Collective Efficiency Strategies and Regional Development:

EVOLUTION AND PERFORMANCE OF THE COMPETITIVENESS AND TECHNOLOGY POLE FOR ENERGY IN PORTUGAL

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Abstract

This dissertation intends to understand the general interest in the cluster concept, focusing specifically on the Competitiveness and Technology Cluster for Energy, concentrating on the need to characterize the regions inherent to its activities, through the analysis of indicators of geographic concentration.
To this end, the main objectives are: to determine the regional concentration, the growth of employment and turnover of the activities within the framework of the Energy CTC; and evaluate its evolution and performance.
This dissertation also intends to attest to the research hypothesis: The positive variation of employment is related to the increase in the turnover of the Energy CTC.
For the preparation of this study a mixed methodology was used. The quantitative analysis was based on the calculation of the Location Quotient and a shift-share analysis of its activities, for 2010 and 2015.
In the qualitative analysis was considered the critical success factors proposed by Chorincas, complemented with information obtained from interviews, as well as the analysis of the "Strategy Evaluation Study and the Implementation Process of the Collective Efficiency Strategies - Cluster Type".
The results obtained showed that the Energy CTC entities are located in the most privileged regions by the concentration of this sector, presenting a reasonable territorial adjustment.
The present study allows us to empirically understand that the hypothesis that "The positive variation in employment is related to the increase in turnover of the Energy CTC" is not confirmed, since the two concepts do not have a direct relation, and that the most evident weakness for the success of the Cluster is the lack of involvement and interaction between actors.

Keywords: Collective Efficiency Strategies, Cluster, Competitiveness and Technology Cluster for Energy, location quotient, shift-share analysis

1. Introduction

The globalization of markets constitute a powerful breach of the 'status quo' of all systems (especially economic, but with strong social, political and ideological-cultural effects). Currently, it is not possible to analyze economic policy issues in a closed system logic because the still growing impact of globalization destroys traditional references and requires a re-reading and re-elaboration of modes of action. (Lopes, 1996).

Thus, in a turbulent economy, dominated by open and demanding markets, where companies operate in a complex and constantly changing environments, characterized by rapid technological evolution, ease of accessibility and strong consumer easiness in seeking information on the production processes or on the characteristics of the products, so that companies can acquire or maintain some kind of advantage over their competitors, it is necessary to adopt new strategies to approach the markets (Santos e Cerdeira, 2013)

Against this background, for companies to be able to overcome their peers, it is necessary to adopt new strategies, and "a strategic union of efforts between competing Small and Medium-sized Enterprises (SME), through the formation of cooperation and collaboration alliances, may allow to obtain advantages in building a more effective response to new market demands, which can in turn be a guarantee of survival in these turbulent markets." (Camarinha-Matos et al., 2009)

In Portugal, in order to improve companies' performance, Collective Efficiency Strategies (CES) have been defined, resulting in a public policy centered on a cluster typology that aims to follow relevant international trends. This paper focuses on studying the Competitiveness and Technology Cluster (CTC) for Energy, also known as EnergyIn.

2. Objectives and Methodology

"Globalization, first believed to render location and distance unimportant, turned out to raise the importance of understanding the specific conditions and cross-company interactions within and across locations" (Porter & Ketels, 2009)

Therefore, this paper attempts to understand this paradigm, arising the need to characterize the regions inherent to the activities of the cluster.

So, the main objectives of this dissertation are:

- Determine the regional concentration of employment and turnover of the PCT Energy activities;
- Determine the growth in employment and turnover of the PCT Energy activities;
- Evaluate the evolution and performance of the Energy CTC.

This analysis intends to test the following hypothesis of investigation: The positive variation of the employment is directly related to the increase of the turnover of the Energy CTC.

A mixed methodology was used with an exploratory purpose, complementing a quantitative statistical analysis of several economic indicators, based on companies' statistical database (presented in chapters 3 and 4), and a qualitative-descriptive analysis, that aims to evaluate the evolution and performance of the cluster, applying the critical factors for cluster success proposed by Chorincas (2009), complemented with information obtained from interviews, as well as the analysis of the "Strategy Evaluation Study and the Implementation Process of the Collective Efficiency Strategies - Cluster Type" (located in chapter 5). Conclusions are then presented in chapter 6.

3. Location Quotient (LQ)

In order to characterize the regions where the Energy CTC is inserted, a descriptive analysis was carried out, namely its concentration / location, using the Location Quotient (LQ), which is one of the most used indicators in regional analysis.

The location quotient is calculated by the ratio of the concentration of the variable under analysis in the sector in the region and the concentration of that variable in the sector in the reference region, as demonstrated below:

$$LQ = \frac{\frac{E_{i,r}}{E_{i,n}}}{\frac{E_r}{E_n}}, \qquad QL \geq 0$$

$E_{i,r}$ – Number of employees or turnover of sector i in region r

$E_{i,n}$ – Number of employees or turnover of sector i in the reference region

E_r – Total number of employees or total turnover in region *r*

E_n – Total number of employees or total turnover in the reference region.

When interpreting this indicator, the unit value is taken as the reference value, that is, when it is verified that the weight of the sector *i* of region *r* is equal to the weight of the same sector in the reference region (in this case in Portugal).

