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Patent Analysis as a Vector for Innovation in Developing Countries

Sri Damayanty Manullang[1], Jacky Kister[2], Henri Dou[3] and Audy Aldrin Kenap[4]
[1,2,4] Aix-Marseille Université, METICA, France
[3] ESCEM Atelis (Strategic Intelligence Workroom), France

Abstract

In developing countries, most of the higher education programs are focalized on theoretical aspects and there is a lack of practical applications of this knowledge for industry and research development. We believe that this trend is mainly due to the lack of facilities in laboratories but also to the idea that theoretical knowledge is more valuable than actionable knowledge. To break this cycle and to improve the degree of innovation in higher education, we believe that the introduction in the curricula of a general knowledge about intellectual property and more specifically of patent information and analysis is one of the best ways. In this presentation, we will show how we intend to develop this approach. Access to patent information via the EPO (European Patent Office) world patent database will be presented as well as access to patent information from the same database via a smartphone (android) application. Some examples of the use of patent analysis in Thailand will show a systematic use of patent analysis improve the innovation in SMEs and clusters. Some recommendations will be incorporated to improve the development of innovation and competencies transfer in developing countries, as well as succinct bibliography.

Keywords: Pre-clusterization, cachassa, moringa oleifera, ipc

Introduction

The economic crisis which hits developed and developing countries at the same time prompted most of the economists as well as some politicians to think and claim that innovation is one of the keys which will enable most of the countries to overcome the crisis by boosting new developments and jobs. In this frame of mind the Palmisano report (Shumpeter, 2004) in the USA (Innovate America) , the Beffa report (Louis Beffa, 2005) in France, the Commonwealth (Department of Industry, Australian Innovation System Report, 2013) report in Australia, as well as numerous others in Canada, England, etc. pleaded for the development of a policy of global innovation in these different countries. In developing countries, the situation is the same and different ones move to frugal innovation or inclusive innovation, such as India (Dou, 2014), Viet Nam[1], China, and Thailand (Stembridge, 2014). The same is true for African countries which developed with the help of International Institution, a different way to valorize the research results as well as the competencies and knowledge developed in public laboratories and research centers. The goal of this presentation is to open a discussion on the real need for developing countries (but this can also be the same for some developed countries) a technological culture besides the knowledge necessary to develop academic research and academic education. Most of the people in charge of the research and higher education in developing countries get their diploma and training in developed countries and, when they are back in their countries, they try to develop the same type of research. This is difficult for several reasons among which are the lack of funding and the lack of equipment. It is clear that if this situation remains, most of the efforts developed in research and theoretical education will not participate to the country development. How to try to bypass this problem will be presented in this paper.

The Mechanism of Innovation

Most of the time there is a mix-up between invention and innovation. An invention is not an innovation and the difference must be cleared up. According to the work sponsored by the European Community (Erikson, 2006) and the statement of E. Zerhouni when he was the Director of the NIH, the following mechanism is developed:

- The state finances the laboratories and research centers to develop various competencies and knowledge. In fact, they build the national intellectual capital.
- These competencies and knowledge must be transformed in products and services robust enough to reach the market and to be (at the best) exported.

It is this second step which is called innovation. This means that laboratories and industries with the help of the state (Federal of Regional) must be associated in such a way that they will build up common projects with a better facility to innovate. These calls are presented according to the work for the development of clusters and public and Private Partnerships (PPP) (Mike Porter, 1998). The following figure which is part of the work of the consortium VINNOVA sponsored by the European community illustrates this point of view.

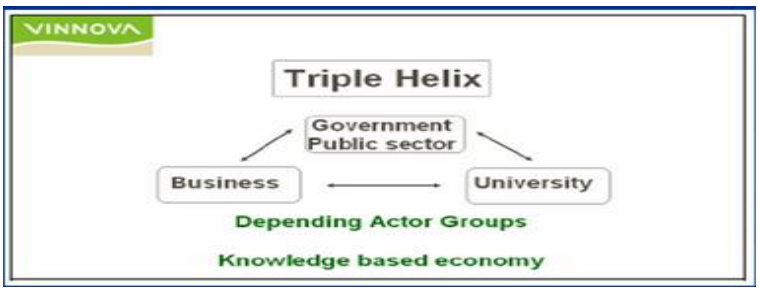

Figure 1: Cluster Development

If the necessity to develop innovation is a common way to increase industrial development today, the question of time is important. Of course, the development of knowledge is one of the

[1] Viet Nam Inclusive Innovation Project, 2014, Bid package Number: AED4-CS-13

best factors to eliminate poverty and if we look to the development of South Korea we have one of the best examples of this (Watkins, 2008). The following figure indicates the trend of its development over the years. But we can see in this figure that this development went on for over a period of more than 30 years. One important challenge is to try to accelerate this development for several reasons, one of the most important being the demography (Mubila, 2012).

