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Local knowledge creation with the use of industrial energy efficiency networks (IEENs): A Swedish case study

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ABSTRACT

This paper presents a case study of a Swedish municipality, focusing on how local industry and local authorities, collaborating through industrial energy efficiency networks (IEENs), can increase the amount of realized energy efficient measures. The Swedish case discussed here has similarities to a German/Swiss organizational model with the purpose of supporting small and medium-sized enterprises (SMEs) in their implementation of energy efficient measures. Both models have a strong focus on knowledge creation through practice rather than on information sharing. The background, design, benefits, and drawbacks of the Swedish case model are discussed here through document studies and interviews with participants in the project. The Swedish model implies that by supporting knowledge creation in SMEs through a practice dimension, the amount of realized energy efficient measures can be increased. This model should therefore be recognized as an effective policy instrument for municipalities that are interested in supporting local industry. Another conclusion is that information sharing in networks must be complemented by the creation of situated local knowledge through practices. Finally, value, situated practical experience, trust, knowledge creation, and informal meetings are important factors that enabled the network to fully support SMEs in implementing energy efficient measures.

1. Introduction

Increasing industrial energy efficiency is considered to be one of the most fruitful ways of reducing existing cost-effective energy efficiency potential in industry [1]. However, research shows that a gap exists between potential cost-effective energy efficiency measures and the measures that are actually implemented in reality [2–6]. This is often termed the “energy efficiency gap” and this gap can be explained by the existence of various barriers to energy efficiency [7].

In the Swedish context, some studies have been conducted on barriers to energy efficiency for both large companies and small and medium-sized enterprises (SMEs). In these studies, the major barriers to energy efficiency were found to be: lack of time or having other priorities for capital investments; lack of access to capital or lack of budget funding; cost of production disruption, hassles, or inconvenience; technical risks such as the risk of production disruptions; and the difficulty or cost of obtaining information on the energy use of purchased equipment [8–11]. More specifically for SMEs, in the largest study done on SMEs in Sweden, namely Project Highland, it was found that lack of time and having other priorities were the two main barriers to improving energy efficiency [8].

Sandberg and Söderström [12] argue that these existing barriers could indicate a need for other types of external support for SMEs (i.e., regarding lack of time or having other priorities). This need for external support points to a new way of working with energy efficiency were the aim is to promote a more comprehensive way of working with energy efficiency [13,14]. It is also clear that this external support should provide some type of knowledge enhancement to the companies (i.e., regarding the difficulty or cost of obtaining information) [8–10]. Ammenberg et al. [15] consider the importance of educating SMEs to be vital because it motivates and helps staff to understand and deal with energy-related issues much better. In this way, staff members receive support in ways that help them establish an improved energy efficiency decision-making process [16,13].

Local authorities, like municipalities, are often said to be vital for developing sustainable societies. They are considered to be key actors when it comes to adopting and implementing energy policy and goals [17–20]. For municipalities, improving energy efficiency in industry is important in order to reach the goal of making regions more sustainable. In this context, the significance of SMEs has been historically underestimated. However, there has been a shift in this trend such that the importance of SMEs in energy efficiency improvement is recognized by many today [21,13,22]. In Sweden, SMEs account for 30% of industrial energy use, meaning that there is great potential for energy reduction in Sweden [23]. Even though the potential for energy efficiency improvements in the industry is significant for SMEs, the rate of

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implementation of energy efficiency measures is low [24].

Through their environmental work municipalities have the possibility to provide external support for local industry. They can for example act as brokers for their environmental policies, promoting networking in the form of dialogue, interaction, and cooperation among different actors [25,26]. Here participating SMEs are offered an opportunity to cooperate in these networks for a specific purpose, often with financial and administrative support. Effective networks acting as a support structure can benefit SMEs in overcoming barriers and constraints regarding energy efficiency [27].

However, when it comes to public policies and initiatives that are designed to support industrial SMEs in their energy efficiency networks, knowledge creation usually takes the form of energy audit programs. The main output from such projects is often only a technical report [28]. After an energy audit, the realized measures are usually of a limited scope and are often characterized by a limited implementation rate of 50% or lower [28,29]. This result can be explained by the fact that energy audits are often based on mostly economic criteria [30]. A focus on economic incentives alone will miss out on factors that are important for companies and their business environments [31–33,11]. Such initiatives often lack the social context of energy-saving work and can miss the way in which social context is intertwined with technical context [34–36]. People do not just absorb abstract knowledge and then implement optimal energy efficient measures [34]. Rather, people primarily absorb internal and external knowledge through social interaction, for example through input from peers in industry [37] or from ideas that are available inside organizations [28,38].

