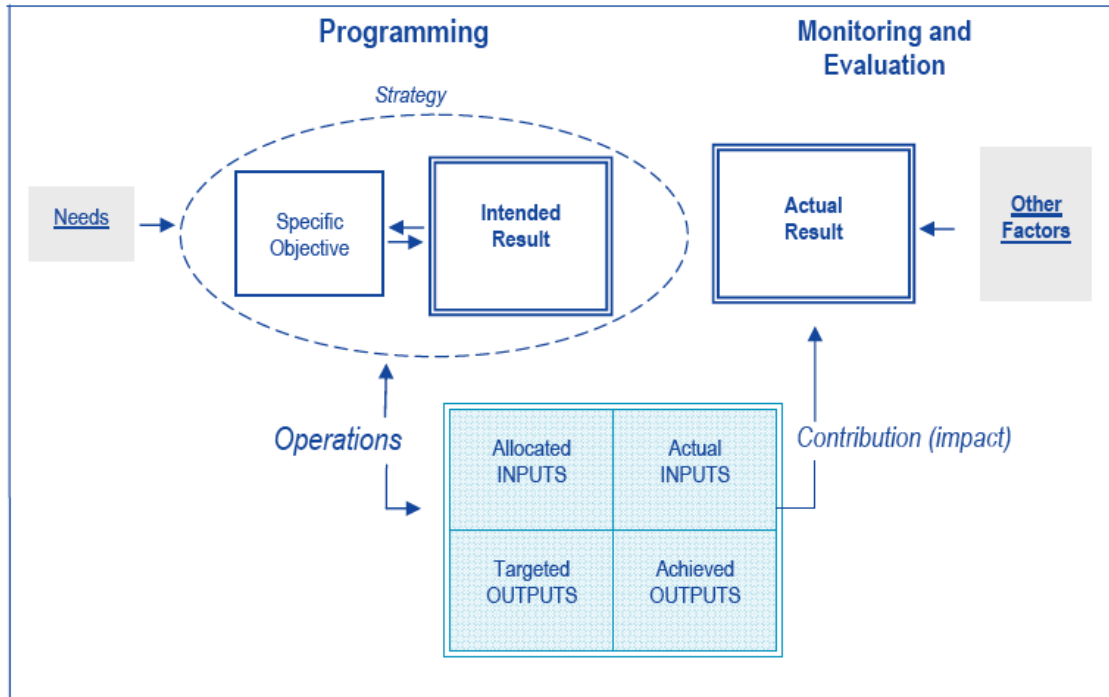
- *did the public intervention have an effect at all and if yes, how big – positive or negative – was this effect. The question is: “Does it work? Is there a causal link?” This is the question counterfactual impact evaluations aim to answer.*
- *why an intervention produces intended (and unintended) effects. The goal is to answer the “why and how it works?” question. To answer this question is the aim of theory-based impact evaluations.²*

An example of a counterfactual methodology is given in paragraph 2.4.1. The basic idea is to observe the change of result indicators in two separate groups: the one of direct beneficiaries of the intervention and a group having the same characteristics as the previous one, but not exposed to the intervention (control group). In this way the additional effects of the intervention can be assessed.

Theory-based impact evaluation, on the other side, does not rely on quantitative methods but rather on qualitative assessments and evaluations that try to provide insights on the inner functioning of things, with the aim of understanding if and in what measure things worked as expected to produce the desired change. Literature reviews, administrative data analysis, case studies, interviews and focus group discussions belong to this class of methods.

A schematic representation of the concepts discussed so far is reported in the following graph, taken from the document cited in the notes.

² The Programming Period 2014-2020 - Guidance Document on Monitoring and Evaluation - Concepts and Recommendations. 2015



As a general comment about the choice of indicators, in order to be robust and intervention-specific they should have the following characteristics³:

- *change value as a result of a public intervention (be responsive to the public intervention, otherwise they do not measure the effect of the intervention),*
- *reflect the essence of the planned change,*
- *minimize the manifested apparent effects,*
- *minimize the possibility of distortion,*
- *be statistically robust,*
- *enable straightforward interpretation,*
- *be easy to collect and measure without excessive costs,*
- *be possible to disaggregate.*

Besides that, indicators should be SMART, that is specific with respect to the quantity that is measured (S); measurable (M); achievable with the available resources (A); relevant with respect to the phenomenon under observation (R); and time-bound (T), limited in time.

2.2 Monitoring and evaluation of Smart Specialisation Strategies

2.2.1 General considerations

Smart Specialisation Strategies (RIS3) pose new challenges to the public administrations that aim to implement them, requesting an improved capability to read and understand the innovation dynamics as they deploy in the territory. The selection of priorities and the definition of suitable policy mixes are not in fact one-shot activities, they instead require to be adapted and

³ Guideline Note for a Monitoring and Evaluation System for Innovation Strategies (RIS3) in Poland, The World Bank

revised through a periodic update, on the basis of a sound assessment of the strategy performance and of the changes of the local and global context.

An effective monitoring system can highly contribute to the success of RIS3 strategies, providing the needed “intelligence” for adaptation and fine-tuning. This is not a new task for Regions and National Authorities, however, the monitoring (and evaluation) of RIS3 requires a clear and specific focus on RIS3 priority areas, something usually not needed and foreseen in usual Operational Programmes’ monitoring. This is clearly and synthetically stated by the EU S3 Platform as follows:

RIS3 monitoring focuses on tracking the developments related to policy interventions within the specific priority areas identified in the strategy. The monitoring mechanism should be able to capture and follow the relevant expected changes that are foreseen in each RIS3 priority by means of an appropriate choice of result indicators; it should also capture and follow the policy output that ought to make expected changes happen.⁴

The segmentation of result indicators across the priority areas of RIS3 is not a straightforward task in any way, mainly for two reasons:

- priority areas are often defined in a way that does not make it easy to cluster the policy targets into separate, non-overlapping sets, as could for example be done for enterprises belonging to different industry sectors and NACE codes;
- the RIS3 goals in each priority area could involve systemic and area-specific aspects for which traditional indicators are not adequate and no established measuring approaches are available or easily applicable.

The design of a RIS3 monitoring and evaluation system can therefore be a challenging effort, especially for those regions that do not have a consolidated experience in monitoring and evaluation, and thus the exchange of good practices and monitoring tools can be of invaluable help.

As a general “roadmap” for building RIS3 monitoring mechanisms, we report the recommendations included in a well-known JRC Technical Report⁵:

- *Establish a structured mechanism of stakeholder involvement for the definition of RIS3 monitoring.*
 - *You need stakeholders in order to devise meaningful solutions for complex problems with regard to implementation/monitoring issues. Remember that within the priority areas of RIS3 the stakeholders are the ones (sometimes the only ones) who have the specific knowledge about how to represent and measure certain phenomena.*
 - *Assess whether your internal administrative capabilities are sufficient to coordinate the implementation of monitoring mechanism. Identify the main challenges and possible solutions to this.*
- *Identify the main building blocks constituting the logic of intervention of the RIS3 and make sure you share this logic with stakeholders.*

⁴ <http://s3platform.jrc.ec.europa.eu/monitoring>

⁵ Carlo Gianelle and Alexander Kleibrink, *Monitoring Mechanisms for Smart Specialisation Strategies*, S3 Policy Brief Series No. 13/2015

- *Clearly identify the needs and challenges initially recognised, the overall objectives of the strategy, and the proposed operational solutions to achieve these objectives based on your choice of priority areas for intervention.*
- *For each RIS3 priority, define explicitly the expected change(s) reflecting the specific and operational objectives you want to achieve.*
 - *Explain your choices and the underlying assumptions in the text of the RIS3 document.*
 - *Be sure the expected changes are realistic enough to be largely supported by stakeholders while being ambitious enough to represent a true improvement over the current state of affairs.*
- *Identify appropriate result indicators measuring expected changes.*
 - *Whenever official statistics cannot effectively capture the expected changes, consider the use of proxy indicators and explain why they have been chosen, what their limitations are, and discuss plans for improving their precision.*
 - *Consider using alternative data collection approaches like surveys of end-users or focus groups.*
 - *Consider entering a dialogue with national and regional statistical offices on new information to be collected.*
- *Define a set of output indicators which can quantify the implemented measures (mix of policy instruments) for achieving each of the expected changes.*
 - *Explain how the choice of indicators reflects cause-effect relations of policy instruments and results.*
- *Organise the indicators into a dashboard-like visualisation device.*
 - *Be sure the dashboard is included in the RIS3 document together with all relevant definitions of its elements, explanations of the logical links, description of the process of definition of the elements and contributions of the stakeholders.*
 - *Give visibility to the monitoring dashboard through the internet and other means that can reach stakeholders, potential beneficiaries, and citizens.*
- *Describe how the follow-up of RIS3 monitoring will be ensured.*
 - *Define how the monitoring mechanism and the resulting data are linked to your innovation governance system.*
 - *Define how the mechanism engages with other governmental and non-governmental stakeholders (e.g. through periodical innovation fora) and how it actually supports a continuous entrepreneurial discovery process.*

2.2.2 S3 monitoring in the partner regions and countries

Puglia Region (IT)

The Apulian RIS3, approved in 2016, is structured as a “living” document to be updated periodically on the basis of the information collected throughout the implementation phase.

The identification of areas of Specialisation represents a new approach to understand the territory and requires a continuous and inclusive mechanism always careful to appreciate and valorise systematically strategic new skills needed for smart planning interventions. Decisions about investments to be undertaken and the priorities / time to be allocated to them can not disregard the outcome arising from the analysis of the first output generated by the the first policies launched, and by the same monitoring S3: careful analysis and combination of these elements, contextualized within the broader framework of Kets and social challenges to be achieved, will help to generate priority trend of interventions, as described at the beginning of the chapter, will be over the next seven years monitored, evaluated, and if necessary re-directed in order to reconcile the opportunity offered by European programming, direct and indirect funding, with forward-looking, strategic regional smart specialisation, highlighting what has been achieved during the previous programming cycle, and without neglecting the needs that emerge from the region, citizens, businesses, the research system.

In light of these consideration, it is easily understandable why there is an increasing awareness of the need to adopt a systematic monitoring and evaluation system.

Nevertheless the monitoring of a such complex strategy as RIS3 poses several challenges due to the high number of the implemented policies, the complexity of the indicators the difficulty of implementing a data collection system able to take into account the trade off between accuracy an efficient data collection system, and which provides timely data of high quality and the cost that this type of system involves.

ARTI is in charge of the design and implementation of the RIS3 monitoring system; during the design phase of the strategy, a great effort has been posed aiming at identifying an indicator set able to monitor the efficiency and efficacy of the strategy within the regional context.

The objectives of the Apulian RIS3 monitoring system are:

- Monitor the efficiency and effectiveness of the measures implemented under RIS3 through the use of indicators (program output, project output, results), evaluated across RIS3 priority areas
- Monitor the effectiveness of the S3 strategy as a whole, looking at the changes within each RIS3 priority area
- Evaluate, experimentally, the impact of some selected implemented measures through specific methodologies (e.g counterfactual approach)

The monitoring system is organized around different categories of indicators, each of them with a specific role and different characteristics:

- Output indicators
- Results indicators
- Transition indicators
- Impact indicators

The main challenges faced in the implementation of a monitoring system are:

- identification of short list of indicators suitable to measure the expected changes in the specialisation areas identified in the RIS3
- finding of a system for acquiring the needed data that can be applied on a large scale and not excessively expensive
- identifying a methodological approach useful for delimiting the specialisation areas.

- having the needed information timely and consistently with the revision process of the strategy.

Extremadura (ES)

Extremadura's RIS3 Strategy Monitoring and Evaluation System has been developed internally, by the Technical Office of Fundecyt-PCTEX. This Technical Office was involved in the design phase of the Strategy, when the system was created in order to guarantee a proper orientation to results. Right after the design phase, the Technical Office starts working on the implementation phase in order to set up the Monitoring and Evaluating System for the whole lifetime of the Strategy. Therefore, the Technical Office has been working on this issue, among others, since 2013.

Although the activities began in 2013, the Technical Office main activities for the set up of the system in order to make the first evaluation of the Strategy started in January 2016. So far, the system is being used to monitor and evaluate the entire RIS3 Strategy, with its 4 main objectives, 12 strategic lines and 41 action programmes.

The evaluation plan includes necessary activities for:

- Evaluating the effects the implemented actions have had on the RIS3 Strategy framework;
- Determining their exact contribution on the outcomes observed, distinguishing the possible influence of other external factors;
- Identifying the corrective actions to be taken in case of non-compliance or deviations in the planned milestones and outcomes.

The reports derived from monitoring the Strategy's implementation will be reviewed annually, so that if needed, the appropriate adjustments can be made in the shortest time possible.

After the formal submission of RIS3 Extremadura, in August 2015 the European Commission asked to the Regional Government to elaborate an Action Plan in order to provide clarifications regarding identification of indicators, their starting point and objective values in order to evaluate more directly the development / progress of identified priorities and integrate them in the monitoring system.

