Article

A Study of the Wages in the Spanish Energy Sector

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Abstract: The role of the energy industry has always been central for one reason or another, being environmentalism the main motive in the last two decades. Therefore, attention and research have been directed in this sense. However, human resources—or human capital—have remained understudied, especially concerning the salaries received. Thus, this study is disruptive as it explored the factors that influence employee remuneration in the energy subsector, using Spain as a case study. For this, the PLS-SEM (Partial Least Squares Structural Equation Modelling) path modelling methodology was used, executing a traditional PLS analysis, bootstrapping and, finally, IPMA (Importance-Performance Analysis). Solid and significant relationships were found among labour conditions, human capital, market and wages, with the relationships between human capital and wages and between human capital and labour conditions being especially relevant. Besides, through IPMA, a series of considerations was made regarding the individual indicators according to their relative importance and performance. Consequently, this paper significantly contributes to the extant literature by analysing the composition of wages in the energy sector, which might allow taking valuable management decisions. Nevertheless, the main limitation of this study lies in the availability of data for Spain and, specifically, for workers in the energy supplying industries.

Keywords: human capital; energy; PLS-SEM; salaries; Spain

1. Introduction

Energy industries have always played a leading role in the current affairs of countries around the world. However, the reason for its relevance has changed substantially over the centuries. Currently, in Western countries but, above all, in Europe, the attention falls on the effects of the European Green Deal on them. Thus, amid the greatest feint of ecological transition made by the European Union, the increase in taxes and the reduction of emissions from energy industries are emerging as two of the main pillars of action for this.

Along these lines, the bulk of the scientific literature of the last decades focuses on quantifying their emissions and devising new means to mitigate them. However, unlike other sectors, energy industries are especially understudied in terms of human resources. Either due to the characteristics of the industry itself, not being labour-intensive, or the assumption of good labour conditions, there are hardly any relevant studies that analyse the human resources of these companies from the point of view of the workers.

Of course, the lack of studies in this regard does not imply that the issue is uninteresting and irrelevant. Consequently, this study aimed to approximate the situation of workers in the energy industries in the case of Spain. Specifically, this study focused on the relationships among various factors that characterise employees and their salaries. In summary, the objective of this study was to know what elements and to what extent these factors influence the wages of workers in the energy industries. Thus, this work demonstrates the existence of significant relationships among human capital, labour conditions,

the market and wages, while offering recommendations based on the individualised study of the indicators of these constructs.

After this brief Introduction, a review of the literature is presented on existing studies on human resources—or its current name as human capital—and the energy production subsector. Second, the methodology and the database used are presented. After that, the results obtained are shown and discussed. Finally, the conclusions of this study, the limitations and future lines of research are exposed.

2. Literature Review

As introduced above, the energy subsector is little studied in terms of human resources. The volume of studies that include variables related to employees is indeed high, but these are often included as elements of studies whose objective differs substantially from the analysis of workers per se. That is evident when conducting a broad search on the issue as, of the 500 unique results obtained, only 61 deal with it in a somewhat direct way. Furthermore, of these, only 28 articles analyse the role of human resources—or human capital, according to its current name.

However, sustainability is emerging as the central axis of most scientific articles. Among them, some focus on the role of human capital—and investments in it—in pollution, either with respect to the company's emissions [1–9] or regarding the awareness-raising actions of the human resources department so that workers pollute less [10]. In addition, other studies consider the effects of human capital in the sector itself [11], as well as eco-innovation [12–17] or the SDGs (Sustainable Development Goals) [18], all with direct and positive relationships among them. Conversely, other studies have not proved the relationship between human capital and sustainability [19]. On the other hand, a positive relationship has also been found between human capital and production [20–24], although these studies consider the energy subsector within the industrial sector, so there could be nuances. In this line, there are also more specific cases for the energy subsector [11], even studying economic sustainability [20], although this may have repercussions as a drop in wages [25]. Additionally, the comparison between management theories [26] and the application of alternative methodologies for specific purposes [27] have been addressed, but they remain secondary and not aligned with the purpose of this article.

However, all the above does not put the focus of study on the worker but on the returns that this brings to the company. For this reason, the objective of the present work is to transfer the study interest to the employees since it is hardly dealt with in the existing academic literature. Thus, several papers emphasise the need to enhance the skills and knowledge of employees, as well as ensure a work environment that encourages their personal and professional development [28–32]. For this, and even to improve the company performance, the development of its competencies seems essential [33–35].

