# *THE USE OF SCIENTIFIC INDICATORS WITHIN THE FRAMEWORK OF THE DEVELOPMENT OF INDONESIAN PROVINCES*

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**Summary :** The integration of the scientific and technical expertise as element of the regional development becomes an important subject in Indonesia. Indeed, the political power having granted autonomy to the Indonesian Regions, those will become concurrent and all the forces available will have to create a regional attractivity supporting the development. In this work we present a method to use simple indicators, resulting from commercial information products dealing with the chemical field. We chose the database CA-Search from Chemical Abstracts as well as the statistical facilities afforded by ScienceFinder Scholar. The objective is not to carry out a complete analysis of chemistry and para-chemistry in Indonesia, but, starting from the results obtained, to set up a methodology and a critical analysis of the results to support the strategic choices and to allow the development of actionable knowledge.

**Résumé :** L'intégration de l'expertise scientifique et technique comme un élément du développement régional devient un sujet important en indonésie. L'autonomie qui a été accordée par le Gouvernement Central aux différentes Provinces Indonésiennes, ces régions vont devenir concurrentes et toutes les forces disponibles auront à créer une attractivité facilitant le développement. Dans ce travail nous présentons une méthode qui utilise des indicateurs simples résultant d'informations commerciales fournies dans le champ de la Chimie. Nous avons choisi la base de données des Chemical Abstracts ainsi que les outils statistiques directement accessible via ScienceFinder Scholar. L'objectif n'est pas de réaliser une analyse complète de la Chimie et de la para-Chimie en Indonésie, mais, à partir des résultats obtenus de développer une méthodologie et une analyse critique des résultats pour supporter les choix stratégiques et permettre le développement de résultats pour supporter les choix stratégiques et permettre le développement d'une connaissance pour l'action.

**Key-words :** Regional development, Competitive Intelligence, statistical analysis, bibliometry, strategic choices, information, chemistry, patent analysis

**Mots-clés :** Développement régional, Intelligence Compétitive, analyse statistique, bibliométrie, choix stratégiques, information, chimie, analyse des brevets

# The use of scientific indicators within the framework of the development of Indonesian Provinces

## 1 - INTRODUCTION

Central Indonesian government, to maintain the cohesion of the country and to allow him to face the passage to the AFTA (1) under the best conditions, granted the autonomy to Indonesian provinces (we will use the term provinces or regions). (2) From this point, the Regions will become concurrent in certain fields and all the forces must seek the best possible synergy to support the economic development. We want in this work, to show how simple indicators, obtained from directly accessible commercial products via the Internet allow to avoid the exoduses internal (3) and external (4) on the one hand, and on the other hand allow to launch the base of an analysis to reach a close coordination between the strategic sectors and the fundamental and technological research. We will use as example the sector of chemistry, and as tool of information the Chemical Abstracts database as well as the statistical tools available with this database and on the Internet.

## 2 - MATERIAL

The material used is simple. Chemistry on the documentary level is indexed in the database of CA Search of Chemical Abstracts. One thus obtains information starting from the 12.000 surroundings sources analyzed by this producer of information. The descriptions of Chemical Abstracts include a certain number of elements which can be used like criteria of selection of research (with combination by Boolean operators), or like criteria leading to simple statistical representations being able to be used as indicators. A description contains in general: the title, the authors, the address of the latter (generally the one of the first author), a certain number of key words (Index terms and supplementary terms), various sections of Chemical Abstracts (division of chemistry in various fields), the language of publication, the type of document published (Newspaper, Essay, Proceedings…), the date and country of publication. The summary is also present. It is not used for the statistics, but it informs more completely about the contents of the work. The whole data provided by the base CA Search is in English.

**Example of publication**

**Fermentation process for the production of Acetobacter sp. EMN-1 biomass.** Melliawati, Ruth; Komara, Wenda Yandra; Sukara, Endang. Research Center for Biotechnology-Indonesian Institute of Sciences (LIPI), Bogor, Indonesia. Biotechnology for Sustainable Utilization of Biological Resources in the Tropics (2001), 15 432-437. CODEN: BSUTFT Journal written in English. CAN 138:3753 AN 2002:773442 CAPLUS (Copyright 2003 ACS)

**Abstract**

Acetobacter sp. EMN-1, a local bacterial isolate of Indonesia, was used in this study. The culture was obtained from Research Center for Biotechnol. LIPI's Culture Collection. Two methods of shaking namely rotary and reciprocal shaking were used resulting in a different cell growth and biomass yield. Using a rotary shaking at 170 rpm and 72 h fermn., the total no. of 6.05x108 cfu per mL with cell biomass of 11.4 g wet wt. or 1.7 g dry wt. per L were produced. Meanwhile, using a reciprocal shaking at 120 rpm, the total of 1.05x108 cfu per mL with a biomass yield of 13.6 g wet wt. or 2.0 g dry wt. per L culture medium were produced. The use of peptone, polypeptone, yeast ext. or tryptone as a nitrogen source could accelerates the growth rate of the culture and reduces the fermn. time to only 48 h. Scale up was carried out using a 2 L air-lift Fermenter but the max. cell population reached was only 5.3x107 cfu per mL after 72 h. The total amt. of biomass produced was 6.52 g wet wt. or 1.35 g dry wt. Preliminary study using a 10 L stirred-tank Fermenter was carried out and the result was discussed.

One will note in the field addresses, a difficulty: the address is that provided by the authors during the publication of work. If this one incomplete or is badly written or not homogeneous from a publication to another, the search on one hand and the analysis of the other can be partially distorted.

## 3 - METHOD

The working method is simple. One has available the millions of documents present in the base since approximately 1965. One can carry out a research by country by selecting Indonesia for example, then one can limit this research by date or topics and on each part to carry out simple statistics by counting. (5)
Research is assisted, which allows people little specialized to have a certain performance. The use of the statistical tools is also assisted (SciFinder Scholar), which largely facilitates the realization of various sorting and then makes it possible to focus

its attention on interpretation. The results of counts or the time series are
generally presented in the form of histograms, but the data can also be transferred to Excel.

We used the whole work indexed with the name Indonesia in the field addresses, which leads to 3010 references since the creation of the database (1965). A limit over the last years of 1999-2003 (January), led to 686 references.

The 686 references have been analyzed, step by step, using the different fields available for analysis in the Chemical Abstracts database via SciFinder Scholar.

## 4 - NUMBER OF PUBLICATIONS PER YEARS

Let us note that for the most recent years, as the whole of analyzed work is not taken into account in its totality, one notes differences.
To eliminate those, and to have a general tendency of the evolution of the scientific and technical production in the sector of chemistry, one examines the 11 last years. This makes possible to highlight a general trend in research papers production..
The following distribution is obtained:

| Year concerned | Data frequency |
|---|---|
| 2000 | 306 |
| 2001 | 261 |
| 2002 | 233 |
| 1999 | 222 |
| 1998 | 208 |
| 1996 | 183 |
| 1997 | 177 |
| 1995 | 177 |
| 1994 | 172 |
| 1993 | 141 |
| 1991 | 129 |
| 1990 | 125 |

Table 1 – Repartition of the publications per year

A regular growth is noted. However, in a relatively strategic sector (presence of oil and various ores, potentiality of biotechnology), the increase is not what could have been hoped over 10 years (growth of a factor of 2, 48).

Evolution of the whole number of papers on the whole Chemical Abstracts database is indicated in he next figure.

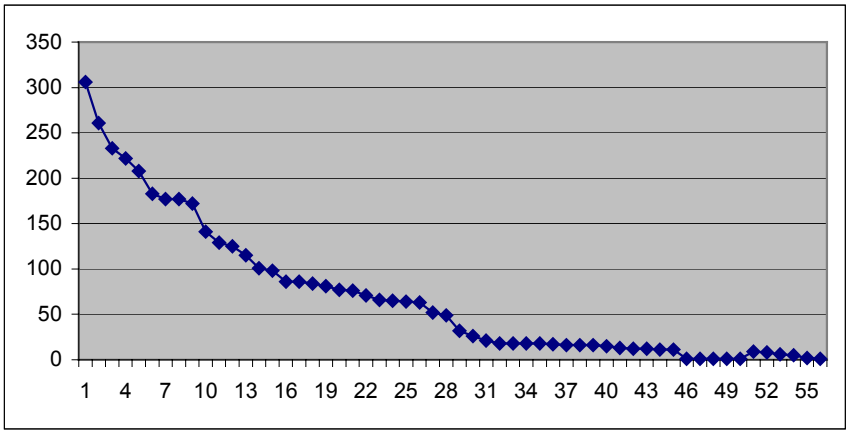


Figure 1 – Evolution of the descriptions per year from 2003 to 1949

## 5 - DISTRIBUTION BY LANGUAGES

L ` analysis is carried out on the 686 references of 2003 to 1999.

| Type of language | Data frequency |
|---|---|
| Anglais | 598 |
| Indonésien | 78 |
| Japonais | 8 |
| Allemand | 2 |

Table 2 – distribution of the various by languages

The preponderance of English is noted. Few reviews in Indonesian exist on one hand, and on the other hand they are not necessarily taken into account by Chemical Abstracts. Moreover those which exist accept publication works in English. This highlights the importance of English like common language.

