European Commission

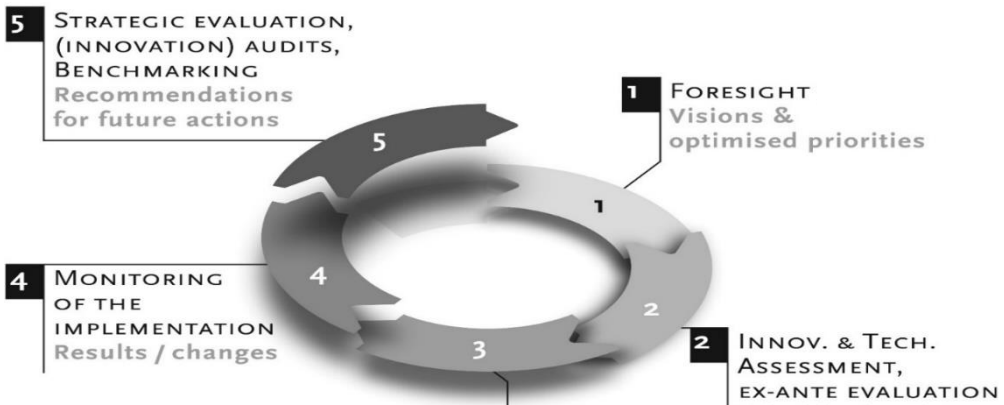
JRC SCIENCE FOR POLICY REPORT

Guiding investments in place-based development. Priority setting in regional innovation strategies

S3 Working Paper Series no. 13/2018

Günter Clar

2018



Contact information
Name: Dr Guenter Clar
Address: Im Finkenschlag 9, D-70563 Stuttgart (GERMANY)
Email: clar@c3-solutions.eu

JRC Science Hub
https://ec.europa.eu/jrc

JRC112689

Seville: European Commission, 2018

How to cite this report: Clar, G., *Guiding investments in place-based development. Priority setting in regional innovation strategies,* Seville: European Commission, 2018, JRC112689

Cover picture: Clar and Sautter, 2014.

Contents

Abstract

Optimising priority setting for higher returns on investment

As the Structural Funds (ESIF) constitute a large part of the EU budget, considerable contributions to the overall EU2020 Growth Strategy are expected. In the 2014-2020 programming period, there is a strong focus on Research and Innovation (R&I) with the aim to boost ESIF impact on competitiveness and broader benefits (public and private returns) across the EU. Towards this larger aim, R&I Strategies for Smart Specialisation (RIS3) are means to concentrate investments in place-based, innovation-oriented activities, which are well positioned vis-à-vis global value chains, and also related to territorial or sectoral strategies with other regions.

Recent assessments show that the concentration of investments towards this goal has not everywhere been optimally achieved, which is often traced back to the types of priorities selected. At first sight, this can be attributed to the nature of the strategy processes, the innovation actors involved, and their methodological and strategic competences. Looking deeper, especially where Managing Authorities and ESIF applicants/recipients had little former experience with R&I priority setting, weaknesses lie in understanding state-of-the-art concepts underlying R&I strategies, in applying the broad spectrum of R&I support tools, and in the ability to guide a range of R&I related interaction processes continually and competently.

Against this backdrop, the report sets out to synthesise the dispersed knowledge on a range of issues relevant for the success of priority setting processes and practices in innovation policies and strategies. Outlining changing contexts, rationales and approaches of priority setting in R&I policies leads to the "new prioritisation logic" guiding RIS3 exercises. This is followed by two main lines aiming to facilitate improved priority setting: better understanding the wider innovation policy context of RIS3, and making better use of Strategic Policy Intelligence (SPI) and other support tools (including learning from private sector strategies) to structure and guide policy cycles, and to implement place-appropriate policy mixes. Evidence (case studies) on effective priority setting processes in RIS3-type exercises and policy recommendations complete the report.

1 Background and overview

Priority setting and innovation (policies), competitiveness, concentration of resources

Rightly, priority setting is considered a persistent challenge (OECD 2007) in any policy area, but it is equally true that good priority setting is a key aspect for enhancing the quality and effectiveness of policies and strategies, and for increasing return on public and private investments. Regarding the current EU Cohesion Policy (CP), the prioritisation of strategic areas for innovation-oriented investment - through comprehensive place-based analyses and "Entrepreneurial Discovery Processes" (EDP) - is the core aspect of the Smart Specialisation (S3) approach.

Priority setting is a multifaceted challenge, and with regard to research and innovation (R&I) challenges concern i.a.: the type of strategic processes implemented (tools and continuous nature), the priorities (focus, granularity and nature) selected and positioned vis-à-vis global value chains (GVC), the territorial governance and capabilities, the actors to be involved, their R&I, strategic and methodological competences, their understanding of innovation, and their experience with the broad spectrum of innovation boosting tools.

Truly understanding innovation (policies), and taking the appropriate, place-specific measures for implementing related policies are vital; the importance has been stressed through decades in international settings, countries and regions. Various projects of the EU or the Technology and Innovation Policy Working Party (TIP) of the OECD had this focus, and their recently finished exercise (Innovation Policies for System Transformation. OECD 2016) opens by saying: "The demand for innovation among policy makers has never been greater and more purposeful."

At EU level, a long list starts with the "Green Paper on Innovation" (EC 1995) and has certainly not come to an end with the 2017 Communication "Strengthening Innovation in Europe's Regions" (EC 2017a). The latter cites, e.g., the "White Paper on the Future of Europe" (EC 2017b) stating that innovation is recognised as one of the main economic drivers for boosting jobs, growth and investment. In addition, the "Political Guidelines" of the Juncker Commission (EC 2014b) see innovation as a precondition for "sustainable and job-creating growth", which could lead to higher productivity and competitiveness while offering social and environmental benefits.

Given the close correlation between R&D performance and economic performance (comparing the results of the "Regional Innovation Scoreboard" and the "EU Regional Competitiveness Index"; or analysed in OECD 2015), it is all the more disquieting when aiming at "resilient, inclusive and sustainable growth", that the competitiveness and innovation divide between some advanced EU regions and less strong regions is widening (EC 2017c). When research and regional policies work closely together to encourage knowledge absorption, it will be easier for lagging regions and countries to diminish the gap towards the technology frontier (Aghion, Jaravel 2015).

With their strong focus on R&I in the 2014-2020 programming period, the European Regional Development Funds (ERDF) aim to reduce this divide and to boost investment impact on competitiveness and broader benefits across the EU. Towards this larger aim, R&I Strategies for Smart Specialisation (RIS3) are a means to concentrate (co-) investments in place-based activities, which are well positioned vis-à-vis GVCs, and also related to territorial or sectoral strategies outside of the region.

Recent assessment and status reports (see below) show that, so far, the concentration of investments has not everywhere been optimally achieved. Many of the reasons often cited relate, either directly or indirectly, to priority setting and the types of priorities selected for innovation-oriented investment, a key element of the S3 policy concept.

This introductory chapter

As a basis and guiding frame for this report, we summarise first important aspects of prioritising S3 investments, as well as the requirements to do so effectively and efficiently. This is then related to the current state of affairs of S3 (re-)design and implementation, as pointed out in recent assessments, and revealed through work on the ground with regional actors. Finalising this introduction, we give an overview on the report as a whole.

Aspects of S3 priorities and phases of the strategy cycle

- They are based on own territorial strengths, and related to development status, governance and 'thickness' of the innovation eco-system, as well as to other regions' and/or actors' activities (to be analysed in the *inward- and outward-looking phases*).
- With granularity depending on context and governance level, their emphasis could lie on industry domains, technologies, knowledge fields, societal challenges - all with a view to harnessing the potential of positioning them in GVCs and multi-level governance (MLG) settings (to be assessed, tailored to the context, and selected in the *forward looking and agenda setting phases*).
- They are developed with a view to structuring and guiding all parts of the (hierarchy of) policy and operational cycles, and to ensuring coherence from the strategy development phase through to call management/investment decisions, and monitoring.
- The resulting strategies had been detailed by considering a range of policy tools to ensure an appropriate policy support mix, and designed to allow for consensual adaptation during implementation.

Requirements for effective and efficient priority setting:

- state-of-the-art administrative capabilities, transparency, openness;
- methodological and process competence;
- competences to develop and implement strategies and strategy cycles, and to make case-optimised use of strategic tools;
- understanding of underlying concepts (innovation, innovation actors and systems, 'innovation' policies and strategies), and ability to guide R&I related interaction processes continually;
- broad knowledge of R&I support-tools (available locally or to be adapted from good practice elsewhere);
- and, last but not least, deep knowledge of the S&T areas and developments most relevant for the region, and/or the competence and the tools to get this information from elsewhere, assess its relevance, and then adequately 'translate' it.

State of affairs

The RIS3 concept has successfully been applied in various regions and Member States, in other cases challenging aspects remain. In the current phase of S3 (re)design and implementation, those difficulties have become evident through work with regional actors, and been outlined in recent publications, e.g. EC 2017a, Capello, Kroll (2016), Sörvik et al (2016), Clar et al (2015).

Weaknesses and areas for improvement have been identified, which can be directly linked, or traced back to underlying concepts, which have influenced key aspects of the priority setting processes and their results, and, subsequently, also strategy implementation:

- R&I governance;
- broadening the understanding of innovation and innovation policies (for system transformation), and on this base broadening topics and spectrum of support tools for 'whole-government' policy mixes;
- methodological and strategic competences across key actor groups for impactful priority setting;
- broadening the scope of actors (true *quadruple helix*) involved in the interactions at local level in general, and in priority setting especially;
- understanding the 6-step-process (Foray et al 2012) as a Cohesion Policy (CP) adaptation of a proper R&I policy cycle;
- understanding the essence of the individual EDP elements, the EDP cycle as a whole (Gianelle et al 2016), as well as the relationships with the 6-step-process, governance processes and other policy-related processes of a cyclical nature;
- choosing – in an evidence-based approach – S3 priorities ("domains, areas and economic activities, where there is a competitive advantage, or the potential to generate knowledge-driven growth needed to address major and urgent challenges for society and the environment");
- including priorities, which allow harnessing cross-sectoral potential from related variety and combinations of knowledge bases, or specific territorial capital (traditional and of mainly intangible nature);
- improving connections to the wider R&I community, and increasing advantages from integration in GVCs and MLG settings;
- increasing cooperation in innovation investment across regions;
- harnessing synergies and complementarities between EU policies and instruments.

Overview on the report

Against this multidimensional backdrop, this report sets out to synthesise the dispersed knowledge on a range of issues relevant for the success of priority setting and practices in place-based innovation policies. Policy dimensions of priority setting are outlined, followed by an overview on changing rationales and approaches to R&I policies and priority setting, and leading to the "new prioritisation logic" guiding S3 approaches. This is followed by two main lines aiming to facilitate improved priority setting: understanding better the wider innovation policy context, especially STI policies for system transformation, and making better use of Strategic Policy Intelligence (SPI) and other support tools (including learning from private sector strategy systems) to structure and guide policy cycles and implement appropriate policy mixes. Evidence (case study) on effective priority setting processes in S3-type exercises and policy recommendations complete the report.

2 Policy dimensions of setting priorities in strategy development: harmonising and adapting them for effective implementation

Priority setting, a persistent challenge to policy makers, has always and foremost been a reflection of political priorities and of political bargaining processes. Yet from the beginning of conscious efforts of prioritisation of policy actions, policy makers have also sought the support of tools of what nowadays is called 'strategic policy intelligence'.
(OECD 2007).

In this statement, three aspects have been highlighted, which strongly relate also to EU Cohesion Policy (CP) RIS3 development and implementation.

- It is a persistent challenge: as policies always compete for scarce resources, the selection of any priority (fields, activities, actors e.g.) impacts on, or is at the expense of other fields, activities, actors, and this means consequences for resource (re)allocation.
- It is influenced by political processes including the impossibility of implementing investment priorities decided originally. This implies that priority setting itself should be designed as a process, not a once-off exercise.
- Strategic policy intelligence (SPI) tools are (or should be) used with the aim to develop a convincing evidence base for the political bargaining, and to increase the impacts of the chosen policy options.

As challenging as it is, state-of-the art priority setting approaches have been proven key to enhancing the quality and effectiveness of policies and strategies, and to increasing return on public and private investments.

In today's fast-changing and complex policy environment, priority setting is a demanding task for policy makers aiming to position their region in a globalised economy, but even more so regarding R&I investments.