In order to answer the requirement from the European Commission, FUNDECYT-PCTEX as Technical Office of the RIS3 Extremadura, during the first quarter of 2016 has carried out the following activities:

- Meetings with the several regional ministries related to RIS3 implementation to analyse how to improve the indicator system, revising them regarding output and outcomes. In these meetings, indicators were agreed and the measure criteria for each of them established. Template sheets for collection and monitoring of indicators were created, in order to be used during the whole process of strategy monitoring and evaluation.
- Gathering and classifying data to explain the starting point and objective value of the identified indicators to better evaluate the impact of the implementation of lines and programmes of the RIS3 in the specialisation areas selected for Extremadura.
- Collaboration with the University of Extremadura - Faculty of Science, Economics and Business for the definition of new or combined indicators for a better evaluation of identified priorities. The collaboration included also the methodology to apply for

calculating these new indicators and the establishment of base and objective values for each of them. The need for this collaboration was mainly due to the general absence of information sources of indicators at regional level, what made it necessary to employ statistical methods for their estimation, as well as combine several individual indicators in order to get complemented information and obtain a vision as close to reality as possible.

During 2016, information regarding RIS3 indicators were collected and used to elaborate the first monitoring report of RIS3 Extremadura for 2014-2015. This report included quantitative information of outputs and outcome indicators. A mid-term evaluation (both quantitative and qualitative) of the RIS3 Extremadura is foreseen for the first semester of 2017 in order to measure the success of developed actions and the adaptation to smart specialisation needs at regional level.

Some of the criticalities and challenges are:

- the great amount of information and the complexity of the system (not based on sectors but on specialisation areas). In the case of Extremadura, the implementation of such a system is rather new and specifically designed to the regional characteristics, with combined indicators that need to gain experience while implementing the system in order to be able to make necessary changes and improvements for the future.
- the involvement of stakeholders enriches the evaluation process but also needs to be continuously monitored.
- In technical terms, a challenge to address is the development of software to allow collection and processing of information. This is of great importance for continuous monitoring and gathering results in real time.
- A challenge for the future is to identify new ways/methods to monitor/analyse specialisation/innovation areas. NACE codes cannot measure cross-sectorial innovation, but there is no other way to measure it and without categorisation, nothing can be measured. The only usable categories available now are given by the NACE codes.
- Another challenge is to solve the inconsistency between ERDF and smart specialisation indicators. There is a need to work with public authorities to align the used indicators and to simplify a coherent set of indicators.

Hungary

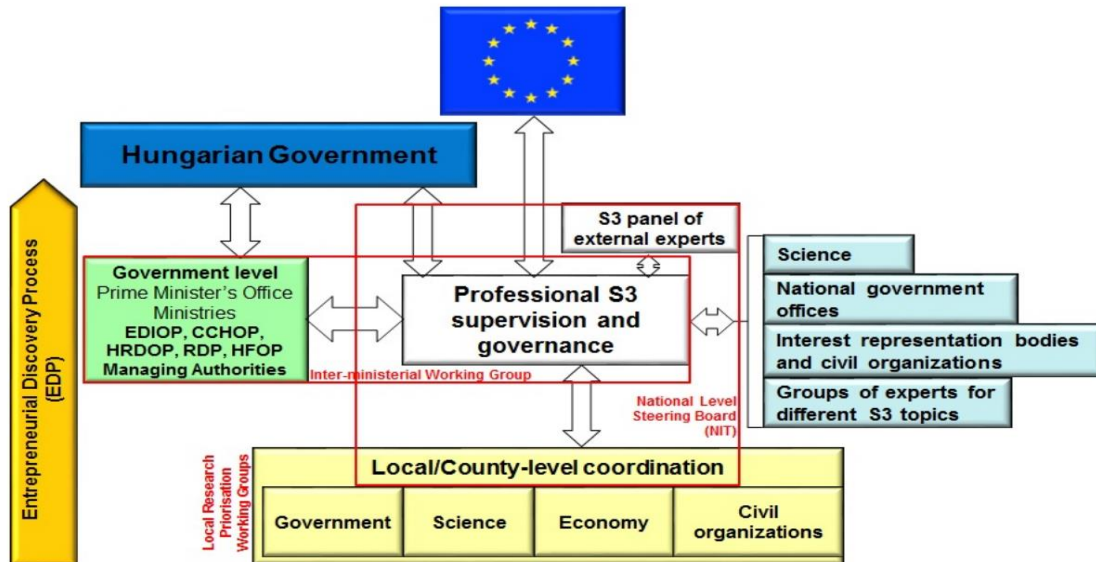
Hungary has several national strategies addressing R&I, which have been adopted in recent years and take a new perspective on R&I, in line with EU and international policies.

The strategic framework is characterized by:

- A large number of national strategies addressing R&I issues have been adopted in recent years that acknowledge R&I as a key driver and policy instrument for enhancing competitiveness and growth = based on a multiannual planning, which is expected to improve planning and predictability of funding,
- A formal dimension of regional innovation policy has been introduced by the National Smart Specialisation Strategy (S3) = brings about a focus on current or emerging regional R&I strengths and also tests some soft instruments for innovation financing, like pre-commercial procurement (PcP) and two pilot measures for strengthening University-Industry links,

- An emphasis on R&I that goes beyond science and technological research into the development of an innovative ecosystem has been introduced by the National RDI Strategy and is supported in particular by the EU Economic Development and Innovation Operational Programme (GINOP),
- Poor policy-design, with many generic and few thematic programmes that have no clearly defined objectives,
- Lack of/incomplete implementation, evaluation and monitoring methodologies in the case of the National RDI Strategy and the Higher Education Strategy, which do not have implementation methodologies yet, while the first Action Plan for the implementation of S3 is expected around mid-2015,
- Lack of integrated (“packaged”) policy instruments to promote synergies and improve the balance between public and private actors, local and global focus, and complement traditional policy instruments that target specific objectives, such as SMEs.

The governance and monitoring system of the National Hungary S3 Strategy is shown in the following diagram.



Source: National S3 Strategy (2014)

The comprehensive assessment and monitoring is continuous between 2015 and 2020 and build on:

- **Interim assessment** (Assessment relevant to a specific time (from-to) carried out during the implementation of the strategy, programme and project or the operation of the organisation.
- **On-going assessment** (the evaluation takes place continuously/periodically, rather than at a particular time):
 - ✓ It monitors the process implementation and the realisation of the targets of the given programme;
 - ✓ It constantly analyses the outputs and outcomes achieved.
- **Ex-post assessment** (Assessment after the completion of the strategy, programme or project)
 - ✓ Design of the intervention (e.g., development of the program's objectives and main features (directions and budget of the field))
 - ✓ Design of the programme structure (including the duration and sub-programmes of the programme, ideas for organisational implementation, other supportive measures, assumptions and conditions, and expectations regarding future evaluation)
 - ✓ Implementation (e.g., by means of tenders after clear project evaluation)
 - ✓ Assessment of the entire intervention

2.2.3 On-going experiences

In the following paragraphs we briefly report about some S3 monitoring approaches, with a focus on indicators selection.

Emilia-Romagna Region (IT)

Emilia-Romagna Region made a clear effort to devise an indicator system that is capable of keeping track of all the main elements of the intervention logic at the basis of its RIS3 strategy and in particular describe and monitor the expected changes in each of the priority areas defined in the strategy.

The current approach of Emilia-Romagna to smart specialisation focuses on two lines of action: reinforcing and modernising existing clusters as well as discovering emerging ones with a high potential for innovation and employment. The idea is to support the evolution of the industrial system towards a higher capacity for better managing the immaterial/intangible aspects of value chains. ASTER - a consortium for industrial research, technology transfer and innovation - oversees the monitoring activities of the S3 through a system capturing four measurement dimensions:

1. Implementation (output indicators)
2. Change of the regional economy in terms of specialisation domains (specialisation and transition indicators)
3. Effectiveness of the overall strategy (result indicators)
4. Evolution of the regional economy (context indicators).

Especially "change indicators" are at the core of Emilia Romagna's effort to promote specialisation in activity areas with proven strengths and potential. These indicators show how the regional economy is advancing in the selected specialisation areas. They also capture how the regional economy is moving along the selected innovative drivers.

The specialisation indicators are intended to measure the level of specialisation of the five regional production systems (agrofood, mechatronics and motors, constructions, health and wellbeing, culture and creativity), in relation to the 19 thematic orientations identified by the RIS3. They are:

- number of innovative start-ups;
- number of patents;
- number of research grants;
- number of business-research contracts;
- number of innovative SMEs.

The transition indicators are intended to measure the direction and magnitude of the expected changes in the production systems, with respect to the technological objectives of the strategy. These indicators vary according to each of the five regional production systems (also called specialisation areas). As an example, the transition indicators for agrofood are:

- percentage of recycled agrofood wastes;
- number of environmental process certifications;
- number of environmental product declarations;
- energy intensity of agrofood companies;
- share of biologic agriculture;

- number of biologic operators;
- number of companies producing specific food products;
- number of functional food products;
- Diffusion of e-commerce.

An online portal allowing the visualisation of monitoring data has been developed as a communication tool to inform the stakeholders and the broader public about the implementation of the S3 in the region, providing freely accessible data⁶.

Galicia (ES)

RIS3 in Galicia individuates three main challenges with related priorities⁷:

1. New model for innovative management of natural and cultural resources based on innovation
 - P.1.1. Valorisation-Sea
 - P.1.2. Aquaculture
 - P.1.3. Biomass and Marine Energies
 - P.1.4. Primary Sectors Modernisation
 - P.1.5. Tourism-ICT
2. New industrial model based on competitiveness and knowledge
 - P.2.1. Diversification of Driving Sectors
 - P.2.2. Competitiveness in the Industrial Sector
 - P.2.3. Knowledge Economy: ICT & KET
3. New healthy lifestyle model based on active ageing population
 - P.3.1. Active ageing
 - P.3.2. Nutrition-Food

The S3 monitoring system of Galicia (ES) comprises a panel of 74 indicators categorized into output, result and context, which will be updated continuously during the programming period covered by the S3. Data will be collected by the Galician Innovation Observatory, the body responsible for analysing the impact of public innovation policies in Galicia, with the support of a team of independent experts and stakeholders.

The indicator structure identified in the Galician S3 is reported in the following chart:

⁶ <http://www.regione.emilia-romagna.it/s3-monitoraggio/>

⁷ http://www.ris3galicia.es/wp-content/uploads/2015/09/RIS3_Strategy.pdf



These three interlinked sets of indicators constitute the Galicia S3 scorecard, conceived as the key management tool integrating the strategy's executive and operational levels with the aim to achieve the S3 mid- and long-term objectives.

The result (outcome) indicators measure the degree of achievement of the proposed Strategic Priorities within the framework of the Strategy, in terms of:

- Scientific Specialisation: both the number of current Research Groups and their productivity will constitute a basic tool for analysing outputs generated by scientific activity, as well as the degree of participation of the aforementioned agents in Collaborative International R&D&I Projects
- Technological Specialisation: patents will be used as indicators of the region's capacity to profit from investment in research, as well as the number of Collaborative International R&D&I Projects in which enterprises and agents from the knowledge generation system collaborate and the number of Technology-Based enterprises that are created within the Galician S3 Strategy framework.
- Economic Specialisation: the increase in Gross Added Value of each of the sectors given priority in the strategy.

Intermediate and target values of indicators were fixed in mutual agreement with the Government departments involved in S3, also taking into account the historical evolution of each indicator and the expected impact of the S3 strategy. Baseline values were defined using different sources, such as the Galician Institute of Statistics (IGE), the Galician Innovation Platform (PINNG) or the Galician Service of Industrial Property (SEGAPI).

There will be an interim and a final assessment, in 2018 and 2020 respectively, in which the indicators' actual values will be confronted with the target values. The assessments will take into account qualitative information obtained via surveys to beneficiaries and Quadruple Helix discussion groups to further confirm the evidence gathered through quantitative information. The assessments will analyse both the evolution in time of individual indicators and the comparative performance of context indicators in the region as well as in other Spanish and European regions. In case of negative deviations from expected targets, corrective measures will be devised according to a risk analysis. In case of positive deviations, the likely causes will be analysed in order to try to transfer the experience to other areas and inspire future actions.

Wales (UK)

A transparent monitoring system that concisely conveys the relevant information about S3 implementation contributes to the credibility and reputation of the ambitious transformational plan contained in the strategy. Stakeholders can either be involved in the follow-up of monitoring activities or be empowered by having access to factual information on progress made. In this way trust, ownership and commitment can be built up and maintained.

The Government of Wales (UK) commissioned the innovation charity NESTA with the development of a novel data platform that collects and assesses information about innovation activities in Wales and the interconnectedness between people and organisations. Arloesiadur (meaning “innovation tool” in Welsh) will gather data automatically from very different sources, combining established statistics and web data (company websites, software developing or professional meeting platforms, Twitter accounts, etc.). Learning how to engage constructively with these unconventional data sources for improving innovation policies is part of the entrepreneurial discovery process. This also implies that the public sector has to innovate and rethink current approaches. Valuable lessons can be learnt from this exercise on monitoring developments in S3 priority areas and dealing effectively with the lack of regionalised data from official sources, which are common challenges for national and regional authorities across Europe.

Aquitaine (FR)

In the monitoring system of the region Aquitaine (FR), indicators for the appraisal of projects are selected to be realistic and to offer the S3 governance bodies a dashboard, enabling an update of the strategy if necessary.