In line with the above, a series of papers focuses on the energy industry, although their content is diverse and not related to the composition of wages or the returns to human capital. Thus, they cover topics such as commitment to work [36], the training of workers and their shortcomings [37,38] or employee care within CSR (Corporate Social Responsibility) strategies [39]. However, although they do not quantify the phenomenon of returns to human capital, some papers deal with elements of the model proposed in this study. On the one hand, the authors of [40] analysed the existence of particular interest in the choice of studies related to the energy industry at those times of its peak. Similarly, the authors of [41] studied the hiring needs from the point of view of the companies, something quite related to the theory of human capital, which is the theoretical support of the proposed model. Finally, the authors of [42] considered the role played by factors such as the hardness of the job and the risks to which the worker is exposed as part of their compensation.

However, the lack of recent studies on the wages of energy industry workers is evident, although this approach has previously been used in especially labour-intensive fields, such as the tourism sector [43,44]. This issue generates a gap of knowledge concerning the

human resources of the energy industry, which this paper aims to cover. In this context, the paper analyses the factors that determine the composition of the salaries of these workers in order to be able to define the current state of affairs and, if necessary, to suggest actions for improvement using the statistical techniques employed. Consequently, this paper significantly contributes to the extant literature through this analysis, which might allow taking valuable management decisions.

3. Materials and Methods

To contrast the hypotheses proposed below, the PLS-SEM path modelling methodology was used. This method formulates the hypotheses through a system of structural equations formed by indicators and constructs (Table 1). This method combines principal components analysis and regressions, estimated through partial least squares, allowing researchers to draw complex interrelations between variables and latent constructs. This methodology was chosen because of its benefits over other similar methods—typically compared to CB-SEM (Covariance-Based Structural Equation Modelling)—or others commonly used in human capital studies such as regressions. In brief, this study used PLS-SEM path modelling because of its favourable characteristics regarding distribution issues, e.g., lack of normality; the complexity of the model; and, above all, the use of secondary data to perform the analysis [45]. Such usefulness against common problems in data processing is essential since the data were not collected by the authors. However, this study was exploratory in nature [46] since there are no precedents in the scientific literature for this subsector, as shown in the literature review. SmartPLS 3.0 software (Release 3, Boenningstedt, Germany) [47] was used, as shown in Figure 1, to estimate the model using the PLS-SEM methodology.

Table 1. Constructs and indicators of the structural equation model.

	Latent Factor			
	Human Capital	**Labour Conditions**	**Market**	**Wages**
Items	Education (HC1)	Type of working day (LC1)	Type of market (M1)	Gross hourly wage (W1)
	Experience (HC2)	Type of contract (LC2)	Regulation (M2)	Responsibility (W2)
	Tenure (HC3)	Job category (LC3)		Business size (W3)

Source: Authors.

Based on the literature review and the existence of similar hypotheses in academic works from other fields, the following hypotheses were formulated. These were intended to offer a general vision of the factors that influence the salaries of the workers of the energy subsector, following the original idea of Mincer [48] but adapting it to the PLS-SEM path modelling methodology. These types of studies have been carried out mainly in labour-intensive industries, with low returns to human capital, such as the tourism industry [43,44,49].

These works support practically all the hypotheses. Specifically, the works of García-Pozo et al. [34] and Kortt et al. [49] support Hypotheses 2 and 4; the work of Marfil-Cotilla and Campos-Soria [35] is more specific for Hypothesis 1; and the work of García-Pozo et al. [50] supports Hypothesis 3.

Hypothesis 1 (H1). *Human capital (HC) positively influences the labour conditions (LC) of workers.*

Hypothesis 2 (H2). *Human capital (HC) positively influences the wages (W) of workers.*

Hypothesis 3 (H3). *Market conditions (M) positively influence the wages (W) of workers.*

