Early Adoption of ISO 50001 Standard: An Empirical Study

Maria Wulandari, Iker Laskurain, Martí Casadesús Fa and Iñaki Heras-Saizarbitoria

Abstract The adoption of international standards for Environmental Management Systems (EMSs) has grown significantly over the last years. Following this successful path some other management standards which deal with environmental and energy management issues have been launched as well. This is the case of ISO 50001, a certifiable international standard to adopt an Energy Management System (EnMS), which was launched in 2011 by the International Organization for Standardization (ISO). From then on, ISO 50001 certifications have experienced a huge growth: from 459 in 2011 to 1981 in 2012, with a total annual growth of 332 %. Regardless of the huge growth, within the scholarly literature only case-based studies have been published on the early adoption of this standard. In order to fulfill this gap this contribution summarizes some of the preliminary results of an empirical study carried out in Spain with the participation of a total of 57 early ISO 50001 certified organizations, aimed at analyzing the early adoption of ISO 50001 standard. The findings facilitate the characterization of ISO 50001 certified organizations and anticipate benefits of the adoption of the standard.

Keywords ISO 50001 · Energy management · Environmental management · Survey · Spain

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1 Introduction

Since it was created in 1987 the International Organization for Standardization (ISO) has launched various management systems standards. Known as meta-standards (Heras-Saizarbitoria and Boiral 2013a), they are in many respects different from the technical standards or regulations, which provide the requirements which certain products or processes need to meet. To name a few of the most well known meta-standards, for instance ISO 9000 family—quality management, ISO 14000 family—environmental management, ISO 26000—social responsibility and ISO 50001—Energy management standard. Although there are plenty meta-standards, this contribution is focused on one specific management system, namely ISO 50001 EnMS standard. Referring to the standardization of very diverse aspects of business activities, ISO 50001 standard contains similarly-structured models of management systems specific to a particular organizational function or stakeholder.

Energy is crucial for the survival of human being; therefore it is not a surprise that energy supply chain, from production to consumption is one of the most important activities of human life. With the rising of energy prices and the situation where energy is an organization's most significant environmental impact, the energy management has emerged as a crucial field. This is where ISO 50001 standard found its niche. ISO 14001 helps to identify all environmental impacts in the broad sense while ISO 50001 focuses on the continual improvement of energy performance, efficiency and consumption. ISO established ISO 50001 standard in order to support organizations to save money by using energy efficiently as well as helping to conserve resources and deal with climate change (Eccleston et al. 2011). ISO 50001 is expected to give a big impact in energy management in the present and in the future. "This standard established a framework, not only for industrial plants but also for commercial, institutional, governmental facilities; and entire organizations to manage energy. Targeting broad applicability across national economic sectors, it is estimated that the standard could influence up to 60 % of the world's energy use" (ISO 2011b).

Since the day it was established, ISO 50001 has been adopted in various industrial and commercial activities. The certification of ISO 50001 standards grows rapidly in only one year, from 459 on 2011 to 1981 on 2012, with total annual growth of 332 % (ISO 2013a). According to ISO 50001 certification world share, Europe has the highest world regional share followed by East Asia and Pacific. The ISO 50001 certification share of Europe 79 and 89 % for 2011 and 2012 respectively. Beside covering the highest ISO certification worldwide, Europe also showed an enormous growth of 383 % on ISO 50001 certification, followed by North America and East Asia and Pacific respectively. In Europe, the highest share of ISO 50001 comes from Germany with 1,115 certificates, followed by Spain, Denmark, Sweden, Italy, Romania, France, Ireland, Austria and United Kingdom respectively. In spite of the high quantity of certificates around the world, especially inside Europe, it is surprising to see that in the specialized literature only several

case studies found (Chiu et al. 2012; Wessels 2011; Velázquez et al. 2013; Lambert 2013; Straughan 2013).

In order to fulfill this gap this contribution summarizes some of the preliminary results of an empirical study aimed at analyzing the early adoption of ISO 50001 standard. Specifically investigated in the survey were the motivations, the resources used, the difficulties faced, and the benefits achieved by the adoption of ISO 50001 energy management standard. In this chapter a fairly basic and descriptive analysis is provided, structured around the main topics of the questionnaire answered by the responding organizations. This rest of this contribution is arranged in the following manner. A detailed explanation regarding the structure of ISO 50001 is explained in the next section. Subsequently in the following section, the methodology of the survey and the survey profile are explained. Afterwards, the main results of the survey are presented in section number four. And finally, the overall results are recapitulated in the final section of conclusions.

2 Structure of ISO 50001

Before ISO 50001 was issued on June 2011, EN 16001:2009 has already been applied in Europe. EN 16001 was issued on July 2009 and it is now superseded by ISO 50001 and withdrawn on April 2012. The structure of ISO 50001 is designed according to other ISO management system standards, in particular ISO 9001 (Quality Management Systems) and ISO 14001 (Environmental Management Systems). Since all three management systems are based on the PDCA cycle, ISO 50001 can be integrated easily to these systems. The structure comparison between ISO 50001 with EN 16001 (Duglio 2011) and ISO 140001 is shown in Table 1. The novel parts in ISO 50001 standard compared with EN 16001 and ISO 14001 are shown in bold letters.