On the challenge-side:

- There are always less resources available than demands for their allocation, the percentage of R&I investments is still small in many countries' budgets, and often the first to be scaled down in times of economic crises.
- Especially in times of tighter public budgets and at the same time growing demands for 'unavoidable expenses', e.g., for health, the public service, retirement payments, security, it is all the more important to set R&I priorities that are convincing to policy makers in other fields, and to society at large.
- Investments in R&I are of a more long-term nature, inherently risky, the returns are often more difficult to understand and to communicate to the general public than in other policy fields, and their impact on societal well-being is sometimes unsure, and sometimes difficult to concretise.
- Hence, it has to be shown that sound considerations have taken place to balance expected public/private returns and possible risks, that the related investments are optimised for a high impact on other development goals too, and that the mix of policy tools chosen has been optimised for an efficient implementation.

On the facilitating side, positive outcomes of R&I investments can have multiplying effects, come in the form of high private and a range of public returns, and increase positive impacts in practically all policy areas (EC 2017d). Therefore, key aspects to enhance the quality and effectiveness of policies and strategies in general, are especially relevant for the prioritisation of R&I investments:

- setting priorities in the strategy development phase in a methodologically sound way, and as participative as this is possible respecting the nature of other policy processes in the society in question,
- harmonising own priorities as appropriate with priorities, strategies and programmes of other policy fields, territories and governance levels for increasing impact (synergies),
- reviewing and adapting priorities continuously to guide efficient implementation.

Given the political challenges to 'sell' R&I investments, and their inherently risky nature, longer-term programmes with their assurance of continuity are important, also to incentivise the participation of the private sector. Examples of such longer-term programmes of high relevance for European innovation actors are the EU R&I Framework Programmes (FP), which emerged themselves as a result of a new priority setting suggestion followed by a bold political bargaining move in 1984.

For the period of *Horizon 2020* (the 2014-2020 FP), a unique opportunity came with CP 2014-2020 aiming to strengthen the R&I focus of the ERDF. Part of the budget was 'R&I earmarked' through the R&I ex-ante-conditionality (ExAC), with the consequence that the related additional EU R&I support could result in approximately doubling the FP R&I investments.

ExACs, one of the key elements of CP reform, were introduced to ensure high quality and correctness of the investments, and at a higher level to better relate different parts of the EU budget and increase their contributions to the overall EU 2020 Growth Strategy. The R&I ExAC requires a RIS3 in line with the National Reform Programme and complying with the features of well-performing R&I systems.

The specific rationale given for introducing the R&I ExAC is as follows (EC 2013):

- ESIF investments in R&I risk not to deliver a sustainable impact on the regional / national economies in terms of higher knowledge-intensity and added value, unless they fit into a well-conceived comprehensive and targeted policy strategy that takes into account all national/regional assets, competitive advantages, and potential of businesses, researchers and universities.
- R&I policies – in particular at regional level - are often inward looking and fragmented, remain heavily focused on supply-side measures.
- Policies often concentrate on the manufacturing sector, are not supporting emerging sectors, innovation in services, cross-fertilisation between sectors, public sector innovation and non-R&D innovations.
- Policy measures are often generic copies of practices elsewhere that are not adjusted to the local/regional needs and potentials.

Some of the areas needing improvement, which were mentioned in chapter 1 concerning the 2016 state of affairs in ERDF implementation, clearly reverberate with the bullet points above. This shows how foresightful this ExAC was drafted anticipating key problems, which might arise in S3 development.

3 Priority setting in STI policies: changing rationales and approaches

Priority setting is only one element in political, economic and societal activities, but changes in R&I priority setting approaches have wide-ranging consequences on, e.g., other policy domains, policy mixes, instruments and funding, or resulting regional specialisation or S&T differentiation. It is a key element, and regarding S3, we see that a range of difficulties appearing in S3 implementation can be linked to inadequate priority-setting processes and to the type and granularity of priorities selected. In some cases, and more difficult to recognise, implementation difficulties can be traced back to conceptual thinking not reflecting today's innovation and societal reality any more, but still influencing important dimensions of the priority setting processes.

Some regions, often the ones with 'thick' innovation eco-systems and a broad spectrum of R&I policy measures in place, have done quite well with S3 design and implementation. To make their and other sources of know-how broadly accessible, the Joint Research Centre of the European Commission (JRC) has established the S3 Platform in Seville facilitating (http://s3platform.jrc.ec.europa.eu), i.a., peer-review and mutual learning.

Learning from good practice is important, but for learning in the EU's very heterogeneous R&I arena to be impactful the 'learners' should also have absorbed the concepts underlying those 'good' practices, and have (acquired) the necessary competences to apply them to the specifics of their 'place'.

With the demand for increasingly systematic and systemic approaches to strategy formulation in public policy the need arises for a systematic and functional integration of thorough and efficient priority-setting processes guiding policy action beyond selecting S&T investment areas (OECD 2007). This is also reflected in the growing number of actors with interests, competence and capacity for priority formulation, from macro-level to the intermediate and operational levels. To keep such processes feasible and manageable requires new cooperation approaches, and also appropriate divisions of labour between these levels, the allocations to general budget lines, and, further in the process, the operationalisation in the form of derived priorities and specific budgets.

This chapter gives an overview on how some aspects relevant for R&I priority setting have evolved: STI policies and selected aspects including types of priorities, levels of priority setting and institutional actors. A short overview on the R&I policy research background leading to the S3 concept builds then the bridge to the "new prioritisation logic" guiding the CP approaches.

Taking this up, the two subsequent chapters focus on improving priority setting for S3 design and implementation.

3.1 Priority setting in evolving public STI policies

As not only Carayannis et al. (2016) point out, priority setting for R&I is a complex, multi-dimensional undertaking. Not surprisingly, therefore, priority setting has seen shifting rationales and approaches in the changing environments of S&T developments and societal ones. Not surprisingly either, outcomes and processes still differ significantly due to national cultures, historically grown characteristics, and the rigidities of institutional frameworks and organisational settings (OECD 2016). Nevertheless, converging aspects of the guiding concepts underlying 'good' R&I policies, and the use of similar but case-adapted SPI tools (e.g. Foresight, Technology and Innovation Assessment, Roadmapping, international benchmarking and strategic, forward-looking evaluations, cf section 5.3) could make mutual learning and good-practice implementation a promising option.

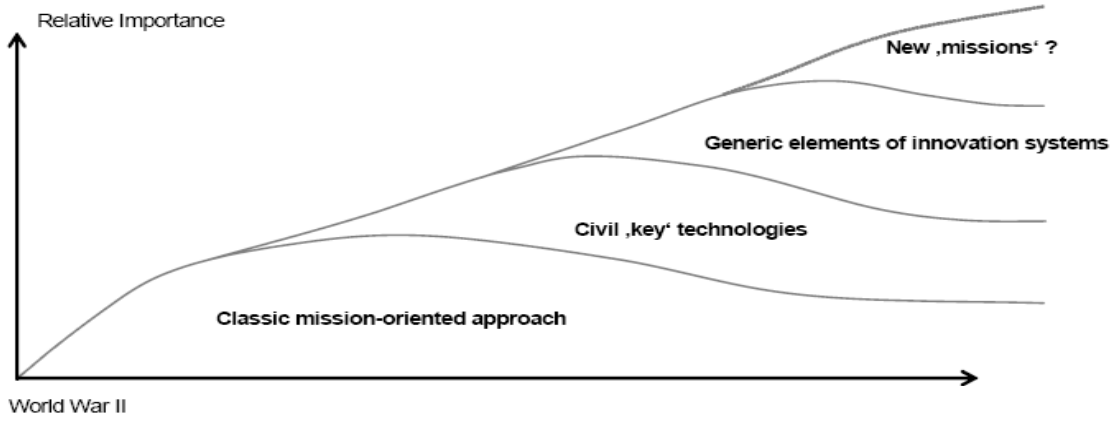
International cooperation in this respect has been incentivised, e.g. by the OECD-TIP 2007 exercise on priority setting, from which we summarise a general differentiation of priority setting processes.

- Types of priorities: mission-oriented, functional, thematic (details below).
- Levels and actors of priority setting concerning the hierarchical position of the priority setting actors and institutions in the regional/national innovation systems.
- The nature of priority setting processes (continuous; case- and phase-specific balances of top-down/bottom-up or of expert-input/participatory).

Types of Priorities: in Figure 1, four overlapping 'phases' of conceptualisation are outlined with their foci on different types of technologies or priorities:

- the 'classic' mission-led approach evolved during the 1940s (WWII) and the 1950s (emerging Cold War) concentrating on key military technologies;
- in the 1960s, broader approaches towards civil industrial 'key' technologies;
- from the 1980s, and with a new push by the rise of the (national/regional) innovation systems framework in the 1990s, a more systems-oriented approach focused on the improvement of functional and generic aspects, adopting principles of strategic planning, and decentralising priority setting to new intermediary institutions;
- from the first decade in this century on, a 'new' mission-led approach focused on new types of 'thematic' priorities, now oriented towards S&T areas crucial for addressing global societal challenges, and on priorities determined by societal needs and opportunities (cf. below for details).

Figure 1 : Overlapping phases of priority setting approaches



Source: OECD 2007

In Table 1, different dimensions of these phases are synthesised reflecting changing roles of R&I in society in general and the broadening of the rationale for R&I policies, the increasing complexity of globally interconnected innovation systems, with a larger number of actors involved, and policy tools available.

Table 1 Policy paradigms and priority setting dimensions

Technology Policy Paradigm	Thematic dimension	Legitimatory dimension	Institutional Dimension
'Old' Mission oriented approach	Emphasis on 'large-scale' technologies (i.e. defense, energy, transport etc.)	Production of 'public' and/or 'merit' goods	Top down definition of thematic priorities; Establishing of thematically specialised large-scale public R&D organisations (e.g. nuclear research centers)
'Industrial policy' approach ("key technologies")	ICT; Biotechnology; New Materials, Nanotechnology	Fostering competitiveness; Emphasis on static and dynamic economies of scale and specific market failures, especially spill-overs from 'generic' technologies	Emphasis on planning, technology forecasting, technology assessment; National Technology Programs;
Systemic approach	Emphasis on 'functional' aspects of the innovation system (co-operation; conditions for business start ups, regulation etc.)	"Systems failures" instead of market failures	Increasing number of actors/institutions involved in technology policy; Agencies as important players in technology policy
'New' mission oriented approach	Sustained Development; Information & Knowledge Society; Demographic Change and Aging; Mobility	Orientation towards societal needs and challenges	Integration of different societal groups; horizontal coordination of hitherto different/distinct policy areas, increasing number of actors

Source: OECD 2007

Understanding the nature of innovation processes has developed from a linear-process to a networking- and "open" model, and, influenced by the concepts of 'regional learning' and 'constructed advantages', has facilitated the evolution of related policy making: from 'science policy' to 'technology policy' and to full-fledged 'innovation policies' in a knowledge society.

With this changing nature of policies, prioritising has evolved from setting politico-scientific priorities in a strongly top-down manner, to techno-industrial priorities through processes with more bottom-up contributions, and to socio-political priority fields as results of integrated top-down and bottom-up process elements. Jointly developed by different 'helix actors' a range of new types of priorities can emerge such as addressing societal challenges aiming to fully harness synergies and to optimise the impacts of the public and private investments across a region.

With more details on the links between *understanding innovation – related policy making – prioritising*, Table 2 positions the changes in priority setting in the evolutionary context of other characteristics of public STI policies. It gives an idea how deeply priority setting is influenced by, and also influences a multitude of governance, political and societal developments. It thus indicates that many aspects, beyond the 'mechanics' of priority setting, have to be considered to arrive at impactful priorities allowing the implementation of strategies promising broader benefits for the economy and society.