Hypothesis 4 (H4). *Labour conditions (LC) positively influence the wages (W) of workers.*
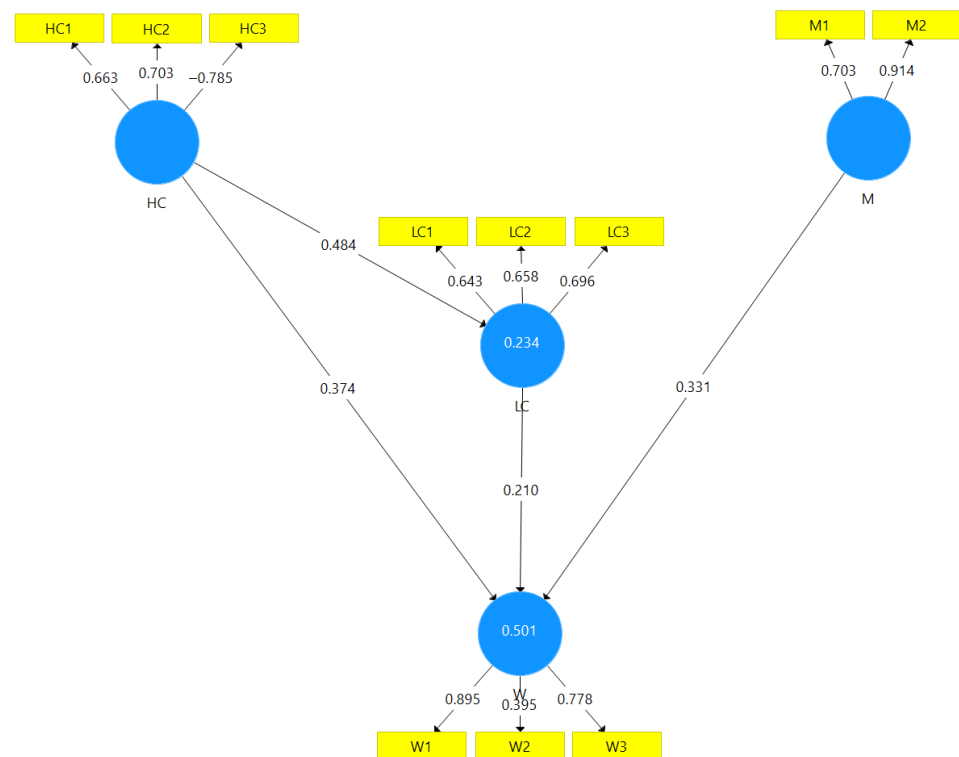
Figure 1. Proposed exploratory model. Source: Authors.

Regarding the specification of the model, the indicators are related to the constructs in a reflective way, as shown in Figure 1. With this, the relationships among the constructs formed the hypotheses to be tested (Table 2), the construct "Salaries" (W) being the main object of the study. Additionally, it was hypothesised that human capital (HC) positively influences the labour conditions (LC) of workers. In addition, regarding the number of variables used, an attempt was made to include the most relevant, considering that these were predefined by the 2018 Wage Structure Survey, the database used for the execution of the model. However, although a higher number of indicators positively influences the reliability of the composite measures in avoiding indeterminacy problems [51–53], only the most relevant ones were added to not artificially affect the value of R^2.

Table 2. Hypothesis test for direct effects between latent variables.

Hypotheses	Direct Effects	Standard Errors	t Statistics
HC→LC	0.484	0.024	20.297 *
HC→W	0.374	0.022	16.724 *
LC→W	0.210	0.026	8.050 *
M→W	0.331	0.024	13.715 *

Source: Authors. Note: * $p < 0.001$.

In relation to the execution of the analyses, two types of analyses were carried out, framed in the same PLS-SEM path modelling methodology. First, a traditional PLS analysis was performed to find the intensity and sign of the relationships between constructs and between indicators and their constructs. After that, the execution of a bootstrapping allowed contrasting the significance of these relationships, being the relationships between constructs the ones of greatest interest insofar as they imply the contrast of the hypotheses. Finally, an IPMA analysis was carried out, which made it possible to know the relative importance and performance of both the constructs and their indicators.

4. Results and Discussion

4.1. Sample and Characterisation of the Spanish Energy Industry

The specification of the model was performed according to previous studies carried out in other industries [43,44,49], since it is the first time that this methodology is applied for the energy subsector. Regarding the indicators chosen to build the constructs, they correspond to the variables generated by the 2018 four-year Wage Structure Survey [54]. This database was chosen for its high representativeness thanks to the rigour of the Spanish National Institute of Statistics in collecting the sample.

Although this database contains data from more than 28,500 establishments and 220,000 individuals [55], for this study, the records were limited to Group D, Subgroup 35 of the CNAE-09 [56]. This subgroup includes those activities related to the supply of electricity in all its sources of production, gas, steam and air conditioning. In total, it represents a sample of 1596 individuals.

