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Application of Competitive Intelligence for Insular Territories: Automatic Analysis of Scientific and Technology Trends to Fight the Negative Effects of Climate Change

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Application of Competitive Intelligence for Insular Territories: Automatic Analysis of Scientific and Technology Trends to Fight the Negative Effects of Climate Change

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Islands are fragile territories because of their geographical position. As a result, climate impacts can have serious consequences, of which some are irreversible. Therefore, it is necessary to allow insular territories to benefit from the latest scientific and technological advances in combating climate effects. The current article shows how to deal with automatic analysis of scientific information on the one hand, but also its applications via patents. We will analyse the latest scientific results as well as their possible applications using patent analysis. We will also focus on experts, laboratories, and leading companies, that are active on the field. The sources used are scientific data obtained via Google Scholar using PoP, the various patent databases accessible. Data extractions will be analysed using the Patent Pulse system.

Key Words: competitive intelligence for insular territories, island, climate change, patent, Patent Pulse

Introduction

The islands, as a whole (we are not limiting ourselves to the simple Mediterranean aspect) are fragile territories where the impact of climate change can have dramatic effects. It, therefore, becomes essential to analyse scientific advances and technologies to enable political decision-makers to develop protective actions according to the risks analysed locally. In addition, this analysis can serve as a basis for prospective studies required in the field. In this work, we will highlight the expertise and possible implementation of the means to fight against climate change, not just limited to the Mediterranean. European countries have remote ultra-marine territories and on the other hand, the impact of climate change knows no borders and will be exerted to varying degrees in various parts of the world. It is therefore important to develop a general methodology applicable without distinction of places and without favouring a particular impact.

It will be up to the decision-makers to use the methodology depending upon the problems to be solved and the means available to make the necessary choices (Rimmer, 2011). The results obtained highlight one of the methodologies

as well as the appropriate tools used within the framework of the development of a Competitive Intelligence for Insular Territories (Fournie & Dou, 2020; Dou, 2019a; Dou 2019b), the objective is to provide to political decision-makers with factual elements so they can select the best possible solutions.

Materials and Methods

The query

In this type of investigation, this is a critical phase. The quality of the analysis will depend on the quality of the query. We can generally proceed with a very broad interrogation. however, depending on the local problems to be solved, or the prospective studies to develop, we can also question in specific ways. For example we could use the following searches:

- fight AND 'climate change' in string search mode
- shore AND protection or 'shore protection' in string search mode.

It will therefore be necessary for potential users of the method to be able to clearly define their subject using specific terms. Note that the term 'island' has not been used, as it would be reductive in that scientific or

technological advances are not necessarily specific to islands on one hand and on the other because the term 'isle' is also used in publications.

Scientific information

For this study, in extracting scientific information, we have favoured free sources of information with three levels of analysis.

- Targeted query of Google Scholar (Google, 2021b)
- Polling and downloading via the PoP system (Harzing, 2021; Harzing, 2011)
- In-depth analysis via the *Matheo Analyzer* system (Matheo Analyzer, 2021)

One can, according to the means of the users, use as a primary source of information the Web of Science (WoS) (2017) and proceed in the same way as above, or work directly from the downloading of the data obtained by the WoS to the *Matheo Analyzer* system.

Mastering the questioning is essential to achieve a good quality analysis. We can proceed via a very general interrogation of the type:

((fight OR struggle) AND (weather OR climate))

and then limit it to a certain number, 5 years for instance, to extract the most recent data. It will be necessary to use the advanced search function in Google Scholar to perform the query (Dou, 2017). The query may deal with the title of the article or its full text including the title. Do not forget to also make the query in various languages since the information in Google Scholar is not translated.

As an example, we will present also the use of the Medline database (free) via PoP, but also directly by importing the results into the *Matheo Analyzer* system.

After performing the query you will immediately notice that the amount of data obtained is very large and that a global view of all the results is difficult because it will take too much time. It is from this observation that Anne Harzing (2011) developed the PoP (Publish or Perish) system which allows the extraction of 1000 data elements (maximum allowed by Google) from Google Scholar and to present them in a synthetic way allowing a global and deconstructed vision of the results.

However, in some cases, it is necessary (for example to locate research groups on a given topic or to know where the main expert has published) to analyse the data obtained in a deeper way. To do this, the result obtained in PoP are integrated into *Matheo Analyzer*, a specialised software, to perform an automatic analysis.

Technological data: patents

Two solutions are possible when extracting patent data. First, one can query patent databases which offer free access. These are available via the EPO (European Patent Office) site (EPO, 2021), Google Patents (Google, 2021) or Patentscope (WIPO, 2021) (see Box 1). In these cases, the overall analysis of selected patent notices cannot be extracted. Instead, it will be necessary to consult them one by one.

For such a reason, we will use a system of analysis with extended features and capacities. It will allow knowing who does what, where, how, when, and with whom. The tool we use is called Patent Pulse (Patent Pulse, 2021). Patent Pulse allows the querying of a range of databases: Worldwide database (identical to EPO), full-text World database, European, French, US published, US granted, Canadian and Spanish patents.

From a query, the patent notices obtained can be consulted one by one and the full texts obtained online or offline. A global analysis of applicants, inventors, international classification, dates, as well as concepts are automatically extracted from summary titles and claims and their various correlations can be performed automatically (lists, networks, matrix, etc.).

Box 1: Free Patent Sources

EPO - This site (EPO, 2021) provides access to the worldwide database in addition to French, English and German patent databases. These databases are searchable by title, or title plus abstract. Querying in 'string search' mode is not possible.

