COMPETITIVE INTELLIGENCE FOR POWER MARKET MONITORING

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ABSTRACT

A methodology to monitor Power Markets using the concept of Competitive Intelligence is described in this paper. This concept gives an integral vision to the environment monitoring process, involving from obtaining information to information analysis and diffusion in order to support making decisions. The methodology development was based on the study of public information available on the Internet for the countries of Argentina, Bolivia, Colombia, Ecuador, Panama and Peru. The methodology proposes the activities and tools that should be followed and used to perform a continuous monitoring to the Power Market and it may be used by any concerned agent of the market. Its application allows to obtain variables and indicators related to statistical information of the market, organized in four categories: production, infrastructure, consumption and economic – environmental. The methodology was validated for the Colombian case, obtaining 27 variables and indicators.

INTRODUCTION

The Competitive Intelligence (CI) is a practice that has been used mainly in the business sector to support making strategic and operative decisions. The CI starts from capture, analysis and information distribution of the competitive environment of the enterprises. This concept appears as a response to the necessity of systematizing and interpreting the huge information volume which may be accessed nowadays and which is indispensable for getting competitive advantages.

The present paper describes a Methodology to Monitor the General Behavior of the Power Markets (MCGM[1]) using the CI concept. At a worldwide level different methodological proposals to monitor the power markets are known, which have the definition of monitoring areas, indicators and important variables of study in common [1],[2]. However, a methodological alternative is not known where monitoring is considered as an integral process, this is to say, involving from obtaining information to information analysis and diffusion.

OVERVIEW OF CI

In general, the words "Monitoring" and "Intelligence", are used indistinctly to express "The systematic and organized effort of observation, reception, analysis, precise diffusion and recovery of information about the facts of the economic, technological, social or commercial environment, which are important for the organization because they imply an opportunity or threat for this, in order to be able to make decisions with smaller risk and to be ahead of the changes" (Palop y Vicente, 1999) [3].

The term Competitive Intelligences is used in this paper, in the sense of observing the environment (monitoring) but with an analysis, classification and systematization of the information to facilitate making decisions. This way, the basic functions inherent to an intelligence system are: objective definition of the intelligence, search and information gathering, analysis, diffusion and action (making decisions). In accordance with the areas that might be monitored, it is possible to cite different kinds of intelligence. For example, according to Porter contributions and their four decisive factors for competitiveness [4], a company should obtain information about: current and potential competitors (Competitive), clients and suppliers (Commercial), current or just appeared technologies (Technological), external facts as sociology, environment, regulations, politics, etc. (Environment).

Tools such as bibliometrics, "datamining" and intelligent agents, among others, can be used in intelligence exercises. Depending on the type of study and available resources, the methods and/or tools to be used are chosen.

In the present research the basic CI methodology steps were followed. The Internet was used as searching tool (in order to access free databases) in addition to statistic analysis support tools. Next, the guidance premises used to develop the methodology and the steps that make it up are described.

MCGM DESCRIPTION

One of the established objectives for MCGM is to be adaptable to any Latin American Power Market, so its development was performed based on the study of five Latin American countries: Argentina and Ecuador [5], Bolivia [6], Panama [7] and Peru [8]. Its validation was carried out for the Colombian case. The methodology steps presented next were defined based on the search and information analysis carried out for these countries.

1. Objective identification

In this first methodology stage, the type of information of interest should be specified. For this, an environment subdivision into fields that facilitates the aspects to monitor

1 From its acronym in Spanish.

is recommended.
The particular Latin American Power Market characteristics impel the following fields: market field (statistical information associated to the electric power value chain) and economic – environmental field (statistical dates of economic environmental nature).
These fields definitions are based on the premise of perform monitoring to the power markets starting from variables of statistical nature. However, depending on the user's interest who puts into practice the methodology, i.e. generator, transporter, marketer, distributor, regulator, manager market or system operator, they should be defined fields related to their particular interest.