## 6 - DISTRIBUTION BY TYPES OF PUBLICATIONS

The documents taken into account by Chemical Abstracts are varied. The analysis is carried out on the 686 references from 2003 to 1999.
The results are as follow:

| Type of publications | Data frequency |
|---|---|
| Journal (scientific) | 610 |
| Conference | 45 |
| General survey | 45 |
| Patent | 21 |
| Preprint | 9 |
| Meeting announcement | 3 |
| Letter to the editor | 2 |
| Proceedings | 1 |
| Miscelaneous | 1 |
| Electrinoc publications | 1 |
| Repport | 1 |

Table 3 – Distribution by type of documents (publications)

## 7 - DISTRIBUTION OF AUTHORS

The analysis is carried out on the 686 references from 2003 to 1999.
The distribution of the authors is significant, because of the scientific practice where generally the name of the director of the laboratory appears several times, which will help to determine the presence of the most productive groups.

The results are as follow:

| Names of the main authors | Data frequency from 2003 to 1999 |
|---|---|
| Indrayanto Gunawan | 19 |
| Kagawa Kiichiro | 13 |
| Kurniawan Hendrik | 13 |
| Tjia M O | 13 |
| **Tjia May On** | 13 |
| Barmawi M | 12 |
| Arifin P | 9 |
| Syahrani Achmad | 8 |
| Zainuddin | 8 |
| Hakim Lukman | 7 |
| Mart T | 7 |
| Schultink Werner | 7 |

| | |
|---|---|
| Fryauff David J | 6 |
| Ghisalbert Emilio L | 6 |
| Sani R A | 6 |
| **Total Général des auteurs** | **1936** |

Table 4 – Distribution of the main authors

The number of authors per publication appears correct, about 2,8. The distribution (traditional bibliometric curve) does not highlight strong publishing groups. There is thus an activity distributed without particularly productive group of research.

Certain authors, because of collaborations are not Indonesians, although the name Indonesia appears in the address.

Let us note for Tjia , different writing which come from the fact that Chemical Abstracts take into account what is written in the publication, without changing it. That introduced differences, if the spelling or the manner of writing (here first names) are not homogeneous.

## 8 -DISTRIBUTION BY INSTITUTIONS

The analysis is carried out on the 686 references from 2003 to 1999.

We indicate on this table the 20 principal institutions.

| **Institution name** | **Data frequency** |
|---|---|
| ***Gadjah Mada University*** | 32 |
| *University of Indonesia* | 29 |
| **Bandung Institute of Technology** | 23 |
| Bogor Agricultural University | 19 |
| **Institut Teknologi Bandung** | 19 |
| National Nuclear Energy Agency | 17 |
| Airlangga University | 16 |
| *The University of Indonesia* | 13 |
| Indonesian Institute of Sciences | 9 |
| Eijkman Institute for Molecular Biology | 8 |
| ***Fakultas Farmasi Universitas Gadjah Mada*** | 8 |
| Diponegoro University | 7 |
| ***Universitas Gadjah Mada*** | 7 |
| *Universitas Indonesia* | 7 |
| Brawijaya University | 6 |
| Indonesian Institute of Sciences (LIPI) | 6 |
| **Institute of Technology Bandung** | 6 |
| Udayana University | 6 |
| Widya Mandala Catholic University | 6 |
| Directorate of Mineral Resources Inventory | 5 |

Table 5 - Distribution of the principal institutions

One notes in the table, that a certain number of institutions have different spelling, which introduces different distributions. This is very significant, because total perception will be distorted. It is thus significant to tell to the scientists that the names of authors and the addresses of the organizations must be written with the same manner over time. It is the only way of profiting from the work of indexing made by the producers of databases to perform fine statistics. This is also valid when internal databases are build up.

The corrected table becomes:

| **Institution name** | **Nn** | **Town** | **geographical location** |
|---|---|---|---|
| ***University of Indonesia*** | 49 | Jakarta | Java |
| ***Bandung Institute of Technology*** | 48 | Bandung | Java |
| ***Gadjah Mada University*** | 46 | Jakarta | Java |
| Bogor Agricultural University | 19 | Bogor | Java |
| National Nuclear Energy Agency | 17 | Serpong | Java |
| Airlangga University | 16 | Surabaya | Java |

| | | | |
|---|---|---|---|
| Indonesian Institute of Sciences | 15 | Jakarta | Java |
| Eijkman Institute for Molecular Biology | 8 | Jakarta | Java |
| Diponegoro University | 7 | Semarang | Java |
| Brawijaya University | 6 | Malang | Java |
| Udayana University | 6 | Denpassar | Bali |
| Widya Mandala Catholic University | 6 | Surabaya | Java |
| Directorate of Mineral Resources Inventory | 5 | Jakarta | Java |

Table 5 - Distribution of the main institutions (corrected)

One notes thus that three institutions are largely detached and ensured practically 21% of the total production. Then a group of four institutions accounting for approximately 10% from the total production comes. Thus approximately 30% of the total production in chemistry are carried out through 7 institutions. This represents a considerable concentration and should imply the development of a network of competencies in chemistry starting from these establishments. Moreover, it is noted that the very great majority of the institutions are localized in the Island of Java. That poses within the framework of autonomy a certain division of competence to be set up. Indeed, if material facilities can be quickly developed thanks to attributions of credits and grants, it is not the same for the intangible properties, such knowledge.

## 9 - THE DISTRIBUTION OF COMPETENCIES AT A GENERAL LEVEL

One can carry out this distribution at the general level by using the chemistry division in broad fields, which is carried out via the sections of Chemical Abstracts. This segmentation is significant because it makes possible to visualize correctly the distribution of research by large fields, this is more perceptible than with the indexed terms or the supplementary terms. Another manner to access to this information is to consider the principal journals, which by their names and specialties , makes possible to carry out another type of segmentation. This will be analyzed in the following paragraph.

The analysis is carried out on the 686 references from 2003 to 1999.

| **Chemical Abstracts Sections** | **Freq.** |
|---|---|
| *Pharmacology* | 46 |
| **Animal Nutrition** | 45 |
| **Plant Biochemistry** | 40 |
| Electric Phenomena | 31 |
| **Microbial, Algal, and Fungal Biochemistry** | 31 |
| Fossil Fuels, Derivatives, and Related Products | 28 |
| *Pharmaceuticals* | 28 |
| **Food and Feed Chemistry** | 24 |
| **Fertilizers, Soils, and Plant Nutrition** | 23 |
| Nuclear Technology | 22 |
| Optical, Electron, and Mass Spectroscopy and Other Related Properties | 22 |
| **Fermentation and Bioindustrial Chemistry** | 17 |
| Biochemical Genetics | 16 |
| Immunochemistry | 16 |
| *Pharmaceutical Analysis* | 16 |
| **Cellulose, Lignin, Paper, and Other Wood Products** | 14 |
| Synthetic Elastomers and Natural Rubber | 14 |
| Mineralogical and Geological Chemistry | 12 |
| Nuclear Phenomena | 12 |
| Waste Treatment and Disposal | 12 |
| Water | 12 |
| Plastics Manufacture and Processing | 10 |
| Unit Operations and Processes | 10 |
| Air Pollution and Industrial Hygiene | 9 |
| Mammalian Pathological Biochemistry | 9 |
| Toxicology | 9 |

| | |
|---|---|
| Electrochemical, Radiational, and Thermal Energy Technology | 8 |
| Enzymes | 8 |
| Extractive Metallurgy | 8 |
| Biochemical Methods | 7 |
| Cement, Concrete, and Related Building Materials | 7 |
| Ferrous Metals and Alloys | 7 |
| Nonferrous Metals and Alloys | 7 |
| Agrochemical Bioregulators | 6 |
| Inorganic Analytical Chemistry | 6 |
| Mammalian Hormones | 5 |
| Plastics Fabrication and Uses | 5 |
| Surface Chemistry and Colloids | 5 |
| Crystallography and Liquid Crystals | 4 |
| Industrial Carbohydrates | 4 |
| Physical Properties of Synthetic High Polymers | 4 |
| Benzene, Its Derivatives, and Condensed Benzenoid Compounds | 3 |
| Biomolecules and Their Synthetic Analogs | 3 |
| Ceramics | 3 |
| Industrial Organic Chemicals, Leather, Fats, and Waxes | 3 |
| Magnetic Phenomena | 3 |
| Mammalian Biochemistry | 3 |
| Phase Equilibriums, Chemical Equilibriums, and Solutions | 3 |
| Apparatus and Plant Equipment | 2 |
| Carbohydrates | 2 |
| Essential Oils and Cosmetics | 2 |
| Industrial Inorganic Chemicals | 2 |
| Inorganic Chemicals and Reactions | 2 |
| Nonmammalian Biochemistry | 2 |
| Radiation Chemistry, Photochemistry, and Photographic and Other Reprographic Processes | 2 |
| Aliphatic Compounds | 1 |
| Catalysis, Reaction Kinetics, and Inorganic Reaction Mechanisms | 1 |
| Chemistry of Synthetic High Polymers | 1 |
| Electrochemistry | 1 |
| General Physical Chemistry | 1 |
| Heterocyclic Compounds (One Hetero Atom) | 1 |
| History, Education, and Documentation | 1 |
| Radiation Biochemistry | 1 |
| Thermodynamics, Thermochemistry, and Thermal Properties | 1 |
| References not containing Information for this analysis | 23 |

Table 6 – Distribution of the Chemical Abstracts Sections

Taking into account the number of years considered (2003 to 1999), one can consider that there is a dispersion of the research area much too large. It is not possible to do everything, because the means necessary will be certainly lacking. Thus it is necessary to carry out a concentration of the available facilities. This is well noted if one examines the beginning of the table However there is a certain concentration of the activity in the field natural sciences (plants, culture, animal nutrition.), but most of the area remain too dispersed and it is obvious, that if one wants to reach the critical masses in certain fields, it will be necessary to concentrate the means on the subjects determined as being strategic by the country. It is obvious that within this framework, a general dialogue at the national level must be organized. This dialogue must transcend the regional wills to some extent (6) , because it is the only way of concentrating sufficient means.