A LQ above 1 means that sector *i* has a higher concentration in region *r*, relative to the country

Table 1 – LQ for the no. of employees in 2010 and 2015

Portugal	2010			2015		
NUTS III	Total No. of employees	No. of employees in energy sector	LQ in 2010	Total No. of employees	No. of employees in energy sector	LQ in 2015
TOTAL	2779077	97745	-	2716011	111237	-
Alto Minho	54164	2149	**1,13**	56865	1625	**0,70**
Cávado	115660	2044	**0,50**	116890	2737	**0,57**
Ave	126591	1811	**0,41**	131033	1682	**0,31**
Área Metropolitana do Porto	529135	20917	**1,12**	519452	23202	**1,09**
Alto Tâmega	13046	181	**0,39**	12990	191	**0,36**
Tâmega e Sousa	112759	884	**0,22**	113798	1339	**0,29**
Douro	35892	659	**0,52**	33847	780	**0,56**
Terras de Trás-os-Montes	18183	165	**0,26**	17956	198	**0,27**
Oeste	91721	2023	**0,63**	85074	2161	**0,62**
Região de Aveiro	109754	2896	**0,75**	108508	2885	**0,65**
Região de Coimbra	108404	2531	**0,66**	101551	3003	**0,72**
Região de Leiria	92130	1563	**0,48**	90173	2190	**0,59**
Viseu Dão Lafões	61964	1899	**0,87**	60826	2354	**0,94**
Beira Baixa	17300	191	**0,31**	16988	279	**0,40**
Médio Tejo	60706	1212	**0,57**	54724	1111	**0,50**
Beiras e Serra da Estrela	46496	614	**0,38**	44765	1428	**0,78**
Área Metropolitana de Lisboa	889870	51613	**1,65**	862910	59810	**1,69**
Alentejo Litoral	23729	436	**0,52**	23369	409	**0,43**
Baixo Alentejo	23497	624	**0,76**	24788	608	**0,60**
Lezíria do Tejo	61333	1291	**0,60**	55003	756	**0,34**
Alto Alentejo	21555	345	**0,46**	20704	472	**0,56**
Alentejo Central	37593	363	**0,27**	36817	511	**0,34**
Algarve	127595	1334	**0,30**	126980	1506	**0,29**

Source: GEP/MTSSS, Quadros de Pessoal

as a whole. This sector is therefore over-represented in the region. On the other hand, a LQ below 1 means that the sector *i* is not relatively concentrated in the region *r*, i.e. the sector *i* in region *r* is underrepresented, relative to the reference region as a whole.

The results obtained for the LQ of the Portuguese regions using the number of employees are shown in table 1, for the years of 2010 and 2015.

The results show that only the regions of Alto Minho, Porto Metropolitan Area and Lisbon Metropolitan Area obtained a LQ greater than one in 2010, that is, these regions present a greater spatial concentration of Energy CTC employment, relative to the country. Since, in addition to the Alto Minho region, only the regions of Lisbon and Porto have a LQ greater than one, these results reveal a high concentration of this sector in these regions, when compared to other inner regions that fall below the national average. In 2010, the regions that most approached the reference value were the regions of Aveiro, Viseu Dão Lafões and Baixo Alentejo, with LQ of 0.75, 0.87 and 0.76, respectively. The other regions generally presented a reduced LQ.

It is also observable that of the three regions that presented a LQ greater than one in 2010, the Alto Minho region ceased to be part of this lot, seeing a fall of LQ of 1.13 to a LQ of 0.70 in 2015, corresponding to a variation of -38%. On the opposite side, the highest LQ increase in percentage terms belonged to the region of Beiras and Serra da Estrela with a variation of 107% (LQ increased from 0.38 to 0.78).

In order to complement and improve LQ's previous analysis based on employment, this was recalculated, but this time based on turnover (Table 2). In this way, it is intended to show the concentrations of turnover of regions for the Energy Cluster activities, relative to the country, for the same time frame.

Table 2 shows that the regions with a LQ greater than one were the Lisbon Metropolitan Area and the region of Alto Minho. The latter had the higher levels of concentration in the energy sector with a LQ of 2.59 and 2.62, in 2010 and 2015, respectively.

It should also be noted that, in terms of turnover, Porto Metropolitan Area ceased to have a LQ above the national average.

Analyzing the evolution between 2010 and 2015, there were no significant changes in LQ. It should be mentioned that, in 2015, about 74% of the energy sector turnover comes from the Lisbon Metropolitan Area, followed by the Porto