It is necessary to highlight that, although the survey used as a database collects the variables as they appear in this work, they appear with different measurement scales since they are very heterogeneous. Therefore, it was necessary to adapt the variables to the needs of the PLS-SEM path modelling methodology. In this regard, the variables were scaled following a Likert scale from 1 to 7, using intervals with the same opening. Likewise, a Likert scale from 1 to 3 was used in those cases in which there are no other categories (M1 and M2), and those variables that required it (W2, LC1 and LC2) were modelled as dummy variables.

Regarding the Spanish energy sector, some characteristics need to be highlighted, especially concerning human resources. First, it is a highly masculinised industry since 79.7% of the workers are men, in contrast to the 55.5% in the Spanish economy. Besides, the average age is 47 years old, that is, three years higher than the average, which leads to an ageing workforce. However, above these facts, others stand out. Regarding the characteristics of their contracts, 97.3% are full-time employees while 97% work under indefinite-term contracts, compared to 81.1% and 78.7%, respectively, for the case of the Spanish economy. This is also the case of the workers with employees in their charge, accounting for 33.6% of the workforce, more than double the national figure (14.3%) [54].

In addition, their job category is worth highlighting too since 71.6% of the employees are managers, professionals or technicians—commonly known as white-collar employees. These workers only account for 35% of the Spanish economy. Lastly, the collective agreement form also substantially differs from other sectors. In that sense, energy industry employees' contracts are mainly regulated by collective agreements at the firm level (93.3%), while these collective agreements only account for 32.3% of the rest of the Spanish economy [54].

4.2. PLS-SEM Path Modelling Analysis

Once the PLS algorithm and bootstrapping were executed, the reference thresholds indicated by Hair et al. [57] were taken. Based on them, the individual reliability of the indicators and constructs were analysed, with especially positive results (Table 3). Consequently, this means that, for this study, the chosen indicators and the design of the constructs are adequate and valid. In addition, the fit of the model is good. Thus, even considering the adjusted values of R^2, which is more restrictive for consistency, the goodness of fit is very good. Indeed, both values exceed the necessary threshold, so the model has good predictive capacity.

Besides, to contrast the hypotheses raised, a bootstrapping with 10,000 samples was executed, following Streukens and Leroi-Werelds [58]. The result of the calculations is shown in Table 2, being the values of all the t-statistics statistically significant at 99%. Therefore, all the proposed hypotheses are confirmed.

Table 3. Reliability measures.

Constructs	AVE	Composite Reliability	R^2_A	Cronbach's α
HC	0.517	0.189		−1.658
LC	0.444	0.705	0.234	0.378
M	0.664	0.795	0.500	0.521
W	0.521	0.748		0.520

Source: Authors.

4.3. Importance-Performance Analysis (IPMA)

Finally, IPMA (Figure 2) was carried out to obtain better conclusions thanks to knowing the relative importance and performance of the indicators and latent variables. Thus, these conclusions can be implemented efficiently, as they are aimed at a real application, complementing the hypothesis contrast by providing additional relevant information [59].
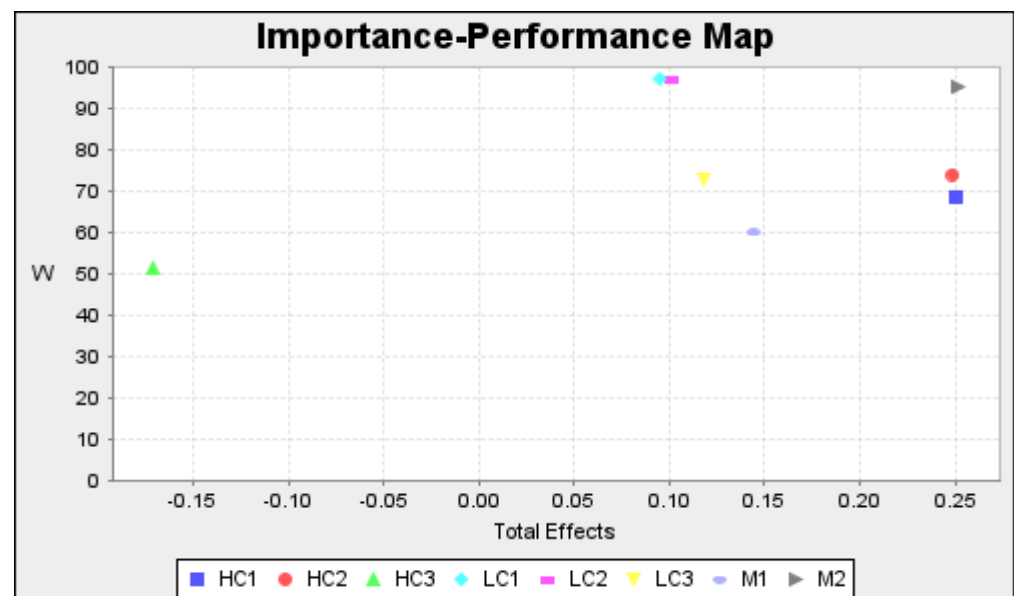

