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MASTERS THESIS DISSERTATION

DEFINING A MANAGEMENT STRATEGY FOR THE AZOREAN NATURAL THERMAL RESOURCES: VALUING CRITERIA IDENTIFICATION

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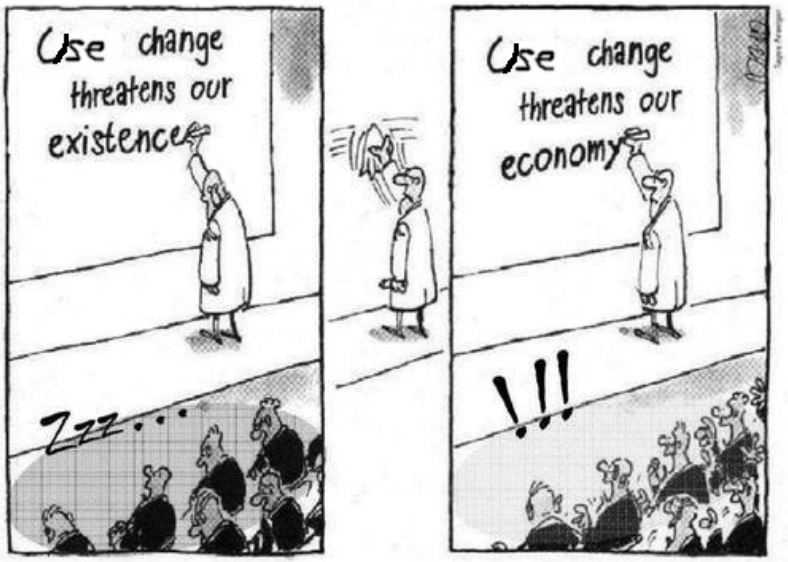

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RESUMO

Recursos termais são importante para as regiões onde ocorrem e, em alguns casos, são pedras angulares para o desenvolvimento económico. Os Açores não são excepção. O presente trabalho é uma primeira abordagem europeia desta natureza e pretende ser um estudo académico exploratório. Uma natureza diversa de recursos termais promove uma diversificação de usos, especialmente no caso dos Açores, uma pequena área geográfica descontínua. Não existe actualmente no arquipélago nem uma compilação nem uma quantificação adequada de usos de recursos termais. No entanto, o desenvolvimento socioeconómico, com base na utilização destes recursos naturais, faz parte da estratégia governamental regional. O aumento da procura não só irá aumentar a pressão sobre a sua exploração, mas também, eventualmente, impulsionar o aparecimento de conflitos de interesses em áreas em que os usos se sobrepõem. Nenhuma informação de base está disponível no momento. Os dados gerados pelo presente trabalho podem ser uma base de trabalho que permitirá futuros estudos e/ou projectos na área, proporcionando uma melhoria na identificação dos problemas e questões a ser endereçadas, a fim de desenvolver uma estratégia de gestão coerente com o uso de recursos termais dos Açores.

Um painel internacional de especialistas selecionou, a partir de uma extensa lista compilada e facultada durante este estudo, os usos de recursos termais naturais mais comuns que consideraram importantes. Os usos relacionados com utilização da energia termal foram os mais referidos, seguidos de usos tradicionais no campo da saúde e bem-estar, não sendo esquecida a importância de usos directos específicos como a "cozinha geotermal". Os critérios económicos de valorização (diretos e indiretos) foram os principais critérios escolhidos quando pedido para atribuir valor aos recursos termais naturais. A estes critérios, seguiu-se o valor relativo à saúde pública associado à utilização dos mesmos. A capacidade de criar emprego (direto e/ou induzido) ocupou a quarta e a quinta posição do ranking dos critérios de valorização. O valor dos recursos termais naturais como potencial uso de lazer, as diversas funções de serviço de ecossistema que garantem, o valor de não-uso com fins altruístas, e a importância da existência dos recursos como promotores de conhecimento e de inovação completam a lista dos dez critérios de valoração mais relevantes para o painel internacional de especialistas.

O uso dos recursos termais açorianos pode potenciar o desenvolvimento regional de forma transversal nas diferentes áreas estratégicas prioritárias para a região. Estes recursos podem proporcionar o aparecimento de produtos únicos, distintos e diferenciados na região, contribuindo assim para aumentar a base de exportação regional. Apesar do presente trabalho ter sido desenvolvido no âmbito académico pretende-se que as informações aqui fornecidas sirvam de base para o desenvolvimento de uma estratégia de gestão adaptativa, consertada e unificante (ambiental e económica) para os recursos termais do arquipélago dos Açores.

ABSTRACT

Thermal resources are of major importance at the regions where they occur and, in some cases are cornerstones to their economic development, the Azores are no exception. The current work is the first approach to this subject in Europe and aims to be an exploratory study. In the Azores the diverse nature of thermal resources promotes a multitude of uses within the small geographical area. A resource accurate quantification is non existent. Socioeconomical development based on use of this natural resource is part of the regional governmental strategy. The rise of the demand will not only increase pressure on the resources exploitation, but will also eventually led to the rise of conflict of interest in areas with overlapping needs. No baseline information is currently available. The data generated by the present work can help launch a preliminary framework that will enable future developments within the field. One expects also that this work will lead to a better identification of the problems and questions that need to be addressed in order to develop a coherent management strategy for the use of the azorean thermal resources.