Table 2 – LQ for the turnover in 2010 and 2015

Portugal	2010			2015		
NUTS III	Total Turnover	Turnover in energy sector	LQ in 2010	Total Turnover	Turnover in energy sector	LQ in 2015
TOTAL	362 002,2	20 939,1	-	322 158,1	20 236,3	-
Alto Minho	4 392,9	659,1	**2,59**	4 682,7	771,0	**2,62**
Cávado	9 417,3	170,8	**0,31**	9 064,5	223,9	**0,39**
Ave	9 112,7	138,2	**0,26**	10 319,2	134,6	**0,21**
Área Metropolitana do Porto	61 426,0	2 611,0	**0,73**	55 327,8	2 171,6	**0,62**
Alto Tâmega	756,7	17,8	**0,41**	744,0	19,5	**0,42**
Tâmega e Sousa	7 736,2	48,2	**0,11**	6 816,5	80,2	**0,19**
Douro	2 092,6	36,4	**0,30**	2 389,2	93,0	**0,62**
Terras de Trás-os-Montes	1 673,4	30,7	**0,32**	1 671,2	6,7	**0,06**
Oeste	8 150,1	144,0	**0,31**	7 517,9	185,8	**0,39**
Região de Aveiro	10 223,9	334,0	**0,56**	10 498,6	334,1	**0,51**
Região de Coimbra	8 956,8	125,5	**0,24**	8 646,6	147,8	**0,27**
Região de Leiria	8 909,7	79,0	**0,15**	9 128,6	143,8	**0,25**
Viseu Dão Lafões	5 583,6	218,2	**0,68**	5 152,9	248,7	**0,77**
Beira Baixa	1 242,1	10,1	**0,14**	1 093,3	47,0	**0,68**
Médio Tejo	6 252,7	298,8	**0,83**	5 697,6	329,9	**0,92**
Beiras e Serra da Estrela	2 967,2	33,1	**0,19**	2 830,1	77,1	**0,43**
Área Metropolitana de Lisboa	191 666,9	15 709,3	**1,42**	160 299,2	14 959,3	**1,49**
Alentejo Litoral	2 104,2	7,0	**0,06**	2 212,2	32,3	**0,23**
Baixo Alentejo	1 750,1	72,6	**0,72**	1 985,4	74,1	**0,59**
Lezíria do Tejo	5 491,6	77,6	**0,24**	5 439,8	43,5	**0,13**
Alto Alentejo	1 661,9	24,7	**0,26**	1 604,4	27,8	**0,28**
Alentejo Central	2 379,2	17,4	**0,13**	2 525,1	25,2	**0,16**
Algarve	8 054,6	75,6	**0,16**	6 511,3	59,3	**0,14**

Source: GEP/MTSSS, Quadros de Pessoal

Metropolitan Area with about 11% and the region of Alto Minho with approximately 4%. It is clear the discrepancy between these values, which shows the weak development of the regions in Portugal and the importance of the Metropolitan Areas. However, it is worth highlighting the data obtained by the Alto Minho region. Although there has been a downward trend in relation to LQ based on the number of people employed in establishments between 2010 and 2015 (1.13 to 0.70), turnover-based LQ has remained practically constant (slight increase of 0.03), registering the highest value among all regions of the country, including the Lisbon Metropolitan Area. That is, there was an increase in turnover in this region, even though there was a reduction in employment in the energy sector. The high LQ values for Alto Minho indicate the presence of an agglomeration of companies in this sector.

In fact, Alto Minho has one of the largest onshore wind farms in Europe and is home to the largest national cluster of wind power generators, result of the installation of the German multinational company called Enercon, one of the largest companies in the world, in this field.

4. Shift-Share Analysis

The Shift-Share analysis is a method that has been used in the analysis of dynamic conditions and regional specific characteristics. (Couto, 2007) The classic Shift-Share model was formalized by Dunn in 1960, existing already several variations of this model. For this dissertation, the classic model has been applied.

The classic Shift-Share model is a statistical tool used to decompose regional growth between two time periods, usually using employment as a variable, into distinct factors that may influence its behavior. (Dunn, 1960)

"The differences in growth between regions can be attributed not only to differences in the productive composition of each region (due to the greater or lesser preponderance of more dynamic sectors), but also to different advantages of a locational nature" (Silva, 2011)

Succinctly, according to Silva (2011), shift-share breaks down the growth given in a particular industry into three main components: (1) National Component, that reflect the national trend and the rate of growth of local employment that is attributed to the growth of the national economy, i.e. represents the employment growth that the region would have if it had the same variation as observed at the national level; (2) Structural Component shows whether the region has a more or less favorable specialization, according to the presence of a composition and a regional sectorial dynamics with growth rates above or below the national average; (3) Regional Component measures the deviation of regional growth relative to the national growth rate and can be explained by the presence of competitive advantages (such as natural resources, interconnected industries or skilled labor) inherent to the unique region's characteristics.

The classic model of the shift-share analysis is calculated as follows:

$$\sum_k \Delta X_{ik} = \sum_k [X_{ik}(t) - X_{ik}(t-1)] = \sum_k [NX_{ik} + SX_{ik} + RX_{ik}$$

where:

ΔX_{ik} represents the variation observed in the variable employment or turnover, in region *i*, for sector *k*;

Xik (t) represents the variable employment or turnover, measured in region *i,* in sector *k*, and at time *t*;

NX_{ik} represents the national component;

SX_{ik} represents the structural component;

RX_{ik} represents the regional component.

These three components are calculated as follows:

$$NX_{ik} = g_{NX} \times X_{ik}(t-1)$$

$$SX_{ik} = (g_{NXk} - g_{NX}) \times X_{ik}(t-1)$$

$$RX_{ik} = (g_{ik} - g_{NXk}) \times X_{ik}(t-1)$$

where:

g_{NX} is the percentage variation of the variable employment or turnover, observed at national level;

g_{NXk} is the percentage variation of the variable employment or turnover, observed at national level, referring to sector *k*;

g_{ik} is the percentage variation of the employment or turnover variable, observed in region *i*, for sector *k*.

