

Automatic Patent Analysis Used to Improve Innovation and Development in Developing Countries

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Authors' contributions

This work was carried out in collaboration between all authors. Authors MSD retrieved the patent notices and performed part of the statistical analysis. All other authors comment and interpreted the results. Authors DH and DJM were particularly involved in the redaction of the paper.

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ABSTRACT

The improvement of an industrial policy is a key focus in developed countries as well as in countries in development. The efficient use of competencies and knowledge of the research laboratories is one the strategies that can lead to the creation of new products and services linked to market's needs. The management of natural resources and the development of new offers based on local resources can become for some countries a strategic lever in the setting of their economic policy. This paper presents an easy way to provide key information enabling the people engaged in these processes to be informed about what is going on in their area of interest: Who is

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doing what, when, where, what technology is involved, etc. To fulfill this objective we will use the APA (Automatic Patent Analysis). Most of the time patents are used to protect an invention but in this paper we will focus on the use of patent information to promote innovation and to facilitate regional development. Most of laboratories, regional decision makers, have various questions about new areas of research, new developments, valorization of local resources, etc. Patent information because it deals with real applications and products and is validated by patent examiners is one of the best sources of data to be explored. Moreover, in scientific papers patents are poorly cited even if the information provided by this source is most of the time not published elsewhere.

Methodology: The APA is an analysis methodology based on patent information which permits by screening a technical subject or from a company or inventor names from a natural resource or technology, to map in details technological strategies and trends, major players and corporate collaborations... For the purpose of this papers APA will be performed with Matheo Patent software. The software will help us to research patents from the European Patent Office (EPO) worldwide database, to download the relevant information, and to perform analysis (simple and combined) of the Patent Assignees, the technological classification of patents, the inventors, and basically of all the technical information provided by a patent. All these added value materials will highlight: possible collaborations, innovative ideas, main trends. The level of necessary technological knowledge to develop patent applications is also available through the patent classification combined with the invention description.

Results: All the outputs of the patent analysis can be used either to help innovative thinking in SMEs (Small and Middle Size Industry) for instance or to engage the local decision makers in a policy to prepare the development of clusters or to indicate to the researchers what new directions they may take with their today knowledge. In this paper the method will be presented as well as various examples dealing with Indonesia, Thailand and the valorization of "*Moringa oleifera*".

Keywords: Automatic patent analysis; patent; innovation; developing country; regional development; competitive Intelligence.

1. INTRODUCTION

Many works and seminars concern the use of patents to determine the technologies or to analyze the strategies of different firms. Recently the patent information has been used in the WIPO program of innovation and development of SMEs [1] and in this context the cluster development, innovation and strategic dependence have been discussed in various seminars. In this paper we are not going to discuss the use of patents as a legal protection tool, but we will discussed of what can be done from the patent information available and also what is allowed or not allowed to do according the international patent laws. The used of APA (Automatic Patent Analysis) has been developed by various authors to facilitate the development of cluster especially in agricultural areas and to determine the level of strategic dependence [2,3]. In the context of APA, this is all the patent information present in the local database which is analyzed. Then the only bias which can be introduced in the analysis concerns the way that the examiner select the IPC (International Patent Classification) for each patent. The discrepancies coming from misspelling of inventors or applicant

names are reduced to the minimum since in the software used to perform the APA tools to reformat names are available and have been used. Another bias which can be important if the fact that in some patents the name of the applicant country is not indicated. This problem can be overcome by looking to the priority country afferent to the patent concerned.

In the innovation area a publication of the Carnegie council pointed out that in domains such has the wind energy, the solar power, the biofuels most of the patents are concentrated in United States and OECD countries, which means that these countries develop these technologies and that the gap with the developing countries increases [4]. This introduces the concept of technology dependence when the number of foreign patents (concerning a specific technology) extended in a developing country becomes very important compared to the local patents. Other studies used the cited patents as a way to determine the key patents in one field and to see if they are extended and where [5].

The link between innovation and patent analysis has been widely described in the literature [6,7]

as well as the mapping of the technologies used in various areas. The use of patent analysis to open the way to create added value products from natural resources in developing countries is a starting area of applied research as well as the use of patent information to inform the researchers of what is done with their competences and knowledge. The analysis of patent information allows the knowledge of products and applications already available and may suggest partnerships or new product development or improvement [8-10]. The focus on the couple technologies locally available and new products has not been widely explored. The WIPO (World International Patent Organization) makes available for the practitioners a wide range of information located in various publications freely available through the Internet and especially directed to the SMEs (Small and Medium Size Enterprise) [11]. Among the information available the following one are in direct relation with this paper [12,13] as well as the analysis conducted by Mendonça [14] which indicated that “the assumption of limited technological progress for primary commodities versus manufacturing products is no longer relevant. The relationship between manufacturing and technology has changed over years”. The work cited by Lisuka [15] indicates that “low technologies” may be used to create a new path for the development”. In this paper, we will indicate how to use patent information to facilitate innovation, regional development and cluster organization. We will not develop here the concept of strategic dependence, but this can be done by using the same information source and the same method of analysis [3]. The development of “low technologies” or frugal innovation or innovation Jugaad [16-19] is concerned by the APA. In fact, certain countries such as India [20] makes a move to grant “petty patent” or “innovation patent” so called “utility model” to ideas or improvements coming from low technology development. China already developed this model of protection and it uses widely utility model to protect new ideas which cannot fulfill the technological standard of a true patent or the low life time improvements [21]. This is the reason why we indicate in this paper that Chinese utility models must be considered with care. But, using the APA may also be useful in the perspective of the development of frugal innovation or simplification of already existing applications. The APA gives the trend in technology and indicates how various products are developed, opening the way to develop alternatives or simplifications. If in the literature

they are many references dealing with the way to go from ideas to patents, there are just a few dealing with the concept to go from patent to new ideas and this is why we believe that APA will second widely people engaged in this direction [22].