It can be seen that ISO 50001 and 14001 have similar structure of Scope and Normative references, while EN 16001 does not. However, between EN 16001 and ISO 50001, beyond some differences, which does not change substantially the contents, there are four steps of greater distinction:

1. The scope of ISO 50001 refers to continual improvement of energy performance, including energy efficiency, energy use and consumption while EN 16001 only focuses on energy efficiency.
2. The Management responsibility (in 4.2) and the subsequent subsections of the ISO 50001, absent in the EN 16001 and ISO 14001. ISO 50001 emphasizes the fundamental role of the so-called Top Management. It's a strategic actor, which defines policy, objectives and, consequently, allocates resources and defines operational roles (Duglio 2011).
3. The third aspect is present in the Plan phase where ISO 50001 adds some concepts (in 4.4.3—Energy Review, 4.4.4—Energy Baseline and 4.4.5—Energy performance indicators). Coming to the second aspect, in the Plan phase

Table 1 Structure comparison of ISO 50001 with EN 16001 and ISO 14001

Index	EN 16001	Index	ISO 50001	Index	ISO 14001
1	Scope	1	Scope	1	Scope
		2	Normative references[a]	2	Normative references
2	Terms and definitions	3	Terms and definitions	3	Terms and definitions
3	Energy management system requirements	4	Energy management system requirements	4	Environmental management system requirements
3.1	General requirements	4.1	General requirements	4.1	General requirements
		4.2	Management responsibility1		
		4.2.1	Top management a		
		4.2.2	Management representative1		
3.2	Energy policy	4.3	Energy policy	4.2	Environmental policy
3.3	Planning	4.4	Energy planning	4.3	Planning
3.3.1	Identification and review of energy aspects	4.4.1	General requirements a	4.3.1	Environmental aspects
3.3.2	Legal obligation and other requirements	4.4.2	Legal and other requirements	4.3.2	Legal and other environmental requirements
3.3.3	Energy objective, targets and programme(s)	4.4.3	Energy review a	4.3.3	Objectives, targets and programme(s)
		4.4.4	Energy baseline a		
		4.4.5	Energy performance a indicators		
		4.4.6	Energy objectives, energy targets and energy management action plans		
3.4	Implementation and operation	4.5	Implementation and operation	4.4	Implementation and operation
3.4.1	Resources, roles, responsibility and authority	4.5.1	General	4.4.1	Environmental aspects
3.4.2	Awareness, training and competence	4.5.2	Competence, training and awareness	4.4.2	Legal and other environmental requirements

(continued)

Table 1 (continued)

Index	EN 16001	Index	ISO 50001	Index	ISO 14001
3.4.3	Communication	4.5.3	Communication	4.4.3	Communication
3.4.4	Energy management system documentation	4.5.4	Documentation	4.4.4	Documentation
3.4.5	Control of documents	4.5.5	Operational control	4.4.5	Control of documents
3.4.6	Operational control	4.5.6	Design a	4.4.6	Operational control
		4.5.7	Procurement of energy services, products, equipment and energy a	4.4.7	Emergency preparedness and response
3.5	Checking	4.6	Checking	4.5	Checking and corrective action
3.5.1	Monitoring and measurement	4.6.1	Monitoring, measurement and analysis	4.5.1	Monitoring and measurement
3.5.2	Evaluation of compliance	4.6.2	Evaluation of legal requirements and other requirements	4.5.2	Evaluation of compliance
3.5.3	Nonconformity, corrective action and preventive action	4.6.3	Internal audit of the EnMS	4.5.3	Nonconformity, corrective and preventive actions
3.5.4	Control of records	4.6.4	Nonconformities, correction, corrective, and preventive action	4.5.4	Records
3.5.5	Internal audit of the energy management system	4.6.5	Control of records	4.5.5	Internal audit
3.6	Review of the energy management system by top management	4.7	Management review	4.6	Management review
3.6.1	General	4.7.1	General		
3.6.2	Inputs to management review	4.6.2	Input to management review		
3.6.3	Outputs from management review	4.6.3	Output from management review		

[a] Novel parts of ISO 50001 Standard

Source put together by the authors based on the ISO standards

it's interesting to analyze the concept of energy analysis (4.4.3—Energy Review). A section is entirely dedicated to this concept because thanks to it the organization should establish reference energy data (4.4.4—Energy baseline).

The span of time is decided by the organization itself and the purpose is to be a basis for comparison of changes in the organization's energy performance, measured through appropriate indicators (4.4.5—Energy Performance Indicators).

4. Finally, the Do phase of ISO 50001 system has been added two new paragraphs (4.5.6—Design and 4.5.7—Procurement of energy services, products, equipment and energy). Regarding the latter ones, the methodologies are not indicated for the selection of indicators, but the single organization can define method that will be assessed during the visit of the certification body.

In order to provide compatibility and integration opportunity between different ISO meta-standards, ISO 50001 uses the same method of continual improvement Plan-Do-Check-Act cycle as employed in ISO 14001 and ISO 90001 (Fig. 1).

There are several activities that need to be conducted to implement ISO 50001. The activity list of Plan-Do-Check-Act cycle of ISO 50001 is shown in Table 2 below. The novel activities in ISO 50001 are shown in bold.

The novel parts of ISO 50001 are located in Energy Planning and the Implementation and Operation. Energy planning at minimum includes the specific processes to improve energy performance. The schema of energy planning process according to ISO (2011a) is shown in Fig. 2.