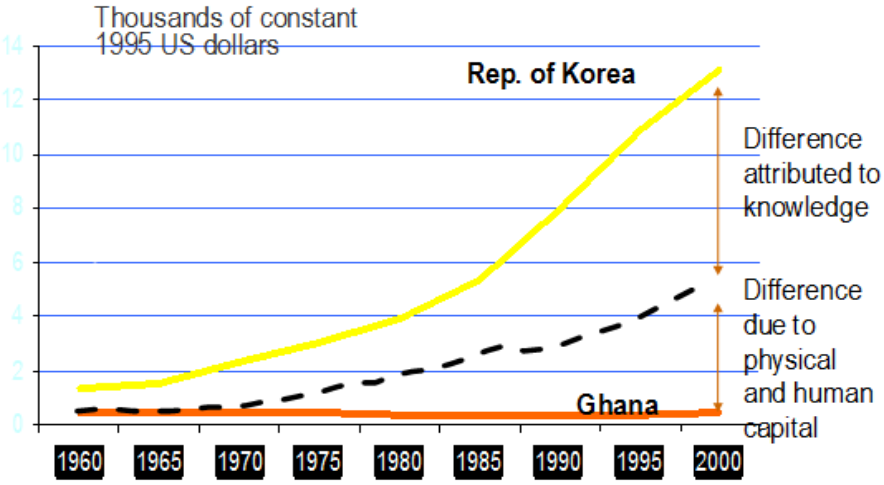

Figure 2: Wealth Development in South-Korea

As mentioned above, the demography in African countries is one of the most important in the world simply due to its rapid growth. The following figure indicates the trend in its development.

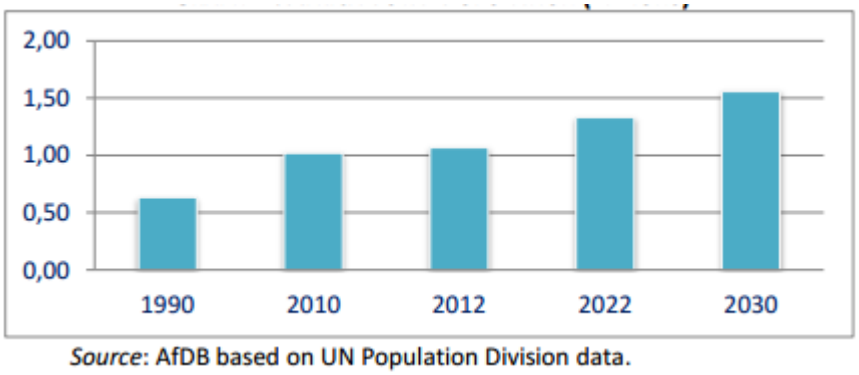

Figure 3: Trend in Demography Development for Africa

An Education and Research Mixing Theoretical, Technological and Practical

If we refer to the innovation step described above, one of the ways to improve it and to accelerate it is to fill the gap which exists between academic teaching and research and the need of regional (of) national industries. Obviously in developing countries because of the demography the main problem will be the creation of jobs and this cannot be done by very large companies since most of the jobs are created by SMEs. But, in developing countries the SME sector is not really developed and often the basic knowledge necessary is not available. On the other hand, to benefit from the foreign direct investments and to be able to "digest" the foreign technologies it is necessary to have an intellectual and technological capital ready for this task. This is the reason why, we believe that this is from higher education and research that the move must come. Of course, there are vocational and engineering schools present, but they are not so many compared to the number of universities and higher education institutions.

How to introduce a certain amount of technology in education and research is the challenge. If we look to most of the work published by the academics, the references to the technology or application of the results are not common place. If we want to fill the gap between academics and industrialists (or valorization of the research result and competencies) we must find a way to do it. The following figure indicates globally which kind of publications are most of the time used to disseminate the research and development results (Dou, 2010).