Google Patents – Google provides an access to all US patents in full text.

Patentscope – Is a database of the world patents developed the WIPO (World International Patent Organization)

Figure 1 - Results Obtained with PoP and Google Scholar.

Maximum number of results: 1000 (may be further limited by data source)	Cites	Per year	Rank	Authors	Title	Year	Publication	Publisher	Type
Publication years: 2015-2021	0	0.00	377	A Attlee	CLIMATE JUSTICE Hope, resilience, and the fight for a sustainable future	2018		TIMES SUPPLEMENTS LL	CITATION
Citation years: 6 (2015-2021)	1	0.33	86	A Baillet	What link (s) between the fight against terrorism and climate change?	2018	Les Champs de Mars	cairn-int.info	CITATION
Papers: 893	0	0.00	128	A Baillet	From vulnerability to weak power: Bangladesh in the fight against climate change	2018	Revue internationale et strategique	cairn-int.info	HTML
Citations: 146.83	0	0.00	124	A Bainbridge	We need to fight for 2030 climate targets	2020	Green Left Weekly	Green Left	CITATION
Cites/year: 2.27	1	1.00	233	A Cruickshank	COVID pandemic-19 shows telecommuting can help fight climate change	2020	... pandemic-shows-telecommuting-can-help-fight-cl...		CITATION
Cites/paper: 1.46	4	0.67	232	A Davydova	Russia's forests overlooked in climate change fight	2015	Sci. Am		CITATION
h-index: 10	2	0.33	259	A Davydova	Russia's forests overlooked in climate change fight', Thomson Reuters Foundation, 15 January	2015			CITATION
g-index: 10	0	0.00	385	A Dubois, N Seminario Hurtado	Paris agreement: instrument of International Law in the Fight Against Climate Warming	2019		alicia.concytec.gob.pe	CITATION
h1_norm: 1.67	2	0.40	286	A Eil	Dear Ivanka, Here's how you can fight climate change	2016	New York Observer		CITATION
h1_annual: 8	3	1.50	277	A Ekin	All Can Help Us Fight Climate Change: But It Has An Energy Problem, Too	2019	Horizon: The EU Research & Innovation Magazine		CITATION
h-index: 2.27	0	0.00	94	A Garcia Mied	INFLUENTIAL TEENAGERS: Greta Thunberg and the fight against climate change	2020		repositori.uji.es	CITATION
Papers with ACC >= 1,2,5,10,20, 98,42,11,4,1	1	0.20	110	A Ghezlou, A Saïdane, N Oucher...	Contribution of the conferences of the parties and the renewable energy role for the fight against...	2016	AIP Conference ...	ap.sciation.org	CITATION
	0	0.00	95	A Ghezlou, H Merabet, N Oucher...	COP 24: Algeria's commitments in the fight against climate change	2020	AIP Conference ...	ap.sciation.org	CITATION
	0	0.00	387	A Guðmundsdóttir	Climate Justice: Hope, Resilience, and the Fight for a Sustainable Future, editr Mary Robinson	2019	Ritroð Guðfræðistofnunar	ojs.hi.is	PDF
	0	0.00	182	A HEFFERNAN	... the Moroccan authorities and their allies in the greening of their public policies: modernisation...	2016	Relaciones Internacionales	revistas.uam.es	PDF
	0	0.00	85	A Klem	People fight the state on climate	2016	New scientist	dialnet.unirioja.es	PDF
	0	0.00	183	A Kona, P Bertoldi, G Melica, SR Calvete, P Zancan...	European Cities Leading The Fight Against Climate Change: Achievements Of The Covenant Of ...	2016	aece.org		CITATION
	0	0.00	71	A Maqbool, M Abzar, A Bakhtsh, S Çalıskan...	Biofortification Under Climate Change: The Fight Between Quality and Quantity	2020	Environment, Climate ...	Springer	CITATION
	1	0.20	122	A Mooney, RK Sahu	Seed Banks in the Centre of Origin: The Fight Against Climate Change	2016	Journal of Development and Management Studies	viss.ac.in	PDF
	2	2.00	38	A Mooney, O Walker	Blackrock seeks to regain lost ground in climate fight	2020	Financial Times, Jan		CITATION
	0	0.00	121	A Mu, JW Moreau	CAN BACTERIA LIVING UNDERGROUND HELP FIGHT CLIMATE CHANGE?	2016	pdfs.semanticscholar.org		PDF
	6	1.20	22	A Nagoumey, H Fountain	California, at forefront of climate fight, won't back down to Trump	2016	New York Times		CITATION
	2	0.33	219	A Oke	Japan's action plan to fight climate change	2015		.../japans-action-plan-to...	CITATION
	2	2.00	338	A Otunuga	Why the Fulani Herdsmen & Farmers Fight: How Climate Change & the Boko Haram Crisis Creat...	2020			CITATION
	2	0.67	313	A Rathi	Trump signed a landmark bill that could create the next big technologies to fight climate change	2018	URL: https://qz.com/1203803/donald-trump-signed-...		CITATION
	2	0.40	230	A Saldamando	We Are Mother Earth's Red Line: Frontline Communities Lead the Climate Justice Fight beyond th...	2016	Indigenous Environmental Network, Climate Justice ...		CITATION

Scientific Information Analysis

On Google Scholar we will obtain many references when using the full text search function. As a consequence, it is sometimes better to use the interrogation only on the title. For instance:

Query: (fight AND (weather OR climate)) between 2015 - 2021 (undertaken on March 29, 2021)

Query throughout the text of the article: **115,000** results

Query title of articles only: **399 results**

Two strategies are possible. The first is to restrict the subject, for example, by adding the term **sea**: (fight AND sea AND (weather OR climate)) between 2015 - 2021: 45,600 results which is still too vast; or by using the word **tide** (16,900 results). Playing with the date range to further restrict the subject will then become necessary. Alternatively, it is possible to introduce the specificity of **island**: (fight AND sea AND tide AND island AND (weather OR climate): 16,100 references. We can also exclude several terms: migration, etc. for example.

