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# Sharing a common resource in a sustainable development context: The case of a wood innovation system

Marie-Claude Bélis-Bergouignan [a], Rachel Levy [b,*]

[a] GREThA - UMR CNRS 5113, Bordeaux IV University, Bordeaux, France
[b] LEREPS, Toulouse University, Toulouse, France

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ABSTRACT

This case study of the Aquitaine wood *filière* emphasizes the need to integrate a stronger consideration of natural resources in the analysis of innovation systems. The analysis focuses on eight eco-innovation projects representing the Aquitaine wood *filière*, and carried out under the aegis of the Industries and Maritime Pine of the Future 'competitiveness cluster.' We show that dependence on the wood natural resource can configure the limits, objectives and expected performance of such innovation systems. While previous approaches have considered similar innovation systems from territorial, sectoral or technological perspectives, we argue that centering the analysis on this natural resource better enables consideration of the technological and environmental tensions and risks that are likely to destabilize the system.


## 1. Introduction

The concept of the innovation system is based on replacing the idea of innovation as an individual decision-making process, instead considering the interactions among all actors in the innovation process that comprise institutional networks within their environment [1,2]. This perspective has successfully guided new approaches to public policy. For example, in France, the "*pôles de compétitivité*" ('competitiveness cluster') policies, implemented in 2005, stem from the recognition of the need to improve the integration of innovation, industry and territory. In their second phase of development (2008–2013), they have to address sustainable development and environmental responsibility challenges.

The wood *filière* provides an example of the application of these policies. The French term wood *filière* [3,4] is used here to designate an interactive value chain, from upstream to downstream, among the subsectors of wood-based industries including the forestry, wood and paper industries and sharing a common dependence on the wood resource. The 'competitiveness cluster' policy has been applied to this system, with the emergence in 2005 of the *Industries et Pin Maritime du Futur*[1] (IPMF) 'competitiveness cluster' in the Aquitaine region of southwestern France. The IPMF has been involved in the implementation of eco-innovation projects since 2005. Eco-innovation projects include any project whose implementation is new for the actor, is likely to be a process, product or organizational innovation, and has the explicit or implicit aim to reduce environmental pollution [5,6].

This article examines the ways in which the *filière*'s strong dependence on the wood resource affects the configuration of the Aquitaine region's wood innovation system (AWIS). We analyze here the effects and impacts of the promotion of eco-innovations on a system that shares a natural resource.

Our conceptual approach departs from previous research that has attempted to link forest innovation processes with various systems models. To set these systems, these approaches have focused on their geographic, sectoral or technological dimension [7,8].

* Corresponding author.
*E-mail address:* rachel.levy@iut-tlse3.fr (R. Levy).
[1] Industries and Maritime Pine of the Future. Since 2008, this organization has been named Xylofutur (for more information, please visit www.xylofutur.fr).

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By situating the wood resource at the heart of our analysis, we suggest a more inclusive approach whereby the system is defined in its frontiers and in its dynamics through the sharing of a common resource. Our research highlights dynamic features of the wood *filière* within a multidimensional framework. The eco-innovation projects represent disruptions that impact the system in various ways and are likely to affect its boundaries and performance. Reciprocally, this theoretical framework also enables us to measure the effect of the wood innovation system's configuration on the directions and contents of the eco-innovation projects.

## 2. Theoretical framework: innovation systems

### 2.1. Definitions of innovation systems

An innovation system can be defined as a system — i.e., a set of interacting elements — that aims to create and diffuse knowledge allowing the production of innovations [1]. To define an innovation system, one must define the elements (actors and institutions[2]) that comprise the system, and the links (market relations, cooperative and conflicting relations) between these elements.

Using this definition, many authors have demonstrated the existence of particular forms of innovation systems. Following the work of Freeman on Japan [9], some authors [10,11] have applied the innovation system concept at the national level, showing that the nation constitutes an analytical framework in which the actors who produce knowledge share the same language, culture, and, most of all, particular institutional rules.

More recently, research on regional innovation systems has been based on the hypothesis that the learning and knowledge creation processes are regionally situated [12–15]. This approach is inspired by the conceptualization of districts [16], innovative '*milieux*' [17] and other territorial concepts, like clusters introduced by Porter [18], while fitting into the theoretical framework of innovation systems.

By combining the systemic approaches of the innovation process and the work on technological regimes and evolutionist theories at the level of the firm [19,20], other authors have developed the concept of a sectoral system of innovation and production [21]. This concept attempts to provide an integrated vision of the structure and dynamics of a sector. By grouping actors and institutions who share the same knowledge bases through working on the same product, this approach stresses the diversity of behaviors and variety of actors trying to meet a demand (potential or effective) that emerge within the same sector of activity. It is this demand for a new product or for a new use of a product which defines the borders of the system. Indeed, as explains Malerba [21] (p.254): "differences in demand conditions play a major role in affecting sectoral differences in firm's competencies, behavior and organization."

There is some convergence between this approach and the concept of a technological innovation system, defined as a set of actors (companies, research and transfer bodies, product users) and institutions gathered around the same technological artifact or product [22,23]. This approach focuses on the final product, thereby neglecting the resource on the upstream end of the innovation system.

All of these approaches have been diversely mobilized in order to analyze the innovation processes in forestry [8,9]. However, study of the wood innovation system, based on the exploitation of a common resource, requires a broader approach than an analysis that is territorialized or focused on a technical object or industrial sector. Through our case study, we suggest a complementary vision that mobilizes all of these levels of study while integrating an additional analytical dimension of the sustainable development of a specific natural resource, the forest resource.

### 2.2. Characterization of innovation systems

The characterization of an innovation system proceeds in stages [22–25]. The first stage is the identification of a relevant level of analysis (e.g., a territorial or sectoral level). The limits of this system must then be determined by characterizing its components and the links among the components and the system's environment. It is also necessary to characterize the functions and objectives of this system. This stage can result in assessment of the system's performance and the recommendation of public policies that will help improve its performance.

In order to establish the relevant level of analysis and the limits of an innovation system, it is necessary to identify the actors and institutions that compose this system, and the types of relationships among these actors. The actors (individuals or organizations; particularly companies, training and research bodies or transfer-of-technology centers) and institutions (social standards, regulatory bodies) composing an innovation system will influence the system's dynamics. The links between these elements may take the form of market or non-market relations, cooperation or conflict relations. The elements of the system may also be linked by the use of a technical artifact or a common natural resource.

In the approaches presented earlier, the limits of the system are determined by geographic, sectoral or technological dimensions. For example, all companies and research bodies in a region are considered actors in a regional innovation system, and all car manufacturers and subcontractors are considered to belong to the same sectoral innovation system. We suggest a more holistic approach whereby the limits of a system are defined through the sharing of a resource that is common to all actors in the system.

To complete the characterization of components and the links between them, a system can also be defined through functions and the primary interactions among these functions. Following the definition of Johnson [26], we considered functions as relevant

[2] In our view, the term *institutions* applies to routines, norms, regulations and beliefs and the term institutionalization correspond to the creation of news routines, norms, regulations and beliefs, and not to non-firm organization.