More specifically, S3 indicators need to address the following objectives:

- Objective 1: Indicators should measure the extent to which the projects to be funded by European Structural Investment Funds (ESIF) or other type of EU funding are aligned with the selected S3 priority areas (i.e. number of projects per S3 priority).
- Objective 2: As innovation and creation of economic value emerge from the junction of two or more domains, indicators should be able to track cross-fertilisation (i.e. number of projects covering more than one domain or sector).
- Objective 3: As one of the most prominent goals of the S3 is to improve firms' innovation output, indicators should reflect the impact of S3 projects on firms' development (i.e. patents, collaboration, training, etc.).

2.3 Monitoring tools and good practices

In the following paragraphs we summarize a number of good practices and monitoring tools of which project partners have a direct experience. Full details can be found on a series of short good practice evaluation reports, available on request.

2.3.1 In process monitoring & ex-post evaluation of public aid schemes (ARTI and Puglia Region)

In order to analyse the additionality effects (in terms of increasing inputs such as expenditure on R&D and number of researchers and output such as introduced innovations and patents) produced by Puglia Region's Programme “Direct Aid to SMEs for R&D investments” on companies that have been funded, a contra-factual approach named “Difference in Difference” was devised.

For this purpose, the following groups of companies are identified:

- companies that applied for funding and received support (Beneficiaries);
- companies that applied for funding but were rejected and did not receive any support (Non-Beneficiaries);
- companies that decided to not apply for funding, although they were eligible (Non-Participants).

Therefore, for the purposes of the investigation, Beneficiaries are considered as the Experimental Group, while a Control Group is constituted by Non-Beneficiaries and Non-Participants.

The analysis takes into account the differences among the three groups (Beneficiaries, Non-beneficiaries, Non-participants) as regards the average value of a set of indicators related to the innovation behaviour of firms (e.g. expenditure on R&D, number of researchers). Data are gathered in two different moments: at time t_0 (or at the time of applying for funding) and at time $(t_0 + T)$, where T is the duration of the research project.

A further collection of data can be made a number of years after the conclusion of the project, in order to analyse possible longer-term effects of the participation to the funded measure/grant.

In practice, it is researched whether after the same time period T the Experimental Group performed significantly better than the Control Group. For this purpose, improvements of the two groups over the time T have to be measured and compared. In other terms, for any selected indicator, the difference of its values at times t_0 and $(t_0 + T)$ for the beneficiary and control groups are measured and these differences are then compared, as shown in the following table.

	Value of the selected indicator A		Difference
	at time t_0	at time $(t_0 + T)$	
B = Beneficiaries	A_B	A'_B	$\Delta A_B = A'_B - A_B$
C = Control Group	A_C	A'_C	$\Delta A_C = A'_C - A_C$
			$\Delta A = \Delta A_B - \Delta A_C$

The value $\Delta A = \Delta A_B - \Delta A_C$ is considered a measure of the effect produced by the policy under examination for the indicator A. If this difference shows an increased value over time, it could be said that the funding received by companies within the aid-scheme has produced a beneficial effect in terms of the indicator A, where A can be any selected indicator, such as the number of new researchers hired by the companies or their expense in R&D.

The implementation of the GP within the regional context

The analysis is fed by data and information collected from companies through two different questionnaires:

- Ex-ante questionnaire, aiming to gather, on the one hand, general information about the innovative capacity of the companies (number of innovations, R&D investment amount, R&D employees) and their innovative behaviour (networking capabilities, research result exploitation, fundraising, access to information).

The questionnaire should be submitted both to companies that apply for funding and to companies belonging to the control group.

- Ex-post questionnaire, aiming to estimate the additional effects produced by the funded project and to analyse the changes in innovative behaviour of supported companies after the conclusion of the project. The questionnaire for the Experimental Group consists of the following parts: identification; general information about the company's innovative capacity; general information about the funded project; financial resources, R&D and employment; industrial exploitation of the research project supported; overall impact of the funded project on the company; evaluation of regional policies.

A shorter version of the ex-post questionnaire, containing only information about the behaviour of firms, is submitted to the Control Group. The purpose is to detect the differences among the two groups of firms (Beneficiaries and Non-Beneficiaries/Non-Participants).

The data collected through the questionnaires are fed into a database, in order to calculate for each indicator the difference between the Experimental Group and the Control Group.

Summary table

Who monitors?	Internal data collection	External data collection	Internal data processing	External data processing
What is monitored?	Inputs	Outputs	Outcomes	Impacts
What is the level of monitoring?	Project / activity	Program / measure	Strategy of regional innovation policy	
When the monitoring is performed?	Ex-Ante	In process/ Ex-Post	Continuous	One-shot
How the monitoring is performed?	Declarative / qualitative analysis	Statistical / econometric study		
What is the purpose of monitoring?	To assess and improve the action	To improve the management system/ create a mind-set change	To build knowledge and promote communication	To increase consensus

Implementation history

The Good Practice was developed by ARTI in the framework of the Interreg IVC project SCINNOPOLI, carried out in the years 2010 and 2011, capitalising on the exchange of good practices among the project partners.

Two people were involved in the drafting of the questionnaires and the whole work of GP definition and adaptation to a specific regional measure took about two months.

Only a partial application of the methodology was performed until now, by monitoring the ex-ante data from the applicants to two measures from Puglia Region (years 2012-2013):

- Direct Aid for R&D investments in SMEs

The Programme “Direct Aid to SMEs for R&D investments” is funded under the ERDF OP 2007-2013, AXIS I, Action Line 1.1 - Action 1.1.2 (Industrial Research Programmes and Experimental Development Programmes carried out by SMEs).

The call was launched on January 2009 and closed on March of that year, provided funding for 148 projects related to ICT, New materials and New technologies for production systems, Energy, Agro-food, Mechatronics, Environment, Biotechnology for health and care, Aeronautics, Space and Avionics.

- Regional Innovation Partnership

This program launched in 2011 aims to finance the public-private technological partnership for research and innovation programs.

- Direct Aid for Information and Communication technologies in SMEs

This program aims to spread the Information and Communication Technologies (ICT) in the production and management operations of SMEs, through the acquisition of specialized consulting goods and services, with particular reference to advanced digital services.

The ex-ante questionnaire is currently used in numerous regional calls supporting company innovation; an example is the initiative “Technological clusters”.

Strong points

Strong points of the good practice are the following:

- Possibility of implementing at a very low cost a data collection facility by including in the public-aid calls for proposals the obligations for applicants to fill-in data collection questionnaires (ex-ante and ex-post).
- Good degree of flexibility for adapting the GP to different measures/calls, by adjusting the set of questions included in the questionnaires.

Even if the application of the GP was limited to ex-ante data monitoring, it provided the advantage of gathering high quality information about the innovation performance and behaviour of the applicant companies.

Weak points and criticalities

Weak points of the good practice are the following:

- A dedicated budget is needed for implementing the data collection, ex-ante and ex-post, from the companies belonging to the control group; this budget should be made available to the organisation who manages the monitoring of the policy measure in proper time.
- It needs a clear governance of the different stakeholders involved; specifically a strong cooperation among the monitoring body, regional policy makers and financial aid managing authorities is necessary.
- It may be necessary to integrate data collected through questionnaires filled out by the companies with interviews conducted with the companies at their premises.

Possible criticalities of the GP are:

- The collection of data relies on the answers autonomously provided by the companies and therefore there is no control of their reliability and correctness.
- The identification of the companies constituting the control group can present difficulties, because one has to find a group of companies with the same characteristics of the beneficiary companies, in order not to bias the comparison between the two groups.
- Data collection from companies that are not beneficiaries of the public aid grant can be difficult, because they are not motivated to answer to the questionnaires.

Replicability and transferability

Given its conceptual and practical simplicity, the degree of transferability of the good practice to other organisations managing similar SME innovation support schemes is very high.

The replicability of the GP to different classes of innovation support actions needs to take into account the specific objectives of the program and the identification of the indicators that need to be collected. After that, the questions to be included in the questionnaires have to be defined. This work can be of varying complexity, according to the specificities of the case of interest.

ARTI is currently evaluating the possibility of revising the GP and running it on the coming regional policy measures addressing SMEs.

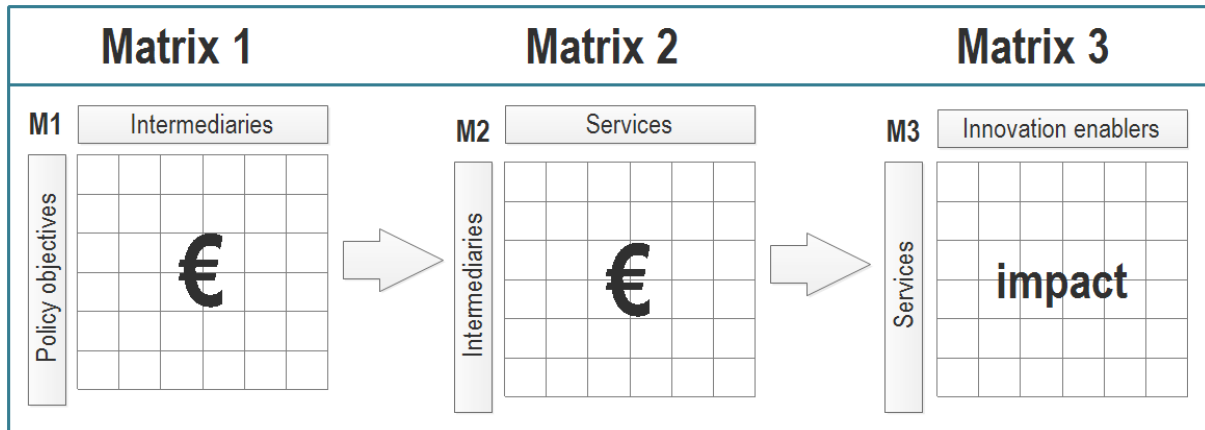
Room for improvement

The pilot implementation realised in the past years revealed a large room for improvement so as to maximise the potential benefits of this good practice. The main areas for improvement identified are the following:

- The phase of information acquisition from the applicants and beneficiaries should be made simpler and less time consuming, by reducing the quantity of requested data and by using online tools for data input.
- There is clearly a trade-off between the completeness of the information and the simplification of the survey instrument, therefore a careful attention should be put in the selection and organisation of the questions listed in the survey.
- The dissemination of the results to stakeholders involved in the monitoring process should be carefully planned and organised, guaranteeing the return of information to the different parties involved.

2.3.2 IMPACTSCAN application to Industrial Liaison Offices (ARTI and Puglia Region)

IMPACTSCAN is a matrix model used to quantify and analyse regional innovation policies. It is a methodology developed by the regional government of Lower Austria, IWT Flanders and Bretagne Innovation and represents a complex and articulated tool for assessing and measuring the impact of regional innovation policies, looking at the system of intermediaries, the services that they offer and the impact that the same services produce on the final beneficiaries.



Source: Scinnopoli Policy Recommendations (2011)

This methodology has been experimented with a specific category of intermediaries, University Industrial Liaison Offices (ILOs). Following the general structure of IMPACTSCAN, a structure made up of three matrices was used.

- **Matrix 1**, which represents a combination of policy objectives and intermediaries. In each column of Matrix 1, one of the ILOs operating in Apulia are indicated, while in the rows the “standard” policy objectives are reported. Each cell thus represents the budget spent by a given ILO office to develop the support services for the policy objective of the corresponding row.
- **Matrix 2**, whose values give the budget spent by a given ILO to develop one of the listed innovation support services. In a second phase, also an alternative version of the Matrix 2 will be proposed, reporting service outcome indicators, to be collected on a specified time base and for each ILO.
- **Matrix 3**, reports the average scores indicating the influence of services offered by ILOs on innovation enablers of their end-users. The information needed to build the Matrix 3 will be obtained through questionnaires administered to end users.

Summary table

Who monitors?	Internal data collection	External data collection	Internal data processing	External data processing
What is monitored?	Inputs	Outputs	Outcomes	Impacts
What is the level of monitoring?	Project / activity	Program / measure	Strategy of regional innovation policy	
When the monitoring is performed?	Ex-Ante	In process/ Ex-Post	Continuous	One-shot
How the monitoring is performed?	Declarative / qualitative analysis	Statistical / econometric study		

What is the purpose of monitoring?	To assess and improve the action	To improve the management system/ create a mind-set change	To build knowledge and promote communication	To increase consensus
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Implementation history

- The good practice was provided by Lower Austria, IWT Flanders, Bretagne Innovation and was transferred to ARTI during the Capitalization Scinnopoli project; there has been an adaptation to the regional context and to the specific intermediary category.
- There have not been financial costs for acquiring the good practice; however, there has been a great effort in term of human resources involved to adapt this good practice to the specific policy.
- The good practice/methodology was experimented in 2011. It has been used only for one year.
- It has been used only for monitoring the effectiveness of the services of ILOs.
- At the moment it is not used by ARTI.

Strong points

- This GP allows to capture a different but at the same time interesting point of view of evaluation, which is not taken in great consideration: the perception of beneficiaries of the impact of the services on the innovation enablers.
- This experimentation had no direct implication on the definition of policies and on improvement of the innovation system.

