

Quantifying Firm-Level Environmental Innovation Performance: Determining the Sustainability Value of Patent Portfolios

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Abstract : The development and diffusion of green technologies are crucial for achieving our ambitious climate targets. The Paris Agreement commits its members to develop strategies for achieving net zero greenhouse gas emissions by the second half of the century. Governments, executives, and academics are working on net-zero strategies and the business of rating organisations on their environmental, social and governance (ESG) performance has grown tremendously in its public interest. ESG data is now commonly integrated into traditional investment analysis and an important factor in investment decisions. Creating these metrics, however, is inherently challenging as environmental and social impacts are hard to measure and uniform requirements on ESG reporting are lacking. ESG metrics are often incomplete and inconsistent as they lack fully accepted reporting standards and are often of qualitative nature. This study explores the use of patent data for assessing the environmental performance of companies by focusing on their patented inventions in the space of climate change mitigation and adaptation technologies (CCMAT). The present study builds on the successful identification of CCMAT patents. In this context, the study adopts the Y02 patent classification, a fully cross-sectional tagging scheme that is fully incorporated in the Cooperative Patent Classification (CPC), to identify Climate Change Adaptation Technologies. The Y02 classification was jointly developed by the European Patent Office (EPO) and the United States Patent and Trademark Office (USPTO) and provides means to examine technologies in the field of mitigation and adaptation to climate change across relevant technologies. This paper develops sustainability-related metrics for firm-level patent portfolios. We do so by adopting a three-step approach. First, we identify relevant CCMAT patents based on their classification as Y02 CPC patents. Second, we examine the technological strength of the identified CCMAT patents by including more traditional metrics from the field of patent analytics while considering their relevance in the space of CCMAT. Such metrics include, among others, the number of forward citations a patent receives, as well as the backward citations and the size of the focal patent family. Third, we conduct our analysis on a firm level by sector for a sample of companies from different industries and compare the derived sustainability performance metrics with the firms' environmental and financial performance based on carbon emissions and revenue data. The main outcome of this research is the development of sustainability-related metrics for firm-level environmental performance based on patent data. This research has the potential to complement existing ESG metrics from an innovation perspective by focusing on the environmental performance of companies and putting them into perspective to conventional financial performance metrics. We further provide insights into the environmental performance of companies on a sector level. This study has implications of both academic and practical nature. Academically, it contributes to the research on eco-innovation and the literature on innovation and intellectual property (IP). Practically, the study has implications for policymakers by deriving meaningful insights into the environmental performance from an innovation and IP perspective. Such metrics are further relevant for investors and potentially complement existing ESG data.

Keywords : climate change mitigation, innovation, patent portfolios, sustainability

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