The results obtained for the different components of the classic Shift-Share model are shown below on table 3, for the Energy CTC activities, according to its sectoral framework. Data on employment and turnover were withdrawn over a period of five years, in particular for the years 2010 and 2015.

Table 3 - Shift-Share Analysis based on the number of people employed in establishments for the Energy CTC activities, between 2010 and 2015

NUTS III	National Component	Structural Component	Regional Component		Actual variation
			g_i [%]	Rx_{ik}	
Alto Minho	-48,77	345,40	-24,38	-820,63	-524
Cávado	-46,38	328,52	33,90	410,86	693
Ave	-41,10	291,07	-7,12	-378,98	-129
Área Metropolitana do Porto	-474,67	3361,90	10,92	-602,23	2285
Alto Tâmega	-4,11	29,09	5,52	-14,98	10
Tâmega e Sousa	-20,06	142,08	51,47	332,98	455
Douro	-14,95	105,92	18,36	30,04	121
Terras de Trás-os-Montes	-3,74	26,52	20,00	10,22	33
Oeste	-45,91	325,15	6,82	-141,24	138
Região de Aveiro	-65,72	465,46	-0,38	-410,74	-11
Região de Coimbra	-57,44	406,80	18,65	122,64	472
Região de Leiria	-35,47	251,21	40,12	411,25	627
Viseu Dão Lafões	-43,09	305,22	23,96	192,88	455
Beira Baixa	-4,33	30,70	46,07	61,64	88
Médio Tejo	-27,50	194,80	-8,33	-268,30	-101
Beiras e Serra da Estrela	-13,93	98,69	132,57	729,25	814
Área Metropolitana de Lisboa	-1171,26	8295,54	15,88	1072,72	8197
Alentejo Litoral	-9,89	70,08	-6,19	-87,18	-27
Baixo Alentejo	-14,16	100,29	-2,56	-102,13	-16
Lezíria do Tejo	-29,30	207,50	-41,44	-713,20	-535
Alto Alentejo	-7,83	55,45	36,81	79,38	127
Alentejo Central	-8,24	58,34	40,77	97,89	148
Algarve	-30,27	214,41	12,89	-12,14	172

Source: author's calculation from GEP/MTSSS data

Between 2010 and 2015, the national economy registered a reduction in total employment levels at a rate of 2.27%, while the evolution of the energy sector employment at the national level increased at a rate of 13.80%.

As it can be seen from table 3, the national component for all regions, resulted in negative values. This is explained by the fact that there has been a reduction in total employment at the national level between 2010 and 2015, with the largest falls in employment coming from Porto and Lisbon Metropolitan Areas, as they are the regions with the highest employment numbers. That is, if the evolution of the sector depended only on the evolution of the national economy, all regions would reveal negative results, ie, all regions would reveal a decrease in employment. The structural component, which compares the performance of the energy CTC activities at national level with the performance of the national economy, showed positive results for

all regions, showing that the energy sector grew at a higher rate than the national economy, with the highest contributions belonging to the regions of the Lisbon Metropolitan Area and Porto Metropolitan Area, with 8296 and 3362 jobs, respectively.

Regarding the regional component, this is positive if the employment of the sector for each region grows at a rate higher than the growth rates of the sector verified at the national level. The region of Alto Minho has the highest negative value for this component (-820.63), indicating that this region had an employment variation of the activities of the Energy CTC at a lower rate than the national rate of the sector. Resulting in an actual reduction of 524 jobs in the energy sector for this region. This result is in line with the reduction in the value of LQ based on employment.

Lisbon and Porto Metropolitan Areas are the regions with the greatest actual employment variation, far above any other region, meaning that these are the regions of greater relevance for the sector. It is also necessary to refer the regions of Cávado, Leiria and Beiras and Serra da Estrela, which had a growth in employment in the sector above the average of the actual variations of the regions, which is 587.

This analysis is merely descriptive, providing details of the contributions of the components that define the employment growth of the regions. However, it does not clarify the reasons for the variations in employment in the various regions. In order to obtain a more detailed analysis of each region, it would be necessary to analyze employment trends in all sectors for each region in order to gain a better understanding of sectoral and regional contributions, detailing the sectors that contribute most to regional growth and the regions that contribute most to the development of the sectors.

Next, the shift-share analysis is carried out, this time considering as a variable the turnover.

Between 2010 and 2015, the national economy saw a reduction in turnover at a rate of 11.01% while the evolution of the energy sector based on the activities at the national level decreased at a rate of 3.36%.

As previously shown in the shift-share analysis based on employment, the national components based on turnover also gave negative results, which are explained by the fact that there was a reduction in turnover across all sectors, at National level. If the growth of the regions depended only on the national economy, the largest fall would belong to the Lisbon Metropolitan Area, registering a reduction of around 1729 million euros, as shown in table 4.

