

The innovation system of the German wood-based bioeconomy – taking stock and perspectives

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1. Relevance of the innovation system for a wood-based bioeconomy

- The **path transition** towards a **bio-based economy**, the so-called bioeconomy, is based, as a start, on the **substitution** of fossil inputs for bio-based inputs such as wood or agricultural products.
- However, to meet its societal goals, this transition also requires **sustainability** as well as **innovation** of processes and products, including innovation which limits additional pressures on ecosystems.
- Innovation is enabled by a spirited societal **innovation system**, which can be defined as “the elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge” (Lundvall 1992: 2).
- Whereas some wood-based products such as wood pellets are already **marketable** and **mature**, many others are still **under development** (see Figure 1) and in need of further innovation and diffusion.

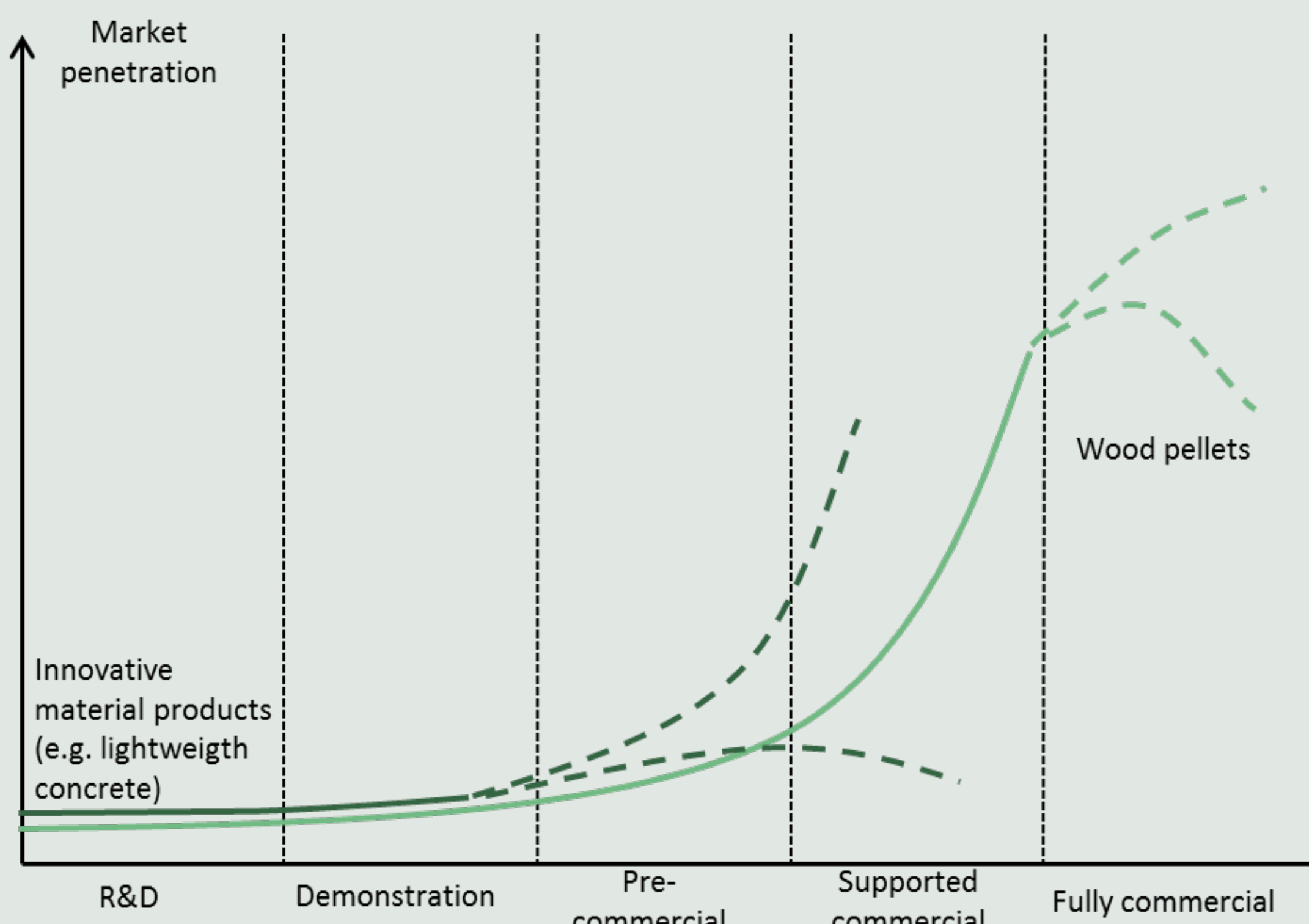


Figure 1: Maturity stage of different bioeconomy product pathways (based on Foxon et al. 2005)

2. Research question

What are the characteristic elements, strengths and weaknesses of the innovation system for a “wood-based bioeconomy” in Germany?

3. Methodology: Elements and functions of innovation systems

The analysis of the innovation system of the wood-based bioeconomy in Germany is based on the identification of

- **elements** of the innovation system (Figure 2) and
- **functions** fulfilled by the interplay of the innovation system’s elements.