The second strategy is to use only the query in the title. If the terms appear in the title, we will consider the publication as more relevant. That is the strategy we will retain in this paper.

Use of PoP and Google Scholar

The PoP software system is free and accessible via the Internet, but you need to download it to your computer. Note however, that in PoP we cannot use the Boolean operator 'OR'. In this case, we need to perform the search

in two stages. The first time with 'fight' and the second time with 'weather'. With the term 'fight', the result is almost identical to the one obtained via Google Scholar when the two terms are used (374 versus 399). We will therefore limit ourselves to the query using 'fight'. This is indicated in Figure 1

The left column indicates data that are relevant to the evaluation of the research. They do not relate to the current work. 'Cites' and 'per year' indicate the number of citations of the work. These two figures are interesting, but we must not forget that recent work is not widely cited even if it is of good quality. Next is the list of authors, followed by the titles, the year of publication, the journal name, the publisher, and the type of work. In this part, when the terms HTML or PDF are present this means that the publication is directly available in full text when you click on HTML or PDF. It is also noted that it is not possible to break the title or the authors as separate words. Nonetheless, the presentation of PoP still allows a quick vision of the subject. Note that the contents of the columns can be sorted. This makes it possible to quickly search for authors whose name are known, or for a date, publisher, journal name etc..

Use of a more efficient analysis system

In order to process the findings, the previous information groups have to be exported in ISI / WoS Export format, present in PoP, and inputted to *Matheo Analyzer* for processing. The expert tool will recognise and differentiate authors, words of the titles, dates, publishers, as well as journal names.

Figure 4 - PoP and Pubmed as a Source of Information

Cites	Per year	Rank	Authors	Title	Year	Publication
0	0.00	310	A K Ettinger, D M Buonaiuti, C J Chamberlain, I M...	Spatial and temporal shifts in photoperiod with climate change.	2021	The New phytologist
0	0.00	140	A L Carter, Fredric J Janzen	Predicting the effects of climate change on incubation in reptiles: methodological advances and ...	2021	The Journal of experimental biology
0	0.00	32	Aaron T Simmons, Annette L Cowie, Cathy M Wat...	Pyrolysis of invasive woody vegetation for energy and biochar has climate change mitigation pot...	2021	The Science of the total environment
0	0.00	319	Abdimalik Ali Warsame, Ibrahim Abdulkadir Sheik...	Climate change and crop production nexus in Somalia: an empirical evidence from ARDL techniq...	2021	Environmental science and pollution research internat...
0	0.00	80	Abdalmajid Nadein Beni, Nick Marriner, Arash Sha...	Climate change: A driver of future conflicts in the Persian Gulf Region?	2021	Heliyon
0	0.00	39	Abdul Waheed, Thomas Bernward Fischer, Muha...	Climate Change Policy Coherence across Policies, Plans, and Strategies in Pakistan-Implications f...	2021	Environmental management
0	0.00	354	Abubaker Omer, Nadir Ahmed Elagib, Ma Zhuguo...	Water scarcity in the Yellow River Basin under future climate change and human activities.	2020	The Science of the total environment
0	0.00	6	Ademe Mihiretu, Eric Ndemo Okoyo, Tesfaye Lem...	Causes, indicators and impacts of climate change: understanding the public discourse in Goat ba...	2021	Heliyon
0	0.00	300	Agatha Agudelo, Micaela Carvajal, Maria Del Car...	Halophytes of the Mediterranean Basin-Underutilized Species with the Potential to Be Nutritious ...	2021	Foods (Basel, Switzerland)
0	0.00	294	Alan E Stewart	Psychometric Properties of the Climate Change Worry Scale.	2021	International journal of environmental research and p...
0	0.00	258	Aleksi Lehikoinen, Åke Lindström, Andrea Santan...	Wintering bird communities are tracking climate change faster than breeding communities.	2021	The Journal of animal ecology
0	0.00	102	Alex MacMillan	The Climate Change Act will now shape the nation's health: an assessment of the first policy reco...	2021	The New Zealand medical journal
0	0.00	3	Alexander Kurganskiy, Simon Creer, Natasha de V...	Predicting the severity of the grass pollen season and the effect of climate change in Northwest E...	2021	Science advances
0	0.00	290	Alexander N Larcombe, Melissa G Papini, Emily K ...	Mouse Lung Structure and Function after Long-Term Exposure to an Atmospheric Carbon Dioxid...	2021	Environmental health perspectives
0	0.00	132	Alexandra Lavrillier, Semen Gabyshev	An Indigenous science of the climate change impacts on landscape topography in Siberia.	2021	Ambio
0	0.00	289	Alexandra Luccioni, Victor Schmidt, Vahe Vardany...	Using Artificial Intelligence to Visualize the Impacts of Climate Change.	2021	IEEE computer graphics and applications
0	0.00	162	Alexandre Schickele, Patrice Francour, Virginie Ray...	European cephalopods distribution under climate-change scenarios.	2021	Scientific reports
0	0.00	254	Alfonso Prado-Cabrero, John M Nolan	Omega-3 nutraceuticals, climate change and threats to the environment: The cases of Antarctic ...	2021	Ambio
0	0.00	37	Alice Lacity	Daniel R. Brooks, Eric P. Hoberg, Walter A. Boeger, The Stockholm Paradigm: Climate Change an...	2021	History and philosophy of the life sciences
0	0.00	97	Allison M Louthan, William Morris	Climate change impacts on population growth across a species' range differ due to nonlinear res...	2021	PLoS one
0	0.00	314	Alyssa R Pfadt-Trilling, Timothy A Volk, Marie-Odi...	Climate Change Impacts of Electricity Generated at a Waste-to-Energy Facility.	2021	Environmental science & technology