2. THE CONTEXT

There are different ways to fill a patent. After the first patent granted in one country (priority country) there is a delay of 12 months to extend this patent to other countries. In this case there will be different patent numbers covering the same invention. This is called a patent family. There is also the possibility to fillan European Patent (EP) or a World Patent (WO), or and OA patent (OAPI, the 16 French speaking countries of West Africa) or ARIPO (the African English speaking countries) or to get a patent within the framework of the convention of the Eurasian patents. The PCT (Patent Cooperative Treaty) is a procedure in use in 145 states to fill a world patent or to introduce a demand to move for instance from a national patent to a world one. Here are a few examples of patents and their meaning:

Patent title: A coconut de-husking apparatus, is an Australia Priority Patent PR=AU1997PO05061 10-02-1997 which has been extended to Indonesia PN = ID20936A 01-04-1999. Then, the Indonesian country will be dependent of Australia for this type of application.

Patent title: Blade with empennage of vertical-axis windmills, is a Chinese priority patent PR = CN20092052708U 16/03/2009 which has not be extended to other countries. Then if another country wants to extend a patent in China or to ask for a Chinese priority patent in this field, the foreign patent will be facing the technology already protected in China by the Chinese patent. But because this Chinese patent has not been extended to other countries, if somebody wants to use it out of China it can done. But the products issued from this technology cannot be exported to China.

Patent title: Gazoline engines fuel of enhanced properties, is a US priority patent PR = US74910191A 08/23/1991, extended as an European patent EP92307609A 08/20/1992, and has more than twenty years of age. It is then in the public domain.

3. MATERIALS AND METHODS

The database used is the world patent database available from the EPO (European Patent Office) [23]. To query the database and to download the results (patents notices) we will use the Matheo Patent software facility [24]. It is also very important to note that the downloading of the patent notices from the world patent database is free. This is a mandatory requirement for developing countries and even for research laboratories when the financial facilities available become weaker.

Once the data are downloaded automatically all the possible correlations involving the various information fields of the patent notices can be done. The main fields used for the APA are the following: Patent Assignees (Applicants), Inventors, IPC (International Patent Classification), words from titles or abstracts (automatically extracted), the different patent dates, the PN (Patent Number) the PR (Priority Number). If necessary different patent notices concerning a peculiar point: Group of inventors, or countries, or companies or dates or PR or PN, or words from titles and abstracts, or IPC may be created by the user from the local database. These groups will be used for further specific analysis.

If the lists of technologies (through IPC), or themes (through patent titles and abstracts), or inventors, or patent assignee are useful, they do not answer the various questions such as who is doing what, with whom, etc. In these conditions matrix such as the patent assignee versus the IPC or the inventors networks, will answer the questions. Many examples of the used of such types of analysis are already described in the literature [25].

The method that we will use will be the following: Let us say for instance Indonesia, which is one of the larger producers of coconuts in the world. In some regions, such as North Sulawesi, most of the production concerned a very limited numbers of transformations of the coconut, leaving the global added value to foreign companies (for instance from Singapore). The used in this case of the analysis of patent dealing with the concept of coconut will enable the stakeholders to access most of the technologies and applications available in this field. Moreover, the patents which are certainly or possibly in the public domain (surely for those of more than twenty years, and may be for those up to ten years of

age) will be also available. The name of companies involved in the development of products from coconut transformations are present in the patents, opening the way for possible collaborations or competitors mapping. When the applicant names are some universities or research centers these names can be used to move to upstream research by using them in a database such as Google Scholar.

The national or regional development involves most of the time the synergy between all the national or local knowledge and competencies. But often this is done without the use of an unquestionable information source. The interest of the APA is to provide results which do exist, which are described and which can be used to feed a SWOT analysis or a mind-mapping exercise.

4. RESULTS

The presentation of the results is done in three parts, one which deals with Indonesia and the coconut field, the second with the application of this methodology in Thailand to boost the various local clusters and the third to explore the products obtained from the treatment of the "*Moringa oleifera*".

4.1 Indonesia

We present here the coconut field development from 2010 to 2014. Former studies dealing with the prior years have been done and presented in other papers [25]. The query used was the following: Coconut in title from 2010 to 2014. The result were 624 patents and 402 families (done in July 2014).

4.1.1 The main countries involved

We build up a group of patents for the most important countries present. The number of patents present shows the overwhelming role of China, but it is noticeable that the number of world patents (WO) from this country is very small as well as the number of patents extended to other countries. The various data are presented in Tables 1 and 2:

From the analysis of the results of Tables 1 and 2, it can be seen that if China has the larger number of patents only two world patents are present. Other countries such as the United States show a very different trend in patenting, aiming first to world patents. This does not mean

that the Chinese patents are not relevant, because what we are considering is not only the commercial value of the patents, but mainly the amount of information that they deliver. This means that to seek for new ideas or applications which can be developed outside China, the information provided by the Chinese patents (not extended) must be carefully considered. The 83 Chinese utility models (petty patents) must also be considered with care because most of the time they described new ideas or technological improvements. [26]

4.1.2 Who is doing what

The matrix of the IPC 4 digits versus the main countries will provide a condensed view of which country is doing what. (limited view of the matrix)

A more precise result may be obtained using the full IPC. (limited view of the matrix)

The Figs. 1 and 2 are an example of an automatic benchmarking using IPC as differential. The same can be done with different groups (applicants, inventors, specific applications, etc.) [27].

The Academic R&D in the field of coconut is characterized by a large number of Chinese Universities or Institutes as applicants. Malaysia is second and South Korea third. Let us note some work of Czechoslovakia, Brazil and Saudi Arabia. The result is indicated in Table 3.

When universities or research centers appear as applicants, they provide a good way to access to some research work upstream of what is described in the patent. This may be done by accessing to some research works published by the institutions or the inventors.

4.1.3 Seeking for new ideas

New ideas are often present in titles and abstracts words. If the use of IPC 4 or full IPC is interesting for a macro vision of the subject, it is very interesting to browse through the titles and abstracts words to seek for more precise applications. They can be analyzed separately or put together in a group for further analysis. Let us see an example:

The Fig. 3 gives an example of browsing through titles words. In this example the user build up a group concerned by the concept of fiber(s) in titles and abstracts.

When the subject is defined: Here all the data concerning the fiber(s), we can go back to the local database and search for the term fiber* in titles or abstracts (* is used to include singular and plural). All the notices concerned are gathered in the group fiber*. Further analysis of this group will provide indications on the technologies used in this area. This type of analysis is useful to show what is done from a very common part of the coconut, often burned or used only as fertilizer or soil subsidiary. The Figs. 4, 5, 6 show the main technologies (IPC) involved.