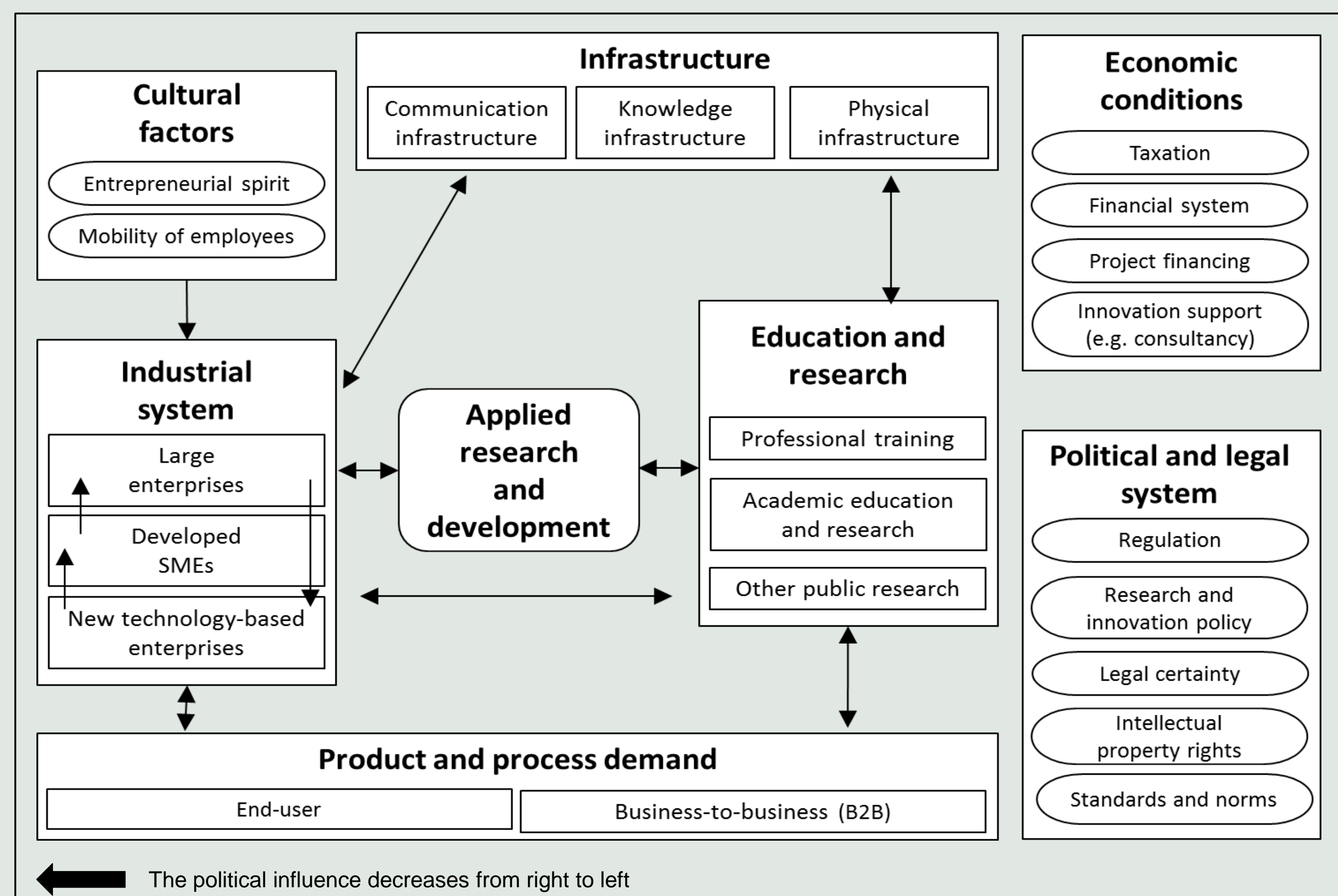


Figure 2: Elements of an innovation system (based on Kuhlmann and Arnold 2001)

Key functions of innovation systems are the following (cf. Johnson and Jacobsson 2001; Foxon et al. 2005):

- **Creation and diffusion of new knowledge**
- Guiding the direction of **search processes** among technology users and suppliers
- **Supply of resources** (e.g. financial and human capital)
- **Creation of positive knowledge and learning externalities**
- **Facilitation of market formation**

4. Innovation system of the wood-based bioeconomy: A status quo analysis

Based on an analysis of these functions, **strengths and weaknesses of the German wood-based bioeconomy innovation system** are identified.

Strengths:

- The current **legal and economic framework conditions** (e.g. patent protection), public infrastructure and cultural factors (e.g. entrepreneurial spirit) provide generally favourable conditions for innovative activities in Germany.
- **Policies pushing technology supply** (support for R&D, demonstration projects and knowledge exchange networks) are well developed.

