SPATIAL AND ORGANIZATIONAL DYNAMICS

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SPATIAL AND ORGANIZATIONAL DYNAMICS

Environment and Land Use Management

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URBAN PLANNING THROUGHOUT ENVIRONMENTAL QUALITY AND HUMAN WELL-BEING

PLANEAMENTO URBANO ATRAVÉS DA QUALIDADE AMBIENTAL E DO BEM--ESTAR HUMANO

José Antonio González Duque
Thomas Panagopoulos

ABSTRACT

The cities of today present some requirements that are not similar to the past. There are cities that the industrial and service sectors are in decline; others begin their journey into the technological and industrial sector. In general, politically and socially are restructured in terms of its economy, which results in an entirely different shape to their primitive structures. As people begin to understand the dynamic nature of landscapes, they will change the way they see the landscape as a static scene. Sustainable cities must be simultaneously economically viable, socially just, politically well-managed and ecologically sustainable to maximize human comfort. The present research suggests a multi-disciplinary approach for a holistic understanding of urban environmental quality and human well-being in sustainable urban development.

Keywords: Well-being, Urban planning, Liveable city, Environmental quality.

RESUMO

As cidades de hoje apresentam alguns requisitos que não são semelhantes do passado. Existem cidades que os sectores industriais e de serviços estão em declínio e outros apenas iniciam a sua jornada para o sector tecnológico e industrial. De um modo geral, politicamente e socialmente são reestruturadas em termos de sua economia, o que resulta na transformação das suas estruturas iniciais. Como as pessoas começam a compreender a natureza dinâmica da paisagem, muda a maneira que eles vêem a paisagem como um cenário estático. Cidades sustentáveis devem ser simultaneamente economicamente viáveis, socialmente justas, politicamente bem geridas e ecologicamente sustentáveis para maximizar o conforto humano. A investigação actual sugere uma abordagem multidisciplinar para uma compreensão integral da qualidade do ambiente urbano e do bem-estar humano no desenvolvimento urbano sustentável.

Palavras-chave: Qualidade de vida, Planeamento urbano, Cidade habitável, Qualidade ambiental.

JEL Classification: Q01, R1

1. INTRODUCTION

Urban Habitat is aggressive or unnatural for human beings? In many cities, urban green spaces may be missing or wrongly distributed. It must take into account the noise pollution produced by cars and household heating systems in countries with cold winters. Also consider the heat island effect in urban areas and conurbations.

Socio-spatial variations in urban environmental quality and human wellbeing (see fig.1) are not new but are an established characteristic of city life. Cities have always represented a mixed blessing for their inhabitants (Pacione, 2003).

There are other important factors such as suburban areas if well designed, if there is accessibility to green areas that are outside the city and if the outputs of the city can be done in addition to the usual means of transport, by bicycle.

While it is unnecessary for different forms of landscape knowledge to share a methodology or a theoretical foundation, the key is a common frame of reference that has a reasonable fit with the range of ways in which disciplines and communities perceive and value landscape (Stephenson, 2008).

2. ECOLOGY AND BIODIVERSITY

2.1. Ecology

The heart of landscape ecology is the evaluation of spatial configuration and temporal sequencing as they affect landscape ecological integrity and aesthetic appeal, we believe it is the logical discipline within which to elaborate the union of these issues. This union has been called 'the landscape ecological aesthetic'(Thorne, and Huang, 1991).

Natural sounds, meanwhile, may improve the quality of built-up environments to a certain extent. However, any incongruence between sound and image in a landscape quite clearly diminishes the value assigned it, indicating the need to conserve singular soundscapes. Such cases call for the application of soundscape conservation measures in protected natural spaces, cultural landscapes and parks and green areas (Carles et al.1999).

Fragmentation is a research concept properly belonging to the biosciences and agriculture, yet it is one finding application in the planning and design fields. Cultural landscape, on the other hand, is a concept uniquely rooted in landscape architecture and resource management. The planners and designers are challenged to consider whether human actions are "natural" actions, or whether they belong in a separate philosophical category (Taylor, 2002).

The masonry retaining walls together with their vegetative companions constitute a distinctive urban ecology in Hong Kong. Whereas humans have built the artificial cliffs, it is nature which has bestowed a munificent, handsome and serendipitous gift of green livery. The fortunate combination of abiotic and biotic factors, in an inordinately harsh compact city milieu, on an apparently inhospitable habitat, has allowed tenacious and abundant vegetative colonization (Jim and Chena, 2010).

Soils perform a number of crucial functions which make them environmentally, economically and socially important. Which soil functions can be distinguished? The production, the carrier, the filter, the resource, the habitat, and the cultural function are usually recognized. Some of these functions are exclusive and in competition (EC, 2006).

The sealing of soil can lead to decrease of water permeability, in the loss of biodiversity, and in the reduction of the capacity for the soil to act as a carbon sink (Scalenghe and Ajmone Marsan 2009).

2.2. Biodiversity

Maintaining biodiversity requires a wise combination of protection, management and recreation of habitats to secure representative and functional habitat networks. As urbanisation is increasing worldwide, town and cities are becoming the most common habitat for humankind.

The successful maintenance of representative habitats can be viewed as a series of partly overlapping and complementary "green infrastructures" in the landscape, each of which have various properties to which species are adapted (Sandström, Angelstam and Khakee, 2006).

The information on biodiversity issues that planners have at disposal often offers a very limited support, due to the lack of informative data and suitable planning support systems (PSS) (Geneletti, 2008).

To help prevent further loss of biodiversity, there is an urgent need for more strategic approaches to conservation planning in urban environments based on a scientific understanding of landscape patterns, species requirements and development pressures.

The conservation planning tools can be better integrated into the different stages of landuse planning for future urban growth (Gordon et al., 2009).

3. URBAN ECOSYSTEMS

Ecosystem services provided by a Green Infrastructure can provide healthy environments and physical and psychological health benefits to the people residing within them. Healthy environments can contribute to improved socio-economic benefits for those communities (Tzoulas, K. et al., 2007).

That ecosystem quality tends to decline continuously as urban density increases, although the scatter evident in many of these relationships suggests that for any given urban density, and with appropriate consideration to the proportion and configuration of green space and tree cover, there is substantial scope for maximising ecological performance (Tratalos el al., 2007).

Urban ecosystems are a complex mosaic of climates, land uses, biophysical, and socioeconomic variables. Future studies of urban forests and their role in environmental quality should consider the ecological and socio-economic heterogeneity within the urban ecosystem (Escobedo and Nowak, 2009).

The maintenance of ecosystem goods and services, i.e. natural capital, is the basic guarantee of environmental security that aims to evaluate the level of threats to the actual flux of natural capital. This is of particular relevance considering that in each European partner country there is a great number of areas that are recognized for their natural value (Petrosillo et al., 2009).

Key ecological services, such as clean air and water, drought and flood protection, soil generation and preservation, and detoxification of wastes are disrupted, risking the health and welfare of society. An understanding of ecosystem responses to urbanization is necessary to evaluate and balance short-term needs with long-term sustainability goals (Styers el al., 2010).

4. LANDSCAPING AND SPATIO-TEMPORAL VARIATIONS

Landscaping can and should support environmental functions as well, such as conserving water and providing wildlife habitat. However, for persuasive health, social, and environmental reasons, these design elements must increasingly be incorporated within traditional and neo-traditional urban settings. (Jackson, 2003).

Geographical information systems (GIS) are excellent tools for landscape modelling and three-dimensional analysis. They allow easy digitalisation of geographical information and coverage structure, as well as facilitating graphical representation (Hernández et al., 2004).

There is little information available on the spatial variation of landscape functions. It was developed a methodological framework to map and quantify landscape functions depending on the availability of spatial information.

Making landscape functions spatial explicit, adds an important component to research conducted in the field of quantification of landscape goods and services (Willemen et al., 2008).

Analyzing spatio-temporal characteristics of land use change is essential for understanding and assessing ecological consequence of urbanization. More importantly, such analysis can provide basic information for appropriate decision-making (Deng el al., 2009).

Space and time are intrinsic components of the decision-making process in natural resource management. As such, the spatio-temporal nature of decision-making should be acknowledged and incorporated into models developed to assist the management of natural resources (Bone and Dragićević, 2010).

5. URBAN AND INDIGENOUS VEGETATION. URBAN PARKS AND WOODLANDS

5.1. Urban and Indigenous Vegetation

The areas of indigenous vegetation within cities and towns are mostly endangered even when they are protected by law. It is necessary to know the endangering factors to improve the efficiency of protection of these areas and to develop conservation strategies depending of the special quality of the different sites (Breuste, J., 2004).

The full range of aesthetic functions incluyes visual, scenic. olfactory and tactile effects of urban vegetation as well as multisensory effects (Smardon, 1988).

5.2. Urban Parks

People from all ethnic backgrounds spend some of their leisure time in green areas. This study found that urban parks are more inclusive green places than non-urban green areas, and that urban parks can promote social cohesion. The urban green areas that are designed to meet different cultural needs and to facilitate social interaction may contribute to social cohesion in the culturally diverse cities and towns of late modern society (Buijs et al., 2009).

Analysis of these different parks shows that spatial articulation (e.g. lines of trees, groups of trees, the configuration of corner, etc.) is the clue to spatial occupancy (Goličnik and Ward Thompson, 2010).

When internationally evaluating cities in terms of competitiveness, one major aspect to take into account is the presence of public facilities such as urban parks. Another consideration is citizen accessibility to these parks. These notions can be viewed as differences between an industrial society, in which the primary focus is on economic efficiency and productivity, versus a more cultural oriented society where a higher quality of life is prioritized. Providing parks near neighborhoods is vital for their function as recreational areas for citizens to congregate and socialize, while aesthetically upgrading the vicinity (Oh and Jeong, 2007).

5.3. Urban Woodland

Urban forestry research in the Nordic and Baltic countries is very diverse. Project topics range from tree selection to studies of the impacts of urban woodland and nature on human health and wellbeing. The results emphasise the importance of international research networks for the development of urban forestry research. By enhanced networking and

collaboration within the research community, across disciplines, and between researchers and those commissioning and using research, urban forestry research can be strengthened and made more relevant (Konijnendijk et al. 2007).

The present concern for the urban environment and the quality of life in cities, along with a scientific awareness of the role played by trees in all these aspects, has given rise to a great interest for the tree-planted areas of the city. It can be affirmed the existence of a correlation between the possibilities of urban comfort and the existence of green zones, the more accurate the greater the size of these tree-lined or green space zones (Gómez, Tamarit and Jabaloyes, 2001).

The urban forest patches may play in mitigating particulate matter air pollution and should be considered in plans for improving urban air quality (Cavanagh, Zawar-Reza and Wilson, 2009).

The potentials for creating urban coppice woodlands that are managed for multiple uses by local residents is an exciting prospect and one that will become increasingly in demand as the debate on nature conservation, climate change, and human health and well-being intensifies (Busse and Møllerb, 2008).

6. PLANNING AND MANAGEMENT. SPATIAL PLANNING AND LANDSCAPE CONSERVATION

6.1. Planning and Management

From a climatic point of view, the comprehensive planning level is very important as it gives a good view of the interaction of the different climatic effects produced by the city and the surrounding rural landscape. This information is important in order to understand how changes in land use will affect the local climate (Eliasson, 2000).

Analysis and planning of ecological networks is a relatively new phenomenon and is a response to fragmentation and deterioration of quality of natural systems. In urban areas, the problems of land use intransigence, political and jurisdictional issues create a difficult environment for implementing ecological networks (Cook, 2002).

It is unlikely that landscapes can ever be sustainable, except where we attempt to adopt an overtly conservationist approach (Potschin and Haines-Young, 2006).

It is increasingly recognized that more sustainable approaches are needed for planning and managing landscapes worldwide. The spatial dimension of sustainability engages processes and relations between different land uses, ecosystems and biotopes at different scales, and over time (Botequilha Leitão and Ahern, 2002).

Landscapes change because they are the expression of the dynamic interaction between natural and cultural forces in the environment. Cultural landscapes are the result of consecutive reorganization of the land in order to adapt its use and spatial structure better to the changing societal demands. The planning and managing future landscape remains difficult and extremely uncertain. The processes and management in past traditional landscapes and the manifold relations people have towards the perceivable environment and the symbolic meaning it generates, offer valuable knowledge for more sustainable planning and management for future landscapes (Antrop, 2005).

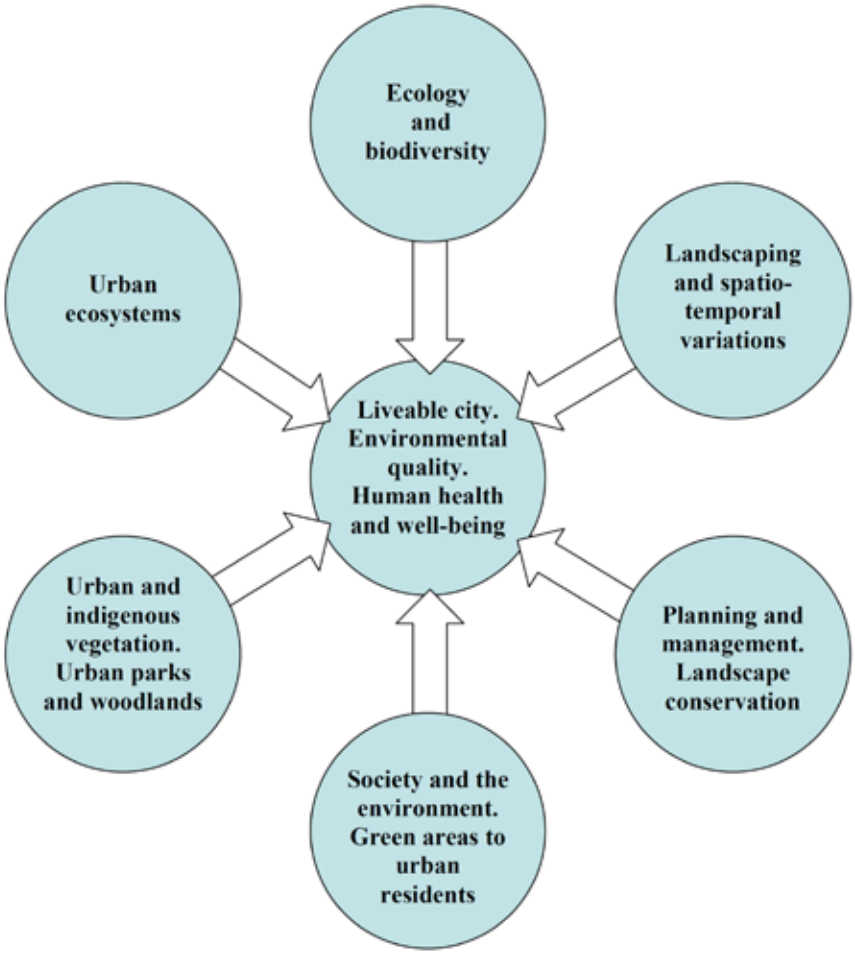
As people begin to understand the dynamic nature of landscapes, they will change the way they see the landscape as a static scene, which does not address ecological sustainability and will embrace the new ecological aesthetic idea (Panagopoulos, 2009).

The concept of soil quality represents the integration of the physical, biological, and chemical aspects of soils. Limited attention has been given to the holistic assessment of soil quality in landscape and urban planning, as it is typically addressed only through chemical

analyses. The use of a holistic test that provides information of all three aspects of soils (physical, biological, and chemical) provides a more meaningful approach to monitoring soil quality and it provides farmers, consultants and agencies with a tool to identify soil constraints and to target management practices or remediation strategies (Schindelbeck et al., 2008).

"Urban tsunami" is spreading worldwide and threatening natural resources and human health. Unfortunately, current conventional urban planning often focuses more on economic growth than on natural assets and ecological sustainability (Wang, 2009).

Figure 1. Liveable City and Environmental Quality, Human health and Well-being



6.2. Spatial Planning and Landscape Conservation

Spatial planning and land management may have important impacts on the potential transfer of pollutants from contaminated soils to humans. For those areas where risk is identified as unacceptable, alternative planning or management options should be defined to achieve a maximal risk reduction in a cost-effective way (Poggio et al., 2008).

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(physical, biological, and chemical) provides a more meaningful approach to monitoring soil quality and it provides farmers, consultants and agencies with a tool to identify soil constraints and to target management practices or remediation strategies (Schindelbeck et al., 2008).

The shape and health of the landscape legacy that we have inherited and that we will pass on to future generations is a subject of critical concern. It was concerned as well with the loss of the 'public landscape', the sense of shared places and purposes that build convivial communities. These are only a few of the many issues that need to be addressed, if the nature of landscape architecture and other allied practices concerned with the maintenance and management of our landscape is to remain relevant in the next century (Jacobs and. Mann, 2000).

In order to reconcile landscape conservation with changing demands on land use and natural resources, it is essential that the ecological, socio-cultural and economic values of the landscape be fully taken into account in planning and decision-making (Groot, R. de., 2006).

New landscapes emerge with changing life-styles. Decision making for landscape planning, conservation and management use the concept of sustainability widely. To make it operational, many new associated and more specific concepts have been proposed such as natural and social capital, conservation economy and quality of life capital. As landscape changes, also its meaning and significance changes and consequently its management (Antrop, 2006).

7. SOCIETY AND THE ENVIRONMENT. GREEN AREAS TO URBAN RESIDENTS

The interconnections between society and the environment are profound (Bartuska, A.M., 2005).

The green areas located close to residential settings areas may be one among potential protective factors that can buffer against the adverse health effects due to chronic traffic-noise exposure (Gidlöf-Gunnarsson and Öhrström, 2007).

Information concerning the social values and meanings of green areas to urban residents is scarce nowadays. This information should be made available in a usable form for urban land use and green area planning (Tyrväinen, Mäkinen and Schipperijn, 2007).

Urban residents worldwide express a desire for contact with nature and each other, attractive environments, places in which to recreate and play, privacy, a more active role in the design of their community, and a sense of community identity. The design of urban landscapes strongly influences the well-being and behavior of users and nearby inhabitants (Matsuoka and Kaplan, 2008).

Today there exists a critical mass of research that has identified human needs related to nature and the role the environment plays in providing social interaction for nearby residents Rodiek, J. (2008).

8. FINAL REMARKS: LIVEABLE CITY AND ENVIRONMENTAL QUALITY. URBAN DEVELOPMENT AND GROWTH. HUMAN HEALTH AND WELL-BEING

8.1. Liveable City and Environmental Quality

Clearly, in order to attain the goal of a liveable city, a wide range of social, economic and environmental needs must be satisfied (Pacione, 2003).

Social viewpoints such as employment, education and safety have recently been given much attention in the development of indicators of urban liveability. In addition, environmental

aspects, such as healthy air, a quiet neighbourhood, an attractive street scene and green spaces within walking distance, are gaining weight. (See fig.2). The amount and quality of green spaces affect citizens' patterns of activities, the modes and frequencies of every day recreation, the way knowledge about the environment is acquired, the opportunities to relax of daily stress, etc (Van Herzele and Wiedemann 2003).