Matrix: IP Class (4 digits)/Group 2		A01G	C05F	Empty Field	A23L	C10L	C11B	A23N	A47J	B65D	A23B	A43B	A47G	B67C	A23D	C12G	C07H	C08L	B29C	C08K	A23C	A23G	D01F	D01D	A01N	A01P	A23P	A01M	
China		11	1	74	1	9	6	8	2	1	5	1	2	10	2	15	5	13	18	14	4	3	6	5	5				
USA		2	2	3	11		7	4					1	1							2				2		1		
Australia					1		2	2																					
South Korea		3	1		4	3	1			1					1							1					1		
India		1		3																									
Brazil					1		1			1	1																		
Malaysia				2	2	1	1								1						1					1			
Japan						1																	1						
Taiwan					1																					1			
Thailand										1								2		1									
Mexico					1		1																						
Chinese utility model		6			2		5	5	5		1	5										1					2		

Fig. 1. Various domains of development according the main countries involved IPC 4 digits)

Table 1. Number of patents and families per main countries

Countries	USA	Brazil	India	Malaysia	Australia	Thailand	China	Mexico	Czechoslovakia	South korea	Taiwan
Patents frequency	29	7	5	19	3	3	330	4	4	22	3
Family frequency	27	4	4	5	3	3	306	4	4	22	3

Table 2. Number of WO patents per main countries

Countries	USA	Brazil	India	Malaysia	Australia	Thailand	China	Mexico	Czechoslovakia	South Korea	Taiwan
WO frequency	8	4	3	3	2	2	2	1	1	0	0

Matrix: IP Class (Full)/Group 2

	A01G1/00	C05F5/00	C05F11/02	Empty Field	A23L1/00	A23L2/38	A23L2/02	A23L2/44	A23L2/46	A23L2/52	A23L2/68	C10L1/08	C10L8/00	C11B1/00	C11B1/06	C11B1/10	C11B3/00	A23N1/02	A47J25/00	A23N5/03	A01G9/00	B65D5/40	B65D85/72	A23L2/385	A23L2/60	A23B7/02	A23L2/39	A23N5/08	A47J19/00	A23N15/00
China	2		1		4	14	1		8	1				1					5			4	2	3			2		2	
USA	2	2	1	3	2	6	3	1	1	4	1								1	5	1			1	3			1	1	1
Australia						1	1	1	1	1	1							1	2											
South Korea	2																													
India			3																											
Brazil																				1		1	1			1	1	1		
Malaysia			2			1		1		1		1	1	1	1	1	1													
Japan												1	1																	
Taiwan																														
Thailand																														
Mexico					1																1							1		

Fig. 2. Various domains of development according the main countries involved. (IPC full)

Table 3. Universities and Institutes involved in the coconut field

Universities or Institutes	Number of families	Countries
University Hainan	16	China
Coconut research Int. of Chinese Academy of tropical Agricultural Sciences	8	China
Coconut research Inst. of Chinese Academy of Tropical Agricultural Sciences	4	China
University Central South Forestry	3	China
University South China Tech.	3	China
Univ. Dognhua	3	China
Technicka Univerzita Libercy	2	Czechoslovakian
University Jangnan	2	China
Coconut Research Inst. of Chinese Acad. Sciences	2	China
Technicka Univerzita Libercy Katedra Strojirensku Technologie	2	Czechoslovakia
Coconut Inst. of Chinese Academy of Sciences	2	China
Univ. Seoul Industry Coop. Found.	1	South Korea
Univ. Transilvania Din Brasov	1	Romania
Univ. Federal Alagoas	1	Brazil
Univ Jinan	1	China
Univ Yangzhou	1	China
Shandong Inst. light Industry	1	China
Univ Putra Malaysia	1	Malaysia
Nat Univ. Chunbukind. Acad.	1	South Korea
Univ. Nanjing Forestry	1	China
Fundacao Universidade Estadualco Ceara	1	Brazil
Tropical Crops Genetic Resources or Chinese Academy of Agriculture Tropical Sciences	1	China
Univ of Hunan Agricultural	1	China
Federal oil and Food Research Inst. of Hanan Province	1	China
Inst. Tropical of Bioscience and Biotechnology of Chinese Academy of Agricultural Tropical Sciences	1	China
Univ Heilongjiang	1	China
Univ. South China Tech	1	China
HeinianInst Engineering	1	China
Univ Northeast Forestry	1	China
Univ ChungangInd.	1	South Korea
Univ King Saud	1	SaudyArabia
Fujian Food Industry Research Int.	1	China
Malaysian Agricultural Research Inst. and Development inst. Mardi	1	Malaysia
Coconut Institute Chine Tropical	1	China
Univ. Teknolgi Mara	1	Malaysia
Universtar Science & Tech. Shenzhen	1	China
Inst Process engcas	1	China

The knowledge of the technologies used for the development of a products or an application is important since it can be matched with the local competencies. This will indicate if this orientation can be developed locally or if new competencies must be hired or created or if this is too complicated for the local level of facilities and knowledge.

4.1.4 Example of new applications

A close look to the patents involved in the group fiber(s) indicates that some insulating panels can be done from coconut fibers:

Patent RO129073A0 Biodegradable sound roofing material made of hemp fibres and coconut fibres with latex....

DE102009056015A Dry building panel has main surface provided with surface coating, where panel is made of mold material

More examples of applications are available from the prior years (period 1990 – 2000).

This indicates that some various insulating or sound roofing products may be derived from coconut fibers. In North Sulawesi, there is a house wood building industry which develop traditional houses, which in some cases are exported (mainly to Australia). One of the problems of those houses is that the noise and is very perceptible from one room to the other and also that they are not well insulated. This raises two problems: how to use coconut fibers to improve the quality of the houses, how the coconut fibers may be fire proof? The first aspect may be solved by putting the fibers between two planks when they build the dividing walls, the second aspect may be solved by queering the world patent database looking for the concept of fire proof chemicals to impregnate the fibers. One of the question is to know what amount of fibers can be used to insulate properly the house and to make it soundless. This aspect is more scientific because it is necessary to know the value of the insulation power of the coconut fibers question which can be solved by the scientific competences of the local universities.