Table 4 - Shift-Share Analysis based on the turnover of the Energy CTC activities, between 2010 and 2015, in millions of EUR

NUTS III	National Component	Structural Component	Regional Component		Actual variation
			g_i [%]	Rx_{ik}	
Alto Minho	-72,54	50,42	16,98	134,04	111,92
Cávado	-18,80	13,07	31,11	58,87	53,13
Ave	-15,21	10,57	-2,58	1,08	-3,56
Área Metropolitana do Porto	-287,38	199,75	-16,83	-351,77	-439,41
Alto Tâmega	-1,96	1,36	9,67	2,32	1,72
Tâmega e Sousa	-5,31	3,69	66,37	33,63	32,01
Douro	-4,01	2,79	155,24	57,80	56,58
Terras de Trás-os-Montes	-3,38	2,35	-78,05	-22,95	-23,98
Oeste	-15,84	11,01	29,10	46,72	41,89
Região de Aveiro	-36,76	25,55	0,03	11,31	0,10
Região de Coimbra	-13,82	9,60	17,75	26,50	22,28
Região de Leiria	-8,69	6,04	82,02	67,43	64,78
Viseu Dão Lafões	-24,02	16,69	13,99	37,85	30,52
Beira Baixa	-1,11	0,77	366,88	37,28	36,95
Médio Tejo	-32,89	22,86	10,38	41,05	31,02
Beiras e Serra da Estrela	-3,64	2,53	133,11	45,11	44,00
Área Metropolitana de Lisboa	-1 729,06	1201,78	-4,77	-222,75	-750,02
Alentejo Litoral	-0,77	0,53	362,69	25,57	25,33
Baixo Alentejo	-7,99	5,56	2,03	3,91	1,47
Lezíria do Tejo	-8,54	5,94	-43,99	-31,55	-34,15
Alto Alentejo	-2,72	1,89	12,78	3,98	3,15
Alentejo Central	-1,91	1,33	45,04	8,40	7,82
Algarve	-8,33	5,79	-21,64	-13,83	-16,37

Source: author's calculation from GEP/MTSSS data

The structural component, which compares the performance of the energy CTC's activities at national level with the performance of the national economy, registers positive values for all regions. Although both rates are negative, their difference results in a positive value (due to the fact that the percentage variation in turnover for the sector at national level is lower in absolute values than the observed change in total turnover at the national level). For this reason, all regions recorded positive values for the structural component between 2010 and 2015, with the largest growth belonging to the Lisbon Metropolitan Area, with an increase of around 1202 million euros, followed by Porto Metropolitan Area, with an increase of approximately 200 million euros.

Regarding the regional component, this compares the performance of the Energy CTC's activities at regional level with the performance of the sector at the national level. It should be noted that, in terms of turnover, it was observed that the regions of Porto Metropolitan Area, Terras de Trás-os-Montes, Lisbon Metropolitan Area, Lezíria do Tejo and Algarve registered negative values for this component. In other words, these regions observed a negative percentage change in the regional turnover, but higher in absolute terms than the percentage change in the sector's turnover at the national level.

On the other hand, the regions with the largest percentage changes in regional turnover were

Beira Baixa, Alentejo Litoral and Douro regions, with 367%, 363% and 156%, respectively.
However, the region of Alto Minho recorded the most important regional component, with an increase of 134 million euros and a percentage variation of approximately 17%, which proves that this region presents some kind of competitive advantages for the energy sector.
Comparing the actual variation based on employment with the actual variation based on turnover, it can be stated that in some regions, despite having increased employment in the sector, this did not translate into an increase in turnover. Furthermore, there has been cases in which occurred an increase in employment and a decrease in turnover between 2010 and 2015, such as the Metropolitan Area of Porto, Terras de Trás-os-Montes, Metropolitan Area of Lisbon and Algarve. On the other hand, there are also regions where there has been a decrease in employment and an increase in turnover, such as in the Alto Minho, Aveiro, Médio Tejo, Alentejo Litoral and Baixo Alentejo regions.

5. Evaluation of the Evolution and Performance of the Energy CTC

According to Chorincas (2009), there is a set of critical factors that enhance the success of the Collective Efficiency Strategies (particularly those oriented towards clustering, aiming at the national and, above all, international projection of economic activities with a stronger technological content, such as the Competitiveness and Technology Poles and other clusters.
Supported by the selection criteria of the CES and by the experiences made in other countries, Chorincas (2009), considers the following critical factors:

- Network Consistency;
- Cluster scope;
- Strategy consistency and its Program of Action;
- Ambition and results;
- Governance Model.

Based on its foundations and supported by a set of main questions made by the author, the evolution and performance of the Technology and Competitiveness of Energy Pole was analysed.
For this evaluation, the information was gathered through interviews by email, with the President of the Cluster, Custódio Miguens and Executive Director, Teresa Bertrand, as well as the analysis of the results and conclusions obtained from the "Evaluation Study of the Strategy and the Process of Implementation of Collective Efficiency Strategies - Typology Clusters" carried out by the Portuguese Innovation Society, in 2013.
This study is part of the evaluation exercises set out in the Global Evaluation Plan and has the central objective of contributing to the strategic follow-up of the EEC-Clusters public policy, by evaluating the strategy followed, its implementation process and of its first results. (Sociedade Portuguesa de Inovação e Inno TSD, 2013).

