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Extended Abstract EU-SPRI conference 2020
Protecting and building Strategic Innovation Assets for competitiveness and societal challenges

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1 Research question and relevance

Innovation policy is evolving from a neutral position of supporting R&D and innovation systems to a more normative position aiming to address societal challenges and support transformations. Directionality becomes an important notion in these new mission-oriented policies (MOP) (Wanzenböck et al., 2019, Hekkert et al., 2019).

At the same time industrial policy is also changing in response to technological developments (the rise of global IT-based platform companies) and geopolitical upheavals such as the tech wars between the USA and China and the breakdown of old multilateral institutions such as the WTO. While supporting competitiveness remains important for industrial policy, a new ambition of the EU and its member states is to retain or achieve sovereignty in key technologies and industries. The new German National Industrial Strategy 2030 is a case in point (Federal Ministry for Economic Affairs and Energy, 2019), as is the European Battery Alliance (European Commission 2019). Countries are becoming more aware of the value of their "*crown jewels*" or "***strategic innovation assets"*** for competitiveness, prosperity and employment.

We argue that one way of operationalizing MOP is for countries and the EU to protect and build Strategic Innovation Assets (SIA) that contribute to societal missions. The aim of this study is to provide a framework for gaining strategic insight into the (future) importance - or 'criticality'- of a country's innovation assets in the context of value chains and innovation ecosystems. This study offers guidelines to identify such *strategic innovation assets* and provides a basis for the development of policies and strategies aimed at building, protecting or strengthening these. The study was a joint project of TNO and the Netherlands Ministry of Economic Affairs and Climate.

2 Theoretical framework

We define **Strategic Innovation Assets** by successively operationalizing the concepts of Assets, Innovation Assets, and the 'criticality' of Strategic Innovation Assets (Figure 1).

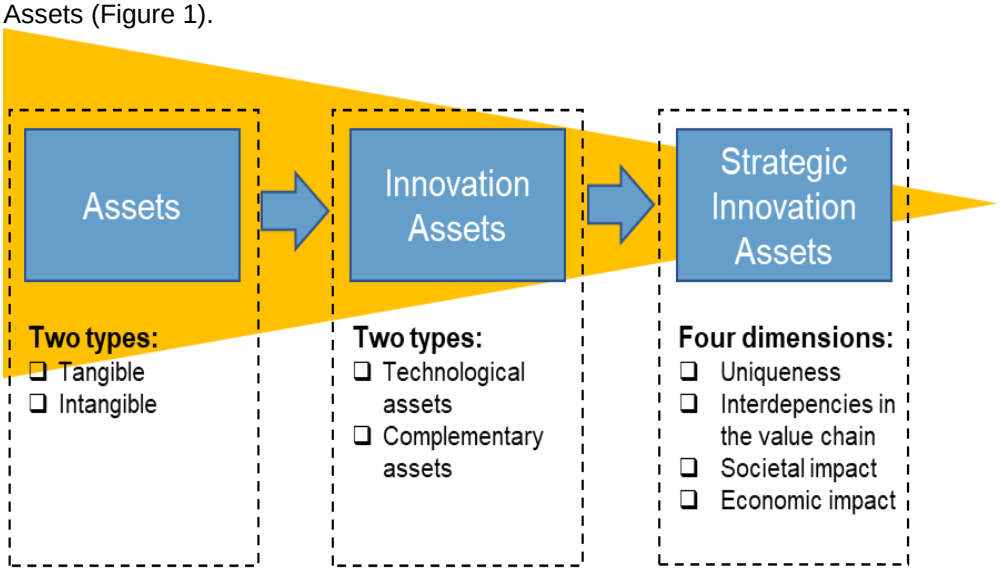

Figure 1 Strategic Innovation Assets analytical framework

First the concept of **Assets** is defined. The Economist simply refers to assets as: "Things that have earning power or some other value to their owner".[1] Assets include resources, actors (companies and knowledge institutions) infrastructures and networks. Assets are often divided into two types: tangible and intangible. Tangible assets include means of production, money, raw materials as well as production companies, labs and facilities, financial institutions, et cetera. Networks of actors and infrastructures can also be regarded as tangible assets. Intangible assets, at company level, include patents, trademarks, R&D investments, marketing, software and databases. At the macro level intangible assets include, for example, the business climate, the knowledge base and the technology base of a country. This indicates that assets can be viewed at different levels of analysis.

The second step elaborates the concept of **Innovation Assets.** For this we build on the Profiting from (Technological) Innovation (PFI) framework of David Teece. In a series of articles in Research Policy, Teece (1986, 2006, 2018) has continued to develop and refine this PFI framework, most recently (Teece 2018) focusing on enabling technologies and general purpose technologies. The central question that Teece poses in all of these articles is: under what conditions do companies benefit or make a profit from innovation? Why and when do first movers develop into market leaders and why, in other cases, do the benefits of innovation mainly accrue to followers and copycats? For Teece, the core of the innovation process is mastering a (key) technology. This involves not only patents but also the know-how to exploit them. The benefits mainly accrue to the owner of that technology if the

[1] https://www.economist.com/economics-a-to-z

technology can be protected by patents or secrecy, and/or when the technology is difficult to copy or emulate (e.g. because of its inherent complexity).

There are two main reasons why companies cannot benefit from a technology they own. First, if the technology cannot be protected and second, if they lack the **complementary** assets to successfully transform a technological breakthrough into a product that can be put on the market.

The third step is to decide which innovation assets can be regarded as strategically important or 'critical' to the functioning of the innovation system. The scientific literature on *Critical Assets* provides some starting points (Bak, 1996). *Critical Assets* are often discussed in the context of protecting existing physical infrastructures such as roads, bridges, dykes, (air)ports and internet exchanges from damage and destruction.

