Revista **Turismo** & Desenvolvimento | n.º **27/28** | 2017 | [**1221** - 1236]
e-ISSN 2182-1453

'Greening' no setor da **hotelaria e restauração**

'Greening' the **hospitality** and **restaurants industry**

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Resumo | Apesar do impacto do turismo no ambiente já ter sido discutido na literatura, não existe muito conhecimento sobre a orientação ambiental nas empresas no setor do turismo. Estarão as empresas do setor atentas à adoção de inovações ambientais? Qual a relação existente entre as atividades de Eco inovação e atividades de inovação em geral? Estão as empresas destes setores a ser pressionadas para se tornarem mais "verdes"? Este artigo pretende dar resposta a estas questões considerando dados da indústria da hotelaria e restauração em Portugal. A análise é efetuada com dados ao nível da empresa recolhidos no *community innovation survey* (CIS). Os resultados revelam que o enfase tradicionalmente colocado na tecnologia e na regulação poderá ser exagerado no caso das empresas de hotelaria e restauração.

Palavras-chave | GEco-inovação, hotéis e restaurantes, turismo, CIS, Portugal

Abstract | While the impact of tourism on the environment has now been widely discussed in the literature, there is not much knowledge about the environmental orientation of firms in the tourism sectors. Are tourism firms active in what concerns adoption of environmental innovations? How these eco-innovations articulate with other forms of innovation? Are the firms in these sectors being pressured to 'green' its operations? This paper investigates these questions in relation to hospitality and restaurants within the context of Portugal. The study draws on quantitative firm level data from the community innovation survey (CIS) for restaurants and hospitality. Our paper provides evidence that the traditional focus on 'technology' as a push and on regulation might be overstated for the case of Hospitality and restaurants firms'.

Keywords | EcoInnovation, hospitality and restaurants, tourism, CIS, Portugal

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1. Introduction

Tourism as an economic sector has a growing role in both the national and international political agendas, considering its role for job creation and growth (WTTC, 2015). The rise of tourism propelled the interest on analyzing the environmental impacts of this activity. While the conflicts between tourism and the environment are evident, from a social and environmental perspective, tourism, if properly regulated, could become an essential tool in protecting the environment and valuing heritage by enhancing benefits for local economies (UNWTO, 2015).

In order to inform policy and regulation, further studies are necessary on the environmental behavior of the stakeholders involved. Central on the matter are firms, and how they are regarding pressures for 'greening'. Yet, information on the behavior of tourism related firms is scant.

This paper aims to tackle this gap. We analyze the eco-innovative behavior of firms in the hospitality and restaurants (HR) sector, a leading tourism subsector. The study is applied to Portugal, where tourism is mentioned as a strategic pillar in the national economy assuming a highly visible role in job creation, income and value-added creation. The study uses data from the Community Innovation Survey (CIS) of 2006-2008.

The rest of the paper evolves as follows. Section 2 presents a theoretical exposition over eco-innovation drivers, while section 3 presents the methodology and data. In section 4 we present our main results attained through implemented methodologies and section 5 concludes and discusses the implications of the results attained.

2. Theoretical Background

2.1. Eco-Innovation

Eco-innovation may be defined, according to the literature, as the introduction in the market of a new or significantly improved product, technique or management system that avoid or reduce damages on the environment (Horbach, 2008; Arundel & Kemp, 2009). Our study is based on the data collected on the CIS conducted in 2009, which follows closely the above definition, with some more detail. An environmental innovation is "a new or significantly improved good or service, process or organizational method or marketing method that creates environmental benefits compared to alternatives". These definitions are consistent with the Oslo Manual definition of innovation which is the guidebook for the official innovation surveys worldwide.

Two important conditions should be mentioned on this definition. First, it is not relevant where, on the stage of the product production cycle, the environmental results occur: may be on the production or on the after sale use; and, second, the stemmed environmental benefits may be the result of other purposes and not only the primary aim of the innovation.

2.2. Determinants of Eco-Innovation

Environmental innovation, differently from traditional innovation, has "win-win" effects, due to their positive externalities and the internalization of negative environmental effects (Frondel, Horbach & Rennings 2007). Thus, it is essential to identify the driving forces of eco-innovation in order to work on the best incentives.

Based on the literature we may organise the determinants for eco-innovation into four groups:

technology push, market pull factors, regulation and firm specific factors (De Marchi, 2012; Del Rio Gonzalez, 2009; for a review Ghisetti et al., 2015).

