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Reasons to Adopt ISO 50001 Energy Management System

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Abstract: Purpose: The main aim of this paper is to analyze the relationships between the corporate motivations that lead organizations to establish the ISO 50001 Energy Management System (EnMS) standard, and the difficulties and benefits derived from its adoption. **Design/methodology/approach:** Three independent exploratory factor analyses (EFA) were conducted in order to identify (i) sources of motivation: social requirements, ecology drivers, and competitive advantage; (ii) the difficulties of an ISO 50001 adoption: operational difficulties and organizational difficulty; and (iii) types of benefits: ecological benefits and operational benefits. In a second step, an exploratory path analysis, performed through Structural Equation Modeling (SEM), was used to analyze the relations among motivation, difficulties, and benefits related to the adoption of the ISO 50001 standard. **Findings:** Social requirements explain operational difficulties, which in turn impacts on operational benefits. Ecology drivers are directly related to ecological benefits. Organizational difficulties have an inverse relationship with operational and ecological benefits. Operational difficulties are related to operational benefits and ecological benefits. **Research limitations/implications:** The questionnaire was disseminated to 87 Spanish companies with ISO 50001 certification. Managers and other practitioners such as consultants, auditing companies, and official organizations in charge of developing standards might find useful implications. **Originality/value:** The standard was published in 2011 by the International Organization for Standardization (ISO). This paper contributes to assessment of the benefits of the standard by collecting information directly from the pioneer organizations that have adopted it, and provides clues on how to implement the standard and improve it in future.

Keywords: sustainability; ISO 50001; Energy Management System; motivations; difficulties; benefits

1. Introduction

The adoption of international standards on Environmental Management Systems (EMSs), notably the ISO 14001 standard, has grown significantly worldwide over the last two decades [1,2]. Following this successful path, some other management standards that deal with environmental management aspects have been launched, such as the ISO 14006 standard for eco-design [3], the ISO 14064 standard for quantification and reporting of greenhouse gases, and the ISO 14031 standard for environmental performance evaluation, among many others. This is also the case with ISO 50001, a standard to guide the adoption of an Energy Management System (EnMS), which was published in July 2011. Targeting broad applicability across national economic sectors, it is estimated that the standard could influence up to 60% of the world's energy use [4].

In particular, ISO 50001 accounts for 11,985 registered organizations in 2015. The certification grew rapidly, from 459 in 2011 to 1981 in 2012, with total annual growth of 332%. Considering the growth of ISO 50001 and ISO 14001, also referred to as meta-standards [2], and given the importance of the promotion of energy management for cleaner production [5], a study analyzing causal relation between motivations, difficulties, and benefits is needed.

The main aim of this paper is to analyze the relationships between the corporate motivations that lead organizations to establish the ISO 50001 EnMS standard and the difficulties and benefits derived from its adoption. This research helps to fill this gap, based on the information obtained from 57 Spanish companies that participated in a survey.

2. Description of the ISO 50001 Standard and Literature Review

In a recent study, Lee and Cheng conducted an extensive review of academic articles showing how different EnMSs yield substantial energy-saving effects [6]. Particularly, they prove how these energy-saving performances correlate with specific EMS functions. Their main contribution, according to their review, is that EnMSs are efficient in terms of savings. Previously, May et al. proposed the four key elements that guarantee the full integration of energy efficiency into the manufacturing process [7]: strategy, tool, process, technology. Accordingly, an efficient EnMS should be embedded in these four pillars.

Merli et al. conducted an extensive study [8], based on a large survey (nearly 562 valid questionnaires were collected in Italy), which analyzed the motivations, main difficulties, and results (in terms of environmental and financial performance) of the implementation of a formal management system based on Eco-Management and Audit Scheme (EMAS). Tourais and Videira also analyzed [9], through a literature review of 80 papers, the motives and benefits that drive organizations to adopt the EMAS.

However, the literature devoted to the ISO 50001 standard is still scarce. Chiu et al. [10] analyzed, through some case studies, how the implementation of the ISO 50001 standard improved energy performance indicators. These good results are also an additional motivation for competitors to implement the standard. Karcher and Jochem [11] also found that the positive results of ISO 50001, in terms of monetary savings, motivate other organizations to implement it. Moreover, they also state that the main enabler is the positive attitude of the staff. The EnMS energy savings have been analyzed in different settings and geographical areas: Cholette and Venkat [12] focused on the logistic chain for food and beverages in USA; more recently, Jabbour et al. [13] analyzed how ISO 50001 can optimize the emissions of CO_2 and the management of the green and low-carbon supply. McKanet et al. [14] provided a methodology to assess the impacts of these gas emissions at a national, regional, and global scale. All in all, there is a stream of research devoted to technical issues. However, there is a lack of research related to the impact of the standard in the management of the organization. There is one precedent in this minority research line: Wulandari et al. [15] analyzed motivations and difficulties in implementing the ISO 50001 standard, but without studying the relationship between motivations and benefits.

