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The importance of the Mix Methodology for Studying Offshore Energy sector

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ABSTRACT : *The research in social science is not only qualitative but also quantitative. The tendency is to use qualitative or quantitative methods, although, mix methods are welcome. They performed a confirmation for the research. Recent studies on clusters have tried to link both methods towards a consistent with the research**.** On offshore energy sector the linkages between qualitative and quantitative approached are proposed. The qualitative will follow Michel Porter "diamond" model, analysing its four points (factor conditions; demand conditions; related and supporting industries; and firm's strategies, structure and rivalry, as well as government and chance. The quantitative method will be based on an I-O model for the Portuguese economy, estimating intra and inter sectorial relationships as well as the output and employment Keynesian model for this sector. The mix confrontation between these methodologies will achieve relevant results for further research on this sector.*

Keywords: *energy sector, I-O matrix, mix methodology, Porter´s Diamond Model*

I. INTRODUCTION

The increase of energy spending has become one of the main issues in developing economies. The use of offshore energy is an option for optimizing offshore territory, and energy consumption. Therefore, the use of offshore energy and in particular renewable is an option to change attitudes towards a natural resources use and pollution decrease. The projects, which will be part of this study (Offshore energy cluster in Portugal) is the first step towards economic efficiency. The mix methodology demonstrates to the researcher a confirmation of his goals. This paper evaluates both inter and intra sectorial relations for I-O matrix in the offshore energy sector and a preliminary results from Porters Diamond Model in Portugal. The article presents four main points: the mix methodology proposes; the Porter´s Diamond Model; the I-O matrix for the offshore energy sector, and conclusions.

II. THE MIX METHODOLOGY

The researcher has a tool to achieve his research, the methodology. The investigation is related with epistemology (researcher perspective and the method how researcher achieves that perspective), ontology (research phenomenon) and methodology (researcher knowledge process) (Matos, 2006: 91). The triangular design defined by Crewswell and Clark (2007:210) explores a set of procedures where the researcher compares results from qualitative and quantitative collected data; the researcher can confirm the empirical and quantitative data. Moreover, the researcher identifies at the same time the variables for answering research questions. The research is a map where objectives and goals are confirmed in positive (quantitative) and interpretative (qualitative) way. Mixing data is connected with data analysis (first analysis) and data collection (second phase) Crewswell (2009:208). The interesting issue about the mixing methodology is integrating and embedding data for a better phenomenon understanding towards a better interpretation of the entire analysis. The mix methodology allows researcher compares two databases (quantitative or qualitative) and determines if there is any convergence, differences or combinations. Therefore, the mix methods are advantageous because it is familiar to the most researchers and can result in well-validated and substantiated findings. For this propose, the article analysis two methods (Porters Diamond Model and I-O matrix analysis). The objective is to compare data and findings.

III. PORTER'S DIAMOND MODEL AND OFFSHORE ENERGY SECTOR

Porter's diamond Model is associated with the organizations competitiveness. The market is a game where an organization plays; therefore, "compete" is a dynamic process where there are strategies towards competitive advantages. The objective is to get success in the market with a relative position, where there are industry effect or positions' effects, both positive. Competitive advantage is concerned with lower cost and rivals, or the ability to differentiate and command a premium price that exceeds the extra costs of doing so (Porter, 1991:101). The market is the key challenge for a better organization performance. The organization deals with opportunities, values and barriers (Porter, 1980:37). Another point of view about the competitiveness

is the "information factor" available in the market. Information technology generates more data as a company performs its activities and permits to collect or capture information that was lost, but necessary (Porter, 1980:152). In this sequence, information can be the key factor for estimating the relationship within market factors, as described by Porter's diamond model (1990). Porter's diamond model was used for estimating the relationships within the market taking in account internal (factor conditions; demand conditions, related support industries, firms' strategies, structure and rivalry) and external variables (Chance, Government) towards industry competitiveness. In Portugal researchers, and the lack of information about the relationship between supply and demand still deficient presented few studies. Although, it can be considered the data from initial projects (waves and wind) made in this sector since 2000 (Azores Island), others will follow the same typology, *i.e.* prototypes with the prevision of a pre-commercial projects after 2018. The results from qualitative analysis are: first, *factor conditions*, the weather conditions (strong winds on Atlantic façade, Araújo (1990: 54); sea waves (Cruz& Sarmento, 2004: 17) and the infrastructures (marine ports, network electricity, dry dock assembly) near the production; second, *demand condition*, the increase of renewable consumption both in Europe (Europe2020) and Portugal (DGEG); third, *related supporting industries*, the companies involved in the construction of a wave park (Azores and Aguçadora) and wind park (Aguçadora and Viana do Castelo (projected for 2018), and, fourth, *firm strategies, structure and rivalry*, the innovation process through high-tech on these projects confirm the competition and strategy for competition on the energy market. Other factors, as chance and government are also important to the offshore energy sector. The new opportunities in the market as well as the use of technologies are considered chance to increase its benefit. On the other hand, European funds for R& D for these projects are important to increase competitiveness.