Table 2 Evolution of public science, technology and innovation policies – selected characteristics

	1950s …….. mid 1970s	mid-1970s …… mid 1990s	from mid 1990s …..
Geographic scale	Mainly national	Growingly international and at the same time regional	Globalisation of economies, including more cross-border and inter-regional
Role of the state	Central actor in technological research & innovation processes	Decreasing role of the state, and diminishing regulative structures	Facilitator and coordinator of the self-regulation of innovation
Type of policies	Direct control	Towards more context control	Context control, support favourable conditions, strengthen absorptive capacity
Policy objectives	Political, economic, space	Economic stability, more social, organisational/institutional, environmental	Economic, social, cultural, organisational, institutional, environmental. Towards ethical and social responsibility
Policy guiding lines	Defence, economic growth, productivity	Industrial competitiveness, energy efficiency, change of industrial structure, towards diversification, information society	Techno-economic competitiveness, employment & quality of life, social & environmental compatibility, knowledge society
Justification of public funding	R&D effects to welfare; market failure; S&T infrastructure; areas of critical mass	Market & government failure. Areas of critical mass and long time horizon. Schemes for more actors. Negative externalities (environment, …)	Market, government, system failures. Positive innovation network externalities. Negative externalities (climatic change, ….)
Priorities and priority setting	Politico-scientific, top-down	Techno-industrial, more bottom-up elements	Socio-political, integrated top-down & bottom-up
Principal selection criteria	Scientific excellence	Scientific excellence and contribution to competitiveness & welfare	Contribution to needs of society, industry, environment; increasing pub/pub & pub/private co-investment synergies

	1950s …… mid 1970s	Mid 1970s …….. mid 1990s	from mid 1990s …..
Policy instruments	R&D subsidies, regulation, patent system	R&D subsidies, R&D programmes, taxation, technology transfer, incubating, pilot & prototypes, liaison offices, venture capital	cf. chapter 5
R&D activities	Individual - researchers and labs	Towards professional R&D activities, cooperation of researchers and labs	Professional & integrated R&D and production systems
Processes	Linear from R&D investment to R&D rates of return	Towards complex, growing emphasis on creation and dissemination	Complex, interactive and systemic innovation processes
Main innovation focus	Radical technological innovations	Incremental technological innovations, increase of social & organisational innovations	Technological and social innovations
Main funded technology areas	Large scale nuclear, military, aeronautics, physics, chemistry	Energy, civil aircraft, automation, electronics, computers, ICT; economic & social studies	ICT, materials, nano, bio & -omics, renewables; hybrid & generic S&T to address "Grand Challenges" (environment, energy, health, mobility, security, ….)
Evaluation scope	Scientific impact of research projects	S&T impact of projects, programmes, valuation of institutes and policies	Socio-economic, environmental, ethical impacts of projects, programmes, institutes, policies
Evaluation timing	Ex-post	Ex-post, towards ex-ante and intermediate	Integrated ex-ante & foresight & ex-post technology assessment & R&D evaluation
Evaluation process	Occasional	Towards professional and systemic	Professional and systemic practices

Source: Leijten, Loikkanen, 2015

3.2 Governance levels and institutional actors

Which types and granularity of priorities are appropriate, and how are they harmonised with the respective wider environment strongly depends on the focus of the exercise: whole governance levels, or individual actors such as funding bodies, research & technology organisations (RTO), or other institutional actors in the wider innovation system. Ensuring coherence between the levels and actors, and positioning the identified priorities convincingly in national, EU and global value chains becomes an increasingly difficult task. Specific support structures were established to help achieve greater coherence in the strategy and priority setting processes – councils, advisory bodies, inter-ministerial groups, or mutual-learning and support structures regionally, nationally or the EU JRC S3 platform.

Policy tasks at a higher level include addressing failures hindering the optimal development of a NIS/RIS, or defining which societal needs to be prioritised as having an R&I focus. Subsequently, intermediaries (funding agencies, innovation support organisations, etc.) and R&I performers (universities, research centres, enterprises) can translate those policy orientations into concrete actions and operational priorities.

Beyond formally agreeing on priorities and the division of labour, coherence requires that the totality of the decisions, taken by the innovation actors in a given priority area, can actually transform the potential of a field/domain/technology into benefits for the economy and society. Effective priority-setting requires, beyond a broad knowledge of a complex world, coherence, between the different actors in research, industry, policy and society, in their (up-to-date) understanding of innovation and innovation policies related concepts. This does not come automatically, as often the existing institutional remits and organisational structures and processes had developed at different times in the past, and are influenced by the concepts of those times, at least subconsciously. The same is true for a key feature of a strategic approach to priority-setting: the ability to thoroughly and optimally change course if context conditions change. Often, long-established institutional settings influence the nature of priority setting processes and also the type of R&I priorities chosen. Resulting path-dependencies limit the options to adapt policy strategies and reallocate resources.

3.3 Towards a 'new prioritisation logic' in the EU

The growing number of actors with interests in and competence for priority formulation, across the 4H spectrum and from macro-level to the intermediate and operational levels signifies considerable challenges for policy making. To keep processes in such a multi-actor, multi-governance environment feasible and manageable requires not only new cooperation approaches, but also appropriate divisions of labour between these levels, between broad strategic orientations, the allocations to budget lines, and further concretising them in the form of 'new' types of priorities and specific budgets. The 'new prioritisation logic' of Smart Specialisation is the most recent EU-wide approach to guide EU CP and related national and regional R&I funding.

The notion of Smart Specialisation was conceived around 2009 in a fruitful context – a range of academic discussions and policy deliberations on priority setting and S&T specialisation and support. OECD-TIP had finalised its Priority Setting exercise at that time, and CREST (today ERAC) discussion papers (in the context of the "Open Method of Coordination") brought priority setting and "European R&D and technological specialisations in the global economy" on the political agenda. In the framework of the multi-dimensional debate on New Perspectives for the ERA (EC 2007), the High-level ERA Expert group "Optimising research programmes and priorities" published its findings and recommendations for the way forward concerning research programme design and priorities across the EU, requirements for new policy initiatives, and policy options to address these (Acheson et al 2008).

Technical reports regarding international S&T specialisation were commissioned subsequently, i.a. in the context of "Strengthening the Foundations of the ERA" (Technopolis 2010), and a more focused policy support for General Purpose Technologies (GPT) was suggested to modernise existing industries by enabling them to conquer new markets (Landabaso 2012). Looking at the globally interconnected R&I systems, Vinnova studied the R&I prioritisation mechanisms in four settings: Europe's complex MLG arenas (especially the EU FPs), the US, China and Japan (Andree 2009).

On the 'fertile ground' of the deliberations in those years, JRC/IPTS and DG RTD organised a R&D specialisation workshop discussing whether there are benefits of having R&D efforts concentrated in a limited number of thematic areas and, if so, whether public funding should focus on, and corporate R&D investment be steered towards these areas guided by a transformation agenda aiming at structural changes to the economy. There, Foray outlined "a more vertical, targeted and preferential intervention logic of prioritisation" to help identify truly desirable areas for R&I policy intervention – those few new activities which originate from a decentralised and well-conducted EDP (Foray et al 2009). For this vertical priority-setting in a decentralised innovation economy, Foray refers to *New Industrial Policies* (Rodrik 2007, Aghion 2012) when emphasising the vertical logic of (broader-based, participative) prioritisation and at the same time avoiding the government failures often associated with top-down bureaucratic processes of technology selection.

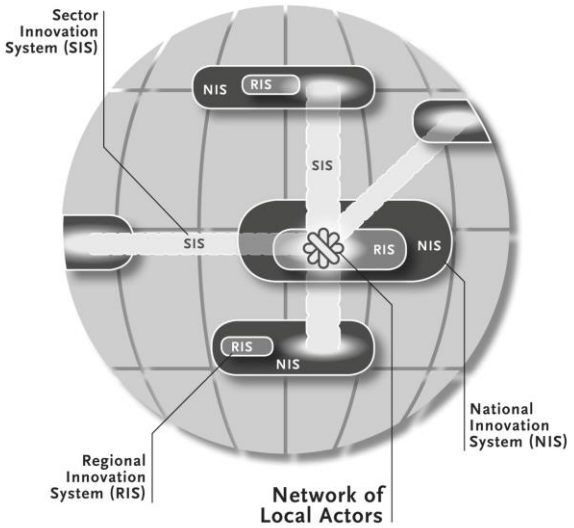
For success in this regard, the top-down priority fields have to be precise enough to focus resources and leverage synergies on the macro level, but also broad enough to enable regional actors to elaborate their most promising R&I priorities (Sautter, Clar 2017). An example for this type of priority setting is the focus on Key Emerging Technologies (KETs), at the EU level both in *Horizon 2020* and in ERDF, as well as in various national and regional support programmes. Aiming to create synergies and to optimise the impacts of public and private investments, current innovation-related policies focus on priority fields jointly developed by the different 'helix' actors – e.g. at a national level in the context of the German *Industry-Science Research Alliance*. Building on this, and earlier phases of its *High-Tech Strategy 2020*, Germany supports at present ten '*forward-looking projects'* harnessing the potential of KETs, i.a. for *Sustainable Mobility*, *Industry 4.0* or *Treating diseases more effectively with the help of personalised medicine*. At the European level, the second focus of *Horizon 2020 - Competitive Industries* – aims at developing European industrial capabilities in six KETS to achieve global leadership, and in the ERDF, one of the investment foci is "first production in KETs and the diffusion of General Purpose Technologies (*GPT)*". Numerous events and papers of different EU institutions stress the importance of KETs for regional development and for harnessing cross-programme synergies, and the "Roadmap for cross-cutting KETs activities in Horizon 2020" (EC 2014a) gives detailed guidance in the form of 13 specific roadmaps comprising 117 innovation fields of industrial interest.

Looking from another angle, this could be interpreted as *'macro-level smart S&T specialisation'* providing broadly defined priority fields as a frame or guidance for *'micro-level S3'*, in which regional stakeholders can develop (and implement) in a bottom-up process their strategies to generate specific technological solutions. The objective of this bi-directional approach is that the different regional strategies and priorities, if developed within the same macro-level priority fields, become complementary or mutually enhancing, and as a consequence increase the macro-level impact for the benefit of the EU as a whole (Sautter, Clar 2017).

Harnessing the potential of such approaches through impactful strategies requires to successfully integrate all relevant knowledge, which is usually divided and dispersed in, or even across innovation eco-systems. Therefore, Foray (2014) concluded that the organisational forms most appropriate for successful specialisation are networks, associations or partnerships, as well as large integrated companies. These types of local nodes in global knowledge flows ('clusters' in a more general sense; cf. Figure 2) and 'innovative hot-spots' in globalised value chains (cf. Cooke 2001; Bathelt et al. 2004) can

provide a solid base for entrepreneurial discovery and priority-setting processes with a view to regionally developed answers to societal problems, and also to trans-regionally aligned R&I specialisation strategies. As 'microcosms' in a complex world of cross-cutting regional and sector innovation systems, these types of 'clusters' constitute an important focus for multi-level, multi-sector strategic innovation policy support.

Figure 2: Network of local innovation actors as node in global value chains



Source: Clar et al 2014

Given their characteristics and roles in local and global innovation eco-systems, and the support toolboxes available to engage actors, to provide collective services and business linkages, and to support collaborative R&I and commercialisation, traditional clusters can also be important starting points for developing and implementing S3 and overcoming more inward-looking approaches to regional development policies. Cluster Policies, therefore, are highlighted as an important tool for both, S3 (Ketels et al. 2013) and system innovation (OECD, 2016).

In chapter 4, we elaborate further on similarities of "R&I Policies for Smart Specialisation" and "Innovation Policies for System Transformation".

By supporting these types of clusters/consortia/networks (capitalising on unique local assets of specialised regional systems, which are smartly interlinked within a global perspective), policy makers can expect two seemingly contradictory goals to be achieved: promoting *regional specialisation* (appropriate to the context of the regional related variety!) on the one hand, and *contributing to solutions of global challenges* on the other. With regard to the European Research and Innovation Area (ERA), the EU Council highlighted in its conclusions to the *Innovation Union* flagship the role of the smart specialisation concept "to guide priority-setting in national and regional innovation strategies, as well as cross-border cooperation where appropriate" (EU Council 2010). When the learning and priority-setting processes in the multitude of European regions are set in a common framework, trans-regional cooperation and priority 'harmonisation' can increase the impact of public and private R&I investments within but also, in the bigger economic and societal context, across regions.

Current Cohesion Policy applies this 'new logic' to the EU's heterogeneous regional landscape. S3 priorities are expected to be based on the different territorial strengths, related to the regional context such as development status, governance and 'thickness' of the innovation eco-system, as well as to other regions' and/or actors' activities. As varied as the most pressing local needs are, priorities could emphasise industry domains, technologies, knowledge fields, or societal challenges - all with a view to harnessing the potential of GVC synergies and the EU's multi-level governance (MLG) settings.

In order to optimise the spectrum of (parallel and subsequent) investments, S3 priorities are developed with a view to structuring and guiding the relevant policy and operational cycles, and to ensuring coherence from strategy development to implementation, which includes an appropriate policy support mix, call design and management and monitoring.