Weak points and criticalities

- The exclusive use of qualitative evaluation may represent a limit of this kind of approach.
- The main difficulty is connected to the complexity of describing, in a single questionnaire, all the elements and innovation enablers. The questionnaire may result too long and probably is not easy to understand.
- Probably the best compromise is to combine these elements with quantitative evaluation.

Replicability and transferability

- This good practice does not represent a high level of transferability as the questionnaire needs to be adapted to the single innovation intermediary.
- The main difficulty is to make an exhaustive list of all services delivered by a specific innovation intermediary and imagine all possible impacts of these services on innovation enablers.
- The identification of innovation enablers may be another difficult task.

Room for improvement

In our opinion, there is a large room for improvement with reference to the structure and contents of the questionnaire, as well as the form of representation of information. In fact, the questionnaire should be made simpler and revised in order to capture the specificities of the single innovation intermediary and the single service beneficiary.

2.3.3 RIS3 Strategy monitoring system (FUNDECYT and Extremadura Region)

Along with its Regional Research and Innovation Strategy for Smart Specialisation, the Autonomous Community of Extremadura has designed a Monitoring and Evaluation System with the purpose of guaranteeing the transparency of the implementation process and the continuity of the governance system during the whole process. The system will also enable the monitoring of the process, the performance measurement and the verification of the effectiveness of the activities performed and, if necessary, the activation of adjustment mechanisms to keep the activities aligned with the desired results.

Extremadura's RIS3 envisages 4 main challenges, each challenge being articulated in a limited number of strategic lines and each strategic line implemented by diverse action programmes.

The Monitoring and Evaluation system of the RIS3 Strategy of Extremadura contains six key elements:

- A set of Performance Indicators/”Output” for monitoring the activities contemplated in the different Strategic Programmes.
- A set of Outcome Indicators linked to the different Strategic Lines, which aid in measuring the contribution of these Lines to the regional socio-economic changes observed.
- A set of Context Indicators aligned with the Challenges, in order to measure the global impact of the Strategy on the region.
- A Monitoring Plan that establishes monitoring actions for the Strategy, and the verification of results, their periodicity and those responsible for their implementation.
- An Evaluation Plan to determine suggested actions, their periodicity and those responsible for their implementation.
- A Governance structure for the Monitoring and Evaluation System.

The RIS3 Strategy Evaluation will be used to assess the adequacy of the actions developed and the Strategic Priorities defined.

The Indicator System makes a scorecard that will allow for short-term adjustments to actions implemented in the framework of the different Strategic Programmes, in order to guarantee their efficiency and effectiveness, while in the mid-long term it will aid in evaluating the Lines and Priorities defined and reconsider their suitability.

There will be a few Context Indicators for each Challenge identified in the RIS3 Strategy, through which the global impact of the Strategy in the region will be measured. Furthermore, there will be a Results Indicator for each Strategic Line, used to measure the contribution of said Lines on the regional socio-economic changes observed. There will be one or multiple Performance Indicators/”Output” for the set of Strategic Programmes associated with each Line, in order to monitor the implementation of the actions set out in the programmes.

These Indicators were defined keeping in mind the objectives and desired results for Programmes, Strategic Lines and global impacts, and contemplating a series of milestones consistent with the evaluation of the intermediate stages by the European Commission (2016, 2018) and the final goal (2020).

According to the Monitoring Plan, the Context and Outcome indicators will be monitored annually. Monitoring of the Performance/”Output” indicators will be linked to the

implementation of the Strategic Programmes, in which the milestones and periodicity of data collection will be established. Additionally, a Monitoring Report will be prepared annually to collect the data related to the Strategy's implementation over the past year.

The reports derived from monitoring the Strategy's implementation will be reviewed annually, so that if need be, the appropriate adjustments can be made in the shortest time possible. Upon reaching the milestones in the intermediate stages of the evaluation by the European Commission (2016, 2018) and the final goal (2020), a further evaluation will be carried out on the outcomes and the impact of implementing the Strategy. This review will analyse and process the regional RIS3 compared to other Autonomous Communities, the national average and the EU27 average.

Summary table

Who monitors?	Internal data collection	External data collection	Internal data processing	External data processing
What is monitored?	Inputs	Outputs	Outcomes	Impacts
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How the monitoring is performed?	Declarative / qualitative analysis	Statistical / econometric study		
What is the purpose of monitoring?	To assess and improve the action	To improve the management system/ create a mind-set change	To build knowledge and promote communication	To increase consensus

Implementation history

- Extremadura's RIS3 Strategy Monitoring and Evaluation System is being developed internally, by the Technical Office set up by the Regional Government. This Technical Office was involved since 2013 in the design phase of the Strategy, in order to guarantee a proper orientation to results.
- The Technical Office of Extremadura's RIS3 Strategy is formed by personnel of FUNDECYT-PCTEX.
- Around 6 to 10 people are involved in the Technical Office, depending on the moment of the year and/or intensity of work. At least four of them are primarily, but not exclusively, working on the monitoring and evaluation of the Strategy.
- The Technical Office's main activities for the setup of the system in order to make the first evaluation of the Strategy started in January 2016.
- So far, the system is being used to monitor and evaluate the entire RIS3 Strategy, with its 4 main objectives, 12 strategic lines and 41 action programmes.

Strong points

- The RIS3 Strategy monitoring and evaluation system was created comprising a Governance system that guarantees its objectivity and allows possible rectifications of the Strategy if necessary.
- The involvement of FUNDECYT-PCTEX as Technical Office for the design, implementation, monitoring and evaluation of Extremadura's RIS3 Strategy allows the organization to access key information about the programmes and activities performed in the region and to gain a great experience in the design of innovation policies.

Weak points and criticalities

- The system was designed from scratch and no previous experience on its functioning exists.
- Because of the great amount of information emerged from the implementation of the Strategy, the complexity of the system is considerably big.

Replicability and transferability

- The main aspect of the good practice that can be transferred to a different organisation is the governance system that lies beneath the monitoring and evaluation system. The governance enriches the system by guaranteeing the involvement of key stakeholders in the evaluation process.
- Probably the most critical issue to bear in mind when thinking of transferring the good practice to a different context is the fact that the whole system was designed specifically for the Spanish Extremadura region. Therefore, the adaptation of the system to a different innovation ecosystem might be a challenge.

Room for improvement

- The development of a software for the collection and processing of the information could be a great improvement to tackle in the future.
- As also suggested by the European Commission, the indicator set should be enriched with new indicators measuring the regional specialisation.

2.3.4 *Startup Programme 2016-2020 monitoring system (FUNDECYT and Extremadura Region)*

The monitoring and evaluation system of the Startup Extremadura Programme is aligned with procedures of the strategies and programmes in which it is inspired and served as framework:

- Smart Specialisation Strategy of Extremadura (Estrategia de Investigación e Innovación para la Especialización Inteligente de Extremadura - Estrategia RIS3 Extremadura 2014 - 2020)
- V Regional Plan for Research, Technological Development and Innovation (2014 - 2017)
- Operational Programme "Investment for Growth and Jobs"
- ERDF Regional Operational Programme for Extremadura (2014 - 2020)

Output Indicators

The indicators measure the progress of the actions carried out to achieve expected results, describing the resulting product of such actions. The quantified value is accumulative and at the beginning of the intervention its starting point or base value is zero.

Performance indicators (outputs) allow monitoring the execution of the different defined measures and understanding how the activities as a whole contributes to the value of the related result indicators (outcomes).

Outcome indicators

Outcome indicators will allow to verifying the success of the designed actions and analysing if these actions contribute to the expected change to which they were defined. They must count with a starting point or base value before the intervention. They must go accompanied by objective values at short, medium and long term.

Impact indicators

Following the expected objectives of the chapter 13 of the RIS3 Extremadura: monitoring and evaluation, the following indicators will be taken into account as impact indicators of the different actions at regional level, that together with the Startup Extremadura programme will measure impact of the challenge 3:

- development of a competitive business and industrial environment,
- able to generate wealth in a sustainable way for a time.

Summary table

Who monitors?	Internal data collection	External data collection	Internal data processing	External data processing
What is monitored?	Inputs	Outputs	Outcomes	Impacts
What is the level of monitoring?	Project / activity	Program / measure	Strategy of regional innovation policy	
When the monitoring is performed?	Ex-Ante	In process/ Ex-Post	Continuous	One-shot
How the monitoring is performed?	Declarative / qualitative analysis	Statistical / econometric study		
What is the purpose of monitoring?	To assess and improve the action	To improve the management system/ create a mind-set change	To build knowledge and promote communication	To increase consensus

Implementation history

- The whole process of definition for the Startup Extremadura Programme, including its monitoring system, took almost a year (during 2015), staff working for the Regional

Government of Extremadura and Extremadura Avante was in charge of the development of the monitoring system.

- The VPRI monitoring system was developed internally and will be subject to revision and improvement with the analysis of the first results.
- The Startup Extremadura programme became operational in 2016 and it will be running until 2020.

Strong points

- The monitoring system includes an evaluation performed by a Monitoring Committee, the Startup Extremadura Community, and also by users, by means of a virtual evaluation questionnaire, at the end of each activity.
- The system is continuously growing, allowing the development of technology based innovative enterprises, and is shared with the entire community of persons and public and private entities that offer support and promotion services for the creation of technology enterprises in Extremadura.
- The evaluation process allows to gain knowledge and information about the evolution and impact of activities implemented, useful for defining corrective measures, when needed, in connection with other regional plans for research, technological development and innovation.

Weak points and criticalities

- The monitoring and evaluation methodology is new and needs to be checked and improved after its application.
- Some indicators are collected for the first time and their values will be used for establishing objective values for next years.

Replicability and transferability

- The collaboration among actors supporting technology based enterprises is needed for implementing the system
- The system is flexible since it is open to introduce modifications after revision of evaluation results.

Room for improvement

- Possible improvements will be decided at the end of year 2016, when first results will be available.

2.3.5 *Monitoring of the Integrated Settlement Development Strategy (2014-2020) (IFKA Hungary)*

The Integrated Settlement Development Strategy (2014-2020) (hereinafter: Strategy) is a mid-term strategy (with a set timeframe of 7-8 years) that has been discussed and approved by a resolution of the elected General Assembly of the municipalities for ensuring legitimacy. Contrary to initial reluctance at the beginning, finally two third of the Hungarian cities prepared and submitted it.

The Strategy is a result of various public consultations and policy dialogue as follows and is based on the revision of the previous spatial development plan referring to the period of 2007-2013:

- Modification of the Act on Local Governments in 2011
- National Development Concept and National Concept for Territorial Development 2014-2030 – their revisions are under preparation.

Who monitors?	Internal data collection	External data collection	Internal data processing	External data processing
What is monitored?	Inputs	Outputs	Outcomes	Impacts
What is the level of monitoring?	Project / activity	Program / measure	Strategy of regional innovation policy	
When the monitoring is performed?	Ex-ante	In process / Ex-Post	Continuous	One- shot
How the monitoring is performed?	Declarative / qualitative analysis	Statistical / econometric study		
What is the purpose of monitoring?	To assess and improve the action	To improve the management system / create a mind-set change	To build knowledge and promote communication	To increase consensus

Implementation history

Based on the principles set by the 2007-2013 – Manual on Urban Renewal, Integrated Urban Development Strategy (IUDS), the Department of Spatial Planning and Urban Development on behalf of the Ministry of Interior revisited the priorities and monitoring practices of the Strategy. In line with the Government Decree (1181/2013 Gvt.) the scope of eligible cities has been extended enabling cities of county rank to apply for approx. 40 million HUF for a city (130 thousand €), where planning should be extended to functional urban areas. The overall objective of the revised Strategy was to renew the IUDS in the light of cohesion policy and prepare, if the strategy justifies, ITIs in harmony with the thematic objectives and investment priorities.

Based on the aforementioned Governmental Decree, the Budapest Metropolitan Governmental Office oversees the observance of the material, legal and procedural rules for the adoption of these plans and ordinances under its general legal authority (over the metropolitan and district governments), while on the other hand the Office of Construction and Heritage Preservation (and within this, the State Head Architect's Office) through its conclusive opinions in every stage supports or corrects (and in the end can prevent) the coming into force of local governments' town regulatory plans and local construction regulations that comply with the material, legal and procedural rules.

Strong points

- New monitoring concepts in place: Unlike to any other strategies in place, the Integrated Settlement Development Strategy provides the freedom to Hungarian cities and municipalities to apply unique and mainstream development and monitoring concepts,

in terms of indicators and methodology of monitoring. Most of the development concepts studied, shows that cities are applying SMART criteria when defining objectives as well as mainstream set of indicators for measuring the efficiency of actions performed.

- Individual solutions per cities: One promising good practice has been elaborated by the City of Pécs. Today Pécs is one of the biggest cities in Southern Hungary with approx. 146 000 inhabitants. Due to the special structure of the city management (Pécs is the capital of Baranya county) a new concept has been elaborated for the monitoring activity concerning the Integrated Settlement Development Strategy. The creation of the SMART City system fits together with the organisation development goals for strengthening the city development functions and recovers smart deficits in data collection and management, goal-tracking (indicator definition, registration and tracking), planning, decision-preparation and city management areas.