Therefore, there is still a lack of consensus related to which motivations, difficulties, and benefits organizations have in implementing the ISO 50001 standard. Hence, our aim contributes to the extant literature providing deep insight in how the motivations and difficulties to adopt the ISO 50001 standard really impact on performance results, both ecological and operational. In order to address this, this section starts with a description of the standard, and follows with a literature review on these three issues.

2.1. Description of the Standard ISO 50001

The ISO 50001 Energy Management System is a standard, created by the International Organization for Standardization (ISO), defining the requirements of an Energy Management System. The standard specifies the requirements for establishing, implementing, maintaining, and improving an Energy Management System, with the purpose of enabling an organization to follow a systematic approach in achieving continual improvement of energy performance, including energy efficiency, energy security, energy use, and consumption [16]. ISO 50001 aims to facilitate the establishment of the systems and processes necessary to improve energy performance in organizations, including energy efficiency, use, and consumption [4].

ISO 50001 is not the first energy management standard in the world. Earlier, there were approximately 14 regional and/or local energy management standards. The research conducted by Anisimova [17] concluded that the previous energy management standards have many features in common. This is not accidental, since all the previous energy management standards before ISO 50001 were developed by individuals working within the ISO management model for continuous improvement. Still, ISO 50001 has several significant improvements, especially compared to the European Energy Standard EN 16001:2010 [18].

The structure of ISO 50001 is designed according to other ISO management system standards, ISO 9001 (Quality Management Systems) and ISO 14001 (Environmental Management Systems) in particular. Since all three management systems are based on the Plan-Do-Check-Act (PDCA) cycle (Figure 1), ISO 50001 can be integrated easily to these systems [19].

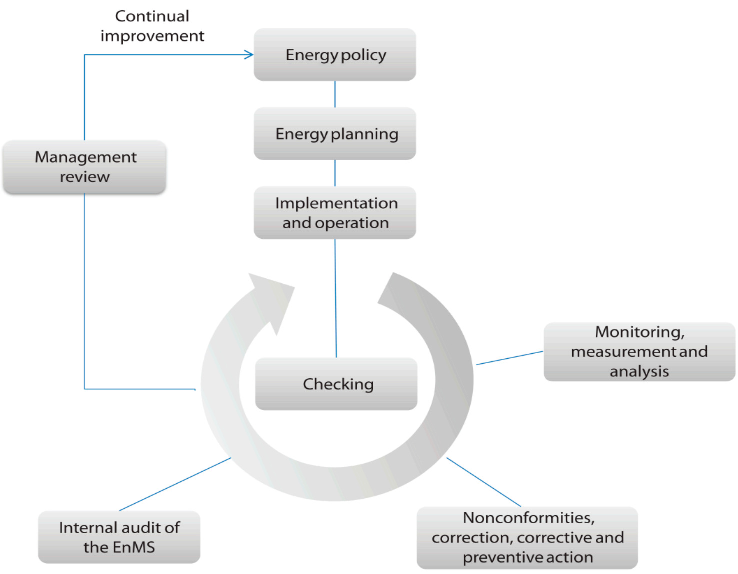

Figure 1. Plan-Do-Check-Act (PDCA) Cycle of ISO 50001. Source: [20].

In the context of energy management, the PDCA cycle can be summarized as follows [20]:

- Plan: conduct the energy review and establish the baseline, energy performance indicators (EnPIs), objectives, targets, and action plans necessary to deliver results in accordance with opportunities to improve energy performance and the organization's energy policy.
- Do: implement the energy management action plans.
- Check: monitor and measure processes and the key characteristics of operations that determine energy performance against the energy policy and objectives and report the results.
- Act: take actions to continually improve energy performance and the EnMS.

2.2. Motives

There are various motives behind the application of standards. From an empirical perspective, Bansal and Roth [21] propose three types of motive that lead companies to implement ISO 14001: competitiveness, legitimation, and ecological responsibility. Neumayer and Perkins [22] also underlined a couple of motivations that lead companies to adopt ISO 14001: internal related to efficiency, and external related to the social pressure exerted by different agents to persuade company managers to adopt certain practices. Pan [23], exploring the motivations of firms registering ISO 14001 in four far Eastern countries (Japan, Taiwan, Korea, and Hong-Kong), found that the desire for improving corporate image, environmental improvement, gaining marketing advantage, and improving relations with communities were the most important reasons for the ISO 14001 certification. In the same vein, Psomas et al. [24], through exploratory factor analysis in Greek companies, emphasized three main sources of ISO 14001 motives: competitive advantage, social requirements, and environmentally-friendly policy. González-Benito, J. and González-Benito, O. [25] 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). Gavronski et al. [26] proposed four typologies of motivation in implementing the ISO 14001 standard: pressures from the external stakeholders; pro-action looking for future business concerns; legal motivations; and internal motivations. Recently, Marimon et al. [1] found that some sectors are using the ISO 14001 certification in order to "clean" their image as "dirty" sectors or sectors which are aggressive against the environment. This is particularly true in the energy sector. In the same vein, Marimon et al. [27] claim that other standards such as the Global Reporting Initiative (GRI) are also used by the energy sector in order to disclose information about their interaction with and respect to the environment.

