



Stakeholders' influence on the adoption of energy-saving technologies in Italian homes



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HIGHLIGHTS

- Why energy saving technologies are rarely adopted in buildings?
- Diffusion is slowed by the late participation of stakeholders with great interest for energy technologies.
- The influence of construction stakeholders for the adoption of energy saving technologies is measured in Italian case studies.
- More integrated relationships among stakeholders are required to help the adoption of energy saving technologies.
- Process re-organizations and policies which increase final users' power are needed.

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ABSTRACT

The instability and fragmentation of the temporary aggregations of many stakeholders in construction processes are barriers to adopting new technologies. This paper investigates the influence of different stakeholders on the adoption of mature energy-saving technologies in new residential buildings. Recent literature about the influence of different stakeholders on construction processes is reviewed focusing in their interest for energy saving technologies. To gain an insight into the specific roles played by stakeholders (general contractors, construction firms, architects, users and public governments) in different projects, a case study methodology was used. The influence on the adoption of energy-saving technologies of stakeholders was assessed through semi-structured interviews. These interviews focused on the interest and power for the adoption of several energy-saving technologies. Having recognized that the interest in adoption is often expressed late in the construction processes, the time of introduction of this interest was assessed. This paper provides an empirical insight into significant barriers for the adoption of energy saving technologies which are the low influence of highly motivated stakeholders on the decision of adoption, and the delay at which the interest in energy-saving technologies emerges. Finally, policies to overcome these barriers are suggested.

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1. Introduction

Increasing attention to sustainability has led to policies and regulations that promote green technologies in construction worldwide. In particular, energy efficient buildings are more and more considered a priority to create a sustainable world. This attention for the building sector arises from its energy consumption and greenhouse gas (GHG) emission which, in developed countries, represent 30% and 40% of total quantities, respectively. Moreover, according to the Intergovernmental Panel on Climate Change, the building sector has higher energy and pollution reduction potentials than any other sector (IPCC, 2007; GhaffarianHoseini et al., 2013).

Although many policies encourage the adoption of energy-saving technologies in constructions, the rates of adoption are still low (Manseau and Shields, 2005; Beerepoot and Beerepoot, 2007; WBSCD, 2009). Several reasons have been given for this, such as the high risk in case of failure of the innovation and the cultural stability of the building image (Vermeulen and Hovens, 2006; Häkkinen and Belloni, 2011). Moreover, it is widely recognized that the construction sector differs from other sectors because its products are unique, expensive, lasting and fixed, whereas its processes are unstable, fragmentary and deprived of a continuous flow (Gluch, 2005; Berardi, 2013). A main barrier for the adoption of innovations is hence represented by the structure of the construction sector, which is based on the temporary network of many people who collaborate side by side on a single project (Anumba et al., 2005). Finally, the most common barrier to the adoption of energy-saving technologies is the contrasting

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priorities among stakeholders (de Blois et al., 2011). The main example of this is represented by the low interest of the builders to invest in energy-saving technologies (Albino and Berardi, 2012). One reason for this is that the main benefit for the adoption is for the end-user of the building, whereas the building promoter rarely recovers advantages (Pinkse and Domnisse, 2009). However, several experiences contradict this simple picture. Studies have shown that technical and economic potential for the adoption of energy-saving technologies is quantifiable for every stakeholder (Cole, 2000; Svenfelt et al., 2011).

The influence of stakeholders on more efficient construction has shown contrasting results. Lack of cooperation in the supply chain and inadequate support from governments have constituted important barriers for energy efficient choices (Lutzenhiser, 1994; Häkkinen and Belloni, 2011). Lack of stakeholders with know-how and modest demand are other common barriers to energy efficiency (Runhaar et al., 2008). However, strong support from engaged stakeholders has sometimes been a driver for spurring this transformation (Andrews and Krogmann, 2009; Lee and Yao, 2013). For example, institutional customers, such as social housing organizations, generally support the adoption of green technologies in homes (Brown and Vergragt, 2008). Contrasting examples have led to a questioning of what influence stakeholders have on the adoption of energy-saving technologies. This paper aims to determine which influences different stakeholders have on the adoption of mature energy-saving technologies; doing this, it shows in the context of analysis which policies should be promoted to overcome barriers related to the reduced influence on the adoption of mature energy-saving technologies.