Summing up and given the strong interdependencies with political and societal developments, S&T priority setting processes and the resulting strategies differ significantly due to national cultures, historically grown characteristics, and the rigidities of institutional frameworks and organisational settings. In spite of these path-dependencies, converging aspects of the guiding concepts underlying 'good' R&I policies, and an integrated use of similar strategic tools could make mutual learning and good-practice implementation a promising option. Harnessing this potential, however, requires that the 'learners':

- are fully aware of the wider innovation policy context,
- have absorbed the concepts underlying those 'good' practices,
- and have (acquired) the necessary competences to apply the concepts to the specifics of their 'place'.

This will be further developed in the two following chapters.

4 Towards improved priority setting: policies focusing on system transformation

The considerations in chapters 2 and 3 have outlined how the changes in priority setting for 'R&I' were influenced by a broad range of related societal developments, and strongly shaped by the evolution of STI policies. Given the importance for setting impactful priorities, this chapter outlines more aspects of this evolution, especially regarding the most recent OECD-TIP project on Innovation Policy (OECD 2016). With its focus on priority setting for system transformation, it shows strong conceptual similarities with S3 'place-based transformation agendas'. The recommendations to make systems innovation harness its potential allow to draw important conclusions on how to address the current challenges of S3 implementation.

At the EU level, the *Europe 2020 Strategy* (smart, sustainable and inclusive growth), and similarly at a national level, the *High-Tech Strategy 2020 for Germany* (Ideas / Innovation / Prosperity, BMBF 2010) aim at a new policy framework for strengthening all facets of innovation systems. Broadly defined grand societal challenges (climate change, energy, mobility, food, security, diminishing resources, or an ageing population) as 'visionary' goals motivate innovation actors and entrepreneurs to leverage (trans-) regional learning and priority-setting processes with the aim to jointly develop answers to these challenges.

Another impetus for 'innovation policy learning' and setting priorities in a larger context and in cooperation with a larger spectrum of actors came from "Open Innovation" approaches at the enterprise level (cf. Chesbrough 2003). According to their new logic for R&I processes, market success comes mainly from continuously exchanging and linking knowledge from all types of sources from the identification of external knowledge to the anticipation of user needs. This requires the integration of actors from various fields and locations. For success in highly competitive markets, complex information flows, interactions and relationships between public administration, research organisations, industry and consumers have to be developed and managed. This is quite a challenge given traditional approaches concerning new knowledge developed in companies. Consequently, new ways of supporting innovation systems should aim to 'harmonise' more open and inter-national R&I activities at multiple governance levels, from organisational to regional and national up to supra-national levels. EU funding supported projects experimenting with approaches, which link regional open innovation cooperation across borders aiming to strengthen GVC (e.g. Clar, Sautter 2008).

To facilitate the absorption of this principle in the practical work of regional policy making, and already highlighting the importance of the outward looking dimension, e.g., the Commission supported the "Best Practices Guide on Open Innovation Policies" to facilitate the "opening up of the governance system for better horizontal and vertical cooperation, in order to accompany Open Innovation processes, which have become more and more transnational" (cf. Muguerza 2012). Guidance and support is published constantly in this field, such as WIPO's Guide "Strategic Management of Open Innovation" (Enkel 2015), a web-based compendium such as "21 Toolkits, Whitepapers, and Best Practices for Open Innovation" (WE THINQ 2017), or a hands-on introduction such as "Effective Co-Creation – A Guide to Open Innovation Programs" (Meisterjahn 2017)

Bringing main current lines of thinking together, the recent OECD-TIP innovation policy project focuses on the concept of 'system transformation' to orient innovation policies towards meeting societal challenges with the overall goal of sustainability (OECD 2016).

System innovation as a horizontal approach to innovation policy is directed at systemic problems, and aims, taking a longer-term view, at large-scale transformations in the way societal functions are fulfilled. It is built on a socio-technical understanding of innovation, which includes, beyond technological substitutions, changes in broader societal elements. It can be prompted or driven by new enabling technologies and firms, which often emerge at 'niche level' (spaces for radical innovation and experimentation), and

challenge or interact with established technologies, firms, and institutions at the 'regime level'.

Engaging a broad range of private and public sector actors, a successful transformation results from processes of co-evolution between the different elements and actors in socio-technical systems. This includes interacting at different levels (MLG). Various projects, e.g. in the FP7 Capacities Programme's Regions-of-Knowledge strand, experimented in this direction. By way of example: as a project addressing system transformation by focusing on KETs and lead markets, Open Innovation and MLG, the multi-regional CReATE project fostered the cooperation of highly innovative clusters in the creative industries, one of the emerging lead markets of the European knowledge economy. It incentivised and enabled a more systematic use of the innovation potential of ICTs. To strengthen the research potential of EU regions, and to increase related investments from EU, national & regional funds, CReATE aimed to "position regional capabilities in the most promising international technology and market development perspectives" (Clar 2007). Prospective tools and a focus on the trans-regional dimension laid the ground for self-sustaining economic success powered by iterative and participative priority setting cycles: agreeing first, at the trans-regional level, on common broader priority areas, then, in each region, developing focused regional priorities, and, again at the transnational level, adapting the different regional priorities in order to harmonise overall implementation. Thus, CReATE promoted synergies between regional, national, EU & research policies, and facilitated intra- and trans-regional cooperation and knowledge exchange between cluster development agencies, administration, researchers, SME and MNE.

Similarities of system innovation approaches with concepts of a true understanding of the CP's S3 as place-based transformation agendas can also be seen through the barriers to implementation: resistance to change, path dependency, inappropriate policy mix, gaps in skills and capabilities, and not considering the interdependencies of socio-technical systems in economic development. This can impede innovations from scaling and diffusing across socio-economic systems, resulting in limited gains to productivity, industrial competitiveness and sustainability. Therefore, similar to what we suggest for addressing current challenges in S3 implementation (cf. chapter 7), the overarching OECD 2016 recommendation to make systems innovation harness its potential focuses on broadening and improving the understanding of innovation (in general, and of barriers and facilitators in specific domains of systems innovation specifically).

Special emphasis is given to improving the context for, and to rethinking public funding and support (supply, demand, connectivity) for business R&D, i.a.

- Incentivising redesign of organisations and the institutional spectrum (incl. transfer of authority)
- Developing new ways to identify and set priorities to facilitate transitions by engaging incumbents and supporting new entrants.
- Increasing and improving policy intelligence and new tools such as agent-based modelling, network analysis and dynamic systems analysis to detect emerging technologies and facilitate their diffusion and widespread use.
- Promoting and experimenting with more 'targeted' innovation policy instruments such as public-private partnerships, public procurement of innovation, technology roadmapping and demonstration projects to better manage the process of co-creation in the development of new technologies
- Differentiating supply-side support (direct, and indirect such as tax credits) in a way that lock-out is facilitated, not lock-in.
- Intensifying whole-of-system co-ordination across policy domains (beyond R&I), governance levels and *quadruple helix* stakeholders, focus on connectivity support instruments.

- Fully exploring the potential of the knowledge-triangle concept, e.g. creating new ways to link research to innovation.

5 Towards improved priority setting: making better use of strategic tools to guide policy cycles

Innovation policies aiming at system transformation take impulses from and impact on practically all policy areas. Effectively supporting or reorienting R&I network configurations in this multitude of political, economic and societal activities requires the competent use of a combination of policy instruments (policy mix). Many of those instruments have been developed over time, but often there is insufficient knowledge of those tools, or lacking competence to use them for designing appropriate prioritisation and strategy processes.

After an overview on available innovation policy instruments, we discuss the importance of considering the cyclical nature of different policy-related processes. For an impactful use of those tools it is essential to allow for reviewing and adapting the original priorities while progressing along the overall cycle. We mention difficulties of actors not experienced in R&I policy making and participative processes to address S3 complexities with integrated priority setting and adaptation, and indicate how learning from private sector strategies could be useful for improving S3 approaches in more hierarchical governance settings.

Arriving at impactful priorities, which allow for the implementation of strategies promising a high return on public and private investments, has always been a key policy objective. Achieving this goal is closely related to developing, refining and using an appropriate combination of Strategic Policy Intelligence (SPI) tools and techniques, e.g. strategic evaluation, foresight, impact assessment and roadmapping. Those tools help identify, select, structure and 'translate' knowledge from the most diverse sources. This supports policy-makers to understand possible future S&T developments, to assess potential impacts, to arrive at preferred priorities, and to address related consequences. We outline a stylised policy cycle with its distinctive but interlinked phases, which is structured by SPI tools and guided by priority setting and continuous adaptation.

5.1 Essential for effective priority setting – selecting competently from the spectrum of implementation support instruments

For obtaining high returns on public and private investments, identifying promising priority fields is important, but it is not sufficient without prioritising the best suited instruments for implementation, referred to as the policy mix.

Given its importance, a spectrum of such instruments has been developed and discussed in the literature. In the synthesis paper of the NESTA compendium on "evidence of the effectiveness of innovation policy intervention", e.g., Cunningham et al (2013) have developed a taxonomy of (groups of) innovation policy instruments using overall policy orientation and policy goals as structuring elements (Table 3). For comparisons from a macro perspective, Boekholt et al. (2014) have, in their report on benchmarking impact, effectiveness and efficiency, looked at the accomplishments of innovation policy instruments in an international context.

Despite this ample availability of information, reality on the ground shows that there still is a long way to go until this potential is fully harnessed.

- Gianelle et al (2017), e.g., find in their detailed analysis of recent calls launched under ERDF OPs only a small involvement of new types of beneficiaries (third sector organisations, financial institutions, open-innovation platforms etc.), and that less than 1 % of the funds are allocated to more innovative instruments.

- Looking wider at the national level and budget lines across the EU, and over a longer period, the "Lessons from a decade of Innovation Policy" (Izsak et al 2013), point to a similar direction regarding the use of tools, highlighting, i.a.:
    - There is still a large share of institutional funding, an increase in funding devoted to R&D, direct support to business R&I, technology transfer, venture capital and support to start-ups, but a decrease in funding awareness-raising and innovation skills development compared to its importance as policy challenges.
    - EU27 innovation policy mixes remained very much oriented around industry-science collaboration R&D, which may be appropriate for technology leaders but not necessarily for modest and moderate innovator countries with less absorption capacity for businesses to innovate, unless the R&D is complemented by a focus on non-R&D innovation and innovation skills.

The analyses show a high homogeneity of the policy mixes, in spite of wide differences between countries: in technological and economic development, and concerning the roles of knowledge generation and absorption in the territorial growth trajectories. Therefore, the report questions the exclusive focus on policy transfer and the diffusion of 'best practice', as it would "de facto preclude a critical understanding of the factors that influence a country's technology upgrading".

There is a truth to this, of course, but equally there is a huge potential for gains that could come from good practice learning - if properly prepared and focused:

- learning from advanced policy making and priority setting will only be impactful if the 'learners' have absorbed the concepts underlying the measures taken elsewhere, and are able to apply them to the specifics of their 'place'.

This message for any 'mutual learning' approach is very relevant when analysing how others have developed their S3 priorities, and arrived at a truly place-specific policy mix aiming at a diversified specialisation in relation to the opportunities derived from the related variety in their economy.

Concluding, we mention here more reports synthesising the importance of optimally using innovation support instruments, to justify national and regional R&I investments and their impact, and, at the EU level, for their contribution to achieving the 3 % GERD goal:

CREST (today ERAC – European Research Area and Innovation Committee) had established a policy mix expert group peer-reviewing national practices in various rounds (Cunningham, 2007). DG RTD had commissioned a report on "Policy mix for R&D in Europe" (Nauwelaers et al, 2009), and the OECD had given prominence to "The innovation policy mix" in its STI Outlook 2010. In the above mentioned NESTA compendium on innovation policy intervention, policy mixes play a horizontal role in various of the 20 reports, and one report specifically reviews the "Innovation policy mix and instrument interaction" (Cunningham et al, 2013). The S3 Platform also commissioned a policy brief specifically on RIS3 Policy Mixes (Nauwelaers et al, 2014). It includes detailed recommendations on a range of aspects, so we do not have to go into the specifics of RIS3 policy mixes here.

Also mentioned in the RIS3 Policy Mix document, when discussing the need for more robust, systematic and systemic policy evaluations, are the policy cycle and SPI tools – the subjects of the following sections.