Then remain to examine the localization of the main institutions:

| Institution name | Nb | Geographical localization | |
|---|---|---|---|
| ***University of Indonesia*** | 49 | Jakarta | Java |
| ***Bandung Institute of Technology*** | 48 | Bandung | Java |
| ***Gadjah Mada University*** | 46 | Yogyakarta | Java |
| Bogor Agricultural University | 19 | Bogor | Java |
| National Nuclear Energy Agency | 17 | Serpong | Java |
| Airlangga University | 16 | Surabaya | Java |
| Indonesian Institute of Sciences | 15 | Jakarta | Java |

Table 7 – Localization of the principal research institutions

## 10 – ANALYZE PRINCIPAL SUPPORTS (SCIENTIFIC JOURNALS)

The analysis is carried out on the 686 references from 2003 to 1999.
The scientific newspapers at the same time make it possible to have an idea of the practices of publication and in a certain way of the impact of the research by the means of the impact factor of the various journals. We will not speak here about quality, because the publication as such is subjected to the will of an invisible college as wall as to economic rules of the editor (subject, size of paper, …).
We gathered the results in the following table:

| Journal names | Frequency |
|---|---|
| Maj. Farm. Indonesia | 74 |
| JAERI Conf. | 26 |
| Lembaran Publ. Lemigas | 25 |
| Biotechnol. Sustainable Util. Bio. Resour. Trop | 16 |
| PCT Intl. Appl. | 12 |
| J. Nutr. | 10 |
| Publ. Anstralas. Inst. Min. Metall. | 10 |
| Ann. Bogor | 8 |
| Asian Australas. J. Anim. Sci. | 7 |
| Gan to Kagaku Ryoho | 7 |
| Proc. SPIE Int. Soc. Opt. Eng. | 7 |
| Am. J. Trop. Med. Hyg. | 6 |
| Chishitsu Chosa Kenkyu Hokoku | 6 |
| Fitoterapia | 6 |
| J. Plar. Chromatog. Mod. TLC | 6 |
| Radiat. Pys. Chem. | 6 |
| Am. J. Clin. Nutr. | 5 |
| Appl. Spectrosc. | 5 |
| Clin. Hemorheol. Microcirc. | 5 |
| Desalination | 5 |
| Drying Technol. | 5 |
| Los Alamos Natl. Lab. Prepr. Arch. Condens. Matter | 5 |
| Physica C (Amsterdam, Neth.) | 5 |
| Adsorpt. Sci. Technol., Proc. Pac. Basin. Conf. 2nd | 4 |
| Asia Pac. J. Clin. Nutr. | 4 |
| Clin. Infect. Dis. | 4 |
| J. Asian Nat. Prod. Res. | 4 |
| Spectrochim. Acta, Part B | 4 |

Table 8 – Principal sources of publication
Total number of analyzed sources 489

One notes, here a vision not very different from that of the Chemical Abstracts sections, but more precise The aspect application seems to have a significant concern, which indicates despite a large dispersion a tentative programming. However, it should be stressed that this only source of information is not sufficient (Chemical Abstracts), because it must certainly exist in Indonesia other

information sources, connected to the work and competencies of researchers of university staff, which are not analyzed by Chemical Abstracts. Admittedly, for the the teaching staff, the publication as such is taken into account, but the expertises of research contracts, etc… do not appear. It is important also to note the presence of patents. Let us note in good place the publication of Lemigas (Lembaran Publ. Lemigas), which indicates that some work on petroleum derivated products, is made.

## 11 – FINER ANALYSIS OF MAIN SETS OF THEMES

The analysis is carried out on the 686 references from 2003 to 1999.
Chemical Abstracts makes possible to carry out such an analysis. One can work from the Indexed Terms (kind of key words), or from the Additional Terms, which reflect the descriptive vocabulary of the moment. These two types of terms are assigned to a description of the various papers by Chemical Abstracts Service. One can also work via the RN or Registry Number, which are an affected univocal number for each chemical molecule. Chemical Abstracts Service, affects for all the products present in an abstracted paper a registry number. The latter makes possible to work by products, without passing by the nomenclature and the chemical names which are complex. The correspondence between the chemical name and the RN is carried out via accessible online chemical dictionaries. This part being rather complex do not give a global vision and will not be used extensively here. One will simply give as an example a list of RN concerning the most quoted RN present in the Indonesian papers, but the latter can describe not only the molecules on which one works, but all the commonplace chemicals such as solvents used, etc…

### A – Analyze of the Index Terms

| **Index Terms** | **Nb** |
|---|---|
| Nutrition, animal | 33 |
| Human | 28 |
| Fermentation | 15 |
| Simulation and Modeling, physicochemical | 14 |
| Drug delivery systems | 13 |
| Plant tissue culture | 13 |
| Antimalarials | 12 |
| Antitumor agents | 12 |
| Development, mammalian postnatal | 12 |
| Gene, microbial | 12 |
| Soils | 12 |
| Enzymes, biological studies | 11 |
| Growth and development, plant | 11 |
| Molecular structure, natural product | 11 |
| New natural products | 11 |
| Plasmodium falciparum | 11 |
| Bacteria (Eubacteria) | 10 |
| Laser induced plasma | 10 |
| Mutation | 10 |
| Protein sequences | 10 |
| Proteins | 10 |
| Proteins, general, biological studies | 10 |
| Crystal structure | 9 |
| DNA | 9 |
| DNA sequences | 9 |
| Genetic polymorphism | 9 |
| Hemoglobins | 9 |
| pH | 9 |
| Rice (Oryza sativa) | 9 |
| Vapor deposition process | 9 |

Table 9 – Principal index terms appearing
Total numbers of index terms 6050

There is a vision here more precise of the sets of themes. But however, it should be stressed that the number of index terms used by Chemical Abstracts to describe the contents of a paper is not constant. So certain research, described by more indexed terms will see their "weight" increased artificially. One does not find, for example sets of themes related to oil work, which is however present through the journal names analysis (cf table 8).

**B – Use of the supplementary terms**

| Supplementary term | | Nb |
|---|---|---|
| Indonesia | | 97 |
| effect | | 47 |
| review | | 46 |
| analysis | | 38 |
| Indonesian | | 35 |
| using | | 35 |
| nutrition | | 30 |
| **oil** | | 30 |
| acid | | 25 |
| effects | | 26 |
| protein | | 26 |
| new | | 25 |
| plasma | | 23 |
| production | | 23 |
| study | | 23 |
| Treatment | | 22 |
| activity | | 21 |
| studies | | 20 |
| cell | | 19 |
| growth | | 19 |
| Low | | 19 |
| natural | | 19 |
| reactor | | 19 |
| determination | | 18 |
| water | | 18 |
| Characterization | | 17 |
| detn (determination) | | 17 |
| induced | | 17 |
| method | | 17 |
| application | | 16 |
| carbon | | 16 |
| **gas** | | 16 |
| gene | | 16 |
| laser | | 16 |
| oxide | | 16 |
| properties | | 16 |
| rubber | | 15 |
| system | | 16 |

Table 10 – Main supplementary terms
Total number of supplementary terms 4205

One finds here more "comprehensible" terms for research policy maker. One finds the work related to petroleum (oil, gas), which corresponds to the Lemigas journal. It is obvious that certain of these additional terms are relatively commonplace like new, system, low, etc.... One finds also in these additional terms an orientation relatively close from applied research.

**C – The Registry Numbers**

Although not making part in of the macro indicators, we give here some indications on RN.

| RN | Frequency |
|---|---|
| 7439-89-8 | 28 |
| 7440-66-6 | 28 |
| 7440-50-8 | 27 |
| 11103-57-4 | 19 |
| 7440-70-2 | 18 |
| 54-05-7 | 14 |
| 7727-37-9 | 14 |
| 7439-92-1 | 12 |
| 7723-14-0 | 12 |
| 7732-18-5 | 12 |
| 7439-95-4 | 11 |
| 7440-09-7 | 11 |
| 50-99-7 | 10 |
| 7440-21-3 | 10 |
| 7631-85-9 | 10 |
| 9005-25-8 | 10 |

Table 11 - Example of frequencies of RN
Total RN taken into account 2010

On the whole list, one notes very strong dispersion, but this is obvious, according the fact that on 18 millions RN only approximately 100.000 are used with a frequency higher than 10.

## 12 – MORE SOPHISTICATED INDICATORS

It is quite obvious that the preceding indicators are only lists and histograms. One can starting from these latter have a total idea of the sets of themes, experts, institutions and temporal evolution of the research in chemistry. Even if these indicators are quite simple, their value lies in the fact that they do not distort information (the selected base is powerful and complete), and that they can be obtained in very little time: about a few tens of minutes, and this without constituting a local database, *i.e. without paying the downlaoding of all the references from the Chemical Abstracts*. A subscription to Scifinder Scholar is necessary, but this one is perfectly affordable on the scale of a country. However, there is the possibility, by the traditional bibliometric techniques, to create finer indicators (7), connecting the authors (networks of authors), their expertise (matrices or networks of authors and indexed terms or or Chemical Abstracts sections), competencies of the institutions (matrix or networks of relations between institutions and index terms, …), etc… These methods and tools are used in a permanent way at the laboratory (8), but they generally concern groups of publications more significant and distributed on a number of years and geographical areas more restricted.

To produce such indicators, it is necessary to have access to have a file formatted (i.e. homogeneous) containing the data to correlate (in the form of documentary fields well delimited). Of course, the data resulting from Chemical Abstracts will constitute a starting point for a developing country. The reason is that in these countries only a few laboratories and companies published data and results in international databases. Then, the Chemical Abstracts analysis should be complemented with local data, if competency databases (e.g. knowledge base of Chemical Indonesian expertise) do exist.