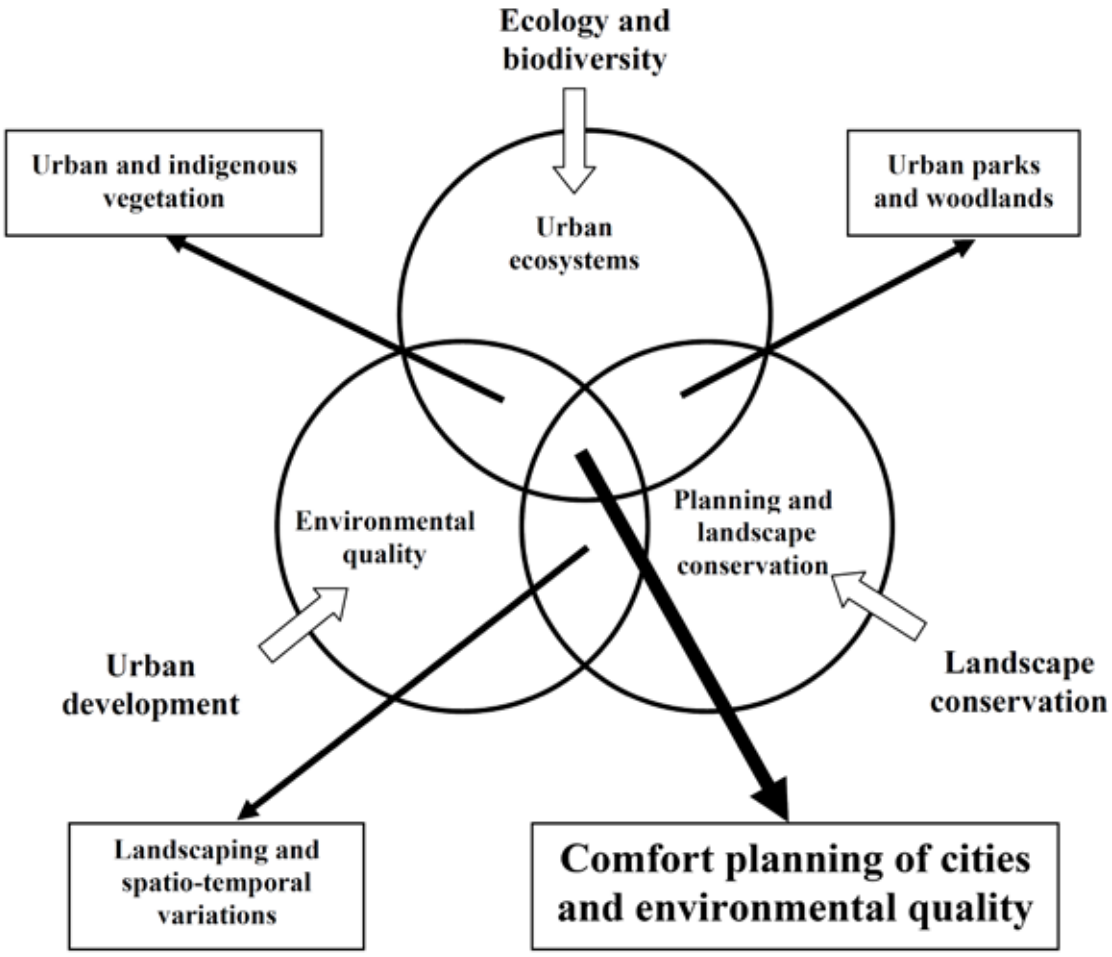
Concepts as livability, living quality, living environment, quality of place, residential-perception and -satisfaction, the evaluation of the residential and living environment, quality of life and sustainability do overlap, and are often used as synonyms—but every so often are contrasted (Van Kamp et al., 2003).

Environmental quality specialists have an important role in providing tools that can measure and compare, both in sum total, and distributively across different groups, the environmental quality implications of different futures (Brown, 2003).

The presence of natural areas contributes to the quality of life in many ways. Besides many environmental and ecological services (Chiesura, 2004).

The quality of urban soil should be evaluated to support public services for good environmental quality management. Planners should also adjust their decisions towards more sustainable urban design (Vrščaj et al., 2008).

Figure 2. Comfort Planning of Cities and Environmental Quality



8.2. Urban Development and Growth

Monitoring the urban development in order to assure sustainable cities in the future is an absolute necessity. Decision support in this domain needs some spatial information enabling to forecast the urban development trenes (Weber, 2003).

The analysis of the factors which condition walking in the urban environment is an important issue in urban planning. The landscape, in its entirety, plays a role in encouraging pedestrian movements. The frequency of pedestrian traffic in the streets is analyzed as a function of accessibility and landscape preferences with the help of a conceptual framework (Foltête and Piombini, 2007).

The capacity to project urban growth scenarios that reflect various public policies so that their relative impacts can be evaluated on natural resources is broadly hended (Beardsley et al., 2009).

Four out of five European citizens life in urban areas, and urban form – like the density or compactness of a city – influences daily life and is an important factor for both quality of life and environmental impact. An interdisciplinary study of urban form including landscape metrics, socio-economic factors and governance structures combined with a historical analysis would greatly enhance the understanding of emerging urban form (Schwarz, 2010).

8.3. Human Health and Well-being

The quality of the urban environment as a living space for the peoples of the world is, therefore, an issue of fundamental concern for academic researchers, policy makers and citizens. Increasing concern over the nature and extent of these socio-spatial divisions in urban environmental quality and human wellbeing has focused international research attention on the problems of living in the contemporary city (Pacione, 2003).

The identification of quantifiable landscape attributes that affect health is seen as an important factor in enabling future landscape design to be of benefit to human health (Velarde, Fry and Tveit, 2007).

Sustainable development requires, among other things, that development projects not result in the degradation of natural resources for outdoor recreation. There has been a rapid increase in knowledge regarding the importance of the external environment to our health and well-being (see fig.3). The urban forest investments for health and well-being can be an important part of strategic decisions in spatial planning. As preconditions for a permit, the development and financing of new urban forests and green areas can be part of the total development plan. This is an issue of global interest, as many countries are in a process of rapid urbanization, and urban greening and urban forestry have an important role to play in the process of promoting quality of life and improving environmental quality (Skärbäck, 2007).

Figure 3. Urban Well-being

To many people, solitude and peacefulness are the main qualities of landscape and especially of woodland in relation to recovery from stress and attention fatigue (Busse and Nilsson, 2007). Research indicates a relationship between sensory perception of natural environments and human health. The urban green spaces can be viewed as elements of importance to public mental health (Grahn, P. and Stigsdotter, 2010). The present research suggests a multi-disciplinary approach for a holistic understanding of urban environmental quality and human well being in sustainable urban development.

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BIODIVERSITYAND FISHERIES: A STUDY CASE IN THE SOUTH COAST OF PORTUGAL (ALGARVE)

BIODIVERSIDADE E PESCAS: UM CASO ESTUDO NA COSTA SUL DE PORTUGAL (ALGARVE)

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ABSTRACT

Biodiversity is now one of the main concerns worldwide. With the increase of people on Earth and activities dangerous to the environment, like habitat destruction and overexploitation, species extinction rates rapidly increased, raising serious concerns for future biological diversity.

Fishing is one of the oldest human food sources, catching a great number of species with a variety of techniques and fishing gears. Undoubtedly, the bottom trawl is the fishing gear that raises most concerns due to its negative impact on the habitat, overexploitation of commercial species and collateral effects on non-commercial species.

The southern coast of Portugal (Algarve) is one of the most important fishing areas of the country. Recent studies show that of all species captured by the most important fishing gears fishing in the area – bottom trawl, purse seine and trammel nets – around 70% are always discarded, and the main reasons are low or lack of commercial importance, low gear selectivity and fishing legislation. Direct observations revealed a heavily trawled bottom, with strong parallel marks caused by the doors of the trawl nets, indicating a high disturbance on the habitat, and consequently on the biological communities.

Keywords: Fisheries, Biodiversity, By-catch and Discards, Ghost-fishing.

RESUMO

A biodiversidade é hoje em dia uma das principais preocupações mundiais. Com o aumento mundial da população humana e de actividades que actuam negativamente no ambiente, como sejam a destruição de habitats e a sobrexploração, as taxas de extinção das espécies aumentou rapidamente, aumentando as preocupações sobre o futuro da diversidade biológica.

A pesca é uma das fontes de alimento humana mais antigas, capturando um grande número de espécies com uma variedade de técnicas e artes de pesca. Uma das artes de pesca mais preocupantes é, sem dúvida, o arrasto de fundo, pelo seu impacto negativo no habitat, sobrexploração das espécies comerciais e nos efeitos colaterais nas espécies não comerciais.

A região do Algarve, Sul de Portugal, é uma das principais áreas de pesca do país e onde estudos recentes demonstram que das espécies capturadas pelas principais artes de pesca que actuam naquela zona – arrasto de fundo, cerco e redes de tresmalho – cerca de 70% são sistematicamente rejeitadas, sendo as razões principais a inexistência ou baixo valor comercial, baixa selectividade da arte de pesca e legislação pesqueira. Observações directas revelaram fundos muito arrastados, com marcas fundas paralelas provocadas pelas portas das redes de arrasto, indicando alterações fortes no habitat e, consequentemente, nas comunidades biológicas .

Palavras-Chave: Pesca, Biodiversidade, Capturas Acessórias e Rejeições, Pesca Fantasma.

JEL Classification: Q22

1. INTRODUCTORY NOTE

Much has been written about the falling of the biodiversity worldwide and how a large proportion of all species are in danger of extinction within the foreseeable future. Governmental and non-profit institutions have dedicated much of their time, efforts and budgets to the subject of biodiversity.

The 1992 Convention on Biological Diversity has been signed by most Member States from the United Nations Conference on Environment and Development in Rio de Janeiro, which seek "to anticipate, prevent and attack the causes of significant reduction or loss of biological diversity at source because of its intrinsic value and because of its ecological, genetic, social, economic, scientific, educational, cultural, recreational and aesthetic value". In 2001 in Goteborg the European Council adopted the objective of halting the loss of biodiversity in the European Union by 2010, and in 2002, at the Johannesburg World Summit on Sustainable Development, the Heads of State agreed to significantly reduce the loss of biological diversity.

At the end of the 1990's a strong concern was raised on human understanding about the oceans. Questions were raised on what kinds of life, what species live where and how much, showing how little we knew about our oceans. To attempt to answer these questions several programmes were founded, like the programme "Census of Marine Life" designed to explore the knowledge of marine life. In 2010 the results reported an unanticipated estimation of marine species, from about 250 000 now to more than one million estimated. More than 6 000 probable new species were discovered, including many living species in unexpected extreme habitats (Ausubel *et al.* 2010).

Although the Census reported an interesting number of living species it also discovered a decline on the number and sizes of commercial marine species within a human generation, which raises concerns since diversity is essential for the long-term viability of fishing activities, forming the basis for various industrial processes and new medicines.

Recently, at the Nagoya Biodiversity Summit, Japan, governments agreed on a new ten year strategic plan to meet the unprecedented challenges of the continued loss of biodiversity. This adopted strategic plan includes several targets, among which is to bring to half, if possible close to zero, the rate of loss of natural habitats; to increase the terrestrial and inland water protected areas from 12.5 percent to 17 percent, and marine and coastal areas from 1 percent to 10 percent; to restore at least 15 percent of degraded areas; to make special efforts to reduce the pressures faced by coral reefs. Governments also agreed to a substantial increase in the level of financial resources in support of implementation of these targets. (CBD COP 10, 2010)

In the present paper the concept of biodiversity and the reasons of its importance are presented, related to one of the more damaging human activities – fisheries – a human primary food source and that provides directly or indirectly employment for millions of people worldwide.

2. THE IMPORTANCE OF BIODIVERSITY

Biodiversity or biological diversity is not only the number of species, genes or ecosystems as sometimes is simply interpreted. **Biological diversity is the variety and variability among living organisms and the ecological complexes in which they occur.** Therefore, biodiversity must measure elements at different levels of organisation, from the basic chemical organisation that is hereditary, the genes, up to the **community and** ecosystem level, involving complex ecological and evolutionary processes.

As complex as it can be, it is necessary to establish means of addressing the distinct and measurable parts of biological diversity. The most basic is **genetic variation** within and between populations of species, which affects their physical characteristics, viability, resilience to stress, and adaptability to change. A more easily recognized aspect of biological diversity is **distinct species,** in which some are abundant and others are much reduced or may even face extinction. Species diversity is essential to biological diversity, which includes the continued existence of native species in numbers and distributions. **The Census found that in every habitat most species are rare, but abundance changes with condition (Ausubel** *et al.* **2010).** A third element of biological diversity **is** species **associations, also known as** biological communities, such as old-growth forests or wetlands, which form the biotic part of an ecosystem. The species variety of a community is the bases of the structure and diversity of the ecological processes of an ecosystem. Finally, biological diversity includes variety in the types of ecosystems, their patterns, and connexions across a region (e.g., Amazon Forest). Although this hierarchy of elements of biological diversity might be considered artificial, it can provide the understanding of the variety and dynamics needed.

Biodiversity is not consistent, either across the Earth or through time. In the terrestrial context for example, Tropical Regions are typically rich, whereas Polar Regions support fewer species. Through time, 99.9 percent of the species that have existed on Earth are now extinct. Several major extinctions have led to large and sudden drops in the Earth biodiversity, classified as mass extinction events, some have a recovery period of millions of years (Sahney & Benton, 2008).

Since the emergence of humans on Earth the speed of extinction of species has increased, with the consequent reduction in biodiversity. Most human activities that cause extinction are not new – habitat destruction, hunting, fishing, introduction of invasive species, diseases – but there are much more people on Earth today and more activities that endanger species, rapidly increasing current extinction rates, now raising serious concerns about future biological diversity.

But why care about biological diversity?

Since the beginning humans have been a cause of damage to biological diversity, primarily by habitat destruction and overexploitation. Habitat destruction for species with highly specialised requirements, like freshwater aquatic organisms, is the primary cause of endangerment, while overexploitation has caused danger of extinction of some species until today – elephants, rhinoceros, tropical forest hardwoods, and others.

Habitat restoration and species recovery is possible but requires assistance. Many ecosystems will not recover by themselves or will do it very slowly, and many endangered species need to be maintained in captivity to fully recover. However, both habitat restoration and species recovery, if possible are slow and costly.

Species are essential to the functioning of ecological communities and ecosystems. The permanent loss of a simple species, as small and unimportant it might look, can deprive us

of answers to the evolution and ecological functioning of the community and ecosystem in which it occurs.

Humans depend on animal and vegetable species for food and medicine, but the pleasure from interacting with other organisms is far more than feeding and healing; is also aesthetical and ethical, something not to be forgotten or depreciated since it has always received the attention of philosophers, ethicists and artists.

Although biology and ecology are the main sciences in biodiversity, management and socio-economic are becoming essential sciences, since biodiversity preservation is becoming a socio-economic problem due to the lack of good management. This need lead to an increase of new important research on those fields. Therefore, to preserve biological diversity there is a strong need of knowledge on population genetics, evolution, ecology, management, economics and sociology.

3. THE EFFECTS OF FISHING ON THE ENVIRONMENT

Fishing is one of the oldest forms of primary production for human food, with a history as old as humankind, and can simply be defined as the gathering of any animal and vegetable from fresh and sea waters. Remains excavated show that already pre-hominids used to kill fish with pebbles, probably one of the first fishing gears of the predecessors of modern humans (Gabriel *et al.* 2005).

A great number of species are harvested, not only for human food but also as fertilizer and for extraction of various chemicals. Although fish is probably the best known group captured in fisheries, other animals and plants have also a significant importance, like sponges, molluscs, crustaceans. Even frogs, crocodiles and snakes are considered important "fisheries" in some countries (Gabriel *et al.* 2005).

To capture all these species, very early humans felt the need to invent specific methods and tools from the simplest pebble to more complex and sophisticated equipment used now. With the need to improve fishing gear and with the increase of manpower and energy costs, the consequent increase of mechanised and computerised fisheries happened, not only at the level of the fishing operation itself – navigation, searching and positioning – but also on the fish capture and processing on board. However, these fishing gear and operation improvements to increase catches and decrease costs had collateral effects: the declining of stocks and habitat destruction. Census of Marine Life projects report that about 90% of the big fish is gone – globally (Lotze & Worm 2010)! This removal of the largest individuals of commercial species is changing fishery practice, reproductive characteristics of stocks and even the structure of whole ecosystem (Worm et al. 2005; Myers & Worm 2003). Another recent global review (O'Dor *et al.* 2010a) lists habitat destruction as the next cause of biodiversity loss after extraction. The consciousness of these two negative effects is leading to a focus on more responsible and sustainable commercial fisheries globally.

Bottom trawls are one of the gears that raise most concerns since the size and power of these vessels are increasing and fishing operations are moving deeper and further into poorly known areas. In addition to the removal of target species, effects of fishing activities on the environment include alteration of habitat structure, damage to bottom communities, and by-catch. Studies conducted focus either on the physical effects of the fishing gear in contact with the bottom and consequently with the resident communities on different timescales (e.g. Morais *et al.* 2007; Schratzberger & Jennings, 2002; Sparks-McConkey & Watling, 2001) or addressing the consequences of indiscriminate removal of non-target species that are discarded soon after, with varying survival rates and possibly leading to changes in the trophic structure (e.g. Demestre *et al.* 2000; Greenstreet & Rogers, 2000).

3.1 The study area

Despite strong declines on the past, the Algarve region, south of Portugal, with a coastline of about 160km, is still today the most economically dependent region on fisheries in the country, with intense and continuous fishing effort acting throughout the year by several types of fishing gear and *métiers* (Borges *et al.* 2001). Trawl fishing is one of the most important, and is performed mostly by bottom otter trawl, for several hours and miles, on the entire continental platform and some adjacent plateaus. Although targeting primarily specific valuable species, it is actually a multispecies fishery, with an important contribution from incidental catch species (Borges *et al.* 2002).

3.2 Effects on habitat and biodiversity

The growing number of studies on the impact of fishing on bottom habitats indicates that the effects vary with the physical nature of the seabed and with the local natural disturbance regime. Scraping the sea bottom with a trawl device removes or destroys bed form structures as well as organisms, and re-suspends sediments, and these effects can now even be seen from satellites (Anon, 2007). However, the impacts and recovery rates seem to differ for different animal size classes, bottom types and natural disturbance levels (e.g. Kaiser *et al.* 2002; Schratzberger & Jennings, 2002), leading to different spatial and temporal effects and making the overall panorama a more complex one to study.

Direct observations conducted by Morais *et al.* (2007) off the south coast of Portugal (150-300m depth) with a manned submersible, showed a heavily trawled bottom, with several types of parallel marks on the sediment for several hundred metres. Most conspicuous were the marks caused by the otter boards of the trawl nets, as they displace large volumes of sediment (about 20-40cm wide and 20cm deep). Lighter surface lines and flattened surface features between the otter marks were attributed to tickler chains, associated to the ground rope of the trawl nets.

The occurrence of low relief, rocky-boulder substrates, with relatively high densities of finfish and shellfish, appeared to work as refuge for several species, showing abundance greater than in flat areas of fine-grained substrates. These hard substrate areas are of biological importance, mainly by increasing habitat complexity and patchiness on a small spatial scale, as well as protecting species from trawl disturbance since fishermen avoid these areas to protect their fishing gear.