2. Search and gathering

2.1. Searching the Web. Once the object of study is defined, it continues the information search stage. Taking into account the premise of using secondary sources of public access through the Internet, at this stage, *the electronic addresses identification and exploration of the sources of relevant information is performed*.
The search engine developed in Stanford University, "Google", was chosen as the most appropriate one to carry out the initial exploration process. Its election was made based on the experience of searching the Web for information on the countries under study. Nevertheless, other search engines such as, AltaVista, Vivisimo, Yahoo Search and meta engines such as Copernic also can be used.
To define the keywords that lead to relevant information sources, a list of words related to the area under study, should be settled down.
Once the keywords are defined, the word random combinations sample to use at the search engine is determined. The search experience for the countries under study showed that groups of five words should be used in order to get the best results for the search. The possible number of word combinations is calculated with (1) and the sample size (n) of these combinations with (2) [9].

$$lCr = \frac{l!}{(l-r)!\,r!} \qquad (1)$$

Where:
l : Number of keywords
r : Size of the group of words used on the search engine.

$$n = \frac{z^2 s^2 N}{\varepsilon^2 (N-1) + z^2 s^2} \qquad (2)$$

A confidence level between 90% and 95% and an error rate between 5% and 10% are suggested. Nevertheless, these parameters should be defined by the researcher according to the particular process necessities.
Next, on the search engine, the word combinations sample calculated is introduced. The number of times each web page appears is registered on a frequency table. This way, the Web pages that are going to be explored are selected by choosing those with the largest number of appearances.

2.2. Information Gathering. In the electric sector, the web pages are characterized by being dynamics, that is, they are updated constantly. In some cases when updates are carried out, dates from the last period are eliminated. For this reason, it is necessary to extract to a database the collected information (html, .xls and .pdf files) in order to develop a historical information record of the market and perform analysis on the same one.

3. Analysis and valuation

3.1. Document preselection. In general, web pages of the electrical sector organizations offer information of interest as well as for general public as for the sector agents. This way, institutional information for end users, such as instructive records on efficient use of energy, is found in these "Web" sites. For this reason, a preselection of documents which have exclusive relation with the market should be performed to produce a better system performance in the subsequent information processing.

3.2. Document valuation. Once documents are preselected, their valuation is essential. This valuation is carried out according to precise criteria (factors) and related strictly with the objective of the methodology (monitoring) in order to identify documents with valuable information for identifying relevant variables. In the same way and according to the information features, a number of grades should be defined for each factor.
The defined factors to valuate the documents of the methodology to monitor the general behavior of the power market and their respective gradation are described below:

Type of dates: information may be found in the form of tables, graphics or text. In that sense, documents that include mainly information on tables are the first candidates to analyze because they contain the greatest amount of information in the smallest extension.
History: considering that market monitoring is carried out continuously, it is necessary to log historical dates for a long enough period of time to detect changes in the observed variables. So, in the present methodology, documents with historical dates from the last 5 years are more important than their similar ones from the last year.
Resolution: each of the spaces in which the time is divided and while the information is developed. In some variables, it is of vital importance the information resolution to market monitoring. Variables with resolution of years, months and days into the same document, make of this a very important document to be analyzed.
Processing: analysis grade of the document. It is measured

by the existence of variables, indices or indicators. Due to the analysis is carried out for secondary information, in many cases this information has already been processed, this is, it presents indices and/or indicators of interest for particular market agents. So, in the present methodology, variables are very important because they are less processed and hence may be interpreted in a general way allowing indices and indicators deduction.
According to the latter description, the gradation for each factor is proposed on table I. The grade I is the most important for the methodology.

TABLE I. GRADES PER REFERENCE

Factor	Grade	Item
Type of dates	I	Tables
	II	Graphics
	III.	Text
History	I	Last (4 – 5) years.
	II	Last (3 – 4) years.
	III	Last (2 – 3) years.
	IV	Last (1 – 2) years.
	V	Last year.
	VI	It is not found into the range.
Resolution	I	Resolution of years, months and days.
	II	Resolution of years and months or years and days or months and days.
	III	Resolution only of months (bimonthly, quarterly, etc.).
	IV	Resolution only of days (weeks, hours, etc.).
	V	Resolution only of years.
Processing	I	Include variables: characteristic of interest on each individual element of a population
	II	Include indices: no dimensional measure. Relation between two or more variables.
	III	Include indicators: Relation between one or more variables.

Points per grade: in order to assign the valuation of the preselected documents, it is necessary to estimate a punctuation for the grades of each factor. This punctuation is obtained as the product between the weight assigned to each factor and a grade score, according to its importance for the monitoring process, like this:

Points per grade = (factor weight)*(grade score)

This way, a score scale was defined. The most important document has a score of 1.000 and the least important a score of 0.070. On table II, the points to document valuation are shown.

3.3. Variables and document selection. After documents are valuated, they must be ordered from major to minor ones and, applying the Pareto technique, the most important are chosen. This way, 20% of the documents with the highest score are selected. Later, the selected documents must be explored in order to identify and extract variables included in the same one.