Table 3 Taxonomy of Innovation Policy Instruments

Report Title and Instruments	Overall orientation		Goals						
	Supply	Demand	Increase R&D spent	Increase non-financial capabilities		Systemic capabilities, complementarities	Enhance demand for innovation	Framework	Discourse
				Skills	Access expertise				
Fiscal Incentives for R&D	●●●		●●●	●○○					
Direct Support to R&D and Innovation in Firms	●●●		●●●						
Access to Finance, Publicly Supported Venture Capital and Loan Guarantees	●●●		●●●						
Policies for Training and Skills on Improving Innovation Capabilities in Firms	●●●			●●●					
Innovation and Human Resources Migration and Employment Protection	●●●			●●●					
Support Measures for Exploiting Intellectual Property	●●●				●●●			●○○	
Entrepreneurship Policy	●●●				●●●				
Technical services and advice	●●●				●●●				
Cluster Policy on Innovation	●●●					●●●			
Policies to Support Collaboration for R&D and Innovation	●●●		●○○		●○○	●●●			
Innovation Network Policies	●●●					●●●			
Measures to Stimulate Private Demand for Innovation		●●●					●●●		
Public Procurement Policies		●●●	●●○				●●●		
Pre-Commercial Procurement	●○○	●●●	●●○				●●●		
Innovation Inducement Prizes	●●○	●●○	●●○				●●○		
Standardisation and Standards	●●○	●●○					●○○	●●●	
Regulation	●●○	●●○					●○○	●●●	
Technology Foresight	●●○	●●○							●●●

Source: Cunningham et al. (2013): *Impacts of Innovation Policy: synthesis and conclusion*. Nesta Working Paper 13/21

5.2 Priority setting, adaptation and harmonisation - the cyclical nature of policy related processes

"the process … to select priority domains for investment does not finish once an S3 is adopted."

This citation of the Handbook on *Implementing S3* (Gianelle et al 2016) reminds us that, in addition to identifying priorities and designing appropriate policy mixes, it is essential to develop approaches, which allow for reviewing and adapting the originally set priorities when progressing along the overall cycle, and for relating them to other cycles in multi-actor, multi-level governance settings.

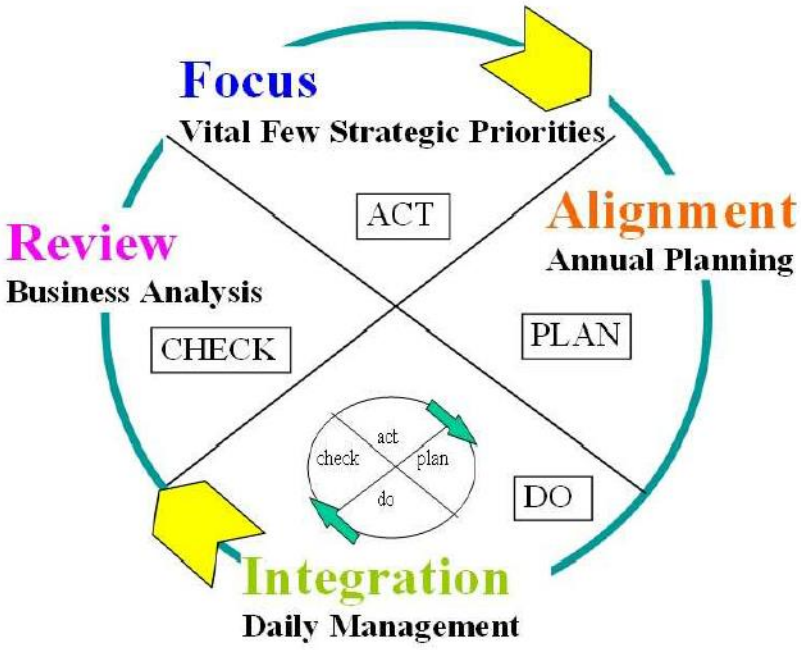
As a general background to the next section, we outline here quite different examples of graphical representations stressing this feature, and illustrating key policy making aspects and phases:

Learning from the private sector

As designing and implementing S3 successfully in today's complex innovation eco-systems is based on deep-going 4H interactions it is worth to also look for cyclical policy processes in the private sector.

One approach of companies, originally developed in Japan and then spread across the world, is the Hoshin Kanri strategic planning system (from Japanese "compass" and "execution"). It is based on a hierarchy of continuous cycles, where strategic priorities are set, communicated, transformed into actions at different levels, and constantly reviewed.

Figure 3: the FAIR Framework of Hoshin Kanri



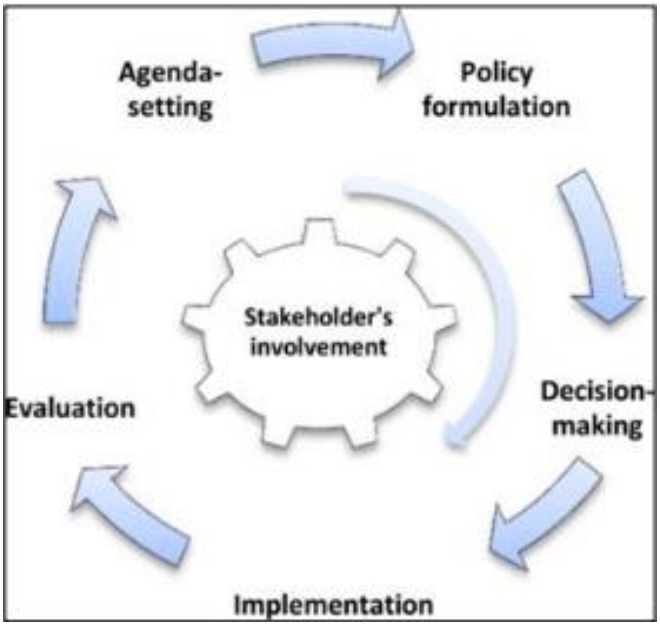
Source: Witcher et al, 2008

In the frame of this report, we outline two issues relevant for S3 as a place-based approach, which is supposed to link a multitude of activities at different levels, and which were designed and are implemented by a multitude of different actors:

- Figure 3, although a very simplified illustration shows how Hoshin Kanri works through its dynamic hierarchy of cycles. The main strategy cycle guides different strategic and operational circles, and levels of circles with their specific but harmonised timings. This dynamically stabilised system ensures that – constantly and interactively - the strategic goals can be (re)operationalised, resources (re)allocated, implementation reviewed, and feedback given into the respective phases of the higher-level cycles - with the final objective to get the overall highest possible return on investment.
- Although Hoshin Kanri is basically a top-down approach, one of its operational elements ensuring effective implementation could nevertheless be relevant for implementing the more participative S3 approach: a type of "catch-ball system" with regular meetings and interactions between hierarchical levels and functional entities to ensure that trans-department and also bottom-up information flows effectively and continuously throughout the company. Learning how to design and implement systematically a similar type of place-specific catch-ball system could be useful in regions, where the governance makes strongly participative approaches difficult to establish.

The EDP cycle (Gianelle et al 2016)

S3 implementation reality shows that sometimes the linear sequence in the S3 Guide 6-step-process (Foray et al 2012) is seen as an on-off approach, and not as guiding, and vice versa, adapting to, the subsequent phases of long and complex implementation processes towards achieving the strategic goals originally set in the strategy. In addition, Grienice et al (2016) stress that it does not represent distinct policy-making phases as understood and applied outside the CP community. In their *Horizon 2020* project, they suggest to use, instead, the (new) EDP as guidance for structuring S3 methodologies and online tools.



The EDP cycle (Figure 4), a multi-faceted knowledge-management process, was introduced in 2016 as the motor of the S3 methodology for "prioritising investment based on an inclusive and evidence-based process driven by stakeholders' engagement allowing a continuous reflection on market dynamics and opportunities".

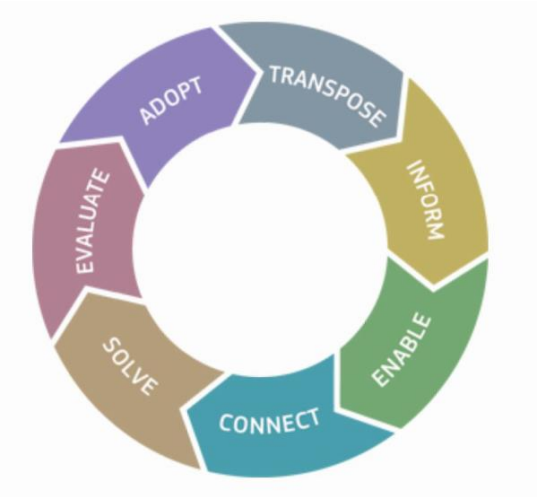
It highlights the cyclical nature by stressing that "the process … to select priority domains for investment does not finish once an S3 is adopted." Knowledge flowing from continuous and structured stakeholder interaction generates the base for realising those market opportunities, and for providing impactful support.

Figure 4: The Cycle of EDP, Source: Gianelle et al 2016

Figure 4, as well as the other figures in this section, are simplified diagrams. In reality, a well-designed EDP embraces a wide array of interconnected interaction processes.

Governance - how rules/norms/actions are produced, sustained and regulated – or more simply, how stakeholders interact and make decisions (i.a. set priorities):

As an important dimension of both S3 design and implementation, governance has a strong influence on priority setting (Gianelle et al 2016). Given the cyclical nature of good priority setting it is important to consider governance cycles, and the complex interactions of those cyclical elements between the levels of the EU's MLG system. Ensuring coherence between governance levels (the "transposing" element in Figure 5) generates strong dynamics influencing RIS3 design and implementation.



Only for illustrating this latter aspect we use the example of the Single Market governance cycle, "the set of mechanisms, rules and practices to design, implement, apply and enforce the (Single Market) regulatory framework", or "the way in which (the Single Market) works in practice and delivers concrete results."

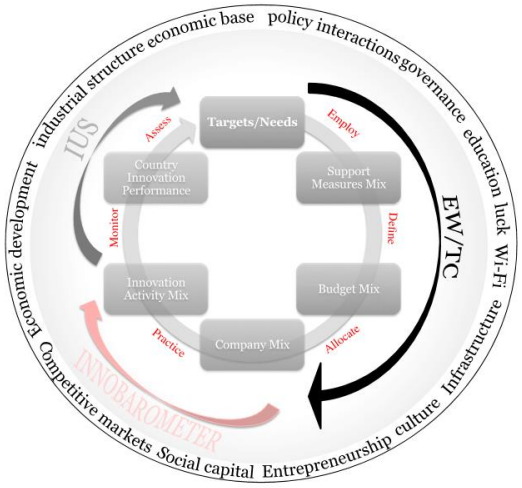
Figure 5: the Single Market governance cycle

Source: http://ec.europa.eu/internal_market/scoreboard/governance_cycle/index_en.htm

Lessons from Innovation Policy report (Izsak 2013)

As another example related to EU innovation policy, this report envisages possible future directions, and suggests a circle of evidence-based innovation policy (Figure 6) with interconnections between policy measures, innovation performance and practice. It encourages, besides monitoring parts of the innovation policy process, the joint analysis of results of these (and other) policy tools.

Figure 6: Evidence-based policy-making circle supported by key monitoring instruments



Source: Izsak 2013

These examples from different sources and domains stress the importance to consider, in general, the cyclical nature of policy-related processes. Concretely, however, it can be quite difficult for actors less experienced in R&I policy to understand the full picture of all connections between priority setting and re-orientation at different policy phases, and to draw the 'right' consequences for their place-based policy making without further guidance.

5.3 SPI tools and priority setting to successfully structure and guide policy cycles

To arrive at implementable and impactful priorities in complex and multi-linked R&I systems, it is essential to develop, refine and use Strategic Policy Intelligence (SPI)[1] tools and techniques, and also to exchange know-how and experience EU-wide (e.g. Cuhls, Jaspers 2004). SPI tools are methodologies used to provide decision-makers with comprehensive, objective, politically unbiased and future-relevant information. Those tools help identify, select, structure and 'translate' knowledge from the most diverse sources, thereby supporting policy-makers in understanding possible future S&T developments, assessing aspects and scope of related impacts, arriving, on this base, at preferred priorities, and addressing related consequences.

Regarding R&I policies, the SPI toolset had, in the 1960s and 1970s, a strong focus on technology planning and forecasting. Later, with strategic economic and societal goals incorporated in the R&I policy agenda, the toolbox was greatly enriched, e.g. by S&T and territorial foresight, technology & innovation assessment and complex roadmaps, but also (e.g. innovation) audits, (international) benchmarking, and, especially, a more strategic, forward-looking evaluation. Not taking the importance of the latter for priority setting sufficiently into consideration has negative consequences both on the type of priorities selected and on the policy mixes chosen.

