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## Barriers and drivers for energy efficiency: different perspectives from an exploratory study in the Netherlands

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### Abstract

Increased energy efficiency represents a crucial opportunity for European industrial sustainability, but several barriers still need to be tackled, as recent policies have not often succeeded as expected. Thus, it is crucial to understand the existing mismatches between the perception of enterprises, and what the major actors promoting energy efficiency believe enterprises suffer from and need to within the decision-making process of investing in energy efficiency. To do so, we have performed an exploratory investigation analyzing a set of Dutch manufacturing enterprises. The study involved other actors, namely the Dutch National Energy agency, the local government, as well as industrial associations to map the views of stakeholders in the decision making cycle. Results show that even a general common understanding of the barriers is disputed, as the interviewees exclusively agree on the primary role of economic barriers. Large mismatches appear when considering how single barriers affect the decision-making process and which drivers – and actors promoting them – need to be addressed. Therefore, much greater attention should be paid to such issues, extending policies from industrial final users to all companies supplying enterprises with capital, technologies, services, information, and competences.

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### 1. Introduction

The actual increasing trends on energy consumption renovate environmental and competitiveness concerns, especially in the European industrial sector, with growing importance of energy efficiency [1]. In particular, great improvement potential is found among European small and medium enterprises (SMEs), where more than two thirds do not implement even simple rules to manage the energy use. The

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metalworking sector is the most representative segment in industry, as it consumes high shares of the total energy. Unfortunately, policy makers and environmental associations do not seem to act effectively in promoting the energy efficiency measures (EEMs), as they neither tackle the existing barriers nor they are able to address the relevant drivers. Thus, it is necessary to adopt an innovative approach in assessing the importance of barriers and drivers on the firms' decision-making process for adopting EEMs, as well as understanding the role of the actors responsible for drivers' promotion, highlighting the key mismatches between the companies' and external actors' perspectives.

## **2. A novel framework for barriers, drivers, actors and decision-making process**

Considering barriers, many different theoretical approaches can be found (see, for e.g., [2]), as well as empirical studies [3-5]. On the contrary, scarce contributions on drivers exist [6], focused merely on highlighting which drivers should be fostered without characterizing them in the decision-making process, and just a few taxonomies have emerged recently. After a comprehensive and exhaustive literature review, a very recent framework for the analysis of both barriers and drivers has been chosen, encompassing the latest taxonomies of barriers and drivers, as well as their effect on the decision-making process [7,8]. In particular, 27 specific barriers were categorized into 7 macro-areas: economic, organizational, behavioural, technological, competence-related, informative and related to awareness. Moreover, 23 single drivers were divided into 4 groups, according to the type of action that has to be done in order to promote them, respectively: regulatory, economic, informative and vocational training.

The need of a broader perspective is clear, since previous empirical research has not fully analyzed the decision-making process and the involved actors. This can give a very interesting contribution in understanding which barriers are experienced and how to overcome them. For this, the decision-making process is divided in six steps. First, awareness on energy efficiency issues must be achieved, followed by needs and opportunities identification, technology identification and planning of the effective intervention. Financial analysis and financing represent the fifth phase, while the last step regards the effective installation, start-up and training. The model encompasses several external actors, such as Government, technology and energy suppliers, installers, industrial association (IAGs), etc.

Such innovative approach aims at identifying and defining mechanisms connecting barriers, drivers, decision-making steps and actors. This approach would lead to the acquisition of fresh knowledge on firms' perceptions, but would also serve for policy-makers' purposes, as it might support the development of the most effective instruments to overcome the barriers and promote the adoption of EEMs. Figure 1 shows the main features of the model, through which firms - and external actors - may recognize the main mechanisms. It is possible to represent the categories of barriers with reference to their impact on the decision-making steps, and to link single drivers to the barriers they strongly address in each specific step. The actors are also taken into account, and they are connected to the driver/s they are responsible for.