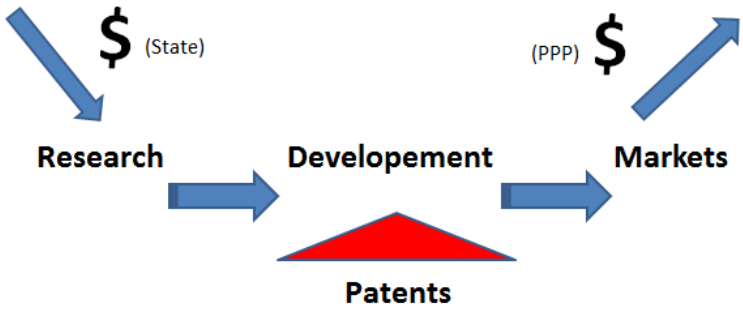

Figure 4: Patent Information is a link between Research and Market

If patents are seen as a tool to protect inventions, another way to use the patents is to analyze their information. With more than 90 million of patent notices the world patent database (EPO European Patent Office, 2013) covers more than 90 countries and contains about 90 million notices. Moreover, the access to the data is free, which is mandatory for developing countries. Patents are very interesting since they cover most of the applications and products development. Most of the information available in patents is not published elsewhere and their evaluation process is quite close and even more drastic than the one used by the scientific journal referees. Patents also have the quality to be well understood by industrialists and technicians and with a decent effort; they can also be understood by researchers and professors. This means that this type of information seems to be invaluable to facilitate the development of more integrated education and research programs. But, even if the patent information is important and can be used to understand how research results and competencies can be applied and used in industry, it is noticeable that if you look to scientific publication's references, most of the time they do not contain patent citations (except for disciplines like law and to a lesser extent economy).

The information available in patents is not only technical and scientific but also it gives the applicants and inventors names, the patent dates, the patent number and priority number, the protected states, the technologies related, the drawing, the technology used, etc. all of that in a simple bibliographic notice. But, one of their main features is that they enable people to test their ideas, to have a large view of what is done with their knowledge, with some natural resources, etc. The patent information, when correctly used, is a strategic tool to create actionable knowledge, to motivate the industry and the researchers and to demonstrate to the politicians in charge of the development the various opportunities available with the local knowledge and resources. In this way, they are used as a TTP (Tierce Third Party), which demonstrates own added value products are developed from natural resources, how theoretical competencies and results can be integrated in product developments etc.

Using Patent Information to Develop Innovation

The link between innovation and patent analysis has been widely described in the literature (Abraham, Moitra, 2001;Zoltan, Anselin, Varga, 2012) as well as the mapping of the technologies used in various areas. But, 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 introduce technology development in theoretical educational programs.

The analysis of patent information allows the knowledge of products and applications already available and may suggest partnerships or new products development (WIPO, 2009; Yanhong, Runhua, 2007; Zoltan, David, 1998) but 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 practitioner a wide range of information located in various publications freely available through the Internet and specially directed to the SMEs (WIPO, no. 493, 2009). Among the information available the following one are in direct relation with this paper (OMPI, 2006). The patent analysis conducted by Mendonça (Mendonca, Tunzelman, 2004) 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 (2006) indicates that "low technologies" may be used to create a new path for the development. In this paper, we will develop how to use patent information to facilitate innovation, regional development and pre-clusterization. A close analysis also, which can be done by using the same information source and a very close treatment may be done to determine the technological dependence of a country (Dou, Manullang, Dou JM, 2009).

There are different ways to patent in a country. After the first patent granted in one country (Priority country) there is a delay of 12 months available to extend this patent to other countries. In this case there will be different patent numbers covering a family of patents. There is also the possibility to have an European Patent (EP) or a World Patent (WO) via the PCT procedure, or/and OA patent (OAPI, the 16 French speaking countries of West Africa). Example of various patents coverage:

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 this patent (then from Australia) for this type of application.

Blade with empennage of vertical-axis windmills, is a Chinese priority patent PR = CN20092052708U 16/03/2009 which has not be extended in other countries. Then if another country wants to extend or to design China as a country of extension or deposit, the foreign patent will be facing the technology already patented by the Chinese. A contrary, because this Chinese patent has not been extended if somebody want to use it out of Chine it can do it freely.

