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研究課題名(和文)How Japanese Firms Profit from Environmental Innovation

研究課題名(英文)How Japanese Firms Profit from Environmental Innovation

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研究成果の概要(和文)：企業はなぜ、どのように企業活動による自然環境への悪影響を軽減するための能力を開発するかを考察した。1) 環境汚染を低減する技術を開発している企業は、組織活用よりも組織探索に取り組み、革新的技術ではなく、持続的技術の開発に力を入れる、2) 一般的に日本企業は環境規制が厳しい国に進出しないが、環境能力の高い企業は反対の傾向である、3) 多くの地方都市に拠点展開している企業の製造事業所の方が地域環境に害を与えている、4) 地元利害関係者との関りが強い地域では、競合他社よりも環境を汚染した場合、企業は環境能力の向上に力を入れる。このように、本研究は環境ビジネス戦略への重要な理論的・実践的洞察を導き出した。

研究成果の概要(英文)：This research project investigated why and how firms develop and deploy capabilities to mitigate the impact of business activities on the natural environment. 4 separate studies into this topic found that: 1. firms developing pollution reducing technologies, engage in more organizational exploration than exploitation, and emphasize incremental-rather than radical-technologies; 2. stronger national environmental regulations discourage Japanese firms from entering a country but this effect is reversed in Japanese firms with high environmental capabilities; 3. Japanese manufacturing facilities cause more damage to the local environment in firms that operate in more Japanese municipalities; 4. Japanese facilities polluting more than competitors work harder to improve their environmental when located in Japanese municipalities with more powerful local stakeholders. Together, these studies provide important theoretical and practical insights into environmental business strategy issues.

研究分野：経営学

キーワード：business strategy corporate greening environmental technology organizational learning profit from innovation stakeholder theory pollution in Japan

### 1. 研究開始当初の背景

This research was motivated by the increasing contemporary importance of understanding the impact of business activities on the natural environment—both for firms themselves and for society more broadly. As the scale of the impact of business activity on the natural environment increases—both in aggregate and within individual firms—society is becoming increasingly concerned, leading firms themselves to pay greater attention to their environmental impacts. Understanding both the antecedents and responses to business activities that cause environmental damage can provide valuable insights that can help firms with reducing their impact on the natural environment while simultaneously improving their competitiveness.

### 2. 研究の目的

The overall purpose of the research was two-fold. First to understand how firms develop and deploy new capabilities designed to mitigate their environmental impacts. Second, to better understand the reasons that firms cause negative environmental impacts in the first place. To that end, this project developed several working papers addressing various important dimensions of these two lines of investigation.

### 3. 研究の方法

This research employed quantitative analysis combining several data sets on firm activities with respect to their impact on the natural environment including data on: patenting activities, environmental technologies, pollution emissions, international location decisions and financial data. Combining these data sets in various ways provide me with several broad samples through which I was able to test novel hypotheses regarding antecedents to firm environmental pollution and how developing environmental innovations influences firm strategy. I detail my theoretical arguments and findings below.

### 4. 研究成果

The first study examines firms' strategic approach to developing novel technologies that mitigate the impact of business activity on the natural environment. Theoretically, this study builds on Teece's profiting from innovation framework to articulate how developing environmental technology is associated with a double-externality problem. Specifically, all innovations are

discouraged as a result of knowledge externalities that make it possible for competitors to appropriate the knowledge. However environmental innovations are characterized by an additional externality whereby the intended benefits are at least partially appropriated by society rather than the firm. This double-externality characteristic of environmental technology weakens the appropriability regime—that is, the environmental factors, excluding firm and market structure, that govern an innovator's ability to capture the profits generated by an innovation—surrounding pollution reduction technology (PRT).

I argue that weak appropriability induces firms to modify their innovation strategies for PRT development in two ways. First by increasing the extent to which they engage in organizational exploration rather than exploitation. Organizational exploration aims to improve existing firm capabilities, while exploration is more concerned with developing new capabilities. Second, by emphasizing incremental, rather than radical, technologies. Incremental technologies embody refinement and relatively minor improvements to current alternatives, whereas radical technologies constitute fundamental technological change, often establishing entirely new trajectories along which future innovation may proceed.