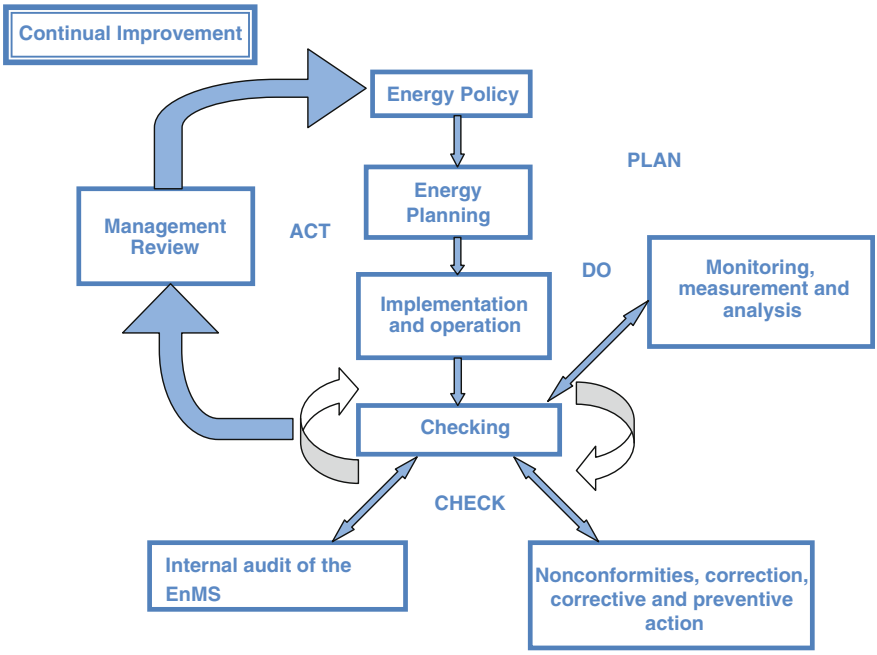

Fig. 1 Plan-Do-Check-Act Cycle of ISO 50001

Table 2 Activity List of ISO 50001

No	Cont. improvement	Activities	Energy management document output	Person in charge
1	PLAN	Establish energy policy	Energy policy	Top management
2		Appoint energy manager	–	Top management
3		Form energy management team	–	Energy Manager
4		Conduct energy review[a]	Energy review	Energy manager and energy management team
5		Establish energy baseline	Energy baseline	
6		Establish energy performance indicators (EnPIs)	EnPIs	
7		Establish energy objectives and targets	Objectives and targets	
8		Establish and action plans	Action plans	
9	DO	Ensure competent, training, awareness	–	
10		Communicates internally	–	
11		Documentation	EnMS documentation	
12		Operational Control	–	
13		Design	–	
14		Procurement energy services, products and equipments	–	
15	CHECK	Monitor and measure processes and key characteristics	–	
16		Evaluation of compliance with legal requirements and other requirements	–	
17		Internal audit of the EnMS	–	
18		Review and make corrections, corrective action, and preventive action.	–	
19		Establish and maintain records	–	
20		EnMS management review	Changes of EnMS documentation	Top Management
21	ACT	Take actions to continually improve energy performance		Energy manager and energy management team

[a] Novel activities of ISO 50001 Standard

Source put together by the authors

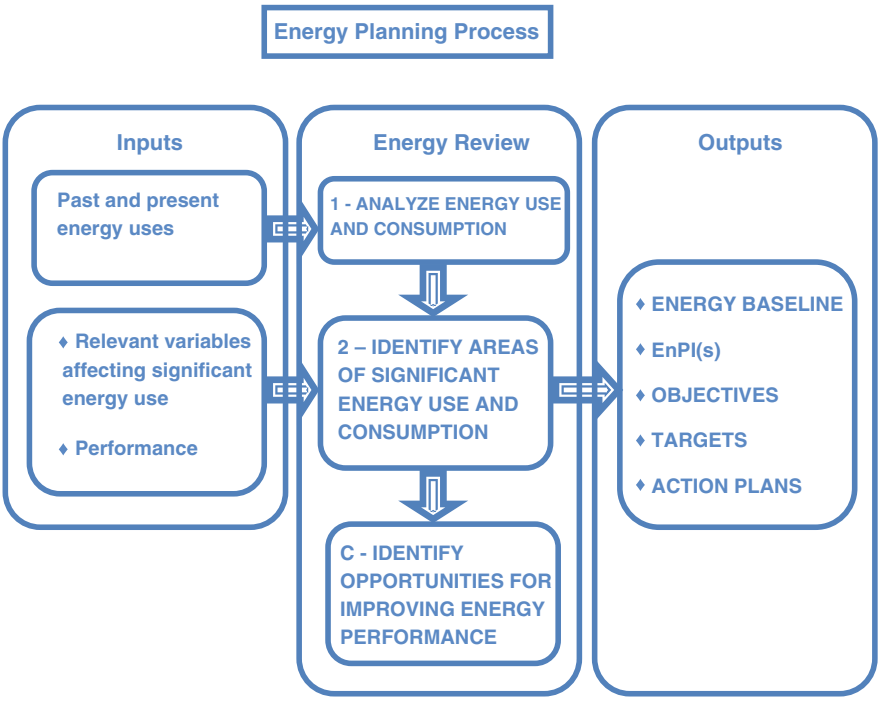

Fig. 2 Energy planning process concept diagram

- Energy review
  Energy review is the determination of the organization's energy performance based on data and other information, leading to identification of opportunities for improvement (ISO 2011a). It is a review of the organization's processes which affect energy use and consumption.
- Energy baseline
  Energy baseline is quantitative reference(s) providing a basis for comparison of energy performance (ISO 2011a). While according to Reichl and Kollmann (2011) the energy baseline is the energy consumption that would have occurred if no direct measures had been taken to influence energy consumption. The changes in energy performance shall be measured against the energy baseline (ISO 2011b).
- Energy Performance Indicators (EnPI)
  Energy performance indicator is quantitative value or measure of energy performance, as defined by the organization (ISO 2011a). It should be identified to assess energy performance and to subsequently evaluate progress towards objectives and targets. It could be expressed as a simple metric, ratio or a more complex model, depending on the organization need.