Weaknesses:

- Only **little supply** of wood-based innovative products and processes by enterprises because of a low demand pull by **consumers**; **demand pull policies** focus on energetic biomass uses.
- **Consumer trust** in new technologies is critical due to sustainability concerns; trust/interest in wooden bio-based products is low because of information deficits (e.g. regarding resource availability, impacts of production processes).
- **Policies** do not clearly define and address **economic and ecological requirements** for sustainable products and processes.
- A comprehensive **policy mix** supporting a path transition is lacking. To increase bio-based innovation activities, policy instruments that set **incentives to reduce fossil resource use** need to be strengthened and complemented by policies which support the bioeconomy resource base as well as bio-based processes and products (Figure 3), thus providing **innovation premiums** on markets.

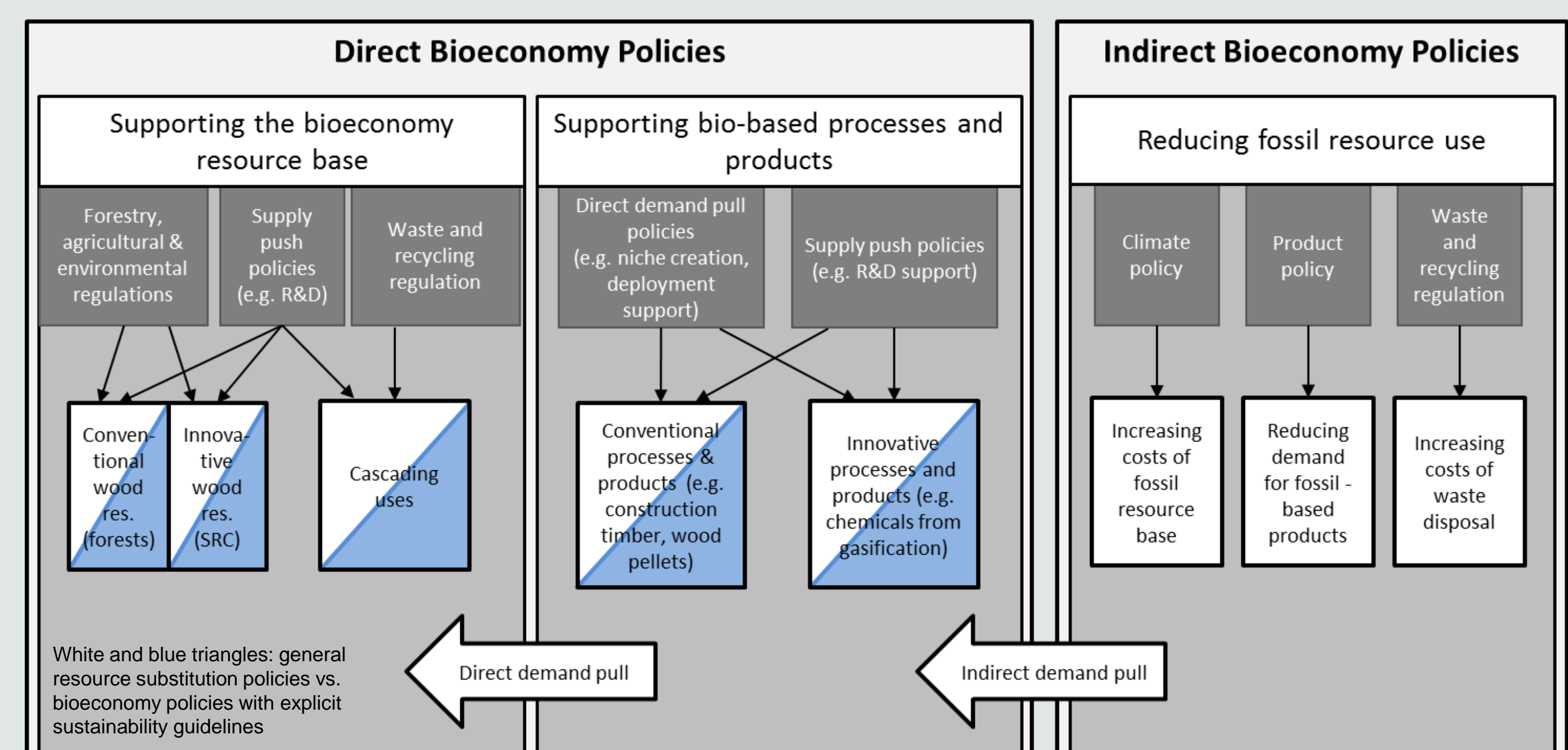


Figure 3: Three pillars of wood-based bioeconomy policies (Pannicke et al. 2015)

5. Recommendations for the German wood-based bioeconomy

Important role of policies in supporting the innovation system:

- Need to **guide search processes towards sustainable wood-based resources, processes and products** (e.g. supply chains based on recycling material and/or waste wood): necessitates adjustments in environmental and waste regulations, and a stronger focussing of **support on sustainability-enhancing** innovation, research and knowledge exchange
- **Setting incentives** for enterprises to invest in bio-based innovations requires **continuity and reliability of policy signals**, to allow for long-term planning
- Addressing **trust of consumers/voters** in bio-based products is key.

Literature

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