Regarding environmental innovation, technology push factors include all new eco-efficient technologies while demand-pull factors include consumers' preference for environmentally friendly products/services and the need for companies to maintain their environmentally responsible reputation (Rennings, 2000).

The concept of 'technology push factors' has been clearly associated to the introduction of eco-efficient technologies. However, this environmental concern ranks very low as motive for innovation. This is not surprising considering that accordingly to Triebswetter and Wackerbauer (2008) 'it is very unlikely that firms point it out as the first motive for innovation unless it is obliged by law'. Hence, while introducing a process innovation a firm might register with environmental benefits even if such was not the primarily aim of the innovation itself. Indeed, eco-innovation may indirectly result from other objectives, such as search for cost savings (Horbach et al., 2012). As discussed by Galia, Ingham and Pekivic (2013), traditional innovations (such as product, process, organizational and marketing) may lead to environmental benefits, even if it not being the first aim of the investment behaviour. Hence, the innovation profile of the firm itself may well be a determinant for eco-innovation performance.

Horbach (2008) and Horbach, Rammer and Rennings, (2012) found organizational innovation and cost savings respectively as main motivations for environmental innovation. Kammerer (2009) found investments in product innovation (for example to in order to turn the output greener) to have positive environmental benefits (or end users for example). On their study, Galia et al. (2013) concluded that product innovation does not affect future environmental footprint, but process innovation does. In Gerstlberger, Præst Knudsen and Stampe (2014) it is stated that product innovation and energy efficiency may be compatible and even complementary objectives for the firms.

Frondel et al. (2007) conclude that the importance of regulation to determine eco-innovation depends on the benefit achieved: 'end-of-pipe technologies are essentially explained by regulation while for cleaner technologies the main determinant seems to be cost savings'.

Galliano and Nadel (2013) highlight that it is important to test the dynamics between different forms/types of innovation. Product innovation is more likely linked to benefits for the end-user, while process innovation is more likely to reflect upon the production process of the firm. The intensity of innovation that defines the commitment of the firm with strategies of innovation will therefore impact on both, innovative behavior and eco-innovate performance.

Regulation is a common driver for innovation, but it is likely to play an even more important role in environmental innovation than in traditional innovation. Kammerer (2009) points out that regulation does give incentives for firms to eco-innovate their products. Yet, he argues that firms tend to concentrate their environmental decisions on areas where there is recognized and direct benefit for consumers.

Applied to eco-innovation, the market-pull approach refers, as mentioned, to customer demands, but also to public pressure as essential drivers (Horbach, 2008). Some elements of environmental policies, such as regulations or taxes which may impact on consumers' decisions may be included in these factors (Oltra & Saint Jean, 2009). Kammerer (2009) gives an important contribution to this approach introducing from the marketing literature the consumer benefits as a driver for eco-innovation. He shows empirical evidence that this factor plays a key role. Yet, even if the environmental consciousness of the consumers seems to be an important variable for consumer decision, the high price of eco-friendly products tends to overcome it (Rehfeld, Rening & Ziegler, 2007; Horbach et al., 2012). Hence, eco-innovations are less likely to be market-driven when compared to traditional innovation.

Finally, company-specific features or specific factors regarding the internal organization should be considered when ones attends to explore firms' position towards eco-innovation (Horbach et al., 2012). The size of the firm is usually considered as an indicator for the internal capacity to invest in innovations in general. Size has been found correlated with eco-innovations. In line with Kammerer (2009), larger firms, being more visible, are more affected by the public recognition as "green". In a different vein, Kesidou and Demirel (2012) suggest that smaller firms are more likely to lack internal capabilities to deal with the complexity of environmental innovations, whereas large firms are more likely to have internal R&D units and thus the know-how needed. The role of size is not however consensual. Wagner (2007), for example, did not find firm size to affect the probability of a firm to eco innovate. Hence, the role of size and internal capabilities are factors deserving further study from the point of view of eco innovation.

3. Methodology

3.1 Econometric Procedure

To address our main research focus, we estimate a discrete choice model detecting the specificities of each kind of environmental innovation. The logistic regression model [1] was chosen to be implemented over our cross-section data analysis considering the nature of our dependent variables (dichotomous). This estimation procedure is the usual one when we deal with binary-choice variables, where y takes the value 1 if the event occurs and 0 if it does not for individual i following Baltagi (1995).