4.2 Thailand

This country developed a very aggressive cluster policy [28] which is based on the recommendations of Michael Porter and the help of USAID. Several clusters have been developed which deal with the main strategic areas of development of the country. It is remarkable to see that for most of the clusters a general APA process is followed. Part of these results is available from Internet and surely most advanced works are done but are not accessible. The APA provides for one area of development the main patents, the most accurate technologies, etc. The analysis is done by using Matheo Patent. The following example extracted from an article available from Internet shows the type of analysis which is performed:

Although that most of the people are not speaking or reading Thai, this example is taken to show how a country can use patent information in key areas of its development. The

example deals with coconut, but nanotech, palmoil, rice, water massages are also available [28]. The process is the following: From a query (see underneath), a certain number of patents are selected and downloaded locally. The APA performed on this set of patents is done following a certain order: Technologies (from IPC) and selection of the most important domains, from these domains, selection of the most relevant patents (according the need of the Thai industry). From the selected patents an extraction of the most important parts which could help the local companies to “copy” or to ameliorate or to innovate in this area is done. Parts of the results are indicated in Figs. 7, 8, 9. In the example all the sentences in Thai language have been translated into English.

(Analysis of technology trends on the coconut. Patent)

(Search is made with the European Patent Office <http://ep.espacenet.com> and the United States Patent Office <http://www.uspto.gov> With the search and mapping technology with Matheo-Patent (<http://www.matheo-software.com>) one found that from 1905 to present the patents which are related to the search term "Coconut" in the title of the patent are 532 patents (this result from the search is analyzed)

(Analysis of the technology from the International Patent Classification, level categories)

1. (FOODS, FOODSTUFFS, OR NON-ALCOHOLIC BEVERAGES)
2. MACHINES OR APPARATUS FOR TREATING HARVESTED FRUIT, VEGETABLES
3. (HORTICULTURE; CULTIVATION) (PREPARATIONS FOR MEDICAL, DENTAL, OR TOILET PURPOSES) A23 (MACHINES OR APPARATUS FOR TREATING HARVESTED FRUIT, VEGETABLES)

All the different selected IPC are treated the same way: Patents extraction, patents full text, extraction of the most interesting parts. Then the technology trend per year is analyzed as well as the enterprises active in the various sectors selected. If necessary, analysis in depth of the selected patents or of certain companies (by performing another APA on their patent production) can be done, etc.