Setting up the SMART City subsystem creates the framework to the activities as follows:

- strategic management of the strategy implementation
 - operative management of the strategy implementation
 - institutionalisation of the basic partner connections of implementation (stakeholder platform)
 - with the help of the necessary info-communication apparatus management of the integrated monitoring system (built up by basic strategic goals) covering the total information procedure from database creation through indicator tracking till reporting and planning
 - setting-up an integrated city database which integrates the database of “external” actors of the city management up to the necessary and possible levels.
- Financial resources dedicated: Among the operative programmes of the 2014-2020 programme period, the Territory and Settlement Development Operative Programme (TOP) allocated planning resources to Hungarian City of County Rank. The Territorial and Settlement Development Operational Programme is the follow-up of regional operational programmes (among others of the North Hungary OP) for the budgetary period 2014-2020. It is a centralised OP in the sense that there will be only one OP that incorporates the territorial development objectives of all regions. Nevertheless it draws on NH 3 counties' and on its urban counties' inputs (i.e. on county-level OPs and on cities' integrated development programmes). The funding allocated from this programme accounts for 16.15% of the total funding available from Structural Funds (this applies to six Hungarian convergence regions, hence, depending on its absorption capability, NH will receive approximately one sixth of the expected amount). Funding will be managed in a decentralised manner by the counties, urban counties and by communities (in the case of community-led local development (CLLD) programmes). Policy measures related to innovation-specific objectives include support to the development of industrial parks and incubators, SMEs' market-oriented innovation and to their investment in technology upgrading. Prioritised industries include tourism and food industry and to a certain extent also eco-industries.

Weak points and criticalities

- The monitoring and evaluation methodology is new and needs to be checked and improved after its application.

- Some indicators are collected for the first time and their values will be used for establishing objective values for next years.

Replicability and transferability

For the cities participating in the ISDS program have the guide prepared by the Ministry of the Interior and their Strategy is worked out and based on the same four basic goals (pillars), also the strategic and operative management of the implementation of that Strategy is basically similar, the monitoring system is well-replicable and transferable.

Room for improvement

The digitalisation and harmonisation of the used systems could be the new way. Automation of the data collection and decision support (including the possible common data processing of internal and external data sources) must be the near future of such kind of monitoring processes.

2.3.6 National Framework Strategy on Sustainable Development of Hungary (2012-2020)

National Framework Strategy on Sustainable Development of Hungary has been approved by the Hungarian Government on 28th March 2013 by Resolution 18/2013. The objective of the strategy is to promote sustainable development, the possibilities of future generations and the long term responsible management of natural resources, as set out in the Fundamental Law of Hungary. The Strategy functions as a long term concept in the system of public policy decision preparation and decision making. In comparison with the strategy of the European Union, it interprets the concept of sustainability in a considerably narrower sense. In its interpretation, sustainable development policy is first of all a long-term resource management activity. The framework strategy distinguishes four resources: human, social, natural and economic resources. The choice and finalisation of the final indicator system following up the realization of the strategy is presented in this document.

Who monitors?	Internal data collection	External data collection	Internal data processing	External data processing
What is monitored?	Inputs	Outputs	Outcomes	Impacts
What is the level of monitoring?		Program / measure		
When the monitoring is performed?			Continuous	
How the monitoring is performed?	Qualitative	Quantitative / Statistical / econometric study		
What is the purpose of monitoring?	To assess and improve the action	To improve the management system / create a mind-set change		

Implementation history

Based on the Resolution 08/2013, the Parliament mandated the **National Council for Sustainable Development** to :

- a) monitor the implementation of the Framework Strategy, endorse the review of the results and report to the Parliament every two years;
- b) coordinate the review of the Framework Strategy every four years.

Strong points

The methodology – compared to other monitoring practices in place – contains several promising approaches that contribute to the professional measurement of achievements and direct feedback, if needed.

One of the most decisive benefit of the monitoring system is the fact that the source of data applied is the data collection and reports published by the Central Hungarian Statistic Office which applies coherent data processing activity. However, it is important to note, that the evaluation of the indicators is not only based on statistics but it also contains tendency analysis (comparison of the base and the current value) as well. It supports policymakers and stakeholders to better understand the impact of interventions and measures.

Last but not least, the involvement of an independent professional body (HETFFA) in elaborating the evaluation and monitoring methodology is the main strengths of the strategy as it guarantees that results and achievements will be measured based on evidence and not on political will.

With regard to the selection of key indicators, the preparatory research by HETFFA has been built on the in-depth analysis of indicators previously applied by benchmark countries, namely by Austria, Germany, the United Kingdom, Switzerland and the United Nations' data collection methodical frameworks. To this end, it is ensured that mainstream monitoring techniques enrich the Hungarian monitoring practice.

Weak points and criticalities

According to the NSDS the Hungarian nation is currently very far from the state, which would satisfy the requirements of sustainability and thus a sustainable development path can only be realized gradually. The Framework Strategy is the first stage towards the transition to sustainability, and it focuses on areas of sustainability, which is likely to be the most effective way to eliminate, to mitigate the reasons for unsustainability. The Strategy uses the concept of sustainable development in a more general sense, than those who bound it to the ecological opportunities, although it does not deny its primary importance. During analysing the concept the development and the sustainability are dealt separately and the meaning of the concept is being deducted from them.

According to the NSDS the development is understood as an inseparable harmonious growth of the conditions and opportunities of the good life for the individuals and the communities, as well as for the nation and the humanity. It also notes that the good life has not got just financial dimension, but also mental and spiritual side as well. The good life term commonly used synonym for well-being in the Strategy parlance.

Replicability and transferability

Motivated by the fact, that the strategy monitoring is based on coherent methodology with clear indicator system easily replicable, the entire monitoring approach is easily transferable to other

organisations or strategies. There is only one bottleneck that should be observed: data management may differ within the analysis in a different sector or industry. Similarly, the definition of the base values and the related actions, plans should be also subject to further research regarding the performance and results of the actions and the progress itself.

Overall, the Monitoring Handbook gives not only a direct guideline of how to compile the monitoring report but also a strategic view about the background, the authorisation and the general approach for such kind of monitoring activity. Due to these general advantages this good practice is flexible to use in different class of innovations.

Room for improvement

Basic issue in such kind of strategies and the monitoring systems is to provide the necessary transparency for the civil population. Regarding the National Framework Strategy of Sustainable Development the relevant Resolution clearly defined the reports needed (every second year a Progress report and the Review report every fourth year for the revision of the strategy) but the Indicator report is not mentioned on the right place with right expectations. For having a clear view of the reports and their structure it would be better to have all the needed reports to be defined in one resolution.

The indicator system has been revised and renewed by the HCSO in 2013. Previously the indicators were the Eurostat indicators, in the new system the Hungarian indicators are thematically grouped and in a special section these indicators are compared to the previous Hungarian and the relevant Eurostat ones.

3 Designing a monitoring tool for S3

3.1 Rationale, vision and goals

The design of a complete monitoring and evaluation system for S3 is obviously a complex and time consuming task that does not fit in a small scale project like NETIM, where only improvements and/or adaptations of existing good practices can be dealt with.

On the other side, the aspects worth to be considered are also manifold, so some choices need to be made about the aspects of a MES on which to concentrate the efforts.

The NETIM project choice has been that of concentrating exclusively on the set up of a practical monitoring tool, while at the same time developing a coherent conceptual framework for the monitoring tool, which also includes the evaluation and impact assessment aspects.

In our vision, an effective S3 monitoring tool should have the following characteristics:

- a) be able to collect different categories of information (inputs outputs, results), at the level of programs and projects;
- b) be able to disaggregate the collected information according to the various S3 specialisation domains;
- c) be cost effective, meaning that the collection of data should at least partly be incorporated in in the routine processes of policy interventions call for proposals and grants management;
- d) provide a sound base for the implementation of impact assessment exercises, in order to evaluate the effectiveness of the implemented policies.

From this vision, the following goals for the definition of our common monitoring tool have been derived:

1. Define a general criterion for segmenting the RIS3 priority areas and goals in a limited number of subdomains.
2. Define a general criterion for mapping the submitted and approved projects (under each policy intervention call) into the defined RIS3 subdomains.
3. Define the general structure of the monitoring indicator system.
4. Define the basic structure of the tools for indicator data collection.
5. Implement the monitoring tool for a couple of case studies.

3.2 Basic approach description

A Regional Smart Specialisation Strategy (RIS3) typically individuates goals and priorities that apply to specific “priority areas” and their thematic sub-domains (i.e. sectors, areas, fields...), so, in order to monitor the effectiveness of the strategy, we need to define a methodology and/or a set of indicators that discriminate among these sub-domains. There are two complementary ways to do this:

- a) compute the values of “traditional” indicators for each priority area sub-domain;

- b) identify new indicators that closely describe the internal dynamics of each priority area sub-domain⁸.

Concerning the last possibility, it is strongly advisable to involve the relevant stakeholders in the choice of the indicators, in particular the regional policy makers and the private and public actors that operate in the thematic domains (companies, associations, R&D...).

Concerning the disaggregation of indicator measurements across the various sub-domains, a major problem arises: RIS3 thematic sub-domains are not easily translated into economy sectors and their related sets of NACE codes. In fact, what we call “thematic sub-domains” here, are often complex value chains in which companies and other organisations from different sectors exchange goods and services of various kinds. An example is the agrofood value chain, which not only includes companies in the food business, but also companies in the logistics, packaging and ICT sectors, as well as research organisations and other influencing actors. As matter of fact, a better definition for the RIS3 thematic sub-domains - that shall be adopted from now on - is that of “Innovation Value Chains”.

What is needed, is a careful mapping of each Innovation Value Chain in the region, through direct surveys - a time consuming and somewhat costly effort. A “proxy” of this analysis can be obtained by simply relying on the information provided by the companies (or other organisations) when they submit a proposal to a regional public call: our approach is indeed based on questionnaires that the applicants must fill in at application time and at project conclusion time. This allows to map each project to a specific Innovation Value Chain and consequently attribute the output/result indicators computed for the applicant organisations to that Value Chain.

An assessment of the public policies obviously requires that also the organisations (i.e. SMEs) that do not beneficiate of the public funds be considered. This is usually done by extending the surveys to non beneficiaries and/or by building a “control group” with the same characteristics of the “beneficiary group”, thus allowing the application of a counterfactual approach, comparing the variation of the same indicators in the two groups.

In the case of RIS3 policies, the construction of control groups can be more difficult, because we need to differentiate the organisations by Innovation Value Chain and because we cannot rely for this segmentation on the easy way of the NACE codes, as previously said. However, the information gained from the beneficiaries can help in this effort.

⁸ These indicators are typically referred to results but, in order to distinguish them from the “general purpose” result indicators, we will call them transition indicators.

BASIC PRINCIPLES OF THE NETIM MONITORING TOOL

- Activation of a structured **data collection system**, mainly based on information related to the participants to the public calls, which allows to elaborate and analyse data by type of notice, applicant/beneficiary organisation, sector, Innovation Value Chain and Innovation Field, enabling technology.
- **Monitoring** based on information mandatorily provided by the participants to public calls and beneficiaries, at project proposal submission time, at project conclusion and in a later follow-up phase.
- Use of **different indicator sets**:
 - measure/program input indicators
 - measure/program output indicators
 - project output indicators
 - result indicators that are common to all RIS3 priority areas
 - result indicators that are specific to RIS3 priority areas or their sub-domains (transition indicators)
- **Disaggregation** of all input, output and result indicators across the various RIS3 priorities, according to a three-level tier:
 - Priority Area
 - Innovation Value Chain
 - Innovation Field
- Crossing matrix between Innovation Value Chain and innovation scope on one side and **enabling technologies** (KETs) on the other side.

3.3 Defining the RIS3 classification tree

In order for the described approach to be applicable, a robust classification tree for the various fields of the RIS3 must be defined.

We propose that this tree be articulated in 3 levels:

1. Priority Area
2. Innovation Value Chain
3. Innovation Field

Priority Areas are the higher level articulation of an RIS3, corresponding to the broad priorities defined by the strategy, as could for example be Health and Well-being, Environment, Intelligent Manufacturing etc. The number of priority areas for a specific Smart Specialisation Strategy is usually quite limited, in the order of a few units.

Innovation Value Chains are the “sectors” encompassed in each RIS3 Priority Area. As already discussed, RIS3 sectors often do not straightforwardly map to what we currently understand as economic activity sectors, that is well-defined groupings of actors belonging to the same subsets of NACE codes. More often, RIS3 sectors are “application domains” that correspond to specific societal challenges and imply a combination of different industrial sectors, areas of scientific and technical competence and enabling technologies. For these reasons, it seems more appropriate to speak of “innovation value chains”, as this definition comprises the idea of a functional network among different subjects that cooperate for achieving a common goal. Examples can be the Agro-food, Pharmaceutical and Healthcare “sectors” under the “Health and Well-being”

Priority Area. Again, only a few Innovation Value Chains are expected to be included in each Priority Area.

Each Innovation Value Chain is divided into a number of Innovation Fields, which correspond to homogeneous classes of solutions (process, product, organisational, market innovations). To make an example, the Agro-food Value Chain could include the Food safety and Functional foods Innovation Fields.