The estimated model, under the logistic model, takes the following form:

$$\log_{it}(y_i) = \ln(P_i/1-P_i) = \beta_0 + \beta_{jt}X_{i,j} + \beta_{kt}W_{i,k} + \beta_{nt}Z_{i,n} + \varepsilon_i \quad (1)$$

Where yi represents the eco-innovation variable (9 different estimations in total), explained by a number of independent variables. The error term is assumed to be normally distributed and i refers to the ith firm. The dependent variables (yi) in this estimated model were those respecting to the Innovations' environmental benefits variables explained and presented in table 1. The X vector corresponds to innovation intensity variables as described in table 2, W corresponds to a vector of drivers (see table 2) and Z to a vector of control variables (table 2). The $\beta's$ represent the estimated coefficients related to each of the independent variables, being j the index for innovation intensity variables (2 in total), k respecting to the drivers (we use 5 in total) and n corresponds to the different control variables (3 in total).

3.2 Data and Variables

Our study rests on data collected in the context of the Community Innovation Survey of the European Commission, carried out with two years' frequency.

In 2009, a separate section on environmental innovations was introduced (section 10). The section questions directly if during the three years 2006 to 2008 the enterprise introduced any innovations with environmental benefits.

We used the data from this survey because

[1] The logistic qualitative choice model is chosen over the probit model provided that the later has a cumulative distribution function taking the integral form turning difficult mathematical calculations. Gujarati (2003) puts forward that there is no difference between both and so they both produce similar results.

of its wide coverage and reliability, being possible to establish cross country comparisons. The 2009 round was the first and unique to include information on enterprises' eco-innovation. Subsequent CIS did not include the section on eco-innovation.

The CIS conducted for Portugal comprises a total sample of 6328 firms, from several different sectors, but we analyze here the sample of 151 firms belonging to the Hospitality and Restaurants sector, the one analyzed in particular.

Eco-innovations as dependent variables are measured for nine different areas of environmental impacts. Six refer to impacts stemming from processes in the firm while three are areas of environmental impacts from the after sales use of a product by its use (Table 1). All environmental innovations must have been introduced during the three years' period 2006 to 2008.

Table 1. Innovations' environmental benefits- dependent variables

Eco-Innovation Type 1 **Description**	
Environmental benefits from the production of goods or services within your enterprise	
Reduced material use per unit of output _BMATR	Yes=1; Otherwise=0
Reduced energy use per unit of output - BENR	Yes=1; Otherwise=0
Reduced CO2 'footprint' (total CO2 production) by your enterprise - BNENS	Yes=1; Otherwise=0
Replaced materials with less polluting or hazardous substitutes - BNMAT	Yes=1; Otherwise=0
Reduced soil, water, noise, or air pollution - BPOLU	Yes=1; Otherwise=0
Recycled waste, water, or materials - BRECIC	Yes=1; Otherwise=0
Eco-Innovation Type 2	
Environmental benefits from the after sales use of a good or service by the end user	
Reduced energy use - BUENR	Yes=1; Otherwise=0
Reduced air, water, soil or noise pollution - BUPOL	Yes=1; Otherwise=0
Improved recycling of product after use - BUREC	Yes=1; Otherwise=0

As explanatory variables for the adoption of each type of eco-innovation we considered factors that accordingly to the review conducted in the section 2 are likely to be relevant (Table 2). Hence, first we considered firms' innovation profile. The innovation breath variable presented in table 2 is formed by the sum of product and process innovations reported by the firms in the CIS survey. In the survey firms reply if they introduced any improved goods or new or significantly improved services; new or significantly improved methods of manufacturing or producing goods or services; new or significantly improved logistics, delivery or distribution methods for your inputs, goods or services; new or significantly improved supporting activities for your processes, such as maintenance systems or operations for purchasing, accounting, or computing.

We considered the main drivers for eco-innovation directly questioned in the CIS questionnaire, as well as firm level characteristics.