TABLE II. POINTS FOR DOCUMENT VALUATION

Factor	Grade	Factor Weight	Grade score	Points per grade
Type of dates	I	0,35	1	**0,35**
	II		0,5	**0,175**
	III		0	**0**
History	I	0,20	1	**0,2**
	II		0,65	**0,13**
	III		0,45	**0,09**
	IV		0,25	**0,05**
	V		0,1	**0,02**
	VI		0	**0**
Resolution	I	0,20	1	**0,2**
	II		0,9	**0,18**
	III		0,85	**0,17**
	IV		0,8	**0,16**
	V		0,1	**0,025**
Processing	I	0,25	1	**0,25**
	II		0,6	**0,15**
	III		0,2	**0,05**

4. Making decisions

4.1. Categorization. Unified variables are classified in accordance with four categories which represent different perceptions to perform a general monitoring of the market and they are fundamental to identify minimal information requirements for making decisions. These categories, in concordance with the established fields in the objective of study, are:

Production*:* variables related to the inputs to produce electric power.
Infrastructur*e:* elements related to the physical structure to power supply and its expansion.
Consumption*:* Involve elements associated to electric power demand.
Economic – environmental category*:* this category is included due to the importance of economic and environmental variables for power market expansion.

4.2. Making decisions. The user of the methodology according to his/her specific interest, he/she chooses the relevant variables for market monitoring. Taking into account that the methodology begins with the usage of free access secondary sources with dynamic nature; resultant variables from the process of information search, information gathering and document valuation and selection can be different depending on the period of time in which monitoring was carried out, which is consistent with the

continuous and cyclic nature of the competitive intelligence.

RESULTS FROM THE METHODOLOGY VALIDATION IN THE COLOMBIAN POWER MARKET

The results described below were obtained by the application of the methodology in the Colombian Power Market. Sixteen words were defined for searching the web: antecedent database, Colombia, dates, electricity, electric, energy, statistics, generation, informs, market, price, references, transmission, transportation, experts. A pre-sample of 50 words was made with the above words and applying (3) and (4) were obtained the mean and standard deviation. Applying (1) was obtained a population size of 4368 word combinations.

In order to facilitate information analysis, a confidence level of 90% and an acceptable error rate of 13.4% were used in (2) to calculate the sample. The above-mentioned, because the process of word combinations insertion into the search engine and gathering results was totally performed in an interactive way (desk test).

With these dates a sample size of 157 word combinations was obtained, which corresponds with the number of searches to perform on the "Web".

The results showed by the search engine for each of these word combinations were tabulated on a frequency table. In accordance with the number of appearances, the Web pages which had to be explored were easily identified.

Afterwards, each one of the 353 depurated files were qualified (*document valuation*) in accordance with the levels of each established factor.

Once the qualification was made, 166 relevant documents were selected using the Pareto technique. Within these documents, 27 variables and market indices were found. They are listed below and classified in the four categories proposed by the methodology.

Production: SIN real hydric contributions, Real hydric contributions per region, real hydric reserves by SIN reservoir, Hydric reserves by reservoir, SIN hydraulic generation, Thermal generation, Smaller generation monthly total. Co-generators and self-producers generation, Power average price on international stock exchange, Power average price on national stock exchange, Dispatched contract power average price, Stock exchange pondered price, Total power buys on stock exchange, Power buys by contracts, Power sales on stock exchange, Power sales by contract, System bid reservoir.

Infrastructure: Energy equivalent cost (CEE – CERE), Net effective capacity: hydraulic generation, thermal generation, smaller generation, co-generator and self-producer plants.

Consumption: Total power buys on stock exchange, Power buys by contracts, Total power sales on stock exchange, Power sales by contracts, Power maximum demand (total sales on stock exchange), Power national demand, Not attendant demand (programmed causes), Not attendant demand (not programmed causes).

Economic – Environmental: Consumer Prices index (CPI), Producer price index (PPI), Gross domestic product (GDP), Rate of exchange according to the U.S. dollar.

CONCLUSIONS

It was proposed a methodology to perform continuous monitoring to the power market. Its development was based on public information available on the Internet, which makes it useful to carry out continuous monitoring with much reduced costs. In addition, the generic steps of the methodology can be followed by any market agent interested on a specific area. Nevertheless, it should be taken into account that its information search proposal begins from ignorance about the market of study and the relevant information sources. For this reason, depending on the grade of knowledge about the market to study, the identification and information search stages may be indistinctly performed. The next stage, after the methodology development, is the incorporation of computer tools that facilitate the process of search, analysis and information display. One alternative is to incorporate Intelligent Agents which allow to automate the methodology through intelligent algorithms that perform human process tasks.

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