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CONTENTS

Editorial

The publication of the *European Journal of Geography (EJG)* is based on the European Association of Geographers' goal to make European Geography a worldwide reference and standard. As a result, the papers published in the EJG, including those on this issue, are focused in promoting the significance of geography as a discipline, in resolving global issues or applying geography, complementing, of course, the fundamental goals of improving the quality of research, learning and teaching of Geography. In other words with the EJG the European Association of Geographers provides a forum for geographers worldwide to communicate on all aspects of research and applications of geography with a European dimension, but not exclusive.

As a result, every issue of the EJG provides a glimpse of the important role Geography can play in helping researchers, academics, professionals as well as decision makers and politicians in resolving a wide spectrum of problems. In other words, EJG following Geography which connects the physical, human and technological sciences is aiming at enhancing teaching, research, and of interest to decision makers, problem solving. That is, in every issue of the journal a reader can find answers of how aspects of these sciences are interconnected and are forming spatial patterns and processes that impact on global issues and thus effecting present and future generations.

The goal of the editorial team, which up to now has been achieved to a great extent, is that the papers of the EJG by dealing with places, people and cultures, will explore those issues ranging from physical, urban and rural environments and their evolution to climate, pollution, development and political-economy. Thus, your contributions to the EJG are not only desirable, but necessary for Geography and Science as a whole.

Kostis C. Koutsopoulos

Editor EJG

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BOOSTING INNOVATION AND DEVELOPMENT? THE ITALIAN SMART TOURISM, A CRITICAL PERSPECTIVE

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Abstract

This paper deals with smart tourism practices and innovative tools supporting cultural heritage, with the aim of evaluating their potential in the Italian scenery. In particular, it evaluates the theoretical and methodological implications of the Smart City paradigm, above all in the tourism sector, as well as analysing the results of data, indexes and good practices related to Italian smart tourism. Furthermore, it provides an innovative methodological approach named STeMA, used within different UE-funded projects with the aim of promoting integrated, strategic and competitive tourism management plans thanks to the development of ICTs.

***Keywords**: smart tourism, smart culture, sustainable development, Eurogeo2014*

1. INTRODUCTION

In recent years smart technologies as well as the digitisation of cultural resources have been increasingly regarded as inputs for added-value products and services in fields such as *cultural heritage and tourism, growingly interwoven one each other.*

The increasing convergence between culture and economics in the process of city branding and the emergence of the so-called "commercial cultures" have been transforming urban spaces as well as their representations/narrations elaborated by citizens, city-users and tourists.

However, economical crises affecting Western - and specifically European - economies since 2008 have strongly affected the ascending trajectory of capitalism-based service societies where tourism is a very important economic driving force. Apart from this, other kind of "crises", namely environmental and institutional, induce an innovative change in cultural and tourist practices which have been recently oriented towards the paradigm of the Smart City, whose potential could be exploited particularly in a country such as Italy where tourism suffers from an integrated and holistic approach.

In effect, it is interesting to evaluate to what extent main Italian cities provide a smart sustainable access to cultural heritage for a wider range of users by the use of digital technologies in order to transform passive audiences into active practitioners, through the cross fertilization between ICT enterprises, Creative and Cultural Industries and local actors.

First of all the work underlines potentialities and limits of the Smart City concept - both at the theoretical level and the methodological one - . Secondly, the Italian smart tourism is analysed through a set of indicators at the core of indexes defining the Smart city, particularly

in tourism and cultural heritage. Finally, the paper analyses the methodological approach called STeMa (Sustainable Territorial environmental/economic Management Approach, developed by Prezioso, 2004; 2011; 2013) that, together with STeMA-GIS, aims at promoting integrated, strategic and competitive tourism management plans thanks to the development of ICTs, since smart tourist technologies should not be developed just for final users but above all in the planning stage.

2.CONTEMPORARY CITIES, BETWEEN SMARTNESS AND GLOBAL COMPETITION

During the last decades, competition across cities – both the so-called "global" cities and the small or medium-size ones – has growingly increased, due to globalization together with trade liberalization measures and fast technological changes, as underlined by Giffinger et al. (2007).