- Objectives and Targets
  Energy objective is specified outcome or achievement set to meet the organization's energy policy related to improved energy performance (ISO 2011a). Energy target is detailed and quantifiable energy performance requirement, applicable to the organization or parts thereof, that arises from the energy objective and that needs to be set and met in order to achieve this objective (ISO 2011a). Energy objectives and targets shall be established and implemented at the relevant processes and facilities within the organization inside the established time frames.
- Action plans
  According to ISO (2011a), the action plans shall include:
  - designation of responsibility;
  - the means and time frame by which individual targets are to be achieved;
  - a statement of the method by which an improvement in energy performance shall be verified;
  - a statement of the method of verifying the results.

After the energy action plan is prepared, it must be communicated to all the persons in charge in its implementation.

Those documents are to be developed by energy manager and energy management team. The energy management team must consist of professional from various technologies and discipline (Eccleston et al. 2011).

Regarding the other novel part, Implementation and Operation, in this part, the organization needs to conduct the entire plan that has been developed by energy manager and energy management team. ISO (2011b) requires an organization to:

- ensure that any person(s) working for or on its behalf, related to significant energy uses, are competent;
- provide training to meet these needs;
- communicate internally with regard to its energy performance and EnMS;
- establish, implement and maintain information;
- identify the operations and maintenance activities which are related to significant energy uses;
- consider energy performance improvement opportunities and operational control in the design of new, modified and renovated facilities, equipment, systems and processes;
- establish and implement the criteria for assessing energy use, consumption and efficiency over the planned or expected operating lifetime when procuring energy using products, equipment and services.

3 Methodology of the Survey

In order to investigate the motivations and benefits of organizations who have adopted ISO 50001 standard a survey was planned. A questionnaire was designed on the basis of a comprehensive literature review. First, it was conducted a literature review about ISO 50001, the search resulted in several case studies (Chiu et al. 2012; Wessels 2011; Velázquez et al. 2013; Lambert 2013; Straughan 2013), with no empirical studies found. Afterward, as a basic reference, it is considered the researches about ISO 9001 and ISO 14001 (Corbett et al. 2002; Liyin et al. 2006; Williams 2004; Gavronski et al. 2008; Karapetrovic et al. 2006; De Oliveira et al. 2010; Psomas et al. 2011) since it is logical to believe that the adoption of ISO 50001 will follow the same reasoning valid for the adoption of ISO 9001 and ISO 14001. Based on the basic reference, it was formulated the concepts and the various variables affecting it. In this way, it was established the relation between questions and analyzing categories in respect with motivations, implementations and benefits of the early adoption of ISO 50001. The literatures referring to similar and identical concepts were aggregated, generating a list of concepts and references. The survey contained four sections: (1)—organization data, (2)—organization input prior, (3)—implementation process of ISO 50001, and (4)—output of ISO 50001 adoptions. Each section has different content, as shown more detail in Tables 3 and 4.

A total of six pages of questions were employed using a combination of the one to five Likert scale and open-ended answers. The Likert scale provides five alternatives with different degrees of agreement: (a) completely agree, (b) partially agree, (c) do not agree nor disagree, (d) partially disagree, and (e) completely disagree. The survey was disseminated through internet (Survey Monkey) and through paper questionnaire to 87 organizations of the total 120 organizations based

Table 3 ISO 5000 survey sections

Chapter	Contents
1. Organization data	Organization classification
	International scope
2. Input	Motivations
3. Implementation	Commitment leadership
	Human resource
	Other resources
	Time and cost
	Difficulties
	Integration
4. Output	Operational benefits
	Financial benefits
	Innovation

Source put together by the authors

Table 4 Profile of the ISO 50001 studied organizations

Study date	October 2013–January 2014
Study population	120 ISO 50001:2011 certified organizations based in Spain in November 2013
Study sample	87 organizations
Number of responses	57 organizations
Response rate	65 %

Source put together by the authors

in Spain that were registered to ISO 50001. The envelope and the cover letter were addressed to the responsible person for energy and environment or quality of the company. The survey was carried out from October 2013 to January 2014.

4 Results

This section provides a very short discussion of the main results of the empirical work that we carried out. Regarding ISO 50001 standard in organization stemming from the 2014 survey (for a more detailed analysis of the survey can be found in Wulandari et al. 2014). The first factor relates to the motivations for the adoption of the ISO 50001:2011 standard. Afterward, an analysis of the implementation of this process, specifically the commitment leadership, human resource, time and cost, difficulties and integration with other standards, are illustrated. And finally, an analysis of the outputs of this process, in term of operational benefits including energy saving and environmental benefits, and financial benefits are described.

