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Economic Intelligence And Frugal Development

Application to La Reunion island

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Abstract:

This work presents two examples of how small industries may take advantage of patents or scientific publications and Internet information to develop frugal applications through frugal engineering using value analysis methodology. The context of the application is "La Reunion Island" a French's department. We explain first the role of information to generate new applications or new ideas and following it we developed two examples one dealing with the coconut field and the second to the improvement of mosquitoes trapping.

Keywords: *frugal development, value analysis, competitive intelligence, mosquito trapping, added value chain, coconuts, economic intelligence, patent, APA, automatic patent analysis*

Résumé:

Ce travail présente deux exemples de la façon dont les petites industries peuvent tirer parti des brevets ou des publications scientifiques et des informations Internet pour développer des applications frugales grâce à l'ingénierie frugale en utilisant la méthodologie d'analyse de la valeur. Le contexte de cette présentation est « La Réunion », un département français. On présente d'abord le rôle de l'information pour générer de nouvelles applications ou de nouvelles idées et à la suite de cela on développe deux exemples, l'un traitant du

champ des noix de coco et l'autre de l'amélioration du piégeage des moustiques.

Mots clés : *développement frugal, analyse de la valeur, intelligence économique, piégeage des moustiques, chaîne de valeur ajoutée, noix de coco, competitive intelligence, brevet, APA, analyse automatique des brevets*

1.THE CONTEXT

The Reunion Island is characterized by a low employment rate and by very small SMEs. (Small and Medium Industry) Because of the purchasing power of most of the people being low, we will concentrate the study on the development of frugal products or applications. The two examples deal with two aspects, one which takes advantage of a natural resource: the coconut and the second to improve the sanitary conditions by increasing the mosquito's trapping power of classical commercial or home-made systems. The research will be performed using the patent information from the EPO worldpatent database, the scientific information from Pubmed (Medline) and the Internet information. The analysis of the patents as well as Pubmed information will be processed through the Patent-Pulse and Matheo Analyzer systems from the company Matheo Software¹. The data obtained from scientific databases,

¹ <http://www.matheo-software.com>

Internet or the patent database have been used into a value analysis scheme [1] to implement a system of frugal reengineering [2 ; 3].

II. PATENT INFORMATION

Most of the time, patents are seen by people as a tool to protect products or applications and then to give a monopoly of exploitation during twenty years. Many considerations on the role of patents in this area have been published [8], but the goal of this work is not to look to this aspect but rather to the information that patents provide. One of the largest patent databases available is the Worldpatent² database from the EPO (European Patent Office) which provides more than 100 million of patent notices from more than 90 countries. Other databases such as Patent Scope (WIPO World Intellectual Patent Organization) or European Patent Database (EPO) or national patent databases (US, Japan, European countries, etc.) are available via Internet and free of charge. This tremendous amount of information provides a living technical encyclopedia always up to date which provides information in the following items described in detail in the Glossary of Patent Terminology [4 ; 5] (Park 2008, OECD 2006). The fields available and useful in patent analysis are indicated in Table 1.

²https://worldwide.espacenet.com/advancedSearch?locale=en_EP

Table 1: Information provided by patents

Type of data	Description	Usefulness
Title TI	Titles words	Describe shortly the patent purpose
Applicant(s) AP	Patent owner(s)	Knowledge of new entrants, main leaders, old timer. Useful to establish contacts or to examine the company site
Inventors IN	Inventors	Can be the same as applicants. Useful to establish contact, or to trace the people on Internet or social networks
Abstracts AB	Describe the patent purpose	Useful for a quick view of the patent coverage
International Patent Classification IPC	Describe the technologies or applications. From 1 to 8 digits according the precision e.g AC47 (IPC 4 digits)	Technology mapping, technology trend, application areas, etc.
Application date	The patent application date is the date on which the patent office received the patent application	The two first digits represent the country. Searches can be done to find a specific patent or the patents from the same country eg FR* *=truncation
Priority date PR	the filing date of the first application is considered the "priority date."	Date from which the protection starts. Delay of extension of the patent to other countries, 12 months from the PR
Priority country	Country where the patent is first filed before being (possibly) extended to other countries	Allows to search by country using the first two digits and the truncation
Claims	These define the invention that the applicant wishes to protect.	Help to understand the scope of the patent
Description	Details on the patent	Describe the patent in details
Drawing(s)	Complement of the patent description	Help the expert to understand the patent description
Citations	Examiner(s) of patent scientific and technical novelty may cite other patents or non-patent literature relevant to the patent examined	Help to gather patents related to the same invention or to detect among these patents the ones which are the most important (the most cited).
Span of a patent	Generally 20 years	After twenty year the patent is in the public domain

