

German and Brazilian Innovation Systems for Sustainability

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Environmental problems are increasingly global challenges. In addition to traditional environmental technologies, systems innovations are necessary, which also offer economic opportunities. Science for sustainability has to deal with the question how to support these necessary innovations. Especially the state of knowledge and the innovation dynamics in the most important fields of innovation, but also the socioeconomic embedding of solutions, the functioning of the respective innovation systems and the impact assessment of the strategies and technologies are of strategic interest.

The challenge posed by sustainable development is becoming increasingly urgent from a global perspective. The question raised is how economic growth in newly industrializing countries can be designed in such a way that it does not undermine the achievement of ecological sustainability goals. At the same time, sustainable innovations can also play an important role for the economic and technological development of emerging economies. In addition, the prospect of establishing lead markets for sustainability technologies adds an additional incentive for emerging economies to move towards sustainability technologies.

Both strategies require absorptive capacities and technological competences in the sustainability technologies. It is hard to capture all the relevant issues in indicators. However, the existence of targeted research programs, achieved competences in knowledge build up which are indicated by publications and patents as well as success on the world markets are important proxies for the build up of capabilities.

The sustainability relevant publications in both Germany and Brazil show high dynamics recently, and have been growing faster than other areas. However, the specialization on sustainability publications in both countries is still below average. Thus, there is a need to strengthen the international focus of the engineering community and to increase the social science perspective of sustainability research (Walz et al., 2008).

Germany is among the world leaders in sustainability technologies, which is expressed by a positive specialization in both patents and exports of these technologies. This has been supported by specific research programs for sustainability and environmental policies in many areas. In the future, it is necessary to further integrate demand pull and supply push policies, e.g. within the master plan on environmental technologies, and to strengthen the international focus of national players.

In Brazil, research programs and sector funds show research activities in areas such as energy, transport and water. The positive patent specialization for Brazil indicates a build up of knowledge recently. However, trade specialization reveals that there is still a high dependency on imported technologies in areas such as energy supply and water technologies. In transportation technologies, Brazil is already achieving considerable export success, however with an indigenous knowledge level below average. Perhaps this can be explained by the specific role of multinational enterprises in this sector and calls for further research on the types of knowledge spillovers from the multinational to the national companies. On the other hand, Brazil developed a strong position in renewable materials, which is underlined by a strong positive specialization in both patents and exports in that area.

Successful policies to foster cooperation require a strategic and systemic positioning. The experiences in both countries show various starting points. In many areas of energy and water technologies, the emphasis should be on building absorptive capacities and enhancing indigenous competences in Brazil. Comparative research and exchange on topics such as technology transfer and the analysis of the strengths and weaknesses of the respective innovation systems are necessary. In transportation technologies, questions such as the role of multinational enterprises and obstacles to knowledge spillovers are important issues for further analysis. With regard to resource use, Brazil has been emerging as important actor for renewable resources and accompanying technologies. Cooperation in this area should also include developing a common perspective for cooperation on the level of the world market. Furthermore, there is a need for strategic sustainability assessment of the various options. This relates not only to the ecological dimension, but also the social dimension, which is of uttermost importance in the Brazilian debate. However, the economic opportunities of sustainability technologies should also be analyzed. This includes statistical or case study analysis on the characteristics of firms which engage in sustainability innovations as well as strategic sustainability assessment of strategies and policies using scenario analysis and economic models.

Recommendations for enhanced sustainability oriented research and innovation cooperation between the two countries:

Future research should emphasize the social science conditions for sustainability innovations and instruments for their improvement within a system of innovation framework. Especially the topics of

- climate change,
- water,
- transportation technologies and
- use of natural resources

are well suited topics for comparative research and offer high cooperation potential. The research should compare the functioning of the innovation systems with regard to these technological fields and should develop measures how to improve the innovation systems. This also includes comparative research on the design of innovation-friendly environmental policy measures and their integration into successful industrial policy. Within this research, topics such as the conditions and rationale of technology cooperation for actors involved should be studied. Furthermore, aspects such as importance of IPR (Intellectual Property Rights) and trade regimes, the role of standardization, the influence of governance structures of national institutions and international environmental agreements, the role of FDI (Foreign Direct Investment), multinational and medium sized enterprises, and the need for building absorptive capacities should be addressed. With regard to strategic priority setting, a thorough analysis of the areas which are particularly well suited for a lead market strategy in the respective country is necessary. Finally, strategic sustainability assessment with the aim of identifying win-win situations for both countries and within all three dimensions of sustainability should be performed. This requires, among others, scenario analysis which do not only show the potential diffusion and demand for sustainability technologies in both countries, but which are also able to model the exchange of sustainability goods and technologies between Germany and Brazil on a technology specific level in these scenarios.

References

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