These two patents explain the mechanism of the technology dependence for the first one and of technology protection for the second but also the free availability of its results. With these different aspects in mind we are going to show some uses of patent information to induce a local development, as well as the process of pre-clusterization and innovation.

The Different ways to Use Patent Information

The main structure of a patent consists of the following documentary fields: Title, Inventor(s), Applicant(s), PN (patent number), PD (patent date), PR (priority patent), EQ (Equivalent patent or family), CT (cited patents: patents related to the invention and cited by the examiner of the patent office), AB (abstract of the patent), IC4 (International Patent Classification (IPC, 1997) with 4 digits), IC (full International Patent Classification 8 digits) (The International Patent Classification divide the field of products, applications and technologies in different domains, the more digits the classification used the more precise it is). There is also the European Patent Classification as well as the US and Japanese ones, but the most useful is the IPC because it is present in all patents.

There are two ways to use the patent information. One which is closely related to the documentation practice will consist to obtain by using more and more precise questions, the most pertinent answer concerning a given subject. The goal is then to get rid of all the "noise" and to restrain the number of answers. The second one which is the one that we will use is very different and opposite of the documentation practice. The goal is to enlarge the view of the user, enabling him to understand all the whereabouts of a subject. In this case, the objective is to perform a larger query, which will overlap the subject and to perform after and APA (Automatic Patent Analysis).

This process is necessary, because the number of patent notices which will be retrieved will be often of several hundred, even thousands.

The APA (Automatic Patent Analysis)

To perform such an analysis, we will use the Matheo Patent[2] resident software which enables to query the world patent database or the USPTO databases[3]. Once the query is done and the answer is obtained, all the patents (including the family if necessary) are downloaded on a local computer. At the same time, the data are formatted and a pre-determined analysis done. This will enable the user to make all possible combinations of the data present in the various bibliographic fields of the patent notices giving rise to lists, networks, matrices. These statistical treatments are done in a few seconds since pre-programmed allows the user to get answers about the classical questions: who is doing what, with whom, where, when, what technologies and applications are in use, etc.

For academic people, research laboratories and centers, this is interesting since they will be able to test new ideas, to see what people do with their knowledge and competencies, to search for potential partners and for the patents where universities or research centers are the applicants to move up to upstream research. Another aspect of the patent is important (for US, EP and WO patents) this is the non-patent literature cited very often by the examiner. This literature contains scientific publication references and provides a good way to embrace the fundamental research linked to the products or applications protected.

Another condition which, in our opinion, is fundamental for developing countries is the following: patents provide wide information on the way that natural resources (for instance various plants, ores, etc.) are transformed to get them out of added value products. This aspect is important since most of the time natural resources are not transformed and sold as crude material. Moreover, because it is possible to map the various technologies used, it is possible to match some transformations with the local scientific and technological facilities.

The easy way to access the patent literature, its quality as well as its large number of notices is a good way to introduce in research and education some technical aspects which will build a bridge between theory and practice. We believe, because of the low cost (quasi nil) of this methodology that it can induce for developing countries, a move in research subjects and also in the way to consider the competencies of an individual or of a laboratory. In the next part of this presentation, we will develop some examples related to these different aspects.

Examples of the use of Patent Information in Developing Countries

We have been developing for several years this way to promote technology and applications in developing countries and the examples which are presented underneath have been published in various papers. This is the reason why they will be presented globally and not precisely detailed.

Indonesia and the Coconut Field

As early as 2001, we tested this methodology with success in the North Sulawesi[4]. Coconuts are one of most valuable products from North Sulawesi (Indonesia), but only a small number of products are developed locally such as coco fibers, or carbon black (wood burned and crushed to produce a very thin powder that can be used to absorb chemicals in gases or water) from coconuts. Mostly the coconuts are sold as unprocessed material. The profit made from this remains limited. Therefore, it is urgent that within the framework of Innovation a move should be made towards a more sophisticated approach. The results obtained from the patent information analysis opened the

[2]For more information on Matheo Patent, consult the following site http://www.matheo-software.com A demo version of the software is available as well as different examples.