Societal developments towards more participation influenced also the types of actors involved in "policy making": from groups of S&T experts in the S&T fields in focus, towards a broader spectrum of societal actors. In such participative approaches, an integrated use of SPI tools can guide the following: identify, come to a common understanding of, and select promising priorities, 'translate' knowledge between different institutions, actors, and domains in 4H innovation systems, and thus facilitate the development – and implementation – of a new type of 'better' policy options:

- more broadly based and consensual, more credible and implementable and, on average, less risky and more optimum. (Clar et al, 2008)

The implementation of SPI tools takes the form of SPI-based exercises addressing the logically linked but distinct phases in the policy cycle. Those use techniques which are also known from other activities, and include, data analyses (bibliometric, patent, big data etc), horizon scanning, weak signal identification, SWOT and STEEPV analyses, competence and stakeholder mapping, mind-mapping, relevance trees, morphological analysis, multi-criteria analysis, expert panels, focus groups, future workshops, web-based platforms, scenario workshops, to name a few.

SPI tools are most effective when supporting all phases of policy cycles. In this regard, the Commission Green Paper "ERA: New Perspectives" (EC 2007) mentions key SPI tools when stressing the need for "common principles for evaluations and quality assurance, joint identification of major societal challenges, optimised individual priority setting based on shared foresight and technology assessment exercises and their results."

Setting appropriate priorities is fundamental for evidence-based strategy processes to achieve the aim of shaping the future state (of a research area, an industrial sector, a

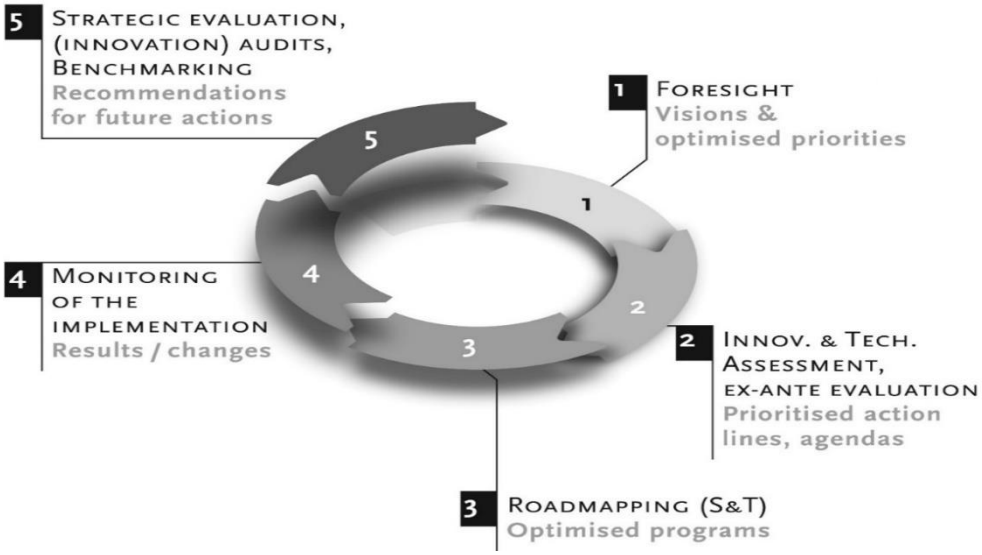
[1] "the set of actions to search, process, diffuse and protect information in order to make it available to the right person at the right time in order to make the right decision" (Tübke et al, 2001)

public or private organisation, a territory, or for S3, a "domain") by harnessing opportunities and addressing successfully the challenges it faces. Developing impactful strategies in globalised economies and complex societies, and this evidently applies to S3, requires advanced intelligence gathering going far beyond a traditional SWOT.

Over the years and in quite different policy environments (from e.g. Acheson et al 2008, to Sautter, Clar 2017) we have developed a policy cycle framework to guide strategy processes (Figure 7). Given its stylised nature, it is important to stress that in the reality of S3 design and implementation, e.g. by a 'cluster', a region or a country, a hierarchy of different strategy cycles are to be considered, all guiding and interacting with their related operational cycles. Harmonising the dynamics of the overall system through structured interaction and communication is key for the success of "strategies for resilient, inclusive and sustainable growth" through innovation.

This conceptual framework can support, and has indeed guided, RIS3 development and implementation in a variety of settings by stimulating new insights and opening new perspectives for the innovation actors involved, and by building mutual trust and strengthening commitment to joint actions.

Figure 7: From Vision to Action to new Futures: Strategic Policy Intelligence tools (upper lines) & main results (lower lines) in the policy cycle phases



Source: Clar, Sautter, 2014

0. *Stock-taking* (the territorial base for setting future priorities): 'auditing' with a focus on 'inward-looking' to analyse the localised assets within the region (specific territorial capital of a traditional and a more intangible nature), and linking it to international benchmarking (outward-looking') activities to assess the current position in the global context (global markets, GVCs, international scientific knowledge communities, potential competitors and cooperation partners, etc).

1. *Forward-looking* (the frame for future priorities): developing common perspectives, and defining visions of the future, through applying foresight-type approaches to reduce and structure global S&T as well as economic, societal and political developments. The aim is to identify the strategically most relevant ones, making recommendations on how best to realise them, and pointing to optimised priorities. As it looks into the longer term future, foresight can also stimulate trust building between stakeholders, which in the present could be competitors, and thus generate the commitment to work together in the future, in a 'co-opetition' type of implementation.

2. *Agenda-setting* (narrowing down the set of potential priorities): After a common vision is agreed, the higher-level priorities are concretised into prioritised lines of actions, and the implications of adopting particular options are assessed, compared, and prioritised. Subsequently, an agenda to move towards the prioritised options is worked out. This comprises general lines for a broad spectrum of R&I-related investments - in direct innovation support actions, but also strengthening infrastructure, facilitating cross-industry knowledge & technology transfer and innovation, establishing or reorienting education and training at all levels of the education system, reforming the R&I governance etc.

Although this phase is unavoidably influenced by different interest groups and political bargaining, it should still represent the results from the previous phase to deliver implementable and accepted outcomes. Technology or more generally innovation impact assessment techniques can be used to assess which of the identified options are most feasible, which impacts are to be expected for the different actors directly involved or indirectly affected, and how positive impacts can be increased and negative ones decreased.

In regions, where there is no strong tradition of foresight and technology assessment, there might be a familiarity with ex-ante evaluation approaches to assess potential success and utility of the options available.

3. *Action-planning* (from priorities to policy mixes): Detailing an agenda, e.g. a place-based, sectoral or organisational one, means concretising the issues on the agenda into mutually enhancing initiatives, programmes or policies supporting the innovation actors to harness promising innovation opportunities. A roadmapping exercise can develop an agreed perception of the options - available at present and which could be exploited in the future - together with concrete steps to best realise them, e.g. through support programmes optimised in the form of coherent policy mixes exploiting synergies with programmes in other policy areas and at other governance levels, and in other territories.

4. *Action-Taking and Monitoring*: In the implementation part of the policy cycle measures are applied to mobilise, from the most diverse public and private sources, the necessary resources against regional, national and global competition. The need for political and practical trade-offs and the constantly internal and external changing context makes this a different challenge to that of the design phase. Implementation should be accompanied by ongoing monitoring activities to ensure that the process is followed-up adequately, that appropriate actions are taken, and that the expected outcomes are achieved. (cf. Gianelle, Kleibrink 2015 for Cohesion Policy RIS3 monitoring). This means continuous feedback and a willingness to modify the implementation process – including the originally set priorities - to optimise its outcomes.

5. (or 0. for the next cycle) *Reviewing, renewed stock-taking* (adapting priorities): Results and outcomes are examined by means of benchmarking and strategic evaluation, providing recommendations for improvements in an ongoing, iterative process, or, closing this cycle, a starting base for future actions.

This phase should also include policy learning between territories, policy fields, and governance levels, referring to all processes by which knowledge and understanding is generated within decision-making processes through feedback on the underlying causes and preconditions for policies and initiatives, and on their effects.

It is beyond the scope of this report, to go deeper in the endless number of reports and guides on monitoring and evaluation, many with an increasing focus on whole-policy-cycle approaches and all-embracing sets of indicators. We briefly mention key issues of a just published report on good practices of evaluation and impact assessment (Dinges et al. 2017) of Joint Programming Initiatives (JPI), large inter-national consortia, where Member States commit to develop and implement together joint Strategic Research Agendas (SRA) to address major societal challenges. It highlights the benefits of Monitoring & Evaluation frameworks and activities, which include:

- the development of a comprehensive, focused set of indicators beyond operational objectives and the explicit linking of (the JPI's) vision, aims, and objectives to the indicator framework;
- tools for organisational learning, where impact assessment provides the opportunity to reflect on internal organisational processes that can feed back into revisions of SRAs;
- assisting the overall coordination and giving direction for future activities; and
- raising awareness among key stakeholders and improving impact communication.

6 Evidence on priority setting processes designed and implemented for successful S3 exercises

Case study: place-based, innovation-driven growth guided by integrated multi-level, multi-actor priority setting

In the preceding chapters, we have synthesised various aspects relevant for successful priority setting, and concepts and practices in innovation policies and strategies. Here, we highlight the specifics of a concrete specialisation exercise promoting excellent science and effective innovation for regional prosperity by aiming to position local innovation systems sustainably in global value chains (cf. Figure 2).

As elaborated in detail below, the MicroTec Südwest consortium (MTSW) of about 200 entities covering the whole spectrum from knowledge generation to transformation and exploitation, had emerged from a microsystems technologies (MST) cluster in Baden-Württemberg (BW), Germany. With its activities covering an area of about 5 million inhabitants, this exemplary case bridges place-based and more thematic policy approaches to develop the current local production stage in global value chains into a building block of place-based innovation strategies.

Matching 50/50 high private sector investments, the consortium had received national and regional support for its broad range of research, innovation, education and commercialisation activities. One argument for winning this support was that the consortium would have an additional focus on structured learning and competence building. A strategically and methodologically experienced team guided the projects by continuous priority development, setting and adaptation, well integrated in interlinked strategy and operational cycles of different 4H actors and at different levels. This approach was also key for the macro-economic results and the sustainability of the consortium as a whole, and the successful activities of the individual participants.

After having finished its first five-year cycle recently, MTSW can now build on new STI-related knowledge generated during the exercise, and new cooperation and market opportunities, but also on new R&I priority setting and management competences. Acquired in the guided strategic activities from benchmarking to priority setting to monitoring, those competences facilitate the sustainable continuation with new collaborative, developmental initiatives and additional partners.

In the following, we structure relevant features of this exercise by using aspects, which are considered characteristic and important for 'good' S3 as described in the S3 Guide (Foray et al 2012), the S3 Implementation Handbook (Gianelle et al 2016) or other related publications.

- Getting stakeholders fully involved in developing evidence-based strategies including a strong focus on priority setting, and sound M&E systems.
- Focusing policy support and investments on key priorities for knowledge-based development with a high potential to address societal challenges.
- Developing priorities based on own strengths, and, with a view to GVCs, on competitive advantages and potential for excellence – towards regional prosperity through global outreach.
- Aiming at an innovation-driven, place-based approach, embedded in a sound governance structure, stimulated by private sector investment, and supported by a multi-level, multi-policy-areas mix.
- Supporting all types of innovation priorities, developing a coherent policy mix for strengthening the whole innovation eco-system.
- Ensuring continuity in an upgraded innovation eco-system by increasing (in addition to STI) the strategic competences of all stakeholders, and by establishing sustainable and recurring policy cycles that can be reiterated and adapted.

1. Getting stakeholders fully involved in developing evidence-based strategy cycles including a strong focus on priority setting and adaptation, and sound monitoring and evaluation systems (see Figure 8: Interlinked strategy and operational cycles).

   Professionally guided, the consortium developed, adapted and harmonised the priorities for its strategy and for the strategies of individual actors, (Clar et al 2014) through an 'entrepreneurial discovery process' implemented as a three-year series of participative workshops and intermittent 'working phases'. It applied advanced intelligence gathering and management methodologies, and involved 130 participants from academia, industry, government/administration and funding agencies. The aim was to develop promising investment plans and identify funding options and instruments aiming at a broad mix of MLG support, but also to ensure sustainable progress by upgrading the regional innovation eco-system through integrated 'learning processes'.

   As a base for its strategy, the consortium considered a broad range of foresight exercises worldwide, but also harnessed the specific knowledge and know-how of the participants, and the experience embedded in the institutional, R&I and governance systems of the region. Interlinked with the main process at consortium level to harness the specific MLG arrangement, large projects and actor-groups implemented specific prioritisation processes in order to support the optimisation of their individual strategies, but with a view on the strategies of the other participants.

