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Development and deployment dynamics of sustainability-driven innovations in the electric and energy utility industry

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ABSTRACT

The purpose of this paper is to examine sustainability-oriented innovations within the electric and energy utility industry in US through the lens of innovation theory and obtain insights on the development and commercialization of sustainability-oriented utility innovations. This research focuses on the top MSCI ESG-rated U.S. utility companies and explores a mix of innovations and strategies that differentiate these top companies. The three emerging propositions from this study are the importance for companies to diversify their innovation portfolio, engage their customers, and establish an intrapreneurial culture. The conjoining of these three propositions offers an evaluation and decision making framework for the companies to maximize the efficacy of profitable and sustainable innovations at all levels and gain a competitive edge against their competitors.

1. Introduction

Environmental sustainability has become a visual problem globally. The 2015 United Nations Climate Change Conference, also known as the 21st Conference of the Parties (COP21), resulted in 195 countries agreeing to reduce emissions to prevent the global temperature average to exceed 2 degrees Celsius. Unless the world collaborates and finds innovative solutions to support these efforts, a plethora of consequences will ensue, including sea level rise that displaces large populations and extreme weather resulting in drought and flooding which takes a toll on food security. Businesses often ignore impacts from their activities, such as consuming energy, which often means burning fossil fuels and releasing greenhouse gases (GHGs) into the atmosphere. Finding solutions to sustainability is extremely challenging due to the lack of intent, awareness, and action to address environmental externalities.

We define an innovation, in its broadest sense, as the creation of a unique solution to economic, environmental and social problems. Thus, we use frameworks and types of innovations that are not only technological but also organizational, institutional and social (Ashford, 2011; Jay & Gerand, 2015). In particular, our research is intended to provide a lens of understanding on how organizations could lead and manage their efforts to achieve the development, adoption and diffusion of sustainability-oriented innovations and expedite the transition to a more sustainable economy. We take a lens on sustainability-oriented innovations that have become recognized as potentially transformational solutions.

Considering its high environmental impact, the focal industry of our study is energy utilities, which involves the generation, transmission, and distribution of energy. We have looked into practices of select companies, as rated by Morgan Stanley Capital International environmental, social and governance-related practices (MSCI, 2016), which would result in improvements in ambient air quality, reduction in greenhouse gas emissions and better human health. In particular, we focus on top four MSCI ESG rated U.S.

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utility companies: NextEra Energy, Sempra Energy, Exelon Corporation and Eversource Energy. Our research evaluates these utility companies in terms of innovations that have made them leaders in their industry. With a thorough review of news, company information and literature we identify key activities of each firm with respect to air quality and emissions. We analyze each activity of these sustainability-informed firms through the lens of innovation theory and identify the types of innovations each company has invested in over the past 10 years. We then gather insights on innovations and innovation strategies of top utility companies, which allow them to achieve their sustainability goals.

We use MSCI ESG rating as our criteria due to trending growth in sustainable investing. Sustainable investing is an investment strategy that takes ESG factors into consideration during portfolio selection and management. This is driven by shareholder interests such as climate change, human rights, and environmental issues (non-climate) (USSIF, 2016). By the start of 2016, global sustainable investments grew by 25% since 2014 and represented 26% or \$22.89 trillion of assets out of all professionally managed assets globally (GSIA Alliance, 2016). There is a clear global trend that investment decisions are increasingly made incorporating ESG factors, which is also reflected on a national level in the U.S.

Our contribution in this research is two-fold. We provide a closer look at different types of sustainability-oriented innovations in the utilities industry. Based on our findings we make three emerging propositions, which, when conjoined, could maximize the effectiveness of sustainability-oriented innovation and in return generate cascading innovations for entrepreneurs and managers. Thus, we propose to entrepreneurs and managers to diversify their innovation portfolio, engage their customers, and establish an intrapreneurial culture. The conjoining of these three items could allow companies to improve the development, adoption and diffusion of sustainability-oriented innovations.

2. Theoretical background

Despite the fall in clean energy investment in the recent years to \$287.5bn in 2016, 18% lower than the record investment of \$348.5bn in 2015, large utility companies are willing to invest more rigorously in clean energy projects with falling equipment costs; e.g., more power can be generated with solar and wind for the same investment costs. In addition, in 2016, acquisitions in clean energy totaled \$117.5bn in 2016, up from \$97bn in 2015 (Financial Times, 2017). To better understand the underlying decisions, we utilize a theoretical framework with three key drivers – operations, market and regulatory – of developing and deploying clean technology projects, as proposed by Erzurumlu and Erzurumlu (2013). We take a look at the interest in clean energy by electricity utilities from three drivers postulated within their framework.

On the operations (i.e., supply) side, a utility company's progress with sustainability developments may be characterized by three factors: dynamic structure of resources and processes, the impact of technological improvements on the existing technologies, and the capital and R&D intensity of the industry (Erzurumlu & Erzurumlu, 2013). Utilities on the supply side are particularly involved with clean energy innovations and infrastructure developments because these technological and infrastructure because infrastructural developments could improve production economics with economies-of-scale (Oliver & Jackson, 2000). In addition, information technology in the energy sector has impacted the costs and risks associated with continuous availability (Walker, 1986), enhancing the performance of energy goods and driving the interest by utilities to invest as well.

To illustrate the extent and influence of the supply side of clean energy developments, consider the smart grid infrastructure. The grid makes generation and transmission of power supply more flexible and convenient. The development of underlying technologies could enable reliable supply, reducing dependence on expensive back-up capacity. Further, the information infrastructure of the smart grids could manage the intermittent supply of electricity from a network of decentralized energy sources. The US utility companies all consider a smart grid technology that integrates with the distribution system and utilizes the power from renewable resources.

On the marketing (i.e., demand side), a utility company's interest with sustainability-oriented developments may be characterized by three factors: the maturity and scale of the market, the firm density of the market, social structures (Erzurumlu & Erzurumlu, 2013). The electricity utility companies now face an increasingly more mature and networked market, leading to higher rate of sustainability-oriented innovations (Norberg-Bohm, 2000). Further, the number of utility companies improve public acceptance of the clean energy solutions and sustainability-oriented innovations (Sine, Haveman, & Tolbert, 2005). Finally, consumers are becoming more socially aware in emissions intensive mature sectors. That social awareness is becoming essential for utilities selling sustainability solutions directly to consumers (Berkhout, 2005).

Finally, regulatory uncertainties affecting utility companies can be listed as price setting, technology standards and quality, financial practices, labor laws, marketing and distribution laws, and accounting laws (Miles & Snow, 1978). Thus, taking the perspective of regulations and policies to overcome these uncertainties, a utility company can characterize the development potential of sustainability-oriented innovations with two factors: price setting, economic entry barriers, and stable regulations, (Erzurumlu & Erzurumlu, 2013). A more stable economic environment is established for sustainability-oriented innovations when regulations and policies are also stabilized; e.g., increasing state financial support in tax credits, subsidies, loans, and exempt status (Wholey & Sanchez, 1991). For example, Solar Cells Hellas, a Greek firm, received support in the form of local feed-in tariffs by Greek government in its very critical growth phase (Makower, Pernick, & Wilder, 2012). Thus, enabling policy and regulatory frameworks could remove barriers for innovations and underline a number of social, economic, political and environmental benefits (Huacuz, 2005).

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