DEFINING THE RIS3 CLASSIFICATION TREE: CRITICALITIES AND HIGHLIGHTS

- The Classification Tree resulting from the definition of these three levels of articulation of the RIS3 should be a straightforward translation of the goals and choices already defined by the Smart Specialization Strategy. However, in some cases a **lack of specification and detail** in the RIS3 can make things less simple, requiring further analysis and discussions.
- The final version of the RIS3 Classification Tree should be **agreed by all involved parties**, including at least the regional/national department or ministries who hold the responsibility for RIS3 planning and implementation, the Operational Program Managing Authority, the organisation charged with RIS3 monitoring and evaluation, and any other organisation acting as an Intermediary Body for the implementation of RIS3 related policies and measures.
- While the definition of the first two levels, Priority Areas and Innovation Value Chains, should obviously be a once and for all choice, some **flexibility margin** should be envisaged for the Innovation Fields, whose list could be revised according to the progress of implementation of the RIS3. More specifically, the process of continuing entrepreneurial discovery could determine the identification of a new Innovation Field not previously considered as strategic and included in the list. At the same time, a lack of results and progress could lead to downgrade as non-strategic another Innovation Field.

3.4 Key Enabling Technologies

Mapping the proposed and approved projects according to the proposed RIS3 Classification Tree allows to monitor WHAT the policy interventions are producing in the different Priority Areas and related sub-domains, for example what innovation fields see the highest number of proposed projects or give rise to the highest number of patents or research-industry agreements and collaborations.

It can however also be of interest to understand HOW innovations are produced in each Innovation Field, that is, what technologies are utilized and/or developed and adapted in order to achieve the project's goals.

For this purpose, a second, technology-oriented classification tree has to be defined. Our proposal is to base it on the six Key Enabling Technologies (KETs) identified at the EU-level: micro and nanoelectronics, nanotechnology, industrial biotechnology, advanced materials, photonics, and advanced manufacturing technologies. For a finer grain classification, a number of sub-KETs (or Technological Trajectories) can be defined under each of the six KETs.

The double classification of projects according to their pertinent Innovation Value Chain and Innovation Field and to the employed KETs allows to understand the relevance of specific technologies and competences for the local economy.

THE WHAT AND HOW OF INNOVATION PROJECTS

WHAT Innovation Value Chain will be impacted by the developed innovation?

WHAT Innovation Field is addressed?

HOW will the innovation be developed? (technologies utilised, adapted or developed)

	Innovation Field 1	Innovation Field 2	Innovation Field 3
Technology 1			
Technology 2	X		
Technology 3		X	
Technology 4			X
Technology 5	X		X

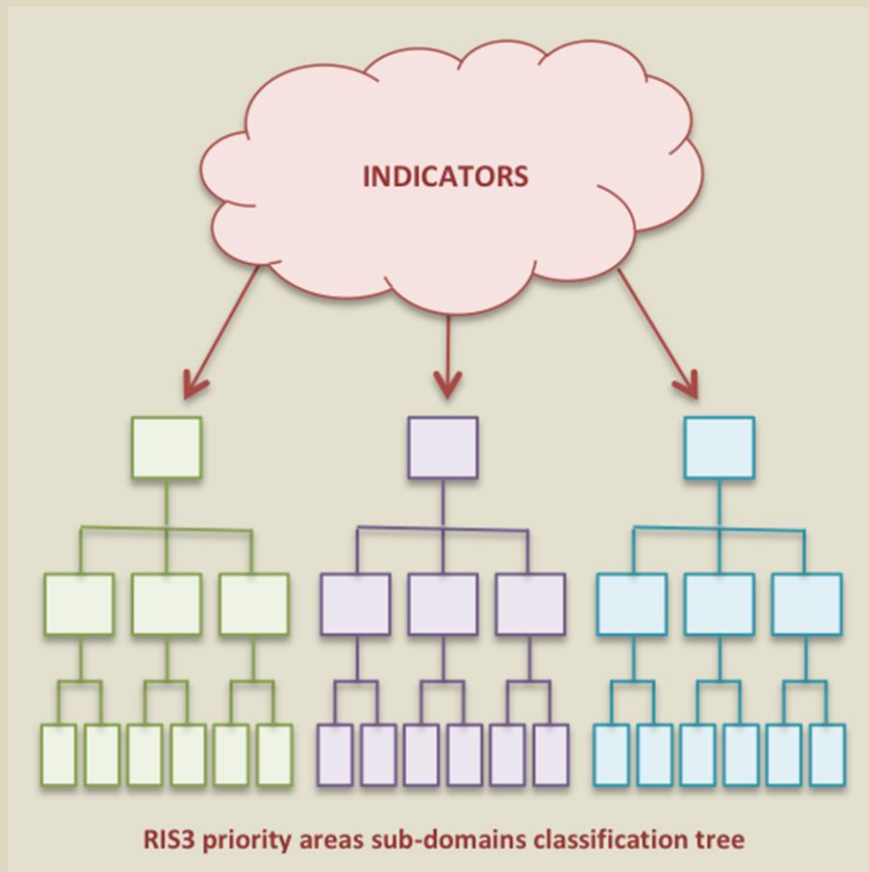
3.5 Setting up the indicator system

At the core of any monitoring and evaluation system there is a carefully designed system of indicators, usually structured in different sets, each set devoted to a specific monitoring phase or covering a given scope. In our proposed approach, the considered indicator sets are the following ones:

- measure/program input indicators;
- measure/program output indicators;
- project output indicators;
- result indicators that are common to all RIS3 priority areas;
- result indicators that are specific to RIS3 priority areas or their sub-domains (transition indicators).

DISAGGREGATING INDICATORS ACROSS THE RIS3 CLASSIFICATION TREE

- In the proposed NETIM Monitoring methodology, the values of ALL indicators belonging to ALL different sets have to be **separately computed** for each RIS3 sub-domain (Innovation Value Chain and/or Innovation Field).



Input indicators measure the implementation costs of the policy intervention and their identification does not represent any particular difficulty, being the observed quantities quite standard. Basically, these indicators, which are measured at the higher levels of policy programs and measures, are related to:

- Financial resources,
- Human resources,
- Administrative resources,
- Equipment required.

Output indicators measure the efficiency of the policy intervention, tracking the release of the expected products or outputs. Outputs can be measured at the level of the granted projects, in order to assess if they respect the approved project plans, or at the level of policy intervention calls, up to measures and programs, usually aggregating lower level output indicator values. As for input indicators, the individuation of output indicators is quite straightforward, being outputs already defined in the design phase of policy interventions and projects.

The real challenge in designing a RIS3 monitoring system relies in the choice of the result indicators. In this respect, we can distinguish different situations:

At a general level, we have result indicators that are common to all RIS3 priority areas, measuring variables like for example employment rate, number of new start-ups, number of agreements between companies and research organisations, number of new patent applications etc.

These are the indicators usually used for the monitoring of Operational Programs, even if in that case their values come from the surveys carried out by the national statistical agencies and do not allow for a disaggregation at the level of Innovation Value Chains and Innovation Fields. It should also be noted that some of these “common” indicators could not be meaningful for specific programs, measures or calls: for example, the number of new start-ups would be of no use for a policy exclusively dealing with training.

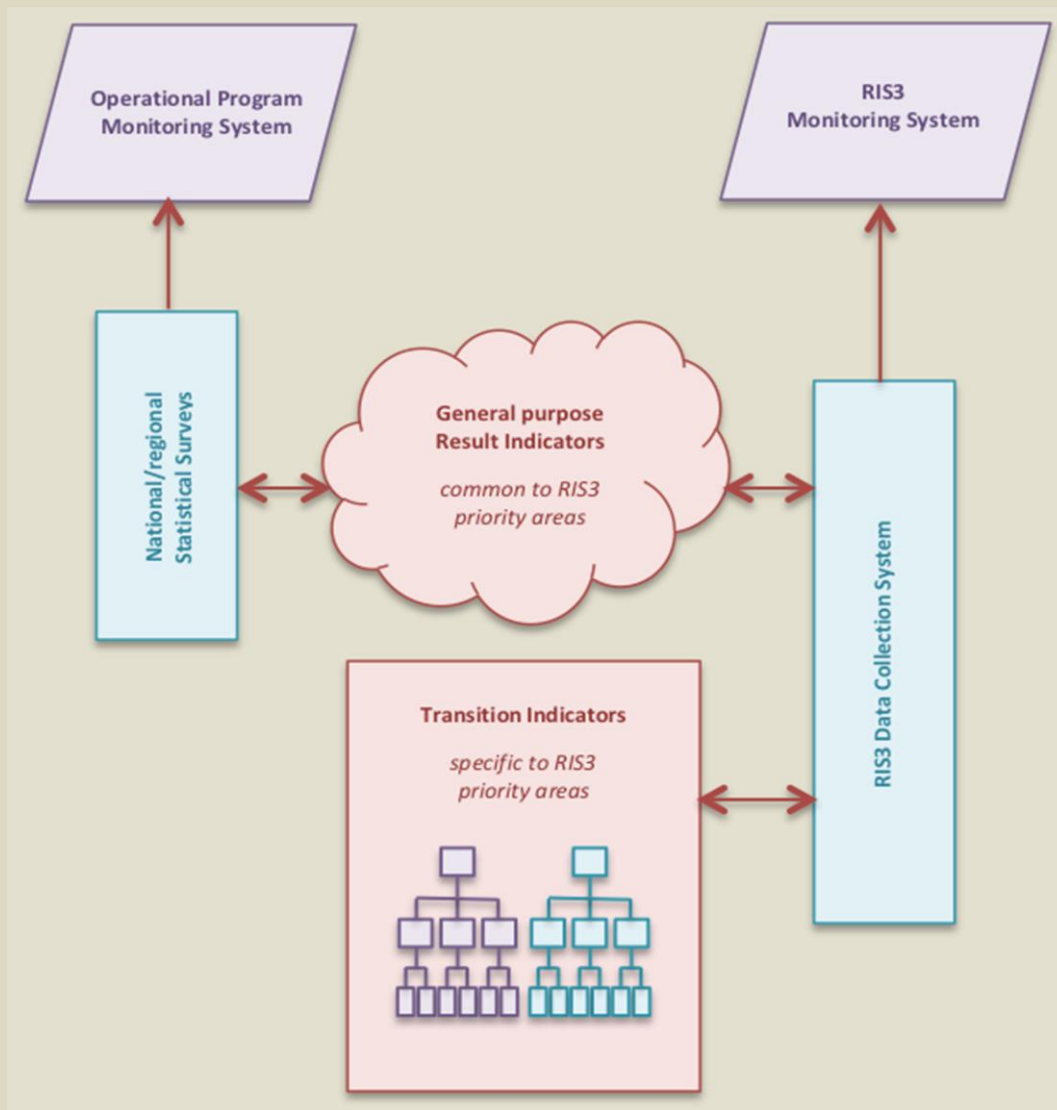
It is therefore better to view these common result indicators as a set of indicators from which to choose those that are appropriate to the intervention under observation. Having a standard set of “general purpose” result indicators, common to all RIS3 priority areas, allows for their aggregation at the level of the whole RIS3 Strategy, thus providing a base for the evaluation of impacts.

At a finer level, it is very useful to define result indicators that more closely describe the specific innovation dynamics of RIS3 priority areas and their related sub-domains, as this allows the monitoring and evaluation of the RIS3 with respect to its proper dimension of “specialisation”. We call these specialised result indicators as transition indicators, signifying their ability to describe and measure the changes wished for by the RIS3.

While the choice of the common, general purpose, result indicators may be made following already consolidated approaches, the selection of transition indicators should be the outcome of a very carefully designed and implemented process, involving the key stakeholders in each RIS3 sub-domain, as for example the potential beneficiaries, experts, sectorial associations etc.

MONITORING RESULTS

- Result indicators of **general use** are collected both by national statistical bodies at national and regional level, considering the whole population of affected subjects (e.g. companies).
- The same information is collected through questionnaires by the local RIS3 data collection facility, primarily considering the policy beneficiaries and control groups.
- Result indicators that are specific to RIS3 priority area and their related sub-domains (Transition Indicators) are the **core indicators** of the RIS3 Monitoring System.



3.6 Designing the data collection system

A key feature of the proposed RIS3 Monitoring System is that the information related to the defined output, result and transition indicators is directly collected by interviewing the

beneficiaries of the public policies, mainly during the usual phases of project proposals in response to a public call and of project conclusion (final reporting). Data collection in a follow-up phase is also envisaged, as well as collecting the same data from control groups of non-beneficiaries, for counter-factual impact evaluations.

The tool used for data collection is a set of questionnaires whose questions are the direct translation of the indicators of interest. Two entities are considered in this regard:

- a) the project, with its expected outputs and result;
- b) the individual project prospers and beneficiaries, with their economic and innovation performance.

