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Research Paper

Technological entrepreneurship applied to Green Spaces and Ecotourism

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Structured Abstract

Purpose: This study aims to present a development project using technological tools that promote guided visits to green spaces, expanding users' knowledge over different dimensions, from botanical to cultural. These tools mainly promote interaction and may have an impact in ecotourism.

Design/methodology/approach: In order to develop this project there were designed the technologic tools contents, selected places able to provide those contents, performed market studies with inquiries for potential users and clients and conducted a product development analysis.

Findings: In the development of the project there have been established many conclusions, mainly related to distinguishing clients from users, assessing general care for greens spaces and creating appealing tools containing features that interest people.

Originality/value: The most valued distinctive characteristic is exactly the ambition of designing tools that interact with the users. In this way, these technologies go beyond the compiling of data for scientific knowledge, creating interactivity through their features such as routings.

Keywords: plants; biodiversity; environment; ecotourism; sustainability; entrepreneurship.

1. Introduction

Green spaces: definition and services provided

Green spaces are defined as land, publicly or privately owned, consisting of predominantly unsealed, permeable, 'soft' surfaces such as soil, grass, shrubs, trees and water (James, et al., 2009). Ecosystem services, defined as "the benefits people obtain from ecosystems" (Millennium Ecosystem Assessment, 2005, p. 49), include provisioning, regulating,

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supporting and cultural services (Daniel, et al., 2012). The cultural services within this frame comprise recreation and tourism (Daniel et al., 2012). Ecosystem services provided by urban green spaces support the ecological integrity of cities (Wolch, Byrne & Newell, 2014). In this context, green spaces may improve air quality by filtering the air, reduce levels of pollution by removing pollutant gases and by noise attenuation, contribute to climate regulation by cooling temperatures (reducing the "heat island effect") and also help stormwater infiltration avoiding surface erosion and improving groundwater replenishment (Wolch et al., 2014).

Green spaces have a relevant impact on the health of urban areas' residents. Many recent studies have correlated the presence of green spaces in urban areas with better physical and mental health conditions of the people that reside in those areas. Maas, et al. (2009) indicate that green spaces have a positive effect on stress reduction and attention restoration. Van den Berg, Maas, Verheij and Groenewegen (2010) describe the availability of green spaces as an important factor in coping with stressful life events, being important for physical health maintenance. A study regarding stress responses using as biomarker the diurnal salivary cortisol patterns of people living in greener environments (cortisol is a vital hormone and variation of salivary cortisol relates to the regulated physiological functioning of the hypothalamic pituitary adrenal axis. Disrupted patterns of cortisol secretion are indicative of circadian rhythm dysregulation which is associated with poor mental and physical health as, in addition, cortisol has a key role in responding to acute stressors) showed a positive correlation, suggesting an association between higher green spaces areas and lower stress levels, which may result from regular visits to and / or views of green spaces (Thompson et al, 2012). Furthermore, Jonker, van Lenthe, Donkers, Mackenbach and Burdorf (2014) refer that quality, besides quantity of green spaces, may correlate with the generally good health of population residing in small-areas and Pietilä et al (2015) suggest that self-rated health is associated with exposure to green areas through an increased number of recreation visits and everyday outings. But impacts on human health have also huge social and economic costs that go beyond those experienced by the individual *per se*. In fact, the European Commission estimated in 2010 that direct costs in healthcare derived from air pollution reached EUR 4 billion (European Environment Agency, 2015).

The accumulated knowledge and increasing awareness of the overall benefits of the presence of green spaces in urban areas has led in more recent years to a new extent of the "green elements" presence in the cities, leading into a broader concept including green spaces and the new solutions, defining *urban green infrastructures*. Urban areas are composed by the built environment and the external environment between the buildings (James et al, 2009). External environment comprises two different spaces – grey spaces and green spaces. James et al (2009) defines grey spaces as the lands consisting of predominantly sealed, impermeable, 'hard' surfaces such as concrete or tarmac. In the sense of the urban green infrastructure, emergence of "greener" buildings (where the "green elements" are infrastructural) and solutions (where site-tailored elements could be added *a posteriori*) have taken place, generating the inclusion of grass, shrubs, plants and trees in the building environment, which wasn't previously considered. Possibilities include buildings' greenery systems: green roofs, green walls, green balconies, sky gardens and indoor sky gardens (Raji, Tenpierik & van den Dobbelsteen, 2015), urban kitchen gardens (Pinto, 2007), community gardens (Algert, Baameur & Renvall; 2014) and domestic gardens (Cameron et al, 2012). More than just a question of human health or as an ornamental aspect, the use of plants as structural and functional elements in buildings is associated with the concepts of sustainable development

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and sustainable cities due to the important ecosystem services provided by the green spaces (Pinto, 2007).