However, the effects of weak appropriability are unlikely to be static over time. I therefore take the additional step of detailing how the accumulation of organizational capabilities for reducing pollution diminishes the extent to which firms modify their innovation strategies for PRT. That is, firms become less exploratory and less focused on incremental technology as they gain experience with pollution reduction.

Results of broad-sample empirical analyses of 206,277 patents held by 203 manufacturing firms over a 20-year period provide support for the theoretical framework.

Figure 1 shows how the likelihood a patent is exploratory is much higher for an environmental than a non-environmental patent. However, this effect diminishes as firms gain experience through developing pollution reduction capabilities.

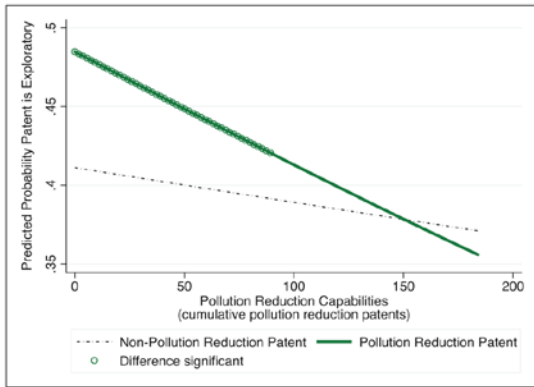


Figure 1.

Similarly, Figure 2. Shows how the likelihood a patent is incremental is greater for environmental technologies and that the effect declines with pollution reduction capabilities.

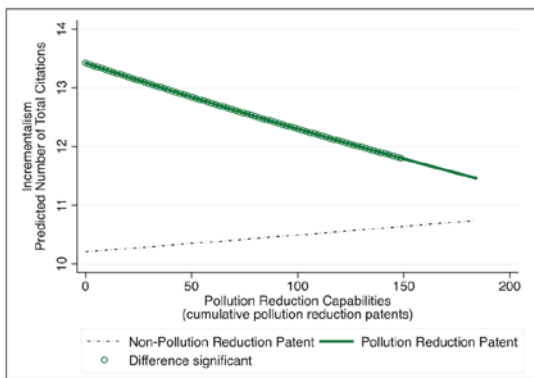


Figure 2.

A second study examines, once developed, the possession of environmental technology influences firm strategy—specifically, international expansion decisions. Stronger environmental regulations at the national level force firms to adopt costly pollution control measures or modify their competitive capabilities. Accordingly, firms are generally reluctant to enter countries as the stringency of environmental regulation increases. However, this deterrent effect becomes weaker for firms that have strong environmental capabilities. Such firms will at least not be hurt by regulation and exceptionally strong firms, in terms of environmental capabilities may even benefit. I tested these arguments using data on 523 instances of international manufacturing expansion into 49 potential host countries by 124 Japanese chemical industry firms between 2001 and 2010.

Empirical tests, provided both statistically significant and practically meaningful support for my main arguments. The main finding is summarized in Figure 3.

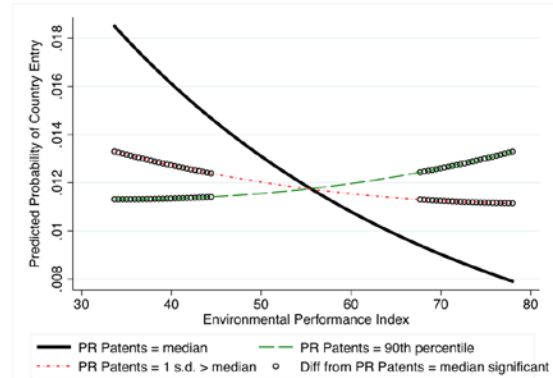


Figure 3.

Here, we see that as national environmental protection regulations become stronger, the average firm becomes less likely to establish a new manufacturing facility in the country (the solid black line). However, for a firm with relatively strong environmental capabilities (that is, a large number of patented environmental technologies), the deterrent effect is much weaker (the dotted red line). Most interesting, for the most advanced firms in terms of environmental capabilities, the relationship was actually slightly positive.