Different questionnaires are used according to the phase of monitoring and the target addressed:

- Ex-ante Project Questionnaire, through which the organisations applying for a grant classify their project in a particular Innovation Value Chain and Innovation Field, select the prevalent KET and Technological Trajectory, insert relevant keywords and provide synthetic information on objectives and expected results.
- Ex-post Project Questionnaire, through which the beneficiary organizations collectively provide information on the direct outputs of the completed project.
- Ex-ante Questionnaire for Applicants, through which each organisation applying for a grant provides organisation-specific information, concerning the variables that have to be monitored (related to Result and Transition indicators).
- Ex-post Questionnaire for Beneficiaries, through which each partner organisation of an approved project provides, at the end of the project or in a subsequent follow-up phase, the organisation-specific information, concerning the variables that have to be monitored (related to Result and Transition indicators).
- Adapted versions of the ex-ante and ex-post questionnaires for applicants / beneficiaries to submit to any control groups (non-beneficiaries of regional measures), for counterfactual analysis.

All questionnaires should be implemented through a web interface.

4 The service delivery system

The service delivery system, or the context within which an initiative is delivered, can be considered to consist of three elements:

- **Target groups:** the actors targeted by the service, in our case the monitoring and evaluation service.
- **Framework conditions & organisations:** the framework conditions within which the service is delivered and the organisations, other than the target groups, that play a role in the service delivery system.
- **Process:** the structured sequence of actions and procedures that make up the service design, implementation and follow-up.

4.1 Target groups

Different actors are involved in the process of RIS3 monitoring and evaluation, each one playing a different role and bearing its own specific perspective. These actors can be grouped in two different groups:

1. The policy intervention providers;
2. The policy intervention clients and targets.

The first group makes up the “institutional framework” of the policy intervention and will be discussed in the next paragraph. Concerning the second group, we can distinguish between the direct targets of the policy intervention and those other actors that, even if they do not access the public grants, are in some way influenced by the policy intervention or do influence its delivery process.

The direct target groups of any policy intervention are its actual and potential beneficiaries, including:

- companies, both SMEs and large ones, belonging to traditional sectors or to knowledge-intensive sectors;
- research organisations;
- educational and training agencies;
- intermediary organisations (incubators, science and technology parks, technology transfer centres, etc.);
- associations;
- public administrations.

Obviously not all the above mentioned actors are targeted by any policy intervention and a clear identification of the policy targets is essential for properly designing or adapting the monitoring tool. In particular, the ex-ante and ex-post questionnaires for applicants, beneficiaries and control groups, envisaged in the NETIM Monitoring Tool, shall be customised according to the type of organisations addressed.

The other relevant stakeholders are those organisations that, even if not directly addressed by the public policy, play an influential role both regarding the objectives and scope of the policy and their strong relation with the direct target groups.

Examples of such stakeholders are:

- entrepreneurial associations;
- chambers of commerce;
- trade unions;
- opinion leaders and experts;
- any of the organisations listed among the direct target groups, when not a direct target of the intervention.

The importance of these stakeholders for the monitoring and evaluation process mainly relies in:

- their possible role in the impact evaluation of the policy intervention, as bearers of expert knowledge about the innovation dynamics in specific areas and sectors (involvement in focus groups, direct interviews, evaluation boards etc.);
- their interest in being informed about the outcomes of the monitoring and evaluation process.

4.2 Framework conditions and organisations

4.2.1 *Creating support and interest in the monitoring system*

National and regional authorities face new challenges when defining and implementing their Smart Specialisation Strategies, the main challenge being that concentrating resources on a limited set of priorities and sectors obviously generates some resistance by those sectors and areas that are not prioritised.

The adoption of a well-functioning S3 monitoring and evaluation system (MES) can also give rise to some negative reactions and opposition, both from the territory and from inside the public administrations and the policy makers. A clear, objective demonstration that a given policy intervention is not producing the expected results or that a given economic sector is not able to profit from the public support can in fact be perceived as a threat to consolidated advantageous positions.

For these reasons, it is very important that the setting up of a MES be accompanied by an effective communication campaign, targeted both at the target groups and stakeholders of the territory and to the public administration, aimed at delivering clear messages about the utility of the MES and the advantages it can provide to all actors:

- a MES contributes to the transparency and accountability of the allocation and use of public funds, increasing the capacity of the stakeholders to monitor the behaviour of the public administration;
- a MES provides the policy makers and public officials with objective data on which to ground and justify their policy choices;
- the data provided by a MES can allow to better tune the S3 strategy, possibly correcting some initial misalignment in the individuation of its priorities and scope;
- the data provided by a MES can help to improve the quality of the public interventions, their efficiency and effectiveness.

What is really needed is a diffused acceptance and support of monitoring and evaluation practices, something that often requires a different cultural approach and a shift of mind-set, starting from the public authorities.

4.2.2 Considering existing initiatives

The RIS3 MES is not the unique system that gathers, organises and disseminates information about the deployment and impact of public policies in a given territory. As a matter of fact, Operational Programmes, both at national and regional level, have their own monitoring systems, which often encompass many of the RIS3 policy measures and interventions.

Besides that, other public and private organisations, like for example academic institutions and banks, perform surveys and produce studies and analyses concerning the local economy and innovation dynamics.

When designing an RIS3 MES, it is therefore necessary to draft a clear map of the other existing initiatives, in order not to duplicate efforts and benefit from already running initiatives. Besides that, operational synergies and agreements should be pursued with these other initiatives, concerning the exchange of data and information.

4.2.3 Assuring an effective institutional framework

In order for the monitoring and evaluation process to be effectively implemented and produce the expected benefits, an effective and efficient synergy must be realised among all institutions that contribute to define, plan, manage, monitor and evaluate the public policy intervention of interest.

Even if the institutional architecture can in practice be different, with more than one subject covering one of the following roles or having some of the roles concentrated in a single organisation, the basic roles typically include:

- The policy makers, who are the main “customers” of the monitoring and evaluation process, the ones who utilise the monitoring information and the evaluation assessments as a feedback that allows them to:
 - gain a better knowledge of the innovation dynamics in the territory;
 - better tune the policy interventions, improving their efficiency and effectiveness;
 - revise and adjust policy goals and strategies.
- The intermediate body, who has been appointed by the national/regional authority for carrying out the implementation of the policy intervention. This body is usually responsible for the following tasks:
 - managing the calls for proposals procedures (call publication, administrative and technical evaluation of proposals, project contracts definition);
 - assessing the periodic technical and financial reporting from approved projects;
 - providing the financial management of the policy intervention (control and transfer of funds);
 - collect data related to the policy intervention outputs and to the projects outputs and results.
- The monitoring and evaluation body, who is responsible for:

- designing the monitoring methodology and tools;
- elaborating the intervention's and projects' monitoring data;
- performing the evaluation of the policy intervention impact;
- producing monitoring and evaluation reports.

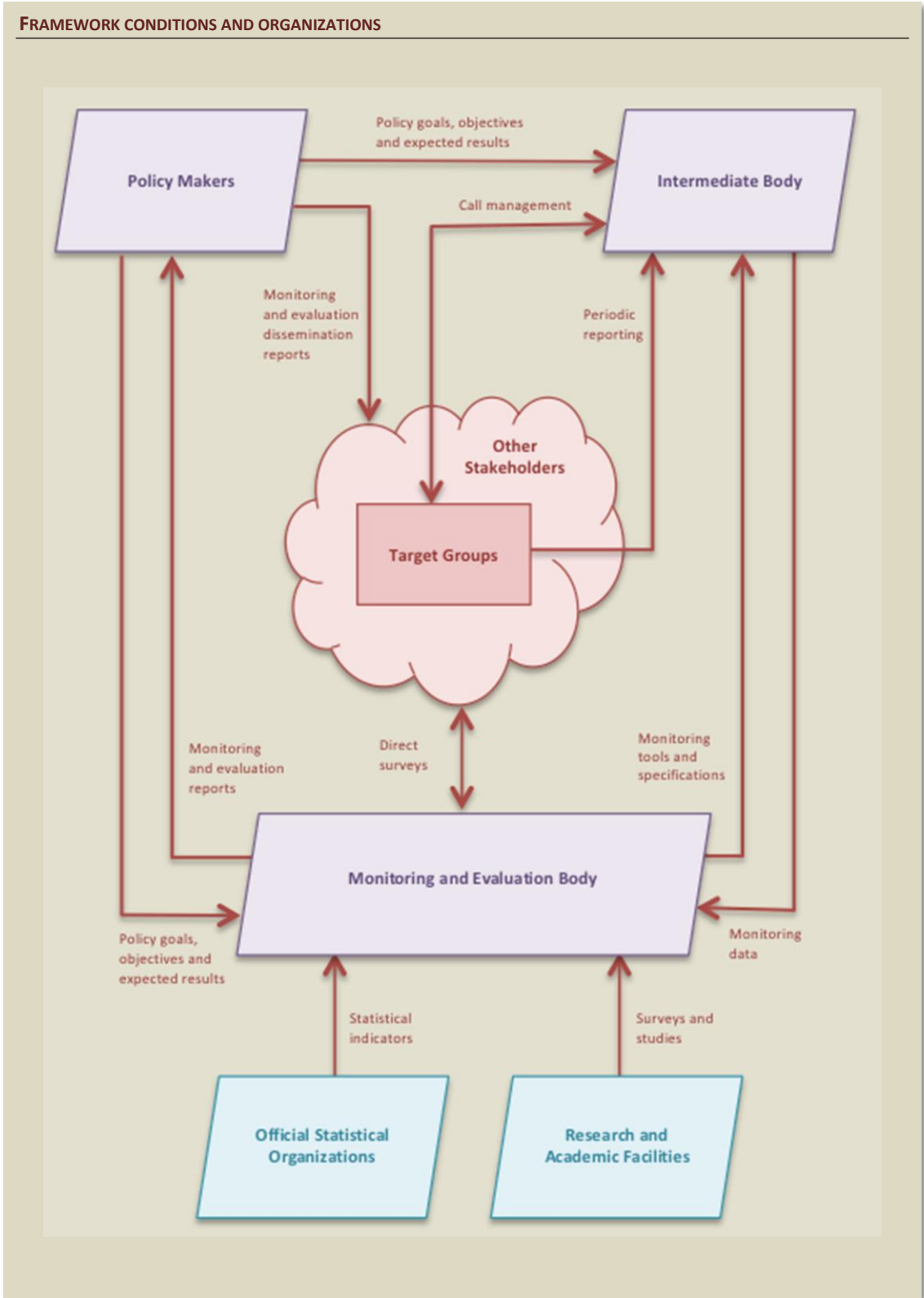
The context described above can be considered as the internal institutional framework for the delivery of the monitoring and evaluation service.

A wider, external framework also includes bodies and organisations that are not directly involved in the service delivery, but nonetheless provide essential inputs for its implementation:

- Official statistical organisations, at international and national level, providing statistical data about a range of indicators of interest, disaggregated at national, regional and provincial level and by industry sectors.
- Research and academic facilities who perform surveys, studies and analyses about the local innovation systems and economies.

The interaction among these entities is strong and substantial and its smoothness and efficiency is a key for the monitoring and evaluation success. A graphical interpretation of these interactions is shown in the next diagram.

FRAMEWORK CONDITIONS AND ORGANIZATIONS



4.3 Design process

The third cornerstone of the service delivery system is the process, including the design of the RIS3 monitoring system, the setup of the necessary facilities and its actual delivery and follow-up.

4.3.1 The design phase

When designing the MES, according to the general principles illustrated in Chapter 3, some basic steps should be followed:

1. Define in a clear and unequivocal way a set of criteria that define the belonging of a project/action to a specific RIS3 priority area, Innovation Value Chain and innovation field.
2. Define the different sets of indicators:
 - a) Input indicators related to the RIS3 program (or set of policies/measures), like the allocated budget, the organisational structures involved and human resources employed for the management of the program.
 - b) Output indicators related to the RIS3 program (or set of policies/measures), like the number of funded projects, number of involved companies, etc.
 - c) Output indicators related to the direct outcomes of the funded projects (e.g. number of product innovations, number of newly employed researchers, ...).
 - d) Result/Outcome indicators related to the innovation performance of the regional actors (SMEs, R&D, ...), which can be applied to the beneficiaries of the regional grants (e.g. R&D employees, turnover, number of industry-academia research agreements...).
 - e) Transition indicators that more closely describe the internal dynamics of the various RIS3 priorities and sub-domains.
3. Define a set of questionnaires⁹, to be submitted to project applicants, project beneficiaries and control groups in different phases of the intervention (start-up, conclusion and follow-up). The questions included strictly reflect the selected indicators, allowing for their collection.
4. Have the monitoring tool (criteria + indicators + questionnaires) be approved by the public authority who is responsible for the RIS3 (e.g. regional ministry for economic development).

4.3.2 The setup phase

Two setup phases should be considered for the NETIM MES:

- a) an initial set-up of all procedures and tools, carried out at the level of the whole RIS3 set of measures and interventions;
- b) a recurrent fine-tuned setup of the MES according to the specific intervention and call.

The initial setup involves a strict collaboration with the intermediate body/ies who is/are responsible for the financial and administrative management of the measures under

⁹ See Paragraph 3.6.

observation. It is in fact up to the intermediate body the implementation of the ICT facilities for managing the monitoring procedures, including a user-friendly web interface for applicants and beneficiaries with the online version of the questionnaires and the underlying database fed by the collected answers.