From an empirical perspective Bansal and Hunter (2003) propose three types of motive that lead organizations to implement ISO 14001: competitiveness, legitimation, and ecological responsibility. Similarly, Neumayer and Perkins (2005) underlined two main sources of motivation that lead organizations to implement ISO 14001: internal motives related to efficiency and, on the other hand, external motives related to the social pressure exerted by different agents to persuade company managers to adopt certain practices. In the same vein, Boiral and Roy (2007) has also stressed that the adoption of ISO 14001 can be driven by external pressures and the search for organizational legitimacy in the eyes of various stakeholders (e.g., clients, public authorities, environmental groups), or by internal motivations to improve environmental practices. While González-Benito and González-Benito (2005) differentiated the following four drivers for the adoption of EMSs: operational competitive motivations (costs, productivity), commercial competitive motivations (market, image, customers), ethical motivations, and relational motivations (regulators, local organizations). Figure 3 shows the motivation to adopt ISO 50001 and its importance attached to each, demonstrated by the answers obtained from Part II of the questionnaire "Motivation of ISO 50001".

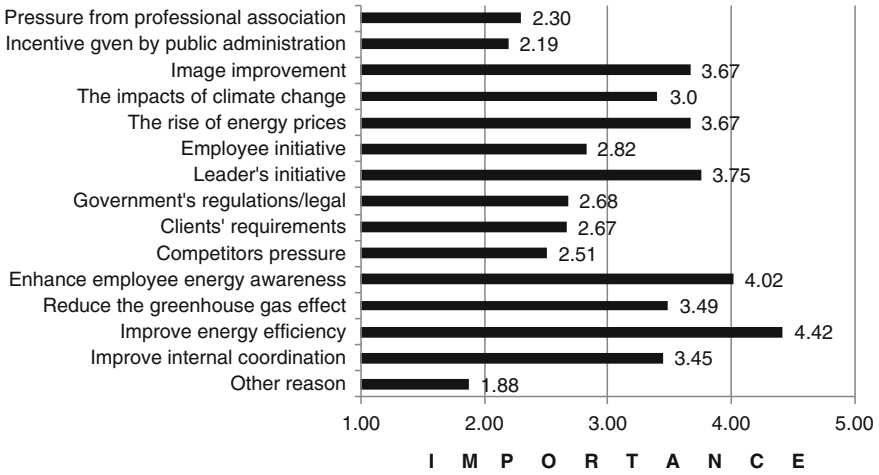

Fig. 3 Motivation for adopting ISO 50001 standard *Source* put together by the authors

By a long run, the most important factor to adopt ISO 50001 was the improvement of energy efficiency, with the median importance level of 4.42 out of 5. The second most important motivation was an issue related with enhancing energy awareness between employees, with the median of 4.02. These two are followed by leader's initiative (3.75), image improvement (3.67) and the rise of energy prices (3.67). And it seems that the drivers such as clients' requirements (2.67), government's regulations/legal (2.68), competitor's pressure (2.51), pressure from professional association (2.30) and incentive given by public administration (2.19) were not deemed as essential as the previously mentioned drivers.

In Fig. 4 the difficulties perceived in ISO 50001 adoption. The most evident difficulty perceived is the necessity of "Continuous measurement instruments" with

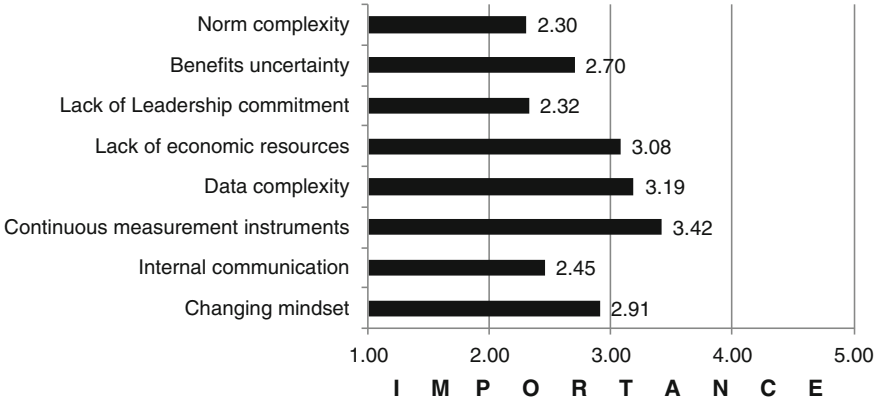

Fig. 4 ISO 50001 implementation difficulties *Source* put together by the authors

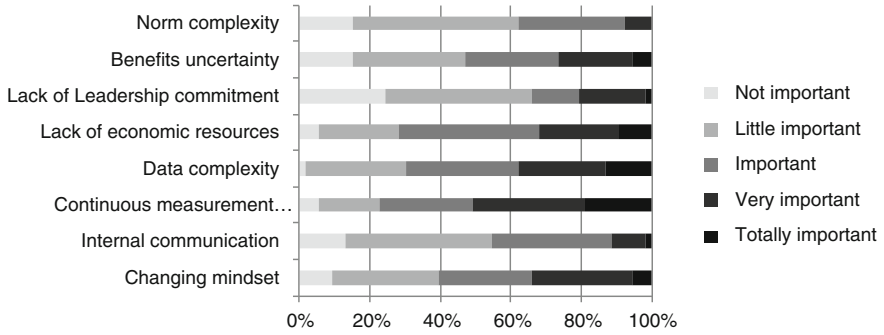

Fig. 5 Distribution of ISO 50001 implementation difficulties *Source* put together by the authors

the median of 3.42, while the second most important is "Data complexity" (3.19). They are followed by "Lack of economic resources" (3.08), "Changing Mindset" (2.91), "Benefits uncertainty" (2.70), "Internal communication" (2.45), "Lack of leadership commitment" (2.32).