Example of specific processing by networks

Figure 3 illustrates an analysis by location and country. This is a network representation of the links between user selection and publication date. The figure shows the distribution of links, as well as those shared between different years. We notice the low number of places or countries present simultaneously in different years: Canada, China, Denmark France, Europe. This type of analysis is useful for developing an overview of the locations that have been the subject of publication, and also of the aspects covered year by year.

Processing via matrices

We can also by using matrices, see who has spoken about what. For example, we see the presence of the name Trump in the expressions extracted from the titles. We proceed to the selection of the Trump group then we carry out the matrix Trump Group versus sources to obtain the results indicated in table 1:

Sources	Trump
The New York Times	4
url :https://qz.com/1203	1
The Guardian	1
Yale Environment	1
Al Jazeera	

It is obvious that in analysing the information available in Google Scholar via PoP, we are driven by the richness of the indexing. If there is a need to go even further, you can use WoS (Web of Science, 2021) , but to use the WoS you must be a subscriber.

Use of the Medline database (free)

In some cases it is important to investigate health problems, their treatments, as well as various biological approaches in relation to climate change. In that case, the Medline database is suggested.

Use with PoP

We will operate in the same way as for Google Scholar. The results are presented in the same way. Figure 4 shows an extract of result using ‘Climate AND change’ as the research equation. But in this instance, we have the possibility of querying the Medline database directly. PubMed (2021) is free and downloaded documents, can be directly inputted and analysed using *Matheo Analyzer*.

Using Matheo Analyzer

Searching for titles and summaries with the ‘fight AND climate AND change’ equation we obtained 77 results from PubMed, which were downloaded in the available Title-set .txt format.

Figure 5 shows the main extractions performed as well as the selections made by the user. These extractions or selections can then be combined together to obtain networks, lists, matrices, etc.

Figure 6 shows a possible combination where the concepts extracted by the user are crossed with the origin of the authors (Affiliation) to find out which countries are affected by which issue. We see that there are isolated issues (not represented here), and others related to different clusters.

Automatic Patent Analysis

Patents represent a large source of information; in fact they are a living technical encyclopedia. Most of the time, data published in patents are not published elsewhere. Unfortunately, such a source of information is not used as it should be. The following examples introduce the methodology applicable for patent analysis.

Public access to EPO patent base

Patents are accessible free of charge using the EPO (European Patent Office) server. However, as we have pointed out earlier, results cannot be statistically processed. Figure 7 shows the query guide, and Figure 8 shows results. In this example, we are simply considering the classic full-text query fields available: title or summary title. We will not consider for the time being, the other fields: applicants, inventors, dates, patent number, or fields related to various aspects of intellectual property. The international patent classification is useful as it allows the selection of ‘fields of application’ (IPC, 2021). We will discuss it separately.

The database selected is the Worldwide database. We could also have chosen the databases of French, English

or German patents that are available. A search on: water AND saving AND agriculture leads to the result presented in figure 8. A click on the patent title gives access to the notice, as shown in figure 9.

Patents can only be viewed one after another. Therefore it is not possible to carry out a global analysis of the results. To achieve this we will use a more powerful system: Patent Pulse (Patent Pulse, 2021).

The International Patent Classification (IPC)

This classification allows the selection of major application themes. It is formed by the letters A to H, with the addition of letters and numbers to refine the various application groups. Figures 10 and 11 show the structure of the classification.

We obtain the result in Figure 8 by querying the entire classification with the terms ‘agriculture AND water’, via the EPO website (IPC, 2021). It is also possible to limit the search by using certain classes. Here, the classes Y02A20 / 00 or Y02A40 / 00 appear as the most relevant. Such a limitation can be introduced in Patent Pulse to restrain the search, when necessary.