Frequent and putative uses of natural thermal resources were selected from an extensive list of uses supplied to a panel of international experts. The energy related uses where the most often selected, followed by traditional uses within the field of health&wellness, not to be forgotten the importance of geothermal direct use as the geothermal cooking. The economical valuing criteria (direct and indirect values) were chosen as priority valuing criteria when planning for and, evaluating, the use of the natural thermal resource. Values related with public health were the next valuing criteria selected, followed by the ability to create jobs (direct and/or induced). The value attributed to leisure and relaxation activities that thermal resources can provide for residents and visitors, the value inherent to the several ecosystem functions, the value of non-use for altruistic purposes, and the value attributed to the putative knowledge&innovation development use leverage that this resource provides completed the top 10 most important valuing criteria.

It is our understanding that the use of azorean thermal resources can enhance the regional development across the various priority sectors, giving rise to unique products (services as well as goods) within the region, and improving the regional exportation level. The present study was developed as an academic exercise, nevertheless it is intended that the information provided in this document will assist in creating a unifying, adaptative environmental and economic management strategy for the use of this resource within the Azores.

to my father that after all this time is finally thinking that was not just natural sciences after all, and… that "his numbers" finally talked to me…

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It was only possible to develop the greater body of this project with the help and support of various people. Since it is impractical to name each person that has been, in some instance, involved in this project, I would like to acknowledge them as a whole and then name a few that I would like to especially thank.

I would like to acknowledge all the people from the Biology and the Economy departments at the University of the Azores, Portugal, that supported, encouraged, and helped start this research project. Among these, I would like to let you know that quite a few influenced strongly my carrier choices. A special thanks to Dr. Pedro Pimentel that, as the MBA coordinator, accepted my application to the MBA program in 2012 and gave me the chance to develop the present project with a better understanding of the total valuing of resources.

This project would not even had taken place if, even in the midst of their busy schedules, all the international experts had not accepted the challenge of replaying to the project´ survey.

I cannot thank enough my advisors Dr. João Pedro Couto, for his invitation and challenge, and for Dr. Helena Calado support. Both accepted the hard task off keeping me going and above all they always believed that we could do it! Their input was invaluable and their love for science, seen through questions and constructive criticism in our discourse, helped enrich each section of this thesis.

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1 INTRODUCTION

The present dissertation was developed within the *Masters in Business and Administration* framework, ministered by the Department of Economics and Management, University of the Azores (Despacho nº 22 547/2006). The research project here presented was planned and developed as an academic exercise and, as a preliminary outcome of the use of interdisciplinary competencies of the author (life sciences and environmental management, in conjunction with economic and management skills, more recently acquired).

It is intended that this exploratory interdisciplinary framework, outlined within the present study, will not only assist in informing regional policy, but will also be used as the basis for submission of new, more into depth, projects.

The Azores archipelago is formed by nine volcanic islands located in the North Atlantic Ocean, separated by the Mid-Atlantic Ridge oceanic spreading center. The Azores are the emerge territory of the officially Autonomous Region of the Azores (Região Autónoma dos Açores-RAA), one of the two Portuguese autonomous regions. The diverse nature of azorean thermal resources, associated to the small geographical area in which they occur, leads to the development of a myriad of potential uses for which there is no accurate resource quantification.

Thermal systems harbour unique ecosystems that contribute with several ecosystem services at the regions where they occur. This ecosystem services list is not as yet correctly identified nor quantified for the Azores. The gross domestic product (GDP) generated by tourism is increasing within the region and new emerging touristic trends, in combination with increased demand for new touristic products, are also a current reality at the archipelago. At the Azores, growth within the energy and tourism sectors is expected within the near future and, will lead to an increase in the monetary contribution to the regional economy. In what concerns azorean thermal natural resources most direct uses of geothermal energy occur only at small, localized areas within the archipelago, exception being made to use related with bathing and touring activities. Nevertheless, this restricted localized areas of use are highly important within the primary and tertiary economic sectors, specially in terms of employment creation. While azorean natural thermal resources use across activity sectors are not mutually exclusive, overlapping conflict areas may arise and, increase in number within the near future.

The azorean government established, starting in 2014 until 2020, three priority areas for regional development: - agriculture, livestock and agribusiness; fisheries and sea; and tourism; in order to comply with the european *Strategy for Research and Innovation for Smart Specialization* (RIS3)

(Governo Regional dos Açores, 2014). The use of the Azores´ natural thermal resources can enhance the region´s competitiveness among all three (3) selected strategic dimensions, but thermal resources current protection status and management strategies are, at this stage, confusing (Aguiar and Costa, 2010; Oliveira, 2009; Secretaria Regional da Agricultura e do Ambiente, 2011). During the last decade the regional government has invested highly in the promotion of the Azores as a Health&Wellness touristic destination (Nunes and Carvalho, 2009). Unfortunately the integration of several other valuing aspects of the use of the azorean natural resources did not follow up. The challenge for policy makers is in determining what combination of uses will yield higher net benefits, while avoiding irreversible effects that can impact negatively, at short and at long-term the azorean community well-being as well its welfare.

