DESIGNING BETTER ENERGY EFFICIENCY POLICIES: A SCIENCE OF IMPROVEMENT PERSPECTIVE

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Overview

Energy efficiency is now a key strategy for many countries to tackle the global warming issue. The presence of barriers to adoption of energy efficiency strategies have been identified and policies have been crafted to tackle the barriers. However, the progess of improvement has been slow and policy makers have difficulties in replicating successful outcomes from one setting to another. This paper aims to develop a more integrated and systemic approach to energy efficiency policymaking by introducing the perspective of science of improvement, which has its origin in the industrial quality movement. The science of improvement perspective encourages continuous testing and learning cycles in order to create reliable solutions. Science of Improvement was first applied in the healthcare field in the United States in the 1980s. Its success has led to the adaptation of the concept into the education field in 2014 by the Carnegie Foundation (Bryk et al 2015). In this paper we examine the potential application of the science of improvement perspective into the field of energy efficiency, with the aim of guiding policy makers to create policies that will accelerate the progress of energy efficiency, and hence narrowing the energy efficiency gap.

The paper is organised as follows: After the introduction the second section gives a brief overview about the science of improvement approach, particularly in the healthcase and education sectors. The six principles of science of improvement approach will be outlined. The next section will attempt to apply the principles to energy efficiency policy with a view of overcoming energy efficiency barriers. We will analyze the policies in Singapore and Indonesia in accordance to the science of improvement perspective. The paper ends with a discussion with the contribution and future work.

Methods

This study uses a qualitative approach to analyze how adopting the science of improvement approach might help to overcome energy efficiency barriers, as classified according to Chai and Yeo (2012).

Results

Below are the six principles of Science of Improvement and how they might be applied in energy efficiency:

Principle #1 Make the problem user- and work-specific.
In making the problem user-centered, we have to seek to understand the energy efficiency barriers faced by the stakeholders that are key players in promoting drivers to energy efficiency. They should be involved in problem definition and problem solving from the earliest phases of development, continued refinement of efforts, through large-scale implementation of energy efficiency policies. In order to understand the whole context of the barriers that companies are facing, find out about their needs and the contexts in which the needs arise. Engaging them will help in developing, evaluating and refining changes in prototypes of initiatives based on users' experiences with them.

Principle #2 Focus on variation in performance.
Science of improvement aims to make improvement efforts advance reliably at scale. As such, identifying and addressing the sources of variability in outcomes of energy efficiency efforts is essential. Every company, despite being in the same industry or geographical location, has different characteristics and energy efficiency maturity. They also face different barriers and combination of barriers, and have different motivating factors for energy efficiency measures adoption. Therefore, initiatives have to be flexible enough to accommodate the differences across companies. Rather than documenting simply "what works", we have to learn "what works, for whom, and under what set of conditions" and include these in the design and implementation stages. There is no "one size fits all" policy.

Principle #3 See the system that produces the current outcomes.
Best practice in another country or another industry may not work in a local setting. We should attempt to fully understand how our current system operates to produce its results. This may relate to the country's political, social and geographical conditions, as well as industry's and companies' characteristics. We have to learn carefully when benchmarking results across countries or industries as multiple components interact with each other to produce results. Better understanding of the system could be done by identifying primary drivers of the current outcome as well as the following components that are hypothesised to activate each primary driver.

Principle #4 We cannot improve at a scale what we cannot measure.
Ability to measure outcomes is essential in all the initiatives introduced to reduce energy use because it allows us to continuously test the working theory and learn whether specific changes actually represent an improvement. For example, smart metering can be used to deliver real time data of energy consumption in a particular setting. This enables two way communications between users and suppliers, inducing energy saving behaviors through means such as dynamic pricing. Besides measuring the outcome, it is necessary to set measures for the primary drivers or mechanisms that are hypothesised to promote this improvement. They represent important and immediate targets that need to be fulfilled to achieve the main outcome.

Principle #5 Use disciplined inquiry to drive improvement.
Policymakers should start with very small tests of change with a few companies and carry out PDSA cycles. Then, move towards scale by testing the initiative in multiple contexts with diverse industrial companies. The multiple iterative trials of improvement aim to gather robust evidence over time and across different contexts. Next, develop a robust and detailed process of protocol to carry out the improvements in the companies. Identify infrastructure and capabilities to be developed further. As the scale of testing increases, we need to gather common data across companies for learning purposes to achieve quality reliably and under more diverse circumstances. In similar ways, this energy management system approach should be adopted within each company when introducing a new improvement effort.

Principle #6 Accelerate learning through networked communities.
Energy efficiency improvement networks can work on testing different initiatives such as voluntary agreements, new technologies and new performance measures. Also, they follow a procedure to develop, test and refine interventions and organised to accelerate the diffusion of these interventions out into the field and support their effective integration. The networks allow for social connections that are key resource for innovation diffusion. Also, the networks will allow participants to investigate patterns and identify improvement targets from data collected and shared network wide, allowing them to compare results and learn from one another. Sharing success stories of participants in the community will also motivate and attract other businesses to adopt the measures.

Armed with an understanding of energy efficiency barriers from the literature and what constitutes science of improvement, we analyze consider how these principles could help practitioners overcome the common energy efficiency barriers to drive energy efficiency in the industry sector. For this purpose we adopted Chai and Yeo (2012)'s taxonomy of barriers: Motivation-related, Capability-related, Implementation-related and Results-resulted barriers. We also evaluate energy efficiency policies in Singapore and Indonesia according to the perspective of science of improvement. Singapore has, to a large extent, embraced the science of improvement in their policy design. The Design for Efficiency scheme and Energy Efficiency National Partnerships represent the spirit of networked communities where participants share their knowledge and drive improvement together. Also, Singapore encourages the use of energy management system (ISO50001) for energy-intensive users, which uses quality improvement approach rigorously. On the other hand, Indonesian policy seems to be in its infancy. There is a lack of system to organise the learning of policy adopters in Indonesia. Knowledge seems to be dispersed among individual companies, technology manufacturers or suppliers, academic field, and organisations like HAKE and Apkenindo. Nevertheless, there is a huge potential of implementing science of improvement in their current efforts. For example, the pilot energy efficiency program in Suryacipta City Industrial Estate, Karawang in cooperation with New Energy and Industrial Technology Development Organisation of Japan aims to identify and adopt best practices and technologies in the industrial park. If successful, they will commercialise and offer it to other industrial parks. Here, the stakeholders have to carefully consider the variations present in other industrial parks and carry out PDSA cycles iteratively, rather than hastily implementing it to many industrial parks. Also, close engagement with the businesses is needed in adapting the improvement efforts into the industrial park.

Conclusions

Our analysis suggests that by considering science of improvement principles, policymakers design better policies that not only accelerate improvement, but also applicable across settings. It also encourages the more extensive use of networked learning to facilitate learning among different settings.

References

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