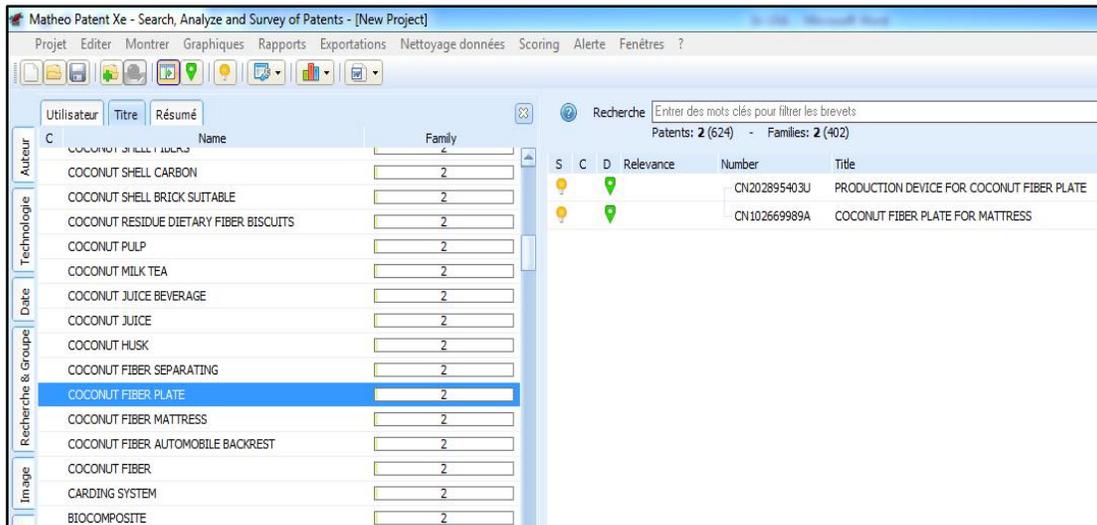


Fig. 3. Browsing through title words

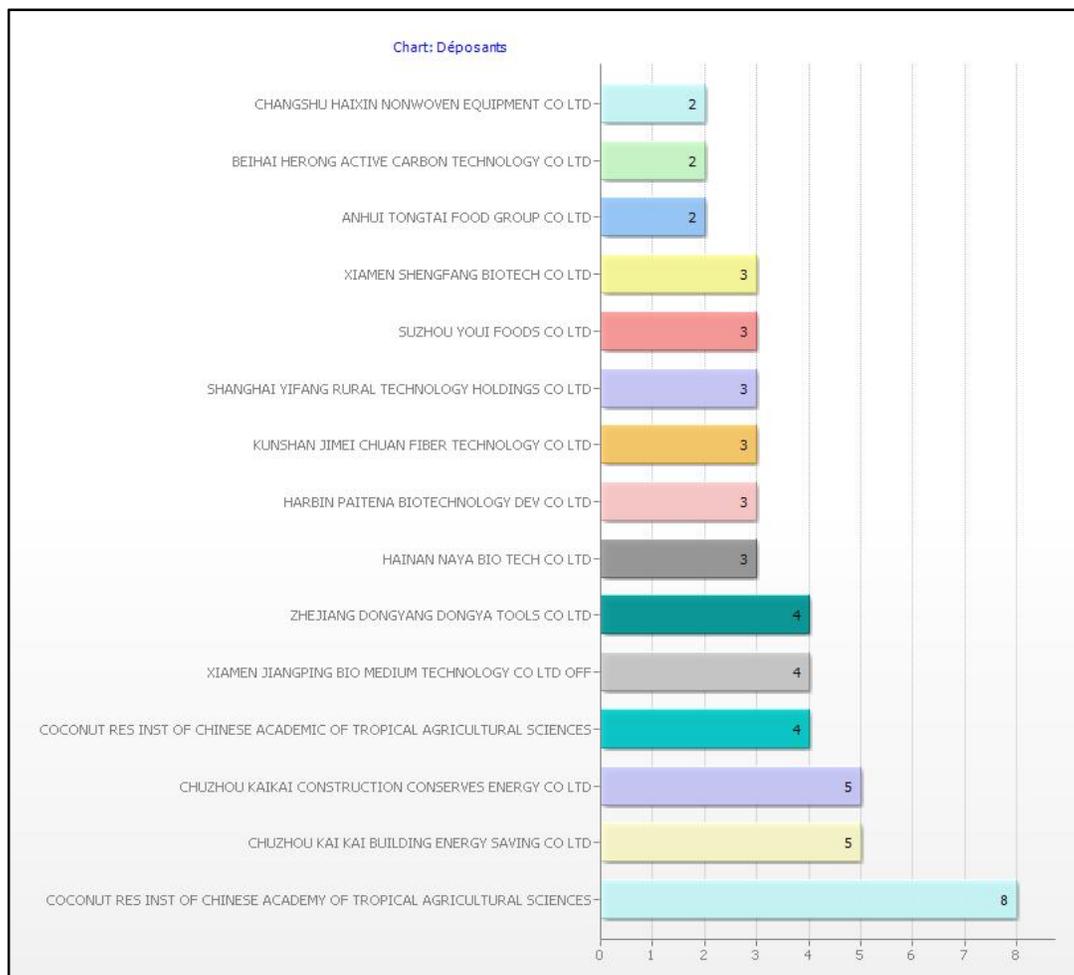


Fig. 4. Main patent assignees in the fiber* group

Matrices:IP Class (4 digits)/Group		A01G	A21D	A23L	A41B	A47C	A47G	B26D	B27N	B29B	B29C	B32B	B60N	B65D	B66G	C05F	C06B	C06J	C06K	C08L	D01B	D01C	D01D	D01F	D01G	D01H	D02G	D03D	D04B	D04H	D06M	D06N	D06P	E02B	E02D	E04D
Fiber(s) (-)		2	3	3	1	6	4	1	5	1	3	5	2	1	1	1	1	2	3	6	5	1	2	3	2	2	6	4	4	3	2	1	1	1	2	1
PI=WO (-)								2					1					2	1	2																

Fig. 5. The main domains of application in the field of fiber* and the WO concerned

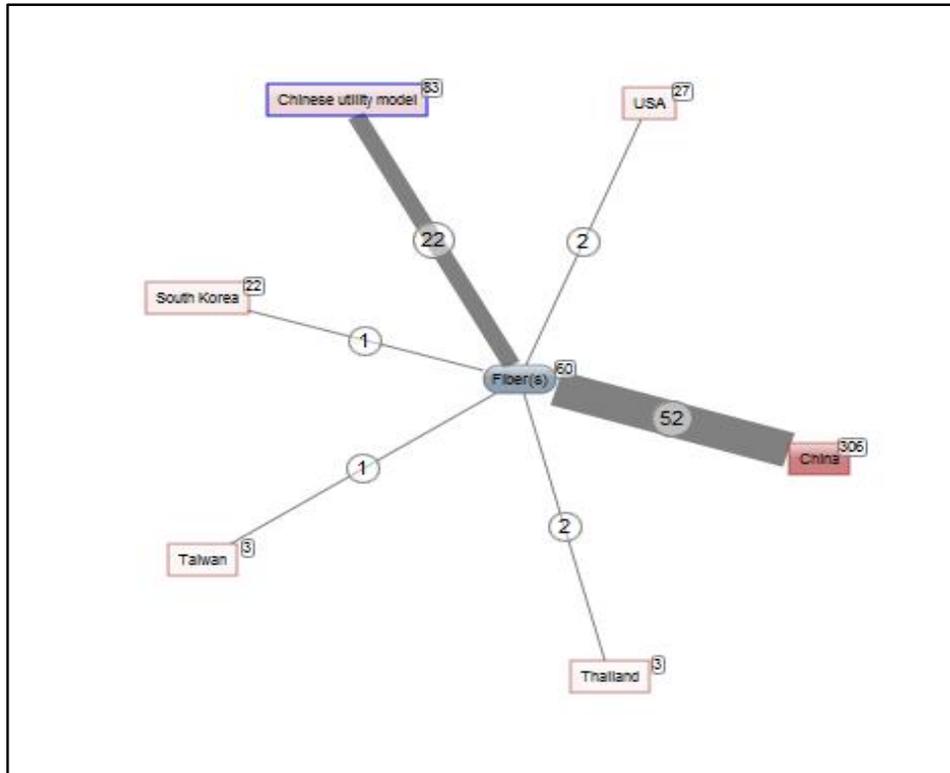


Fig. 6. The main actors in the field of fiber applications
(Analysis of technology trends on the coconut. Patent)

หมายเลขสิทธิบัตร (Patent Number)	ชื่อเรื่องของสิทธิบัตร (Title)
MXJL02000017	COCONUT PERFORATION SYSTEM FOR JUICE EXTRACTION
US6722269	COCONUT SHREDDING/GRATING APPARATUS
TW576138Y	COCONUT SHELL PEELING DEVICE
WO02063981	IMPROVED METHOD FOR PRESERVING ENTIRE COCONUT PULP CONTAINING WATER
EP1360907	IMPROVED METHOD FOR PRESERVING ENTIRE COCONUT PULP CONTAINING WATER
CA2437961	PROCESS IMPROVED TO PRESERVE WHOLE COCONUT MEAT WITH ITS WATER INSIDE
TW540314Y	DEVICE FOR SCOOPING THE INNER WALL OF COCONUT SHELL
TW532079Y	DEVICE FOR CUTTING COCONUT NUCLEUS
TW556490Y	PUNCH-TYPE DEVICE FOR DRILLING COCONUT
AU6878001	SCRAGH - COCONUT SHREDDER - ELECTRICAL