Moreover, a clear arrangement must be defined between the intermediate body and the organisation appointed for RIS3 monitoring and evaluation, concerning the format and protocols for the transfer of data and information. Such an agreement could even be a three-party one, also including the RIS3 authority.

Even if the general architecture of the monitoring procedures and tools can be defined once and for all in an initial setup phase, each specific intervention and/or call for proposals may need some minor adaptations and changes, mainly related to the monitored output and result indicators, that require a finer setup of the MES.

4.3.3 The delivery phase

Two steps are always involved in the monitoring phase:

1. Collecting the data related to the selected indicators and disaggregating them per RIS3 thematic domain or subdomain;
2. Computing the said indicators and thus evaluating the relative performance of the RIS3 policies in each thematic domain or subdomain.

The set of indicators, the time of data collection and the sources considered vary according to the purpose and phase of monitoring, as summarised in the following table:

		Data collection (Time)					Source				Target		Goals				
		Project proposals submission	Projects approval	Projects conclusion	Follow-up	S3 mid-term assessment	S3 final assessment	Program Data	Ex-ante Project Questionnaire	Ex-post Project Questionnaire	Ex-ante Questionnaire for Applicants	Ex-post Questionnaire for Beneficiaries		Survey/Focus groups	Beneficiaries	Applicants (Non-Beneficiaries)	Non-applicants
OUTPUT	Measure/program output indicators																Programme/Policy performance
	Project output indicators																Project performance
RESULTS	Results indicators (for beneficiaries)																Program/Policy Effectiveness
	Results indicators (for non beneficiaries)																
	Transition Indicators																RIS3 effectiveness

Monitoring the performance or efficacy of a given policy or program/measure involves confronting the inputs (funding) and the achieved outputs (e.g. number of funded projects,

number of beneficiaries, etc.). In our approach, this assessment is made for each “Innovation Value Chain”, thus allowing for a relative appreciation of policy performance in the different RIS3 domains. The needed data for mapping the grants onto the RIS3 sub-domains come from the ex-ante project questionnaires, while all needed information for computing the output indicators simply come from the data related to participation to the issued calls, taken at proposal submission and approval time.

Concerning the performance of the funded projects, their output indicators can be computed on the base of the project ex-ante and ex-post questionnaires: the first allows, as usual, the mapping of data on the different RIS3 sub-domains, while the second provides information about what has been directly produced from the project and is collected at project conclusion.

When we go to the effectiveness or impact of a given policy or program/measure, result indicators are involved, so we need to compute variations over time of the variables of interest. Some of these indicators are computed on the basis of the information provided by the organisation who received a grant (beneficiaries), through the ex-ante and ex-post “organisation questionnaires”. These questionnaires are typically compiled at submission time and at project conclusion, but a later follow-up survey can be envisaged.

As already commented, a counterfactual approach can be utilised and in this case the same questionnaires are submitted to control groups, that can include both organisations who unsuccessfully applied for the public grant (non-beneficiaries) and those who did not apply at all (non-participants). As before, the entirety of this analysis is performed by mapping the indicators in the different RIS3 thematic domains.

4.3.4 Follow-up phase

A Smart Specialisation Strategy, as well as its monitoring and evaluation system, is not a static entity to be linearly and rigidly implemented over time. It is on the contrary vital for its same effectiveness that a continuous, well-informed process of critical assessment, learning and revision is actuated. The MES is an important piece of this adaptation and improvement process, providing valuable information inputs and knowledge insights to policy makers and evolving its tools and structure according to the RIS3 changes.

Apart from the minor, day-to-day, adaptation and tuning, a major follow-up step is envisaged as a consequence of the mid-term assessment of the RIS3. Mid-term assessment will in fact require an extraordinary effort for evaluating the impact of specific policy measures and interventions, through extended surveys, counterfactual analyses and other means, and will produce a large amount of information that in turn will support a systematic revision and update of the strategy. From this process, a consequent major update of the RIS3 MES is expected.

5 Pilot implementations

In order to maximise the benefit of the Peer Learning Approach adopted in NETIM, it was decided to conduct a parallel implementation of the proposed monitoring tool and methodology in the two regions of Puglia and Extremadura, considering policies that share the same or very similar objectives and scope.

For this purpose, two policy domains were identified, namely the support to R&D&I in companies and the support to the start-up and growth of new, innovative companies.

In both regions, these policies are part of their Operational Programmes funded under the ERDF fund, and contribute to the implementation of their Smart Specialisation Strategies.

The comparison aimed to highlight:

- a) the policy actions sharing the same specific objectives;
- b) sets of common result and output indicators;
- c) new kinds of information and/or indicators that would be useful to include in the monitoring and evaluation systems, with particular reference to the impact on the Smart Specialisation Strategies.

The last item is probably both the most interesting and most challenging issue, as S3 strategies do not focus on traditional sectors or market segments, but instead target more complex, typically inter-sectorial challenges, for which no consolidated “measuring” approach do exist.

5.1 Puglia Region

5.1.1 Characterizing the RIS3 priorities and goals

The RIS3 of Puglia Region envisages 3 Priority Areas, each of them characterised by specific challenges, technological and scientific excellences, market opportunities, key enabling technologies and areas of innovation.

For our purposes, it was decided to characterise each Priority Area by two elements:

- A) the “Innovation Value Chains” on which the RIS3 concentrates its resources in order to improve their competitiveness and market positioning;
- B) the “Innovation Fields” that the RIS3 prioritises for each Priority Area and Innovation Value Chain.

The list of Innovation Fields and Innovation Value Chains for each Priority Area is given in the following table.

Priority Area: SUSTAINABLE MANUFACTURING	
Innovation Value Chains	Innovation Fields
<ul style="list-style-type: none"> • Aerospace 	<ul style="list-style-type: none"> • Aerostructures • Engine design, Propulsion • Avionics, Systems, Equipment • Design, simulation, validation and management systems
<ul style="list-style-type: none"> • Transport 	<ul style="list-style-type: none"> • Engine design, Propulsion

	<ul style="list-style-type: none"> • Other mechanical parts and subsystems • Systems, Equipment • Design, simulation and management systems
<ul style="list-style-type: none"> • Mechatronics 	<ul style="list-style-type: none"> • Control and actuating systems, robotics • Design, simulation and management systems
<ul style="list-style-type: none"> • Other Manufacturing <ul style="list-style-type: none"> ○ Textiles and clothing ○ Furniture ○ Chemistry ○ ... 	<ul style="list-style-type: none"> • Advanced manufacturing systems • New materials • Design, simulation and management systems • Logistics
Priority Area: HUMAN AND ENVIRONMENTAL HEALTH	
Innovation Value Chains	Innovation Fields
<ul style="list-style-type: none"> • Agro-food 	<ul style="list-style-type: none"> • Food safety • Food products shelf-life prolongation, packaging • Functional foods
<ul style="list-style-type: none"> • Pharmaceutical 	<ul style="list-style-type: none"> • Drug design
<ul style="list-style-type: none"> • Medical & Healthcare 	<ul style="list-style-type: none"> • Medical diagnostics • Advanced therapies • Active aging and self-management of health
<ul style="list-style-type: none"> • Sustainable Energy 	<ul style="list-style-type: none"> • Storage and smart distribution of energy • Distributed production of renewable energy • Energy efficiency
<ul style="list-style-type: none"> • Environment 	<ul style="list-style-type: none"> • Sustainable management of natural resources and safeguarding of biodiversity and terrestrial and marine ecosystems • Risks prevention, defence and securing of land and coastal areas • Sustainable management of wastes and valorisation of scraps and by-products • Environmental remediation
Priority Area: DIGITAL, CREATIVE AND INCLUSIVE COMMUNITIES	
Innovation Value Chains	Innovation Fields
<ul style="list-style-type: none"> • Cultural industry 	<ul style="list-style-type: none"> • Integrated management of cultural heritage • Production and communication of cultural and artistic contents • Promotion of dialogue and collaboration between creative industry and traditional manufacturing sectors
<ul style="list-style-type: none"> • Social innovation 	<ul style="list-style-type: none"> • Empowerment of social networks and social inclusion

The selection of the Innovation Value Chain of reference of the project (only one possible choice) and of the Innovation Fields to which the project contributes (max 3 choices) is made by the proposers when they submit their application (Project Form).

Concerning the Innovation Value Chains, it should be stressed that they do not automatically correspond to NACE codes for economic activity sectors: in some cases the map of the Innovation Value Chain includes organisations belonging to different sectors. One example can be the ICT companies that provide services to the Environment Innovation Value Chain. The clustering of the projects in the different Innovation Value Chains of the RIS3, together with the

information gathered about the individual proposers (companies, research centres, other organisations) can thus help in better defining the supply chains of each RIS3 sub-domain. In the appendix, we introduce a draft of the Project Form that should be completed for a single presented proposal, independently of the number of participants.

5.1.2 Defining Innovation Value Chains specific “transition” indicators

We propose to use additional result indicators, which are Innovation Value Chains specific. This kind of approach allows for a better understanding of results produced by the policy within specific innovation areas, relevant for the regional territory.

A particular attention should be paid to the selection of this category of indicators which may differ across the Innovation value Chains and should be able to capture the actual changes occurred in the Innovation value chain.

For this reason some requirements are necessary:

- ✓ few indicators have to be identified for each Innovation Value Chain
- ✓ indicators selection should be carried out through the consultation of key internal and external actors of the regional innovation system
- ✓ the indicators have to be calculated in order to be representative of the overall regional innovation system
- ✓ the values of the indicators should be calculated in an objective way and be comparable over time
- ✓ information necessary to calculating indicators should be collected through questionnaires by beneficiaries and surveys for other regional subjects
- ✓ they should be measured at least bi-annually

In the following table, there is an example of this kind of indicators identified for the Aerospace sector. In this case, transition indicators selection is based on the results of a study carried out by ARTI during 2013.

Share of SME's sales to large companies located outside the region	SMEs
Number of research projects of SMEs in collaboration with large firms	
Number of SMEs able to supply a complex product or manage the entire life cycle of a product	
Number of R&D employees in large firms	LARGE COMPANIES
Percentage of outsourced services of large companies to regional SMEs	
Number of research projects of large firms in collaboration with regional R&D organizations	SMEs + LARGE COMPANIES
Number of research projects of large firms in collaboration with regional SMEs	
Percentage of engineers on total employees	R&D CENTRES
Number of research projects of R&D organization in collaboration with regional companies	

5.2 Extremadura Region

The RIS3 of Extremadura global objective is increasing the size, added value and global competitiveness of the socioeconomic fabric of Extremadura through policies that enable the use and development of technologies related to the region's sources of differentiation, fundamentally

based on the sustainable exploitation of natural and cultural resources and the capabilities for creating quality of life in its demographic context, in connection with the challenges of Europe 2020 and global opportunity generation tendencies.

It identifies five specialisation areas that refer to new activities which must contribute to improving the competitiveness of the pre-existing opportunities and to generating new ones for the purposes of engendering entrepreneurship and attracting businesses: AGROFOOD, CLEAN ENERGIES, TOURISM, HEALTHCARE and ICT. Within these specialisation areas, a number of innovation fields were identified as follows:

Specialisation Area	Innovation Field
Agrofood	<ul style="list-style-type: none"> Comprehensive management of the pasture Feeding and animal welfare Animal and plant genetics Adaptation to climate change of productions Bio fertilizers ICTs and agricultural production Photovoltaic irrigation Organoleptic Optimization of processes Certification of products by analytical and sensorial methods New ingredients and additives New formats and packaging Food safety in the processing and post-processing industry Products of IV and V range Agro tourism Functional foods, prebiotics and food supplements Production of biogas from agro-food waste
Clean energy	<ul style="list-style-type: none"> Thermo solar and photovoltaic technologies Technologies for small and medium-scale production Intelligent energy management Thermo solar-biomass hybridation Production of biogas from agro-food waste Biomass Cogeneration for self-consumption Technologies for energy storage Systems of isolated management

Tourism	<ul style="list-style-type: none"> Preservation and optimization of natural resources Heritage conservation and restoration Applications for management and marketing Virtual reality 3D modelling and digitization of historical-artistic heritage Accessibility Agro tourism Health and wellness tourism Experiential tourism
Health	<ul style="list-style-type: none"> Telemedicine Tele-assistance Home Care and Attendance Applications Monitoring of chronic patients Biomedical applications, biosensors and nano-sensors Ohmic techniques (genomics, proteomics, etc.) Health Technologies and Medical Devices New Drugs Functional foods, prebiotics or food supplements Experimentation and validation of technological developments
ICT	<ul style="list-style-type: none"> Data management Cloud computing High performance computing Networks and mobile systems Smart Cities Technology Cyber security and digital trust Digital and audio-visual contents

For the purpose of piloting the monitoring tool in Extremadura region, the regional government has the intention to include the questionnaires as a precondition for applying to certain aids to support to R&D&I activities in companies that will be launched during 2017.

It is expected that the information gathered by the questionnaires will help us better understand the performance of our specialisation areas and innovation fields. Moreover, the use of this monitoring tool might allow us to define possible new indicators, not based on NACE codes but focused on the feedback provided by the beneficiaries of the aids and strictly linked to the innovation fields targeted by the R&D&i projects.