   To arrive at the 'right' granularity of priorities in these contexts, the consortium started in a 'funnelling' approach with the very broad priorities of the national Hightech Strategy, then limited it to the MST priority areas where the consortium had, in the preceding phase, identified its main comparative and competitive advantages. These were further narrowed down for each project consortium, and then for those projects, which would be proposed for funding. Proof of the 'right' granularity was that the priorities could be operationalised for each level and purpose chosen.

   If useful for increasing impact, a loop was included in each 'funnelling' phase for positioning or harmonising the own priorities with related ones of other programmes, other regions/countries, or other policy areas.

   The process (Figure 8): priority setting & reviewing underpinning the whole policy cycle:

   - Inward- and outward-looking, stocktaking: in-depth analyses/audits of the consortium, of the cluster, and of the situation in relevant global value chains, as well as benchmarking with key competitors worldwide were conducted in order to outline the territorial base for positioning both the strategic and the operational cycles, and for setting 'implementable' priorities.
   - Forward-looking: foresight and related activities were implemented to develop the frame for future priorities, and sets of potential priorities fitting this frame)
   - Agenda-setting: technology & innovation assessment, and ex-ante evaluation helped narrowing down, in an evidence-based way, the set of potential priorities, differentiated by 'level' – MTSW consortium, project consortia, actors)
   - Action planning, from priorities to 'policy' mixes: various harmonised roadmaps and Balanced Scorecards (BSC) were developed - from company to consortium levels
   - Action taking / mobilising public and private resources (not only financial)
   - Strategic and operational monitoring and evaluation: designing approach and indicators were guided by the priorities at the different levels, and concretely interrelated with the roadmaps/BSC.
   - Reviewing, renewed stocktaking (adapting & harmonising priorities between actors)

   The 'Operational Learning Cycles' were established to monitor and if necessary adapt the implementation of the ongoing projects in shorter periods. They ensure that the

results lead towards the planned project objectives, and also contribute to the overall consortium goals.

The objective of this participative approach was to create solid commitments for joint implementation activities inside the different project consortia and across the MTSW consortium as a whole.

Figure 8 is a simplified picture of interlinked strategy and operational cycles. It represents the different parallel cycles implemented by the consortium as a whole, as well as by key actors and actor groups.

Figure 8: Interlinked strategy and operational cycles

© Clar, Sautter

2. Focusing policy support and investments on key national/regional (EU) priorities for knowledge-based development with a high potential to address societal challenges.

   Microsystems are integrated systems of sensors, actors, data processors & transmitters in the micro-meter (10^{-6} m) dimension, highly miniaturised, multifunctional, robust and durable, multi-purpose 'smart' and efficient products. As General Purpose Technologies (GPT), MST enable intelligent, resource- and cost-reducing applications e.g., for advanced production and networked manufacturing, energy generation and management, mobility, personalised medicine/nutrition and healthy ageing, secure societies, environment and resources management, key infrastructures, and thus can boost economic development in practically all markets and sectors.

   By focusing on products, services, business models and cooperation management in the areas of Smart Health, Smart Production, Smart Mobility and Smart Energy, solutions are developed for key industrial, economic, societal and social challenges.

   As in other countries, MST are national priorities in Germany, embedded in both the the Internationalisation Strategy for Education, Science and Research (BMBF 2008, 2016) and the High-Tech Strategy 2020 (BMBF 2010) and, at the EU level, in H2020 and in ESIF. Concretely, MTSW's "Strategic Learning Cycle" was informed by high-

level national guidance on MST (BMBF 2006), by the EU-wide Strategic Research Agenda of EPOSS[2], and linked to MANU*future*[3] and its national and regional platforms.

3. Developing priorities based on own strengths, and, with a view to GVCs, on competitive advantages and potential for excellence – towards regional prosperity through global outreach.

   Baden-Württemberg is one of the global MST centres, representing about 15 % of all related patents worldwide, and 6 % of the global production with a large share being exported across the globe. Its MST-related research and training organisations have an excellent reputation, and the enterprises are, both, embedded in multiple ways in BW's "associational" innovation system with its "related variety", AND integrated in key global value chains.

4. Aiming at an innovation-driven, place-based approach, embedded in a sound governance structure, stimulated by private sector investment, and supported by a multi-level, multi-policy-areas mix.

   Governance:

   With its priority to further strengthen the MST innovation eco-system as a whole, and its activities in the South-West of the region, the BW government had established a related cluster initiative. Five years later, a large consortium was formed around the cluster management, which was successful with its application in the prestigious and highly competitive national "Spitzen"-cluster competition (BMBF 2010).

   Place-based approach (innovation-related actors and processes):

   The consortium aimed to contribute to the economic and social development of the region through its focus on excellent science and education, and on effective innovation. By its very nature, its priorities had a strong technology but also a place-based dimension: the approximately 200 consortium members are distributed in an area of about 5 million inhabitants, and practically represent a whole innovation eco-system with participants coming from a broad spectrum of university institutes, RTOs, large enterprises and SMEs, transfer and support organisations, education and training, and public bodies. Seen from a place-based knowledge management perspective, it thus covered the whole spectrum of *knowledge generation* (S&T-, innovation-, strategy-, management-, and policy-related research, education and (re)training) from schools to universities and enterprises) and *knowledge transformation and exploitation* (technological solutions, innovative products and business models, strategies, cooperation models).

   Private sector investment, multi-level and multi-policy-area support:

   The consortium aimed at a high impact on both the technology and the regional dimension through the results of its more than € 100 million investments. From a starting base of €40 million allocated by the enterprises, the priority projects developed by the consortium attracted € 40 million national funds from the "Spitzen"-cluster competition, which in turn drew additional € 5 million from the regional government. During the five years of implementing the "Spitzen" cluster funded projects and, in parallel, developing priorities and strategy for the following years, additional public support was mobilised from regional, national and EU programmes in various policy fields, and high investments from the private sector too.

5. Supporting all types of innovation priorities, developing a coherent policy mix for strengthening the whole innovation eco-system.

   The priority activities of the consortium were co-funded by the public sector with the expectation of

[2] European Technology Platform on Smart Systems Integration
[3] European Technology Platform assuring the future of a competitive and sustainable manufacturing in Europe

- sustaining the regional economy and quality of life through a globally competitive innovation eco-system, active in worldwide cooperation along key international value chains,
- maintaining and creating sustainable jobs, and
- attracting investments and qualified labour to the region.

To optimally profit from the national and regional R&I support, consortium members invested own funds in 25 R&I projects in prioritised application areas, but also in 'Structural Projects' which focused on:

- education and (re)training modules for all levels, from schools to vocational training to higher education, and awareness raising across the society
- MST-specific recruiting approaches
- R&I-speeding-up and –support, strengthening related competences, and providing tailored support to the different technology development phases
- Joint system development and system integration, platforms
- Pilot & small-scale series production
- Building methodological and process competence for all actor groups, strengthening knowledge management, communication and cooperation mechanisms
- Internationalisation and market penetration
- Development, adaptation and implementation of priorities and strategies

6. Ensuring continuity in an upgraded innovation eco-system by increasing (in addition to STI) the strategic and methodological competences of all stakeholders, and by establishing sustainable and recurring policy cycles that can be reiterated and adapted

   To improve, also in the long term, strategic capabilities and advanced methodological competences in the MTSW world, the strategy processes were, besides their guiding and knowledge management role, organised with a focus on structured learning and competence building. Public and private decision-makers were supported to advance those capabilities to strengthen strategic competences in the region. The objective was to enable the management of their priorities and strategies without professional guidance, assess them from a broad range of perspectives, and develop actor-specific, synergistic approaches to more promising and less risky R&I and education etc. investments.

   Today, the cluster initiative has grown to nearly 400 partners, and towards the end of the "Spitzen" cluster funding, the self-organised working groups below have emerged:

   Technology-focused working groups:

   - Priority "Functional Embedded Systems": next-generation Smart Systems (deep hardware-software integration; human-machine interaction; security)
   - Priority "Energy-autarkic Systems": energy generation and management for microsystems
   - Priority area "Autonomous Systems" and "Client-specific Integrated Systems": functional printing technologies; functionally structured surfaces

   Application-oriented:

   - Priority "Smart Health": In-Vitro-Diagnostics, intelligent implants

   Horizontal:

   - Priority "methodological competences": cooperative innovation processes (in/between organisations), open innovation and protected spaces, new business models and Cost-Benefit-Analyses or optimisation of established ones

The working groups continue to be active in further developing, assessing and refining their priorities, detailing agendas, and developing joint actions also with partners beyond

the region and the country. After the end of the (once-off) "Spitzen" cluster funding, cluster members successfully attract funding from different types of regional, national, EU and broader international programmes and networks.

7 Policy recommendations

Priority setting is a key element in all policy making, and naturally permeating all types of specialisation policies. Regarding S3, one can easily see the importance by searching for "priorit…" in the S3 Guide (Foray et al 2012): more than 100 hits. In the S3 Implementation Handbook (Gianelle et al 2016) priorities and priority setting appear even more often, about 150 times.

The following, non-exhaustive list of recommendations is based on the current state of affairs of S3 in general, and the case study specifically:

Ensuring that priority setting processes:

- are not seen as a 'tick-the-box' nor a myopic exercise, but based on state-of-the-art methodological competences or guidance;
- have considered, and can be related to the results of other EU or national priority setting exercises, e.g., at the EU level, to Strategic Research Agendas, Strategic Research and Innovation Agendas, Strategic Implementation Plans, Strategic Roadmaps, etc.;
- harness the potential from linking to, e.g., the wider regional, national and international R&I community, other R&I programmes incl. those in sector policies, other R&I settings (e.g. the Knowledge and Innovation Communities, Joint Undertakings, clusters), other policy fields, strategies and activities of other regions and other institutions;
- are based on broad *quadruple helix* (4H) participation, and, in turn, address the interests and needs of the different 4H actors in the region;
- consider all types of knowledge generation and management processes (knowledge triangle);
- play a constant guiding and accompanying role in the whole policy cycle, beyond the forward- and agenda-setting phases, aiming for 'institutionalised' ongoing processes;
- provide direct guidance for implementation and meaningful indicators for monitoring and evaluation, and lead to a monitoring approach which 'enforces' coherence from priorities to strategies to budgets to implementation;
- aim at sustainability by integrated capacity and capability building (strategic, methodological, and R&I management).

Guiding priority setting in a way that the priorities developed:

- focus on areas where, realistically, the local conditions allow for growth when appropriately supported, can contribute to, and be supported by higher-level policies (in the EU, e.g., to the Europe 2020 Growth Strategy);
- focus on areas where, realistically, the integration in GVC brings advantages to the region, and local innovations can be scaled-up take into consideration the advantages from embedding local activities in GVC;
- allow to harness the potential of societal challenges as drivers of economic growth;
- are based on a broad understanding of innovation, and allow for the development of an appropriate policy mix based on a comprehensive knowledge of innovation support tools;
- have the 'right' granularity depending on goals, context, and governance levels;
- can be fine-tuned for new partners, and differentiated for follow-up exercises.

Coaching priority setting and strategy development.

- Generally: ensuring that the broad set of competences are available, or are brought in, or are developed during the exercise, which are necessary for managing the priority setting activities effectively and efficiently.

- Specifically: finding out which concepts of innovation and innovation policies really and deeply guide the thinking of key actors involved, and then guiding participants (from where they are in their thinking and competences) towards the current understanding of key principles of S3, EDP etc.

Designing calls or submitting proposals for S3 related funding:

- Taking key RIS3 aspects seriously - R&I, strategies, place-based and place-specific, experimenting.
- Incentivising in the call text, & subsequently providing evidence in the proposal for:
    - a consortium representing different innovation system actors incl. new types of beneficiaries,
    - a policy mix, which is case-specifically optimised including more innovative instruments.

Allocating specific budgets for:

- continuous and deep-going priority setting and adaptation, and for collecting and structuring all knowledge needed (from inside or outside);
- capability building and interactive 'learning' to ensure strategic and methodological sustainability too;
- improving key processes in the innovation eco-system.

Reducing unnecessary work for applicants and evaluators, and increasing effectiveness of programmes in order to increase the impacts of individual priority setting exercises:

- (really!) 'slim' first application phases, and the 'right' focus and granularity of the paper work demanded in the different evaluation and monitoring phases.