2.3. Difficulties

According to Wessels [28], the difficulty of ISO 50001 implementation in Toyota SA was in changing people's mindset that energy reduction does not necessarily have an impact on safety, quality, or production cycle time. Babakri et al. [29] has investigated the obstacles of ISO 14001 implementation in US companies, such as high cost of certification, lack of available resources, lack of leadership commitment, uncertainty of ISO 14001 benefits, etc. Velázquez et al. [30] stated that the difficulty in EnMS implementation in petroleum industries in Seville was in determining the energy baseline and energy performance indicator (EnPI) because of the complexity of the data; the production rates are highly variable and several interacting processes coexist at a single site. One cannot easily determine the energy baseline and energy performance indicator (EnPI). Another difficulty comes from the technical issue of installing an automated real-time energy measurement in accordance with Wessels [28]. Liyin et al. [31] mentioned that the increased cost, and the time and resources consumed, have discouraged construction companies from engaging actively in improving their environmental performance. In the same vein, Babakri et al. [29] also mentioned that the two highest obstacles of ISO 14001 are the high cost of certification and lack of available resources, along with the benefits uncertainty of ISO 14001 adoption.

2.4. Benefits

The ISO 50001 standard is a powerful tool for organizations to improve their energy performance. Wessels [28] showed that the implementation in Toyota SA has proved to be successful with indicators of energy savings/year and kg CO_2 savings/year. Velazquez et al. [30] also found that 2.82 GWh energy savings have been achieved. Lambert [32] estimated that the Bentley Group saved at least 180 kW and 1,532,768 kWh in one year. Also, it has been shown that in the Bridgestone group, between 2000 and 2010, the energy used on site for each car produced was reduced by two thirds [33]. Recently, Jabbour [13] also identified several contributions of the ISO 50001 in support of the adoption of green supply chain management. The integration-energy-practice model for introducing an ISO 50001 Energy Management System can efficiently meet demands for energy performance indicators and pass the international certification for ISO 50001 Energy Management Systems [34].

Other standards, such as ISO 14001, are proven to give operational benefits as well. ISO 14001 gives operational benefits in terms of cycle time, efficiency, flexibility, cost, plant safety, overall productivity, product innovation, product performance, product quality, defects, quality assurance, and process optimization [35–38]. Giving another perspective, Psomas et al. [24] stated that the internal benefits of ISO 14001 adoption in Greek companies are more significant than the external ones. Chavan [39] highlighted that the ISO 14001 standard is a powerful tool for organizations to both improve their environmental performance and enhance their business efficiency by minimizing environmental liabilities, maximizing the efficient use of resources, reducing waste, demonstrating a good corporate image, building awareness of environmental concern among employees, gaining better understanding of the environmental impacts of business activities, and increasing profit through more efficient operations.

3. Methodology and Data

3.1. Questionnaire

To investigate the motivations and benefits of companies who have adopted the ISO 50001 EnMS, a structured questionnaire was designed on the basis of a comprehensive literature review. Since there is scarce previous empirical literature related to ISO 50001, some items were borrowed from previous authors who have analyzed motivations and benefits of other related standards (e.g., ISO 140001 and EMAS). The questionnaire contained four sections: (1) background information; (2) organization motivation to adopt ISO 50001; (3) adoption process of ISO 50001; and (4) result of ISO 50001 implementation. Each section has different content, as shown in more detail in Table 1. The last three sections correspond to the three constructs analyzed in the literature: motivations, difficulties, and benefits.

Table 1. ISO 50001 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

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: (1) no effect; (2) a little important; (3) important; (4) very important; and (5) totally important.

It is important to stress that since the methodology used to obtain the quantitative information is based on the perceptions of specialized managers in charge of the process, it could suffer from social desirability and other related bias [2].

3.2. Sample

This research is focused in Spain since it has the second-highest share of ISO 50001 certification throughout the world, next to Germany [19]. Given that Spain has been a member of the European Union since 1986, Spanish energy policy goals are derived from the EU goals and aligned with "Europe 2020". In line with the target to reduce greenhouse gas emissions in the EU by 20% from 1990 to 2020, Spain will have to increase energy efficiency to contribute to the EU target of reducing energy demand by 20% by 2020.

As stated, despite the study being focused in Spain, the findings of this research could clearly be of interest to stakeholders from other countries, since it can be argued that the main characteristics of the process of adoption of management standard systems do not differ much from one region to another, since the organizational field in which these kinds of standards have been disseminated is a global one [2].

Consequently, the questionnaire was disseminated first via internet and, for the organizations from which we didn't obtain any response, later through paper questionnaire to senior management representatives who were in charge of energy management certification in the organizations adopting the ISO 50001 EnMS. These organizations were recorded in the database of AENOR (*Asociación Española de Normalización y Certificación*), the company in charge of the development and diffusion of technical norms and certifications in Spain.