It is important to note that trawl gears can penetrate deeper into soft sediment, affecting both the epifauna (fauna that live on top of the sediment surface at the seafloor) as well as the infauna (fauna that live in the substrate of a body of water, especially in a soft sea bottom). Affecting this fauna can affect other species since they can be the primary food source of several other species, some with commercial importance. In other words, it will affect the trophic chain of the ecosystem in which we are the top predators.

3.1.1 By-catch and discards

For the major target species, the probability of reaching biological extinction is quite low since economic extinction will occur first. However, this is not true if a rare species is vulnerable as by-catch. Several species have low fecundity, slow growth, and late reproduction, which make them very sensitive to high levels of fishing mortality. However, they are under high fishing pressure because they are caught by trawlers looking for other specific target species.

Although many definitions of by-catch exists, the most commonly used is the incidental catch of all marine life not directly targeted by fishing (e.g. Alverson *et al.* 1994; Hall *et al.* 2000; Kaiser & de Groot, 2000; Kelleher, 2005; Tingley *et al.* 2000), and may account for a

significant portion of the total catch. Alverson *et al.* (1994) estimated the worldwide annual commercial fisheries by-catch to be an average of 28.7 million tons per year.

Most marine fisheries are mixed fisheries directed at only a few commercial target species but together with the target species a variable number of by-catch species are captured. Having economic value, some of these species can be retained and commercialised, while others are discarded overboard for a variety of reasons.

The impact of discarding practices on fish stocks and marine environment has direct and indirect effects on the population, community, and ecosystem levels. Discards is an important component of total fishing mortality, with significant effect on recruitment to a fishery, representing a loss in terms of production. Furthermore, with the discarding of significant quantities of fish and invertebrates, there are important implications on the conservation and management of species diversity, with strong impact on the community structure, stability and trophic interactions.

Several studies show that discards are lower in small-scale fisheries when compared with active gears, such as bottom trawl. Borges *et al.* (2001) reports discard rates of 13% in weight in Algarve, while Gonçalves *et al.* (2007) reports 49% for trammel net fisheries. Results for crustacean bottom trawlers show much higher percentages, with values ranging between 37% (Monteiro *et al.* 2001), and 70% (Borges *et al.* 2001; Erzini *et al.* 2002).

The importance of the fisheries on biodiversity can be measured by the number of species affected. Recent studies show that of the more than 1 100 species captured by the main fishing gears acting off the Algarve coast (trawls, purse seine and trammel nets), 69% are always discarded, 27% are frequently discarded, and only 4% are occasionally discarded, showing a much higher number of species discarded than commercialized (Borges, 2007). Not only are most species unknown to the general public but also the biology and ecology of most non-commercial species are poorly known or completely unknown. This constitutes a real problem for the management and maintenance of biodiversity and ecological balance, with serious consequences.

The reasons for discarding practices are several, ranging from the ecological constraints (natural mixture of species in a habitat), to legal and regulatory restrictions (quotas and size restrictions), as well as technical (fishing gear selectivity, lack of electronic equipment or space), and economical (non-commercial species). In general, by-catch and subsequent discarding is inevitable due to varying amounts of commercial species and size selectivity of the fishing gear.

In Algarve the main reasons for discarding are economical restrictions (low or null commercial value for species with no immediate market), and technical restrictions (fishing gear selectivity). Other less frequent reasons are the regulatory restrictions (minimum landing sizes and quotas) (Borges *et al.* 2001; Erzini *et al.* 2002; Gonçalves *et al.* 2007). However, it is important to emphasize that discards exist and that it is hardly possible to avoid them completely. In some countries discards are forbidden, e.g. Norway, and in the European Union (EU) that possibility has already been considered, but the diversity of European fisheries is so vast (environmental factors, species, fishing gears, social aspects) that it was concluded that it would be a serious mistake to legislate such prohibition in all EU countries (CEC, 1992). More important than to forbid is to study ways of mitigating discards, with the introduction of technical modifications of the fishing gears, with emphasis on bottom trawls.

Little is known of the fate of discards and their impact on the ecosystem. However, it is likely that discarding associated with purse seines, which involves large quantities released over a short period of time and in a small area, may have a greater potential impact on the ecosystem than trawl discarding that takes place as the trawler moves, over periods of time usually exceeding one hour. Thus trawl discards are dispersed over a much wider area and

the continuous stream of discards going overboard allows sea birds more opportunity to scavenge than when a large catch is slipped (Erzini *et al.* 2002).

The impact of discards is also on the feeding ecology of species that may be making use of discards. Studies in Algarve have evaluated the fates of discards from trawl fisheries, showing average rates around 70% by sea bird scavenging at the surface, and a possible major biomass increase of bottom scavenger species (Monteiro *et al.* 2001). Perhaps, like trawling, it would even be possible to monitor discards remotely from satellites by quantifying the frequency of bird feeding?

3.1.2 "Ghost fishing" – the problem of lost fishing gear

Ghost fishing is the term used to describe the continued capture of fish and other living organisms after a fisherman has lost all control over the gear. The impact of lost fishing gear on the environment is of great concern, particularly because of the danger posed to rare and endangered species of marine mammals, sea birds and turtles. In addition to being a source of mortality, lost fishing gears can interfere with normal fishing operations, increasing gear loss.

Fishing gears may be lost due to entanglement with bottom obstructions such as wrecks and reefs, as well as to rough weather or accidentally damaged or dragged away by vessels (e.g. Ayaz *et al.* 2006; Kaiser *et al.* 2002). Certain types of gears can be more damaging after lost than others, like "fixed" or "static" gears, such as gillnets, trammel nets and traps, since they may continue to capture species efficiently, at least for some time. "Active" gears, such as trawl and purse seine, are not of major concern since their catching ability after lost is negligible (Kaiser *et al.* 2002), although they can still be a hazard.

Lost fishing gear has been directly observed off the Algarve coast, and experimental studies have been conducted on the changes in structure, degradation, movement and catches of set ghost fishing gill nets, trammel nets and traps in Algarve waters (Erzini *et al.* 1997; Erzini *et al.* 2008). Changes in the net structure – net height, effective fishing area, movement, colonisation, wear and tear – and their catches – species, sizes, numbers, and biomass, were observed in all the nets, with a sharp decrease in net height and effective fishing area, and an increase in visibility within the first few weeks. The fishing life time of a lost net was between 15 and 20 weeks, and was completely destroyed after around 8 months, when it was incorporated into the reefs. Other experimental ghost net fishing studies in coastal waters also suggested that catch rates decrease with the net height (e.g. Revill & Dunlin, 2003).

4. FISHERIES AND BIODIVERSITY CONSERVATION

The European Community directive on habitats and species obliges the member states to take measures to minimize the adverse effects of fishing activity. The Biodiversity Action Plan fisheries suggests the use of four technical measures to reduce human impacts on non-target species (Kaiser *et al.* 2004): (1) introduction and promotion of the use of selectivity devices (incorporated within fishing gears) that reduce or eliminate by-catches of non-target species; (2) introduction and promotion of fishing methods that have a reduced physical impact on the marine environment; (3) when appropriate institute temporal and spatial closures to enhance protection of species or habitats, including 'no-take' zones; (4) introduction, as appropriate, of limits on by-catch or incidental catches especially for species listed in environmental legislative instruments.

This shows a strong commitment from the European member states to pursue mechanisms to decrease negative effects of fishing on non-target species, with special emphasis on

technical measures, such as the introduction of sorting devices, and promotion of devices to reduce physical impact on marine environment.

Marine Protected Areas are also strongly implemented as management and conservation tools to restore marine biodiversity. In Europe, some marine areas are closed to all fishing to protect spawning and nursery areas, although with some debate as true useful management and conservation tools for mobile species (e.g. Gell & Roberts, 2003; Steele & Beet, 2003).

The concern raised of large quantities of by-catch has been addressed by the assessment of alterations to existing commercial trawls, designed to improve size and species selectivity. These alterations can involve changes on the size and shape of the codend meshes, or the use of different types of devices, commonly known as By-catch Reducing Devices (BRD).

Although successfully tested worldwide, BRDs have been adopted in few fisheries (e.g., Norway), due to considerable resistance from fishermen to their enforcement. Several reasons are behind this resistance, from operation limitations and gear performance and handling to high costs and unacceptable losses of valuable by-catch species (e.g. Fonseca *et al.* 2005; Hanna & Jones, 2000; Robins & McGilvray, 1999). Several experimental studies conducted in Algarve, showed high by-catch exclusion rates in weight and individual sizes. The results obtained support the idea that an increase in codend mesh size and changes in mesh configuration from diamond to square mesh would allow the exclusion of a high proportion of undersized individuals, as well as non-commercial by-catch. The use of separator mesh panels and square-mesh windows were also experimented but losses registered on legal size valuable commercial species raised concerns on the adoption by fishermen (Campos & Fonseca, 2004). The use of a modified sorting grid to exclude fish by-catch from crustacean trawlers was tried, demonstrating high potential. However, the fact that Portuguese crustacean fishery has three target species – rose shrimp, Norway lobster and red shrimp – with overlapping habitats and mean sizes, emphasised the need of more technical adaptations to reduce short-term losses and gear handling time before fishermen may perceive the advantages of the use of these devices (Fonseca *et al.* 2005).

5. FINAL CONSIDERATIONS

Fishing products have been, and always will be, essential to humans, not only as primary food source but also for extraction of important chemicals, especially to medicines. For most coastal countries, fisheries have an essential socio-economical importance, and governments cannot afford the depletion of their fish stocks, and consequent fishery closing. The process of "natural selection" has started. Only those that can produce catches with the lowest economic and ecological costs, with the least waste, with the least impact on the habitat, will inherit the fisheries (Hall *et al.* 2000). Because of the increasing fishing power and declining catches (FAO, 2008) on average globally long range fishing takes 6kg of fuel to catch 10kg of fish (Tyedmers *et al.*, 2005; Swartz *et al.*, 2010). This consumes over 1% of global oil and clearly is not sustainable.

Technology played an important role in the generation of the problems of environmental fisheries impact and stock depletions. However, technology (acoustic, optical or other) can also be an essential contributor to the solutions. The development of instruments to improve information in advance for better decisions concerning gear settings, identification of target species and size composition, could reduce or avoid sets with high by-catches, and consequent discards. Technological amelioration, or even the replacement, of the most damaging fishing gears, like trawls, would reduce their impact on the habitats. The Ocean Tracking Network plans to construct a fish tracking line across the Strait of Gibraltar next year that will provide a test bed near the Algarve for using tagged commercial species to

reduce the costs fishing and using tagged rarer species to reduce by-catch (O'Dor *et al.* 2010b). Naturally, the short term goals must be to catch fewer fish at greater profits, but in the long term this should lead to stock and biodiversity recover and a restoration to historical production rates (Lotze & Worm 2010).

Public awareness, effective management and political will are essential for taking responsibility for the conservation of marine ecosystems. Essential also is real willingness among governments and decision-makers agencies to implement protected areas needed for spawning, feeding and migration through marine reserves. Without more responsibility for fisheries management and habitat protection, fisheries and marine biodiversity will be permanently compromised.

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INTERNATIONAL ENVIRONMENTAL AGREEMENTS UNDER UNCERTAINTY: DOES THE VEIL OF UNCERTAINTY HELP?

ACORDOS INTERNACIONAIS SOBRE O AMBIENTE NUM CONTEXTO DE INCERTEZA: SERÁ QUE O VÉU DA INCERTEZA AJUDA ?

Michael Finus
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ABSTRACT

Na and Shin (1998) showed that the veil of uncertainty can be conducive to the success of self-enforcing international environmental agreements. Later papers confirmed this result. In the light of intensified research efforts worldwide to reduce uncertainty about the environmental impact of emissions and the cost of reducing them, the result is intriguing. The purpose of this paper is threefold. First, we analyze whether the result carries over to a more general setting without restriction on the number of players and which considers not only no and full learning but also partial learning, that is, three different scenarios of uncertainty dissipation. Second, we test whether the result also holds if there is uncertainty about abatement costs instead of uncertainty about the benefits from global abatement. Third, we propose a transfer scheme that mitigates the possible negative effect of learning and which may even transform it into a positive effect.

Keywords: transnational cooperation, self-enforcing international environmental agreements, uncertainty, learning

RESUMO

Na and Shin (1998) mostraram que o véu da incerteza pode conduzir ao sucesso dos acordos internacionais sobre o ambiente. Artigos posteriores confirmaram este resultado, o qual é intrigante à luz dos intensos esforços de investigação, a nível mundial, tendo em vista a dissipação da incerteza relativa aos impactos das emissões e aos custos da sua redução. Este artigo tem um propósito triplo. Primeiro, analisa se o resultado se mantém num enquadramento mais geral, sem restrições acerca do número de agentes (jogadores) e considerando não só ausência e completo conhecimento, mas também conhecimento parcial, isto é, três cenários sobre a dissipação da incerteza. Segundo, testa se o resultado se verifica quando a incerteza se centra nos custos de redução e não nos benefícios de redução global. Terceiro, propõe um esquema de transferências que mitiga os possíveis efeitos negativos do conhecimento e que pode mesmo transformá-los num efeito positivo.

Palavras-Chave: cooperação transnacional, acordos internacionais sobre o ambiente, incerteza.

JEL Classification: C72, D62, D81, H41, Q20

1. INTRODUCTION

Many economic problems are characterized by externalities across agents at the national and international level. Examples include imperfect competition, research and development with imperfect appropriation of research output, international trade, contagious diseases, international terrorism and transboundary pollution (Arce and Sandler 2004). It is well-known that in the presence of externalities cooperation between agents can improve upon uncoordinated action. As shown for instance in Bloch (2003) and Yi (1997) self-enforcing cooperation proves easy (difficult) in the context of negative (positive) externalities from cooperation. If the enlargement of coalitions has a negative impact on outsiders, there are strong incentives to participate in cooperation and typically the grand coalition forms. The opposite is true for a positive impact, which applies to many examples of pure and impure public good provision. Then free-riding is encouraged and the formation of large and effective self-enforcing agreements proves difficult. Prominent and well-studied examples in the literature are international environmental agreements (IEAs).[1] The difficulties of establishing effective global cooperation are underlined by the current efforts of negotiating a Post-Kyoto Protocol.

Na and Shin (1998) point out that two issues have received little attention: a) the role of asymmetry and b) the role of uncertainty. They construct a public good model of coalition formation with three players. Players are symmetric with respect to abatement costs from individual abatement but receive different benefits from global abatement. Differences are due to different realizations of an individual benefit parameter. They show that if decisions are taken after uncertainty about the parameters is resolved, the grand coalition comprising all three players is never stable: the outcome of the game is either a two-player coalition or complete non-cooperation, depending on the degree of heterogeneity of the benefit parameters. They contrast this case of full learning, which they call ex-post negotiations, with the case of no learning, which they call ex-ante negotiations. In the latter case, under the assumption of ex-ante symmetric expectations about the realization of the uncertain benefit parameters, they show that the grand coalition is stable. The coalitional equilibria under the two models of learning are compared from an ex-ante perspective. It is shown that the expected total payoff over all players under learning is lower than under no learning. This leads to the conclusion that the veil of uncertainty (a term coined by Brennan and Buchanan 1985) is conducive to the success of self-enforcing cooperation. Later papers with slightly different models have confirmed this conclusion (Kolstad 2007 and Kolstad and Ulph 2008 and 2009). This "negative" result, though interesting is intriguing and runs counter to intensified research efforts worldwide to reduce uncertainty about the environmental impact of emissions and the cost of reducing them.

[1] The literature dates back to Barrett (1994), Carraro and Siniscalco (1993) and Hoel (1992) and is surveyed for instance in Barrett (2003) and Finus (2001, 2003).

By exploring and extending Na and Shin (1998) seminal contribution, this paper addresses three research questions: How general is the result? What are the crucial driving forces? Is there a way to avoid the negative outcome? This is systematically analyzed in this paper. One extension which we rule out from the outset is to consider a different payoff function. Though Na and Shin's payoff function is simple (linear benefits from global abatement and quadratic costs from individual abatement), it captures the main driving forces. The evaluation of the success of coalition formation requires the consideration of a particular function anyway and more complicated functions would make analytical solutions difficult to obtain in the context of uncertainty. However, we also do not find it attractive to switch to the simpler payoff function with linear benefit and cost functions considered for instance in Kolstad (2007) and Kolstad and Ulph (2008, 2009) as this leads to corner solutions in terms of equilibrium abatement choices, irrespective of the type of uncertainty.

The most obvious extension is to allow for any number of players instead of only three players. For more than three players, even under no learning the grand coalition will not necessarily form. Consequently, strategic interaction between coalition members and non-members will be present when choosing abatement levels.

The second extension is inspired by the work of Kolstad (2007), and Kolstad and Ulph (2008, 2009) who consider not only the polar cases of no and full learning (as in Na and Shin 1998), but also the intermediate case which they call partial learning. Partial learning means that players have to take their membership decision in the first stage under uncertainty, but will learn the parameter values of the payoff function before they take abatement decisions in the second stage. This implies de facto delayed learning as no uncertainty remains once players learn.[2] Hence, in these models learning takes the form of perfect learning. That is, if players learn about parameter values, no uncertainty remains.

The third and fourth extensions are motivated by the suspicion that asymmetry may be a crucial factor that leads to small coalitions under full learning. As we show in more detail below, Na and Shin's assumption implies that there is pure uncertainty about the distribution of the benefits from global abatement, but the aggregate level of benefits is known. Hence, the third extension looks at the other extreme case, namely pure uncertainty about the level of benefits with symmetric realizations of the benefit parameters. This is what Kolstad (2007) calls systematic uncertainty. We consider a general version of this assumption in the context of Na and Shin's model. In contrast, the fourth extension sticks to pure uncertainty about the distribution of benefits but considers transfers to mitigate the asymmetric distribution of the gains from cooperation. Both extensions (third and fourth) qualify the negative conclusion about the role of learning. Interestingly, it turns out that with transfers asymmetry becomes even an asset.

Finally, the fifth extension considers a mirror image of the Na and Shin's assumption: pure uncertainty about the distribution of the costs from individual abatement, instead of

[2] We stick to the terminology "partial learning" in order to relate our work to the literature on IEAs and uncertainty.

uncertainty about the benefits from global abatement. Again, it turns out that the negative role of learning has to be qualified. For all extensions, we identify three effects (information, strategic and distributional effect) which help to explain the role of learning.

In the following, we outline our model in section 2. Section 3 analyzes the outcome under the various extensions. Section 4 summarizes the main conclusions and proposes some issues for future research.

2. MODEL

2.1 Coalition Formation

Consider as in Na and Shin (1998) and in many other models on IEAs that countries decide in the first stage whether to join an agreement (in which case they are called signatories) or to remain an outsider as a singleton (in which case they are called non-signatories). Players' membership decisions lead to a coalition structure, $K = \{S, I_{n-m}\}$ which is a partition of players, with n being the total number of players (without restriction to $n = 3$ as in Na and Shin), m the size of coalition S, $m \leq n$, and N the set of players, $S \subseteq N$. In this simple coalition formation game, coalition structure K is entirely determined by coalition S.

In the second stage, given that some coalition S has formed in the first stage, players choose their abatement levels y_i. For a start, assume no uncertainty and that as in Na and Shin (1998) the decision is based on the following payoff function:

$$(1)\quad \Pi_i = b_i\left(\sum_{k=1}^{n} y_k\right) - c_i y_i^{\,2}\ ,\ i \in N$$

where b_i is the parameter of the benefit function from global abatement (in the form of reduced damages, e.g. measured against some business-as-usual-scenario) and c_i the parameter of the cost function from individual abatement. Both parameters are assumed to be strictly positive.