Sustainable tourism and ecotourism

Tourism is a phenomenon that moves millions of people around the world, taking part as a major driver of the global economy. It is a multifaceted and geographically complex activity, where different services are ordered and delivered in different stages, from origin to destination (Pearce, 1991). Every year, much due to frequent changes in the tourism environment, there has been fostered competition between and within tourist destinations (Farhangmehr & Simões, 1999). Moreover, tourism sector's great importance in driving economy is that tourism is responsible for creating a large number of jobs. However, female entrepreneurship in the tourism sector has been rather neglected as a field of study. In this way, women's employment opportunities and the segregation of occupations are a major focus of research on women's situation in the tourism context (Costa, Carvalho & Breda; 2011).

As a psychological phenomenon, a tourist trip is preceded by a specific need that generates a reason to travel and sets a goal for the trip, which follows the search for information (Gursoy & McCleary, 2004). Like other emerging sectors in a modern economy, tourism is a dynamic and ever-changing industry, approaching recently, for instance, sustainable tourism. According to Orams (2005), the concept of ecotourism is probably also due to the widespread and growing interest in the natural environment and the corresponding recognition of the vital importance of the conservation of *habitats* and ecosystems. The idea of visiting and experiencing high quality natural environments and also protecting them from harmful impacts (mainly anthropogenic and avoidable) is now an acceptable and marketable one. As a result, a suitable term to coin this new area, which evokes the positive images associated with the term 'eco', such as in ecology, ecosystem, ecosphere and eco-sensitive, together with the activity of tourism has been created – ecotourism -, expressing a concept of gaining increasing popularity.

Similarly, sustainable tourism development should be seen as an adaptive paradigm, a part of the parental concepts of development and sustainable development, at the same time that should aim at contributing to objectives of sustainable development, and development in general, by determining specific principles in the light of its parental concepts (Tosun, 2001). Therefore, and according to Hassan (2000), tourism marketing for the new millennium and beyond must focus on forms of tourism that are sensitive to promoting and sustaining the environmental integrity of natural and cultural heritage resources. In fact, the evolution of the concept of sustainable tourism was evident in the literature before the term sustainable development was officially used (Hardy, Beeton & Pearson, 2002). An example of this is included in Butler's Destination Life Cycle Model (Butler, 1980), which has been argued as reflecting the concept of sustainable development indirectly (Hunter, 1995, 1997) and the concept of carrying capacity (Stankey, 1973). In summary, a review of the variety of ecotourism or sustainable tourism definitions shows that, at a minimum, ecotourism can be described as tourism based on the natural environment that seeks to minimize its negative impact over that environment. However, many authors argue that ecotourists should attempt to do more than simply minimize impacts. They should also contribute to the health and quality of the natural attractions that they visit. It may be that one of the challenges for the

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ecotourism industry is to assist in moving ecotourists from a minimal 'passive' position to a more 'active' contribution to the sustainability of 'eco-attractions' (Orams, 2005).

Portugal is a relatively small European country in area, with 92,225 square kilometers – the thirteenth in the EU – (Fundação Francisco Manuel dos Santos, 2015) but it has a huge variety of landscapes and high diversity of natural habitats. Portugal's year-round mild climate is also a very important asset for ecotourism development. Balance in tourism increased 9.5 % in 2015, positioning Portugal at fifth place in the list of countries with greater balance from European Union (Instituto Nacional de Estatística - INE, 2016). According to the Instituto da Conservação da Natureza e das Florestas[1] (ICNF), about 21 % of the Portuguese territory is formed by protected areas with strong natural values and biodiversity. ICNF also refers that, according to the data provided by the Registo Nacional de Agentes de Animação Turística[2], there were registered about 500 agents with recognition for the practice of nature tourism activities early in 2015. Eight tourist enterprises in places of great natural and scenic value were acknowledged at that time for good practices.

ICNF also provides some data concerning ecotourism, which are the following:

- 352,588 visitants contacted with protected areas in 2015, taking into account the number of users of households managed by ICNF and in visits, besides requests for information and sales brochures and publications.
- The number of visitants that went on a guided visit to headquarters and protected areas interpretation centers in the same year was of 28,896.