Two additional studies examine the forces bearing on why, or to what extent, firms produce environmentally damaging externalities in the first place. The first examines the phenomenon whereby firms today typically are spread out over multiple, and often distant, geographic locations. It then asks how such distance might influence the extent of pollution at local municipalities in Japan. I apply behavioral strategy perspective to questions of how separation from environmental impact influences firm pollution. Specifically I examine how individual attitudes toward pollution deriving from the theory of issue moral intensity translate into firm-level pollution outcomes. I argue that the local impact of firm pollution will be greater (more harmful) in firms more separated from pollution impact of their pollution and in those firms experiencing stronger business performance pressure (that is lower financial performance of their business). Moreover, the influence of separation on local pollution impact will be

augmented in firms confronting stronger business performance pressure.

Empirical analyses of 5,195 Japanese firms with polluting facilities in 1,446 municipalities observed from 2001-2014 using panel fixed effects (firm-municipality-level) estimation methods provide support for the main arguments. Those results can best be seen in Figure 4.

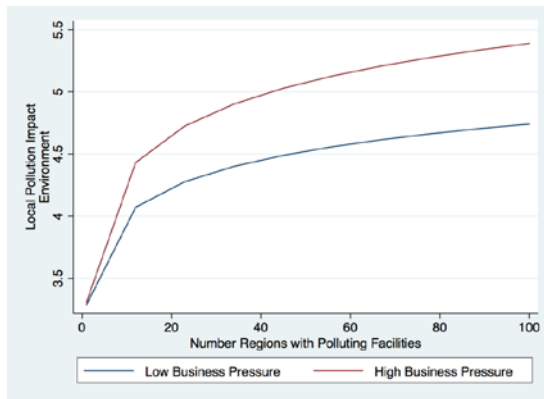


Figure 4.

Here, we see that as firm HQ separation from the local impact of pollution in individual facilities increases (that is the number of total regions with polluting facilities increases), the negative impact of pollution on the natural environment worsens. Moreover, this effect is magnified in firms facing stronger performance pressures on their business.

A final study examines how firms respond to negative performance feedback—that is public evidence that pollution from their facilities is having a more harmful impact on the health of the local residents than their local peers. Building on problemistic search theory and stakeholder theory, I developed a theoretical framework that explains how firms performing below aspirations for environmental performance increase their search for solutions to the shortfall, leading to subsequently more substantial improvements in environmental impact. Conversely, firms that exceed environmental performance aspirations relax their efforts to improve, leading to less substantial improvement. Both responses, however, are conditioned by stakeholder salience—that is the extent to which stakeholder concerns are something firm managers attend, and respond, to. Firms can be expected to increase their search for

solutions to their failure to meet environmental performance aspirations when local stakeholders are more salient. The same forces also weaken firm propensity to relax efforts to improve environmental performance when aspirations are exceeded. Empirical tests of my framework predictions on pollution emissions from over 8,000 facilities from over 1,000 municipalities in Japan over a 14 year period provided support for my arguments. This can be most easily seen in Figure 5.

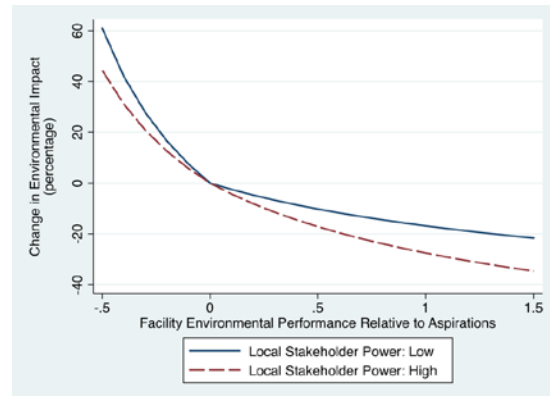


Figure 5.

Figure 5 shows that as the environmental performance of a facility relative to its industry peers in a Japanese municipality becomes worse (that is the firm causes more damage to human health through environmental pollution than peers), their subsequent performance improves—that is, their change in environmental impact becomes more negative (meaning that they cause less environmental damage). The reverse is true when firms exceed their peers—they cause increased environmental damage subsequently. However, the effect of doing worse than local peers on improving environmental performance is stronger (subsequent change is more negative) when local stakeholders have more power (the dotted red line). By contrast, the tendency to perform worse when firms do better than peers is weaker when local stakeholders are strong. In both cases, the prioritization of stakeholder objectives (here better environmental performance) leads firms to respond to environmental performance with better subsequent environmental performance.

## 5. 主な発表論文等

[雑誌論文] (計 1 件)

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## 6. 研究組織

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