For signatories it is assumed that they derive their equilibrium abatement levels by maximizing the aggregate payoff to their coalition

$$(2)\quad \max_{y^S}.\ \sum_{k\in S}\Pi_k(S) \Rightarrow \sum_{k\in S} b_k = c_i y_i \Rightarrow \frac{\sum_{k\in S} b_k}{c_i} = y_i^*(S),\ \forall\, i \in S$$

whereas as all singletons maximize their own payoff

$$(3)\ \max_{y_j}.\ \Pi_j(S) \Rightarrow b_j = c_j y_j \Rightarrow \frac{b_j}{c_j} = y_j^*,\ \forall\ j \notin S$$

where y^S is the abatement vector of signatories, $y_i^*(S)$ is individual equilibrium abatement of a signatory, which depends on S and y_j^* is individual equilibrium abatement of a non-signatory, which is independent of S. Comparing (2) and (3), it is evident that a

country ℓ will abate more if it belongs to the coalition than if it remains outside. Equilibrium payoffs of the second stage are derived by substituting equilibrium abatement levels derived from (2) and (3) into payoff functions (1), which we denote by $\Pi^*_{i\in S}(S)$ and $\Pi^*_{j\notin S}(S)$, respectively, noting that also non-signatories payoffs depend on S as benefits depend on total abatement.

Since the entire game is solved by backward induction, we now move back to the first stage, determining stable coalitions by applying the following definition:

(4) internal stability: $\Pi^*_i(S) \geq \Pi^*_i(S \setminus \{i\}) \;\; \forall\, i \in S$

(5) external stability: $\Pi^*_j(S) > \Pi^*_j(S \cup \{j\}) \;\; \forall\, j \notin S$.

That is, no signatory should have an incentive to leave coalition S to become a non-signatory and no non-signatory should have an incentive to join coalition S. In order to avoid knife-edge cases, we assume that if players are indifferent between joining coalition S and remaining outside, they will join the agreement. Coalitions which are internally and externally stable are called stable and the set of stable coalitions is denoted by S^*. In case there is more than one stable coalition, we apply the Pareto-dominance selection criterion. We denote the set of Pareto-undominated stable coalitions by $\Psi^* \subseteq S^*$. If non-trivial coalitions are stable, they Pareto-dominate the singleton coalition structure. Note that the coalition structure comprising only singletons is stable by definition and hence existence of an equilibrium is guaranteed.[3]

Note that this coalition formation model possesses three interesting properties which are helpful for the subsequent analysis and summarized in Lemma 1.

Lemma 1: Properties of the Coalition Game

Consider payoff functions (1) with equilibrium abatement levels derived from (2) and (3). Let S and $\hat{S} = S \cup \{j\}$ be two coalitions formed in the first stage where $\hat{S}$ is derived by one non-signatory j joining coalition S.

a) Positive Externality (PE): The payoff of a country k, which is neither a signatory of S nor of $\hat{S}$, will be strictly higher under $\hat{S}$ than S, i.e. $\Pi^*_{k\notin S}(S) < \Pi^*_{k\notin \hat{S}}(\hat{S})$.

b) Superadditivity (SAD): The aggregate payoff of the signatories of coalition S and of a non-signatory j is strictly lower than the aggregate payoff of the signatories of $\hat{S}$, including the previous non-signatory j, i.e. $\sum_{i\in S} \Pi^*_i(S) + \Pi^*_{j\notin S}(S) < \sum_{i\in S} \Pi^*_i(\hat{S}) + \Pi^*_{j\in \hat{S}}(\hat{S}) = \sum_{i\in \hat{S}} \Pi^*_i(\hat{S})$.

[3] The reason is that the singleton coalition structure can be generated by $S = \emptyset$, i.e. all players announce not to join the agreement. Then if one player changes her announcement, such that $\bar{S} = \{i\}$, the coalition structure remains the same.

c) Global Efficiency from Cooperation (GEC): The aggregate payoff and the aggregate abatement level of all countries is strictly lower under S *than* $\hat{S}$*, i.e.* $\sum_{i\in S} \Pi_i^*(S) + \sum_{k\notin S} \Pi_k^*(S) < \sum_{i\in \hat{S}} \Pi_i^*(\hat{S}) + \sum_{k\notin \hat{S}} \Pi_k^*(\hat{S})$ *and* $\sum_{i\in S} y_i^*(S) + \sum_{k\notin S} y_k^*(S) < \sum_{i\in \hat{S}} y_i^*(\hat{S}) + \sum_{k\notin \hat{S}} y_k^*(\hat{S})$.

Proof: From the F.O.C. in (2) it is evident that if country j joins coalition S, such that $\hat{S}$ forms, it will choose a higher abatement level, as well as all signatories of S, but all remaining non-signatories' abatement levels remain constant. Hence, total abatement will be higher if $\hat{S}$ than if S forms (GEC with respect to abatement). Moreover, countries which are neither signatories of S nor of $\hat{S}$ will have higher benefits but the same costs and hence higher payoffs (PE). SAD follows from $\max_{y^S} . \sum_{i\in S} \Pi_i(S) + \max_{y_j} . \Pi_j(S) < \max_{y^{\hat{S}}} . \sum_{i\in \hat{S}} \Pi_i(\hat{S})$ because of the presence of externalities and because abatement strategies of all non-merging singletons remain constant. Finally, GEC with respect to aggregate payoffs follows from combining properties PE and SAD. (**Q.E.D.**)

Global Efficiency from Cooperation (GEC) makes it interesting from a normative point of view to analyze the prospects of cooperation. The highest (lowest) global abatement level and the (lowest) highest total payoff is obtained in the grand coalition (if all countries play as a singleton) which corresponds to the social optimum (Nash equilibrium). Note that the property GEC also holds under uncertainty, which we consider later by taking expectations over the uncertain parameters. This will be useful when evaluating the success under the three models of learning below. The Positive Externality (PE) explains why the formation of large stable coalition is difficult, despite Superadditivity (SAD) holds. Starting from no cooperation and forming gradually large coalitions, the SAD-effect is gradually outweighted by the PE-effect. Again, these effects are also present under uncertainty.

2.2 Learning Scenarios

We now assume that some parameter values of the payoff functions are uncertain. Following Na and Shin (1998) and many other papers, we assume risk-neutral agents as players are governments and not individuals. Additional to Na and Shin (1998) and as in Kolstad and Ulph (2008, 2009), we also consider the scenario of partial learning, which gives rise to the following three *learning scenarios*: 1) full learning, 2) partial learning and 3) no learning. *F*ull *L*earning (abbreviated FL) can be considered as a benchmark case in which players learn about the true parameter values before taking the membership decision in the first stage. Hence, uncertainty is fully resolved at the beginning of the game. For *P*artial *L*earning (abbreviated PL) it is assumed that players decide about membership under uncertainty but know that they will learn about the true parameter values before deciding upon abatement levels in the second stage. Hence, the membership decision is based on expected payoffs, under the assumption that players will take the correct decision in the second stage. Finally,

under *N*o *L*earning (abbreviated NL) also the abatement decision has to be taken under uncertainty. That is, players derive their abatement strategies by maximizing expected payoffs. The membership decisions are also taken based on expected payoffs, though these payoffs differ from those under partial learning, given that less information is available.

Thus, viewed together, uncertainty is symmetric: all players know as much or little than their fellow players. FL and PL are identical regarding the second stage,but not regarding the first stage. Hence, differences and similarities between these two learning scenarios in terms of overall outcomes must be related to the first stage. Both scenarios differ from NL as abatement decisions under NL are based on expected payoffs. All three scenarios differ with respect to the first stage. The determination of stable coalitions is based on known payoffs under FL, expected payoffs given that abatement decision will be based on realized parameter values under PL and expected payoffs based on expected parameter values under NL.

In the following, we analyze four cases. Case 1 is the Na and Shin (1998) case, assuming (pure) uncertainty about the distribution of the benefits from global abatement. Case 2 is the Kolstad (2007) case, assuming (pure) uncertainty about the level of the benefits from global abatement. Case 3 is the Na and Shin (1998) case with transfers. Case 4 is a mirror image of the Na and Shin (1998) case, assuming pure uncertainty about the distribution of the costs from individual abatement, considering both, no transfers and transf

3. RESULTS

3.1 Case 1: Uncertainty about the Distribution of Benefits without Transfers

Na and Shin's case requires assuming cost symmetry and hence we set $c_i = c_j = c$, $\forall\, i \in N$, in payoff function (1) and define $\theta_i = b_i / c$, which we call from now onwards the benefit parameter. If this parameter is uncertain, it is represented by the random variable Θ_i with associated distribution f_{Θ_i}. Like in Na and Shin (1998), θ_i is viewed as an individual parameter. Moreover, expectations about Θ_i are symmetric, though realizations are asymmetric as the random variables are correlated. Na and Shin (1998) consider only three players with benefit parameters uniformly distributed over a set of three positive values. We also adopt a uniform distribution, but as we consider an indefinite number of players, we have to define a specific set of benefit parameter values over the set of players. Hence, we assume the following probability distribution:

$$(6)\quad f_{\Theta_i}(\theta_i) = \begin{cases} \dfrac{1}{n} & for \quad \theta_i = k,\ k \in N \\ 0 & otherwise \end{cases}$$

which implies the following expected value, $E[\Theta_i]$, and variance, $Var[\Theta_i]$:

(7) $E[\Theta_i] = \frac{n+1}{2}$ and $Var[\Theta_i] = \frac{n^2-1}{12}$.

In this setting, correlation means that all players have a different benefit parameter: $\theta_i \neq \theta_k, \ \forall i \neq k \in N$. Thus, vector $\Theta = (\Theta_1,...,\Theta_n)$ is composed of all the elements of N , i.e. $\bigcup_{i=1}^{n} \Theta_i = N$.

For the interpretation of this and the following cases, it is helpful to define the level of benefits from global abatement as $L = \bigcup_{i=1}^{n} \Theta_i$. Hence the marginal benefit of player i can be written as $\Theta_i = \lambda_i L$ where λ_i represents the individual share in global benefits. In case 1, the level L is constant. Thus, uncertainty is purely about the shares, or *the distribution of benefits* from global abatement.

For FL and PL, equilibrium abatement levels of the second stage follow directly from (2) and (3), assuming $c_i = c_j = c, \ \forall i \in N,$ and letting $\theta_i = b_i / c$. For NL, payoffs in (2) and (3) have to replaced by expected payoffs. However, as payoffs are linear in the random variables Θ_k , certainty equivalence holds. That is, the maximization of expected payoffs is equivalent to the maximization of payoffs under certainty for $\theta_k = E[\Theta_k]$.

Before proceeding to the first stage, it is already informative to compare second stage outcomes. For this, we take an ex-ante perspective and compute equilibrium expected abatement and payoff levels also in the case of FL and PL. Note that there is an immediate link between individual and total expected levels: individual levels are a fraction n of total levels. This is due to the ex-ante symmetry of all countries – they do not know whether they will be signatories or non-signatories. Thus, in the following analysis and proofs, we concentrate on total expected levels.

Lemma 2: Expected Abatement and Payoffs in the Second Stage in Case 1

Let $K = \{S, 1_{n-m}\}$ be some coalition structure with coalition S of size m. Under all three learning scenarios, the following relations hold ex-ante in case 1:

Individual and Total Expected Abatement Levels: $FL = PL = NL$.

Individual and Total Expected Payoff Levels: $FL = PL \leq NL$ with strict inequality if $S \neq N$.

Proof: See Appendix 1. **(Q.E.D.)**

It is clear that FL and PL are identical regarding the second stage. For payoff function (1), with respect to abatement, there is also no difference to NL. This suggests that despite there is over- and undershooting in terms of optimal abatement levels under NL, compared

to the realizations of the random benefit parameter Θ_i, on average this cancels out. This is different for payoffs.

Consider first the grand coalition, $S = N$, corresponding to the social optimum. Then there is no strategic interaction between players. We call the payoff difference between learning and no learning in the grand coalition the information effect from learning. In other words, the information effect measures the value of information in the absence of any strategic interaction and stability considerations. A priori we know that this information effect cannot be negative – it can only be zero at worst. For $S = N$ the first order conditions require setting the sum of marginal benefits over all players equal to individual marginal abatement costs. By assumption, in case 1, also under NL the sum of marginal benefits is known. Hence, the information effect from learning is zero.

Consider now any other coalitions structure different from the grand coalition, $S \neq N$ where there is interaction between players. We call the payoff difference between learning and no learning in these coalition structures the strategic effect from learning. This effect is negative according to Lemma 2. In order to explore the intuition behind this result, let us take the extreme case where no non-trivial coalition forms, which corresponds to the Nash equilibrium.[4] Under FL and PL, all countries will choose a different abatement level, as all have a different parameter $\theta_i = b_i / c$ due to different b_i's. This is not cost-effective as all have the same cost parameter c. In contrast, under NL, due to symmetric expectations about Θ_i, all countries choose the same abatement level which is also inefficient as under FL and PL (i.e. marginal abatement costs are not set equal to the sum of marginal benefits), but at least cost-effective (i.e. all marginal abatement costs are equal). Thus, the negative strategic effect from learning is a cost-effectiveness effect here. Put differently, getting it on average right across all players in terms of costs is more important than getting it individually right.

We now move to the first stage and determine stable coalitions. In order to make coalition formation interesting, we assume henceforth $n \geq 3$. We find:

Lemma 3: Equilibrium Coalitions in the First Stage in Case 1

In case 1, under the three scenarios of learning, the expected equilibrium coalition size $E[m^*]$ *is given by:* $E\left[m^{*PL}\right] = E\left[m^{*NL}\right] = 3$ *and* $E\left[m^{*FL}\right] = \begin{cases} 1 & if \quad n = 3 \\ 2 & if \quad n \geq 4 \end{cases}$

where under FL for $n \geq 4$ *the only stable coalition is formed by the two players with the highest* θ_i.

Proof: See Appendix 2. **(Q.E.D.)**

For NL the intuition is straightforward. As pointed out above, due to certainty equivalence, equilibrium abatement levels correspond to those under certainty if the parameters θ_k are equal to the expected value of Θ_k. Due to ex-ante symmetric expectations, we have symmet-

[4] The idea is illustrated for two players in an emission game in Ulph (1998). Other examples with negative value of information in non-cooperative equilibria are discussed for instance in Gollier and Treich (2003).

ric payoff functions. For payoff function (1) it is well-known from the literature (see e.g. Finus 2003) that the stable coalition comprises three signatories if $n \geq 3$.[5] Also under PL the ex-ante symmetry leads to the same stable coalitions, though certainty equivalence does not hold. This is different for FL where due to asymmetric realizations of Θ_i signatories receive asymmetric payoffs, implying that only smaller coalitions are stable. If $n \geq 4$, only the two countries with the highest benefit parameter find it attractive to form a coalition.

The driving force of this result is what we call the distributional effect from learning: the payoff difference of various degrees of learning due to the stability of different coalitions. The intuition is along the lines of Young (1994), borrowing the concept of the veil of uncertainty from Brennan and Buchanan (1985), who argues that agreements are easier if potential participants do not know the distributional consequences.[6] Since stable coalitions depend on second stage outcomes, it is generally difficult to disentangle the distributional from the strategic effect. However, this poses no problem when FL and PL are compared as second stage outcomes are identical: the distribution effect is the payoff difference between FL and PL due to different coalition sizes, resulting from different distributions of the gains from cooperation among coalition members.

Hence, compared to Na and Shin (1998), we also confirm for PL the stable coalition size of 3, but this is not the grand coalition as long as there are more than three countries. Like in Na and Shin (1998) the coalition size under FL falls short of the coalition size under NL, and, as just confirmed, also under PL.

We now combine the first and second stage outcomes to evaluate the overall success of IEAs.

Proposition 1: Outcome in Case 1 (Uncertainty about the Distribution of Benefits without Transfers)

In case 1, under the full, partial and no learning scenario, expected equilibrium total abatement levels and expected total payoffs are ranked as follows:

1) *Total Abatement:* $NL = PL > FL$

2) *Total Payoff:* $\begin{cases} NL = PL > FL & \text{if} \quad n = 3 \\ NL > PL > FL & \text{if} \quad n \geq 4 \end{cases}$.

Proof: Relations between NL and PL follow directly from Lemmas 2 and 3. For the relation between PL and FL, we note that second stage outcomes are the same. For $n = 3$, $E\left[m^{*PL}\right] = 3 > 1 = E\left[m^{*FL}\right]$ and hence $PL > FL$ follows from property GEC (Lemma 1). For $n > 3$, though $E\left[m^{*PL}\right] = 3 > 2 = E\left[m^{*FL}\right]$, the identity of players matters for FL, as a two-player coalition among the players with the highest θ_i produces a higher abatement and

[5] Note that similar small coalitions are obtained for other strictly concave payoff functions as long as one does not assume Stackelberg leadership of signatories (see Finus 2003).
[6] The idea is also illustrated in a simple two-player model in Helm (1998) and in Kolstad (2005).

payoff level than an average two-player coalition. Hence, we compute expected abatement and payoffs under PL assuming $E\left[m^{*PL}\right]=3$ and compare them with those levels under FL where a coalition among the two countries with the highest benefit parameters is formed, $n-1$ and n, which delivers the result. The relations between NL and FL follow directly from the relations between NL and PL as well as PL and FL. **(Q.E.D.)**

Hence, the negative role of learning as concluded by Na and Shin (1998) is confirmed for more than three players including the intermediate case of partial learning. The strategic effect from learning is negative, leading to worse outcomes under FL and PL. Additionally, the distributional effect from learning makes FL even worse than PL.

3.2 Case 2: Uncertainty about the Level of Benefits

It became evident that the asymmetric realization of the random benefit variable Θ_i is a driving force for the negative outcome under learning, regardless whether we consider PL or FL. Hence, we consider the other extreme assumption with pure uncertainty about the level of the benefits from global abatement. In order to capture this, we again assume cost symmetry, $c_i = c_j = c \quad \forall\, i \in N$, and again define $\theta_i = {b_i}/{c}$. However, now uncertainty does not relate to an individual but a common parameter, which Kolstad (2007) and Kolstad and Ulph (2008, 2009) call systematic uncertainty. Again, all players have the same expectations ex-ante, but now, once uncertainty is resolved, all countries have also the same benefit parameter ex-post, $\Theta_i = \Theta_k \quad \forall\, i,k \in N$. Thus, uncertainty is perfectly and positively correlated. More important, however, it is to note that in case 2 uncertainty is de facto about the *level of the benefits* from global abatement. For the subsequent analysis, no assumption about the functional form of the probability distribution f_{Θ_i} is required (as for instance in Kolstad 2007). We proceed as in case 1, looking first at second stage outcomes, then at first stage outcomes and finally combining both.

Lemma 4: Expected Abatement and Payoffs in the Second Stage in Case 2

Let $K=\{S, I_{n-m}\}$ be some coalition structure with coalition S of size m. Under all three learning scenarios, the following relations hold ex-ante in case 2:

Individual and Total Expected Abatement Levels: $FL = PL = NL$.