The questionnaire was disseminated in November 2014 to 87 companies of the total 120 ISO 50001 certified Spanish organizations [19], out of which 57 responded, representing a response rate of 65% (Table 2). The small quantity of the data sample is mainly due to the low number of certifications, the difficulty to discover the organizations adopting ISO 50001, the difficulty of data access, and the exploratory character of the study. Although the quantity of organizations which collaborated in the study was small, it is a high response rate when taken as a relative measure.

Table 2. Profile of the "ISO 50001" studied organizations.

Study Date	February 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%

3.3. Statistical Analysis

The statistical software EQS was used for data processing. First, an array of Exploratory Factor Analyses (Kaiser criterion and varimax rotation method) was applied to discover the latent constructs of the motives, difficulties, and benefits. These analyses provide a few factors that account for the original observable variables, which enables the interpretation due to the fact that previous variables are gathered in a small number of factors. The motivations to obtain the ISO 50001 certification comprises the drivers that influenced the top management to seek the EnMS certification. The difficulties are related to the complexity faced during ISO 50001 implementation. The benefits scale is related to performance improved or created by the certification process.

Next criteria were used to retain items from these Exploratory Factor Analyses: (i) load at 0.50 or more on a factor; (ii) do not load at more than 0.50 in two factors; and (iii) have an item to total correlation of more than 0.40.

The reliability of the obtained constructs was assessed through Cronbach's alpha, Composite Reliability (CR), and Average Variance Extracted (AVE). According to Hair et al. [40], in this research the values of 0.6 to 0.7 are accepted as the lower acceptable limit of Cronbach's alpha coefficients. The accepted limit for CR is 0.7 and 0.5 for AVE, although for exploratory studies where the constructs are not settled, these thresholds can be relaxed.

Once the reliability and validity of these constructs were probed, they were used in an exploratory path analysis, which was conducted correlating all motivation with difficulties and all difficulties with benefits. The model obtained was then improved by adding parameters suggested by Lagrange Multiplier Test until it reached the required parameter fit indices.

4. Results and Discussion

4.1. Profile of Respondents

Based on the number of employees it is observed that the responding companies were small, medium, and large, given that 33% employ less than 100 employees and 43% employ between 101 and 500 workers, representing the largest group in terms of size. Interestingly, the percentage of organizations having between 501 and 1000 workers (4%) is less than the percentage of organizations having more than 1000 employees (20%). According to the organizations' average turnover, the organizations with big turnover (>50 M€) comprised the highest percentage (38%) of the respondents, followed by organizations with micro turnover (<2 M€) with 36%, organizations with small turnover (<10 M€) with 14%, and organizations with big turnover (<50 M€). The majority of organizations adopting ISO 50001 (85%) integrate their meta-standards adoption with ISO 9001 and/or ISO 14001, while only 15% do not.

4.2. Motives for the ISO 50001 Implementation

The measured variables, with respect to the motives that led companies to the ISO 50001 certification, were used as the basis for Exploratory Factor Analysis. The result was the establishment of three latent constructs or factors with which the motives were discovered (Table 3). Based on the loadings of the ISO 50001 motives, the latent constructs were labeled as: F1 "social requirements", F2 "ecology drivers", and F3 "competitive advantage". From Table 3 it can be observed that all the Cronbach's alpha are above 0.7. The F2 and F3 achieved the CR threshold recommended by Hair et al. [40], whereas F1 achieved only 0.660. The convergent validity is indicated by an AVE above 0.5 and a CR value higher than the AVE, which is satisfied by all factor loadings except for F1. In any case, even though F1 doesn't comply with the CR and AVE threshold, it is still considered reliable since its Cronbach's alpha, as a lower bound reliability parameter, complies.

Table 3. Exploratory factor analysis for the motives in adopting ISO 50001.

		F1	F2	F3
Variables	**Mean Value**	**Social Requirements**	**Ecology Drivers**	**Competitive Advantage**
Incentive given by public administration	2.19	0.701		
Pressure from professional association	2.30	0.969		
Improve energy efficiency	4.42		0.727	
Reduce the greenhouse gas effect	3.49		0.749	
Enhance employee energy awareness	4.02		0.605	
The rise of energy prices	3.67		0.659	
The impacts of climate change	3.39		0.907	
Competitors pressure	2.51			0.708
Clients' requirements	2.67			0.833
Image improvement	3.67			0.520
Model information				
Eigenvalue		4.674	2.679	1.337
Cronbach's alpha		0.809	0.847	0.721
Composite reliability (CR)		0.660	0.953	0.895
Average variance extracted (AVE)		0.492	0.676	0.501
Mean value [a]		2.246	3.796	2.947

[a] Mean value range: 1 represents "no effect" to 5 represents "totally important".

Consequently, internal drivers such as ecology drivers seem to be the strongest motives for adopting ISO 50001 for the organizations that participated in the present study. However, external motives such as obtaining a competitive advantage and social requirements seem to also be present, but are less significant with regard to their contribution to the organizations' decision to adopt ISO 50001. The term "social requirements" might cause some misunderstanding. In this case, it is composed of two items. The first is related to public administration incentives, and the second is related to the incentives promoted by other professional institutions.

