



Organisational learning, strategic rigidity and technology adoption: Implications for electric utilities and renewable energy firms

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ABSTRACT

This paper examines the implications of strategic rigidity for technology adoption behaviours among electric utilities. Such behaviours lead to heterogeneity in firm performance and consequently affect the electric utility industry. The paper's central aim is to identify and describe the implications of strategic rigidity for a utility firm's decision making in adopting newer renewable energy technologies. The findings indicate that not all utility firms are keen to adopt these new technologies, as these firms have traditionally been operating efficiently with a more conventional and mature technological arrangement that has become embedded in the organisational routine. Case studies of Iberdrola S.A. and Enel S.p.A. as major electric utilities are detailed to document mergers and acquisitions and technology adoption decisions. The results indicate that technology adoption behaviours vary widely across utility firms with different organisational learning processes and core capabilities.

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1. Introduction

As electric utilities respond to market competition, climate change and the importance of increasing the share of renewables in the energy mix, there is a growing recognition of the pivotal role of technology in determining market success. As a result of

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this recognition, most utility firms have increased their adoption of advanced technologies and augmented their focus in introducing novel technologies to the market. Scholars of innovation and organisational theory posit that the fundamental question firms must address is the manner in which the firms can sustain competitive advantage. The literature in this field attempts to answer why firms within the same industry perform differently. Scholars have considered the resource-based view (RBV) to be the underlying reason for firm performance heterogeneity. The RBV proposes that firms within an industry differ in the resources and capabilities they possess and control, thereby leading to heterogeneous positions within the industry. Accordingly, each firm within a specific industry may be considered a bundle of resources and capabilities [1].

More specifically, past research [2] suggests that organisational capabilities considered within the RBV are essential for competitive advantage and are a major source of firm performance [2–4]. Moreover, dynamic capabilities encapsulate wisdom from earlier work on distinctive competence [5,6], organisational routine [7], architectural knowledge [8], core competence [9], core capability and rigidity [10], combinative capability [11] and architectural competence [12]. The variation in the adoption of a technology can be attributed to the integrative capability of a firm [5]. Importantly, the competitive advantage obtained through the adoption of an innovative technology may be temporary at best. Thus, it is essential for firms to adopt technologies that are new or to adopt multiple technologies to achieve a competitive advantage that is more sustainable. In addition, technological opportunism as a firm-level capability is consistent with multiple research perspectives on organisational traits and capabilities [3,4,13]. Miles and Snow [4] suggest that an opportunistic firm senses technology opportunities and is proactive in capitalising on (or countering) these environmental prospects (or threats). Likewise, technologically opportunistic firms are in an enactment mode with respect to new technologies insofar as they explore several novel technologies that could threaten their organisations or be sources of opportunity [14,15].

Within the electric utility industry, competitive advantage is of great importance, as it summarises the process of value creation and value capture for firms. Thus, this paper builds upon the cornerstones of the strategic management literature to analyse decisions made by these firms to achieve a sustainable firm performance. Often, the discourse on energy policy as part of the electric utility industry is based on the assumption that the focus should be on the energy system as a whole and that policy initiatives with respect to deregulation, investment and environmental impact must be considered as a part of this system, from generation to transmission and distribution and finally to consumption. This paper takes a different approach in that it conceptualises the notion of competitive advantage from a firm's point of view and addresses the role of the firm within the energy eco-system. In this paper, we study the role of strategic rigidity brought about by a firm's competitive advantage in a different technological arrangement (often mature) and its implications for the adoption of newer renewable energy (RE) technologies.

Moreover, the renewable energy sector depends on technological innovations for the sustainable production of energy, and the utility firms act as agents of change and innovation. Many of the utility firms that operate within a specific market seek to adopt these new technologies to be competitive in the marketplace. However, not all utility firms are keen to adopt these new technologies, as these firms have traditionally been operating efficiently with a more conventional form of technology that, as a result, has become embedded in the organisational routine. We propose that this reluctance or delay in adopting new technologies can be characterised as strategic rigidity, which forms as

a result of a firm's core competence and core capability in a different, more conventional technology arrangement. Most utility firms have a renewable energy portfolio aimed at augmenting the adoption of RE technologies to increase the sustainable production of energy. This paper examines the role of a firm's capabilities in established technologies in influencing the firm's technology adoption decisions. While some utility firms have made large strides in distributing electricity from RE sources, others have postponed this practice.

This paper argues that firms' stronger capabilities in conventional technologies can become rigidities that push these firms to further exploit more mature technologies rather than investing in new innovative technologies. This paper considers this phenomenon among electric utility firms from a strategic perspective and outlines possible implications.

1.1. Structure and contents

This paper is structured as follows: in the first section, we discuss the research framework by emphasising the relevant literature regarding strategic rigidity, technology adoption and firm performance heterogeneity. In Sections 3 and 4, we examine barriers to RE technology by emphasising various policy implications. In Sections 5 and 6, we provide background on the electric utility industry, describe the data and document the pattern of technology adoption by examining the case studies of Iberdrola S.A. and Enel S.p.A. Finally, the last section concludes with a discussion and future research directions.

2. Research framework

This paper aims to understand how organisational capabilities with respect to factors such as environmental dynamism may create strategic rigidity within a firm (Table 1). In the case of a utility firm, these factors may result in the late adoption of an RE technology that is innovative and that can maintain the firm's competitive advantage in the future. The likely areas of competitive advantage may lie in the periphery of the firm's strategic vision and can easily become blurred as a result of rigidity, thus permeating the firm's decision-making process. These considerations form the basis of this paper's research framework Fig. 1.

For instance, an oil firm's decision to enter or to exit the solar industry has more far-reaching consequences than another firm's decision to extend its manufacturing facilities by one more assembly line. A utility's decision of whether to invest in a new coal-fired power plant or an offshore wind park determines output for decades to come [16]. These decisions are critical in determining a firm's long-term competitive advantage. To refine the understanding of the mechanisms underlying strategic rigidity, this paper builds on the insights from the organisational theory and strategic management literature, particularly the idea that routines are costly and difficult to change once they are institutionalised. This paper explains this concept by outlining the cases of Iberdrola S.A., the world's largest RE developer and Spain's largest electric utility firm [17], and Enel S.p.A., Italy's largest electric utility firm and Europe's second-largest electric utility in terms of installed capacity. The case of Iberdrola illustrates the firm's core competence in the wind energy sector, which imparts competitive advantage in the RE market. Iberdrola's expertise, know-how and superior capability in a more mature technology arrangement (wind energy) has made it strategically rigid in terms of adopting an innovative technology, i.e., concentrated solar power. Additionally, Enel's diversified renewable energy portfolio is embedded in the firm's mergers and acquisition decisions (Fig. 6).

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