Critical Assets are defined as: '…those that are essential for supporting the social and business needs of both the local and national economy. These assets will have a high consequence of failure, but not necessarily a high likelihood of failure.[2] The criticality of an asset is thus mainly formed by the impact of its disappearance. But in relation to innovation it is not only about protecting existing assets (e.g. from industrial espionage), it is also (perhaps mainly) about strengthening and building assets for future competitiveness and addressing societal challenges. It is for this reason that we speak of **Strategic Innovation Assets**, rather than Critical Innovation Assets.

In relation to innovation criticality relates either to the impact that the loss of one or more assets has on the functioning of the innovation system, or, put more positively: SIA make a crucial contribution to innovation, (social) welfare or value creation. Criticality of innovation assets can be seen in four dimensions:

1. The asset is distinctive, i.e. there is **uniqueness**, which determines in part the extent to which an asset occupies an important position in the (global) value chain.
2. The innovation asset addresses a societal challenge or question **(societal interest)**. At national and EU level we see a growing interest in mission-oriented policies that aim to link new technologies to the solution of social problems and challenges.
3. The innovation asset has economic **mass**. Small assets can collapse without having a major impact on the national economy.
4. There are strong **dependencies** in the value chain or in the innovation system. A central position and connections to other actors through forward and backward linkages are key.

[2] https://road-asset.piarc.org/en/data-and-modeling-risk/identifying-Critical-assets

3 Methodological approaches and data

SIA may be viewed at different levels. A company or knowledge institution may possess unique innovation assets in the form of R&D labs or production facilities. Intangible assets come in the form of in-depth knowledge of products and techniques which is anchored in patents and trade secrets. At a higher level, a company that has a number of technological and complementary assets is a Strategic Innovation Asset in its own right. The same holds for ecosystems. The following steps are taken to identify and select SIA in value chains:

1. Selection and delineation of the value chain;
2. Identification of Assets in the value chain;
3. Identification of Innovation Assets - what are the technological and complementary assets in each link of the chain?;
4. Identification of SIA - Which Innovation Assets meet at least three of the four dimensions of criticality in this value chain?;
5. Determining the opportunities and threats.

We follow a case study approach, selecting value chains of interest to the Netherlands on the basis of economic size (mass dimension), specialization, growth (potential), the Netherlands' position in global value chains and social importance. The question is who are the Dutch actors involved (companies and institutions) in 'important' value chains, what exactly is their task and function in the value chain, and on what strong technological and complementary assets can they build. If the actors have technological and complementary assets at their disposal, these are identified as Innovation Assets. These Innovation Assets are then assessed in relation to the four dimensions of criticality: uniqueness, societal interest, mass, dependencies. Once the SIA have been defined, the opportunities and threats of this value chain are mapped out in in-depth case studies.

4 Results

The project has initially produced two main results: a set of two case studies and a manual to support the analysis and assessment of SIA. Case studies (following the above methodology) were done for two value chains: the Dutch vegetable seed improvement sector and the Dutch offshore wind energy sector.

The seed improvement sector is one of the SIA of the Netherlands that builds on unique, specialized knowledge of plant breeding, crops, seeds, seed development and markets. There is a strong mutual dependency of the seed sector with the advanced and demanding horticultural sector in the Netherlands and abroad. Both core technology assets (plant breeding, genetics, biotech) and complementary assets are strongly represented. There is also economic mass: the Dutch seed improvement sector is one of the largest in the world. Complementary assets support this position: high R&D intensity, good logistics, favorable seed production conditions, public and private seed collections and high standards. International acquisitions of Dutch seed breeding companies are driven by the desire to get access to SIA such as seed collections and know-how. This know-how is largely of a tacit nature vested in family companies and strongly embedded in regional ecosystems, which explains that multinationals prefer to acquire seed companies rather than build up their own expertise. This also explains why foreign takeovers are unlikely to lead to transfer of production and R&D outside the Netherlands. Rather the takeover by multinationals has contributed to the growth potential of Dutch seed companies by opening op new markets.

The offshore wind energy case is different. The Netherland no longer has a strong position in the core technology of wind turbines (Wanzenböck et al., 2019). But, based on a strong knowledge, technology and competitive position (in specific niches) in the production of wind technology and especially in the field of construction, management and maintenance - building on its rich history in the oil, gas, dredging, offshore industry and hydraulic engineering (including port construction) - the Netherlands has a favorable starting position to contribute to the construction of wind farms at sea. Offshore wind serves a clear social interest, and it also meets the other three dimensions of criticality of SIA: dependence, uniqueness and (economic) mass. The technological assets of the Netherlands with respect to offshore wind mainly relate to construction, management and maintenance activities. In addition, there is a diverse set of complementary assets on which to build. Overall there are no serious threats to these innovation assets. The most important challenge for Dutch actors is to maintain their market position in the future.

Conceptual and empirical work in this study have also resulted in a manual to support the assessment of SIA. In this manual we have operationalized the concepts of innovation assets and ‘criticality’ of Strategic Innovation Assets in a set of indicators.

4.1 Conclusions and policy issues

The analysis of SIA is a useful approach for identifying those innovation assets that play a 'critical' role for the future prosperity of a country and for gaining insight into opportunities and threats related to these assets. These insights can be used for the formulation of interventions aimed at protecting or building SIA, as well as to the development of mission-oriented policies.

4.2 Interested in collaboration?

Do you want to know more about applying the Strategic Innovation Assets framework? We have developed a manual for assessing assets. This manual is available on request. We are also still improving our framework and we would love to do that in collaboration with national and European partners. Please contact Babette Bakker (babette.bakker@tno.nl) if you want to know more.

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