The findings from the study of Psomas et al. [24] on Greek companies with ISO 14001 is in line with findings from the present survey. Using the Exploratory Factor Analysis, it was shown that both internal reasons and external reasons influence ISO 14001 certified companies, and the internal reason constructs of "environmentally-friendly policy" are of higher significance than external reasons of "competitive advantage" and "social requirements".

4.3. Difficulties for the ISO 50001 Implementation

Using the measured variables with respect to the difficulties during ISO 50001 adoption as the basis for Exploratory Factor Analysis, the result was the establishment of two latent constructs with which the difficulties were discovered (Table 4). Based on the loads of the ISO 50001 difficulties, the latent constructs were labeled as: F6 "Operational difficulties", and F7 "Organizational difficulties". The reliability and convergent validity of these two constructs were found in a way analogous to that in the previous subsection (see Table 4). The construct F7 does not comply with the minimum threshold for AVE. Nevertheless, since the CR index is good enough, it can be considered reliable.

Table 4. Exploratory factor analysis for the difficulties in adopting ISO 50001.

		F6	F7
Variables	**Mean Value**	**Operational Difficulty**	**Organizational Difficulty**
The necessity of continuous measurement tools	3.34	0.849	
Data complexity	3.04	0.721	
Lack of economic resources	3.02	0.715	
Norm complexity	2.26	0.751	
Changing mindset	2.77		0.661
Internal communication	2.40		0.758
Lack of Leadership commitment	2.28		0.759
Benefits uncertainty	2.57		0.559
Model information			
Eigenvalue		4.238	0.943
Cronbach's alpha		0.838	0.775
Composite reliability (CR)		0.971	0.781
Average variance extracted (AVE)		0.721	0.475
Mean value [a]		2.92	2.50

[a] Mean value range: 1 represents "no effect" to 5 represents "totally important".

Based on Table 4, the difficulties faced by the organizations adopting ISO 50001 are quite low, showed by the mean values of 2.92 and 2.50, with the operational issues more difficult than the organizational ones. The previous experience of adopting international standards such as ISO 9001 and ISO 14001 may have facilitated conformity with ISO 50001 requirements. It has to be considered that 85% of the organizations adopting ISO 50001 have adopted other international standards, namely, ISO 9001 and ISO 14001.

4.4. Benefits for the ISO 50001 Implementation

The measured variables with respect to the benefits for adopting ISO 50001were used as the basis for Exploratory Factor Analysis. The result was the establishment of two latent constructs with which the benefits were discovered (Table 5). Based on the loadings of the ISO 50001 benefits, the latent constructs were labeled as: F4 "Ecological benefits", and F5 "Production benefits". The reliability and validity of these constructs were assessed in the same way as in previous subsections (see Table 5).

Table 5. Exploratory factor analysis of the benefits for adopting ISO 50001.

		F4	F5
Variables	**Mean Value**	**Ecological Benefits**	**Production Benefits**
Energy saving	4.43	0.749	
Improve environmental performance	4.02	0.917	
Improve environmental impact	3.83	0.892	
Increase of environmental awareness	3.55	0.784	
Increase plant safety	2.47		0.628
Increase overall productivity	3.04		0.776
Process optimization	3.49		0.712
Improve product performance	2.38		0.782

Table 5. *Cont.*

		F4	F5
Variables	**Mean Value**	**Ecological Benefits**	**Production Benefits**
Improve product quality	2.43		0.793
Model information			
Eigenvalue		4.520	1.825
Cronbach's alpha		0.895	0.858
Composite reliability (CR)		0.962	0.858
Average variance extracted (AVE)		0.561	0.549
Mean value [a]		3.958	2.762

[a] Mean value range: 1 represents "no effect" to 5 represents "totally important".

The mean value of ecological benefits scored quite high in terms of importance (3.958), while the production benefits scored a lower significance (2.762 out of 5). Therefore, the adoption of ISO 50001 is quite successful in granting ecological benefits for the organizations adopting it. However, it is possibly due to the immature age of ISO 50001, which gives the euphoria sensation of a new standard adoption; this was the case for ISO 9001, the benefits of which have actually fallen over time [41].

4.5. Path Analysis

The three previous exploratory factor analyses identified three dimensions of motivations, explaining two dimensions of difficulties which in turn explain two dimensions of benefits. From the obtained latent constructs, an exploratory path analysis was conducted correlating all motivation with difficulties and all difficulties with benefits, as shown in Figure 2. The path analysis model was estimated by using the maximum likelihood method from the asymptotic variance–covariance matrix. EQS Version 6.1 was the software used to compute the empirical work.