Table 2. Explanatory variables

Innovation Profile	
Innovation Breath	Sum of product and process innovations (0 to 5)
R&D Int	R&D expenditures / total number of employees
Drivers	
ECO_CUMP	1 yes to existing environmental regulations or taxes on pollution; 0 otherwise
ECO_FUT	1 yes to environmental regulations or taxes that you expected to be introduced in the future; 0 otherwise
ECO_DISP	1 yes availability of government grants, subsidies or other financial incentives for environmental innovation; 0 otherwise
ECO_CLI	1 yes current or expected market demand from your customers for environmental innovations; 0 otherwise
ECO_SEC	1 voluntary codes or agreements for environmental good practice within your sector; 0 otherwise
Firm specific variables	
SISTRED	1 has procedures in place to regularly identify and reduce enterprise's environmental impacts; 0 otherwise
TNE	Log of number of employees
HC	% of employees with higher education

Note: TNE is the only variable in log since it has no limits - there being high asymmetry of values. The remaining variables are either percentages, or scales.

4. Results

4.1. Descriptive Results

About 43% of all firms did not implement any eco-innovation. Firms in Hospitality and Restaurants are even less eco-innovative, as nearly 60% did not report any innovation with environmental benefits (Table 3).

As shown in table 4, amongst the eco-innovations considered in the CIS survey, the most frequent are innovations with environmental benefits within the firms – about 40% of the firms reported at least one of these innovations. Much less innovations of type 2 (Environmental benefits from the after sales use of a good or service by the end user) are reported – about 28% of firms declared such type of innovations.

Table 3. Eco-innovations

#innovations	Eco-Innovation Type 1		Eco-Innovation Type 2	
	HR	Total	HR	Total
(0) Did not implement any eco-innovation	59.6	42.9	72.2	58.3
1	11.3	11.5	9.9	12.6
2	6.6	9.4	7.3	11.6
3	4.6	9.5	10.6	17.4
4	7.3	9.0		
5	4.0	6.9		
6	6.6	10.9		

A descriptive analysis of this data with respect to different environmental innovation fields shows that recycling is the most frequently reported event (Table 4) for all firms, and for HR. The second most reported benefit is at the level of reduced soil, water, and noise or air pollution for all firms.

Yet, for HR the second most relevant benefits are reduced material use per unit of output. Actions related to CO2 emissions or energy benefits are relatively under-represented. Less than a quarter of the firms reported such type of benefits from innovation.

Table 4. Innovations with environmental benefits from the production of goods or services within the enterprise - % of firms reporting eco-innovation

Environmental benefits	Hospitality and restaurants N=151	All sectors N=6328
Reduced material use per unit of output	24.5	28.0
Reduced energy use per unit of output	20.5	30.2
Reduced CO2 'footprint' (total CO2 production) by your enterprise	14.6	22.1
Replaced materials with less polluting or hazardous substitutes	18.5	31.0
Reduced soil, water, noise, or air pollution	16.6	35.7
Recycled waste, water, or materials	32.5	47.2

At the level of innovations with environmental benefits from the after sales use of a good or service by the end user, recycling and reduced energy use are the two mostly reported (Table 5).

Table 5. Innovations with environmental benefits from the after sales use of a good or service by the end user - % of firms with eco-innovations

	Hospitality and restaurants N=151	All sectors N=6328
Reduced energy use	20.5	27.9
Reduced air, water, soil or noise pollution	13.2	28.7
Improved recycling of product after use	22.5	31.4

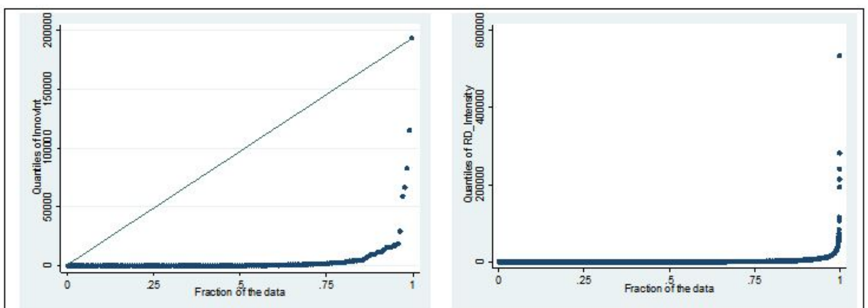
Reading innovation activity, the results in table 6 reveal that HR firms are more innovative than the all sample firms. Nearly 61% of HR firms reported to have introduced some type of product or process innovation. The percentage of innovative firms is lower for the all sample.