Network Consistency

Within this critical factor, it is necessary to focus primarily on the nature of the players that make up the cluster, since the variety of actors is essential, in order to cover all the complexity of network intervention domains.
"The critical mass depends on the consistency of the network to conquer markets and to develop the international visibility of the cluster. Several international experiences show that clusters involving effective networks of players, various companies and international clients/suppliers are able to achieve better levels of competitiveness on a global scale." (Chorincas, 2009).
The Competitiveness and Technology Pole is made up of leading companies in the energy sector such as EDP and REN, currently. However, it had as Founding Associates in 2009, still GALP, EFACEC and Martifer. "European experiences demonstrate that the presence of large companies is an important factor for the success of clusters. The 1st generation evaluation reports of the Competitiveness Poles Program in France conclude that the poles where SMEs predominate often have greater performance difficulties, which may be explained by the longer return on investment by SMEs and by the differentiated nature of R & D developed by this type of companies." (Chorincas, 2009).
According to Custódio Miguens, "the main entities of the National Scientific and Technological System linked to the sector (Universities, LNEG, LNEC, INEGI, INESC Porto, IH and CBE) are represented in the Scientific Council of EnergyIN, which takes part in the elaboration of the Activities and Budget Plan."
"The variety of players that covers the complexity of the network's fields of intervention is fundamental: the presence of corporate players (SMEs and large enterprises) representative of the sector in question; public and private training institutions (at the high school, vocational and higher education levels); R & D centers and technology transfer; other

relevant institutions to the effective process of transfer of knowledge, services, technologies and collective learning" (Chorincas, 2009).

At the outset, the Pole was made up of a small number of members (only five) but at the moment of evaluation, in 2012, it was already constituted by 17 members, which is characterized by a positive variation of 12 entities, proving its growth. (Sociedade Portuguesa de Inovação e Inno TSD, 2013).

However, it currently has 15 effective members, some of whom are new associates, while others have been leaving the PCT. Custódio Miguens explains that "EnergyIN is near the end of a process of strategic reorientation - which will reduce its focus of action - that has already lasted for a year and has caused some of its associates to be removed." , "Briefly, it is expected a substantial increase in the number of members following the announcement of the refocusing into the Smart Grids Association."

It can be concluded that the Energy PCT is made up of partnerships formed by enterprises and relevant institutions, namely leading companies, R&D and higher education and vocational training, as indicated in their typology.

"The network's consistency is not only due to its structure, but also to the level of existing and potential articulation between the players involved - the quality of cooperation between players, as measured by the tradition of cooperation and the possibilities of network sustainability in the medium and long term. And so it is reflected the level of trust between the network players, even if they are competitors, as well as the intensity of the share capital of the cluster." (Chorincas, 2009).

Perhaps this is a weakness of the cluster since when asked about the existence of common projects among the participating entities, Custódio Miguens replies that "there were common projects, such as SOLAR CELL, led by EFACEC, which developed a sealing technology of solar panels using Graetzel cells, which was patented and subsequently sold for € 5 million to an Australian company." But currently, "there is no innovative project under way in partnership, although they have been identified (in meetings held on the initiative of EnergyIN) several topics of common interest to two or more companies."

Cluster Scope

In this key factor, it is essential to ascertain "the nature of the activities that the cluster intends to promote (activities of the cluster specialization profile, as well as accumulated knowledge versus emerging activities, or more traditional activities versus activities of higher technological content and that therefore entail a need to adapt the territory / institutions / economy to new requirements), because this is the way to distinguish Competitiveness and Technology Poles from Other Clusters." (Chorincas, 2009).

When asked about the nature of the activities that the cluster intends to promote, Custódio Miguens points out that the PCT of the Energy intends to "gather, organize and promote the development of value chains that are related to the implementation of Intelligent Energy Networks; promote knowledge, strengthen synergies and sustainably increase human capital and innovation; Foster the development of innovative, standardized, secure, efficient and sustainable solutions; Promote the sector at an international level, demonstrating national competence and facilitating cooperation with other entities; and building on Intelligent Energy Networks, to support the energy transition to a more sustainable future by sharing information, promoting new value-added services and increasing involvement of society and consumers."

Given the persistence of a "clear predominance of projects aimed at the more traditional activities of the portuguese economy, special attention should be given to clusters that have an impact on emerging activities, inducing new dynamics of innovation" (Chorincas, 2009).

According to the Chairman of the Cluster Board, the cluster also intends to contribute to regional specialization through "meetings with the Regional Coordination Commissions, in which companies from the regions concerned have also participated, the main objective of which is to highlight the distinctive competences of the regions and contribute to the definition of investment priorities in the context of the use of the structural funds."

Also states that "the goal of the cluster is to contribute to the creation of conditions conducive to Innovation, whether in traditional sectors or in emerging activities. The real innovation agents are the companies. However, it is not controversial to recognize that there are room for innovation in emerging activities, which have only recently begun to be explored. Smart Grids, Electrical Mobility and Energy Storage are just three examples."

It is important to note whether the "cluster points to a strictly sectoral approach or, on the contrary, to a more comprehensive, multi-sectoral or thematic approach", since this issue

"leads to different levels of integration of activities and territories (of different scales) and very different requirements from the point of view of the cluster's projection capacity" (Chorincas, 2009).