[3] European IPR Help desk – Automatic Patent Analysis – Fact Sheet – December 2013 pp.11-14 http://www.ncbi.nlm.nih.gov/pubmed/advanced consulted October 2014

[4] Competitive Intelligence and Regional Development within the Framework of Indonesian Provincial Autonomy, Henri Dou, Sri Damayanty Manullang, Education for Information, n°22, June 2004

way to new areas to add value to coconut products: biodegradable pet litter, building materials, animal fodder, horticultural material, mattress chairs, and objects made from fibers, organic fertilizer, textiles, water treatment, and so on. The following list presents an extract of the most valuable applications and products obtained from the analysis of the IPC 4 digits, the frequencies indicate the importance of the application in the local downloaded database.

Examples of selected IPC (4 digits). At the beginning we chose only the simpler technological applications according the local expertise.

AOlG, *Frequency 69*, HORTICULTURE; CULTIVATION - - OF VEGETABLES, FLOWERS, RICE, **FRUIT,** VINES, HOPS, OR SEAWEED; FORESTRY; WATERING (picking of fruits, vegetables, hops, or the like AOlD 46/00; plant reproduction by tissue culture techniques AOlH 4/00; devices for topping or skinning onions or flower bulbs

A23K, *Frequency 25*, FODDER FOODS, FOODSTUFFS, OR NON-ALCOHOLIC BEVERAGES, NOT COVERED BY SUBCLASSES A23B TO A23J; **THEIR** PREPARATION OR **TREATMENT,** e.g.COOKING

BOlD, *Frequency 22*, SEPARATION (separating solids from solids by wet methods B04; presses per se for squeezing-out liquid from liquid containing material B30B 9/02; treatment of water COW, e.g. softening by ion exchange C02F 1/42; arrangement or mounting of filters in air-conditioning, air-humidification or ventilation

C04B, *Frequency 22*, LIME; MAGNESIA; SLAG, CEMENTS; COMPOSITIONS THEREOF, e.g. MORTARS, CONCRETE OR **LIKE** BUILDING MATERIALS; ARTIFICIAL STONE; CERAMICS (devitrified glass-ceramics C03C 10/00); REFRACTORIES; TREATMENT OF NATURAL STONE

A47C, *Frequency 21*, CHAIRS (seats specially adapted for vehicles B60N 2/00); SOFAS; BEDS (upholstery in general B68G)

B27N, *Frequency 20*, MANUFACTURE BY DRY PROCESSES OF ARTICLES, **WITH** OR WITHOUT ORGANIC BINDING AGENTS, MADE **FROM** PARTICLES OR FIBRES CONSISTING OF WOOD OR *OTHER* LIGNOCELLULOSIC OR LIKE ORGANIC MATERIAL (containing cementitious material B28B;shaping of substances in a plastic state B29C; fiber boards made from fibrous suspensions

Possible local production selected from the above list:

- People locally produce traditional wood houses that are sold in Indonesia, but also in Australia, New Zealand, the US and even Europe. These houses are not insulated and soundproof (especially the internal partitions), but insulating panels as well as soundproof panels can be made from coconut fibers. This opens the way to innovative thinking in house building by integrating different local resources.
- As the region is volcanic, building materials characterized by their very light weight are potentially interesting.
- The near-by port of Bitung provides facilities to ship all kinds of products. The production of biodegradable pet litter therefore may represent an opportunity, as well as insulating panels or building materials.
- The region of North Sulawesi is well known for its pig breeding. The production of fertilizer by mixing pigs' droppings with coconut material is also an opportunity.

- Wine made from fruits is another opportunity (North Sulawesi is a Christian region). In fact, because we worked for more than seven years with Brazilian students and various Brazilians institutions, south-south cross collaboration is interesting, especially in the domain of alcoholic beverages (cachassa), dry fruits (bade), corn (polenta), etc.
- Coconut fibers can be used for water treatment.

These few examples show how, by using technological analysis and patent databases as a source of unique information, people can acquire a global view of the potential development of the area. We successfully use this method in the course in Technology Watch and Competitive Intelligence at the University of Manado in North Sulawesi. These results were used also to select the subject of the research work that the students have to perform during their three to four months of probation period with the local industry. Other subjects than coconuts have been successfully explored in the same way and gave promising results in the field of cloves, nutmeg, seaweed, dry fruits, etc.