Master's project framing

In the context of this project the selected green spaces comprise urban gardens and parks, typically consisting of herbaceous areas punctuated with shrubs and trees, mostly by its ornamental value but also including many aromatic and medicinal plants. These green spaces intrinsically contain a multiplicity of information regarding plants species, such as taxonomical, ecological and ethnobotanical. Eventually, green spaces also cover some interesting facts about the history of the place that are normally seldom explored. In this way, cultural services of green spaces concerning knowledge expand alongside with educational and cultural heritage values.

Within this perspective, and becoming tourism a highly segmented activity, with growing distinguished groups of consumers, there are still unexplored markets concerning urban ecotourism. Therefore, the study of different activities, resources and services for this segment becomes of high importance.

A fundamental starting point for this work it the belief that if people are alerted for the importance of the green spaces at the same time that their scientific knowledge enriches, their respect and esteem by those spaces increase, leading to a more self-conscious and sustainable use of the environment, in this case of the urban green infrastructures, in a virtuous cycle. In order to globalize this belief and turning it to reality, visits to green spaces need to gain increased value. Our proposed option to increase those spaces' value is the creation of technological tools, in particular a mobile application and an informative website.

Technology takes nowadays an important role in our lives. In 2014, subscribers / users of mobile equipment service in Portugal were 18,973,597. In 2015, more than 90 % of individuals from 16 to 35 years used computer. This number decreased in individuals from

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35 to 44 years to 87.5 %. Even in individuals from 65 to 74 years, computer use reached 29 %. Also in this year, the same tendency was observable for the use of the internet. Decrease in individuals from 35 to 44 years maintained the same number for computer and internet use - 87.5 %. Concerning the internet use, individuals from 65 to 74 years, reached 27.2 %. All of these data are retrieved from Pordata, an online database of Portugal from Fundação Francisco Manuel dos Santos (Pordata, 2015, 2016a). Concerning to applications an easy example is the "Pokemon Go" application, which was reported to have been downloaded at least 15 million times, according to the USA Today, in 13 of July (Brett Molina, USA Today, 2016).

The aiming of this project is to design technological tools that allow a better interaction and fruition of green spaces by the visitors, at the same time that expands their knowledge about the places over different dimensions – from botanical to cultural in a contemporary, intuitive, simple self-oriented way. The competitive edge of these tools is going a step further from compiling data, arranging it to be appealing, especially due to the interaction with the user. There are known several applications that aim to identify plant species and others with the purpose of providing routes (either to cities or natural parks, for instance). However, there has not been brought to our knowledge tools connecting both concepts, therefore being a gap that we can fill. Finally, the use of a mobile application is a tool of easy use for younger people, appealing them to visit more or spend more time at green spaces, leading in the future to a generation of more informed individuals that treasure these places and demand for more natural and ecological cities.

2.Methodology

Contents of the technological tools

For the development of the mobile application and the website, firstly it was analyzed which contents should be common to both tools and which should be specific. In this sense, it was idealized the type of information about the green spaces and particularly about the existing plant species to be present in both tools. Concerning the mobile application, features should include the following: identification tools, QR Code system use and interactive tools - routings and games. On the other side, and in a complementary way, the website should provide a discussion forum, a schedule of any kind of events related to the species present, such as markets, exhibitions, contests and plantations, and the identification of plants of interest, which include, not in a restrictive form, plants of commercial importance, such as ornamental and aromatic plants, of biological or pharmacological interest as medicinal plants, or of symbolism, either by historical facts or region distinctive trade, for example. Tools' content is under constant improvement in order to respond to clients and users feedback.

Selection of places for the pilot study

In the context of this project, there is the absolute need for a pilot study, selecting a restricted number of urban areas. In consequence, there have been chosen two major cities in the north Portugal, that are near located, Porto and Vila Nova de Gaia, belonging to the metropolitan area of Porto. Both cities are highly urbanized touristic areas.

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Porto is the second most important city of Portugal, being a busy and lively commercial, cultural and cosmopolitan center and considered the capital of the North. It has population of 216,405 individuals. Vila Nova de Gaia comprises a more residential area and has 301,496 inhabitants and is also a pole of touristic attraction mainly due to its water front and Oporto cellars. In 2012 and 2014, Porto was named as European Best Destination according to surveys by European Consumers Choice. Numbers of habitants for the cities were retrieved from Pordata and data were last updated on 6 of June of 2016 (Pordata, 2016b).