Table 6. Innovation Breath - \% of firms reporting by number of innovations (product or process)

	Hospitality and restaurants N=151	All sectors N=6328
0	39.07	43.44
1	13.25	14.85
2	15.89	13.53
3	9.93	11.96
4	11.92	9.59
5	9.93	6.62
Average (s.d.)	1.72 (1.76)	1.49 (1.65)

An analysis of the R&D intensity variable reveals a strong asymmetry between the firms (Graph 1), either for HR as well as for all sample. Over 50% of the firms do not report any R&D expenditures.

Graph 1. R&D Intensity – dispersion



Mean 5415.164 (S.D.: 20770.61)
Min: 0 (50.99%)
Max: 193390.4

Mean: 1993.257 (S.D: 10731.19)
Min:0 (56,26%)
Max: 534172.1

Yet, the value of the top 25% pushes R&D intensity to a value extremely high, the same for the all sample for the 90% percentile.

Existing regulation has been reported as relevant by over a quarter of all firms in the sample. Yet, this factor does not seem as relevant for the HR sample. Regulation activities, environmentally related subsidies that capture the influence of state, do not seem to assume any relevance for HR. Voluntary codes or agreements for environmental good practice within the sector emerge as the most important driver for all sample and for HR also.

Not surprisingly, current or expected market demand from your customers for environmental innovations is relatively important for the all sample, whereas it is the second most relevant factor for the HR firms. The importance of this factor is in line with findings from other studies, such as Kammerer (2009).

Finally, less than 30% of the firms reported to have procedures in place to regularly identify and reduce enterprise's environmental impacts (For example preparing environmental audits, setting environmental performance goals, ISO 14001 certification, etc). This value is significantly lower for the HR sample, only 13.9%.

Table 6. Drivers for Innovations with environmental benefits - % of firms saying yes

During 2006 to 2008, did your enterprise introduce an environmental innovation in response to:			
		Hospitality and restaurants N=151	All sectors N=6328
ECO_CUMP	Existing environmental regulations or taxes on pollution	8.6	25.0
ECO_FUT	Environmental regulations or taxes that you expected to be introduced in the future	6.6	14.6
ECO_DISP	Availability of government grants, subsidies or other financial incentives for environmental innovation	2.6	5.0
ECO_CLI	Current or expected market demand from your customers for environmental innovations	13.9	17.4
ECO_SEC	Voluntary codes or agreements for environmental good practice within your sector	25.8	33.9
SISTRED	Does your enterprise have procedures in place to regularly identify and reduce your enterprise's environmental impacts?	13.9	28.3

In what follows, we report the results from our econometric treatment, applied to the HR sample.

4.2 Econometric Results

In a first step, in order to explore the relation between eco-innovations and innovation breath we run a logistic model between each eco-innovation with innovation breath.

The probability functions for each type of innovation in relation to innovation breath is reported in graph 2.

The picture that emerges is indeed of a strong relationship between eco-innovations and implementation of product or process innovations. The results from the econometric model confirm this. Indeed, innovation Breath appears significant for all type of eco-innovations, with the exception to Recycled waste, water, or materials - BRECIC.

Otherwise, innovation intensity is significant only for innovations leading to reduced CO2 'footprint' (total CO2 production) by the enterprise and to actions leading to reduced energy use.

Graph 2. Probability of each eco-innovation in relation to innovation breath

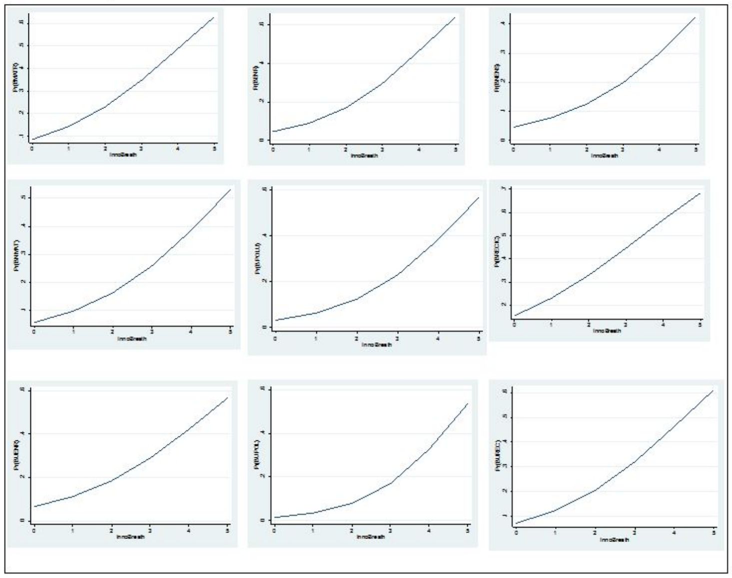


Table 7. Determinants for Innovations with environmental benefits (continues)

