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ARTIST

Assessment and Review Tool for Innovation Systems of Technologies

The ARTIST model provides insight in the factors driving innovation and their interaction

Innovation systems consist of a network of actors, a knowledge infrastructure and a range of incentives, which together drive the development of innovations towards commercialization. ECN's ARTIST model, developed and demonstrated in collaboration with Agency NL, is a multi-criteria evaluation model for innovation systems.

It is instrumental in recognizing factors that may hamper or stop the development of an innovation, and thereby helps in finding solutions to overcome these barriers.

**ARTIST combines qualitative and quantitative analysis**

ARTIST can be used to qualitatively assess whether innovation policy provides a proper framework for an innovation system to function. The model can also perform quantitative analysis based on project information. This analysis provides a factual and real-time insight in the functioning of an innovation system, answering questions like:

- Are there signs that a technology is moving into a next development phase?
- Where are bottlenecks which hamper an innovation moving towards the market?
- What has an individual policy instrument or a mix of policy instruments contributed to achieving goals in the field of innovation systems?

Model principle

Innovation is not a linear process, making linear analysis less appropriate. ARTIST accounts for this feature by representing the process as a matrix. It analyses the network of actors involved in the development of a technology or its components. The basic assumption is that for each development phase the composition, behaviour and drivers of such a network change. The
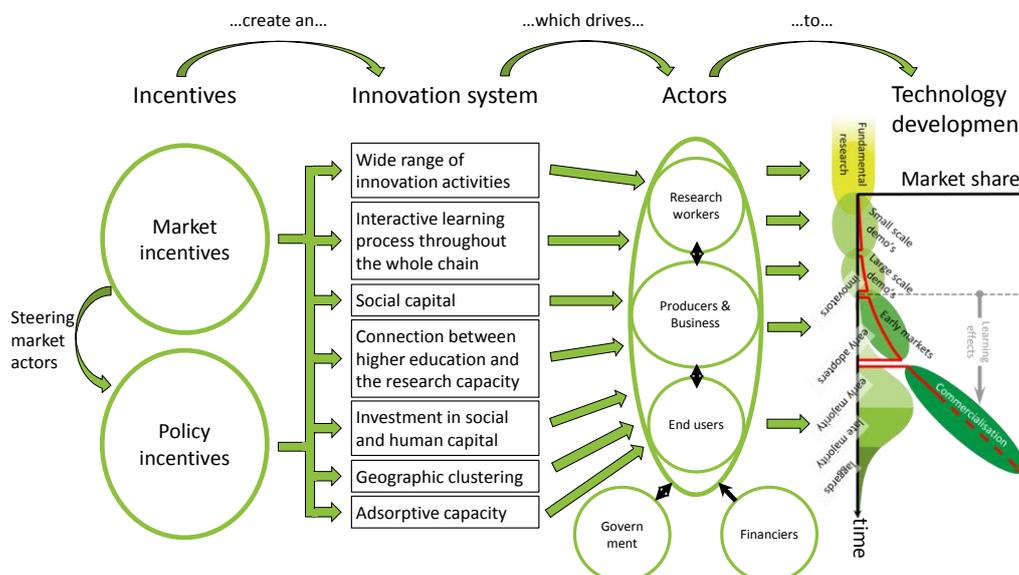
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image above shows the principle behind ARTIST. Starting on the right-hand side, a technology passes through several development stages on its way to commercialization. Each development stage, presents different types of problems. In the fundamental research and early demonstration stages, for instance, technological issues are typically the main issue, while the focus shifts to e.g. scaling of production capacity and market development issues in subsequent stages. Addressing such barriers in developing technology involves different types of actors, ranging from researchers, businesses, end-users, financiers to governments. To enable these actors to bring an innovative concept to commercialization, seven socio-economic factors are important:

1. A wide range of innovation activities
2. Interactive learning throughout the whole chain
3. Social capital (i.e. trust between actors in an innovation system)
4. A good connection between higher education and the research capacity
5. Investments in social and human capital
6. Geographic clustering
7. Adsorptive capacity (demand)

These factors determine the functioning of an innovation system. Incentives from the market and from policies help ensure that these factors are present.

Understanding of innovation processes and driving factors informs strategic decisions

The model's analysis allows different stakeholders in the innovation system to evaluate the effects of their existing activities, and informs decisions on future strategy.

- **ARTIST for policy makers** – the model helps policy makers to better understand how to design innovation policy and how to react to failures in the functioning of innovation systems.
- **ARTIST for market players** – the analysis provides information on the functioning of the innovation system companies are active in, or plan to invest in. This could be used as an information source for justifying the need for policies or strategic decisions.
- **ARTIST for investors** – the model's analysis can be applied to a company's business plan and network to assess whether it is properly equipped and embedded to further develop an innovation towards a commercial proposition.

The ARTIST model has been tested for biomass fermentation in the Netherlands. There we could identify a possible knowledge spill-over effect between the use of biomass fermentation for systems producing electricity and heat, and applications for producing gas to be processed to grid quality and sold as green gas. The results also showed that private companies are more heavily involved in biomass fermentation for green gas than one may expect given its development phase. This indicates that this technology is moving towards market development faster than expected.