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## Analyzing the innovation process for environmental performance improvement

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### Abstract

This paper elaborates the concept of demand articulation in product innovation to analyze innovation for environmental improvement. A conceptual framework has been developed that allows analysis of social demand articulation, the process that stimulates firms toward environmental innovation. Knowledge and information flows that raise the technological capability and awareness level of firms and consumers for environmental improvement are discerned. Their indicators have been developed based on the number of research papers and newspaper articles on environmental issues, respectively. Statistically significant results have been obtained on the role of knowledge and information flows on environmental innovations. Use of the framework on case studies revealed knowledge and information flows on local air quality and global warming led to the development of high-efficiency, low-emission automobiles. In conclusion, social demand articulation is an effective process by which knowledge and information flows mobilize the requisites needed for a successful environmental innovation.

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*Keywords:* Social demand articulation; Environmental innovation

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## 1. Introduction

The objective of this paper is to analyze the innovation process toward environmental performance improvement. The factors and system structure that induce firms to accept environmental considerations into their product development agenda are examined. While a literature on the innovation process of firms and industries is large, only few studies appear to have addressed the area of environmental innovation [1].

Many individual firms and industries successfully realize the needs of potential users at the product development stage through a successful process of *demand articulation* [2]. This paper expands this concept to analyze articulation of environmental considerations. Successful social demand articulation requires environmental knowledge and information to flow among firms and societal stakeholders, such as the public, government, and non-government organizations (NGOs). Below, the role of knowledge and information flows is elaborated, notably with respect to how they can impact the management, competition, and technological capacity aspects of innovative change.

Two research questions are addressed in the examination of technology development for social needs<sup>1</sup> such as global environmental protection and development of a clean urban environment. (1) What is the process of social demand articulation at the global or the community level, and can it be analyzed in a single framework? Even if demand articulation is effective in directing the development of technology, the decision-making process for developing and adopting new technologies differs at these two levels. In urban development, for example, decision makers include citizens, developers, and local governments, while in addressing global environmental problems national governments and international organizations are decision makers. (2) Who are the demand articulation *agents* at these levels, and what are their roles? In urban development these may be local government or pressure-groups, while in global environment these maybe the United Nations or National Governments. These organizations, however, do not have the technological capability required to successfully complete the process of demand articulation, and thus must mobilize and organize the competencies needed for demand articulation [2].

To address these research questions, a conceptual framework is presented for environmental innovation process. Application of the framework on two cases and empirical evidence of demand articulation for environmental problems is reported. The results are discussed, and conclusions drawn with respect to the framework.

## 2. Innovation and demand articulation

Demand articulation is a sophisticated translation skill that converts a vague set of wants into well-defined products [2,3]. The Latin word, *articulare*, has two meanings, “to divide into parts” and “to put together by joints.” Thus *social demand articulation* is defined as 1) realizing a social demand, 2) integrating the demand into a product or system concept, and 3) breaking the concept into a well-organized development schedule to produce innovative science and technology that meets the social

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<sup>1</sup> ‘Social’ needs are phenomenal whereas ‘societal’ needs are structural. This paper is more relevant to social needs, which can then shape societal needs.

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