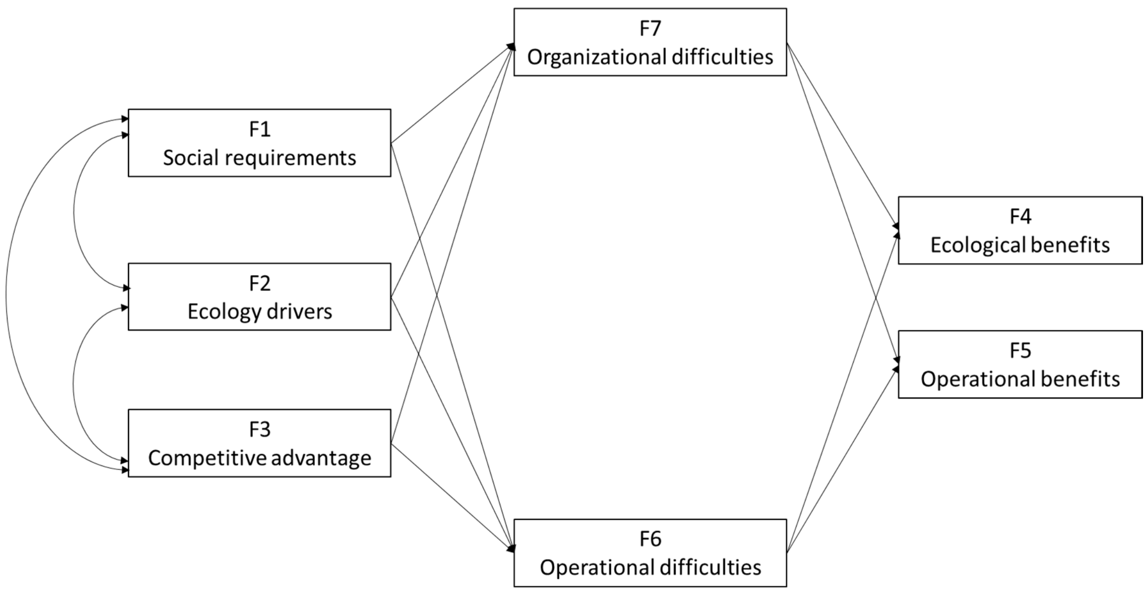

Figure 2. Exploratory path analysis graphical representation.

The model obtained was then improved by adding parameters suggested by Lagrange Multiplier Test until it reached the required fit indices parameter. The selected fit indices parameter was Comparative Fit Indices (CFI) since this parameter performs well even when the sample size is small [42]. The final model and results obtained are shown in Figure 3.

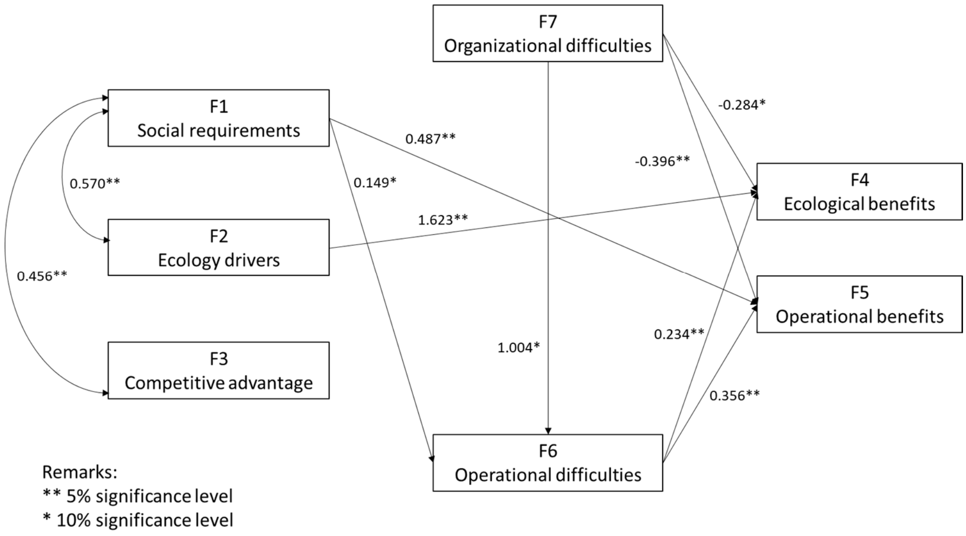

Figure 3. Final path analysis graphical representation. Note: standardized solution paths in the arrows.

Before analyzing the relation further, the discriminant validity was assessed by linear correlations or standardized covariances between latent factors by examining whether inter-factor correlations were less than the square root of the average variance extracted (AVE). Table 6 shows the square roots of each AVE were greater than the off-diagonal elements.

Table 6. Correlation matrix of latent factors.

Correlation Matrix of Latent Factors	F1	F2	F3	F4	F5	F6	F7
F1. Social requirements	*0.702*						
F2. Ecology drivers	0.099	*0.822*					
F3. Competitive advantage	0.438	0.007	*0.708*				
F4. Ecological benefits	−0.099	−0.160	−0.234	*0.749*			
F5. Operational benefits	0.034	−0.016	−0.025	0.426	*0.628*		
F6. Operational difficulties	−0.141	0.034	−0.418	0.354	0.149	*0.849*	
F7. Organizational difficulties	−0.022	0.000	−0.275	0.169	0.098	0.735	*0.661*

The diagonal elements, in italics, are the square roots of average variance extracted (AVE).