Fig. 7. Selection of the most relevant patents

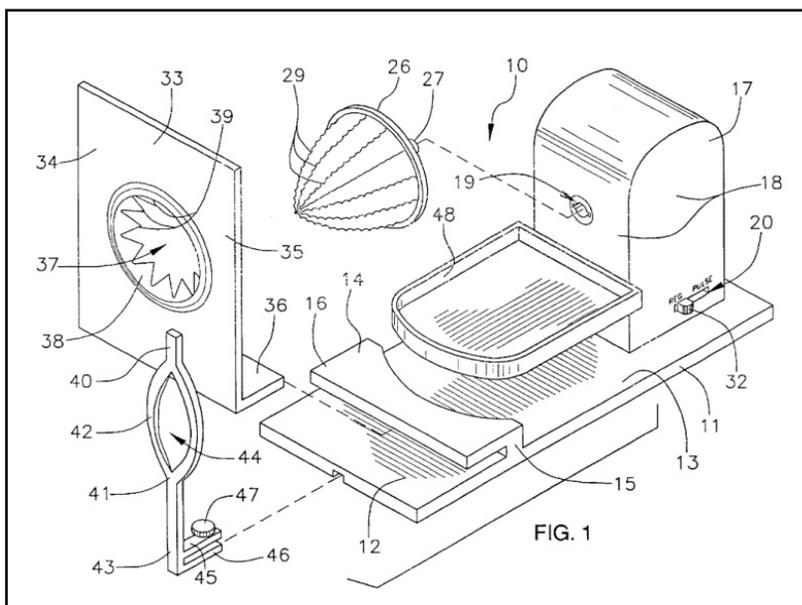


Fig. 8. Image preview coconut grater
US6722269 coconut shredding/grating apparatus

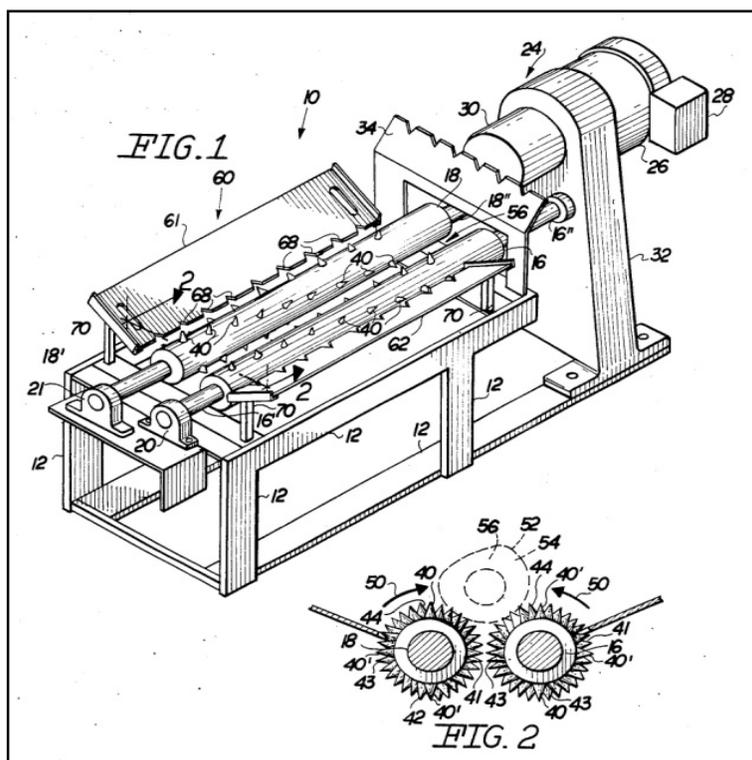


Fig. 9. The second model is a coconut shell casings

Out of the analysis a dashboard can be created. It will include the trend in the technologies used in the field, the type of applications, the new

entrants, the priority countries, etc. This will be matched after with the global governance of the cluster and decisions will be taken.

4.3 Moringa

The “*Moringa*”, [29] is a plant widely used in Burkina Faso, Madagascar and other part of Africa as a subsidiary for its high protein and vitamins contain. In different countries the products from the “*Moringa*” are mainly different powders made from the leaves and from the seeds. An oil is also extracted from the “*Moringa*”. But, most of the time the local people or the stakeholders of this business do not know all the other possible uses of “*Moringa*” as well as the main economic actors. This is important because this may give rise to new ways to valorize the products from various parts of the “*Moringa*” or even to make some joint ventures with foreign companies using “*Moringa*” crude products.

To solve the problem, we performed a search using the term “*Moringa oleifera*” in titles or abstracts, using the world patent database and the same software as above to analyze the local database. Parts of the results are indicated below.

The result of the search is the following: 115 patents and 58 families. The main countries concerned are: China (33 families), India (9 families), USA (5 families), South Korea (5 families), Japan (2 families). (done in July 2014) From the titles and abstract words, we selected various applications:

Each of the above groups may be analyzed in detail, providing the list of patents, the applicants, their benchmarking, main applications (Fig. 10) etc.

Even if the use of “*Moringa*” seed cake (when the oil is extracted from the seeds) as a water cleaning and purifying agent is known [30], the set of patents presents in the above group (Fig. 11) open the scope of the use of “*Moringa*” seeds or roots in various sanitary aspects. This is important since in Africa the water concern is of primary importance and because there is a strong need of drinkable water. This is also important because the user can access the applicant(s) and inventor(s) names, and from the full text of the patents to some protocols of extraction and treatments of various parts of the “*Moringa*”. If in Africa, the culture of the “*Moringa*” is mainly done through cooperatives or NGO, this shrub will be used on a large scale in Morocco where more than 25.000 plants will be used in the South Provinces to struggle against the desert development. In this case a large quantity of crude materials from the “*Moringa*” will be available. Then the knowledge of the technologies used for its transformation will be important as well as the main companies involved. Further, if research projects are coming out from the development of “*Moringa*” it is wise to include in the proposal information coming from APA and not only from scientific information. This will at the very beginning focus the work on useful aspects.