Figure 7 - Espacenet Search Screen

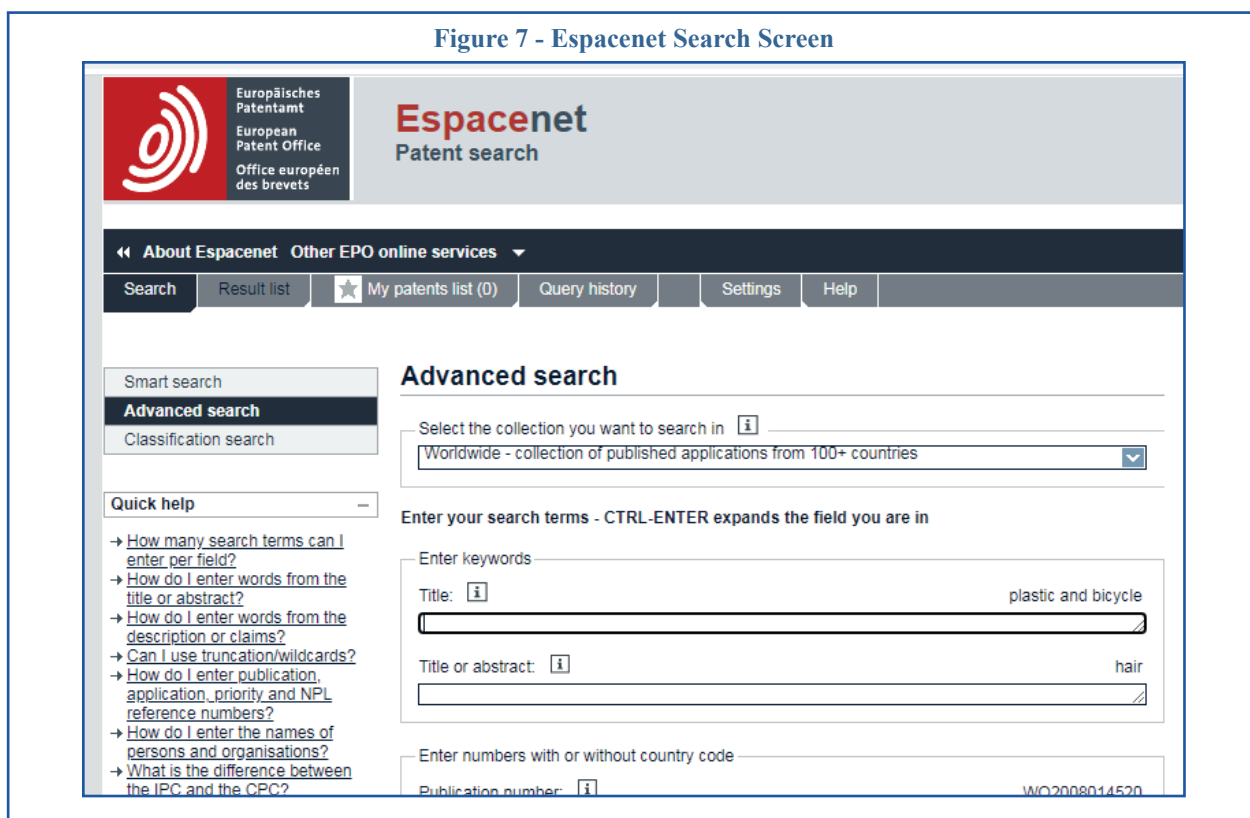


Figure 8 - Results Obtained: 871 Results of which only 500 are Available for Consultation

Result list

Select all (0/25) Compact Export (CSV | XLS) Download covers Print

Approximately 871 results found in the Worldwide database for: **water saving agriculture** in the title or abstract 1 ▾
Only the first 500 results are displayed.

Results are sorted by date of upload in database

1. **IRRIGATION METHOD**

★ Inventor: Черкун Олександр Володимирович, Черкун Александр Владимирович, (+6)	Applicant: INST OF IRRIGATED HORTICULTURE OF UKRAINIAN ACADEMY OF AGRARIAN SCIENCES [UA]	CPC:	IPC:	Publication info: UA16331 (A1) 1997-08-29	Priority date: 1984-01-04
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2. **COMBINED PROCESS LINE FOR PRODUCTION OF MICRONISED FLAKES FOR STARTER AND PREMARARMIC FEEDSTUFFS FOR YOUNG STOCK OF FARM ANIMALS USING PURIFIED BIOGAS**

★ Inventor: AFANASEV VALERIJ ANDREEVICH [RU] OSTRIKOV ALEKSANDR NIKOLAEVICH [RU] (+4)	Applicant: AKTIONERNOE OBSHCHESTVO NAUCHNO PROIZVODSTVENNYJ TSENTR VNII KOMBIKORMOVOJ PROMYSHLENNOSTI AO NPTS [RU]	CPC: A23K10/30 A23K40/00	IPC: A23K10/30 A23K40/00	Publication info: RU2742058 (C1) 2021-02-02	Priority date: 2020-01-10
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3. **METHOD FOR GROWING SUGAR BEET HYBRIDS AT IRRIGATION**

★ Inventor: Писаренко Володимир Антонович, Писаренко Владимир Антонович,	Applicant: INST OF IRRIGATED AGRICULTURE OF UKRAINIAN ACADEMY OF AGRARIAN SCIENCES [UA]	CPC:	IPC:	Publication info: UA37704 (A) 2001-05-15	Priority date: 2000-04-06
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Figure 9 - Example of Patent Notice (Worldwide Database)

Bibliographic data: UA16331 (A1) — 1997-08-29

★ In my patents list Previous 1 / 500 Next Report data error Print

IRRIGATION METHOD

Page bookmark [UA16331 \(A1\) - IRRIGATION METHOD](#)

Inventor(s): Черкун Олександр Володимирович ; Черкун Александр Владимирович ; Онищук Інна Сергіївна ; Онищук Інна Сергеевна ; Щербань Віктор Димитрович ; Щербань Виктор Димитрович ; Биков Михайло Денисович ; Биков Михаил Денисович

Applicant(s): INST OF IRRIGATED HORTICULTURE OF UKRAINIAN ACADEMY OF AGRARIAN SCIENCES [UA] ±

Classification:
- international:
- cooperative:

Application number: UA19843719361 19840104

Priority number(s): UA19843719361 19840104

Abstract of UA16331 (A1)

Translate this text into

patenttranslate powered by EPD and Google

The invention relates to **agriculture**, irrigated horticulture and can be used while irrigating perennial crops by means of combining several irrigation methods. An irrigation method includes distribution of an irrigation rate. For the purpose of maintaining the optimum soil moisture, improving the parameters of micro- and phytoclimate in the irrigation area while **saving** the **water**, the distribution of the irrigation rate is carried out by means of daily combined irrigation with simultaneous local moistening the soil, aerosol moistening of surface air and leaf surface of plants.