And, in fact, Custódio Miguens confirms the existence of "some articulation with other national clusters, in particular with the '*Cluster* Habitat Sustentável' and the TICE (communications) as with other european clusters, in particular with the Energy Cluster (Spain), Merinova (Finland) and OOE (Austria), EnergyIN partners at REINA PLUS project."

In this way, it can be seen that EnergyIN has an impact on emerging activities, inducing new dynamics of innovation, focusing on technologies oriented to markets with strong growth potential, distinctive features of its typology.

Strategy Consistency and Program of Action

The Consistency of the Strategy and the Program of Action is perhaps the critical factor for the success of the EEC, "which is borne out by the emphasis given to both elements in both the selection criteria and the CES application form. It allows to assess the players' common vision, their level of involvement and mobilization around collective strategies and the capacity to plan projects and activities." (Chorincas, 2009).

"The proposal to create a Pole of Competitiveness and Technology of Energy was motivated by the challenge that the energy sector faces, at global level, being summarized in a trinomial Competitiveness, Security of supply and Sustainability, and by the recognition of the existence of a set of tangible opportunities in this sector whose development was important to foster and whose global leadership was important to assume." (Competitiveness and Technology Cluster for Energy, 2009)

Thus, these opportunities were not only in line with the energy policy goals set by the Government but were also in line with economic policy objectives in terms of their impact on innovation, the development of technical and scientific knowledge and the creation of sustained economic activity, often with a strong export potential, by articulating collective strategies and stimulating the grouping of agents of the energy sector in joint projects aimed at achieving the identified opportunities. (Competitiveness and Technology Cluster for Energy, 2009)

"The main activities of EnergyIN are organized in five action programs, transversal to all sectors:

• Innovate in Partnership:

Foster the innovation culture in the portuguese industrial fabric, identify complementarities of interest and stimulate R & D projects in partnership. This program is developed in two strands:

- Encourage partnerships between groups of companies and entities of the National Scientific and Technological System, fostering a constructive dialogue with a view to the emergence of innovative projects;
- Search and identify, together with the scientific community, IDI projects of real interest to the companies, from which new competitive goods, services or solutions can be developed, competitive and exportable;

• Financing and business:

Organize "actions of approximation" (for mutual knowledge and brokerage) between enterprises presenting new ideas with potential for industrialization and the entities that can finance their projects - IDI projects and Innovative Entrepreneurship - from the R & D and construction phase from prototypes to productive / marketing investment.

• Technological Radar:

Develop actions abroad, with the possible support of AICEP, Portuguese Embassies and Chambers of Commerce – but also taking advantage of the presence of portuguese companies in other countries and visits to international fairs – in order to identifying cutting-edge technologies developed abroad that portuguese companies (through the acquisition of licenses or the creation of joint-ventures with the technologies owners).

• Renewables from Portugal:

Strengthen Portuguese exports of goods and services through the organization of corporate missions and the collective participation of portuguese companies in prestigious international fairs, in a single stand of high quality and visibility, thus leveraging the international notoriety that Portugal already has abroad, in the area of renewable energies.

• International projects and development aid:

To stimulate the participation of Portuguese companies in international projects financed under multilateral and bilateral external cooperation programs, in which Portugal has had a residual presence despite the extraordinary expression of this procurement market, in which Energy is one of the priority areas." (Chorincas, 2009)

Ambition and Results

"This critical factor allows us to complement the measurement of the common vision of the cluster, the consistency of the Strategy and Program of Action, the consistency of the network itself and the mobilization of players and the predictable level of projection of the cluster. Therefore, a critical analysis of the results and impacts expected by the EC's proposing entity should be carried out, leading to the evaluation of the quality of the strategic vision for the territory / sector." (Chorincas, 2009).

In general terms, with regard to Cluster's promotion / networking capacity at international level, the data collected show that, since recognition, the Cluster Management Entity has maintained an active stance in the promotion of activities aimed at contributing to the International promotion of the cluster and for the creation of strategic partnerships. (Sociedade Portuguesa de Inovação e inno TSD, 2013).

"In line with this position, the Program of Action of this Pole refers to the promotion of cooperation between companies and entities, national and international, as one of the objectives for the accomplishment of its mission, integrating in that same mission the contribution for the Pole to be competitive at the international level. "(Sociedade Portuguesa de Inovação e Inno TSD, 2013).

"Of the 30 projects of this Pole, 4 of them are based on collaborative bases, bringing together a joint initiative of at least two companies, representing 13.3% of the Pole projects in question and 6.8% of the total between enterprises supported by the Poles and Clusters. None of these 4 projects involves at least one large company and one SMB. "(Sociedade Portuguesa de Inovação e INno TSD, 2013).

In addition to carrying out joint projects and articulating collective strategies, the Program of Action calls for the capacity of the sector to be internationally competitive through initiatives such as networking and promotion efforts, (Sociedade Portuguesa de Inovação e INno TSD, 2013).

According to Custódio Miguens, "one of the objectives of EnergyIN is the internationalization of Portuguese companies, seen as a natural result of the gains of competitiveness. In this sense, several business missions abroad (some in cooperation with ADENE, in Brazil, Mexico, Mozambique, Israel, USA) have already been organized and a project is being funded by the European Commission - led by a Consortium of four European clusters, including EnergyIN. This is the REINA PLUS project. "

In this respect, it is noted that although the Pole does not have structuring projects for internationalization, it maintains a dynamic stance regarding the international projection through the insertion in networks.