The use of patents as a unique source of technical information, associated with a software allowing a fully automatic exploration of the selected set of patents, provide an easy way to build up innovative thinking among the Indonesian students involved in a postgraduate course. The facility provided to build up patent clusters, related technologies, etc. allows the mapping of all the available interactions from the selected patents. This helps the students to begin to think in terms of value-maps and networks. Very often, we associate the results of the analysis to provide data to fill brain storming map, SWOT and Porter diagrams.

The Status of Moringa Oleifera in Africa

The Moringa[5] is a plant widely used in Burkina Faso, Madagascar and other part of Africa as a food complement because of its high protein and vitamins contain. In different countries the products from the Moringa are mainly powders made from the leaves and oil from the seeds. After the oil extraction from the Moringa's seeds, water can also be cleaned using the seed cake. But, most of the time the local people or the stakeholders of this business do not know all the 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 in titles or abstracts, using the world patent database and the Matheo Patent software as above to analyze the local database. Parts of the results are indicated below (Dou, Manullang, Kister, Dou Jean, 2015; Dou, Kister, Dou Jean). 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, automatically extracted from the local database we selected various applications. This is represented in the following figure.

[5] Multipurpose tree, http://en.wikipedia.org/wiki/Multipurpose_tree

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

Figure 5: Various Applications of Moringa and Related Patent Families

Each of the above groups may be analyzed in detail, providing the list of patents, the applicants, their benchmarking, main applications, 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 (31), the set of patents presented in the above group open the scope of the use of Moringa seeds or roots in various sanitary aspects.

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
CN103159954A	INSECTICIDE
CN102599965B	MORINGA OLEIFERA WATER PURIFYING AGENT
CN101485622A	SHAMPOO CONTAINING EXTRACT OF MORINGA OLEIFERA AND PREPARATION METHOD THEREOF

Figure 6: Patent present in the Group Antibacterial Filters

This is important since in Africa the water concern is of primary importance and because there is a strong need for drinkable water.
Other applications can be selected if necessary and the matrix selected applications/ countries indicated in which countries the applications are developed. This is indicated in the following figure.

	China	USA	India	South Korea	Japan	Germany	Switzerland	Great Britain	Norway	France	Australia	Luxembourg	South Africa	Philippines	Taiwan	ivoiry coast	Senegal	univ inst
rabbit feed	5																	1
leaf leaves	58	11	11	2	2	1		1		1			1		1	1	1	6
root(s)	16	6	10		1	2							1		2		1	3
oil	23	12	8	4	2	2	5	6	5	2					1	1		5
ipc autre que A	13	1	5	3	2	2	6	6	4	1		1				1		5
ipc A	91	14	13	10	8	8	7	8	5	4	1	1	1	1	2		2	14
ipc A61K	23	13	10	5	7	8	1	3		4			1		1		1	2
seed(s)	30	8	7	3	1	2	4	3	3	3			1		1			5
IPC A61K8	5	9	3	4	6	8				3								
cigarettes	4																	
anti (inflammatory	16	13	11	1	3	6	4	4	3	2			1	1	1	1	1	3
protein nutrition	31	7	7	3	1	7	4	4	3	3			1		1		1	7

Figure 7: Other Application versus Protected Countries

In this figure ipc A: = Human Necessities (including medicinal aspects and cosmetics), IPC A61K = Preparations for Medical, Dental, or Toilet Purposes, A61K8 = Cosmetic or Similar Toilet Preparations.

Patent information 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.

Conclusion

Introducing patent information in higher education and research will open the way to a link between science and technology. This is important since most of the time the scientific education programs do not include this link. In the same way, most of the research subjects are not develop with in mind the transfer the results and competencies to industry. In developing countries where the national or regional industrial fabric is not very strong (or it is most of the time the fact of international companies which already have their research center abroad), the introduction of a certain amount of technical applications and concern in education and research will speed the way to local industrial partnerships. This is the way to actually follow some institutions such as the OAPI (African Organization of Intellectual Property), the WIPO (World Intellectual Patent Office) the French IRD (Institut de Recherche et de Développement), etc. Moreover the high demographic growth in developing countries should prompt the politicians to organize at the regional or national level the facilities and programs which will create a synergy between research and industry. Patent information because it provides “true facts” demonstrates that a possible organization of the stakeholder of an area of knowledge or development is possible. All the above considerations and examples speak in favor of such an organization.

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