The post-fordism shift and the transition to a neo-liberalist urban paradigm, implying the passage from a public-led urban planning to a entrepreneurial approach of urban policies – has been deeply studied since the late eighties in order to highlight the material and experiential implications linked to the rise of "commercial cultures", based on the convergence between culture and economy (Harvey 1989; Featherstone, 1991; Lash and Urry, 1994).

Consequently, only a few out of many location-based characteristics gain importance for global actors. Among the different economic fields affected by the growing global competitiveness, cultural heritage and tourism seem to represent the sectors where urban image and attractiveness potential become even more important. Thus, several tourism-led or cultural-led regeneration policies have been recently developed in several European regions in order to attract exogenous investments, favour exogenous resources as well as creating a new city image according to the patterns of territorial branding strategies (Cirelli et al., 2013; Graziano, 2013).

Such an increased competitiveness has recently induced many local actors to consider the Smart City paradigm as the competitive asset to face city concurrence on a global scale. Combined with globalisation, the technological transition of the '90s as well as the patterns through which ICTs are being developed and deployed exert considerable impacts on the whole urban fabric, above all in sectors such as tourism for which digitisation has highlighted new potentialities of development. Digitisation does not mean only e-commerce, but it includes a wide range of technological tools which can permit to increase tourist attractiveness and consequently establish the city brand.

Thus, the growing connection among different sectors such as culture and tourism can be used as a privileged scheme of interpretation about the innovative contribution given by the ICTs in the process of reconfiguration of urban spaces.

2.1 The Smart City concept: a critical overview

In spite of the worldwide enthusiasm about the label of Smart City, an integrated and holistic definition of the city smartness is still missing. Different definitions of smart cities have been recently developed in order to generally indicate the use of technologies with the aim of improving competitiveness and ensuring a more sustainable future by symbiotic linkage of networks of people, businesses, technologies, infrastructures, consumption, energy and spaces.

If the use of technology and social innovation seems to be the core issue of the concept (Mosannenzadeh, Vettorato, 2014), generally a the city is regarded as smart when it is well-performing in six macro-areas, that is to say: Economy, Environment, Mobility, Governance, People, Living (Komninos, 2002; Giffinger et al., 2007; Shapiro, 2008).

So, according to Giffinger et al. (2007), "a Smart City is a city well performing in a forward-looking way in these six characteristics, built on the 'smart' combination of endowments and activities of self-decisive, independent and aware citizens".

Linked to the concept of "wired city" (Papa et al., 2013; 2014), the increasingly widespread label of Smart City implies a new dimension to be built through the inclusion of innovation and technological infrastructures into the systemic structure of the city.

In effect, even the very theoretical concept of Smart City is based on a controversial dialectics made of two antithetical representations. The first one implies a top-down approach considering the Smart city as the final output of business, commercial or institutional interests, often linked to the determinist idea of a kind of 'control room' for the city.

The second one refers to a bottom-up approach which considers the Smart City as the result of a participatory orchestrations empowered by active citizens, dismissing any pattern of top-down urbanisation projects (see also Breuer et al., 2014) so that the "smartest cities are the ones that embrace openness, randomness and serendipity — everything that makes a city great" (Mosannenzadeh, Vettorato, 2014). In the concept of the "Intelligent city" developed by Komninos (2002), human and social capital together with infrastructural and technological investments support a cohesive city development thanks to a bottom-up governance (see also Caragliu et al., 2011; Fistola, 2013).

Thus, the Smart City can be regarded as a kind of "enabling city (that) combines the creativity of citizens and experts, politicians and businesses for making cities in collaboration. Even though technology and connectivity are not necessarily the most critical factors in achieving this aim, they have the potential to be the enabler" (Hollands, 2008, p. 310).