Expenditure of municipalities *per* 1,000 inhabitants in protection of biodiversity and landscape in 2014 (parameter a) was of EUR 29,608 in Porto and of EUR 20,851 in Vila Nova de Gaia. Concerning general revenues and expenses in protection of biodiversity and landscape in 2014 (parameters b1 and b2, respectively), none of the cities presented revenues. However, expends were EUR 6,521 for Porto and EUR 6,304 for Vila Nova de Gaia. In each city existed at that time only 1 non-governmental organization dedicated to the environment *per* 100,000 inhabitants (parameter c). (Instituto Nacional de Estatística – INE, 2015a). All of these numbers are summarized in table 1.

Table 1 – Parameters assessing biodiversity and landscape in 2014.

		Cities		
		Porto	**Vila Nova de Gaia**	**Lisboa**
Parameters (EUR)	a	29,608	20,851	49,983
	b1	0	0	0
	b2	6,521	6,304	25,645
	c	1	1	5

Parameter a: Expenditure of municipalities *per* 1,000 inhabitants in protection of biodiversity and landscape.
Parameter b1: General revenues in protection of biodiversity and landscape.
Parameter b2: General expenses in protection of biodiversity and landscape.
Parameter c: Non-governmental organization dedicated to the environment *per* 100,000 inhabitants.
(Own authorship)

In comparison with the capital, Lisboa, these northern cities' expends *per* 1,000 inhabitants were approximately half and in general approximately four times less. Values for Lisboa from INE (Instituto Nacional de Estatística – INE, 2015b) are constant in table 1. In Lisboa existed five non-governmental organizations at the time, which is five times more than Porto and Vila Nova de Gaia.

The criteria to select the green spaces consisted on the following: botanical interest, popularity among the public, visitation frequency, provided services and organization of events frequency. Botanical interest is a very important factor as it may add value to a space that is not so acquainted or visited but that can provide a rich scientific content, attaching a symbolism to that place capable of arising the interest of the users. Popularity among the public is important because spaces with more popularity are probably the best fitted to promote the technological tools, along with visitation frequencies. However, this parameter also implies the densification of information regarding plant species, and more variety of routings and games. Finally, the frequency of events organized in green spaces has direct impact on the website content and the services provided relate to requirements appreciated by the visitors, such as biking park, restaurants and others.

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Potential users' inquiry

It was created an inquiry, available online both in Portuguese and English, for potential users of the mobile application and informative website. This inquiry was made available on a facebook page with specific target parameters. The audience target was geographical, being chosen the locations of the selected cities for the pilot study, Porto and Vila Nova de Gaia and surrounding areas within a radius of 40 kilometers. It was constructed to collect information concerning which green spaces are usually visited, the participants' perspective of their scientific knowledge in relation to green spaces, the potential interest in the technological tools idealized and, in the end, some demographic / professional data.

Contact with green spaces' managers

Meetings with the green spaces' managers, which could represent possible clients, already took place. In this meeting or through other means, such as e-mail, the interviews / inquiries' purpose was to identify eventual necessities or aspirations and to check if the technological solution idealized is within expectancy or if requires changes. This step is important to assess the interest displayed in the presented solution, especially in the mobile application, and wiliness to pay for it. Another essential step is verifying if any similar solution is already being offered. Also, confirming the existence of informative content about the green spaces and / or a schedule of events (and knowing the type of the events) is important, alongside with the availability of those contents to the public, for instance in the form of online presence. Besides that, other data are highly relevant for their contribution to reformulation or modification of the contents offered by technological tools or even to assess other possible products / services, such as the status of the botanical patrimony inventory and whether the inventory is available to the public or not, along with eventual needs or aspirations related to a more effective management.

Product development analysis

Concerning product development, there has been performed strategic planning and marketing-mix construction. Complementarily, inquiries to potential users and green spaces' managers comprised the market studies.

3. Results and discussion

"Grene" ['grin']

Green is the colour associated to nature and plants. Research on the etymology of this word led us to the Old Saxon form *Grene*, which is pronounced as 'grin', being the same word derived from Proto-Indo-European *ghre. Easy to pronounce and easily remembered for the similarity to the present phonetic form of the word, Grene was the chosen word for the technological tools. Its significance also took a crucial place, because, both in Portuguese the word *verde* (arises from the Latin *veridim*) and in English the word *green*, relate to the concept of *growth*. Furthermore, *Grene* has another meaning, which is to indicate something *young*.