## 13 – SPECIFIC INDICATORS

As the Chemical Abstracts database has a very broad coverage , it can be used to carry out surveys in various fields. It will be easy then, to perform research benchmarking, specifically in domains relevant to the country development.. The same technique and method as the former one will be used , only the subject will be different… To give an example of such a treatment, we took a relatively significant domain, linked to the North Sulawesi Indonesian Region where we worked to teach the DEA of Competitive Intelligence (9): **the coconut field**. To carry out the data selection from the Chemical Abstracts database, we used as keyword the name coconut, and we retrieved all the data containing this term in the title or abstract or index term or supplementary term fields. We also selected (this is an option offered by Chemical Abstracts) the extension of the search to the coconut concept. The search was carried out on February 28$^{th}$ 2003. The bulk of references was

then restricted to the period 1999-2003. The result obtained was as follow:
Total number of references: 2036
Total number of references produced by Indonesia (10) for the same period: 3

**Indonesian References:**

**Reference 1**

**A method for producing sheet or board from coconut fibres bonded with aminoplasts.**
Sendayung, Handay. (Indonesia). PCT Int. Appl. (2000), 12 pp. CODEN: PIXXD2 WO 0058061 A1 20001005 Designated States W: AT, AU, BR, CA, CN, CZ, DE, ES, GB, IN, JP, KR, LK, MX, PL, PT, RO, RU, SE, SK, TR, US, VN, YU, ZA, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM. Designated States RW: AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, BF, BJ, CF, CG, CI, CM, GA, ML, MR, NE, SN, TD, TG. Patent written in English. Application: WO 99-ID3 19991222. Priority: ID 99-294. CAN 133:268460 AN 2000:707062 CAPLUS (Copyright 2003 ACS)

**Patent Family Information**

| Patent No. | Kind | Date | Application No. | Kind | Date |
|---|---|---|---|---|---|
| WO 2000058061 | A1 | | ID 1999-294 | A | |
| 20001005 | WO | 1999- | | | |
| ID3 19991222 | | | | | |
| | | W: AT, AU, BR, CA, CN, CZ, DE, ES, GB, IN, JP, KR, LK, MX, PL, PT, RO, RU, SE, SK, TR, US, VN, YU, ZA, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM | | | |
| | | RW: GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW, AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG | | | |

Priority Application
Application No. Date
19990331

**Abstract**
Prodn. of sheets or boards from coconut fibers consists of the following steps: (1) removal of the fibers from the coconut's outer peel; (2) drying the wet fibers to water content 6-14%; (3) cleaning the dry fibers from dust and dirt; (4) solidification and flattening of the dry fibers continuously by using punching machine which has more than 600 needles to make it into soft sheet of fibers; (5) binding the soft fiber sheet with a polymeric resin type adhesive; (6) making the sheet half dry; (7) cutting the sheet into a desirable size; (8) hot-pressing the soft, binder-contg., humid sheet for 3-15 min at pressure 10-25 kg/cm2 and 100-180 □C to obtain boards of a predetd. thickness ; and (9) final cutting of the board or sheet to a predetd. desirable size. Formaldehyde-urea resin or formaldehyde-melamine resin is used as binder for the above purpose.

**Reference 2**

**Flavor characteristics of Indonesian soy sauce (kecap manis).** Apriyantono, A.; Husain, H.; Lie, L.; Jodoamidjojo, M.; Puspitasari-Nienaber, N. L. Department of Food Technology and Human Nutrition, Bogor Agricultural University, Bogor, Indonesia. Editor(s): Shahidi, Fereidoon; Ho, Chi-Tang. Flavor and Chemistry of Ethnic Foods, [Proceedings of a Meeting held during the 5th Chemical Congress of North America], Cancun, Nov. 11-15, 1997 (1999), Meeting Date 1997, 15-31. Publisher: Kluwer Academic/Plenum

Publishers, New York, N. Y CODEN: 68WCAA Conference written in English. CAN 133:119220 AN 2000:292255 CAPLUS (Copyright 2003 ACS)

**Abstract**

Kecap manis is a typical Indonesian soy sauce prepd. from black soybeans. The beans are mold and brine fermented to produced moromi which is then filtered and cooked with coconut sugar and spices for 1 h to afford kecap manis. The brine fermn. took up to 4 mo, during the first month of which the content of glutamic acid reached a max. of 14.33%, based on the dried matter. The content of glutamic acid was then decreased and a similar trend was obsd. for some of the amino acids. The flavor volatiles of kecap manis were then studied after different fermn. periods for moromi prepn. (0, 1, 2, 3, 4 mo). The volatiles contained 16 acids, 4 aliph. aldehydes, 1 phenol, 6 aliph. ketones, 21 furans, 10 pyrazines, 1 pyran, 3 pyrroles, 1 thiazole, 1 pyridine, 4 alicyclic hydrocarbons, and 11 unknowns. While these volatiles were qual. similar, there were quant. differences. Thus, the content of pyrazines and acids increased as the fermn. progressed. However, the highest gurih (tasty, umami) taste was attained for kecap manis prepd. from 1-mo-fermented moromi. Anal. of sensory description, consumer preference and volatiles compn. of seven com. kecap manis showed that the preference of consumer to kecap manis was more affected by its taste where sweet and gurih (tasty, umami) were the taste that consumers like. Volatile compn. apparently did not correlate well with the aroma of kecap manis.

**Reference 3**

**Kinetic aspects of bacterial cellulose formation in nata-de-coco culture system.** Budhiono, A.; Rosidi, B.; Taher, H.; Iguchi, M. Institute for Research and Development of Agro-Based Industry (IRDABI), Bogor, Indonesia. Carbohydrate Polymers (1999), 40(2), 137-143. CODEN: CAPOD8 ISSN: 0144-8617. Journal written in English. CAN 131:321803 AN 1999:614051 CAPLUS (Copyright 2003 ACS)

**Abstract**

The process of cellulose formation in a nata-de-coco culture system was investigated. The medium was prepd. with coconut-water by adding sugar and N-compds. and the culture was conducted in static conditions. The growth of gel thickness, wet wt. and dry wt. was almost independent of the concns. of N-compd. and sugar at least when they were above 0.1 and 1%, resp., suggesting that the process was controlled by oxygen supply. Glucose was the only saccharide found in the coconut water stored for 3 days. While the concn. of sugar dropped quickly to a certain level and decreased monotonically with time, a part of the glucose turned to something other than cellulose. No fructose was found after the initial stage, presumably being consumed by side-reactions.

Computer simulation showed that, after the induction time, the process of cellulose formation or the consumption of glucose is controlled by the diffusion of atm. oxygen.

This whole of references was analyzed to highlight the principal countries and institutions (which makes possible to set up collaborations), the principal sources of information (one sees the level of patents), one determines also the principal journals thus, this will make possible to constitute a basic library, and finally one analyzes supplementary terms to define the covered subjects. The results are presented in the following tables:

**A - Countries and institutions concerned by the concept coconut**

We obtained the following result :

| Institutions or countries | Frequency |
|---|---|
| USA | 61 |
| Peop Rep China | 31 |
| Japan | 27 |
| L'oreal, Fr | 24 |
| Germany | 22 |
| Kao Corp, Japan | 22 |
| Unitika Ltd, Japan | 17 |
| Abbott Laboratories, USA | 16 |
| Unilever PLC, UK | 15 |
| BASF Plant Science G m b H, Germany | 14 |
| The Procter & Gamble Company, USA | 13 |
| Hindustan Lever Limited | 11 |

| | |
|---|---|
| Unilever NV | 11 |
| University of Kerala, India | 11 |
| Asahi Denka Kogyo K K, Japan | 9 |
| Kimberly Clark Worldwide Inc, USA | 9 |
| Lion Corp, Japan | 9 |
| S Korea | 9 |
| Unilever N V, Neth | 9 |
| Universiti Putra Malaysia, Malay | 9 |
| The Royal Danish School of Pharmacy, Den | 8 |
| Central Food Technological Research Institute, India | 7 |
| Dainippon Ink and Chemicals Inc, Japan | 7 |
| Hindustan Lever Ltd | 7 |
| Kanegafuchi Chemical Industry Co Ltd, Japan | 7 |
| Kawaken Fine Chemicals Co, Japan | 7 |
| Matsushita Electric Industrial Co Ltd, Japan | 7 |
| Unilever PLC | 7 |
| University of Florida, USA | 7 |
| University of Granada, Spain | 7 |
| University of Jaen, Spain | 7 |
| University of Southampton, UK | 7 |

Table 12 - Countries and Institutions concerned by the concept coconut
Total of countries and institutions : 1372