The information which is provided by the patents is important since the patent information bridge the gap between fundamental research and markets. In this condition patents are perfect tools to begin to answer one of the first questions that a researcher should ask: How my research may be used for [6]? Generally people in research known the fundamental purpose of their work but because research is specialized, they do not embrace all the whereabouts of their subject especially on the application point of view [7]. One of the best examples of this situation appears when one examines the references in a scientific paper. Most of the time you will not see a patent cited as a reference. This underlines the gap which exists between fundamental research and industry. The situation is not the same on the patent side since in US, European and World Patents the examiners often cite the so call "non-patent literature", which is most of the time scientific papers.

Patent information is then a good way to break the "technical illiteracy" of some people and it will help to "open the window" through which the researcher can understand the facets related to his or her research [8]. Today there are no barriers to use these facilities and most of the patent databases are available from Internet. This is not a question of facility; this is a question of good will and also to develop some indicators which will evaluate the researcher output in a better way. The new role of university is not only to teach and to search, but also to help its environment to become more prosperous [9].

III. THE COCONUT

In La Reunion Island many communities use coconuts as an offering during religious ceremonies, but most of this fruits are unused and finished in garbage dumps. Our objective is to analyze the patent information dealing with the coconut applications to enable us to select the ones which do not involved complex technological manipulations.

III.1. The queries

The worldpatent database was used and the query was the following (performed the 24.02.2018)

Coconut (title – 2010 – 2018) result: 1275 Families³ formed of 1480 Brevets

But, after examination of the results, this query appears to be too large and the results not really applicable to our objective. The results were then divided in various groups, most suitable, the objective was to create sub-groups where we expect to find simple and frugal applications. The various groups were:

- oil AND (manufacturing OR preparation) 18 Families formed of 23 Patents
- Coconut and A47C*⁴ 25 Families formed of 25 Patents
A47C is the IPC (International Patent Classification) 4 digits dealing with Chairs, beds, sofas.
- « coconut fiber » 59 Families of formed Patents 62
Brackets mean the search for the full expression (string searching). The term coir (coconut fiber) was not used here since it is mainly related to gardening etc.
- Coconut and filter 5 Families formed of 5 Patents
- Coconut and charcoal 26 Families formed of 29 Patents
- Coconut AND (A01G* OR A01H* OR coir) (concept gardens, horticulture) 49 Families formed of 57 Patents.
The term coir (WIK 18a) is generic and includes the coconut fiber.

We also perform a search to select the patents extended as PCT (world patent), the patents extended at the world level being considered as important patents. This is a side search considering our objective, but nevertheless useful if some people want to pursue the valorization of coconuts.

- Coconut AND pn:WO* 44 Families 53 Patents

³ Because one patent can be extended to various countries, the same protected item may have different patent numbers. They form a patent family. When the patent is not extended the patent family gets one member only.

⁴ * is a truncation to retrieve all IPC which begin by AC47

The different terms used for the above queries have been selected by an analysis of the most significant terms in titles provided by the first query: coconut.

III.2. The selection of the applications

The selection is done by the analysis of the titles and abstracts of all the patents. Those which involve a technology that the local people cannot provide on a frugal base are not considered.

- oil AND (manufacturing OR preparation)
Most of the patents deal with oil encapsulation, chemical reactions, use of special bacillus. The technology developed is not suitable because it is too complicated.
- Coconut and A47C* (bed mattress cushions...)
We distinguish among the patents relevant to coconut palm and those relevant to coconut charcoal or fiber. The latter are of interest in our study and can be analyzed closely in another query. The others concern the manufacturing of various types of mattresses and they involve especially Chinese utility⁵ models of low technology knowledge.
- « coconut fiber »
The patents selected in this search underline the use of coconut fiber in various applications (mixture with polymer to provide various yarns, etc.). The role of coconut fibers in the confection of various types of mattresses is described. Various machines for processing the fibers (carding, etc.) are described.
- Coconut and filter
The selected patents show that coconut fiber and mainly coconut active charcoal can be used as filter material. One of the patents describes a very simple filter which can be used in developing country. Globally the role of activated coconut charcoal as basic filter material is underlined.
- Coconut and charcoal
The selected patents involve various technologies to produce thread,

⁵ Utility models are small patents (or petty patents). Their term for Chinese utility models is 10 years and they are not extended to other countries, so they can be used freely elsewhere but China. They deal most of the time with small improvement not involving high technology.

coconut charcoal, nonwoven fabrics, etc. Most of the charcoal involved is very finely grounded using special machines. If the use of coconut activated charcoal is underlined as filter material the technology involved in the selected patents are too advanced for our purpose.