Individual and Total Expected Payoff Levels: $FL = PL > NL$.

Proof: See Appendix 1. **(Q.E.D.)**

Again, over- and undershooting under NL compared to the realizations of Θ_i, which is now systematic, cancels out on average. However, the relations in terms of payoffs are reversed to case 1. The symmetric realizations of Θ_i implies that also under FL and PL abatement is cost-effectively allocated in all possible coalitions structures. Though overshooting under

NL is associated with additional benefits, this is costly due to strictly convex cost functions. The additional costs are higher than the cost savings when there is undershooting. Thus, more information is beneficial if there is systematic uncertainty. This is confirmed when evaluating overall outcomes in Proposition 2, as Lemma 5 shows that first stage outcomes are the same under all three scenarios of learning.

Lemma 5: Equilibrium Coalitions in the First Stage in Case 2

In case 2, under the three scenarios of learning, the expected equilibrium coalition size $E[m^*]$ *is given by:* $E\left[m^{*FL}\right] = E\left[m^{*PL}\right] = E\left[m^{*NL}\right] = 3$.

Proof: See Appendix 2. **(Q.E.D.)**

Proposition 2: Outcome in Case 2 (Uncertainty about the Level of Benefits)

In case 2, under the full, partial, and no learning scenario, expected equilibrium total abatement levels and expected total payoffs are ranked as follows:

1) Total Abatement: $FL = PL = NL$

2) Total Payoff: $FL = PL > NL$ *.*

Proof: Follows immediately from Lemma 4 and 5. **(Q.E.D.)**

Taken together, our intuition that Na and Shin's negative result hinges on the asymmetric realization of the random benefit variable Θ_i is confirmed. The strategic effect from learning is now positive and hence no longer upsets second stage outcomes under FL and PL (see Lemma 4). Additionally, the distributional effect from learning is zero, posing no longer a disadvantage to FL in terms of the size of stable coalitions (see Lemma 5).

3.3 Case 3: Uncertainty about the Distribution of Benefits with Transfers

Another possibility to avoid the negative outcome of case 1 is transfers. Transfers can address the negative distributional effect from learning. They are relevant for FL, but have no effect on PL and NL as membership decisions are based on expected payoffs which are symmetric among signatories and also among all non-signatories. Therefore, transfers will affect the ranking between FL and PL, FL and NL, but not the ranking between PL and NL. Because transfers are based on realized parameter values under FL, there is no room for strategic misrepresentation of preferences.

More precisely, the analysis proceeds as follows. First, note that the maximization procedure in the second stage (see (2) and (3)) implies transferable utility and hence equilibrium abatement levels are not affected by transfers. (Hence, transfers have no impact

on the information and strategic effect.) This is different for first stage outcomes. Generally speaking, many transfer schemes have been considered in the literature on IEAs (e.g. Barrett 2001, Botteon and Carraro 1997, Bosello et al. 2003, Eyckmans and Finus 2006 and Weikard et al. 2009). However, in order to avoid the sensitivity of outcomes regarding particular assumptions, we apply the concept of an almost ideal sharing scheme (AISS) proposed by Eyckmans and Finus (2009) of which similar notions are found in Fuentes-Albero and Rubio (2009), McGinty 2007 and Weikard (2009). They argue that if and only if:

(8) potential internal stability: $\sum_{i\in S} \Pi_i^*(S) \geq \sum_{i\in S} \Pi_i^*(S\setminus\{i\})$

holds, then there exists a transfer system which makes S internally stable. A transfer system for which every potentially internally stable coalition is internally stable belongs to the AISS, which gives each coalition member its free-rider payoff, $\Pi_i^*(S\setminus\{i\})$, plus some positive share of the surplus $\sigma(S) = \sum_{i\in S} \Pi_i^*(S) - \sum_{i\in S} \Pi_i^*(S\setminus\{i\})$. For every transfer system belonging to the AISS, coalition S is externally stable if and only if all larger coalitions $S\cup\{j\}$, considering all possible fringe player $j\notin S$ joining coalition S, are not potentially internally stable. Taken together, this means that every transfer scheme belonging to AISS will lead to the same set of internally and externally stable coalitions and hence set of stable coalitions (robustness). Most important, among those coalitions that can be potentially internally stabilized, i.e. $\sigma(S)\geq 0$ (which may not be possible for large coalitions because $\sigma(S)<0$), AISS stabilizes (in the sense of internal and external stability) those with the highest aggregate welfare over all players (optimality). This property hinges on only one structural property, namely the (weakly) positive externality (PE) from coalition formation. As known from Lemma 1, this property holds even in its strong version in our coalition formation game. Applying AISS to our setting, we derive the following result.

Lemma 6: Equilibrium Coalitions in the First Stage in Case 3

In case 3, under the three scenarios of learning, the expected equilibrium coalition size $E[m^*]$ *is given by:* $E\left[m^{*PL}\right] = E\left[m^{*NL}\right] = 3$ *and* $E\left[m^{*FL}\right] = \begin{cases} 3 & \text{if} \quad n\leq 8 \\ f(n) > 3 & \text{if} \quad n\geq 9 \end{cases}$ *where under FL all possible 3-player coalitions are stable if* $n\leq 8$*, no stable coalition comprises less than three players if* $n\geq 9$ *and* $f(n)$ *increases in* n*.*

Proof: See Appendix 2. **(Q.E.D.)**

As pointed out above, the outcomes of PL and NL are not affected by transfers. The coalition size under FL does no longer fall short of those under PL and NL. To the contrary,

if n is large enough (i.e. $n \geq 9$), the coalition size will be larger than under PL and NL. Due to the assumption about the distribution of the variables Θ_i, the degree of asymmetry among players (measured as the variance of the elements of the vector Θ) increases with the number of players n. This asymmetry is conducive to the size of stable coalitions if accompanied by an appropriate transfer scheme. The intuition is the followingCooperation among some players compared to the non-cooperative status quo typically serves two purposes. First, internalizing an externality among coalition members by choosing higher abatement levels than under no cooperation. This is a benefit every coalition member enjoys and, in fact, also non-signatories, as exemplified by the property PE (see Lemma 1). Second, equalizing marginal abatement costs across coalition members and hence reaping the gains from cost-effectiveness. This is an exclusive benefit only the coalition enjoys as a group that does not spread to non-signatories. This is captured by the property superadditivity (see Lemma 1). This exclusive benefit is higher for heterogeneous than for symmetric players. It is particularly pronounced here as without cooperation payoffs would be very low: the Nash equilibrium would be particularly inefficient as marginal abatement costs differ between players under FL (as they do under PL). Taken together, compared to case 1, under FL, transfers reduce the negative distributional effect from learning or may even transform it into a positive effect. Overall, this leads to the following result.

Proposition 3: Outcome in Case 3 (Uncertainty about the Distribution of Benefits with Transfers)

In case 3, under the full, partial, and no learning scenario, expected equilibrium total abatement levels and expected total payoffs are ranked as follows:

1) *Total Abatement:* $\begin{cases} FL = PL = NL & if \quad n \leq 8 \\ FL > PL = NL & if \quad n \geq 9 \end{cases}$

2) *Total Payoff:* $\begin{cases} FL = PL = NL & if \quad n = 3 \\ NL > FL = PL & if \quad 4 \leq n \leq 8 \\ NL > FL > PL & if \quad n = 9 \\ FL > NL > PL & if \quad n \geq 10 \end{cases}$

Proof: The ranking between PL and NL follows from Proposition 2 as transfers have no effect. The ranking between PL and FL follows from the same second stage outcomes (Lemma 2), the same or different first stage outcomes (depending on n) as given in Lemma 6 and applying property GEC (Lemma 1). The ranking between FL and NL is established in three steps. Step 1: For total abatement, we combine second stage outcomes in Lemma 2, first stage outcomes in Lemma 6 and apply property GEC. Step 2: For $n = 3$ and $4 \leq n \leq 8$ the same reasoning as in step 1 applies for the relation between total payoffs under FL and NL. Step 3: For $n \geq 9$, NL produces better second stage outcomes than FL (Lemma

2), but FL produces larger stable coalitions (Lemma 6). Hence, under FL, for each $n \geq 9$, we consider all possible θ-vectors and compute the expected total payoff over all Pareto-undominated stable coalitions.[7] Then, we compare this to the expected total payoff under NL with $E\left[m^{*NL}\right] = 3$. **(Q.E.D.)**

Taken together, the ranking between FL and NL, as established by Na and Shin (1998) and which is our case 1, changes with transfers if the degree of asymmetry between players is large enough. Then the veil of uncertainty is no longer conducive to cooperation but has a negative impact. Thus, transfers may be seen as a successful safety valve or hedging strategy in the presence of uncertainty about the distribution of benefits.

3.4 Case 4: Uncertainty about the Distribution of Costs

In this final section, we consider a mirror image of Na and Shin's case (case 1), namely uncertainty about the distribution of abatement costs. For completeness, we consider a subcase without and a subcase with transfers. The mirror image means benefit symmetry, i.e. $b_i = b_j = b \;\; \forall\, i \in N$, but cost asymmetry in payoff function (1). For simplicity, we again define $\theta_i = b/c_i$ and assume the same distribution as in (6). Now, correlated uncertainty stems from the cost parameter c_i, with $\theta_i \neq \theta_k, \;\forall\, i \neq k \in N$, $\bigcup_{i=1}^{n} \Theta_i = N$. For second stage outcomes, we find:

Lemma 7: Expected Abatement and Payoffs in the Second Stage in Case 4

Let $K = \{S, 1_{n-m}\}$ be some coalition structure with coalition S of size m. Under all three learning scenarios, the following relations hold ex-ante in case 4:

Individual and Total Abatement Levels: $FL = PL > NL$.

Individual and Total Payoff Levels: $FL = PL > NL$.

Proof: See Appendix 3. **(Q.E.D.)**

Comparing case 4 (Lemma 7) with case 1 (Lemma 2) clearly shows that relations in terms of expected total payoffs are reversed. Both the information and the strategic effect, when comparing FL or PL with NL, are now positive. In the presence of asymmetric abatement cost functions, additional information allows non-signatories to better target abatement levels and signatories to allocate abatement duties cost-effectively. The cost savings compared to NL show up in higher payoffs and allows choosing higher abatement levels on average under FL and PL. For first stage outcomes, we establish the following.

[7] As we could not obtain a closed form solution for the expected total payoff, the values in step 3 were obtained through an algorithm programmed with the software package Matlab.

Lemma 8: Equilibrium Coalitions in the First Stage in Case 4

In case 4, under the three scenarios of learning, the expected equilibrium coalition size $E[m^*]$ *is given by:* $E\left[m^{*PL}\right] = E\left[m^{*NL}\right] = 3$ *and*

$E\left[m^{*FL}\right] = 2$ *in the case of no transfers where the only stable coalition is formed by the two players with lowest* θ_i *and*

$E\left[m^{*FL}\right] = 3$ *in the case of transfers, where all coalitions of three players are stable.*

Proof: See Appendix 3. **(Q.E.D.)**

Again, the result for coalition sizes under the scenarios NL and PL are not surprising due to symmetric expected payoffs on which membership decisions are based. Without transfers, FL suffers from the negative distributional effect from learning, leading to smaller coalitions than under PL and NL. In contrast to case 1, it is now the two players with the lowest parameter θ_i, i.e. the steepest abatement cost function, which form a stable coalition under FL. For all other players, the free-rider incentive is stronger than the cost-saving potential from cooperation. With transfers, the distributional effect from learning is zero as the size of stable coalitions is the same as under PL and NL. Different from case 3, under FL no larger coalition than three will be stable. The intuition is that now the cost-saving potential from cooperation with learning is lower than in case 3 as the benchmark case without cooperation, i.e. the Nash equilibrium, is no longer cost-ineffective. Thus, through a higher cost-saving potential, uncertainty about the distribution of benefits (case 3) provides a higher incentive for cooperation than uncertainty about the distribution of costs (case 4).

Pulling Lemma 7 and 8 together, an overall comparison follows almost immediately.

Proposition 4: Outcome in Case 4 (Uncertainty about the Distribution of Costs)

In case 4, under the full, partial, and no learning scenario, expected equilibrium total abatement levels and expected total payoffs are ranked as follows:

No Transfers

1) Total Abatement: $\begin{cases} PL > NL > FL & if \quad 3 \le n \le 8 \\ PL > FL > NL & if \quad n \ge 9 \end{cases}$

2) Total Payoff: $\begin{cases} PL > NL > FL & if \quad 3 \le n \le 7 \\ PL > FL > NL & if \quad n \ge 8 \end{cases}$

Transfers

1) Total Abatement: $FL = PL > NL$

2) Total Payoff: $FL = PL > NL$.

Proof: For transfers all relations follow directly from Lemma 7 and 8. For no transfers, relations between PL and NL also follow directly from Lemma 7 and 8. For FL, we compute expected total abatement and payoff levels using the information that the players with the lowest θ_i values, i.e. players 1 and 2, form a two player coalition. For PL and NL we compute expected payoffs using the information that $E\left[m^{*PL}\right] = E\left[m^{*NL}\right] = 3$. A comparison then delivers the ranking between FL and PL as well as FL and NL. **(Q.E.D.)**

Hence, with transfers, learning, in the form of FL or PL, is always better than no learning, NL, though there is no difference between PL and FL. FL is better than NL if n is sufficiently large. The intuition is that for sufficiently large n the first stage advantage of NL over FL becomes less important (the effect of a slightly larger coalition diminishes in the presence of many non-signatories), giving more weight to the second stage advantage of FL over NL.

4. SUMMARY AND CONCLUSIONS

The starting point of our analysis was the negative conclusion of Na and Shin (1998) about the value of information in a public good game of coalition formation, which was confirmed in later studies (Kolstad 2007 and Kolstad and Ulph 2008 and 2009). We addressed three general questions. How general is this result? What are the driving forces? If the negative outcome occurs, can it be mitigated? We started our analysis by pointing out that in Na and Shin (1998) uncertainty is symmetric and about the parameters of the payoff functions. In particular, uncertainty is about the distribution of the benefits from the provision of the public good "global abatement" with ex-ante symmetric expectations but ex-post asymmetric realizations of the benefit parameter. We confirmed Na and Shin's negative result in a more general setting which allowed for any number of players and considered not only the learning scenarios no and full learning, but also the intermediate scenario partial learning. In a two-stage coalition formation game, no learning means that players never learn the true parameter values, partial learning that they find out about them after the first (membership decision) but before the second stage (abatement decision), and full learning that they know them before the first stage. We denoted this setting case 1. This was contrasted with cases 2, 3 and 4. Case 2 did not focus on uncertainty about the distribution but the level of the benefits from public good provision. Case 3 stuck to uncertainty about the distribution of the benefits but introduced a transfer scheme to balance asymmetric gains from cooperation among coalition members. Case 4 was the mirror image of case 1 and considered uncertainty about the distribution of the costs of public good provision. For completeness, this was done not only without but also with transfers.

It became apparent that a departure from Na and Shin's setting leads to more positive results about the role of learning. In case 2, the value of information is always positive, when comparing full or partial learning with no learning. In case 3, the negative value

of information of case 1 could be partly mitigated. Transfers left no and partial learning unaffected but improved upon full learning. The larger the asymmetries among players, in the form of different realizations of the benefit parameter, the larger are the gains from cooperation which can now be fully reaped through a transfer scheme. In other words, diversity becomes an asset if accompanied by an appropriate transfer scheme. Also in case 4, the mirror image of case 1, which assumed uncertainty about the distribution of the costs, the negative effect of learning was less pronounced and was clearly positive with transfers.

In all four cases, three main effects (though to a different extent and with different signs) were at work, called the information, strategic and distribution effect. The information effect basically means that, in the absence of strategic interaction, i.e. when the grand coalition forms, more information cannot decrease the expected aggregate payoff. The strategic effect refers to the impact of learning on expected payoffs for all coalition structures where there is strategic interaction between players, i.e. the grand coalition does not form. We showed that in Na and Shin's setting this strategic effect from learning is negative such that full and partial learning rank worse than no learning in terms of expected payoffs. Finally, once stability of coalitions is considered, the distribution of the gains from cooperation among coalition members becomes an issue. In Na and Shin's setting this distributional effect from learning is negative under full learning. Asymmetry of the benefit parameter translates into asymmetry of the gains from cooperation, upsetting large stable coalition. With transfers, however, these asymmetries can be balanced. The distributional effect may become even positive – leading to larger stable coalitions than under no and partial learning – as the aggregate gains from cooperation to coalition members increase with diversity.

Taken together, our results suggest that the veil of uncertainty may be good if the uncertainty about the distribution is larger than about the level of the gains from cooperation. This is particularly true if the distribution of the gains from cooperation is more asymmetric ex-post than ex-ante expected. For such cases, a transfer scheme is helpful which hedges against possible asymmetries. Since asymmetries are the result of diversity, and diversity allows for larger comparative advantages from cooperation, transfers may even turn an apparent disadvantage into an advantage. Moreover, it appears that Na and Shin's setting of pure uncertainty about the distribution of the benefits from the provision of a public good is an interesting but also a special assumption. For many economic problems, uncertainty about the level of the benefits as well as uncertainty about the costs of public good provision will be important too. In such cases the positive effect of the veil of uncertainty is less evident from our model which is certainly a relief to all those that believe that learning should be beneficial.

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EQUATION SECTION (NEXT)

APPENDIX[8]

Appendix 1: Proof of Lemmas 2 and 4

For FL and PL, abatement and payoffs in cases 1, 2 and 3, are given by (using (2) and (3) in the text).

(I) $$Y^*(S) = m\sum_{i\in S}\theta_i + \sum_{j\notin S}\theta_j$$

$$\Pi^*_{i\in S}(S) = \theta_i\left(m\sum_{\ell\in S}\theta_\ell + \sum_{j\notin S}\theta_j\right) - \frac{1}{2}\left(\sum_{\ell\in S}\theta_\ell\right)^2$$

(II) $$\Pi^*_{j\notin S}(S) = \theta_j\left(m\sum_{i\in S}\theta_i + \sum_{k\notin S}\theta_k\right) - \frac{1}{2}(\theta_j)^2 = \frac{1}{2}(\theta_j)^2 + m\theta_j\sum_{i\in S}\gamma_i + \theta_j\sum_{k\neq j\notin S}\theta_k$$

$$\Pi^*(S) = \sum_{i\in S}\Pi^*_i(S) + \sum_{j\notin S}\Pi^*_j(S) =$$

$$\frac{1}{2}m\left(\sum_{i\in S}\theta_i\right)^2 + \left(\sum_{i\in S}\theta_i\right)\left(\sum_{j\notin S}\theta_j\right)(1+m) + \left(\sum_{j\notin S}\theta_j\right)^2 - \frac{1}{2}\sum_{j\notin S}(\theta_j)^2$$

Taking expectations gives:

Cases 1 and 3:

(III) $$E\left[Y^{FL=PL}(S,\Theta)\right] = \left(m^2 - m + n\right)E[\Theta_i] = \frac{\left(m^2 - m + n\right)(n+1)}{2}$$

$$E\left[\Pi^{FL=PL}_{i\in S}(S,\Theta)\right] = \frac{(n+1)\left(6n^2 + \left(3m^2 - 5m + 4\right)n + 2m^2 - 4m\right)}{24}$$

(IV) $$E\left[\Pi^{FL=PL}_{j\notin S}(S,\Theta)\right] = \frac{(n+1)\left[3n^2 + \left(3m^2 - 3m + 1\right)n + 2m^2 - 2m - 1\right]}{12}$$

$$E\left[\Pi^{FL=PL}(S,\Theta)\right] =$$

$$\frac{(n+1)\left(6n^3 + \left(6m^2 - 6m + 2\right)n^2 + \left(-3m^3 + 5m^2 - 2m - 2\right)n - 2m^3 + 2m\right)}{24}$$

[8] For some proofs we only provide the intuition due to space limitations. Details are available upon request.