**B- Sources of publications concerned by the concept coconut**

| **Information sources** | **Frequencies** |
|---|---|
| **PCT Int. Appl.** | **358** |
| **Jpn. Kokai Tokkyo Koho** | **344** |
| U.S. | 106 |
| **Eur. Pat. Appl.** | **73** |
| **U.S. Pat. Appl. Publ.** | **53** |
| Faming Zhuanli Shenqing Gongkai Shuomingshu | 52 |
| **Ger. Offen.** | **46** |
| J. Am. Oil Chem. Soc. | 20 |
| **Fr. Demande** | **18** |
| Curr. Plant Sci. Biotechnol. Agric. | 17 |
| Environ. Sci. Technol. | 6 |
| In Vitro Cell. Dev. Biol.: Plant | 6 |
| Ind. Eng. Chem. Res. | 6 |
| Indian J. Exp. Biol. | 6 |
| Int. J. Pharm. | 6 |
| J. Agric. Food Chem. | 6 |
| J. AOAC Int. | 6 |
| J. Colloid Interface Sci. | 6 |
| Langmuir | 6 |
| Lipids | 6 |
| Plant Cell, Tissue Organ Cult. | 6 |
| Appl. Biochem. Biotechnol. | 5 |
| Atherosclerosis (Shannon, Irel.) | 5 |
| Braz. Pedido PI | 5 |
| Carbon'01, Int. Conf. Carbon | 5 |
| Global J. Pure Appl. Sci. | 5 |
| J. Anim. Physiol. Anim. Nutr. | 5 |

| | |
|---|---|
| J. Chromatogr., A | 5 |
| Mol. Cell. Biochem. | 5 |
| Nutr. Res. (N. Y.) | 5 |
| World J. Microbiol. Biotechnol. | 5 |
| Adsorpt. Sci. Technol., Proc. Pac. Basin Conf., 2nd | 4 |
| Anim. Feed Sci. Technol. | 4 |
| Aquaculture | 4 |
| Biomass Bioenergy | 4 |
| Book of Abstracts, 219th ACS National Meeting, San Francisco, CA, March 26 30, 2000 | 4 |
| Cem. Concr. Compos. | 4 |
| Eur. J. Pharm. Sci. | 4 |
| Fett/Lipid | 4 |
| Ger. | 4 |
| Indian J. Environ. Health | 4 |
| Int. J. Toxicol. | 4 |
| J. Food Sci. | 4 |
| Proc. World Conf. Palm Coconut Oils 21st Century | 4 |
| Water Res. | 4 |
| Analyst (Cambridge, U. K.) | 3 |
| Appl. Microbiol. Biotechnol. | 3 |
| Asian Australas. J. Anim. Sci. | 3 |
| Biochim. Biophys. Acta | 3 |
| Biosci., Biotechnol., Biochem. | 3 |
| Book of Abstracts, 217th ACS National Meeting, Anaheim, Calif., March 21 25 | 3 |
| Can. J. Anim. Sci. | 3 |
| Chemosphere | 3 |
| Colloids Surf., A | 3 |
| Environ. Mol. Mutagen. | 3 |
| Eur. Food Res. Technol. | 3 |
| Food Addit. Contam. | 3 |
| Genome | 3 |
| Int. J. Vitam. Nutr. Res. | 3 |
| J. Chem. Soc. Niger. | 3 |
| J. Chem. Technol. Biotechnol. | 3 |
| J. Plant Physiol. | 3 |
| J. Surfactants Deterg. | 3 |
| Kasetsart J.: Nat. Sci. | 3 |
| Microporous Mesoporous Mater. | 3 |
| Nahrung | 3 |
| Nat. Polym. Compos., [Proc. Third Int. Symp., Workshop Prog. Prod. Process. Cellul. Fibres Nat. Polym.] | 3 |
| Nippon Kagaku Kaishi | 3 |
| Plant Sci. (Shannon, Irel.) | 3 |
| Pollut. Res. | 3 |
| Process Biochem. (Oxford) | 3 |
| References not containing information for this analysis | 3 |
| Riyong Huaxue Gongye | 3 |
| Stud. Surf. Sci. Catal. | 3 |
| Theor. Appl. Genet. | 3 |
| Trans. ASAE | 3 |
| Zhongguo Youzhi | 3 |

Table 13 – The main information sources
Total of sources analyzed : 545

The very strong presence of the patents will be noted, which makes it possible by a simple analysis of the sources to position the subject and to show that the research is mainly focalized on applications. One will note also the strong presence of the Japanese patents.

*In this field, the analysis which has been just carried out highlights one of the major problems encountered by the developing countries.*

First of all let us look at the world production out of coconut, then the production by country and geographical areas:

| | | | | | Unit : 1000 nuts |
|---|---|---|---|---|---|
| Country | 1992 | 1993 | 1994 | 1995 | 1996 |
| A. Asia and Pacific | 42113805 | 43671709 | 45462211 | 48295884 | 47934625 |
| F.S. Micronesia | 40000 | 40000 | 40000 | 40000 | 40000 |
| Fiji | 195000 | 198000 | 196200 | 196040 | 196400 |
| India | 10080000 | 11241000 | 11975000 | 13300000 | 13968000 |
| Indonesia | 12376000 | 13030000 | 13245000 | 13521000 | 13595000 |
| Malaysia | 883000 | 800000 | 787000 | 748000 | 722000 |
| Papua New Guinea | 980000 | 1058000 | 840000 | 869000 | 960000 |
| Philippines | 11405000 | 11328000 | 11207000 | 12183000 | 11935000 |
| Solomon Islands | 262000 | 267000 | 272000 | 280000 | 287600 |
| Sri Lanka | 2296000 | 2164000 | 2622000 | 2755000 | 2546000 |
| Thailand | 1103000 | 1128000 | 1849000 | 1898000 | 1130000 |
| Vanuatu | 327000 | 317000 | 317000 | 317000 | 346000 |
| Vietnam | 1010000 | 1000000 | 978000 | 1054000 | 1065000 |
| Western Samoa | 122000 | 144000 | 159000 | 160000 | 160000 |
| Palau | 70000 | 70000 | 70000 | 70000 | 70000 |
| Others | 964805 | 886709 | 905011 | 904844 | 9136 |
| B. Africa | 2129145 | 2230674 | 2181004 | 2196295 | 2193000 |
| C. America | 3352218 | 3097368 | 3487416 | 3522878 | 3469929 |
| *Total* | 47595168 | 48999750 | 51130631 | 54015056 | 53597554 |
| Source: Statistical Yearbook 1996, Asian and Pacific Coconut Community (APCC) | | | | | |

Table 14 – World Coconut Production (Measured in Nut Equivalent) 1992-1996

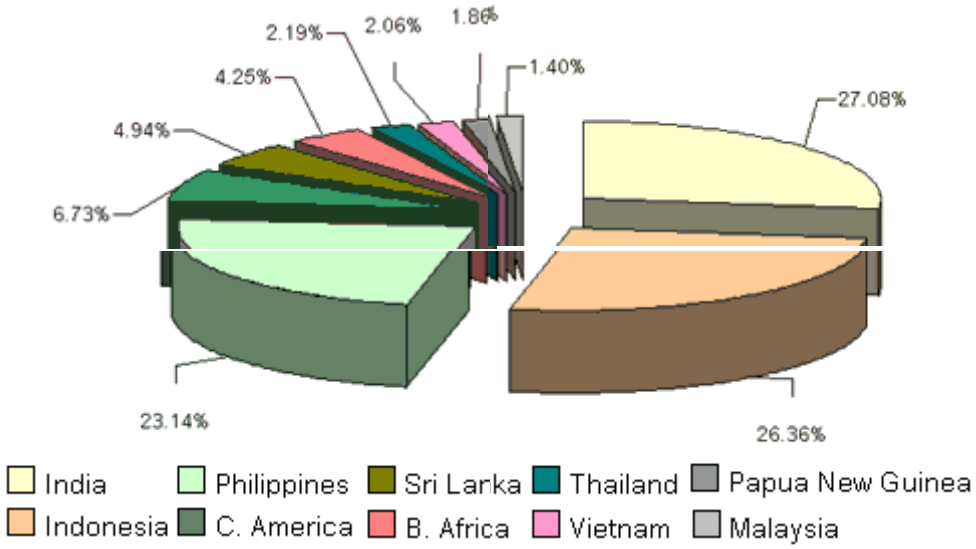


Figure 1 – World Coconut Production

*The problem may be understood by comparing the data from the following table:*

| Countries | Recherche et Développement | Wealth production in % (coconut) |
|---|---|---|
| Indonesia | 3 publications | 25% |
| World without Indonesia | 2036 publications (*) | 75% |

Table 15 – Research and Patents output about the concept coconut
(*) including 892 patents

It is noted here that if the richness (production of "coconut") of Indonesia in this field is significant compared to the world production, the quantity of "knowledge" and "Know-How" in the field is quasi non-existent. There is not adequacy between the richness and the effort of R&D. This means that all the added value which may be created by fundamental research and patents in this field are let to other countries. Then, the only solution is to sell the crude material (coconut, or coconut pulp). But, doing so no added value (and wealth) will be created. At least this observation, rather general, shows well that it is necessary to program the activities of research or to set up a group of qualified people to use the research produced on the fundamental level "elsewhere", to integrate it and/or build a local development starting from these results (amongst other things creation of new products and protection of the later). One of the value carried out by this type of analysis is to show clearly to the decision makers how to build a research and development policy, and to induce scientists towards a production which should be directly useful for the country. Admittedly, fundamental research is necessary, but in the phase of development of a country the creation of medium-term richness becomes a more significant requirement, and the processes of creation of such a value are different from those necessary to the development of an overall fundamental research.

**C – The main Research Areas**

| Termes supplémentaires | Nb |
|---|---|
| oil | 419 |
| coconut | 373 |
| acid | 301 |
| fatty | 236 |
| carbon | 207 |
| containing | 202 |
| composition | 176 |
| Activated | 172 |
| fat | 158 |
| compositions | 154 |
| method | 125 |
| Food | 123 |
| plant | 118 |
| water | 114 |
| compn | 112 |
| fiber | 109 |
| oils | 102 |
| surfactant | 101 |
| use | 100 |
| cosmetic | 94 |
| Manufacture | 94 |
| nutrition | 94 |
| production | 94 |
| using | 88 |
| manuf | 86 |
| adsorption | 85 |
| effect | 85 |
| vegetable | 85 |
| ester | 80 |

| | |
|---|---|
| treatment | 80 |

Table 16 – Supplementary Terms
Total of the supplementary terms used : 6287

Although this analysis is simple, one can see the problems related to carbon (carbon black), to cosmetic, surfactant, nutrition with fatty acids, etc…. A finer analysis could be carried out on the patents, either starting from Chemical Abstracts, but for example starting from the database of the European Patents (Espacenet) (11) and by using software Matheo Patents (12) which will provides an automatic downloading and analysis. A simple research on the coconut term present in the title or the summary of the patents present in this database leads to 3002 references. The analysis will be performed as an example in the following sections.