Governance Model

This is the last critical factor to be appreciated and requires special consideration, since all the factors previously analysed depend directly on the success of the governance model outlined specifically for each cluster.

"The governance model depends on the sustainability of the network, strategic collaboration, the implementation of the Program of Action and its projects and, in particular, the survival capacity of the cluster after initial support for the creation of ECCs" (Chorincas, 2009).

The Competitiveness and Technology of Energy Pole is based on a comprehensive, agile and functional organization. The PCT is organized according to two distinct structures: first, coordination and partnership management and strategic debate, consisting of a General Assembly, a Directorate (which includes an Executive Board), a Statutory Audit Board, a Scientific Board and a Consultative Council, and a second one, to coordinate the strategic ranks of the Pole, consisting of five management bodies, responsible for coordinating the strategic ranks and closely monitoring the respective projects (Competitiveness and Energy Technology Pole 2009).

In addition to the evaluations carried out by COMPETE, Custódio Miguens states that there is only the evaluation of the Associates at the General Meeting, in which the degree of compliance with the Activity Plan of the previous year is the most important factor in this evaluation.

According to the Strategy Evaluation Study and the Implementation Process of the Collective Efficiency Strategies - Typology Clusters (2013), "the data available in the 2011 Report of the Management Entity of this Pole allow to infer a financial autonomy equivalent to 89.9 % (one of the highest among clusters) and a positive net result. This document also supports the conclusion that more than half of the cluster's sources of income do not come from subsidies."

For Custódio Miguens, in the medium / long term it is believed that the Pole can become financially self-sustaining, provided that the

membership base (paying quota) is not less than 30 enterprises.

6. Conclusions

From the analysis carried out, it can be concluded that the regions where the activities of the Energy CTC are more concentrated, in terms of employment are Lisbon and Porto Metropolitan Areas.

In terms of turnover, the Alto Minho region stands out largely from all others, with a LQ in 2010 and 2015 of 2.59 and 2.62, respectively. One of the justifications for these results may be related to the considerable evolution in the wind power subsector, being this region the one that contributes the most to the production of wind power generators and has one of the largest onshore wind farms in Europe.

In general terms, the regions present little expressive results in relation to the concentration of activities within the energy sector, which shows the need to make better use of the specificities of the regions, in order to improve their competitiveness. An example of this is the excellent conditions that Portugal presents with regard to the availability of solar radiation, winds and the vast coastline that could make the country more competitive and sustainable, while also providing environmental benefits associated with the use of renewable energies.

The present study allows us to empirically understand that the hypothesis that "The positive variation in employment is related to the increase in turnover of the Energy CTC" is not confirmed, since the two concepts do not have a direct relation. As we observed in the data analysis, it was found that some regions registered an increase in employment and a decrease in the turnover of activities within the Energy CTC between 2010 and 2015, such as the Metropolitan Area of Porto, Terras de Trás-os-Montes, Metropolitan Area of Lisbon and Algarve. On the other hand, the opposite also occurred, that is, a decrease in employment and an increase in turnover, such as in the Alto Minho, Aveiro, Médio Tejo, Alentejo Litoral and Baixo Alentejo regions.

Regarding the analysis of the critical factors, it can be verified that, although favorable, the performance of the Energy Cluster presents failures in some points evaluated, such as, the small amount of participants (15) and the small amount of projects undertaken; thus, the cluster lacks at achieving the network consistency factor, regarding the cooperation between the clusters participants in joint projects.

It is inferred also, that the involvement of the Energy Cluster's associate network is relatively modest. Reflecting this is the interaction with other clusters' entities, in which although two of the Energy cluster's projects are developed in partnership with associated companies of another cluster, in 2012, the collaboration in anchor and complementary projects between associated companies of the Energy Cluster is non-existent.

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Annex

Activities within the Energy CTC scope, taking into account for data gathering and analysis (determined by National Strategic Reference Framework):

Primary Activities:

- Manufacture of industrial gases.
- Manufacture of Biodiesel.
- Manufacture of communication equipment and devices.
- Manufacture of electric motors, generators and transformers.
- Manufacture of accumulators and batteries.
- Manufacture of engines and turbines, except aircraft, motor vehicle and motorcycle engines.
- Construction of metal vessels and floating structures, except recreational and sports.
- Production of electricity from water sources.
- Production of electricity of thermal sources.
- Production of electricity from wind, geothermal, solar sources.
- Transportation of electricity.
- Electricity trade.
- Construction of electricity transmission and distribution networks and telecommunications networks.
- Hydraulic Engineering.

Support Activities:

- Manufacture of electricity, gas, water and other liquids.
- Manufacture of instruments and appliances for measuring, checking, navigating or othes.
- Manufacture of distribution and control equipment for high voltage electrical installations.
- Manufacture of distribution and control equipment for low voltage electrical installations.
- Manufacture of devices and accessories for low voltage electrical installations.
- Computer programming activities.
- Computer consulting activities.
- Management and operation of computing equipment.
- Other activities related to information technology and computer science.
- Other engineering and related technical activities.
- Other consulting, scientific, technical and similar activities.
- Other business support services activities.