Name	Family
leaf(s)	19
oil	12
ipc autre que A	12
root(s)	9
skin care cosmetic	8
filter antibacterial	8
rabbit feed	4
ipc A	9

Fig. 10. Main applications described in the patent concerning the “*Moringa*”

Antibacterial filters

Number	Title
+ WO2010104288A2	ORGANIC-INORGANIC COMPOSITE FOR COAGULATION AND ANTIBACTERIALS, AND METHOD FOR PREPARING SAME
-KR20120023928A	ECOFRIENDLY BIOFILTER APPARATUS
-KR101172359B1	METHOD FOR FABRICATING BIOACTIVE COMPLEX COMPOSITION AND PRODUCT COMPRISING THE BIOACTIVE COMPLEX COMPOSITION
-JP2000229804A	ANTIMICROBIAL AGENT
-CN103304014A	METHOD FOR EXTRACTING ALGAECIDE OUT OF MORINGA OLEIFERA OIL RESIDUE AND REMOVING ALGAE IN WATER BY USING ALGAECIDE
-CN103155954A	INSECTICIDE
-CN102259965B	MORINGA OLEIFERA WATER PURIFYING AGENT
-CN101485622A	SHAMPOO CONTAINING EXTRACT OF MORINGA OLEIFERA AND PREPARATION METHOD THEREOF

Fig. 11. Lis of patents present in the group antibacterial filters

5. CONCLUSION

Patent information is an invaluable tool to show the technological trends. Most of the data which are published in patents do not appear elsewhere. Moreover, patents can be used as a link between research and development and then they open the way to the creation of clusters or to their development.

When most of the countries are in a world competition, the use of all the available resources: Immaterial (knowledge) or material (natural resource) is essential. In developing countries, the development of universities and research centers, even if this is done on a limited scale should aim to improve the conditions of the local development. But often because of the cooperation with western countries their research subjects are out of phase with the local needs. In developed countries, it is often argued that the process of the evaluation of the researchers and laboratories move the institutions away from the application of their competences and knowledge in areas useful for the development of SMEs for instance. To try to overcome such established fact there is a need to provide to all the stakeholders and the decision makers some information coming from an unquestionable tierce third party, different from the classical marketing or scientific information sources. This is why we believe that an extensive use of Automatic Patent Analysis may facilitate this approach and will open the window on various trends of development of natural resources as well as of new applications of the immaterial asset present in research institutions.

The APA because of its very low cost (mainly due to the availability of the patent data at no charge) open the way to a systematic used of

patent information in developing countries at first but also in all companies and laboratories curious to know what is happening in their field and in their area of competencies. Even the trend in the development of certain areas may help to forecast the close future. For this reason we believe that the development of local Competitive Intelligence Units including patent analysis is very helpful to animate expert groups and to create new ideas and new developments. Because the description of the technology is available in patents it is possible to choose some areas of application with a technological level compatible with the local one. This aspect is particularly important for developing countries [31]. For developed countries various laboratories which use this technique to match their competences and their technical facilities with the applications have been able to increase their rate of publications on one way and to develop strong interactions with industrial partners on the other way [32].

The fact that patent analysis shows clearly what can be done with a certain type of knowledge could also induces decision makers to promote in universities research subjects really relevant with the local needs. This will prevent a large loss of competencies and money and this will also promote the SRR [33] (Social Research Responsibility) one of the key for developed countries to implement the second step of innovation (eg. create from knowledge and competences new products and services economically reliable). The use of patent information in research laboratories will also help the researcher to justify the choice of subjects relevant to the needs of national or local industries, subjects which are considered by some people as negligible compare to "true" research [34]. For the developing countries this

will facilitate the development of added value products from their natural resources and also this will help to build the necessary competences to benefit fully of the FDI (Foreign Direct Investments) [35].

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES¹

1. For more information about these workshops see the ci worldwide site; 2014. Accessed August 6th 2014. Available:<http://s244543015.onlinehome.fr/ciworldwide/>
2. Dou H. Benchmarking R & D and companies through patent analysis using free databases and special software: a tool to improve innovative thinking, World Patent Information. 2004;26(4):297-309. Accessed November 4 2014. Available:<http://www.sciencedirect.com/science/article/pii/S0172219004000493>
3. Dou H, Manullang SD, Dou JM. Jr, Strategic Dependence of a Developing Country - Vision from Patents, Third European Competitive Intelligence Symposium. In Malardalen University Edition, Vastera Eskitsina, Sweden; 2009.
4. Syam N. Rush for Patents May Hinder Transfer of New Climate-related Technologies Nirmalya Syam, Carnegie council. Accessed September 5th 2014. Available:<http://www.policyinnovations.org/ideas/briefings/data/000162>
5. Zhang X, Fang S, Tang C, Xiao GH, Hu ZY, Gao LD. Study on indicator system for core patent documents evaluation, The 12th international conference of the international society for scientometrics and informatics; 2009. Accessed 4 September 2014. Available:<http://ir.las.ac.cn/bitstream/12502/2501/1/study%20on%20indicator%20system%20for%20core%20patent%20documents%20evaluation%20%28ISSI%202009%29.pdf>
6. Biju PA, Moitra SD. Innovation assessment through patent analysis, Technovation, 2001;21:245–252.
7. Acsa ZJ, Anselin L, Varga A. Patents and innovation counts as measures of regional production of new knowledge. Research Policy. 2002;31:1069-1085.
8. WIPO Information service for developing countries, publication n°493(E). Accessed 17 September 2014. Available:http://www.wipo.int/freepublications/en/patents/493/wipo_pub_493.pdf on june 2009
9. Liang Y, Tan R. A test mining-based Patent Analysis in product innovation process, in Trend in Computer aided Innovation, ed. Noël Lean-Riva, Spinger IFIP. 2007;89.
10. Zoltan J, Andrestch DB. Innovation in large and small firms. An empirical study. The American Economic Review. 1998;78(n°4): 678-690.
11. WIPO Information service for developing Countries, publication n°493(E). Accessed 16 july 2014. Available:http://www.wipo.int/freepublications/en/patents/493/wipo_pub_493.pdf
12. OMPI. Inventing the future. Introduction to patents for small and medium enterprises. 2006;48. French, Accessed August 5th 2014. Available:http://www.wipo.int/freepublications/fr/sme/917/wipo_pub_917.pdf
13. National Intellectual Property Systems, Innovation and Economic Development with perspectives in Columbia and Indonesia, OECD; 2014. Accessed November 4th 2014, Available:<http://dx.doi.org/10.1787/9789264204485.en>
14. Mendonca S. Brave old world: Accounting for 'high-tech' knowledge in 'low-tech' industries. Research Policy. Elsevier. 2009;38(3):470-482.
15. Lisuka M. Low tech industry a new path for development? The case of salmon farming industry in Chile, in Sectoral Systems of Innovation and production in developing countries, chapter 8, Edited by Franco Malerba and Sunil Mani; 2009. Accessed November 4th 2014. Available:<http://www.elgaronline.com/view/9781848446564.00015.xml>
16. Radjou N. Frugal Innovation a pioneering strategy for the South, chapter 12. in A

¹ We privilege in the references those which are available in full text via Internet. This enables developing countries laboratories and SMEs to have an easy and free access to this information.