## 15 – PROTECTION KNOW-HOW, CREATION OF VALUE AND PATENT ANALYSIS

In this paragraph, we will carry out the analysis of the European Patents dealing with the concept "coconut". We saw, in the preceding paragraph, that this field was strategic taking into account the importance of the production of this raw material in Indonesia. To carry out the positioning of the technologies, and the main actors (Patent Assignees), we will work on the database of the European patents, which is free and accessible via Internet. This analysis will have value of example, and could be carried out in other fields by Indonesian Institutions concerned by the local or Regional development. The fact that the information is free, and that it is accessible through the Internet, provides the basic facility to used this method widely to have a better view of the trends and actors of various R&D areas.

To complete the work, we used the software Matheo Patent, which was developed by former students of our laboratory (13) within the framework of a micro-enterprise. This software perform two basic functions :

- A very fast access via downloading of the Patents via the Database Espacenet (European Patents), available free of charge via the internet ,
- A bibliometric analysis of the principal significant fields, present in the patents, by carrying out counting, sorting, histogram, matrices and subsequent correlation such as networks, etc.

To be present the last trends in technologies and applications, we downloaded the patents from the last three years. On this patents we will performed various analysis to give as an example various set of data able to help the decision makers in the field of research programming. The various technologies and correlation within this field will be given using the IPC (International Patent Classification) .

## 16 – Analysis of the Patents downloaded per year

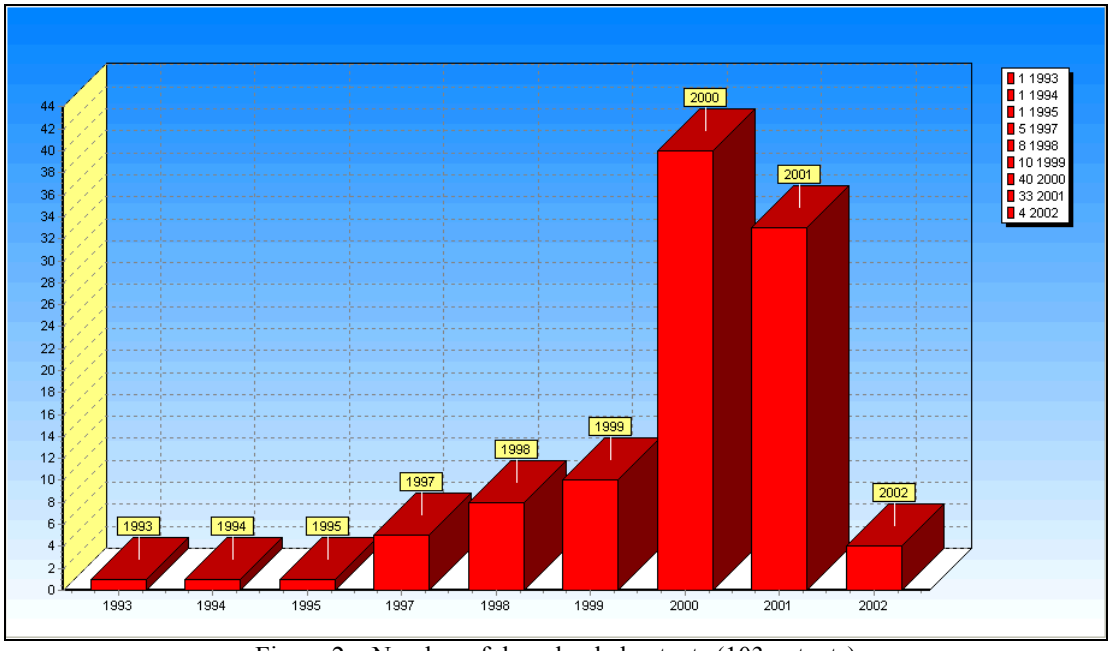


Figure 2 – Number of downloaded patents (103 patents)

## 17 – HISTOGRAM OF THE IPC AND DIRECT ENVIRONMENT OF THESE CODES

Only the 4 digits of the IPC codes are used. This will avoid a too large dispersion, and the meaning of the 4 digits codes is sufficient to ascertain the technological domain of application.

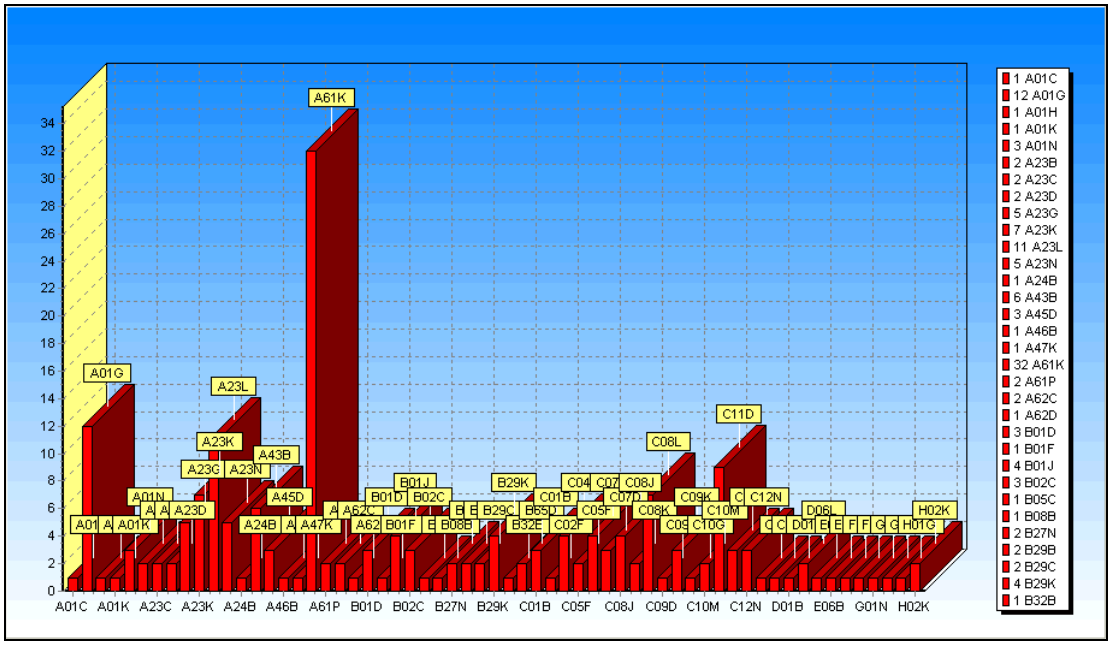


Figure 3 – Histogram of the IPC
For IPC definition consult: http://www.wipo.org/classifications/fulltext/new_ipc/index.htm

**One notes, for the European Patents concerned the presence of a dominating application area:**

**A61K PREPARATIONS FOR MEDICAL, DENTAL, OR TOILET PURPOSES** (bringing into special physical form A61J; chemical aspects of, or use of materials for deodorisation of air, for disinfection or sterilisation, or for bandages, dressings, absorbent pads or surgical articles A61L; compounds per se C01, C07, C08, C12N; soap compositions C11D; micro-organisms per se C12N)

**Following by 4 others**

**A01G HORTICULTURE; CULTIVATION OF VEGETABLES, FLOWERS, RICE, FRUIT, VINES, HOPS, OR SEAWEED; FORESTRY; WATERING** (picking of fruits, vegetables, hops, or the like A01D 46/00; plant reproduction by tissue culture techniques A01H 4/00; devices for topping or skinning onions or flower bulbs A23N 15/08; propagating unicellular algae C12N 1/12; plant cell culture C12N 5/00)

**A23L FOODS, FOODSTUFFS, OR NON-ALCOHOLIC BEVERAGES, NOT COVERED BY SUBCLASSES A23B TO A23J; THEIR PREPARATION OR TREATMENT, e.g. COOKING, MODIFICATION OF NUTRITIVE QUALITIES, PHYSICAL TREATMENT** (shaping or working, not fully covered by this subclass, A23P); **PRESERVATION OF FOODS OR FOODSTUFFS, IN GENERAL**

**C08L COMPOSITIONS OF MACROMOLECULAR COMPOUNDS** (pesticides, herbicides A01N; pharmaceuticals, cosmetics A61K; explosives C06B; compositions based on polymerisable monomers C08F, C08G; paints, inks, varnishes, dyes, polishes, adhesives C09; lubricants C10M; detergents C11D; artificial filaments or fibres D01F; textile treating compositions D06)

**C11D DETERGENT COMPOSITIONS** (preparations specially adapted for washing the hair A61K 7/075; methods or apparatus for disinfection or sterilisation A61L; special washing compositions for cleaning semi-permeable membranes B01D 65/06); **USE OF SINGLE SUBSTANCES AS DETERGENTS; SOAP OR SOAP-MAKING; RESIN SOAPS; RECOVERY OF GLYCEROL**

This representation does not indicate to us the environment (the related applications, i.e. connection) of each one of these classes. This information will be provided in the following table or the immediate environment of a class (compared to the other classes present in the same patent) is automatically realized by the software Matheo Patent. For each class, one to determine its environment (other classes contained in the same

patent which contains already the class object of the analysis). Two examples of this environment are indicated in figures 4 and 5:

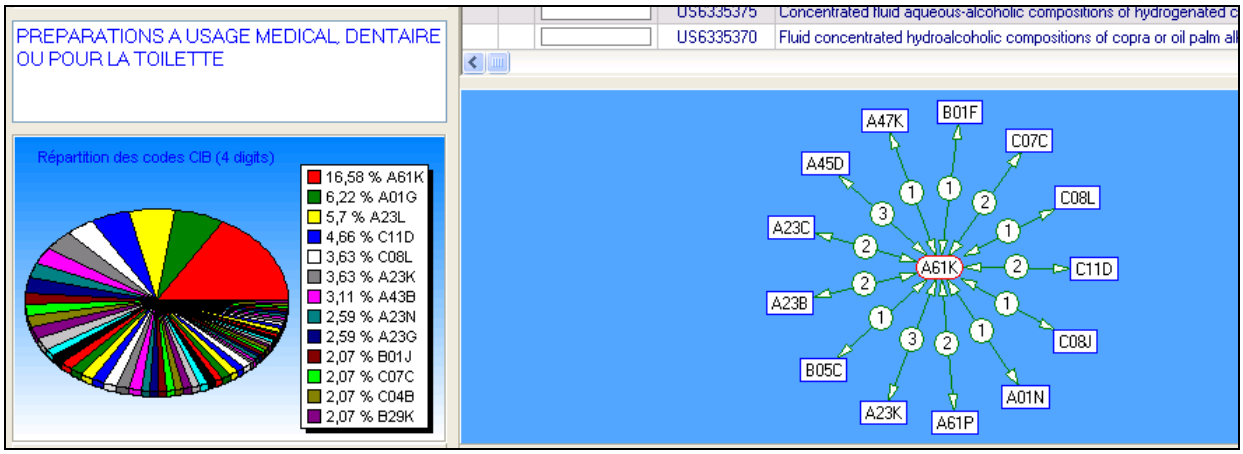


Figure 4 – Environment of the IPC A61K
**PREPARATIONS FOR MEDICAL, DENTAL, OR TOILET PURPOSES**

One also notes, to allow to position the IPC analyzed among the total PIC present that the percentage distributions of all the IPC is indicated on the left side of the figure.

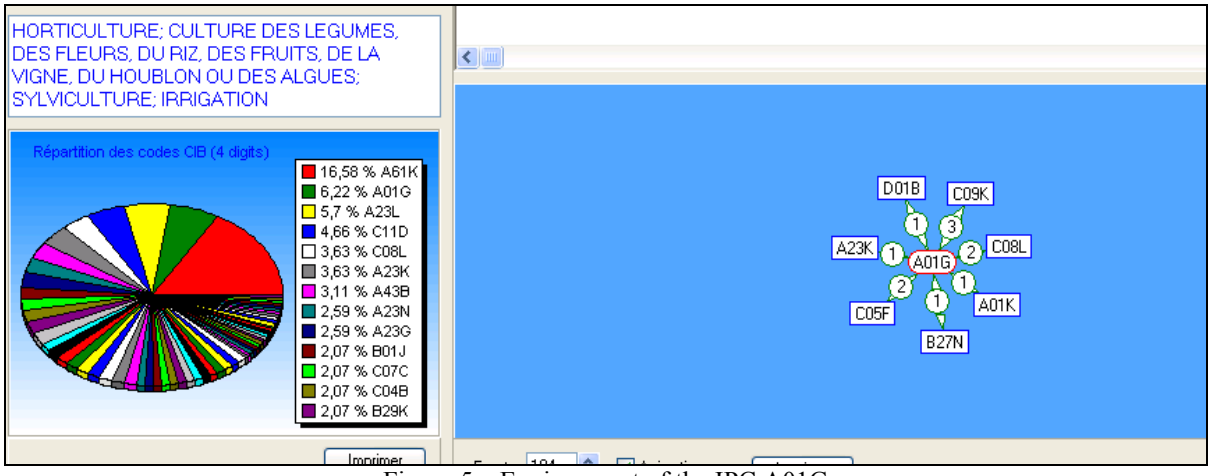


Figure 5 – Environment of the IPC A01G
**HORTICULTURE; CULTIVATION OF VEGETABLES, FLOWERS, RICE, FRUIT, VINES, HOPS, OR SEAWEED; FORESTRY; WATERING**

## 18 – TOTAL ENVIRONMENT OF AN IPC CODE (OF A TECHNOLOGICAL APPLICATION)

We on the two preceding figures presented the direct environment of a technological application domain (IPC code). However, in practice, which is interesting it is to determine the global environment (i.e. the network), in which an IPC class is inserted. To carry out such a network, the method of the associated pairs (here IPC classes present in a patent) will be used. The network is calculated automatically and presented in figure 6.

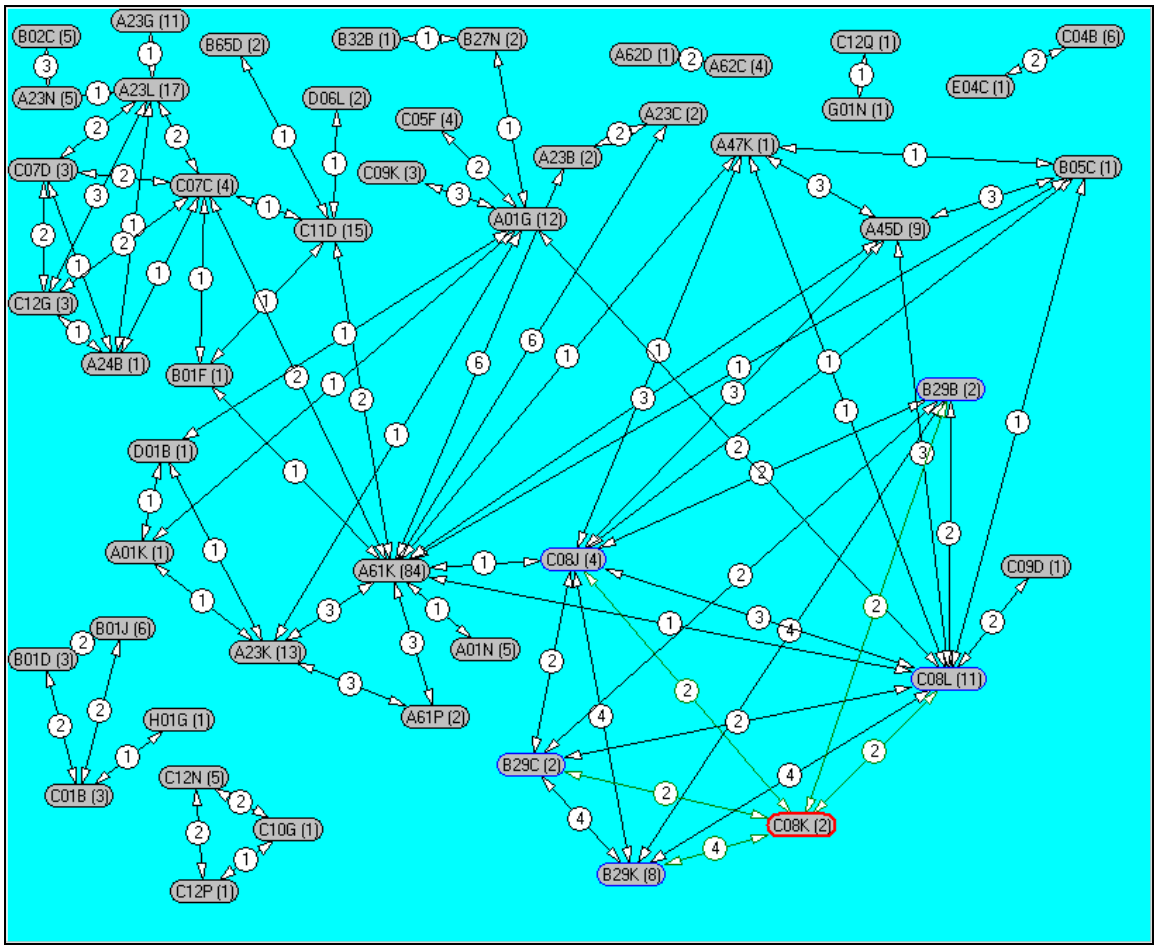

Figure 6 – Global representation of IPC interactions

This representation allows to highlight the main classes (those which present the larger number of interactions) such as A61K – C08L – A01G – A23L – C07C, etc. It is noticed that compared to a representation in simple histogram (figure 3), it is possible by this method to highlight codes which although present at a lower average frequency, are nevertheless significant because of the interactions which they have with other codes. One notices also groups of codes representing small isolated networks, highlighting different application able to show innovative characteristics. This is the case for the groups C12N-C10G-C12P or C12Q-C01N or E04C-C04B etc… Also let us note that the significance of each class is accessible via the Internet where one reaches easily and freely the description of the various classes used for the description of the patents at the international level.