	Reduced material use per unit of output (BMATR)			Reduced energy use per unit of output (BENR)			Reduced CO2 'footprint' (total CO2 production) by your enterprise (BNENS)		
Expl. Var.	Coef.	Z	Odds Ratio	Coef.	z	Odds Ratio	Coef.	Z	Odds Ratio
InnovBreath	0.3516	2.25**	1.4213	0.5895	3.36***	1.8031	0.4193	2.30**	1.5209
InnovInt	0.0000	0.80	1.0000	0.0000	1.62	1.0000	0.0000	2.12**	1.0000
ECOCUMP	3.0019	2.01**	20.1228	0.4680	0.48	1.5967	-0.2902	-0.28	0.7481
ECOFUT	-2.0193	-1.31	0.1328	-0.0797	-0.07	0.9234	0.6888	0.69	1.9914
ECODISP	-0.1900	-0.13	0.8270	-0.0559	-0.04	0.9456	-0.9008	-0.68	0.4063
ECOCLI	2.0981	2.44**	8.1513	1.6394	2.04**	5.1518	1.9693	2.43**	7.1657
ECOSEC	0.1214	0.19	1.1291	1.0429	1.73*	2.8375	0.7632	1.17	2.1452
SISTRED	1.6066	2.21**	4.9857	0.6557	0.77	1.9265	-0.0165	-0.02	0.9837
DimTNE	-0.1103	-0.45	0.8955	-0.3130	-1.22	0.7312	-0.1354	-0.55	0.8733
WHD	-0.6441	-0.63	0.5251	-1.6627	-1.41	0.1896	-2.8608	-2.05**	0.0572
Cons	-2.0907	-2.25**	0.1236	-1.9723	-2.03**	0.1391	-2.1090	-2.21**	0.1214
	LR chi2(14) = 58.70 Pseudo R2 = 0.3491			LR chi2(14) = 58.92 Pseudo R2 = 0.3843			LR chi2(14) = 38.82 Pseudo R2 = 0.3096		

Notes: ECO_CUMP: Existing environmental regulations or taxes on pollution; ECO_FUT: Environmental regulations or taxes that you expected to be introduced in the future; ECO_DISP: Availability of government grants, subsidies or other financial incentives for environmental innovation; ECO_CLI: Current or expected market demand from your customers for environmental innovations; ECO_SEC: Voluntary codes or agreements for environmental good practice within your sector.; SISTERD: Does your enterprise have procedures in place to regularly identify and reduce your enterprise's environmental impacts? *,**,*** means significant at 10%, 5% and 1%.

(cont.) Table 7. Determinants for Innovations with environmental benefits

	Replaced materials with less polluting or hazardous substitutes (BNMAT)			Reduced soil, water, noise, or air pollution (BPOLU)			Recycled waste, water, or materials (BRECIC)		
Expl. Var.	Coef.	z	Odds Ratio	Coef.	z	Odds Ratio	Coef.	z	Odds Ratio
InnovBreath	0.3023	1.74*	1.3530	0.5712	2.94***	1.7705	0.2413	1.63	1.2729
InnovInt	0.0000	1.08	1.0000	0.0000	1.03	1.0000	0.0001	1.51	1.0001
ECOCUMP	0.6365	0.66	1.8900	-1.0331	-0.94	0.3559	-0.3118	-0.28	0.7321
ECOFUT	-0.0227	-0.02	0.9776	1.5202	1.34	4.5733	-0.1451	-0.12	0.8649
ECODISP	0.2786	0.19	1.3213	-1.4414	-0.92	0.2366	-1.4975	-1.02	0.2237
ECOCLI	1.1124	1.32	3.0418	1.1179	1.28	3.0584	1.3072	1.44	3.6960
ECOSEC	1.7509	2.76***	5.7599	1.8863	2.90***	6.5950	2.3463	4.18***	10.4465
SISTRED	0.0932	0.10	1.0977	0.9459	1.02	2.5750	0.3624	0.49	1.4368
DimTNE	0.3448	1.41	1.4120	-0.0081	-0.03	0.9919	0.2371	1.11	1.2676
WHD	-1.2248	-0.93	0.2938	-1.4572	-1.09	0.2329	-1.4014	-1.39	0.2463
Cons	-4.1434	-3.70***	0.01587	-3.7241	-3.23	0.0241	-2.6083	-2.91***	0.0737
	LR chi2(14) = 53.06 Pseudo R2 = 0.3664			LR chi2(14) = 56.70 Pseudo R2 = 0.4183			LR chi2(14) = 65.22 Pseudo R2 = 0.3427		