Figure 2. Importance: Performance analysis of the model indicators to Wages (W). Source: Authors.

Figure 2 shows a series of quite positive conclusions. In the first place, virtually all indicators are located in the upper-right quadrant, with an importance greater than 60%. It is true that, although the performance of all of them is high, the regulation of workers in the sector, collective agreement (M2), educational level (HC1) and previous experience (HC2) stand out. These results are consistent with the reality of the industrial sector, which is characterised by a solid trade union, which undoubtedly has repercussions in the signing of better collective agreements. In addition, in the specific case of the energy industry, very qualified workers are needed; therefore, education level and previous experience play fundamental roles in defining wages, as companies tend to bid for these employees. However, seniority (HC3) is of considerable importance, slightly higher than 50%, although it is located in the lower-left quadrant due to its minus sign. This phenomenon could occur due to the interaction with the other two indicators—education and previous experience—that make up the "human capital" construct, leaving tenure as something residual. That is, due to the characteristics of these indicators for the specific case of the energy industry, since a high educational level is assumed, 24.17% higher than the average in Spain, which functions as a barrier to entry, it does not require previous experience (41.21% lower than the average). Therefore, tenure, being very high compared to the national average (71.67% higher) does not seem to be decisive compared to the other indicators, since employee retention in the company is very high [54]. However, the only indicators that could be improved are the type of market in which the company operates (M1), promoting

the internationalisation of Spanish companies, although this is already a considerable reality [60], and the employment category of employees (LC3), slightly increasing the salary brackets for it. However, the values of both indicators are very good.

5. Conclusions

The workers in the energy subsector is an understudied issue, even more so with regard to their remuneration. Although energy industries are not characterised by being particularly labour-intensive and/or low wage, their analysis is not unimportant. Furthermore, their study is particularly relevant as public institutions and private organisations encourage investment in these industries framed as sustainable and ecological development. Therefore, this study was intended as an exploratory analysis of the factors that define the salaries of employees in this industry subsector, taking Spain as a case study because of the data availability.

Therefore, this work is a first approach to studying energy industry workers from the perspective of human capital returns. In this sense, the results are especially relevant to know the situation of the workers of these companies. Furthermore, these results might be the starting point for future related studies, as well as for their replication in other countries, or sets of countries, and their comparison.

For this, data from the National Institute of Statistics corresponding to the four-year Wage Structure Survey of 2018 were used. After the statistical treatment, the four hypotheses raised were confirmed, thus contrasting the influence of human capital, labour conditions and the market on the wages of workers in the energy industries and showing that human capital influences labour conditions. These results provide a first approach to understanding the state of workers in these industries concerning their wages, and they allow some preliminary conclusions that may support further general managerial actions.

In this sense, IPMA made it possible to understand the relative importance and performance of the indicators used. Thus, virtually all of them stand out for their high importance and performance, highlighting the labour condition ones. However, lines of action were proposed for those indicators with worse relative performance. On the one hand, the type of market in which the company operates could be susceptible to improvement, further promoting the internationalisation of Spanish companies. On the other hand, the labour category of employees could be improved by slightly increasing the salary brackets for it, something dependent on each company, while 93.3% of energy companies are subject to company agreements.

All the above result in filling an existing gap of knowledge concerning the human resources of the energy industry. The analyses of the factors that determine the composition of the salaries of the workers in this industry allow the proposal of managerial actions. Therefore, this paper significantly contributes to the extant literature through this analysis, which might allow taking valuable management decisions. Finally, the main limitation of this study lies in the availability of data for Spain and, specifically, for workers in the energy supplying industries. Therefore, a future line of research would be including more subsectors and/or comparing the results with other European or developing countries.

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