Figure 10 - Overall Classification

Symbol	Classification and description
<input type="checkbox"/> A	HUMAN NECESSITIES
<input type="checkbox"/> B	PERFORMING OPERATIONS; TRANSPORTING
<input type="checkbox"/> C	CHEMISTRY; METALLURGY
<input type="checkbox"/> D	TEXTILES; PAPER
<input type="checkbox"/> E	FIXED CONSTRUCTIONS
<input type="checkbox"/> F	MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING
<input type="checkbox"/> G	PHYSICS
<input type="checkbox"/> H	ELECTRICITY
<input type="checkbox"/> Y	GENERAL TAGGING OF NEW TECHNOLOGICAL DEVELOPMENTS; GENERAL TAGGING OF CROSS-SECTIONAL TECHNOLOGIES SPANNING OVER SEVERAL SECTIONS OF THE IPC; TECHNICAL SUBJECTS COVERED BY FORMER USPC CROSS-REFERENCE ART COLLECTIONS [XRACS] AND DIGESTS

Figure 11 - Classes for Agriculture and Water

Symbol	Classification and description
★★★★ <input type="checkbox"/> A01C 1/00	Apparatus, or methods of use thereof, for testing or treating seed, roots, or the like, prior to sowing or planting (chemicals therefor A01N 25/00 - A01N 65/00 {irradiation in general B01J 19/08 })
★★★★ <input type="checkbox"/> A01G 25/00	Watering gardens, fields, sports grounds or the like (special apparatus or adaptations for fertilising-liquids A01C 23/00 ; nozzles or outlets, spraying apparatus B05B)
★★★★ <input type="checkbox"/> Y02A 40/00	Adaptation technologies in agriculture, forestry, livestock or agroalimentary production
★★★★ <input type="checkbox"/> C12N 1/00	Microorganisms, e.g. protozoa; Compositions thereof (medicinal preparations containing material from microorganisms A61K 35/66 ; preparing medicinal bacterial antigen or antibody compositions, e.g. bacterial vaccines A61K 39/00); Processes of propagating, maintaining or preserving microorganisms or compositions thereof; Processes of preparing or isolating a composition containing a microorganism; Culture media therefor
★★★★ <input type="checkbox"/> C05G 3/00	Mixtures of one or more fertilisers with additives not having a specially fertilising activity
★★★★ <input type="checkbox"/> C05F 11/00	Other organic fertilisers
★★★★ <input type="checkbox"/> C02F 1/00	Treatment of water, waste water, or sewage (C02F 3/00 - C02F 9/00 take precedence)
★★★★ <input type="checkbox"/> A01G 7/00	Botany in general
★★★★ <input type="checkbox"/> Y02A 20/00	Water conservation; Efficient water supply; Efficient water use
★★★★ <input type="checkbox"/> G01N 33/00	Investigating or analysing materials by specific methods not covered by groups G01N 1/00 - G01N 31/00

Use of the Patent Pulse system

The Patent Pulse system allows querying one or more databases as described at the beginning of this article. The results can be examined one by one. You can also analyse all of the results to find out about the different applications and protected products, the filing companies, the inventors, the links between the technologies used, etc.

The result of the query: ‘water AND saving AND agriculture’ limited to the years 2015-2021 leads to 851 patent families (a patent family is made up of patents

which cover the same invention, but which have different numbers when they are extended in various countries).

We can then make all the possible correlations between the concepts extracted from titles and abstracts, applicants, inventors, international classification, priority filing dates, etc. (For more information on the subject see Dou & Bai, 2007). The various figures and lists indicate an extract of the possible correlations.

From the search above, a group of 304 family patents records appears automatically. We will perform various correlations on it. A quick analysis of the group indicates

Figure 12 - List of Concepts and User Choice

The screenshot shows a patent search results page. On the left, there is a list of patent entries with details such as IPC classes, priority dates, and titles. On the right, there is a 'Concepts' sidebar with a search bar and a checklist of concepts. The concepts listed include: Water-saving (112), Agricultural Irrigation (76), Water-saving Irrigation (70), Irrigation Device (69), Saving Water (60), Agriculture Water (59), Irrigation System (58), Preparation Method (46), Watering Device (45), Method Thereof (39), Agricultural Water-saving (37), Saving Agriculture (37), Intelligent (34), Irrigation Water Saving (24), Method For Water (34), Equipment (30), Heat (28), Multifunctional (25), Pipe (24), Cultivation Method (23), Drip Irrigation (23), Agriculture And Forestry (20), Modern Agriculture (19), and Machine (18). The 'Water-saving' concept is checked.

the presence of a majority of Chinese patents. Indeed, China currently produces at least half of the available patents and, in several sectors vital for the country, it can represent more than 80% of the total. In our study, the split corresponds to China 328, Russia 4, Japan 2, US 1, IL 1. On the other hand, Chinese patents are scarcely extended internationally. As a consequence, they constitute a major source of information we may use outside the jurisdiction (For more information on this type of use, see Dou & Dou, 2013). The chosen concepts versus the main applicants are represented in the network shown in figure 13.