Regarding the main obstacles or pitfalls Fig. 5 illustrates the distribution of the difficulties in ISO 50001 adoption. The higher degree of importance is symbolized with darker color; with the darkest indicate the most important difficulties. Seeing the little distribution of the dark color, it can be concluded that the adoption of ISO 50001 does not pose high difficulties. "Norm complexity" seems to be the least difficulty faced during the adoption, while "Continuous measurement instruments" is the highest difficulty faced by certified organizations. "Norm complexity" is perceived as the least difficulty because the parts and structure of ISO 50001 is similar with previous meta-standards, namely quality (ISO 9001), environment (ISO 14001), environment technology service (ISO 20000), corporate social responsibility (ISO 26000), information security (ISO 27000) and supply chain security (ISO 280001). And in line with Wessels (2011), the necessity of "Continuous measurement instruments" is the most difficult challenge in adopting ISO 50001.

Figure 6 illustrated the operational benefits obtained after adopting ISO 50001 and its importance attached to each. The most significant benefit resulted from the adoption of ISO 50001 is "Energy saving" with the median importance level of 4.43. This finding is in line with the study of Psomas et al. (2011) in Greek organizations with ISO 14001. It was shown that "Decrease of energy consumption" is among the benefits of higher importance after the ISO 14001 adoption. The following benefits are environmentally-related, namely "Improve environmental performance" with the median level of 4.02, increase of energy and environmental awareness with median of 3.62. The other benefits are related with day to day operation such as "Process optimization"(3.51), "Overall productivity" (3.06) and "Plant safety" (2.49). Unsurprisingly, the benefits of lowest importance are product related, namely "Improve product quality" (2.45) and "Improve product performance" (2.40).

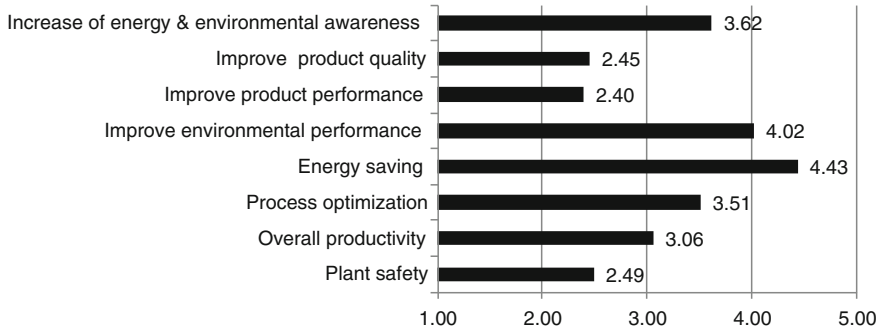

Fig. 6 ISO 50001 operational benefits *Source* put together by the authors

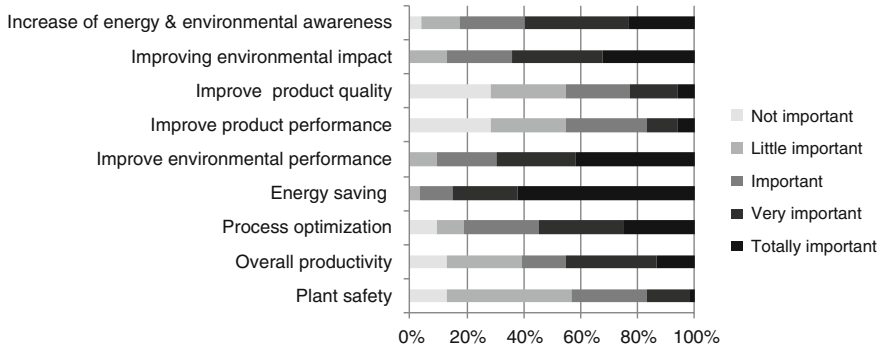

Fig. 7 Distribution of ISO 50001 operational benefits *Source* put together by the authors

Figure 7 illustrates the distribution of the operational benefits for adopting ISO 50001. The higher degree of importance is symbolized with darker color; with the darkest indicate the most important benefits. It is can be concluded easily that "Energy saving" is the most important benefit while "Improve product performance" is the least important operational benefits. As the highest importance of operational benefits is "Energy saving", it is interesting to identify how big is the quantity of energy saving encountered after the adoption of ISO 50001 shown in Fig. 8.

Half of the organizations adopting ISO 50001 achieved 1–5 % energy saving while the rest of the organizations achieve higher quantity of energy saving. For instance 29 % of the organizations achieved 6–10 % energy saving, 11 % achieved 11–15 % and 10 % achieved 16–20 %. This is in line with a study from United States Department of Energy of Superior Energy Performance (SEP) certification resulting that energy saving in the first year after SEP training is 3.8 % and 10.1 % in the first half of the second year (Therkelsen et al. 2013). The quantity of energy saving gained is ranging from 1–5 % and 6–10 % in accordance with energy

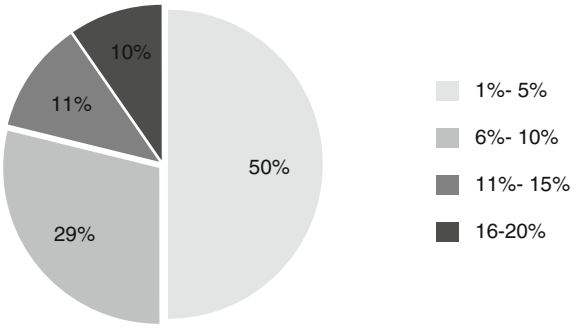

Fig. 8 Quantity of energy saving

management "rule of thumb" from Capehart et al. (2006) saying that typical energy savings of first year energy management program is around 5–10 %.