## **3. Research methodology**

The people knowledgeable and responsible for energy issues within a set of fifteen Dutch metalworking manufacturing SMEs [9] have been interviewed to investigate the mechanisms occurring between barriers, drivers, decision-making steps and actors. The investigation takes place in one of the European most competitive countries, with historical concern on industrial energy efficiency and environmental policies [10,11]. The Netherlands has a long tradition of voluntary long-term agreements (LTAs, i.e. covenants between the government and particular industrial sectors), aimed at accomplishing ambitious energy efficiency goals. To observe the main mismatches in perceptions between firms and national external actors, other five semi-structured interviews have been conducted to governmental institutions at

a national, regional and local level, as well as metalworking IAGs, major and specific, thus representing a so-called “energy efficiency hierarchy”. As a consequence, different perspectives could arise, not only between firms and the single hierarchy levels, but also between governmental and industrial organizations.

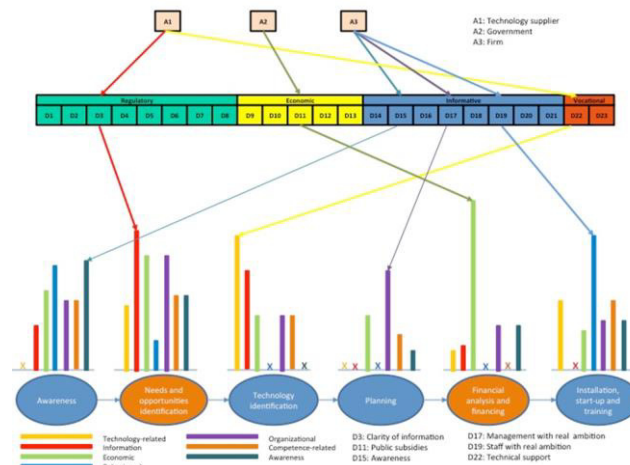


Fig. 1 - The framework to describe the mechanisms connecting barriers, drivers and actors in the decision-making process to undertake an investment in an EEM.

#### 4. Results and conclusions

Results highlight that, although investigated firms had been randomly chosen, they agree on the way barriers affect the decision-making process, on how drivers may help in overcoming them and who is accountable for them (Figure 1). Specifically, alignment in views among enterprises can be observed, since they agree on the most relevant barrier in each step of the decision-making process. The needs and opportunities identification and financial analysis are deemed as the most critical steps by enterprises. Additionally, we can see that mechanisms are aligned as, e.g., in the fifth step the economic barriers are the highest, and public investment subsidies - fostered by the Government - represent the most powerful driver to tackle them. It is also noteworthy that the same barrier affecting different steps could be tackled by different drivers, which are either promoted by the same or by two different actors (see Figure 2a). For instance, clarity of information appears as a strong driver in abating informative barriers in the second step, whilst the same barriers in the third step are better reduced by reliable information (see also [12]). In both cases, technology suppliers are responsible for both drivers. Moreover, economic barriers could be easily reduced by subsidies in the fifth step, whilst a long-term energy strategy seems to be more effective in abating them in the planning phase. Nonetheless, results show that, according to SMEs, while subsidies fall under governmental responsibilities, firms are the only responsible for their own long-term energy strategy.

The most relevant mismatch between companies and the Dutch governmental agency (i.e., at the top level of the energy government hierarchy) can be observed with respect to the relationship and the effects of a long-term energy strategy and voluntary agreements (VAs). Since covenants and VAs, such as LTAs, represent the most frequent environmental policy instrument in the Netherlands, branch organizations were involved to encourage their members to participate and to implement such tools. Yet, these factors are not deemed to be relevant in fostering energy efficiency according to the sampled companies, so they