However, the Smart City concept remains elusive, even though the recent proliferation of definitions mirrors the necessity of developing new ways of looking at the contemporary city. Still, its conceptual dimension should be more critically approached owing to not only its epistemological limits, linked to the wide range of different definitions, but also its methodological and operative ones. The enthusiasm about the concept, increasingly regarded as the new paradigm of urban renaissance policies, sometimes neglects the intrinsic conflict between technology-oriented development and socio-environmental sustainability (Hollands, 2008; Komninos, 2009).

Paradiso (2013) underlines the conceptual haziness and ambiguity of definitions, which should take into account socio-territorial disparities fostered by investments in ICTs, strictly linked to the concept of splintering urbanism developed by Graham, Marvin (2002). In addition to this, it should be highlighted the growing invasiveness of the mobile web, that has been re-drawing virtual aggregation clusters as well as the patterns of interaction between real and virtual spheres.

On a global scale, several cities are promoting a great number of initiatives aiming to become smarter attractive destinations. With regard to the Italian scenery, several studies and analyses have ranked Italian cities on the basis of their level of smartness, whose results often differ one each other because of an heterogeneous set of indicators, variables and data. Among the others, we remember the *ICity Rate* (Forum PA, 2013) as well as the *Smart City Index* (Between, 2014). The last reveals to be more useful for the aims to this work since it includes a specific index dedicated to smart culture and tourism.

Thus, the paradigm of smartness - even in fields such as tourism and cultural heritage – has been increasingly regarded as a panacea to enhance attractiveness. However, even in the tourism sector the concept remains elusive and over-valued. During the first meeting of the Tourism Resilience Committee of the UN World Tourism Organization in 2009 the smart tourism concept has been launched in order to include some relevant issues such as ethics, quality and sustainability at all levels of the service chain, with the aim of providing short-term reactions to the current economic crisis together with the overall goal of a long-term sustainable development.

In public discourse, however, smart tourism, like the smart city, is often associated just to the use and application of new generation technologies. Alongside the smartness related to the specific behaviour of tourists/consumers, smartness should be also referred to the economic structure supporting the tourism sector (travel agencies, tour operators, restoration, accommodation, tourist services) as well as to the whole tourist destination (see also Ercole, 2013).

In recent years, increasingly widespread updated technologies have been transforming the different micro-areas of tourism sector, ranging from the tourists' experience (the demand) to the supply both of individual tourist enterprises and overall destinations.

Particularly, an increasing number of tourists rely on mobile devices, social media and network technologies based on user's generated contents not only in the pre-travel stage with the aim of planning and organising, but above all during the tourism practice to gain information, share experiences and personalize the trip (see also Germann Molz 2012, p. 3).

The term "interactive tour" has been used to describe these new practices of tourism, that imply a rethinking of the well established paradigms of tourism studies in the digital age as well some concepts and narratives linked to traditional tourism experience, such as landscape, tourist gaze, authenticity, escape, increasingly pressed by unprecedented ones such as 'mediated gaze' or 'mobile conviviality' (Ercole, 2013).

It's not surprising that Urry and Larsen (2011, p. 14-15), in introducing the updated version of their seminal work *The Tourist Gaze*, significantly renamed *The Tourist Gaze 3.0*, underline the need to "rethink the concept of the tourist gaze as performative, embodied practices, highlighting how each gaze depends upon practices and material relations as upon discourses and signs".

Germann Molz (2012, p. 3) highlights that "over the past decade, the proliferation of Internet cafés, portable computers, mobile smartphones, wireless Internet, connected hotspots, online social networking sites, user-friendly social media platforms and photo sharing sites has normalized ubiquitous access to the Internet among mobile geographically-dispersed social groups, not least of all interactive travellers."

The author identifies some relevant characteristics of smart tourism, linked to the broader frame of mobile sociality.

First of all, the connection involves the use of smart devices, mobile and Internet-connected interfaces spatially localized (such as GPS or Google Earth), that allow tourists to orient themselves. Secondly, smart tourism transforms tourists in intelligent, co-creative active producers who can promote respect for the tourist destination (civic engagement). Third, smart tourism implies a multi-way, multichannel approach as an interface between the real space and the virtual one that stimulate the tourist's immersion in the physical environment of the destination through the unprecedented narratives and representations provided by mobile devices.