The financial benefits vs adoption cost after the adoption of ISO 50001 is presented in Fig. 9. As can be seen, majority (51 %) responded that the benefit is bigger than the cost, 16 % responded that the benefit and the cost are similar, while 17 % responded that the adoption cost are bigger than the benefit and 16 % do not know yet.

However, the finding from the present study revealed that the response is not extremely high, only 51 %. A research by Carbon Trust Advisory Services (2013) shown that the average payback (a point in time when the cost spent and the profit gained is equal) of energy efficiency investment is one until 5 years. Considering that ISO 50001 was launched on July 2011, thus the adoption time in organizations so far ranges from 1–3 years, thus it is logical that some of the organizations which adopted ISO 50001 have not reached their payback. In the same vein, Psomas et al. (2011) in Greek organizations with ISO 14001 adoption pointed that it takes an extensive period, which seems more than five years, of ISO 14001 adoption to realize a better environmental performance. Therkelsen et al. (2013) constructed an arithmetic model based on case studies in nine facilities adopting SEP certification stating that SEP participation is expected to have less than 2-year payback for facilities with an annual energy consumption level greater than 0.27 TBtu, and shorter payback time with greater annual energy consumption.

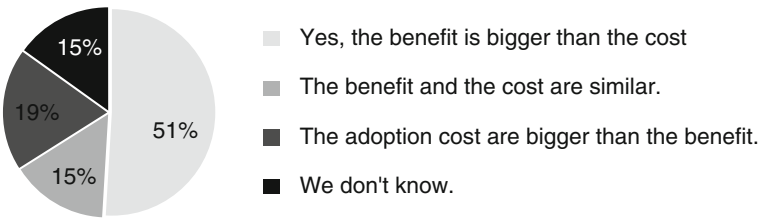

Fig. 9 Financial benefits vs cost after the adoption of ISO 50001 *Source* put together by the authors.

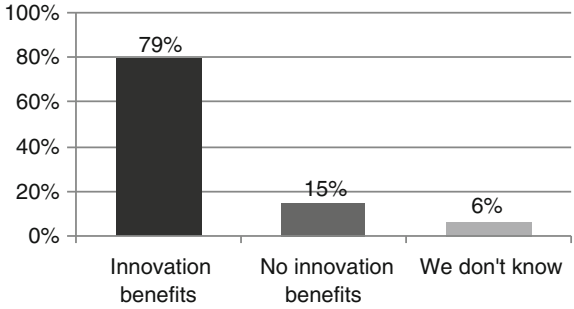

Fig. 10 Organization responds of innovation benefits for adopting ISO 50001 *Source* put together by the authors.

Figure 10 demonstrated that besides giving operational benefits and financial benefits, ISO 50001 also gives innovation benefits. Majority of organizations adopting ISO 50001 responded "Yes" that they reaped innovation benefits for adopting ISO 50001, while 15 % responded "No" and 6 % responded 'We do not know".

The highest innovation benefit for adopting ISO 50001 is "Innovative strategies" with the median importance level of 3.86. It is closely followed by the second highest innovation benefit namely "Process innovation" with the median of 3.58. They are followed by "Primary material innovation" (2.33) and "Final product innovation" (2.19). The finding is in line with Halila (2007) in Sweden SMEs with ISO 14001. He mentioned that corporate environmental strategy has progressed from compliance (i.e. reacting to environmental regulations) to innovative and proactive strategies (i.e. doing more than required by the regulatory authorities) Fig. 11.

Finally, Fig. 12 shows general satisfaction with the adoption of ISO 50001, which as well situated in the last part of the questionnaire to rate the satisfaction. The respondents were given multiple choices between "Very Satisfied" scored 5, until "Very unsatisfied" scored 1. The median importance level is 4.36 out of 5, significance "Very satisfied". The majority of respondents (55 %) respond "Satisfied" while 42 % respond "Very satisfied", leaving only 2 % responded "Little satisfied", 2 % of "Less satisfied" and 0 % of "Very unsatisfied".

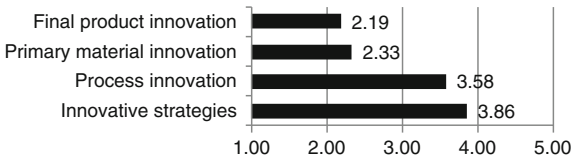

Fig. 11 Innovation benefits obtained for adopting ISO 50001 *Source* put together by the authors.