- Coconut AND (A01G* OR A01H* OR coir) (concept gardens, horticulture)
The use of coconut coir as medium for gardening or for hydroponic cultures is described and the quality of the medium described. The technology involved for the production of various types of coir does not seem complicated.
- Extended patents (PCT)
They are supposed to be the best patents since the applicants extended them in various countries. The list of IPC 4 (International Patent Classification⁶) digits indicates (Fig 1) that most of the applications do not deal with the applications selected above (low technology oriented).

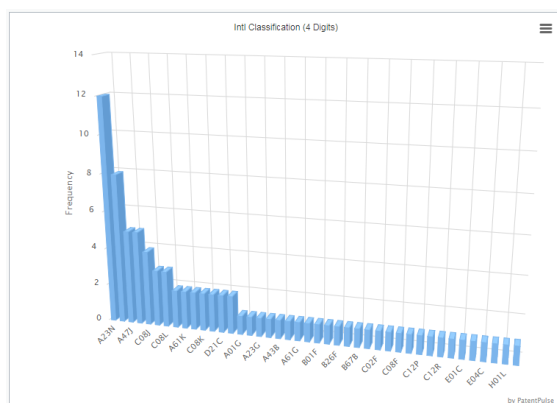


Figure 1: Extended patent (WO) and applications (IPC 4 digits)

III.3.The preparation of coir and coconut charcoal

Coir preparation

Query (same database search in titles and abstracts no dates interval: ta:“coir preparation” or “coir manufacturing” or “coir production” result null. This means that if there is no patent on the coir production this is because the technique is in the public domain (ancestral) and cannot be protected. Since the

coir production can be one of the selected areas of development we queried the Internet to have some ideas of the technology used for the production of coir. The coir preparation involves 10 steps: dehusking, retting, processing the fibers (there are different quality of fibers), etc. The description of this process is described in “How product are made” [10].

Coconut charcoal preparation

Query (same database) search in titles no dates interval: ti:“coconut charcoal” AND (manufacturing” OR production) gives 7 families and 7 Patents. None of them describe the production of coconut charcoal. They deal with the improvement of the charcoal by adding adhesives (to make briquettes) or ignitors such as nitro cellulose, etc. In Pubmed, the coconut fiber role as biosorbents of dissolved hydrocarbons in fuel spills [11] was demonstrated as well as the capacity of coconut fibers to adsorb pharmaceuticals in water [12] and also various heavy metals [13 ; 14]. In Pubmed the cycle adsorption-desorption for coconut charcoal was studied and shows a good reusability [15]. The coconut charcoal is produced when the coconut shell is burned in a low oxygen atmosphere. The technology used is very simple and does not require a specialized manpower. The whole process can be performed in height hours. The charcoal produced can be packed for domestic and metallurgical used, or send for a further processing (grinding) to obtain activated coconut charcoal. The ratio of production is 1 part of charcoal for 30 parts of coconut shells.

III.4.Recommendations

We suggest according the above results, that two areas should be considered to develop further use of coconut wastes after using the juice or the flesh: the production of coir and the production of coconut charcoal. Considering that the system of production of coir is relatively slow (because the retting which lasts several months after dehusking), we suggest to start first by the production of coconut charcoal. Because dehusking is also necessary in this step, it is possible to develop both activities in the same time, charcoal first and coir after, (since the interval of time for retting is longer). Of course the production of charcoal or fibers will be only for local domestic uses in the first time.