### 19 – Representation of the Patent Assignees (histogram and network)

The same approach is carried out as for the IPC classes. The histogram of the Patent Assignees is represented in figure 7:

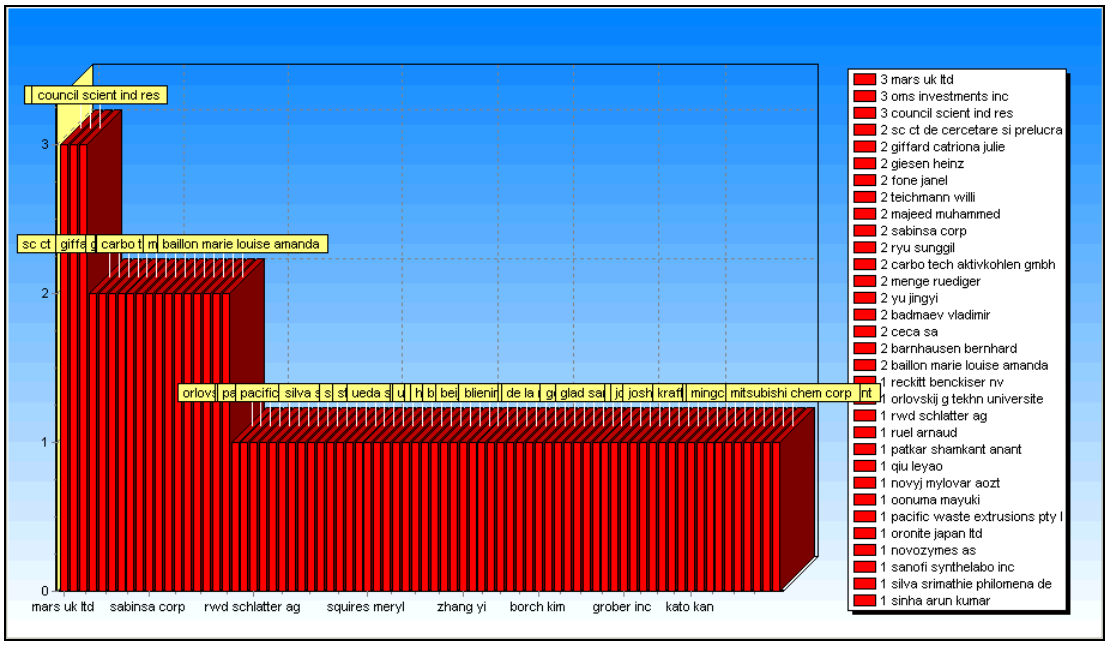


Figure 7 – Histogram of the Patent Assignees

Then by the same method, one will carry out the network of the Patent Assignees which have a common link when they appear in the same patent. In this case, since the number of years taken into account is relatively small, the frequency of the Patent Assignees is weak, although the overall number of Patents Assignees is significant. The network will indicate the key Patent Assignees which have links with other applicants. These companies, are key entries into the domain, and may be used to discuss various possible development, joint venture, licensing, etc.

It will be also noticeable, clusters of Patent Assignees which are separate (no link between the various clusters). These clusters show how the domain is parted into groups of companies. The frequencies of the links are also indicated.

The network is indicated in figure 8.

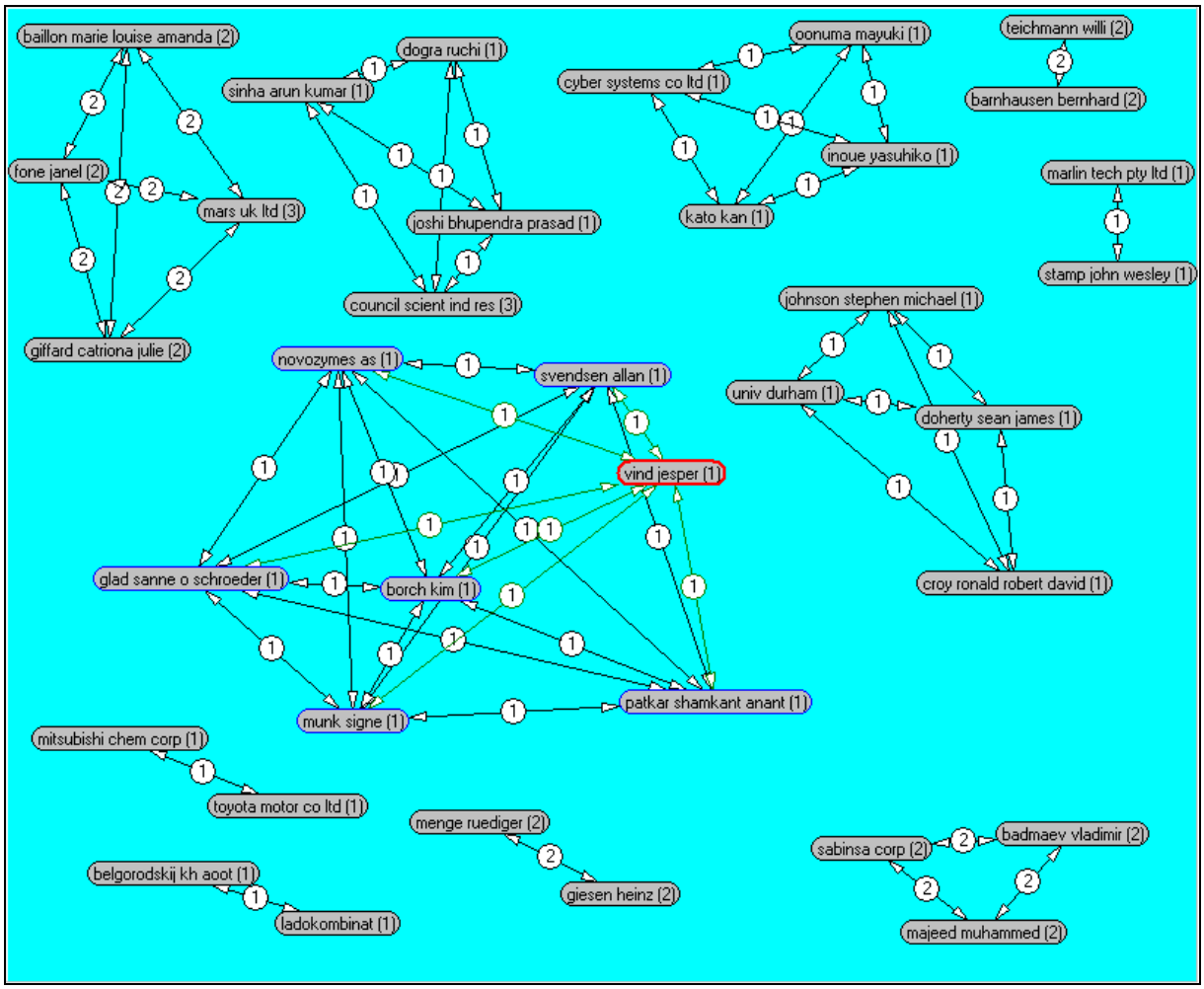


Figure 8 – Network of the Patent Assignees (36 Patent Assignees concerned)

This representation makes it possible to analyze the groups of companies which work jointly. These data underlined the significant tendencies which allow possible partnerships or licence agreement, etc.

## 20 - USE OF THE INDICATORS WITHIN THE FRAMEWORK OF THE COMPETITIVE INTELLIGENCE

The indicators which have been developed either within the framework of chemistry, or within the framework of the patents, but more particularly within the framework of an application like that of the concepts "coconut" are necessary, because they allow in the case of the Competitive Intelligence (14) to create the "value maps" (15) which are useful to determine the relations between all the potential partners in a set of themes. In the present case, it will be necessary to complete the map by other interactions such as the actors of the coconut field in the North Sulawesi (Coconut suppliers, factories, external competitors, etc.). These powerful tools, derived from the game theory, make it possible to familiarize the decision makers with the various “players” engaged in this domain (such as commercial rules, R&D, etc. ). From those picture one will be able to determine the general features of a policy in short and medium term. This analysis is necessary to understand the complexity of the domain, and, to be able to ask to experts the more relevant and strategic questions about the best possible orientation in R&D or joint venture, etc. This is important because the creation of knowledge goes through a mechanism of questions-responses, a key attitude in Competitive intelligence and Knowledge Management (16).

Another use of the results obtained, as well on the research level as in the case of patent is to carry out "morphological boxes", within the meaning of the morphological analyses developed by Zwicky in the current Sixties. This very interesting approach makes it possible determine its objectives, to generate innovative ideas and in certain case to develop scenarios. These methods, being able to be regarded as part of the field of the futurology and innovation are very well exposed and described by the United Nations University (17) and open the way to use bibliometric indicators as a key part of the method..

## CONCLUSION

The whole of these indicators shows how could be solved the problem of the analysis and of the orientation of the possibilities of research and the regional sets of development areas. On the basis of an inventory of local strategic development areas, one can highlight collaborations, main institutions, the specialists, from which an action could be undertaken. It is obvious that one of the qualities of this method is that the total indicators which are necessary can be produced in a very short time (few tens of minutes). One has thus, starting from SciFinder Scholar the operational elements which allow to provide results able to give a vision of the orientations of current research and application. To look further into the relations between the scientific and technological data, the use of the complementary patent database such as the one of the European Patent Office is a significant element. They allow, in the field of the economic development to highlight potential topics and partners on the one hand, but also to clarify the main research area which will be in adequacy with the local needs. In our case, it is interesting to note that the current orientation concentrates on various technologies, easily identified by this method. It should be also underlined that accessibility of patents, amongst other things the European Patents is free via the Internet. This shows that in this case one cannot oppose the lack of financial facility for the non-usage of strategic indicators. Even if the capacities of local research is low, the Patents can nevertheless be used as a "think tank".
It is also obvious that for developing countries that because of the lack of international publications in fundamental research or in R&D, it is generally necessary to complement the data with local databases of competencies. This is why we think that it is significant to integrate (18) as soon as possible strategic indicators in Technology Watch and Competitive Intelligence. Starting from reliable databases and tools easily available, this will help people to integrate significant methodologies (19). In this case, the use of the Chemical Abstracts database, via the Internet and Scifinder as well as the European Patent database, constitutes a set of very valuable tools to help the experts to select the best scientific and R&D orientations. In the case of chemistry, the subscription of Chemical Abstracts is expensive for a lonely institution, but on a national base it is quite affordable and may constitute a link between research, technology and local and international production in these fields.

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