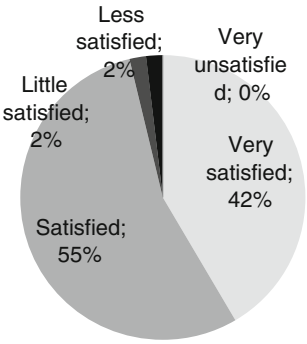

Fig. 12 ISO 50001 general satisfaction *Source* put together by the authors

5 Conclusions

Our findings based on the survey have revealed the motivations and benefits of the early adoption of ISO 50001. The three most significant motivations to adopt ISO 50001 were the internal drivers such as "improving energy efficiency", "enhancing energy awareness between employees" and "leader's initiative" respectively. In our study it was concluded that internal drivers rather than external drivers motivate the implementation of ISO 50001. Based on the result obtained from the questionnaire, the adoption of ISO 50001 does not pose high difficulties. "Norm complexity" seems to be the least difficulty faced during the adoption, while "Continuous measurement instruments" is the highest difficulty faced by certified organizations. "Norm complexity" is perceived as the least difficulty because the parts and structure of ISO 50001 is similar with previous meta-standards. And in line with Wessels (2011), the necessity of "Continuous measurement instruments" is the most difficult challenge in adopting ISO 50001. According to the survey summarized in this contribution, the process benefits among the organizations adopting ISO 50001 are "energy saving", "environmental performance improvement" and "increase of energy and environmental awareness" are most frequently mentioned as the main benefits to adopt ISO 50001 standard compared to product benefits of "product performance" and "product quality". This confirmed that the adoption of ISO 50001 gives process benefits rather than product benefits.

This is in line with the study of De Oliveira et al. (2010) regarding ISO 14001 adoption at industries in São Paulo, Brazil that ISO 14001 adoption contributes especially to the reduction of energy consumption in the production process. In addition, the finding from the study of Psomas et al. (2011) in Greek companies with ISO 14001 is in line with findings from present survey. It was shown that "decrease of energy consumption" is among the benefits of higher importance after the ISO 14001 adoption.

Moreover, the majority of energy saving gained is ranging from 1–5 % and 6–10 % in accordance with energy management "rule of thumb" from Capehart et al. (2006) saying that typical energy savings of first year energy management program is around 5–10 %. However it is interesting to note that several

respondents have gained 11–15 % and 16–20 % energy saving. This is possibly because they are the first organizations/companies who applied ISO 50001 or they have energy management program already in place for long. It is found that half of the respondents opinionated that the direct financial benefits of ISO 50001 adoption is bigger than the adoption cost. However, the finding from the present study revealed that the response is not extremely high and there exist a small finding where the respondents said that financial benefits are equal or even lower than the adoption cost. A research by Carbon Trust Advisory Services (2013) shown that the average payback (a point in time when the cost spent and the profit gained is equal) of energy efficiency investment is one until five years. Considering that ISO 50001 was launched on July 2011, thus the adoption time in organizations so far ranges from 1–3 years, thus it is logical that some of the organizations which adopted ISO 50001 have not reached their payback. In the same vein, Psomas et al. (2011) in Greek companies with ISO 14001 adoption pointed that it takes an extensive period, which seems more than five years, of ISO 14001 adoption to realize a better environmental performance. Furthermore, it is found some percentages of the respondents who are not familiar if the financial benefits are bigger than the adoption cost or not. This is perhaps due to the complexity of organization/company where some people only understand some part of the organizational activities and also due to lack of coordination inside organization/company.

The implications of these findings will be of great interest to the main stakeholders involved in the adoption of ISO 50001, especially for managers, consultants, certified bodies and the policy makers. In the specialized literature of the field internal factors of motivations to adopt management systems have been connected to higher internalization of the standard, or, in other words, to a more substantive adoption of meta-standards, while external drivers are more related to symbolic adoptions (e.g., Heras-Saizarbitoria et al. 2011; Neugebauer 2012; Heras-Saizarbitoria and Boiral 2013b), in other words, aimed at improving corporate image and legitimacy among stakeholders (Boiral 2007; Boiral 2011, 2012; Heras-Saizarbitoria and Boiral 2013a). Then, this evidence leads us to conclude that the adoption of ISO 50001—a more technical and specific meta-standard, which has, so far, a lower brand value for adopting organizations compared to a more disseminated and popular standard such as ISO 14001—, could be more aimed at gaining specific energy efficiency performance improvements than at other objectives.

Apart from the descriptive analysis, the success of this study is shown by the high response rate obtained in the survey and case studies of ISO 50001. The questionnaire was disseminated to 87 organizations of the total 120 ISO 50001 certified Spanish organizations (ISO 2013a), out of which 57 responded. The highest appreciation is given to 57 organizations who have expressed their experience and opinion in survey study.

Finally, possible limitations to this pioneering survey and possible avenues for future research should be mentioned. The methodology used to obtain the quantitative information on the adoption of ISO 50001, as is based on the perceptions of specialized managers in charge of the process, could suffer from social desirability and other related bias (Heras-Saizarbitoria and Boiral 2013a). Similarly, as underlined

by Boiral and Roy (2007), reverse causality bias could be a problem, since the outcomes of ISO 50001 adoption could influence the perception of its drivers. Besides, this study is a static study measured in one point in time from one meta-standard that is still very young and thus the reality of ISO 50001 adoption may change in the future following the maturation of the standard itself. Also, although the main characteristics of the process of adoption of meta-standards does not differ much from one region to another, since the organizational field in which these kind of standards have been disseminated is a global one, specific conditions in other countries and regions may alter the findings (Heras-Saizarbitoria and Boiral 2013a). In any case, this explorative study serves as a stepping-stone for a more detailed and more comprehensive study to be conducted in the future. Future surveys might, on the one hand, collect, analyze and triangulate information from various information sources and on the other hand, collect sample from various countries to analyze the influence of the geographical variable.

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