Case 2:

(V) $$E\left[Y^{FL=PL}\left(S,\Theta\right)\right]=\left(m^2-m+n\right)E\left[\Theta_i\right]$$

$$E\left[\Pi_{i\in S}^{FL=PL}\left(S,\Theta\right)\right]=\left(\frac{m^2}{2}-m+n\right)E\left[\Theta_i^2\right]$$

(VI) $$E\left[\Pi_{j\notin S}^{FL=PL}\left(S,\Theta\right)\right]=\left(m^2+n-m-\frac{1}{2}\right)E\left[\Theta_j{}^2\right]$$

$$E\left[\Pi^{FL=PL}\left(S,\Theta\right)\right]=\left(m^2\left(n-\frac{m}{2}\right)+\left(n-\frac{1}{2}\right)\left(n-m\right)\right)E\left[\Theta_k^2\right]$$

In this case $E\left[\Theta_k^2\right]$ remains unspecified, as no assumption about the distribution of the random variables is necessary for the analysis.

For NL, certainty equivalence holds. Thus, in cases 1, 2 and 3, payoffs and abatement are the same as those under certainty with $\theta_k=E\left[\Theta_k\right]\ \forall\, k\in N$:

(VII)

$$E\left[Y^{NL}\left(S,\Theta\right)\right]=\left(m^2-m+n\right)E\left[\Theta_k\right]$$

$$E\left[\Pi_{i\in S}^{NL}\left(S,\Theta\right)\right]=\left(\frac{m^2}{2}-m+n\right)\left(E\left[\Theta_i\right]\right)^2$$

(VIII) $$E\left[\Pi_{j\notin S}^{NL}\left(S,\Theta\right)\right]=\left(m^2-m+n-\frac{1}{2}\right)\left(E\left[\Theta_j\right]\right)^2$$

$$E\left[\Pi^{NL}\left(S,\Theta\right)\right]=\left(m^2\left(n-\frac{m}{2}\right)+\left(n-\frac{1}{2}\right)\left(n-m\right)\right)\left(E\left[\Theta_k\right]\right)^2$$

where in cases 1 and 3 $E\left[\Theta_k\right]=\left(n+1\right)/2$.

The equality of expected total abatement in the three learning scenarios follows directly from (III) and (VII) for case 1 (Lemma 2), and (V) and (VII) for case 2 (Lemma 4). Regarding expected total payoffs, using (IV) and (VIII), we find for case 1 (Lemma 2):

$E\left[\Pi^{FL=PL}\left(S,\Theta\right)\right]-E\left[\Pi^{NL}\left(S,\Theta\right)\right]=-\frac{\left(n+1\right)\left(n+m^2-1\right)\left(n-m\right)}{24}$ which is strictly negative for $n>m$, implying $S\neq N$, and zero if $n=m$, implying $S=N$, for all $m,n\in N$ and $m\leq n$. For case 2 (Lemma 4), using (VI) and (VIII), we find:

$E\left[\Pi^{FL=PL}(S,\Theta)\right]-E\left[\Pi^{NL}(S,\Theta)\right]=Var\left[\Theta_k\right]$ where $Var\left[\Theta_k\right]>0$ by assumption.

Appendix 2. Proof of Lemmas 3, 5 and 6

Lemma 3: For PL and NL we use expected payoffs in (IV) and (VIII), respective and definition (5) of external stability which delivers the result. For FL, in case 1 we note that there are θ-vectors with asymmetric entries. Consequently, $E[m^{*FL}]<3$, as it can be shown, using payoffs in (II) and the definition of internal stability in (4) that for all non-symmetric θ-vectors no coalition of three or more players is internally stable. The particular result that only the single coalition is stable if $n=3$ and comprises the two players with the highest θ_i if $n\geq 4$ is also immediately derived by using (II) and (4).

Lemma 5: For PL and NL the result follows from applying definition (4) of internal and definition (5) of external stability to payoffs (VI) and (VIII), respe ibrium coalition size immediately follows from symmetry.

Lemma 6: Transfers do not affect the outcomes under PL and NL. For FL we first prove that all coalitions of three or less players are potentially internally stable using payoffs in (II) and the definition of potentially internal stability in (8). Given the relation between potential internal stability and external stability, it follows that all coalitions strictly smaller than 3 must be externally unstable and hence cannot be stable. Thus, $E[m^{*FL}]\geq 3$ follows. Now it suffices to show that potential internal stability is violated for all coalitions larger than three players if $n\leq 8$, considering all possible θ-vectors in case 3 up to these thresholds (and hence $E[m^{*FL}]=3$ follows). Above these thresholds, we show that there is at least one θ-vector of the form $(1,2,3,n)$ for which potential internal stability holds. Since either one these 4-player coalitions or larger coalitions are externally stable, we can conclude that $E[m^{*FL}]>3$.

Appendix 3. Proof of Lemmas 7 and 8

Lemma 7: In case 3, assuming $b_i=b_j=b \;\; \forall\, i\in N$, using $\theta_i=b/c_i$, the payoff function can be written as

(IX) $$\Pi_i=\left(\sum_{k=1}^{n}y_k\right)-\frac{1}{\theta_i}y_i^{\,2}\;,\; i\in N$$

with abatement and payoffs under FL and PL as follows:

(X) $$\begin{cases} y_i=m\theta_i, & \forall\, i\in S \\ y_j=\theta_j, & \forall\, j\notin S \end{cases} \textbf{\textit{ and }}\; Y^*(S)=m\sum_{i\in S}\theta_i+\sum_{j\notin S}\theta_j$$

$$\Pi^{*}_{i\in S}(S)=\left(m\sum_{\ell\in S}\theta_{\ell}+\sum_{j\notin S}\theta_{j}\right)-\frac{m^{2}\theta_{i}}{2}$$

(XI) $$\Pi^{*}_{j\notin S}(S)=\left(m\sum_{\ell\in S}\theta_{\ell}+\sum_{k\notin S}\theta_{k}\right)-\frac{\theta_{j}}{2}$$

$$\Pi^{*}(S)=m\left(n-\frac{m}{2}\right)\sum_{\ell\in S}\theta_{\ell}+\left(n-\frac{1}{2}\right)\sum_{k\notin S}\theta_{k}$$

The corresponding expected values are:

(XII) $$E\left[Y^{FL=PL}(S,\Theta)\right]=\left(m^{2}-m+n\right)E\left[\Theta_{i}\right]=\frac{\left(m^{2}-m+n\right)\left(n+1\right)}{2}$$

$$E\left[\Pi^{FL=PL}_{i\in S}(S,\Theta)\right]=\frac{\left(m^{2}-2m+2n\right)\left(n+1\right)}{4}$$

(XIII) $$E\left[\Pi^{FL=PL}_{j\notin S}(S,\Theta)\right]=\frac{\left(2m^{2}-2m+2n-1\right)\left(n+1\right)}{4}$$

$$E\left[\Pi^{FL=PL}(S,\Theta)\right]=\frac{\left(n+1\right)\left[2n^{2}+\left(2m^{2}-2m-1\right)n-m^{3}+m\right]}{4}$$

Under NL, given a coalition structure $K=\left\{S,1_{(n-m)}\right\}$ has formed in the first stage, equilibrium abatement strategies are given by:

(XIV) $$\begin{cases}E\left[y_{i}(S,\Theta)\right]=m\left(E\left[\dfrac{1}{\Theta_{i}}\right]\right)^{-1}, & \forall i\in S\\ E\left[y_{j}(S,\Theta)\right]=\left(E\left[\dfrac{1}{\Theta_{j}}\right]\right)^{-1}, & \forall j\notin S\end{cases}$$

$$E\left[Y^{NL}(S,\Theta)\right]=\left(m^{2}-m+n\right)\left(E\left[\frac{1}{\Theta_{k}}\right]\right)^{-1}$$

which give rise to the following expected payoffs in the second stage

$$E\left[\Pi_{i\in S}^{NL}\left(S,q^{**},\Theta\right)\right]=\left(\frac{m^2}{2}-m+n\right)\left(E\left[\frac{1}{\Theta_i}\right]\right)^{-1}$$

(XV) $$E\left[\Pi_{j\notin S}^{NL}\left(S,q^{**},\Theta\right)\right]=\left(m^2-m+n-\frac{1}{2}\right)\left(E\left[\frac{1}{\Theta_j}\right]\right)^{-1}$$

$$E\left[\Pi^{NL}\left(S,q^{**},\Theta\right)\right]=\left(m\left(-\frac{m^2}{2}+nm-n+\frac{1}{2}\right)+n\left(n-\frac{1}{2}\right)\right)\left(E\left[\frac{1}{\Theta_k}\right]\right)^{-1}$$

Using (XII) and (XIV) we get

$$E\left[Y^{FL=PL}\left(S,\Theta\right)\right]-E\left[Y^{NL}\left(S,\Theta\right)\right]=\left(\frac{m^2}{2}-m+n\right)\left(E\left[\Theta_k\right]-\left(E\left[\frac{1}{\Theta_k}\right]\right)^{-1}\right)$$

$$=\left(\frac{m^2}{2}-m+n\right)\left(n\left(\frac{1}{2}-\frac{1}{\sum_{i=1}^{n}\frac{1}{i}}\right)+\frac{1}{2}\right)>0,\quad \forall\, n\geq 3\wedge m\leq n$$

Using (XIII) and (XV) we get:

$$E\left[\Pi^{FL=PL}\left(S,\Theta\right)\right]-E\left[\Pi^{NL}\left(S,\Theta\right)\right]$$

$$=\frac{2n^2+\left(2m^2-2m-1\right)n-m^3+m}{2}\left(n\left(\frac{1}{2}-\frac{1}{\sum_{i=1}^{n}\frac{1}{i}}\right)+\frac{1}{2}\right)>0,\ \forall n\geq 3\wedge m\leq n$$

Lemma 8: For PL and NL the result follows from applying definitions (4) and (5) of stability to payoffs (XIII) and (XV), respectively. For FL with no transfers the equilibrium coalition size follows from applying the definitions (4) and (5) of stability to payoffs (XI); with transfers, by using payoffs (XI) and the definition of potential internal stability (8) we show that only coalitions with size $m\in\{1,2,3\}$ are internally stable under the AISS. From the relation between internal and external stability for this sharing scheme, we conclude that the only externally stable coalitions are those of size $m\geq 3$. Hence, the only Pareto undominated stable coalitions are those of size $m=3$.

ESTRATÉGIAS TÉCNICAS E INSTITUCIONAIS PARA O DESENVOLVIMENTO DA CITRICULTURA ALGARVIA - O CASO DA IGP "CITRINOS DO ALGARVE"

TECHNICAL AND INSTITUTIONAL STRATEGIES FOR THE DEVELOPMENT OF ALGARVE CITRUS SYSTEM - THE CASE OF IGP "ALGARVE CITRUS"

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RESUMO

Neste trabalho pretendemos abordar alguns dos factores que têm vindo a afectar a competitividade da citricultura algarvia, após a entrada em vigor do Mercado Único Europeu e perante uma economia cada vez mais globalizada.

Como é sabido numa economia global qualquer estratégia competitiva deve ter subjacente a(s) qualidade(s), entendida(s) como a capacidade de dar resposta ao mercado, considerado como o conjunto dos principais tipos de agentes nos diferentes níveis do sistema citrícola algarvio. Assim, o objectivo principal deste trabalho foi identificar eventuais disfunções (técnicas e institucionais) relativas ao sistema citrícola, que têm contribuído, directa ou indirectamente, para a não satisfação das expectativas dos principais clientes/consumidores.

A investigação teve em conta o contexto geral da citricultura algarvia, com vista a identificar os condicionalismos com que aquela se depara, e incidiu no contexto sectorial, de modo a compreender o funcionamento dos principais clientes, fornecedores e concorrentes.

Os resultados desta investigação permitiram-nos fazer uma caracterização dos atributos de qualidade considerados determinantes na aquisição dos citrinos, designadamente dos citrinos do Algarve, por parte dos consumidores nacionais, conforme estes se apresentem no mercado, de forma indiferenciada ou não, bem como por parte dos principais canais de distribuição.

Na investigação identificaram-se limitações de ordem técnica e institucional que têm inviabilizado ou condicionado, de forma marcante, a capacidade da citricultura (subsistema de produção) dar resposta ao mercado.

As conclusões apuradas para o desenvolvimento da citricultura algarvia basearam-se na teoria da "inovação técnica e institucional induzida" de Hayami e Ruttan (1998). Pensamos, desta forma, dar um contributo para a definição de estratégias para o desenvolvimento da citricultura algarvia tendo em conta o mercado e os recursos disponíveis.

Palavras-chave: Competitividade; Estratégia; Qualidade; IGP - "Citrinos do Algarve"; Inovação técnica e institucional; Sistema citrícola.

ABSTRACT

This research approaches some factors that have been affecting the competitiveness faced by the Algarve citrus culture since the European Single Market came into force and before a more and more global economy.

As it is known in a global economy, any competitive strategy should be based on the quality seen as the ability to respond to the market, considering all the main types of actors at

different levels of the Algarvian citrus system. Thus, the main objective was to identify any malfunctions (technical and institutional) for the citrus system, which have contributed directly or indirectly, for not meeting the expectations of key customers / consumers.
The research took into account the general context of the Algarve citrus culture in order to identify the constraints faced by it. It focused on the industry context to understand the behavior of key customers, suppliers and competitors.
The research results enabled us to make a characterization of quality attributes considered relevant when national consumers acquire citrus fruit, namely the Algarve citrus fruit, if they are introduced to the market, in an undifferentiated way or not, and through the main distribution channels.
The facts identified in the empirical research indicate that limitations of technical and institutional order can make unfeasible or strongly condition the capacity of the Algarve citrus culture (production subsystem) to meet the market requirements.
The conclusions reached for the development of the Algarve citrus culture, were based on Hayami and Ruttan´s "induced technical and institutional innovation" theory (1998). We think we have given a contribution towards the definition of strategies for the Algarve citrus culture development, bearing in mind both the market and the available resources.

Keywords: competitiveness; strategy; quality(ies); IGP – "Algarve´s Citrus", technical and institutional innovation; citrus system.

JEL classification: O3

1. INTRODUÇÃO

A citricultura tem uma enorme importância para o Algarve, região situada no sul de Portugal, quer do ponto de vista histórico-cultural, quer nas vertentes social, económica e de ocupação do território.

A grande expansão desta actividade verificou-se, fundamentalmente no período de 1950 a 1992, no qual foi plantada a maioria (64%) dos citrinos do Algarve (INE, 2002), ainda em mercado fechado, com bons níveis de preços e sem problemas de competitividade. No entanto, a situação é hoje, e será no futuro próximo, muito diferente da outrora existente pois, de uma economia proteccionista, passou-se a uma economia crescentemente concorrencial, sem que tenham sido encontradas soluções, que permitam uma melhor valorização da produção regional. Constatou-se que, de 1995 a 2004, se verificou uma diminuição dos preços correntes médios dos citrinos ao produtor da ordem dos 6%, e aumentos nos bens e serviços de consumo corrente e nos bens de investimento, respectivamente de 14% e de 29% (INE, 2006) o que contribuiu para uma diminuição de rendimentos dos produtores. Registaram-se alterações significativas dos mercados: do lado da oferta, devido, não só à expansão da citricultura a nível Mundial, como também à crescente abertura das fronteiras; do lado da procura, devido às alterações de exigências que se têm vindo a verificar, designadamente em termos de ambiente, de concentração e de qualidade(s).

Como pontos fortes a potenciar é de evidenciar que, até à data, o mercado português tem sido abastecido fundamentalmente pelos citrinos nacionais (91%), designadamente pelos do Algarve (70%). É de destacar também, que não parece previsível uma diminuição do consumo de citrinos, actualmente 27kg de citrinos em fresco *per capita*, tendo em conta o crescente reconhecimento do seu valor, tanto do ponto de vista organoléptico e nutricional,

como para a saúde em geral. Sobre este assunto refira-se também que a última reforma da PAC, pretende estimular o consumo de frutas na UE, nomeadamente nas escolas.

Contudo, a citricultura a nível mundial continua a expandir-se, os mercados estão cada vez mais globalizados e constata-se uma saturação crescente dos principais países, que importam citrinos em fresco. Verificou-se também, que em Portugal tem havido uma afluência cada vez maior de produtos cítricos, e de seus substitutos, oriundos de diferentes origens e com qualidades muito distintas, quer do ponto de vista organoléptico, quer higiénico e de serviços. Os citrinos do Algarve defrontam-se, por isso, com uma concorrência crescente especialmente vinda da parte de Espanha, visto tratar-se do maior exportador de citrinos em fresco. Outras razões têm a ver com: a sua proximidade geográfica em relação a Portugal; a grande expansão que se tem verificado na citricultura espanhola; a coincidência que se verifica relativamente aos períodos de produção/comercialização; as variedades dominantes em ambos os países e a melhor capacidade de resposta ao mercado. Esta última é devida, não só, à já conhecida melhor organização da produção para a comercialização dos citrinos, por parte de Espanha, como também, ao facto dos citrinos provenientes de Espanha apresentarem, em geral, melhor aspecto do que os do Algarve.

A diferenciação dos citrinos do Algarve, com vista à sua valorização, aparece neste contexto como um meio para que as explorações, que não podem aumentar a sua competitividade pela diminuição dos custos, consigam sobreviver neste ambiente concorrencial.

Alavoine-Mornas (1998) refere que a diferenciação pela origem geográfica se fundamenta numa faceta da qualidade, associada não unicamente às técnicas que o agricultor utiliza, mas também à terra (que ele cultiva) e ao clima de que dispõe e donde sabe tirar o melhor partido, graças à sua experiência. Assim, um território e a qualidade que este confere ao produto podem constituir a base de uma diferenciação para os produtores de uma região.

Contudo, o facto de os produtos pertencerem a uma região, a notoriedade que esta confere, as relações de proximidade que esta cria, não dispensam que as empresas envolvidas construam, em conjunto e de comum acordo, as referências de qualidade, que saibam gerir e controlar essa qualidade e que implementem uma estratégia comercial adaptada, a fim de adquirir uma legitimidade reconhecida pelos seus clientes (Fragata, 2003).

Como consumidores, deparamo-nos com frequência com promoções de produtos realizadas pela distribuição, baseadas na sua origem geográfica. A proveniência torna-se, assim, um meio de diferenciação entre produtos. Desta forma, os distribuidores inovam, ao oferecer produtos de uma determinada região, associando-lhes imagens de qualidade, de saúde, de gosto, de "produto da estação", de uma determinada origem, etc.