Moreover, smart tourism involves high levels of sociability, giving tourists increased opportunities to interact with local population or other tourists. Finally, it has the potential to improve local sustainability, since mobile applications and devices can promote awareness

about the host society, transforming tourists from "economic units" in "cognitive unities" (see also Ercole, 2013).

As a result, tourism, travel and backpacking are increasingly regarded as metaphors of the mobile world and generally of the issue of postmodernism: “interactive travel has a lot to tell us about this changing social world, and especially about the way social life has become wrapped up in technologies of moving and communicating ” (Germann Molz, 2012, p. 7).

3. ITALIAN SMART TOURISM AND CULTURE

The analysis of Italian smart tourism implies the selection of a few macro-categories to choose smart cities where cultural heritage and tourism intersect with most evidence or have already been supporting local development inspired to the paradigm of smartness.
The chosen methodology is based on the theoretic and epistemological in depth examination of the Smart City concept, integrated with the analysis of data and statistics both on the national level and related to some selected urban areas. A swot analysis is finally used as an effective instrument in order to evaluate the level of smartness in the Italian scenery.
Generally, the smart enhancement of cultural heritage is related to four dimensions:

- collection, reproduction, protection, management/conservation (i.e. innovative restorative measures or techniques of archiving);
- contents and multimedia information creation technologies, both conservative and productive (i.e. data bases; data mining; semantic web; imagineering; augmented/virtual reality; oleographs);
- user’s interactive experience technologies (i.e. immersive/virtual/augmented reality; context awareness and geo-localisation; smart ambient; applications for smart terminals).
- the dimension of cultural heritage as a specific element connected within a complex system giving new possibilities of urban governance. So, the territory should be regarded as a complex system to be monitored through live data collection and governed by allocating resources according to users/citizens/visitors requests through, for instance, sensor networks that record main activities or platform solutions to manage city events (i.e. sensors to record citizens fluxes; short-ray communication systems such as Bluetooth, WiFi; interactive kiosks; cloud computing platforms to concentrate huge quantities of data and their processing).

So, mobile technologies are the main tools through which citizens and tourists, more and more *prosumers* than consumers, can integrate their personal experience, by changing the relationship with cultural products in a dynamic interaction.

These tools can permit the tourists to represent/describe/interact with the cultural object or tourist site in a fluid space-time dimension trough a multi-way and multichannel approach which imply the simultaneous use of different mobile devices.

As far as the specific Italian scenery is concerned, during the ‘70s Italy was the first international tourist destination, whilst nowadays, in a global context of growing competitiveness, the impressing cultural heritage is not longer sufficient to attract visitors.

Smart tourism, that could involve relevant potentialities of development, is not really supported by institutional actors, as underlined by the *Smart Culture and Travel Report 2014*, published by *Between* with the support of *Agenda Digitale Italiana* (2014). The report analyses a wide range of 70 indicators, related to the possibility to access online information and book hotels and restaurants; to buy online tickets for tourist attractions, museums, theatres; to plan and personalize the travel; and finally, the presence of social network pages

and applications for tablets and smartphones dedicated to culture and tourism as well as the participation to calls for tender about Smart cities.