do not seem to act effectively. However, delivering an Energy Efficiency Plan in the medium-long term, and a monitoring report on an annual base represents the most important obligation for companies within LTAs. Indeed, SMEs do not likely connect this available policy instrument to the highly relevant long-term energy strategy driver. Such mismatch could nonetheless rely in the different perceptions within the levels of the energy government hierarchy. In fact, the governmental agency solely claims the importance of VAs, especially in abating economic barriers in the first four decision-making steps. As reported by the regional and local governmental bodies and by IAGs, the importance of VAs is underestimated, while a long-term energy strategy is deemed as relevant. Moreover, as shown in Figure 2b, long-term energy strategy is perceived as the most relevant driver for abating economic barriers, especially in the planning step (4), whilst the VAs could support in overcoming the same barriers in step 1 (in line with the top level) and step 5. In addition to that, while firms consider the government to be the unique responsible for the covenants, the governmental agency believes the promotion of this driver could be strongly promoted also by IAGs and the company itself. Furthermore, according to the external actors, technology identification (step 3) and installation (step 6) represent the most critical steps. It is noteworthy that such steps follow exactly those two emerged as more critical for enterprises (step 2 and 5, respectively).

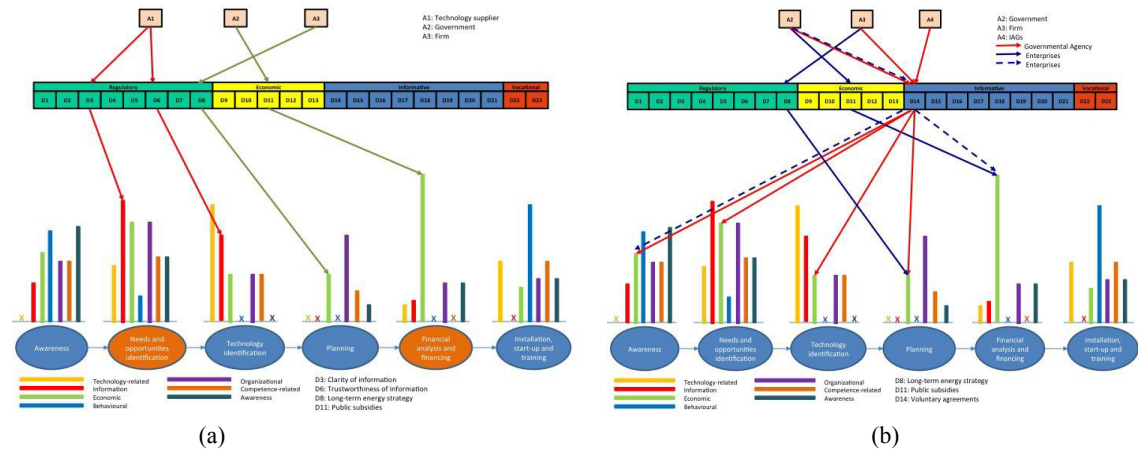


Fig. 2 - (a) Different mechanisms of barriers, drivers, actors and decision-making process. (b) Comparison of mechanisms of barriers, drivers, actors and decision-making process between firms and the governmental agency.

In conclusion, although VAs represent the most popular energy policy in the Netherlands, they do not seem to be considered by SMEs as a stimulus for improving energy efficiency. It is difficult to assess whether an energy efficiency project is implemented because of the agreements, or rather for autonomous initiatives. While companies agree on the high importance of a long-term energy strategy, they do not recognize the strong link with this driver. Moreover, they completely decouple the effect of a long-term energy strategy with the VAs impact on decision-making steps and barriers, even though the submission of an Energy Efficiency Plan in the medium-long term is included in the covenants. This seems due to an evident distortion occurring at the lower levels of the energy government hierarchy. Although this is just an exploratory investigation within metalworking SMEs and much more extensive empirical work should be performed to come up with strong conclusions, it is likely that future efforts should be devoted to align the mismatches observed within the energy efficiency hierarchy. In order to foster the adoption of EEMs, it seems crucial to deal with local governmental institutions and IAGs, supporting them to fully understand the difficulties and needs of SMEs.

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