Em 1992 a Comunidade Europeia criou, no contexto da Política de Qualidade relativa aos produtos agrícolas, sistemas de valorização e Protecção de Denominações de Origem (DOP)[1], de Especialidades Tradicionais (ETG)[2] e de Indicações Geográficas (IGP). O intuito destas políticas foi promover a diversificação da produção, proteger os nomes dos produtos de fraudes e de imitações, e proporcionar aos consumidores informação relativa às características específicas dos produtos.

De acordo com o *Reg.(CEE) 2081/92* do Conselho de 14 de Julho de 1992 e com o Reg. (CE) 510/2006 de 20 de Março de 2006, uma IGP *(Indicação Geográfica Protegida)* é:

> "o nome de uma região, de um local determinado ou, em casos especiais, de um país, que serve para designar um produto agrícola, originário dessa região, desse local determinado ou desse país e que possui determinada qualidade, reputação,

[1] DOP - é o nome de um produto, cuja produção, transformação e elaboração ocorrem numa área geográfica delimitada com um saber fazer reconhecido e verificado. Por exemplo, o queijo da Serra da Estrela, como DOP, obriga a que este seja produzido de acordo com as regras estipuladas no caderno de especificações, o qual inclui designadamente condições de produção do leite e higiene na ordenha.

[2] ETG - Especialidade tradicional garantida, não faz referência a uma origem, mas tem por objecto distinguir uma composição tradicional do produto ou um modo de produção tradicional. Exemplos: presunto Ramon Serrano (Espanha), Queijo Mozarella (Itália), pastéis Panellets (Espanha).

> ou outras características que podem ser atribuídas a essa origem geográfica e cuja produção e/ou transformação ocorrem na área geográfica delimitada".

A Indicação Geográfica Protegida (IGP) é considerada um instrumento, que poderá ajudar a agricultura a conseguir atingir objectivos que lhe estão consignados pela actual Política Agrícola Comum, tais como: a manutenção de actividades económicas nas regiões rurais e desfavorecidas, a preservação da paisagem, a diversificação da agricultura[3] e a satisfação dos consumidores.

Actualmente, no contexto da globalização do comércio, é importante para o consumidor saber o que está a comprar. Neste âmbito, a Comissão Europeia criou logótipos, que permitem identificar os produtos agro-alimentares que beneficiam de sistemas de protecção, como é o caso da IGP. A utilização deste logótipo é uma garantia de autenticidade e permitirá sensibilizar os consumidores para o facto da qualidade do produto estar ligada à sua área geográfica. O logótipo IGP é um símbolo oficial de qualidade reservado a produtos de uma região, que lhes dá um carácter específico. Este símbolo deve garantir a autenticidade do produto. Um produto que beneficie de uma tal menção, deve satisfazer as condições que constam do respectivo caderno de especificações e obrigações.

A principal diferença entre uma indicação geográfica e uma marca comercial reside no facto da marca comercial ser um direito individual exclusivo, enquanto a Indicação Geográfica, pelo contrário, deve estar ao alcance de qualquer produtor da localidade ou região respectiva (Fisher, 2003).

Esta referência protegida não pertence a nenhum produtor nem a nenhuma empresa. Trata-se de um direito de uso. Qualquer entidade, que cumpra as exigências do caderno de especificações, pode utilizar a denominação protegida, desde que se submeta ao controlo da produção, da transformação ou da elaboração do produto por um organismo de certificação autorizado para o efeito.

Uma IGP contribui para a diferenciação de um produto agrícola, tornando-se, por isso, um trunfo importante para o desenvolvimento.

Porém, esta protecção comunitária de produtos agro-alimentares tem gerado expectativas, mas também controvérsias, acerca da capacidade de contribuir para processos de desenvolvimento local.

Com efeito uma Indicação Geográfica deve, pois, "resultar de um processo de construção colectiva que envolva, em regra, produtores, comerciantes, distribuidores e a administração pública como entidade reguladora. Numa fileira agro-alimentar, todos os actores são interdependentes e devem coordenar as suas acções em relação a um produto que, apesar de protegido, está sujeito às evoluções da tecnologia e da distribuição e à mobilização de novos saberes e competências" (Fragata, 2003: 450). Assim, a qualidade do produto deve ser fruto de negociações sucessivas, desde a produção ao consumo, isto é, entre quem oferece e quem procura. A qualidade final será o resultado de um processo de compromisso no conjunto de actores de uma fileira onde cada um joga com a sua estratégia. É de referir que a qualidade deve ser definida pelo cliente (que tem sempre razão) e por um consenso social, expresso ou não em normas (Fragata, 2003).

Enfim, a construção de uma qualidade específica deve ser um processo que dê origem a decisões colectivas, em que os constrangimentos impostos sejam pertinentes e possam ser controláveis pela maioria dos actores. Introduzir uma possibilidade de diferenciação no interior duma convenção comum de qualidade, tomando em consideração os tipos de mercados, permite integrar os interesses e solidarizar actores. A certificação poderá, assim, constituir uma alavanca para o desenvolvimento, se o produto tiver reputação positiva.

[3] Na medida em que, uma IGP é relativa a uma região específica, as actividades agrícolas que lhe estão ligadas não podem ser deslocalizadas para zonas onde a agricultura é mais fácil, encorajando, por isso, os agricultores a prosseguirem as actividades, mesmo em zonas desfavorecidas mais difíceis.

Como já foi referido, as empresas terão que adoptar, cada vez mais, uma óptica de mercado, pelo que deverão estar permanentemente atentas às evoluções dos mercados e perceber que, em muitos casos, estes são segmentados, ou seja, que há grupos de consumidores com necessidades e comportamentos distintos. A adaptação da oferta à procura leva a encarar o produto como um conjunto de atributos que vão ao encontro das necessidades dos consumidores (Duarte, 2005).

Os "Citrinos do Algarve" dispõem de uma Indicação Geográfica (IG) reconhecida pelo Estado Português desde 1994 (Despacho nº63/94 de 21 de Janeiro) e, posteriormente, protegida pela Comunidade Europeia, através do Regulamento (CEE) nº1107/96 de 12 de Junho, como Indicação Geográfica Protegida (IGP).

Desde 1998, a UNIPROFRUTAL, União de Produtores Hortofrutícolas do Algarve, é o agrupamento com responsabilidades inerentes à gestão de uso da IGP "Citrinos do Algarve" (Despacho nº 5250/98, 2ª série, de 3 de Março) e a APAGAL, Associação para os Produtos Agro-alimentares tradicionais certificados do Algarve, é o Organismo Privado de Controlo e Certificação para os "Citrino do Algarve" - IGP.

Esta investigação teve em vista investigar e diagnosticar se a IGP "Citrinos do Algarve" tem funcionado como meio para potenciar o desenvolvimento económico da citricultura algarvia, tendo em conta o mercado e o seu enquadramento sócio-técnico.

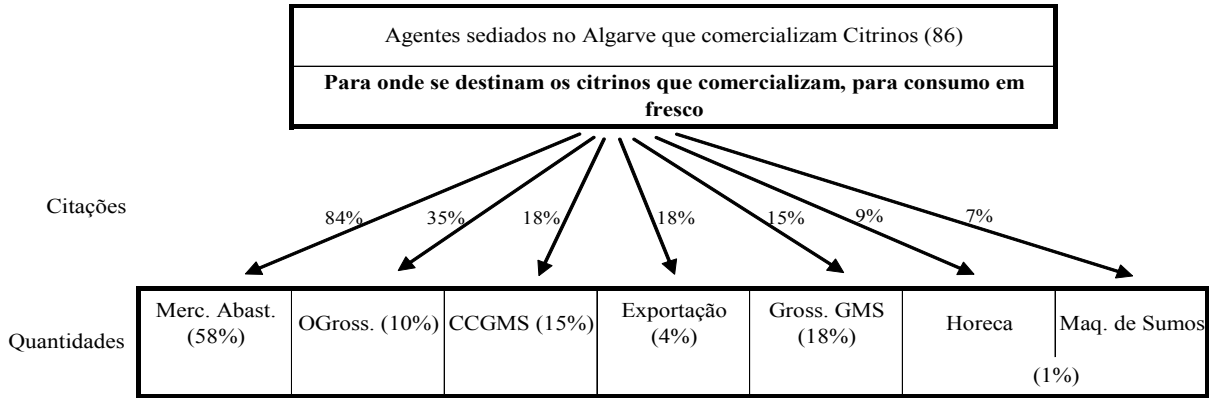
2. METODOLOGIA DESENVOLVIDA

1. Fez-se a caracterização do sistema citrícola algarvio em dois níveis, ao nível do consumidor final e do subsistema de comercialização.

1.1 A análise, ao nível do consumidor final nacional, permitiu perceber quais são os atributos de qualidade que valorizam mais quando adquirem citrinos. Se estes se apresentavam no mercado sem qualquer diferenciação, foram o aspecto exterior (conotado essencialmente com a ausência de manchas), a doçura e o preço os atributos a que os consumidores deram mais importância. De forma diferente, se os citrinos são referenciados como do Algarve, os consumidores atribuem-lhes reputação positiva, em relação aos de outras origens, por serem mais doces, terem mais sumo e serem mais saborosos que os de outras origens.

1.2 O estudo do subsistema de comercialização permitiu a compreensão da estrutura e do funcionamento dos diferentes canais de distribuição, designadamente em termos económicos, sociais, bem como de exigências de qualidade, que lhes estão associadas.

Figura 1 - Canais de distribuição dos citrinos do Algarve – representatividade de cada um relativamente ao nº de agentes que os utiliza e quantidades transaccionadas.



Fonte: Madeira , E. (2007)

Concluímos que, foram os Mercados Abastecedores e as Centrais de Compras de Grandes e Médias Superfícies, os canais de distribuição, que apresentaram maior importância tanto em termos económicos (58% e 15% respectivamente) bem como sociais (84% e 18%).

No entanto, eram os Mercados Abastecedores que tinham maior importância no escoamento dos citrinos do Algarve, 58% da produção, a qual era proveniente de 84% dos agentes que comercializavam estes citrinos (Figura 1).

Relativamente aos atributos de qualidade, mais valorizados por estes dois canais, é de evidenciar que são de natureza e intensidade muito diferentes mas, de entre os quatro atributos de qualidade mais valorizados por ambos, surgem o "aspecto exterior" do fruto e a cor (Quadro 1).

Concluiu-se que os Mercados Abastecedores dão grande importância à qualidade organoléptica, pois três dos quatro atributos considerados mais importantes na vertente comercial (a cor, o teor de açúcar e o aspecto exterior) são desta natureza. Por outro lado, os quatro atributos de qualidade considerados de mais relevância por parte das Centrais de Compras das Grandes e Médias Superfícies estão conotados, não só, com a qualidade organoléptica (o aspecto exterior e a cor) mas também com a qualidade de serviço (o transporte do produto) e com a qualidade higiénica e sanitária do produto (sem resíduos de pesticidas) (Quadro 1).

Quadro 1 - Atributos de qualidade exigidos pelas Centrais de Compras de Grandes e Médias Superfícies e pelos Mercados Abastecedores na aquisição de citrinos, considerados como "muito importantes" e apresentando frequências de respostas superiores a 50%.

Tipos de Qualidade	Atributos de grande importância para as CCGMS	Frequências > 50%	Atributos de grande importância para os Mercados Abastecedores	Frequências > 50%
Organoléptica	Aspecto exterior	100%	Cor	83%
	Cor	92%	Teor de açúcar	79%
	Calibres	75%	Aspecto exterior	77%
	Qt.de Sumo	75%	Calibres	72%
	Teor de açúcar	58%	Qt.de Sumo	64%
De serviço	Transporte do produto	100%	Apresentação na embalagem	75%
	Durabilidade do produto	83%	Durabilidade do produto	75%
	Tipo de embalagem	83%	Contin. e homog. no produto	53%
	Apresentação na embalagem	75%		
	Cont. e homog. no produto	67%		
Higiénico Sanitária	Sem resíduos de pesticidas	92%		

Fonte: Madeira, E. (2007)

2. Procurou-se, posteriormente, obter conhecimento que permitisse comprovar, ou refutar, se a Indicação Geográfica Protegida (IGP) "Citrinos do Algarve", instituída em 1994, dá resposta ao mercado tendo em conta os condicionalismos existentes.

Analisou-se o período de 1996 a 2007 tendo presente a teoria do "progresso técnico e institucional induzido" (Hayami e Ruttan, 1998).

Estes autores consideram como condições necessárias para que haja desenvolvimento, que: as inovações técnicas e institucionais tenham, essencialmente, origem endógena ao sistema; se atribua bastante importância às interacções recíprocas entre progressos técnicos e institucionais; os progressos técnicos e institucionais devem ter subjacentes as características culturais específicas de cada sociedade e que as inovações institucionais devem ter em

consideração a estrutura de poder ou os grupos de interesses instalados numa sociedade, dado que, intervenções governamentais que induzam benefícios para alguns grupos de interesses, normalmente não contribuem para a criação de riqueza e acarretam custos que correspondem a perdas de eficiência de mercado, bem como a desperdício de recursos.

Tendo em conta o referido anteriormente, tentou-se perceber se, a IGP "Citrinos do Algarve" tem contribuído para o desenvolvimento da citricultura algarvia e se foi instituída tendo em atenção os princípios orientadores acabados de enunciar.

3. RESULTADOS

Os elementos fornecidos pela APAGAL, evidenciam a fraca adesão dos agentes a este instrumento de diferenciação desde 1996.

Nos anos agrícolas de 1996 a 2001, este instrumento de diferenciação praticamente não funcionou. A quantidade certificada foi exígua (aproximadamente 200 toneladas em 5 anos), e destinou-se essencialmente a campanhas de promoção e divulgação a nível nacional, aquando da EXPO 98, e para exportar para alguns países considerados não produtores de citrinos, designadamente Alemanha, França, Mauritânia e Cabo Verde.

Soube-se que em 2001, a direcção recentemente eleita da UNIPROFRUTAL, levou a cabo algumas acções de divulgação junto de produtores, centrais fruteiras e distribuidores, sensibilizando-os para o interesse económico que poderia advir da utilização desta referência.

No ano agrícola 2002/2003 a área de pomares certificados para possível utilização da sua produção como IGP "Citrinos do Algarve" rondou os 2500 hectares, o que correspondia a cerca de 14% dos pomares da região.

As respectivas centrais fruteiras estimaram que a produção a comercializar, com tal diferenciação, nesse ano, deveria ser da ordem das 10.000 toneladas, o que tendo em conta a produção média do Algarve nos últimos cinco anos (218.000 ton) corresponderia a cerca de 5% da produção.

Porém, a produção que foi efectivamente comercializada como IGP "Citrinos do Algarve" foi pouco além das 1.500 toneladas (valor irrisório e inferior a 1% da produção de citrinos do Algarve). A maioria desta produção foi comercializada por OP e destinou-se essencialmente (94%) a Centrais de Compras de Grandes e Médias Superfícies (CCGMS) (Quadro 2).

Quadro 2 - Utilização da IGP- "Citrinos do Algarve" no ano agrícola 2002/2003

Unidade: toneladas e percentagens

Ano Agrícola	Pedidos de autorização de uso da IGP	Citrinos comercializados com certificação IGP-"Citrinos do Algarve"		Produção Média de citrinos no Algarve (1999-2003)	Percentagem da produção certificada como IGP em relação à produção média do Algarve (1999-2003)
		Quantidade	Destino da Produção		
2002 / 2003	OP (8)	1.441	GMS		
	Produtor e intermediário grossista (2)	541	GMS		
	Produtor e intermediário grossista (2)	98	MT / Português		
	Total (12)	1.639	6% MT e 94% GMS	≈ 218.000	≈ 1%

Notas: * 6 dos agentes de comercialização que pediram autorização para o uso da IGP, não a utilizaram.
Fonte: APAGAL

Relativamente aos anos agrícolas 2003/2004 a 2006/2007 as constatações, quanto a quantidades comercializadas, bem como quanto aos agentes que utilizaram esta referência, para comercializar os citrinos do Algarve, foram muito semelhantes às referidas para 2002/2003.

Em suma, têm sido muito poucos os agentes que têm pedido autorização para o uso da IGP "Citrinos do Algarve", e as quantidades transaccionadas com esta referência são insignificantes.

Estes factos sugeriram-nos algumas questões, para as quais ensaiamos, de seguida, algumas respostas, com base nos inquéritos levados a cabo junto dos agentes de comercialização de citrinos do Algarve e dos consumidores nacionais, bem como pela análise do caderno de especificações com vista à compreensão de possíveis razões para este insucesso.

1. Por que razão, das 86 centrais fruteiras sediadas no Algarve, tão poucas pediram autorização de uso da IGP? Das centrais que pediram autorização de uso, porquê apenas 4 não são OP, quando a maior quantidade de citrinos do Algarve não é comercializada através das Organizações de Produtores? Será que foi por desconhecimento do que é esta IGP, porque não se adequam às exigências impostas pelo caderno de especificações da IGP ou porque os clientes não valorizam esta referência?

Sobre este conjunto de questões podemos informar que, de acordo com os inquéritos realizados[4] aos agentes de comercialização dos citrinos do Algarve, relativamente à produção de citrinos do Algarve, que se destinou ao consumo em fresco, 70% foi escoada através de intermediários grossistas; 21% através de OP e 9% por Produtores. Mas, efectivamente, todas as OP entrevistadas sabiam o que era a IGP "Citrinos do Algarve", enquanto apenas 28% dos Produtores e 29% dos Intermediários Grossistas, conheciam esta instituição. Relativamente aos Intermediários Grossistas é de referir também, que 55% já tinham ouvido falar desta IGP, mas não dispunham de informação suficiente, nem sabiam se tinham condições para utilizar esta referência e 16% nunca tinham ouvido falar. E, quanto aos Produtores, é de salientar também, que 61% já tinham ouvido falar na IGP, mas não tinham informação suficiente e 11% nunca tinham ouvido falar da mesma.

Quadro 3 - Os agentes de comercialização dos citrinos do Algarve e a IGP

Unidade: toneladas e percentagens

Tipo de agente			Tem feito investimento				Comercialização		Sobre a IGP							
			C/ ajudas comunirárias		S/ ajudas comunitárias		Total p/ consumo em fresco		Sabe o que é		Já ouviu falar mas não sabe se tem condições p/ utilizar		Nunca ouviu falar		Adequam-se às suas exigências	
	nº	*%*	*nº*	*%*	*nº*	*%*	*Ton*	*%*	*nº*	*%*	*nº*	*%*	*nº*	*%*	*nº*	*%*
Produtor	18	**33%**	6	**33%**	8	**44%**	10.228	**9%**	5	**28%**	11	**61%**	2	**11%**	5	**28%**
OP	6	**11%**	6	**100%**	3	**50%**	21.973	**21%**	6	**100%**	0	**0%**	0	**0%**	5	**83%**
Interm.Gross.	31	**56%**	8	**26%**	18	**58%**	80.106	**70%**	9	**29%**	17	**55%**	5	**16%**	4	**13%**
Total	55	**100%**	20	**36%**	29	**53%**	112.307	**100%**	20	**36%**	28	**51%**	7	**13%**	14	**25%**

Fonte: Madeira, E. (2007)

Dos agentes entrevistados apenas 25% cumpriam os requisitos exigidos pela IGP. É de evidenciar que, apesar de muitos dos agentes terem investido nos últimos 10 anos, recorrendo ou não a ajudas Comunitárias, apenas 13% dos intermediários grossistas, 28% dos produtores e 83% das OP cumpriam os requisitos exigidos pela IGP (Quadro 3).