Strengthening the base for achieving the above across the EU and in all types of regions:

- improving, between/in DGs, ministries and agencies, mutual information and the use/adaptation/harmonisation of project cycles, support tools, selection criteria etc.;
- incentivising structured mutual learning and cooperation between EU and national bodies, and different policy communities (R&I, Cohesion, Agricultural, Social, Health, Energy, etc.);
- cooperating – across governance levels - towards longer-term structural changes to better relate post-EU2020-related strategies, processes and their timeframes.

References

Acheson H. et al. (2008): *Optimising research programmes and priorities.* Report of the ERA Expert Group. DOI: 10.2777/32046. Luxembourg

Aghion P. (2012): *innovation process and policy: what do we learn from new growth theory?* In: Lerner, J., Stern, S. (eds): The Rate and Direction of Inventive Activity Revisited. The University of Chicago Press, NBER, Chicago, IL.

Aghion P. & Jaravel X. (2015): Knowledge Spillovers, Innovation and Growth. *The Economic Journal* 125, p. 536

Andree D. (2009): *Priority-setting in the European Research Framework Programmes*. Vinnova Analysis VA 2009:17. ISBN 978-91-85959-69-3. Vinnova Publishing

Bathelt H., Malmberg A., & Maskell P. (2004): Clusters and Knowledge: Local Buzz, Global Pipelines, Process of Knowledge Creation. *Progress in Human Geography,* 28 (1) 31-56.

BMBF – Federal Ministry of Education and Research (2006): Rahmenprogramm Mikrosysteme. i.a. https://www.bmbf.de/foerderungen/bekanntmachung-148.html

BMBF (2008, 2016): *Strengthening Germany's role in the global knowledge society. Strategy of the Federal Government for the Internationalisation of (Education,) Science and Research*.

BMBF (2010): *Ideas. Innovation. Prosperity. High-Tech Strategy 2020 for Germany*.

Boekholt P., Ploe M., Arnold E., Giarracci F. (2014): *In search for a benchmark of impact, effectiveness and efficiency of innovation instruments*. Technopolis report

Capello R., Kroll, H. (2016): *From theory to practice in S3: emerging limits and possible future trajectories*. European Planning Studies, 24 (8): 1303-1406

Carayannis E., Campbell D. (2012). *Mode 3 Knowledge Production in Quadruple Helix Innovation Systems: 21st-Century Democracy, Innovation, and Entrepreneurship for Development*. New York, NY: Springer.

Carayannis E., Grebenyuk A. Y., Meissner D. (2016): Smart roadmapping for STI policy. *Technological Forecasting and Social Change*,

Chesbrough H. (2003). *Open Innovation. The new Imperative for Creating and Profiting from Technology*. Boston: Harvard Business School Press.

Clar, G. (2007): Project proposal for CReATE. cordis.europa.eu/project/rcn/85732_en.html

Clar G., Acheson H., Hafner-Zimmermann S., Sautter B., Buczek M., Allan J. (2008): *The RegStrat Guide to Strategic Policy Intelligence Tools: Enabling better RTDI policy making in Europe's regions*. Stuttgart/Berlin: Steinbeis Edition.

Clar G., Sautter B. (2014): *From shared knowledge to collective action - the Strategy Process of the 'Spitzen'-cluster MicroTEC Südwest*. In Hebakova, Hennen, Michalek, Nierling, Scherz (Eds.) *Technology Assessment and policy Area of Great Transitions*

Clar G., Hafner-Zimmermann S., Sautter B. (2014): *Strategiekompetenz für mehr Innovations- und Wettbewerbsfähigkeit*. ISBN 978-3-95663.003-3. Steinbeis-Edition

Clar G., Boekholt P., Nauwelaers C., Saublens C., Tiits M. (2015): *Perspectives for Research and Innovation Strategies for Smart Specialisation (RIS3) in the wider context of the Europe 2020 Growth Strategy.* DOI: 10.2777/872170. Luxembourg

Cooke P. (2001): Regional innovation systems, clusters, and the knowledge economy. *Industrial and Corporate Change*, 10(4), 945-974.

Cuhls K., Jaspers M. (eds) (2004): *Participatory Priority Setting for R&I Policy*, Stuttgart, ISBN 3-8167-6468-1

Cunningham P. (2007): *Horizontal analysis of country reviews: R&D investment policies*. PREST, synthesis report of the CREST Policy Mix project

Cunningham P., Edler J, Flanagan K, Laredo P. (2013): *Innovation policy mix and instrument interaction: a review*. Nesta Working Paper 13/20

Dinges M., Köngeter A., Wang A. (2017): *Summary report on good practices in the implementation of JPIs*. Austrian Institute of Technology

Enkel (2015): WIPO's Guide *Strategic Management of Open Innovation* (CDIP/16/INF/3)

EU Council (2010): *Council Conclusions on Innovation Union for Europe,* 3049th Competitiveness Council meeting. Brussels, 26 Nov 2010.

European Commission (1995): *Green Paper on Innovation*. COM (95) 688 final

European Commission (2007): *Green Paper: The European Research Area: New Perspectives.* COM(2007) 161 final

European Commission (2010b): *Regional Policy contributing to smart growth in Europe 2020".* COM (2010) 553 final

European Commission (2010c): *EUROPE 2020: A strategy for smart, sustainable and inclusive growth*. COM (2010) 2020 final

European Commission (2013): *Guidance on Ex ante Conditionalities*, Part II, 13 Feb 2013

European Commission (2014a): *Roadmap for cross-cutting KETs activities in Horizon 2020*. Brussels 2014

European Commission (2014b): Political Guidelines for the next European Commission, https://ec.europa.eu/commission/publications/president-junckers-political-guidelines_en

European Commission (2017a): Strengthening Innovation in Europe's Regions. COM(2017) 376, and SWD(2017) 264

European Commission (2017b): *White Paper on the Future of Europe.* COM 2017(2025)

European Commission (2017c): *Paper on Harnessing Globalisation*. COM(2017) 240 final

European Commission (2017d): *The Economic Rationale for Public R&I Funding and its Impact.* doi: 10.2777/047015

Foray D. (2012): *Smart specialisation and the New Industrial Policy agenda*. Policy Brief No. 8 of the High-level Economic Policy Expert Group "Innovation for Growth - i4g" of the European Commission. http://ec.europa.eu/research/innovation-union/pdf/expert-groups/i4g-reports/i4g_policy_brief_8_-_smart_specialisation.pdf.

Foray D., Goddard J., Goenaga Beldarrain X., Landabaso M., McCann P., Morgan K., Nauwelaers C., Ortega-Argilés R. (2012): *Guide to Research and Innovation Strategies for Smart Specialisation (RIS3)*. Luxembourg

Foray, D. (2014): *Smart Specialisation, Opportunities and Challenges for Regional Innovation Policy.* London: Routledge.

Gianelle C., Kleibrink A. (2015): *Monitoring Mechanisms for Smart Specialisation Strategies*. S3 Policy Brief No. 13/2015. ISSN 1831-9408

Gianelle C., Kyrakou D., Cohen C., Przeor M. (eds) (2016): *Implementing Smart Specialisation: A Handbook.* European Commission, doi:10.2791/53569

Gianelle C., Guzzo F., Mieszkowski K. (2017): *Smart Specialisation at Work: Analysis of the calls launched under ERDF Operational Programmes*. JRC Technical Reports JRC106974

Griniece E., Rivera León L., Reid A., Komninos N., Panori A. (2016): *State of the art report on methodologies and online tools for smart specialisation strategies*. (in the

framework of Horizon 2020 project Online S3: ONLINE Platform for Smart Specialisation Policy Advice)

Izsak, K. et al: Lessons from a Decade of Innovation Policy. Final Report, EU, June 2013

Ketels C. et al (2013): *The role of clusters in smart specialisation strategies*. DOI: 10.2777/43211. Luxembourg

Landabaso M. (2012): *What public policies can and cannot do for regional development.* In: Cooke, P., Parrilli, M.D., Curbelo, J.L. (eds): Innovation, Global Challenge and Territorial Resilience. Cheltenham: Edward Elgar, 364-381

Leijten J, Loikkanen T. (2015): *The International Innovation Policy Network 6CP - 40 years of innovation policy research – lessons from the past and future outlook*. Background paper

Leydesdorff L. (2012): The Triple, Quadruple, and N-Tuple of Helices: Explanatory Models for Analysing the Knowledge-Based Economy? *Journal of the Knowledge Economy*, 3(1), 25-35.

Meisterjahn M. (2017): *Effective Co-Creation – A Guide to Open Innovation Programs.* Hype Innovation Blog, https://blog.hypeinnovation.com/effective-co-creation-a-guide-to-open-innovation

Muguerza R. (Ed.) (2012): *Embracing Open Innovation in Europe: A Best Practices Guide on Open Innovation Policies.* Pamplona: Gráficas Lizarra. http://www.euris-programme.eu/docs/euris_guide

Nauwelaers C et al (2009): *Policy Mixes for R&D in Europe.* Study, UNU-MERIT

Nauwelaers C, Perianez Forte I, Midtkandal I (2014): *RIS3 Implementation and Policy Mixes.* doi:10.2791/13295

OECD (2005a): *Governance of Innovation Systems. Volume 1: Synthesis Report*. Paris

OECD (2007): *Issues in Priority Setting*. Working Party on Innovation and Technology Policy, 29-OCT-2007

OECD (2010): *The innovation policy mix*. in OECD STI outlook 2010, OECD Publishing, Paris, http:/dx.doi.org/10.1787/9789264083479-en

OECD (2015): *The Impact of R&D Investment on Economic Performance*. DSTI/EAS/STP/NESTI (2015)8

OECD (2016): *Innovation Policies for System Transformation*. Working Party on Innovation and Technology Policy, DSTI/STP/TIP (2016)9, 11-OCT-2016

Rodrik D. (2007): *Normalizing Industrial Policy*. Paper prepared for the Commission on Growth and Development.

Sautter B., Clar G. (2008): *Strategic Capacity Building in Clusters to Enhance Future-oriented Open Innovation Processes.* EFMN Foresight Brief No. 150. http://www.foresight-platform.eu/brief/efp-brief-no-150-strategic-capacity-building-in-clusters-to-enhance-future-oriented-open-innovation-processes/

Sautter B., Clar G. (2017): Strategic guidance in 'leading-edge' clusters for sustainable business success in future markets. *International Journal of Business and Systems Research* 11(3):243, doi: 10.1504/IJBSR.2017.085468

Sörvik J., Midtkandal I., Marzocchi C., Uyyarra E. (2016); *How outward-looking is Smart Specialisation?* Policy Brief Series No. 16/2016, doi:10.2791/943671

technopolis group, Peter V., Bruno N. (2010): *International S&T Specialisation: where does Europe stand?* DOI: 10.2777/83069. Luxembourg

Tübke A., Ducatel K., Gavigan J., Moncado-Patrerno-Casello P. (Eds.) (2001): *Strategic policy intelligence: Current trends, the state of play and perspectives*. IPTS Technical Report Series, EUR 20137.

WE THINQ (2017): *21 Toolkits, Whitepapers, and Best Practices for Open Innovation*. https://www.wethinq.com/en/blog/2015/04/07/tools-for-open-innovation.html

Witcher B.J., Chau V.S., Harding P. (2008): *Dynamic capabilities: top executive audits and hoshin kanri at Nissan South Africa*. International Journal of Operations & Production Management 28(6):540-561

GETTING IN TOUCH WITH THE EU

In person

All over the European Union there are hundreds of Europe Direct information centres. You can find the address of the centre nearest you at: http://europea.eu/contact

On the phone or by email

Europe Direct is a service that answers your questions about the European Union. You can contact this service:

- by freephone: 00 800 6 7 8 9 10 11 (certain operators may charge for these calls),

- at the following standard number: +32 22999696, or

- by electronic mail via: http://europa.eu/contact

FINDING INFORMATION ABOUT THE EU

Online

Information about the European Union in all the official languages of the EU is available on the Europa website at: http://europa.eu

EU publications
You can download or order free and priced EU publications from EU Bookshop at: http://bookshop.europa.eu. Multiple copies of free publications may be obtained by contacting Europe Direct or your local information centre (see http://europa.eu/contact).

JRC Mission

As the science and knowledge service of the European Commission, the Joint Research Centre's mission is to support EU policies with independent evidence throughout the whole policy cycle.

EU Science Hub
ec.europa.eu/jrc

@EU_ScienceHub

EU Science Hub - Joint Research Centre

Joint Research Centre

EU Science Hub