The measurement model was estimated by using the robust maximum likelihood method. Th fit indices obtained in the measurement model estimation showed that the variables converged (see Table 7). The x^2 Satorra–Bentler was 358 with 294 degrees of freedom, the *p*-value was 0.00613, the Root Mean Square Error of Approximation (RMSEA) was 0.065, and the CFI was 0.907. Taking the significance of the robust x^2 statistic with caution, and noting the global indicators, the global fit was acceptable.

Table 7. Standardized solution of the causal model.

		Coefficient	*t*-Value	Sig. Level
Path	F1 Social requirements–F5 Operational benefits	0.487	2.998	5%
	F1 Social requirements–F6 Operational difficulties	0.149	1.003	10%
	F2 Ecology drivers–F4 Ecological benefits	1.623	5.503	5%
	F6 Operational difficulties–F4 Ecological benefits	0.234	2.101	5%
	F6 Operational difficulties–F5 Operational benefits	0.356	2.367	5%
	F7 Organizational difficulties–F4 Ecological benefits	−0.284	−1.751	10%
	F7 Organizational difficulties–F5 Operational benefits	−0.396	−2.001	5%
	F7 Organizational difficulties–F6 Operational difficulties	1.004	1.725	10%
Correlation	F1 Social requirements–F2 Ecology drivers	0.570	2.035	5%
	F1 Social requirements–F3 Competitive advantage	0.456	2.581	5%
Fit statistics: x^2 Satorra–Bentler (df = 294) = 358 (*p*-value = 0.00613); RMSEA = 0.065; CFI = 0.907; BB-NFI = 0.656; BB-NNFI = 0.889				

The social requirements (consisting of incentive given by public administration and professional associations) cause the operational difficulties, which arise during the implementation process. On the other hand, the ecology drivers cause ecological benefits. In other words, without ecology drivers, "only" operational benefits would be attained. The incentive and pressure received from public administration and professional associations enable the organizations to perform on a superficial level resulting in operational benefits such as safety, productivity, optimization, performance, and quality, but not ecological benefits.

The ecology drivers are directly related to ecological benefits. This finding is logical since the organizations obtain ecological benefits by having ecology motives in mind before adopting ISO 50001. Regarding the relations between motivations and benefits, there is a positive relationship between the level of internal motivation of Spanish companies when adopting the ISO 14001 standard and the internal benefits obtained from that process [2,43]. This finding is also in line with that of Gavronski et al. [26] on ISO 14001 adoption in Brazilian companies, where internal motivations presented a strong relationship to the perceived internal benefits and legal motivations.

The organizational difficulty has an inverse relationship with the operational and ecological benefits. This is logical since change management is initiated first on organizational and managerial activities, and afterwards continues to technical activities. Therefore, organizational difficulties—ranging from changing mindset, internal communication, lack of leadership commitment, and benefits uncertainty—restrain operational and ecological benefits. With a reduction of organizational difficulty, an organization is more agile and able to work faster and, as a result, achieve higher operational and ecological benefits.

The last finding is that operational difficulties, which comprise the necessity of continuous measurement tools, data complexity, lack of economic resources, and norm complexity, are related to operational benefits and ecological benefits. ISO 50001 requires the organization to develop a policy for more efficient use of energy, fix targets and objectives to meet the policy, manage energy data, measure the results, and so on. These activities inevitably cause operational difficulties and, although it may sound counterintuitive, the more seriously an organization takes the implementation of ISO 50001, the more ecological benefits gained due to the effort required to face these difficulties. In other words, these operational difficulties cause operational and ecological benefits; it is a challenge which the organization needs to overcome to win the energy challenge and gain benefits.

5. Conclusions and Policy Implications

This research gives an initial view of the relationships between motivations, difficulties, and benefits in ISO 50001 adoption, which is especially of great interest for the managers, engineers, consultants, certified bodies, and policy makers.

Two dimensions characterize the difficulties of an ISO 50001 adoption: operational difficulties and organizational difficulties. There are also two types of benefits: ecological benefits and operational benefits. An exploratory factor analysis identified three sources of motivation: social requirements; ecology drivers; and competitive advantage. The analysis also showed that social requirements explain operational difficulties and result in operational benefits. Ecology drivers are directly related to ecological benefits. Organizational difficulties have an inverse relationship with operational and ecological benefits. Operational difficulties are related to operational benefits and ecological benefits.

Findings show that for gaining ecological benefits, firstly, it could be necessary to detect and internalize ecology motivations. Organizations must also realize that social requirements only bring them as far as operational benefits, but not as far as ecological benefits. Organizational difficulty, such as changing mindset, should be minimized in order to obtain operational and ecological benefits, whereas it may be necessary to face and overcome operational difficulties in order to gain operational and ecological benefits.