IV. I-O MATRIX AND OFFSHORE ENERGY SECTOR

The fundamental purpose of the I-O table is to analyse the interdependence of industries in an economy. Over the years, many authors have extended the I-O model in various issues: interregional flows of products and accounting for energy consumption, environmental pollution and employment associated with industrial production. On the other hand, the I-O model has two types of economic effects on the other sectors in the economy: the backward linkages effect and the forward linkage effect (Chang et al., 2008: 338). As Flegg et al (1994:1) point out the I-O analysis has become a routine tool for impact analysis. The IO model describes how the economy works in a geographic area and reflects the economic changes between agents and their interdependency. Some restriction are each sector has his own product with their own input structure (homogeneous); the technological conditions are stable; the prices are constant; the production function is linear (scale economy), and the input supply is elastic (infinite) (Haddad et al, 2011; Henriques, 2008). Henriques (2008:35) argues that for a specific sector the I-O tables are desegregating in n sub-sectors. Each sector is an equal sector in row and column in the inter-industrial matrix. The impact of renewable energy on employment (direct effect; indirect effect and, induced effect) and in three categories (technological development, installation/ uninstallation and, operation and maintenance) can be measure by I-O matrix. The importance of using IO tables on regional performance has gain impact in geographers and economists. Variables as wage, wage growth, employment growth and patenting rate (Porter, 2003) were important to study economic activities and their distributions on regions. Today´s the use of I-O tables are use for economic development decisions. Those require information about the impacts of economic growth and relative benefits and costs of alternative development strategies. Moreover, the fundamental underlying relationship of I-O analysis is that the amount of a product (good or service) produced by a sector in the economy is determined by the amount of what product purchased by all the product users. However, today's input-output analysis has become important to all the highly - industrialized countries both economic planning and decision making because of its goods flow and services that traces between different industries. Input-output tables are capable to simulating almost any conceivable economic impact. The energy started to be significant when countries realized that energy consumption was a critical factor of production in many industries and regions; therefore, the researcher and government policy makers began to focus on the role of energy in the economy. During oil crises in 70's and early in 80's in the wake of the Arab oil embargoes and their effects on US economy the I-O tables were extensively study. There has been resurgence in their use in recent years to analyse the relationships between energy and climate change. Recent studies related energy with energy account and environmental activities (Miller & Blair, 2009: 400). The use of I-O tables on energy sector determines the total amount of energy required to deliver a product to final demand, both directly as the energy consumed by an industry's production process and indirectly as the energy embodied in that industry´s input. This means that, a process analysis can be made through a primary resource; the first round of energy inputs is the direct energy requirements; subsequent rounds of energy inputs comprise the indirect energy requirements, the sum of both we call it total energy requirements. These impacts measure directly or indirectly the influence of investments, employment in the economy, through the Keynesian multiplier. Starting from the Portuguese "Input-Output Matrix of Domestic Production" (431p x 123p – INE, 2013), at basic prices, one has derived one symmetric matrix [A1] (97 x 97)

that was previously inverted taking into account that Leontief inverse matrix multiplied by a change in final demand yields a change in total output. The next step was the creation of the corresponding technical coefficient matrix [A2], whose elements allow assessing the strength of the linkages between the industries, (Simões et al. 2012, Simões et al., 2015) and the impact of past or near future investments. As the offshore renewable energy industry ("Nomenclature Statistique des Activités Économiques dans la Communauté Européenne – NACE", Rev. 2, 35113) has still very poor data due to being an emerging industry, one has adopted as a working hypothesis that NACE 35113 follows the same pattern has NACE 351, the larger group where it is integrated. The research made in this sector (351) shows that there are fewer impacts from the others on its demand and supply. Taking into account all 97 sectors, technical coefficients of Leontief matrix, one concludes that there are just small linkages (a_{ij}> 0,02) between the sector 351 and the rest of the economy, and Keynesian multiplier is 2,53 (type 1), 3.18 (type 2) and employment (2.11).

V. DISCUSSION AND CONCLUSION

The importance of a mixed methodology on energy sector study is important and necessary. Firstly, the offshore energy sector is recent in Portugal, so the data available is not consistent in qualitative or qualitative conditions. Secondly, the qualitative analysis based on Porter's diamond model shows that there are conditions for setting up cooperation and collaboration between offshore energy stakeholders. Thirdly, on quantitative analysis, the intra and interrelationships still very weak, although the economic impact on the economy is significant on this sector. Fourthly, the offshore energy sector can be a cluster if there are strong linkages between universities, government, and organisations. On the other hand, this sector has an important role in Portuguese economy, namely in energy supply, technical employment and business competitiveness. Although, we consider some limitations: the lack of information (both qualitative and quantitative), few linkages with other European partners, and lower investments in comparison with other European countries. Therefore, in the nearly future, it is important to compare this sector with European patterns, and give solution for a better business performance in this sector.

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