Notes: ECO_CUMP: Existing environmental regulations or taxes on pollution; ECO_FUT: Environmental regulations or taxes that you expected to be introduced in the future; ECO_DISP: Availability of government grants, subsidies or other financial incentives for environmental innovation; ECO_CLI: Current or expected market demand from your customers for environmental innovations; ECO_SEC: Voluntary codes or agreements for environmental good practice within your sector.; SISTERD: Does your enterprise have procedures in place to regularly identify and reduce your enterprise's environmental impacts? *,**,*** means significant at 10%, 5% and 1%.

Our results reveal that existing regulations are only relevant for actions leading to reduced material use per unit of output. Expected regulations only impact upon actions leading to reduced soil, water, noise, or air pollution. Availability of government grants, subsidies or other financial incentives for environmental innovation is never significant. Hence, regulation activities, environmentally related subsidies that capture the influence of the state, are scarcely significant. This is a surprising result considering that in many studies for other sectors regulation is extremely important (Popp, 2006; del Rio Gonzalez, 2009). Among others, Frondel et al. (2007) argue that regulation effects may differ with regard to different environmental technology fields. For example, if end-of-pipe technologies are triggered by regulation in particular, to introduce cleaner technologies, cost savings and environmental management systems are more relevant. Recently, some pointed deficiencies regarding regulations are pointed at the European level of Western and Eastern comparison by Horbach (2016).

Current or expected market demand from customers for environmental innovations is significant for a number of eco-innovations, namely those leading to reduced material use per unit of output, reduced energy use per unit of output, reduced CO_2 'footprint' (total CO_2 production) by the enterprise reduced energy use, of reduced soil, water, noise, or air pollution. Kammerer (2009) also emphasizes the role of customer benefits as a determinant for eco-innovation. More recently Horbach et al. (2012) also find that customer requirements are another important source of eco-innovations. This fact revealed to be true with respect to products with improved environmental performance, but also to process innovations that increase material efficiency, and reduce energy consumption, waste and the use of dangerous substances.

Voluntary codes or agreements for environmental good practice within the sector is another driver very significant. It appears relevant for innovations related to reduce energy use per unit of output, replaced materials with less polluting or hazardous substitutes, reduced soil, water, noise it air pollution, and recycled waste, water, or materials, reduced energy use, and improved recycling.

Having in place procedures to regularly identify and reduce enterprise's environmental impacts does not appear much relevant either, only for reduced material use per unit of output. Finally, human capital reveals significant and negative for reduced CO_2 'footprint' (total CO_2 production) by the enterprise. Size is never relevant.

Table 8. Determinants for Innovations with environmental benefits (2)

	Reduced energy use (BUENR)			Reduced air, water, soil or noise pollution (BUPOL)			Improved recycling of product after use (BUREC)		
Expl. Var.	Coef.	z	Odds Ratio	Coef.	z	Odds Ratio	Coef.	z	Odds Ratio
InnovBreath	0.4728	2.87***	1.6044	0.7092	3.11***	2.0324	0.3372	2.05**	1.4010
InnovInt	0.0000	2.25**	1.0000	0.0000	1.11	1.0000	7.56e-06	0.67	1.0000
ECOCUMP	-1.2166	-1.12	0.2962	-0.6618	-0.61	0.5159	1.1384	1.11	3.1217
ECOFUT	-0.1350	-0.13	0.8737	1.9269	1.66*	6.8685	0.2079	0.19	1.2311
ECODISP	omitted			-0.9895	-0.56	0.3718	-0.5904	-0.42	0.5541
ECOCLI	1.7971	2.17**	6.0322	1.5899	1.74*	4.9032	1.3652	1.63	3.9165
ECOSEC	1.0326	1.72*	2.8084	0.7637	1.05	2.1462	2.1477	3.47***	8.5650
SISTRED	-0.4868	-0.51	0.6146	1.5006	1.47	4.4846	-1.0308	-1.04	0.3567
DimTNE	-0.1933	-0.84	0.8243	-0.2935	-1.09	0.7456	0.1823	0.76	1.2000
WHD	-0.9747	-0.87	0.3772	-1.1395	-0.81	0.3200	-0.2068	-0.17	0.8132
Cons	-2.0573	-2.24**	0.1278	-3.4785	-2.91***	0.0309	-3.6728	- 3.42***	0.0254
	LR chi2(14) = 37.95 Pseudo R2 = 0.2707			LR chi2(14) = 51.34 Pseudo R2 = 0.4348			LR chi2(14) = 62.47 Pseudo R2 = 0.3878		