This paper aims to understand how the use of industrial energy efficiency networks (IEENs) can bridge the gap between energy audits and the implementation of actual energy efficiency measures by exploring a municipality in Sweden that has worked with local industry in this way. The Swedish case study is also compared to a German experience that involved working with a type of IEEN. The aim of this paper is also to discuss how situated learning can enhance our understanding of IEENs, and how these networks can be developed. A logical extension of this paper should be to give municipal policymakers insight into how they can foster progressive collaboration for improving environmental work in local industry.

To explore the topic in this paper Industrial energy efficiency networks is connect with Community of Practice. This is relevant for understanding how industrial SMEs learn and how municipalities can support them in their energy efficiency work. To address the aim of the paper a case study of a Swedish municipality will be explored.

The paper is organized as follows: Section 2 provide a conceptual framework for how learning networks can be used to support SMEs in their knowledge creating process. Section 3 explains the methodology used in this paper to collect and analyze data. Section 4 presents the case study. Section 5 presents the analyses, and in Section 6 the conclusions and discussion are presented.

2. Conceptual framework: community of practice and industrial energy efficiency networks

2.1. Community of practice (COP)

In this article, the theory of communities of practice (COP) will be used to analyze why and how IEENs seem to be able to increase the amount of realized energy efficiency measures better than other models. The use of COP theory will “provide a very useful theoretical framework for research into the social processes of groups in contexts such as the workplace or the local community” [39].

The term “community of practice” was created by Lave and Wenger [35] and argues for a situated social learning experience. This theory is inspired by both anthropology and social theory [40]. Situated learning activities usually consist of meetings, small group discussions, conference calls, and group searches for new knowledge topics [41,40,42]. One important part of this theory is a focus on mutual engagement, where competence and experience are dependent on each other [41]. It is argued that the social context, environment and activities through which learning takes place are vital parts of the learning process [39,43]. As expressed by Lave and Wenger [35], “Activities, tasks, functions, and understandings do not exist in isolation; they are part of broader systems of relations in which they have meaning”. Therefore, practice and learning depend on each other and cannot be separated [44].

A COP, also called learning network or knowledge network [40], may be understood as a harmonious informal group that is not necessarily geographically co-located, which meets regularly to exchange knowledge and share common issues [45–47]. More precisely, a COP is a group of individuals who share their interests and problems with a specific topic, and who improve their knowledge of and expertise on a topic through their regular interaction with each other [41]. This informal group has the primary purpose of developing community members’ capabilities by building and exchanging knowledge [48]. They share information, insights, and advice; explore ideas; and act as sounding boards, all of which activities are turned into knowledge in the end. This way of creating knowledge leads COP members to connect and to establish relationships and norms of behavior through mutual engagement. They develop a sense of joint enterprise with a common view of knowledge, techniques, routines, tools, methodologies, and approaches that is mutually beneficial for its members [41,40,49].

COP knowledge is different from more traditional use of what is termed information. Since we live in a social world, knowing is not just an individual experience; rather, it is an experience of exchanging knowledge and contributing to the knowledge of a community. Therefore, unless it is possible to involve practitioners in an active way in the process, the ability to gain knowledge will be limited. The people who use this knowledge in their activities are also the ones best positioned to manage it, and should therefore be situated in the correct environment [48].

For the successful creation of knowledge trust, familiarity, and mutual understanding, developed in social and cultural contexts, are prerequisites [50,51]. Without these factors, members of a COP may be reluctant to share their knowledge, thereby defeating the purpose of the COP. This will result in an ability to share a high degree of mutual understanding and leads to a positive outcome for the network [52–54]. COPs have been recognized in the literature as an influential mechanism by which knowledge is created, stored, and exchanged [55,52].

Even though practitioners are in the best position to create and use this knowledge, it does not mean that they know everything, are skilled at managing knowledge creation, or have the time to do everything without help [32,56]. COPs create real value by improving the performance of their members as they apply their knowledge in the context of their work. Since members belong to both their COP and their workplace, they are best suited to understand what is of relevance for their company and therefore self-organize around shared and valued interests that is expressed by their potential members [48,42]. The most successful COPs always combine a bottom-up approach with top-down directives from the organization [57].

When organizations are able to use COPs in a positive way, they can be provided with a range of both long-term and short-term benefits [41,51]. Examples of benefits to the organization include assistance in driving strategy, the provision of a forum for problem solving, the transferal of best practices, and the development of valuable professional skills [48].

2.2. Industrial energy efficiency networks (IEENs)

IEENs are a type of municipally governed initiative aimed at improving the energy efficiency of industrial SMEs by having them work together in learning networks. These industrial energy efficiency