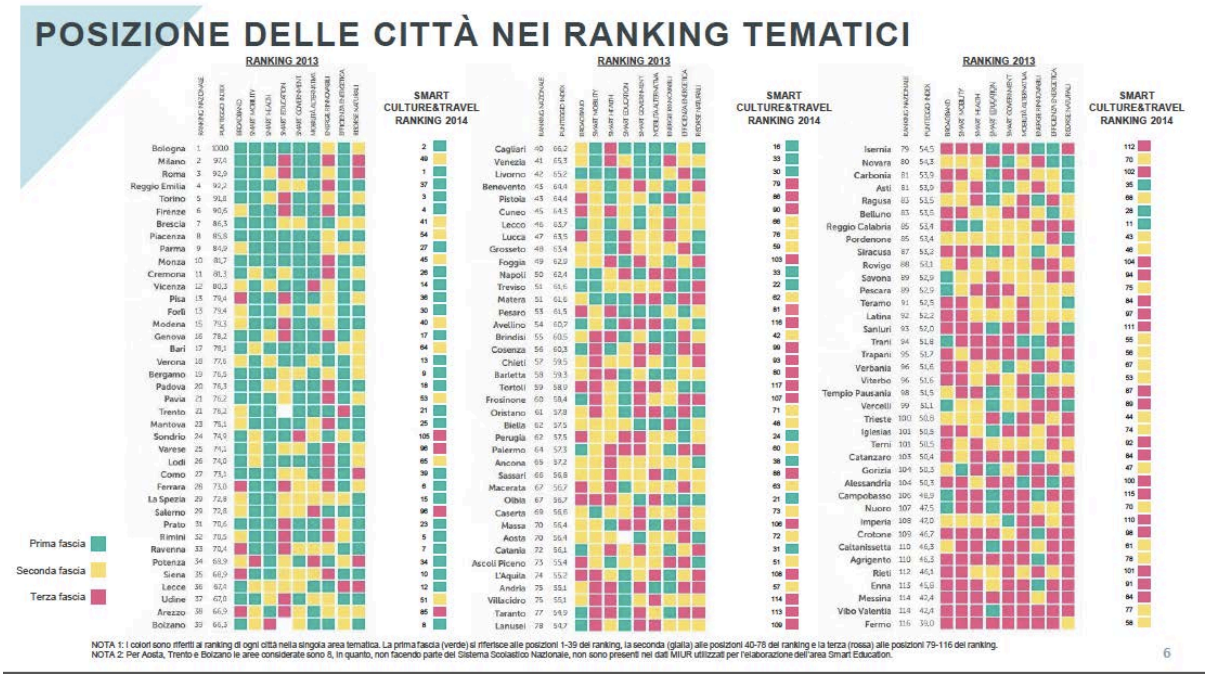

Figure 1. Italian province capitals smart and culture ranking.

According to this report, only 4 province capitals over 117 (Rome, Florence, Siena, Venice) permit the tourist to buy online tickets for museums, archaeological sites and cultural monuments.

Table 1. The first ten Italian smart cities concerning culture and tourism.

Rank	City
1	Rome
2	Bologna
3	Turin
4	Florence
5	Rimini
6	Ferrara
7	Ravenna
8	Bolzano
9	Bergamo
10	Siena

At a first glance, the most interesting result is that Rome, that suffers from deeply rooted issues related to quality of life, is the first smart city from the tourist point of view, even

before Bologna that is the smartest if we consider other aspects such as education, transports, renewable energies etc.

Rome is ranked as the first thanks to a system of thematic portals which permits to have information and book hotels, restaurants and monuments access, in addition to a highly technological library system and a wide range of tourist services offered through web and apps.

Medium-size art cities such as Rimini, Ferrara, Ravenna, Bolzano and Bergamo are inserted in the top ten while Siena is the only one as a small-size city. Reggio Calabria is the first southern city (11th) and as a whole just six southern cities are among the first twenty (Lecce, Cagliari, Olbia, Catania).

With regard to overall percentages about the diffusion of new web channels, applications and services, main Italian cities are far from being smart tourist destinations. Just 14% of municipalities gives the possibility to book online hotels and b&b; 21% of cities has a citizen or tourist card to improve access to city services; 61 % of province capitals has an official page on Facebook, Twitter or YouTube, but just 29% has an official page specifically destined to culture or tourism in all the above-mentioned social networks or sharing platforms. If all the province capitals have their own website, about 50% has a specific portal about tourism and 17% about culture or tourism.

Furthermore, according to a research carried out by Tourism Economics for Google (2013), improving online tourist content would means to give impulse to Italian economy to a such level to create 250.000 new jobs with an increase of PIL of 1%.

So, nowadays, Internet as an instrument of territorial enhancement is still undervalued and underused. The percentage of tourism coming from Web channels is just 26%, over an European media of 49%. Moreover, the market of online reservations and travels is dominated by the Online Travel Agencies that do not generate wealth in Italy, which is even more worrying if we think that 46% of overall global e-commerce, equal to 5 billions per year, is linked to tourism (*ibidem*).