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The logotype was also associated with the green colour. After several attempts, the chosen elements to illustrate were the play icon in the center of a cloverleaf (Fig. 1). The concepts are related to more or less universally generalized ideas. The play icon is used to indicate the start of something. In this case, the start of an adventure and a guided visit, besides the start of an entrepreneurship project that can even contribute somehow to increase awareness and acceptance of gender equality in tourism and entrepreneurship. The cloverleaf is related to luck and is often used as a lucky charm. Finally, the logotype has a small detail. The stalk is slightly curved in order to create similarity to the non-capital g letter, which is the first letter in *Grene*.

Figure 1 – Logotype for the technological tools

Source: Own authorship.

Technological tools' impact in the market

Inquiries are not yet closed, so results of the market analysis are not shown. However, it is possible to refer that there has been a general public curiosity and acceptance for this technological project, which was visible also by discussions in conferences where this project has been presented. It is possible, therefore, to confirm that there is the interest and need for this kind of tools.

Nonetheless, it was already noticed that, even if users were willing to pay in order to access the mobile application, it would be extremely expensive to launch the application without financial aid and difficult to guarantee the minimum number of downloads required with the need to resort deeply to marketing. For all this, and taking into account the data to be provided by the technological tools, major potential clients were considered to be the managers / owners of the green spaces. Unfortunately, a lack of wiliness of potential clients to invest was detected. This is probably explained by the fact that many of the green spaces under focus are managed by the municipalities, which have a restrict budget for environment-related activities. Municipality of Porto dedicated EUR 23,803.998 for promotion of the entire urban environment for environmental sustainability and for improving quality of life, which corresponds to 11.5 % of the total budget. Gardens and parks received an investment

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of EUR 130,000 for municipality services. For the qualification of green spaces, EUR 1,147.700 were attributed (Câmara Municipal do Porto, 2016). Vila Nova de Gaia municipality dedicated EUR 2,216,750.00 for environmental protection and nature conservation, corresponding to 2.55 % of the total budget (Câmara Municipal de Gaia, 2016).

Green or environmental marketing

"Green or Environmental Marketing consists of all activities designed to generate and facilitate any exchanges intended to satisfy human needs or wants, such that the satisfaction of these needs and wants occurs with minimal detrimental impact on the natural environment" (Polonsky, 1995, p. 30).

Applying that definition to the present project, there is a possible framing. Technological resources have a minimum impact on nature, which is an important factor for their choice comparing with resources needed to develop any other type of tools with the same purpose, such as educative games that would require many materials, some even derived from plants like paper, producing a highly negative environmental impact.

Next steps

Further contacts are needed to gather more feedback from other potential clients and users. The progressive expansion to more locations is also envisaged. After the completion of the project development plan, possibilities are to gather investors for fully development of the technologies.

Additionally to the idealized tools there is the possibility of implementing a service to perform the inventory of plant species present in each green space because it was possible to conclude that this work has not been accomplished or has not been updated by the respective management services. This core information is crucial for a complete knowledge of the botanical assets.

Furthermore, there can be implemented more specifications to the application such as introducing the possibility of visitors to integrate the management of the species. These may be considered a type of citizen science and may occur by reporting species that are not inventoried, the absence of species inventoried or even plants' growth in unfavorable conditions. In this way, in distant prospective, as information related to plants can include whether the species are autochthone, exotic or invasive, individuals that acquired this knowledge will be able to recognize and also report exotic or invasive species. 17.9 % of the total flora of continental Portugal comprise exotic more or less naturalized species including species, subspecies and also some hybrids (Almeida & Freitas, 2012). However, this is not a new idea and there are applications restrictedly aimed to inventory, with help of individuals, invasive species, such as "Invasoras.pt" (Plantas Invasoras em Portugal, 2012).

In a parallel alternative there is the possibility of integrating the content of these technological tools in other somehow related solutions already developed and available in the market. For example, touristic applications such as city tour guides, which already at least refer green spaces, accordingly to their own aim.

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There are also other future perspectives for these tools. At first instance, the creation of a network of urban green spaces and their plants species. In this process green spaces will be inventoried as well as all the plants species available.

In second place these tools and respective network, in the future, may also comprise forest parks and protected areas.

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[1] Institute for Nature Conservation and Forests.
[2] National Register of Tourist Animation Agents.