SHORT ANALYSIS
TECHNOLOGICAL INNOVATION SYSTEM (TIS)

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Introduction

This is a short analysis by which you can put into practice the Technological Innovation System Perspective (TIS).

1. What is the innovation for your TIS analysis?

TIS is developed for technology-based innovations, such as PV, offshore wind, biofuels or aquatic biomass. But it was successfully applied to for example Retrofitting.

2. Based on your knowledge of the innovation, use the table 1 below to identify the 'structural dimensions': the actors, institutions, interactions, and infrastructure.

Table 1: Structural elements of TIS

Structural elements:	Subcategories:
Actors:	- Civil society - Companies: start-ups, SME's, large firms, MNC's - Knowledge institutes: universities, technology institutes, research centres, schools - Government - NGOs - Third parties: legal organisations, financial organisations/banks, intermediaries, knowledge brokers, consultants
Institutions:	- Hard: rules, laws, regulations, instructions - Soft: customs, common habits, routines, established practices, traditions, patterns of behaviour, norms, expectations
Interactions:	- At the level of networks - At the level of individual contacts
Infrastructure:	- Physical: artifacts, instruments, machines, roads, buildings, networks, bridges, harbours - Knowledge: knowledge, expertise, know-how, strategic information - Financial: subsidies, fin. programs, grants etc.

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In short, analyse if all relevant actors are present, if they are positive or negative about the system and if they have the capacity to innovate. Are all institutions in place and supportive to the analysed TIS? What are the interactions; are they bilateral or are they within one actor's group only? Infrastructure – is it sufficiently developed to support the creation of the system or is it, for example missing specific knowledge?

3. What is the system's functional pattern?

Use the following indicators (see table 2) and a six-tier scale of: absent, very weak, weak, moderate, strong, very strong to evaluate each of the seven functions. You can use table 3, last page, to jot down your evaluation.

Table 2: The TIS functions

Function	Indicators are for example:
F1 entrepreneurial activities	New entrants, experiments, start-ups, diversification activities
F2 knowledge development	R&D projects, demonstration projects , patents, journal publications, reports, prototypes
F3 knowledge diffusion	Workshops, conferences, network activities
F4 guidance of the search	Long-term targets of governments and industries, expressed visions, alignment of expectations of relevant actors, Visions, expectations, policy documents, demand articulation by leading customers
F5 market formation	The number of niche markets, specific tax regimes , new environmental standards that improve the chances for new environmental technologies
F6 resources mobilisation:	Human capital: education, specialized training programs Financial capital: venture capital, public seed money, private investments Physical: natural resources, infrastructure
F7 creation of legitimacy:	Size and growth of interest groups/advocacy coalitions and their lobby activities, size of network around technology, actions that legitimize technology, number of exhibitions / workshops, technology platforms

4. Focus only on the weakest/absent function(s) and identify what hinders them. Try to identify what systemic problems block the development and functioning of the system?

Based on the coupled functional-structural analysis, identify what types of systemic problems block the analysed system. Use the categories below. Results can be noted down in table 3, next page.

Actors' problems may be of two kinds:

- Presence related: relevant actors (within the categories listed earlier) may be absent;
- Capacity related: actors may lack competence, capacity e.g. to learn or utilise available resources, to identify and articulate their needs and to develop visions and strategies.

Institutional problems may be of two types (hard and soft):

- Presence related: when specific institutions are absent;
- Capacity related: when there is a problem with their capacity/quality:
    - Stringent institutional problems
    - Weak institutional problems

Interaction problems may be of two types (referred to by some as lock-in problems or network problems or unbalanced exploration-exploitation problems).

- Presence related: interactions are missing because of cognitive distance between actors: differing objectives, assumptions, capacities, or lack of trust;
- Quality related: there is a problem with interactions' quality/intensity:
    - Strong network problems – when there is too strong involvement of incumbents
    - Weak network problems (caused by weak connectivity between actors), hindering interactive learning and innovation.

Infrastructural problems – referring to physical, knowledge and financial infrastructure. They may be:

- Presence related: when a specific type of infrastructure is absent;
- Quality related: when an infrastructure is inadequate or malfunctioning.

Table 3. Scheme for the evaluation of functional patterns and the identification of systemic problems

Function	Evaluation of the function	Reasons why the specific function is absent/weak/strong etcetera
F1 Entrepreneurial activities		
F2 Knowledge development		
F3 Knowledge diffusion		
F4 Guidance of the search		
F5 Market formation		
F6 Resources mobilisation		
F7 Creation of legitimacy		

5. What systemic policy instrument can you propose for the analysed system?

Finally, think of the smartest policy mix that will address the identified systemic problems in an orchestrated manner. In the table 4 below initial suggestions are given of individual tools useful for the design of your instrument.

Table 4: Potential of individual policy tools to contribute to the systemic instrument goals

Goals of systemic instruments	Traditional instruments that have the potential to contribute to particular goals
1. Stimulate and organise the participation of various actors	Clusters; new forms of PPP, interactive stakeholder involvement techniques (snowball method; networking (NoE); public debates; scientific workshops; thematic meetings; transition arenas; venture capital; risk capital)
2. Create space for actors capability development	Articulation discourse; back casting; foresights; road mapping; brainstorming; education and training programmes; platforms; technology platforms; scenario development workshops; policy labs, pilot projects
3. Stimulate occurrence of interaction among heterogeneous actors	Cooperative research programmes; consensus development conferences; cooperative grants & programmes; bridging instruments (centres of excellence, competence centres); collaboration and mobility schemes; policy evaluation procedures; debates facilitating decision-making; science shops; technology transfer
4. Prevent too strong and too weak ties	Timely procurement (strategic, public, R&D-friendly); demonstration centres; SNM; political tools (such as awards and honours for innovation novelties); loans/guarantees/tax incentives for innovative projects or new technological applications; prizes; CAT; technology promotion programmes; debates, discourses, venture capital; risk capital; contracting
5. Secure presence of (hard and soft) institutions;	Awareness building measures; information and education campaigns; public debates; lobbying, voluntary labels; voluntary agreements
6. Prevent too weak or too stringent institutions	Regulations (public, private); limits; obligations; norms (product, user); agreements; patent laws; standards; taxes; rights; principles; non-compliance mechanisms
7. Stimulate physical, financial and knowledge infrastructure	Classical R&D grants, taxes, loans, schemes; funds (institutional, investment, guarantee, R&D), subsidies; public research labs
8. Ensure adequate quality of the physical, knowledge, financial infrastructure	Foresights; trend studies; roadmaps; intelligent benchmarking; SWOT analyses; sector and cluster studies; problem/needs/stakeholders/solution analyses; information systems (for programme management or project monitoring); evaluation practices & toolkits; user surveys; information databases; consultancy services; knowledge brokers; tailor-made applications of group decision support systems; knowledge management techniques and tools; TA's; knowledge transfer mechanisms; policy intelligence tools (policy monitoring & evaluation tools, systems analyses); scoreboards; trend charts.