At a micro level, Italian accommodation is not updated in terms of smart tourism. The simplest smart tool, that is to say a booking engine permitting to book online hotel rooms, is included in just 30% of websites, that underlines a very digital divide to be overcome. The digitisation is even more complicated by the extreme fragmentation of the supply and the deeply-rooted tradition of family-run micro-companies of the sector.

What is more, the reform of 2001 about the 5th Title of Constitution, in the 117th article gives the regions the exclusive competences about tourism, thus even more nourishing the already existing fragmentation.

So, on a local scale, in Italy there are only few effective examples of smart tourist and cultural practices, conceived in order to permit the tourist/visitor/user to “build” a tourist’s personalised experience. Actually, some practices can be underlined, both at the institutional level and the semi-private one.

On the institutional level, the national official portal about tourism, recently redeveloped and updated, collects all the tourist cards and official applications destined to tourism for each Italian region (www.italia.it). According to this list, the first smart region is Trentino, with 24 official apps dedicated, followed by Umbria (13) and Piemonte (10). Campania and Sicily have not official apps on tourism, just some tourist apps developed by private actors.

As far as the public or public-private level is concerned, we should remember an innovative Italian project based on digitisation of culture. It’s “Movio”, realised by the *Istituto Centrale per il Catalogo Unico* thanks to the funds of *Invisible Goods 2010* by Telecom Italia. The project is based on the consciousness that, apart from the well-known excellences, Italian cultural heritage is also made of different cultural events and exhibitions

which could be better enhanced thanks to the ICTs. “Movio” is an open source through which archives, libraries, museums, universities, schools and associations can realize virtual exhibitions to promote their own works of art, above all the less known ones, by integrating different tools ranging from photo-galleries, timeline and storytelling to interactive and conceptual maps. The most interesting tool is the ontology builder that permits the curator to create the conceptual map of the exhibition in order to give the user the possibility to follow his own personal path of surfing/visiting within the website.

Figure 2. An example of a virtual exhibition created through Movio.

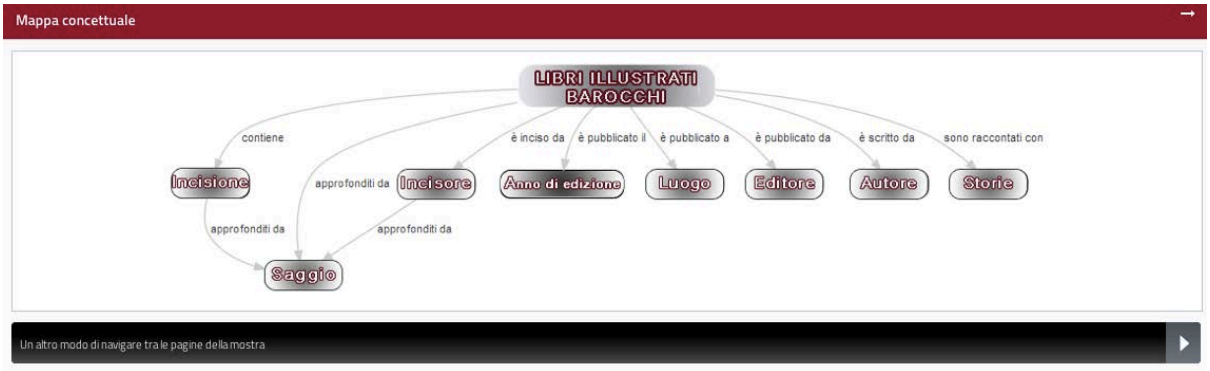

Figure 3. The ontology builder, a useful tool to create a conceptual map of the virtual exhibition.

Another good practice is represented by the Telecom Italia Future Centre located in the former convent of Campo San Salvador in Venice, where different tools of ambient intelligence and augmented reality give new perspectives about the traditional cultural heritage. Recently the contest called “Innovative Interactive Tour on Telecom Italia’s Future Centre” has been organised together with the *Arte Laguna Award* in order to award the most innovative way of tourist fruition of the Future centre architectural elements.