The evolution of the concepts chosen according to the dates can also be followed, as shown in Table 2.

Thus, according to needs, someone can explore the totality of the research. It will offer a global vision of the various technologies studied and of the actors present. One can also go deeper into the subject: by using the websites of the universities involved; by looking at the scientific publications of the inventors; etc. It is also possible to transfer patent notices into *Matheo Analyzer* to perform an even more in-depth analysis, by selecting groups of authors, companies, concepts and exploring the

Figure 13 - Concept Network versus Main Applicants

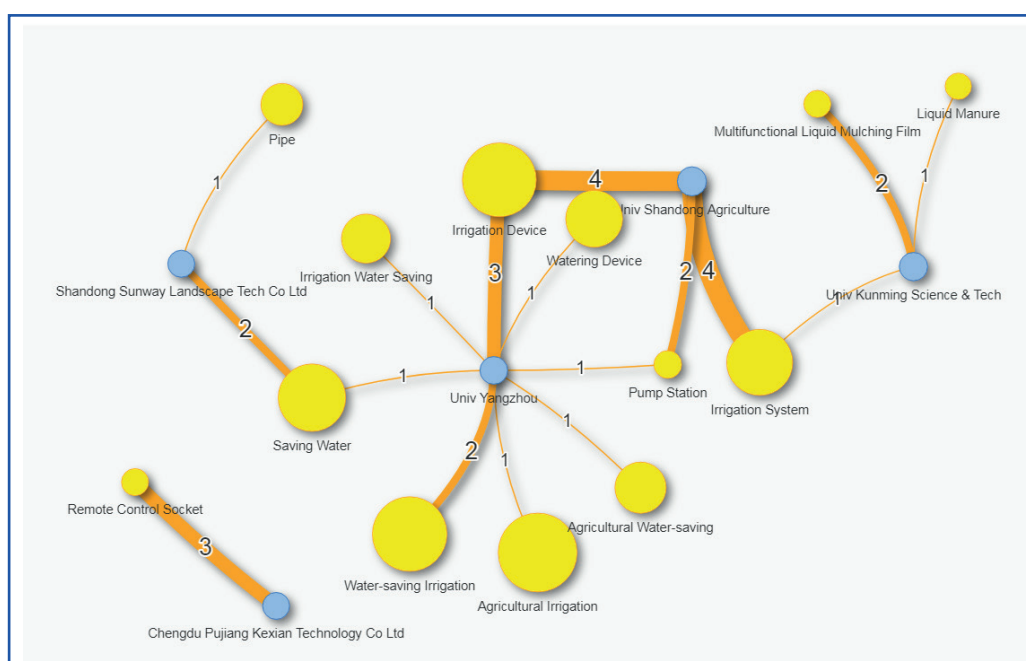


Table 2 - Evolution of Concepts Over Time

	2015	2016	2017	2018	2019	2020	2021	Total
Agricultural Water-saving	2		1	4	8	14	1	35
Cleaning Device			1	1	2		1	7
Cooling System				1				3
Device For Automatically				2		1		9
Drip Irrigation Belt								1
Drip Irrigation Zone			2					3
Efficient Water-saving	1		1		2			5
Hydraulic Automatic			1					2
Irrigation Pipe		2	2		2	2		9
Irrigation Water Saving		10	7	4	4	1		27
Liquid Manure				2				2
Management And Control				1	1			2
Modern Agriculture Water		2	2	1	1	1		7
Multifunctional Liquid Mulching Film				2				2
Oxygenation Device		1			1	1		3
Pesticide Spraying				1	1	2		4
Pipe		3	2		2	3		15
Plastic Pipe								1
Pump Station						1		3
Reducing Valve	1							2
Remote Control Socket	1							3
Spraying Equipment			1		1	1		3
Water-retention Type		1			1			2
Water-saving Fertilizer-saving				1				3
Water-saving High					1			1
Water-soluble Fertilizer		2	3	2		1	1	9
Agricultural Irrigation	4	6	12	15	13	15	1	69
Automatically Cleaning			1					3
Circulating Irrigation System					1	1		3
Drip Irrigation	1		6	2	3	4		20
Saving Water		13	10	7	7	1	1	43
Spraying Device	1		1	2	1	3		14
Water-retaining Agent			1	2		1		5
Water-saving Irrigation	10	1	3	7	16	13		61
Equipment	2	1	5	6	4	6		28
Irrigation Device	3	4	10	5	10	13		58
Irrigation System	6	3	12	10	7	5		55
Watering Device		5	2	5	5	3	1	31
Grand total	32	54	86	83	94	93	6	553

Table 3 - Portfolio Analysis Table of Content	
Selected Applicants	Sectors
Countries of Applications	Top Fields
Global Trend of Applications	Focus on International Patent Classification
Application Trend by Countries	Macro Analysis: Main Top Class
Co-Applicants	Main Top Groups
Top Inventors	Trend of Top Groups
Trend of Inventor	Trend of Top SubGroups
Wipo Classifications	Last Publications (Sorted by Publication Date)

