SCIENTIFIC INTERESTS OF PETROLEUM SPECIALISTS IN THE AREA OF BIODIVERSITY

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Resumo

Os riscos da indústria do petróleo para os ecossistemas levaram a maioria das companhias a exercer ações no sentido de mitigar os impactos. Neste sentido a escolha de métodos e processos mais adaptados ao negócio do petróleo depende do entendimento aprofundado das tecnologias disponíveis. O presente trabalho visa a identificar as necessidades tecnológicas e de conhecimento na indústria do petróleo na área de biodiversidade. Nos últimos 3 anos os autores vêm trabalhando com o setor corporativo de biodiversidade de uma indústria do petróleo, tendo identificado os focos e interesses para a geração de conhecimentos. O processo de identificação de interesse foi construído a partir da seleção de trabalhos científicos, relatando tecnologias, que foram submetidos à aceitação ou recusa por parte dos técnicos da companhia. Foram identificados 400 artigos abrangendo os anos de 2004 a 2007, dos quais foram selecionados 190. A partir dos trabalhos selecionados, foram identificadas as palavras-chave preferidas, nomes de periódicos mais selecionados, autores mais freqüentes nas seleções. Conclui-se do trabalho que a empresa foca seus interesses em trabalhos aplicados à mitigação dos impactos da indústria do petróleo na biodiversidade. Verificou-se ainda que muitos destes trabalhos são realizados por empresas privadas, que algumas vezes disponibilizam os resultados em seus sites, mas na maioria dos casos são relatados em relatórios que não estão disponíveis para o público. Quando trata-se de preservação da biodiversidade, as experiências individuais das empresas deveriam ser disponibilizadas para estudo e desenvolvimento dos processos de impacto.

Abstract

The environmental risks of the petroleum industry have driven most of the companies to proceed for the mitigation of its impacts. In this sense, the choice of methods and processes that are better adapted to the petroleum business depends on the improving of the knowledge of most recent technologies. This article aims to identify the technological and knowledge needs of the petroleum industries in the area of biodiversity. For the last few years, the authors have been working with the biodiversity corporate department of a petroleum company and throughout this period, the researchers were able to identify the staff focus and interests for the generation of knowledge. The identification of the desired knowledge was constructed based on the selection of scientific papers that were sent to the company staff, who evaluated its concern. Over 400 articles were sent to the company staff that were published between 2004 and 2007 and about 190 were selected. From the selected pool of articles an analysis of the keywords, name of journals and most frequently selected authors. It is concluded that the petroleum company focused its scientific interests in applied subjects. It was further verified that a considerable amount of work has been carried out by petroleum companies that, sometimes make their reports available in their home pages, but it is probable that many works remain unpublished.

1. Introdução

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The harm that petroleum industries poses to the ecossistems, took most of the companies to develop a very serious concern on the effects their activities may cause on biodiversity. Presently, most of these companies have staffs of biological scientists that have to deal with state-of-art information. The application of this state-of art technology for biodiversity protection in the petroleum industry is the key for the excellence in health safety and environment.

Despite of the number of professionals dedicated to that area, the activities they are involved into let them very little time for reading the flood of essential scientific and technologic literature that comes out every month. The needs of the environmental professionals of the petroleum industries for being kept informed, with a minimum effort, took our research group to develop a tool that identify and digests this information, presenting it in an easy reading format. For the last three years we have been working with this tool in a petroleum company, identifying their interest and providing them with scientific articles and other publications. Briefly, the process starts with a broad selection of articles in scientific bases like SDOL®, Web of Science®, Google Academic®, where a conceptual search rather than a simple key-word search is carried out. In the example bellow, instead of simply choosing the key-word "biodiversity monitoring", a definition of this concept is given:

> "Biodiversity monitoring: The articles that should be searched in this subject should present monitoring programs of the biodiversity of areas affected by the petroleum industries. Articles that addresses specific methodologies to monitor the impacts of the petroleum industries are also suitable."

This example definition may yield a variety of keywords and combination of keywords that broaden the search. For instance: forest* and "endangered species" and (petroleum or oil). Details on this tool were presented by Wasserman et al (2006).

A number of conceptual definitions were validated by the company specialists and the search for articles pass through a thorough validation by these professionals. Therefore, the selection of themes and articles which meta-analysis is presented in this work represents the real interests of the petroleum industries.

In the present work the articles were organized into groups of subject as described by their keywords and a meta-analysis of the literature was carried out, showing which are the scientific interests of the petroleum specialists in the area of biodiversity.

2. Methods

In order to select articles that collide the interests of the specialists of the petroleum companies, the search started by the definition of the subject. A complete list of these subject was prepared in order to better drive the articles selection (Figure 1). The definition of a subject should be the result of a broad survey of "what is being currently discussed" in the petroleum industry. So, if a tanker has spilled oil in a coastal environment, in that moment we should focus on the impacts of these accidents on the mangrove vegetation. Another example is when the IPCC reports were released, we searched for works on the impact of global changes on the biodiversity.

After the definition of the subject, a broad selection of ten or more articles is made by our junior researchers. This selection is narrowed by the senior researcher to not more than five articles. These five articles are sent to the company specialists who will choose the articles that are consistent with their interests. This methodology took us to overview their interests in the area of biodiversity.

A significant restriction for the research was that only recent (less than two years) articles should be selected, therefore, in the present paper the figures are restricted to the years 2004 through 2007.