IV.IMPROVING THE MOSQUITOES TRAPPING

⁶<https://worldwide.espacenet.com/classification?locale=en-EP>

Mosquitoes are a real problem in La Réunion, mainly because they are the vector of chikungunya infection that causes intense joint pain. Then improving the yield in mosquitoes trapping will be very valuable and will improve the sanitary conditions in the island. Many mosquito traps are described in the literature, they for most of them required a power source and they are more or less sophisticated, with variable prices. We made different searches in the Worldpatent database, Pubmed and Internet. From these searches it appears that one of the cheapest ways to attract mosquitoes is to use CO₂ gas (carbon dioxide). When a person breathes he or she exhales carbon dioxide and mosquitoes spot carbon dioxide which helps them to identify their prey. Various research papers underline the carbon dioxide effect. [16 ; 17; 18 ; 19]. In Pubmed research papers underline the mosquitoes problem in La Réunion [20 ; 21]. There are in Pubmed 36 scientific papers dealing with mosquitoes and La Réunion , most of them are about chikunguna . Only one [21] deals with trapping and a second with the level of expense for trapping [20].

IV.1. Mosquito traps in patents

The search made from the Worldpatent database with the terms Mosquitoes AND (CO₂ OR "carbon dioxide") in titles and abstracts (no interval of dates) conducts to 407 families formed of 562 patents. The division of the patent production per priority years shows that since 1981 there is a growing concern with the development of mosquitoes trapping (Fig 2). Most of the patents are Chinese, but other countries are also present which indicate a strong concern about mosquitoes (Fig 3).

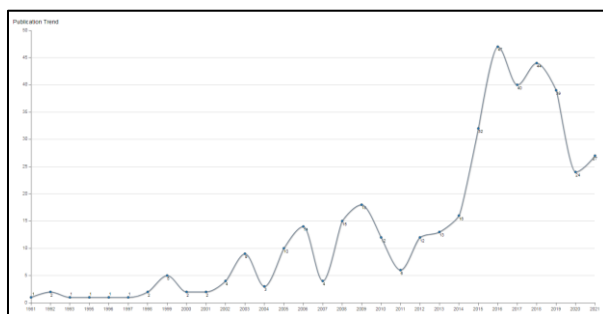


Figure 2 : Division of the patent production per priority dates

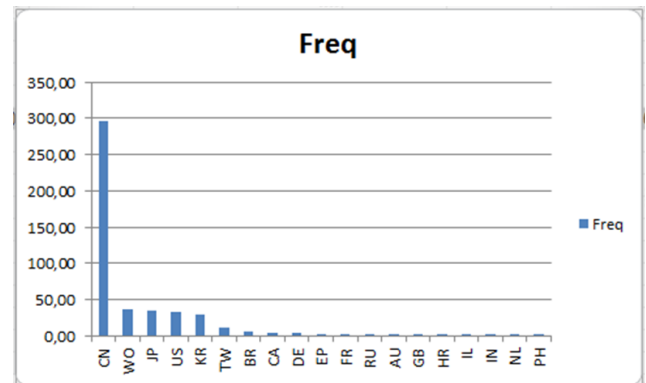


Figure 3: Division of the patent production per country codes

The patents deal mainly with attractants (CO₂ or other Chemicals), carbon dioxide generators, various trapping systems from lamps (diode, uv, etc.) to wall papers, insecticidal paints and coatings, clothe mosquito repellents, systems with active repellent matters such as titanium dioxide, systems with clocks, mosquito nets, sticky mosquitocides, attractant compositions, special insecticides, essential oils, incinerators, etc.

A classic example of patent is as follows:

US2004128904A1 - Mosquito Trap Abstract:

A mosquito trap includes a base, a carbon dioxide container for discharging carbon dioxide to a position near the base, a mosquito collection box mounted in the base, and a fan motor for introducing air into the mosquito collection box. The fan motor creates a wind pressure sufficiently strong to kill mosquitoes trapped in the mosquito collection box.

IV.2. Value analysis of a trapping system

From all the references above, we may split the trapping system in several functionalities, making a very simple "value analysis" of the main part of the "system" such as for instance in the work of Rajadurai [22].

Attractant → Carbon dioxide eventually coupled with uv light

Generator of carbon dioxide

Killing system → nets, lamps, etc.

Mechanical system (shape, wheels, tractors, etc.)

VI.3. Development of a frugal trapping system

A frugal system can be seen as an efficient device, of very low cost and develop with

simple materials, consistent with a low cost approach, especially for local use in small communities. Examining the above sub-systems we may fix the conditions to develop a frugal system [2] :

Generator of carbon dioxide: in the literature most of them are a catalytic production of CO₂, CO₂ by burning propane, production of CO₂ using animals (eg rats for instance), CO₂ from inorganic materials such as titanium dioxide, degradation of organic matter by enzymes or yeast. We choose the degradation of organic materials by yeast.