Figure 4. The Kiosk of the Future Centre with its Augmented Reality Point of Access

It is not surprising that the above-mentioned good practices of smart tourism and culture have been developed thanks the a public-private partnership as well as financially supported by a multinational company of telecommunication. This mirrors the transition to neo-liberalism urban policies and practices, more and more oriented towards an entrepreneurial approach of the city government and moulded by a growing privatisation of the public space. This implies increasing socio-economic and cultural inequalities of contemporary cities, where the smartness is not a prerogative of all citizens.

Within this scenery of the Italian smart tourism made of lights and darkness, a SWOT analysis can be used as an effective tool to evaluate current level of smartness and find out potentialities of future development.

Table 2.SWOT analysis

STRENGHTS	**WEAKNESSES**
World class, globally recognised heritage High tourist attractiveness Recent increase of start up companies in the tourist sector	Extreme fragmentation of the supply Modest technological orientation of the main institutions in the field Small family-run business in the tourist sector Lack of institutional coordination at the national level
OPPORTUNITIES	**THREATS**
Recent diffusion of calls for tenders and funds for developing smart tourism practices (national and international level) Proposal of creation of the *Registro Digitale Turismo* (Tourism Digital Register) Recent creation of Associations and Observatories about smart tourism	Lack of integration in the sector at the national level due to the exclusive competence of Regions about tourism Passive resistance from more conservative players that may prevent innovation in the field Lack of sufficient resources and know-how about smart tourism High burden of administrative issues

3.1. STeMA, an innovative methodology for tourism planning

The paradigm of smartness in the tourist sector should be better developed not only for final users but also in the tourism planning stage, so that new technologies can be exploited as innovative tools to support the ex ante analysis finalised to the tourism development.

With regard to this, an innovative theoretical and methodological planning approach to support tourism development is the STeMA and STeMA GIS methodology (Prezioso, 2004, 2011, 2013), finalised to understand the territorial sensitivity as the final indicator of the territory propensity toward transformation. This is a territorial planning instrument that integrates Plans, Projects and Balance, and acts as preventive measure promoting assessment analysis of projects to achieve social and economic sustainable growth.

The STeMA methodology provides fourth generation plans using Impact Assessments – (Strategic Environmental Assessment – SEA - and Territorial Impact Assessment – TIA -), depending on geographical plan scale, in addition to transforming the European geopolitic integration principles (sustainability, subsidiary, cohesion, integration, perequation) in project actions through a multi-disciplinary and balanced approach.

The model can represent a tool to evaluate and enhance the territorial attractiveness, which implies increasing quality, improving the historical cultural tangible and intangible heritage, supporting sustainability in tourism by an ex ante evaluation of policies, programmes and projects.

For this reason it is really suitable and applicable for ENPI-MED Cultural Heritage programme, UNESCO World Heritage Tourism programme, WHS brand/label for tourist destinations, sustainable conservation and tourist enhancement.

Specifically, the used tools are the following:

- Strategic Environmental Assessment
- STeMA Geographical Information System
- Quality Plan and Quality certification ISO 9000:2000 and 14001
- e-government
- territorial marketing: benchmarking, SWOT, business plan, project financing
- governance
- dissemination
- territorial management of EU budget projects

The first step is represented by the Initial Environmental/ Territorial Framework that implies the ex ante environmental evaluation, defining the overall level of territorial ‘sensitivity’ through the analysis of the following territorial subsystems:

- the morphological sub-units: hydrological, geomorphologic, natural landscape systems;
- the morpho-territorial unit: historical landscape system;
- the settling spatial typologies: natural and protected areas system; fauna system; settling urban system; rural settling system; atmosphere system; noise system; public safety system.

In the second stage, the Initial Programme Framework analyses the different normative typologies and the financial supply of each territory at the national or transnational (EU; UNESCO) level, in order to adapt the plan to the expected results.