Christie et al. (2011) explained the failure in the diffusion of energy-saving innovations through the limits of economic optimization and technology innovation rationality. This happens because choices and decisions are always socially embedded and strongly influenced by cultural, personal and institutional constraints (Gaps, 1998; DeCanio, 1998).

The scope of this paper is to contribute to the understanding of the influence of construction stakeholders over the adoption of energy-saving technologies in buildings. Moreover, this paper aims at presenting a methodology which can be used for monitoring the influence, interest and power of construction stakeholders during the building processes.

The main hypothesis of this research is that the diffusion of energy-saving technologies is slowed by the late participation in the construction process of the stakeholders who have the greatest interest. Consequently, most of the choices related to construction are made by stakeholders with low motivation for the adoption of energy-saving technologies and high power to impose their will. Finally, this paper aims to identify stakeholders with the potential to push the adoption of energy-saving technologies and conditions which encourage these stakeholders to act.

The present study focuses on residential buildings, as these represent the large majority of buildings. For example, in Europe, the residential building stock is 75% of the total (Eurostat, 2010), and it still accounts for a significant part of the annual investment of the construction sector (Eurostat, 2010). The European building sector is currently facing the requirements given the 2010/31/EU Directive, which aims to build only nearly zero energy buildings after 2020 (Directive 2010/31/EU). For example, the UK Government has recently revised building regulations towards the target of “zero carbon” new homes from 2016, and many other countries are acting similarly (Annunziata et al., 2013). However, the levels of compliance with energy regulations in new buildings are still poor. A recent research has shown that in England and Wales, the compliance with the code is below 35% (Pan and Garmston, 2012). Thinking that across Italy new residential buildings still have energy consumption for heating and hot water of 84 kW h/m²

on average (Eurostat, 2010), it is clear that a big gap exists with the target to be achieved in next few years. This highlights the urgency to investigate factors which can facilitate the adoption of energy-saving technologies.

This paper focuses on medium-sized projects (projects which have fewer than 100 dwellings according Eurostat) because these have been shown to be particularly resistant towards the adoption of energy-saving technologies (Williams and Dair, 2007; Nemry et al., 2010). Medium-size projects have large difficulties in becoming more efficient given the lack of home-buyer demand and of economy of scale in case of adoption (Lutzenhiser, 1994; Williams and Dair, 2007; Hauge et al., 2012). The present study only regards new construction, and although the methodology presented in Section 2 could be applied in case of renovations, the conclusions of the study may not be extended to these last.

Aspects related to stakeholder participation in construction processes, their decision-making process, subjective preference and adoption of energy-saving technologies are combined here.

The following section describes the construction process as a network of stakeholders. This involves the identification of the stakeholders, together with the analysis of their power and interest. The section also analyzes the construction process along the time dimension and reviews stakeholders' motivations towards the adoption of energy-saving technologies. Section three reports the empirical research of previous discussions in two case studies: stakeholders are indicated and interviewed to measure their power and interest for adopting energy-saving technologies. Section four discusses the results of the analysis and the efficacy of current policies for the adoption of energy-saving technologies. The final section draws concluding remarks and makes suggestions to incentivize energy-saving technologies in the building sector.

2. Stakeholders of construction processes

The construction process involves a large number of stakeholders from different backgrounds and with different goals (Anumba et al., 2005; Chinyio and Olomolaiye, 2009). Consequently, the stakeholders' mapping in construction processes is a complex task. Stakeholders are people or groups of people who can affect or are affected by the achievement of a project and organization objectives (Freeman et al., 2010). They have been classified as internal or external, depending on whether they are members or not of the project coalition (Freeman et al., 2010). Other common divisions are between business and non-business stakeholders or between primary and secondary stakeholders (Johnson and Scholes, 1999; Newcombe, 2003; Winch, 2010). In this paper, only stakeholders who act in a decision-making capacity for the project organization and for the adoption of new technologies are considered. Attention is thus restricted to primary stakeholders with a business or regulative role in construction projects.

2.1. Stakeholders' mapping

Stakeholders' mapping consists of three steps: stakeholders' identification, determination of stakeholder's concern, and stakeholder impact analysis (Mitchell et al., 1997). These phases are described below.

A construction process is mainly based on the relationship between the owner of the future building and the builder. However, many people interact in the construction process and influence choices and adoption of traditional or innovative technologies (Pries and Janszen, 1995; Cooke et al., 2007; Entrop et al., 2008). Based on literature studies (Manseau and Shields, 2005;

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