Thermal resources are of major importance in most areas and regions where they occur and, in same cases, are cornerstones or leverages for the economic development, *e.g.*, Iceland, New Zealand, and Hawaii. While it may be clear that Iceland´s thermal resources are an economic cornerstone within the country´s current economy, at other geographical areas the natural thermal resources net contribution is not as easily perceived, as for example in New Zealand. For those countries valuing criteria have to be defined in order to more efficiently estimate its value, as well as for the development of a sustainable management use strategy. The Azores archipelago has similar characteristics to New Zealand in what concerns the nature, resources diversity, and diversity of uses of its thermal natural resources.

Thermal resources can enhance the economic development in sectors like tourism and energy as well as by providing an array of ecosystem services. Current social and technological developments increase the demand on such resources, placing higher pressure on the natural resources exploitation which, in turn, tend to increase conflicts of interest in areas where uses overlap. Thus, requiring a careful and more efficient management strategy to the resources “keepers”.

Overlapping conflicting areas in a non managed development scenario leads to increase pressure over natural resources. Hence, non managed use can lead to economic loses due to depletion, temporary loses, and irreversible loses of the resources. This outcome can have more acute expressions at small, discontinous regions like the Azores archipelago, where these resources are highly diverse in nature, but with limited localized geographical expression. A careful management strategy of such resources may be key to assure its maintenance as well as to enable the social development of the local population at medium and long-term and, to maximize the resources use potential.

Presently, a baseline information database with uses and valuing criteria that allow for an up-to-date total value estimation of the Azores natural thermal resources is nonexistent. The sustainable exploitation of such thermal resources, within different sectors, may lead to an economic and social

improvement due to direct and indirect economic effects. In order to better promote a sustainable use of the resources it is necessary to develop a valuing criteria system that allows not only for a better estimate of the resources´ total value, for present and future stakeholders, but above all allows for the establishment of uses priority according to sounded valuing criteria.

It should be possible to identify areas of eventual rise of conflicts where overlapping uses occur (FAO, 2000). Therefore, it is vital to develop an adequate conceptual management model where the right valuing criteria are identified. A step-wise development plan for geothermal resources is a methodology that takes into consideration the individual conditions of each geothermal system, and minimizes the long-term production cost. This allows for a sustainable development based on the available geothermal natural resources and results in an attractive economic way to use these natural resources to their maximum potential without jeopardizing their future use (Björnsson, 2010).

The current work is the first interdisciplinary approach to this subject in Europe and, aims to be an exploratory study. It is expected that the data generated by the present work can help launch a preliminary framework that will enable future work within the field and that will lead to a better identification of the problems and questions that need to be addressed in order to develop a coherent management strategy for the use of azorean natural thermal resources. It is vital, before delineating a strategic management plan, to identify the valuing criteria that are most important to have in account as descriptors so that the conceptual framework is adequate to the region and to the resources being managed. Therefore, it is necessary to identify which are the most important valuing criteria for the use of thermal resources within a geographical region such as the Azores.

The main goal of this project is to identify priority valuing criteria for geothermal resources at the Azores that may facilitate the decision process when designing an adequate strategic management proposal, at medium and long-term, that would be capable of maximizing the economic and social return for this resource´s utilization.

The present dissertation was structured in five (5) main chapters with a first introductory chapter where the main goals of the project are outlined. Follows a chapter (2) where the project framework is laid out and some conceptual issues are presented (2.1); types of uses and examples of their impact and application are explored (2.2 and 2.3) giving special attention to geothermal resources uses related with tourism (2.2.2 and 2.2.3) and energy (2.3); examples of increased demand reflection on the resources management, as well as, examples of conflicts recorded in some developed countries (2.4); overview of concepts and currently valuation criteria for natural resources (2.5); and, the present status and uses registered for the azorean thermal natural resources (2.6). The methodology used on the development of the present work is outlined within chapter three (3) and, was divided in sub-chapters in which the first two are used to better explain the geothermal

resources use selection (3.1) and the valuing criteria working list (3.2) while the last two contain the information referring to the experts panel used to develop the present project (3.3) and data collection as well as its analysis (3.4). The results are subdivided on the experts panel analysis and outcome regarding the thermal uses selection (4.1) and the identification and priority within the valuing criteria selection (4.2). The later encompass results regarding valuing criteria identification but also an analysis of the panel composition influence in this selection. The discussion and conclusions are outlined in chapter five (5) which includes some brief conclusions, theoretical and practical applications of the work developed as well as limitations and future work remarks.