Annex: International Patent Classification; Global List of Inventor

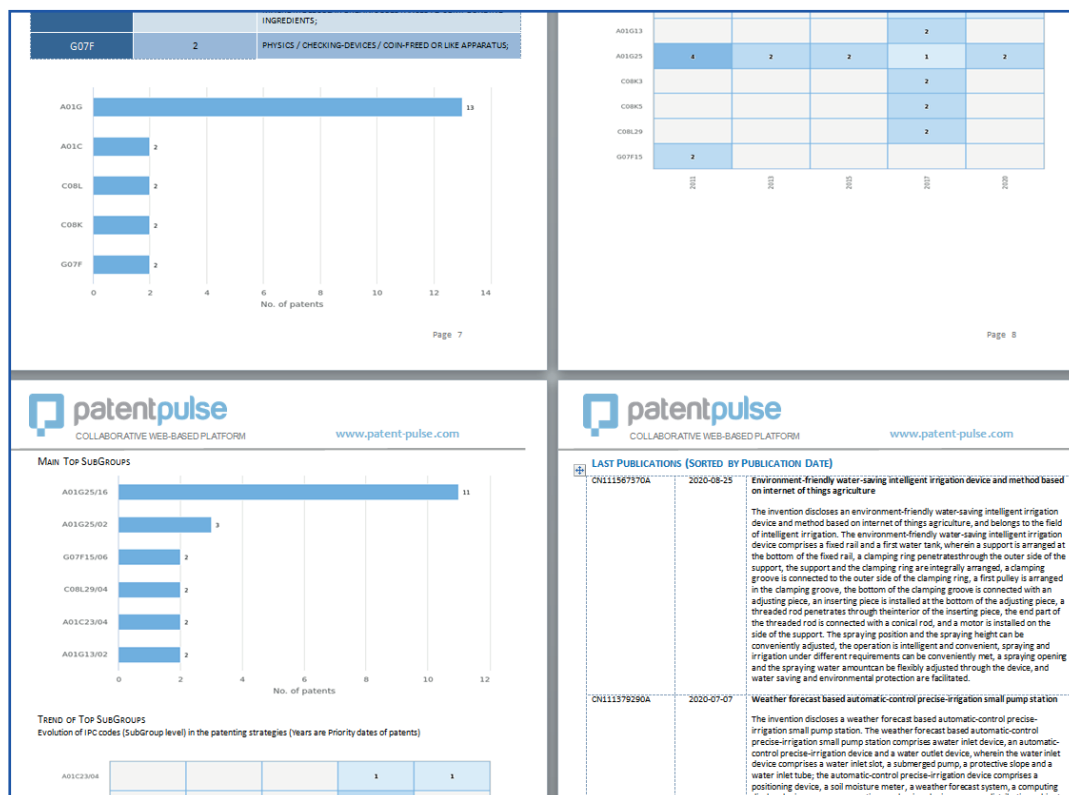
various possible combinations. Finally, to make things easier for the user, Patent Pulse generates automatic reports in Word format: Brief Analysis Report; Complete Analysis Report; Portfolio Analysis Report; List of Patents (according to selection) or; First Pages of Patents (according to selection). The summary of the Portfolio is illustrated in Table 3.

Figure 14 shows an extract from the Portfolio analysis of the three main universities: Univ Shandong Agriculture, Univ Yangzhou, and Univ Kunming Science & Tech which are the 3 main applicants, with the different lists, matrices, and patent notices as indicated in Table 3.

Literature Review

The patent literature (Desheng, 2012; Sarnoff, 2011; Cavalheiro *et al.*, 2021; Wang & Li, 2008), scarcely cited in academic work, provides an overview of the technical applications of many inventions. In this regard, it is useful to understand the link between fundamental research and real applications. (Dou *et al.*, 2005; Dou & Kister, 2016; Dou, 2015; Marešová *et al.*, 2021). The rise of different stresses such as pandemics, weather change (with all its impacts: temperature, ocean level, impact on water supply, etc.) boosts the demand for and development of this ‘new’ academic field (Reekie, 1973; Campbell, 1983;

Figure 14 - Analysis of Univ Shandong Agriculture, Univ Yangzhou, Univ Kunming Science & Tech



Mogee, 1991). Patent analysis considers and explores millions of documents validated by patent examiners, through the international WIPO (World International Patent Organization) or local offices. It offers to decision makers an overview of what can be applied according to circumstances (Kyebambe, *et al.*, 2017).

The geographical position of islands, their economic dependences on tourism or on locally developed activities, strengthens the impact of said stresses. Also, in order to solve the problems that do appear, it is vital to allow access to an up to date worldwide knowledge and access proven technical solutions. Such an approach will offer politicians and decisions makers a large spectrum of solutions that have been developed or implemented elsewhere. It will also allow access to the names of inventors, addresses of firms as well as exploring the scientific background of given research.

Conclusion

The impact of climate change is likely to increase in the years to come. Islands, by their geographical position, will be quickly impacted. It is therefore essential to ask questions about the available solutions could be implemented in order to reduce the effects of this change. No available advances and useful applications should be left apart or unused.

While remaining at the level of science and technology, the volumes of available data make it necessary to use Scientific Information Analysis as well as Patent Analysis. These two approaches combined, will support strategic decision-making processes and future decisions. This is the meaning of the work presented here, which aims at showing how a simple methodology, accessible to all, allows one to achieve significant results. This methodology is general. This is a global approach that makes it possible to consolidate Islands' Competitive Intelligence Activities. This approach will provide, support beyond speech, validated data as well as possible fields of application. The questions to be resolved are obviously multiple and the approaches may differ from one situation to another. The approach requires customisation by experts. However, understanding, what to do, acquiring the methodology and conducting experiments with it, are the necessary first steps.

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