[4] Os inquéritos referiram-se ao ano agrícola 2002/2003.

2. Constatámos também, que foram vários os operadores que, tendo pedido autorização para o uso da IGP "Citrinos do Algarve" e que, por isso, pagaram os respectivos controlos e certificações (bem como etiquetas para as embalagens), acabaram por não utilizar este instrumento de diferenciação do produto, num mercado cuja competição é crescente. Qual terá sido a principal razão para o sucedido? Será que os seus clientes não valorizam esta diferenciação, porque o consumidor final a desconhece, ou será que estes não lhe atribuem uma mais-valia compatível com os custos que lhe estão associados?

- Relativamente à valorização da IGP por parte dos diferentes clientes (canais de distribuição), quando da análise dos atributos de qualidade mais valorizados pelos principais canais de distribuição dos citrinos do Algarve (os Mercados Abastecedores e as Centrais de Compras de Grandes e Médias Superfícies), pudemos constatar que a IGP é referida por 50% dos agentes, que vendiam às CCGMS, como um atributo de qualidade muito importante para este tipo de canal, enquanto os agentes que comercializavam para os Mercados Abastecedores, nenhum se referiu à IGP, como atributo muito importante.

Quadro 4 – Os agentes de comercialização dos citrinos do Algarve, canais de distribuição utilizados e adequação à IGP

Unidade: toneladas e percentagens

Tipo de agente			**Comercialização**		**Comercializa para**				**IGP - Citrinos do Algarve**			
			Total p/ consumo em fresco		CCGMS		M. Abast.		Sabe o que é		Adequam-se às exigências	
	nº	*%*	*Ton*	*%*	*Ton*	*%*	*Ton*	*%*	*nº*	*%*	*nº*	*%*
Produtor	18	**33%**	10.228	**9%**	2.520	**25%**	3.841	**38%**	5	**28%**	5	**28%**
OP	6	**11%**	21.973	**20%**	6.399	**29%**	3.697	**17%**	6	**100%**	5	**83%**
Interm.Gross.	31	**56%**	80.106	**71%**	7.112	**9%**	52.415	**65%**	9	**29%**	4	**13%**
Total	55	**100%**	112.307	**100%**	16.031	**14%**	59.953	**53%**	20	**36%**	14	**25%**

Fonte: Madeira, E. (2007)

Pelo que acabámos de enumerar relativamente, ao conhecimento da IGP "Citrinos do Algarve" por parte dos diferentes agentes, à adequação das centrais fruteiras no que respeita aos requisitos exigidos por esta, à valorização desta referência por parte dos Mercados Abastecedores e das CCGMS e, tendo em conta a importância das quantidades escoadas pelos diferentes agentes[5] para os canais de distribuição, que valorizam esta diferenciação, compreende-se o porquê de tão poucas centrais terem pedido autorização para o uso e nestas haver domínio das OP (Quadro 4).

3. Questionámo-nos também sobre se as exigências impostas pelo caderno de especificações da IGP "Citrinos do Algarve", ao nível da produção e da comercialização, tiveram em conta o mercado, bem como os recursos disponíveis ao nível técnico e social.

A análise do caderno de especificações, no que respeita às exigências quanto aos atributos do produto, bem como quanto às imposições relativas aos agentes de comercialização e respectivas centrais fruteiras, levaram-nos, também, a avançar mais algumas causas possíveis do insucesso verificado.

[5] Na nossa amostra, relativamente ao escoamento de citrinos para consumo em fresco, é de referir que os Produtores procediam à venda de 9% (sendo que 38% destes direccionavam-se para M.Abast. e 25% para CCGMS), as Organizações de Produtores escoavam 20% (em que 29% destes se direccionaram para CCGMS e 17% para M.Abast.) e os Intermediários Grossistas procediam à venda de 71% (em que 65% destes, iam para os M.Abast. e apenas 9% para CCGMS).

3.1. Logo à partida, o ponto do caderno de especificações, relativo ao uso da IGP "Citrinos do Algarve", exclui grande parte da produção de citrinos do Algarve de utilizar esta diferenciação. Isto, devido ao facto de nele aparecer referido que a mesma,

> "… pode ser utilizada por entidades colectivas ou individuais que tenham meios para preparar e acondicionar citrinos, desde que expressamente autorizadas e se submetam às "regras de produção" e ao regime de controlo e de certificação estabelecido; e que a autorização para a utilização da IGP "Citrinos do Algarve" deve ser pedida durante o mês de Setembro de cada ano. As empresas interessadas em utilizar aquela referência deverão comunicar, nessa data, a quantidade prevista a ser comercializada com Indicação Geográfica na campanha seguinte. A autorização depende da verificação das condições de produção, designadamente localização e estado geral dos pomares, variedades existentes, práticas culturais, condições de apanha, transporte, preparação, acondicionamento e conservação dos citrinos."

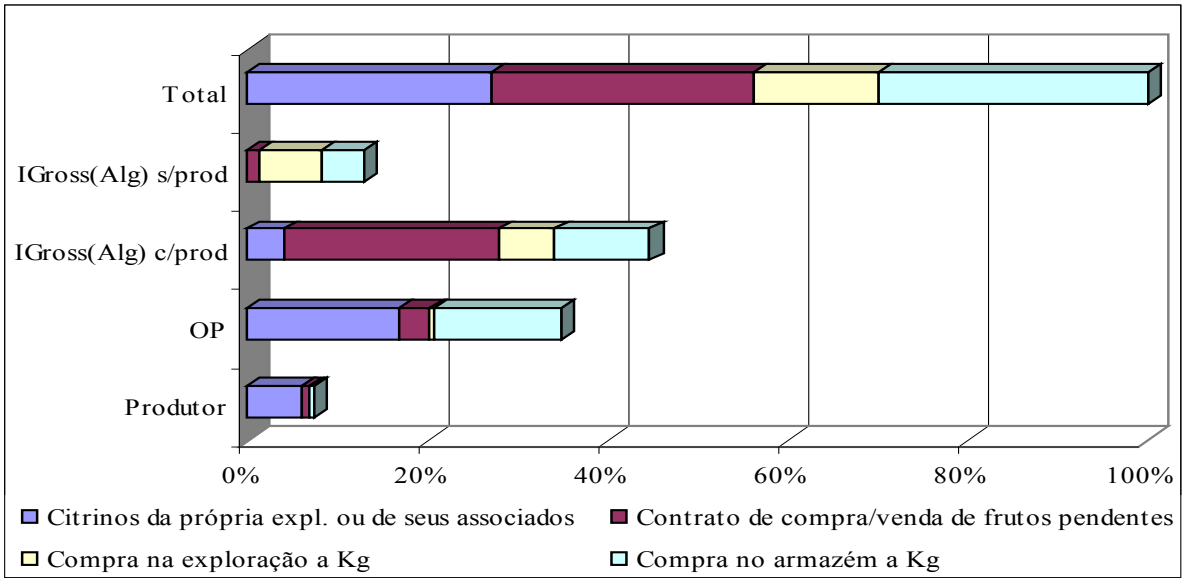
É referido ainda que:

> "deverão ser as centrais citrícolas a diligenciar a recolha dos elementos relativos à produção, junto dos produtores, e sua apresentação ao Organismo Gestor da IGP";

Este ponto, como veremos seguidamente, deixa bem evidente, que esta inovação institucional não teve em conta os recursos disponíveis.

Quanto ao período e à forma como se deve proceder para o pedido de autorização de uso, não foram tomadas em conta as formas dominantes de aquisição dos citrinos do Algarve pelos diferentes tipos de agentes de comercialização, nem que os agentes dominantes na comercialização dos mesmos não são as Organizações de Produtores.

Figura 2 – Aquisição dos citrinos do Algarve pelos diferentes tipos de agentes de comercialização sedeados no Algarve



Fonte: Madeira, E. (2007)

Sobre este assunto, e relativamente aos citrinos do Algarve que os diferentes tipos de agentes comercializaram é de salientar que: 27% eram provenientes de suas explorações ou das de seus associados; 29% adquiridos através de contratos de compra e venda de frutos pendentes; 14% adquiridos, ao longo da campanha, nas explorações a quilos e 30% adquiridos no armazém aos agricultores ou a ajuntadores. Os valores enumerados evidenciam que logo à partida, estará excluída, por esta razão, duma possível utilização como IGP, uma quantidade significativa da produção do Algarve (44%), pois os agentes, que compram ao longo do ano, à porta do armazém (a agricultores ou a ajuntadores) e nas explorações a peso, nunca terão hipótese de cumprir este requisito do caderno de especificações (Figura 2).

3.2. Relativamente às características do produto (ponto IV do caderno de especificações), quanto a defeitos que não alteram a sua qualidade interna, designadamente manchas derivadas de ácaros, cochonilhas, tripes e roçaduras de ramos,[6] são admitidos valores irrisórios e não podem estar presentes em mais de 10% dos frutos de cada embalagem.

Sobre esta matéria, efectivamente, quando os consumidores adquirem citrinos, um dos factores que valorizam bastante é o seu aspecto exterior, sem manchas. No entanto, quando se referem aos "Citrinos do Algarve" como tendo "maior qualidade que os provenientes de outras origens", fundamentam a sua opinião no facto de estes serem mais doces, terem mais sumo e serem mais saborosos.

A exigência relativamente ao "aspecto exterior" dos citrinos, particularmente no que respeita às manchas derivadas dos tripes e às roçaduras dos ramos, evidencia que as especificações para a diferenciação da qualidade dos citrinos do Algarve não tiveram em conta os constrangimentos técnicos e climáticos com que esta cultura se confronta nesta região.

3.3. No que respeita às condições sanitárias nos centros de preparação e acondicionamento (ponto VI no caderno de especificações), considera que "devem ser respeitadas todas as normas elementares de acordo com a legislação em vigor".

É de realçar também que, apesar de uma percentagem significativa de agentes ter investido, com vista à modernização e ampliação das centrais fruteiras, bem como à sua adaptação às normas ambientais, higio-sanitárias e de segurança no trabalho (Quadro 4), a maioria dos produtores e dos intermediários grossistas ainda não cumpre os requisitos exigidos pela IGP (como já se referiu, apenas 28% dos produtores e 13% dos intermediários grossistas cumprem os requisitos exigidos).

4. Perante o facto de alguns operadores terem pedido autorização para o uso da IGP e terem acabado por não utilizar esta referência, tentámos perceber se o consumidor final a desconhece ou se não lhe atribui uma mais-valia compatível com os custos associados. Recorremos, para isso, aos inquéritos aos consumidores finais, onde, mediante as respostas às questões (sobre se estes conhecem ou se já ouviram falar dos citrinos do Algarve; qual a opinião que têm sobre a qualidade destes relativamente a citrinos de outras proveniências e o porquê dessa opinião; bem como, se os encontrassem à venda, o que fariam em termos de comportamento de compra), pudemos concluir que os citrinos do Algarve gozam de notoriedade (89% dos inquiridos, conhecem ou já ouviram falar deles) e reputação, pois, dos inquiridos, que conhecem os citrinos do Algarve, 64% consideram que estes têm melhor qualidade, comparativamente a outros provenientes de outras origens, por serem mais doces (50% das respostas), terem mais sumo (15% das respostas) e serem mais saborosos (13% das respostas).

No entanto, quando da apresentação do logótipo comunitário, relativo à protecção de um produto com Indicação Geográfica, verificou-se que apenas 20% dos inquiridos reconhecem

[6] Referidos como sendo dos "principais defeitos encontrado nos citrinos, numa central fruteira, mas pouco perigosos" (Agroalimentación - La naranja: cultivo e manejo de la naranja. in: http//infoagro.com/citrinos/mandarina.htm).

este símbolo e só 12% o relacionam com "garantia de qualidade", "certificado de origem", ou lhe associam "confiança, garantia e segurança".

5. Para um melhor esclarecimento do assunto, entrevistaram-se agentes que comercializaram citrinos com IGP, para tentar perceber para onde se destinaram estes citrinos e se a relação benefício/custo foi favorável.

Assim, junto dos que comercializaram os citrinos do Algarve com IGP, constatámos que estes se direccionaram, quase exclusivamente, para Centrais de Compras de Grandes e Médias Superfícies. Segundo uns agentes, a IGP é considerada já uma obrigatoriedade, quando da aquisição dos citrinos por parte de algumas Centrais de Compras. Outros consideraram-na como bastante útil, porque as CCGMS lhes exigiam a rastreabilidade (do campo à distribuição) e aceitavam esta referência como cumprimento desse requisito.

Quanto à relação benefício/custo associada à transacção destes citrinos, enquanto uns referiram que os custos eram totalmente suportados por eles e o preço era o normal (para aquele tipo de mercado), outros mencionaram que os clientes que exigiam IGP "Citrinos do Algarve" eram efectivamente os que pagavam melhor, portanto, nem se tinham preocupado com os custos associados à certificação desta diferenciação (que consideravam da ordem dos 0,0075 €/kg).

6. Tentámos saber, como se tinha procedido aquando da criação da IG "Citrinos do Algarve", junto dos investigadores[7] que colaboraram nesta tarefa. A consulta do relatório executado[8] (Outubro 1995) confirmou tratar-se de uma inovação institucional, que careceu de um consenso ao nível dos diferentes tipos de agentes que integram o sistema citrícola algarvio. Os autores desta investigação, naquele relatório, apresentaram diferentes cenários construídos a partir de elementos chave do caderno de especificações, designadamente as características do produto, com níveis de exigências distintas como factores a ponderar antes da implementação de qualquer modalidade de IG.

Constatámos contudo, que a IG "Citrinos do Algarve", que foi instituída, correspondeu ao cenário mais exigente relativamente à qualidade (aspecto exterior) dos citrinos.

7. Enfim, o conjunto de respostas às questões suscitadas, fundamentadas na análise das exigências do caderno de especificações e nos dados obtidos pelos inquéritos realizados junto dos agentes de comercialização de citrinos sediados no Algarve e dos consumidores finais, a nível nacional, permitiram-nos perceber o funcionamento do sistema citrícola algarvio e constatar que, de entre outros, os parâmetros enumerados no caderno de especificações da IGP "Citrinos do Algarve" não se adequam à realidade local, a saber:

- Quanto ao período e à forma como se deve proceder para o pedido de autorização de uso, não foi tomado em conta que os principais agentes, que comercializam os citrinos do Algarve, são Intermediários Grossistas e focalizam-se nas Organizações de Produtores como sendo os principais agentes na comercialização;
- Não foram tomadas em conta as condições, técnicas e sociais, dominantes ao nível da produção e seu reflexo na qualidade, bem como as características que o consumidor nacional mais valoriza nos citrinos do Algarve;
- Não foi tomado em conta que a maioria das centrais fruteiras do Algarve não cumpre todos os requisitos legais impostos para as agro-indústrias em geral. Neste ponto não diferenciaram exigências racionais, relativamente à rastreabilidade do produto, à garantia sanitária dos citrinos e à defesa do ambiente, de exigências utópicas que levarão ao abandono da actividade por parte de muitos agentes como é o caso das exigências relativas a instalações.

[7] Agostinho Carvalho e M. Freitas \ Centro de Investigação de Desenvolvimento e Economia Regional (CIDER).
[8] Relatório executado no âmbito da colaboração estabelecida entre o CIDER/Universidade do Algarve e a UNIPROFRUTAL.

- Enfim, esta não surgiu de um consenso entre actores, não foi fruto de uma construção social, nem teve em conta as condições reais e concretas da produção e da comercialização dos citrinos do Algarve. As obrigações constantes no caderno de especificações, relativas à IGP "Citrinos do Algarve", estão desadequadas das condições reais e concretas da produção de citrinos no Algarve. Assim, por tudo o que anteriormente ficou referido, compreende-se o insucesso da IGP "Citrinos do Algarve", do ponto de vista social e económico.

4. CONCLUSÃO

Concluiu-se assim, que a IGP - "Citrinos do Algarve" foi adoptada de forma exógena, não tendo tido em consideração os condicionalismos concretos com que a citricultura algarvia se debate.

A IGP - "Citrinos do Algarve" foi idealizada sem ter em devida conta os atributos de qualidade, que conferem reputação positiva aos citrinos do Algarve relativamente aos de outras origens, e sem considerar os constrangimentos técnicos, sociais e climáticos inerentes à citricultura desta região.

Em suma, a conclusão que podemos tirar é que, quem decidiu sobre as regras a incluir no caderno de especificações da IGP "Citrinos do Algarve", não valorizou os condicionalismos com que a citricultura algarvia se debate, originando esta inovação como uma construções à margem da realidade. Considera-se, por isso, ser importante uma mudança de paradigma de desenvolvimento.

Recordando a Teoria do Progresso Técnico e Institucional Induzido referida neste trabalho, a concepção desta inovação institucional deveria ter tido em conta os condicionalismos reais e concretos com que os agricultores se defrontam na sua actividade. Estes aspectos, são bastante relevantes e, se não forem considerados, dificilmente haverá desenvolvimento. É aconselhável, por isso, que as estratégias para o futuro, quer inovações técnicas, quer institucionais, quer medidas de política, sejam pensadas tendo como referência este quadro conceptual.

Terminaremos este trabalho, com a apresentação, a título meramente exemplificativo, de alternativas com vista à reformulação da IGP tendo evidentemente como quadro de referência a Teoria da Inovação Técnica e Institucional de Hayami e Ruttan, que orientou esta investigação.

Assim, e no que respeita à IGP - "Citrinos do Algarve", para que esta integre a maioria da produção e das centrais fruteiras, tem de se adequar aos atributos de qualidade mais valorizados pelos principais canais de distribuição dos citrinos do Algarve, os Mercados Abastecedores e as Centrais de Compras das Grandes e Médias Superfícies. A este respeito evidenciou-se atrás que estes canais de distribuição têm níveis distintos de exigências quanto ao aspecto exterior dos citrinos. Os Mercados Abastecedores, que são os que escoam a maior quantidade de fruta (58%), dão menos relevância ao aspecto exterior dos citrinos do que as Centrais de Compras das Grandes e Médias Superfícies e mais importância à quantidade de sumo e à doçura, atributos que, se adequam melhor ao "estado actual" dos citrinos do Algarve. Desta forma, esta IGP deveria integrar dois tipos de diferenciação, com exigências diferentes, consoante o canal de distribuição a utilizar pelos diferentes tipos de agentes. Note-se, que este caderno de especificações deveria ser construído com o consenso dos agentes económicos do sector, pois, como é sabido, uma Indicação Geográfica deve resultar de um processo de construção colectiva, que envolva produtores, comerciantes, distribuidores, associações de consumidores e a administração pública como entidade reguladora. Num sistema agro-alimentar todos os actores são interdependentes e devem coordenar as suas acções em relação a um produto que, apesar de protegido, está sujeito às evoluções da

tecnologia e da distribuição (Fragata, 2003). Assim, a construção desta qualidade específica deve ser um processo que dê origem a decisões colectivas, em que os constrangimentos impostos sejam pertinentes e possam ser controláveis pela maioria dos actores. Como se sabe, introduzir uma possibilidade de diferenciação no interior duma convenção comum de qualidade, tomando em consideração os tipos de mercados, permite integrar a diversidade de interesses e solidarizar actores.

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