- Planet for Life, TERI (Delhi). 2014;221-239. Accessed November 5th 2014. Available:http://books.google.fr/books?id=NC84AwAAQBAJ&pg=PA225&lpg=PA225&dq=jugaad+development+developing+countries&source=bl&ots=H4p02afyIN&sig=PZOR7rQcQ5i0mwtafleLSQT_C8&hl=fr&sa=X&ei=8SJavKyxL4f1OOqXgcAG&ved=0CDcQ6AEwAg#v=onepage&q=jugaad%20development%20developing%20countries&f=false
17. Hesseldahl P, Jugaad Innovation in Innovation Solutions ; 2012. Accessed November 3rd 2014. Available :<http://www.innovationmanagement.se/2012/12/12/jugaad-innovation/>
 18. Hirsch-Kreinsen H. "Low-Technology": A forgotten sector in Innovation Policy, J. Technol. Manag. Innov. 2008;3(3):11-20. Accessed August 7th 2014. Available:http://www.scielo.cl/scielo.php?pid=S0718-27242008000100002&script=sci_arttext&tlng=e
 19. Dou H. The Economic Intelligence at the time of Jugaad. Amazon format Kindle; 2014. Accessed September 9th 2014, Available:http://www.amazon.fr/Boutique-Kindle-Dou-Henri/s?ie=UTF8&page=1&rh=n%3A672108031%2Cp_27%3ADou%20Henri
 20. Home-grown jugaad set for patent cover in The times of India; 2011. Accessed September 3rd 2014. Available:<http://timesofindia.indiatimes.com/india/Home-grown-jugaad-set-for-patent-cover/articleshow/9092731.cms>
 21. Stembridge B. Chinese Utility Models – A lesser-know IP Strategy, Industry Insight; 2010. Accessed September 6th 2014. Available:<http://www.iam-magazine.com/Magazine/Issue/42/Industry-insight/Chinese-utility-models-a-lesser-known-IP-strategy>
 22. Dou H. Dou JM Jr, Getachew MA. Automatic Patent Analysis - Technological Strategic Dependence in: Progress in Competitive Intelligence, Peking University Editions, Beijing ICTCI; 2011. Accessed November 4th 2014. Available:http://s244543015.onlinehome.fr/ciworldwide/wp-content/uploads/2014/01/presentation-corse-connaissance_henri.pdf
 23. Search on the world patent database. Accessed 15, July, 2014. Available:<http://worldwide.espacenet.com/advancedSearch?locale=en> EP
 24. Information and online access to Matheo Patent training edition. Accessed August 4th 2014, Available:<http://www.matheo-software.com>
 25. Competitive Technical Intelligence - A Focus on Industry Development in Developing Countries, Manullang SD, Dou JM Jr, et Dou H, Amazon livre format Kindle; 2013, Accessed November 4th 2014. Available:http://www.amazon.fr/Competitive-Technical-Intelligence-Development-Developing-ebook/dp/B00B24QMC8/ref=sr_1_7/275-3699767-2879069?s=digital-text&ie=UTF8&qid=1415116375&sr=1-7
 26. Dou H, Hongxia X. The role of Patent Information in the development of the innovative SMEs. A focus on Chinese Patents. Revue Inter nationale' Intelligence Economique (R2IE). 2013;4: 187-203.
 27. Dou H, Mohellebi D, Kister J. The importance of bibliometric treatment of patents to develop industrial activity. Example of bitumen in Algeria. RIST (Revue de l'Information Scientifique et Technique). 2012;19(1):135-146.
 28. The development of the cluster policy in Thailand. Accessed September 9th 2014. Available:http://www.google.fr/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0CCEQFjAA&url=http%3A%2F%2Fwww.thaimoodle.net%2Fword%2FPatent%2520Map%2520of%2520Coconut.doc&ei=4LoQVLFdN8XUavergagL&usq=AFQjCNFRbazyTX_bk8XaGxX6wiXRGKQdPg&sig2=If0qalC3mBBiBI_8miqT6w&bvm=bv.74649129.d.d2s
 29. "Moringa Oleifera", from Wikipedia, the free encyclopedia. Accessed September 23rd 2014, Available:http://en.wikipedia.org/wiki/Moringa_oleifera#Water_purification
 30. Ndabigengesere A, Narasiah A, Subba K, Active agents and mechanism of coagulation of turbid waters using "Moringa oleifera". Water Research.1995;29(2):703-710. Accessed November 4th 2014, Available:<http://www.sciencedirect.com/science/article/pii/004313549400161Y>

31. Dou H, Manullang SD, Competitive Intelligence and Regional Development within the Framework of Indonesian Provincial Autonomy. *Education for Information*. 2004;22:99-123.
32. Dou H, Kister J. Integration of Competitive Intelligence and Technology Watch in an Academic Scientific Research Laboratory, in *Competitive Intelligence and Decision Problems*, Edited by Amos David, ISTE, WILEY. 2011;225-242.
33. Dou H. Innover dans la recherche publique en France Innovating in public research in France: Social Responsibility Research (RSR) is it measured? *VSE (Vie et Sciences Economiques)*. 2010;148-167.
34. Krishnan V, Ulrich KT. Product development decisions: A review of the literature, *Management Science*. 2001;47(1):1-21. Accessed November 4th 2014.
Available:<http://opim.wharton.upenn.edu/~ulrich/documents/PD-review.pdf>
35. Blalock G, Gertler PJ. Foreign Direct Investment and Externalities: The case for Public Intervention in Does FDI promote Development? *2004;4:73-106*. Accessed November 4th 2014.
Available:http://iie.com/publications/chapters_preview/3810/04iie3810.pdf

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