Thus, the first lesson extracted is that social requirements are the antecedents of operational benefits, both directly and indirectly through the mediation of operational difficulties. Moreover, social requirements impact indirectly on ecological benefits. Consequently, these social requirements are relevant in order to achieve a good performance in terms of both ecological and operational benefits. On the other hand, the ecology drivers only impact on ecological benefits, not operational. This issue gives rise to a question that managers must face: whether to invest in social requirements or in ecology drivers. If operational benefits are prioritized, managers should invest in social requirements, to the detriment of ecological benefits; on the other hand, if ecological benefits are the main goal, managers should invest in ecology drivers, neglecting operational benefits. There is a tradeoff between both types of benefits. This is the dilemma that the current research model helps to solve.

These results might also be useful to the "makers" of the next version of the standard. The standard is still in its starting phase, with respect to the diffusion phenomenon and regarding the maturation of the standard in itself. These findings will provide insights in order to improve the next release of the standard.

The efficiency of energy use enables organizations to save money, as well as helping to conserve resources; consequently, this is also a factor that helps to prevent damage to natural resources. Due to the extent to which an Energy Management System (and particularly ISO 50001) contributes to saving the use of natural resources, the standard will also contribute to the stabilization of climate parameters, and will therefore be of interest to the national governmental institutions and international associations that are dealing with environmental issues. Hence, the findings of this paper and, in general, research which investigates energy efficiency will be more and more relevant for these institutions.

On the other hand, taking into account that ISO 50001 is based on the management system model of continual improvement (also used for other well-known standards such as ISO 9001 or ISO 14001), the organizations will have an extra incentive to integrate this standard with the previous standards. Both ISO 9001 and ISO 14001 have been very successful and have gained great popularity. Both are well diffused among countries and economic activities. Marimon et al. [27,44] and Llach et al. [45] have analyzed the diffusion phenomenon of both standards. Shortly after the publication of the ISO 9001 standard, Casadesus and Karapetrovic [46] studied the causes that lead organizations to certify under the ISO 9001 standard. In most cases, the main motivation was external. In other words, the organizations were not motivated by a potential improvement in economic or efficiency performance. The main reason to adopt was explained in terms of image and prestige. The subsequent editions of the standard were more focused on customer satisfaction, and the reasons that lead organizations to certify evolved into seeking customer satisfaction [47]. This case demonstrates how the standard adapts to the necessities and requirements of the organizations. Something similar happened with the evolution of ISO 14001, and we foresee that the ISO 50001 standard will also have a process to fit with the real necessities of the organizations. The recent new standard versions ISO 14001: 2015 and 9001: 2015 enable the process and integration with other international standards, which will impact on the diffusion of the ISO 50001 standard.

The ISO 50001 standard provides a framework of requirements for organizations regarding some different issues. Internally, it is intended to help develop a policy for more efficient use of energy, but also to fix targets and objectives to meet this policy. To the extent that organizations are measuring results in terms of efficiency energy, the standard will help them to continually improve energy management. If organizations do not find it useful, the standard will decrease its diffusion, and it might even trigger a decertification process. Hence, the ISO organization has an interest in understanding the motivations that organizations might have to certify, and also those reasons that might lead them to decertify.

Some empirical papers have analyzed how the improvement in energy management can be measured through some indicators. Each industry and each country requires different indicators to show its evolution and how different management decisions impact on the overall energy efficiency [48]. However, this paper contributes to the understanding of the motivations in deciding to adopt an EnMS based on ISO 50001 and the expected benefits. Wulandari [15] analyzed it from a purely descriptive point of view, without finding any relationship between motivations, difficulties, and benefits.

Moreover, the particular case of the ISO 50001 standard has some particular features, which need special attention. Unlike the ISO 9001 standard case, where the only interested party in the adoption process is the organization, the adoption of ISO 50001 affects third parties. Governments have to attain a certain level of emissions in accordance with international agreements. There are also other stakeholders that are demanding sustainable processes and products. Consumers are more and more interested in products that are manufactured according to sustainable requirements [49]. Sustainable consumption is gaining impetus as a new environmental policy objective. Like other ISO management system standards, certification to ISO 50001 is not obligatory. The organizations might decide to implement the standard solely for the benefits it provides or also to show external parties (customers, government regulatory bodies, etc.) that they have implemented an Energy Management System.

Obviously, the fact that the survey was carried out within a single country gives rise to a limitation, since specific conditions in other countries and regions may alter the findings [2]. It will also be interesting to collect data through several years in order to assess evolution and trends, enabling a longitudinal analysis.

Some future research lines arise from the findings of this paper. Once the standard is well established and diffused, among different activity sectors and geographical areas, it will be necessary to analyze differences between adopters and non-adopters. This will shed light on the contribution of the standard to the adopting organizations. Along this line, an analysis of the diffusion will also be needed, in order to understand the phenomenon. The Rogers' typology [50] for adopters will provide specific characteristics for organizations in each phase for the innovation adoption group (innovators, early adopters, and laggards). This will allow forecast behavior of new adopters, which will be of interest not only for managers, but all institutions and organizations involved with this type of certification—including accreditation organizations, certifying bodies, and business consultants specializing in the implementation of the ISO 50001 standard.

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