5. Conclusion and Discussion

Previous empirical analyses on the determinants of environmental innovations rarely distinguish between different environmental areas. This paper tries to close this gap by using the Community Innovation Survey 2006-2008. In this panel wave of the CIS, for the first and only time, a special module on eco-innovation was introduced allowing analyzing environmental innovations by different areas. We pay special relevance to the Hospitality and Restaurants sector for Portugal.

Our paper provides evidence on the importance of 'traditional innovation' for eco-innovation. But, beyond the focus on technology, we reveal that innovation itself (either process or even product) can be an important driver for eco-innovation. Hence, the traditional focus of previous literature on 'technology push' is overstated.

The findings indicate that the HR sector does not receive much attention from the authorities in their role of exacerbating degradation of the environment. This regarding the fact that EU policy and legislation on these sectors targets mainly health and safety issues.

Yet, we found voluntary codes or agreements for environmental good practice within the sector amongst the most significant drivers. On this regard, one must highlight the role played by certain national and EU-wide organizations at regulatory level, and one the dissemination of eco-innovative practices. On this regard, it is to highlight the HORECA in Portugal and HOTREC at European level. Since 2010 HOTREC holds a Task Force on Sustainability, being "Its main objective is to decide on the HOTREC long-term strategy and actions on several legislative and non-legislative issues related to sustainability, such as ecological labels, as well as to revise HOTREC positions in the area so far."

Regarding the existence of voluntary codes, the creation of Eco-labels for tourism is worth mentioning [2]. A website search identified immediately about 52 eco-labels. The impact and firms' decisions regarding ecological certification have not been empirically analysed. Such an evaluation for tourism related sectors is necessary.

[2]Knudsen, P., Salter, A (2006) http://www.ecolabelindex.com/ecolabels/?st=category,tourism

[3]HOTREC represents the hotel, restaurant and café industry at European level. HOTREC brings together 43 National Associations representing the interest of the industry in 26 different European countries. http://www.hotrec.eu/policy-issues/sustainability.aspx. (http://www.hotrec.eu/Documents/Document/20111013171532-Tourism_-_Communication_on_a_new_Framework_for_Tourism_in_Europe.pdf)

The HOTREC [3] position paper suggests a number of policy actions, including the spread of best practices, public support to implement environmental practices, 'the enhancement of the relation between tourism, local agriculture and culture', promote energy efficiency in processes and products, use of renewable energy, as well as the promotion of sustainable water resource use and waste management. Furthermore, to boost sustainability in the tourism sector, the Commission proposes to develop a system of indicators to support sustainable management of destinations.

Customer requirements also revealed an important source for eco-innovations in our study, as expected. More demanding customers will translate into more eco-innovative consumers. Hence, awareness-raising and educational campaigns for tourists are also likely to contribute to promote eco-innovation at firm level.

It should be however clear for firms that in order to improve environmental performance without limiting their activity, strong efforts must be made to eco-innovate. Environmental regulations can spur eco-innovations, but ideally, we should move into a scenario where firms innovate proactively, this is not only for compliance with rules, but because they are driven by the wider surrounding to adopt responsible practices also regarding the environment.

Acknowledgments

This work was financially supported by the Research Unit on Governance, Competitiveness and Public Policy (project POCI-01-0145-FEDER-006939), funded by FEDER funds through COMPETE2020 - Programa Operacional Competitividade e Internacionalização (POCI) - and by national funds through FCT - Fundação para a Ciência e a Tecnologia.

Celeste Varum acknowledges the support from FCT Sabbatical Grant.

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