Killing system: some are very sophisticated, but one of the simpler is water or water solutions where mosquitoes will be attracted and drown. We choose the water solution system.

The organic material: if we refer to the classical production of alcohol from fruits for instance, this is the action of yeast on grapes or other fruits which produces CO₂ and alcohol. Then for organic materials, sugar or fruit pulp (the more sweet the better it will be) are the most suitable. La Reunion produces a lot of cane sugar (brown sugar will be the best for our purpose), or palm sugar. Honey can eventually be also used. There are also fruits available if they have high fructose content.

The yeast: this is the only material which must be bought since it is made from living organisms (mushrooms). It can be bought from Amazon for instance at a price of 12€ per Kilogram [23].

Reaction: the sugar is dissolved in water. When this is done, yeast is added and the degradation leading to carbon dioxide begins. According the amount of sugar and yeast the production of CO₂ will last from one to two weeks or even more. The temperature must be high enough to favor the fermentation, but this is not a problem in La Reunion.

The trap: The design of the trap may be inspired from the ones used to trap bugs, or flies in the culture of olives for instance. Basically this is a cylinder and a reverse funnel introduced in it. (Fig 4).

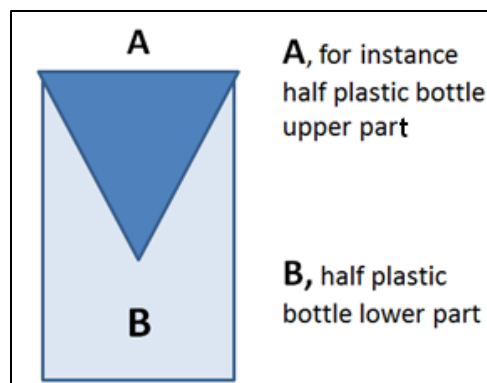


Figure 4 : The trapping system

The bottom part (B) will contain the mixture of water, sugar and yeast. The CO₂ will evolve through part A and will attract the mosquitoes which will penetrate into B, and drown. If plastic bottles are used to trap flies in the culture of olives, for the mosquitoes purpose larger tank may be used such as plastic cans, etc.

IV.4. Is such device described in the literature?

A search performed in the Worldpatent database, ta:(mosquitoes AND (CO₂ OR dioxide)) AND water AND solution (search in the titles and abstracts) leads to 6 families formed of 9 patents. None of them correspond to the above process. A search in Pubmed gives no results. A search performed on Internet via Google was successful using the same search as above we obtain the following answer: "How to make a plastic bottle mosquito trap" [24]. The description is the same as above, but more indications are given about the proportions of water, sugar and yeast as well as the span of production of carbon dioxide:

One cup and half of water, ¼ of a cup of brown sugar, 1 gram of yeast – The span of carbon dioxide production is about two weeks. This indication is important since yeast is the only product to buy. 12 € for 1,000g means that about 1,000 systems or refills are possible for a very low cost.

A global view of the trap with the water solution of sugar and yeast is presented in Fig 5.

It is noticeable that the cost of such system is quasi null and that many such devices can be done and spread in various areas, outdoor or indoor. Of course, the water solution must be

renewed every two weeks, but this is not very complicated and does not need so much effort. The place of such a trap, especially for the tiger mosquitoes (vector of chikunguna), must be done close from the soil (no more than one meter high) because this type of mosquito does not fly very high.



Figure 5 : The plastic bottle mosquito trap according WikiHow

V.CONCLUSION

In countries where people cannot afford a large expenditure to develop products or systems either to valorized by products from natural resource or systems to improve the sanitary conditions, an extensive use of information is an invaluable help to develop a frugal and innovative products or systems [25 ; 26]. All the information sources used in this presentation are free, patents as well as Pubmed and Google Scholar. The only condition for success is to have a goal (in this example coconut by products, mosquitoes trapping) and to be able to retrieve the right information. This information must be analyzed in details to be able from sophisticated systems to split them in different parts. This can be considered as the first step in frugal engineering [22 ; 1]. The second step will be to simplify them as far as possible and the third step to re-engineering the whole in a frugal way. This method is very general and can be extended to many other fields.

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