Biodiversity and the petroleum industry	a. **Governance:** Actions for the construction of a corporate social responsibility in the petroleum industry, focusing on the preservation of the biodiversity. Articles should describe desired actions like management of productive processes preserving biodiversity, biodiversity recovery programs, ecological certification, new raw materials that do not affect the biodiversity. b. **Sensitive and vulnerable areas (sensitivity maps):** Due to the dimension of its operations, the petroleum industry is responsible for considerable impacts. However, the activity is particularly harmful in sensitive areas like macrophytes stands, mangroves and coral reefs. The understanding of these environments may help its preservation. c. **Prospecting and sustainable use**: Within the petroleum industry, the word prospecting involves any type of research for the characterization of petroleum deposits. Among the methods that affect the biodiversity, low frequency seismic or drilling and generation of cuttings constitute treat. d. **Conservation units:** With the continuous need for new petroleum deposits, the impacts of the activity on conservation areas tend to improve. The development of less impacting activities that engender smaller impacts in neighboring areas are necessary for the maintenance of the production. e. **Traditional communities:** The same way as the conservation units, the petroleum industry need new technologies to reduce impacts on tradiotional communities f. **Participating processes in sensitive areas:** Beside the up-to-date technologies that reduce the impacts of the petroleum industry in neighboring areas, the dialog with the society has shown to be a major point for the sustainability of the activity. g. **Rare and menaced species:** This theme is based on three lists of manaced species, produced by the Brazilian Government, by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and by the Red List of the International Union for the Conservation of Nature (IUCN). Methods and management procedures for the preservation of these species are focused in this theme. h. **Biodiversity monitoring:** The articles that should be searched in this subject should present monitoring programs of the biodiversity of areas affected by the petroleum industries. Articles that addresses specific methodologies to monitor the impacts of the petroleum industries are also suitable. i. **Environmental valuation and compensation:** Valuation of natural resources can be tightly associated with environmental compensation, mainly if the biodiversity is to be considered. The understanding of techniques and methods, as well as the identification of regional studies should constitute a major interest for petroleum industry. j. **Bio-fuels:** The industry of bio-fuels has been improving in Brazil, mainly because it constitutes an alternative for fossil fuels and climate change. In this theme, knowledge on the economic setup of bio-fuels projects and experiences on new bio-fuels are to be focused.
Evaluation of the impacts on the biodiversity	a. **Indicators of biodiversity in areas under impact of the petroleum industry:** In many areas where petroleum activities are developed, reduction in the biodiversity can be observed. Information on new indicators of this biodiversity may help to establish mitigation actions for the recovery of the system. b. **Emerging Ecosystems:** New ecosystems are emerging from the introduction of exotic species and from the anthropic modification of the environmental conditions. The Man and the Biosphere Program (UNESCO/MAB) and the Scientific Comittee on problems of the Environment (SCOPE) recently started a discussion on the formation of emerging ecosystems and what issues are expected for the whole planet (http://www.icsu-scope.org/projects/cluster2/EE.htm). c. **Fishing:** Although the petroleum industry has developed procedures in order to reduce environmental impacts, the pressure over fish populations is still elevated. In this theme, it is expected to that a better understanding of how petroleum exploration and production may affect ocean fish stocks. d. **Biomarkers of the greenhouse effect:** Undoubtedly, the petroleum industry increases the world's greenhouse effect that causes climate changes. Biomarkers like mangroves may show how sea level rise may change the biodiversity in the coast line.
Recovery and Restauration	a. **Mitigation and management of degraded areas:** What is it to be done in degraded areas, in order to recover biodiversity? b. **Decommissioning:** Petroleum rigs can last between 20 and 40 years and their decommissioning must be carried out carefully because there is a whole ecosystem that is associated during the operation period. What are the less impacting procedures for the withdraw of this production and exploration units? c. **Ballast water and its impacts on the biodiversity**: The introduction of exotic species may significantly impact the biodiversity. What techniques are being develop worldwide to mitigate transfer of exotic species through ballast waters?

Figure 1: Themes for research divided in sub-themes and their explanation.

Acts and Regulations

> a. **Critical analysis of Governmental Acts:** In this theme articles concerning Regulations and Governmental Acts are to be selected and analysed
> b. **Perspective for the evolution of the Laws, Acts and Regulations:** Knowledge on the larger picture of the evolution of Governmental view may help to improve the discussion for better and best adapted legislation and regulation.

Figure 1: Continued. Themes for research divided in sub-themes and their explanation.

3. Results and Discussion

The broad selection (ten articles per month) has yielded over 400 articles but these were not calculated in the present work, for they were not considered to be of interest for the specialists. The selection process permitted the identification of 190 articles from the years 2004 to 2007. The selected documents were recorded in a bibliographic software, that permitted the organization of the over 1100 keywords used in the selected articles. Besides, it was possible to identify the most used keywords that include the following: biological indicators, environmental impact assessment, management, marine environment, oil spill, plankton, population, quality, risk, sediment, soil, sustainability, toxicity, water. Among the 90 journals, where the articles have been published, it was possible to identify which are preferred by petroleum specialists. The journal Marine Pollution Bulletin was the most selected with 23 articles. The journals Ocean and Coastal Management, Ecotoxicological and Environmental Safety and the SPE journals also contributed with a number of articles. The list of over 700 authors permitted to observe that very few authors appeared many times. The group of A.M. Breure and J. Rombke appeared 4 times and the groups of C. Mulder, M.J. Kaiser and A.P.C. Faaij appeared 3 times.

It can be concluded that there is a very restricted scientific literature that is effectively applied to the solution of the petroleum industry problems. This is probably due to the fact that most of the work that is needed to solve environmental and biodiversity problems are not published, constituting internal reports within the companies. We would advise the companies to open there data, at least as far as environmental issues are concerned. Furthermore, the petroleum industry data should published in the wide circulation journals that would confer reliability to the information.

7. Aknowledgements

8. References

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