In the third step the Project Framework links the previous frameworks through the Strategic Environmental Assessment in order to indicate the most sustainable paths of development.

This model has been already applied in several EU project, such as the Newcimed Project, which focuses on the enhancement of the cultural heritage of the so-called “New Towns”, a urban phenomenon which is widespread in the Mediterranean area. In that case, the STeMA model have permitted to record, classify, normalised in an integrated and systemic way the tangible and intangible cultural heritage (open spaces, public spaces, musical as well as food and wine traditions) by integrating the strategic plan for a sustainable tourism development within the territories involved in the project.

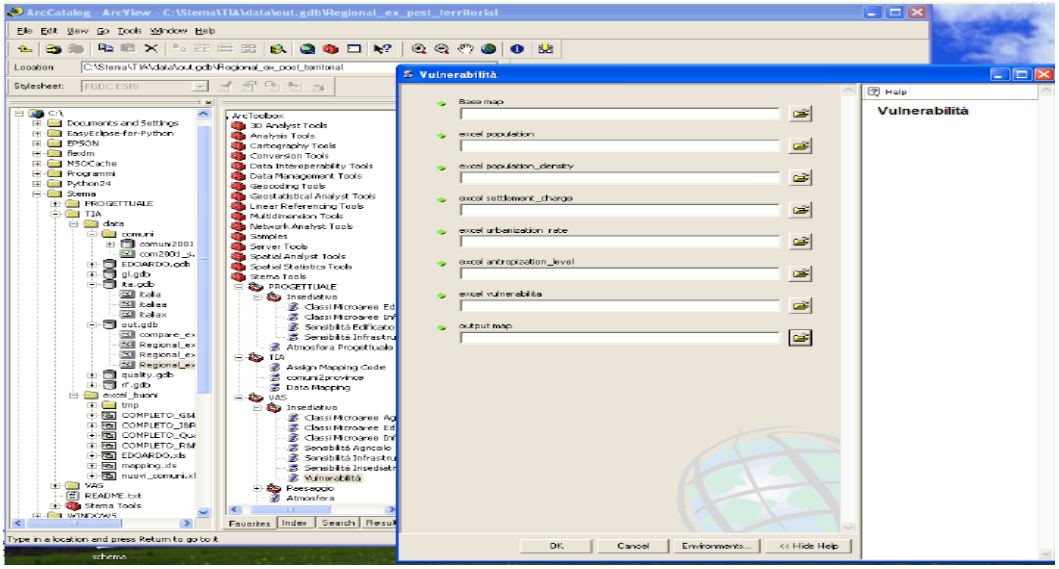

Figure 5. STeMA GIS: The assessment of territorial vulnerability, Prezioso (2004; 2011; 2013).

4. CONCLUSIONS

ICTs provide a wide range of tools able to enhance cultural heritage and, consequently, promote tourism. However, in order to be highly effective new technologies cannot be used just in the stage of user’s fruition, thanks to the possibilities given by mobile terminals, but above all in the planning stage. Promoting smart tourism for a smart city means to take into account all the dynamics of development of the involved territories in order to plan a sustainable process of growth which implies also the possibility to ‘use’ cultural heritage for tourism reasons.

As shown by data and the SWOT analysis, in Italy the process of digitisation is still in progress, due to the lack of central and integrated coordination among different regions and shared standards, apart from the Italian specificity of an accommodation system mainly made of family-run micro-enterprises.

A first step could be the *Registro Digitale del Turismo* (*Tourism Digital Register*) that should be created by the government within the project of *Agenda Digitale* during Expo 2015. It should propose a common national standard, based on interoperability, through which private and public local actors can develop their applications and services for tourist uses.

To this regard, STeMA model provides a theoretical and methodological approach for sustainable tourism management which could reveal to be highly innovative and promote a sustainable smart tourism development.

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URBAN GREEN SPACE NETWORK EVALUATION AND PLANNING: OPTIMIZING ACCESSIBILITY BASED ON CONNECTIVITY AND GIS-BASED RASTER ANALYSIS

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Abstract

The main objective of this paper is to establish a methodological framework, with universal use, in order to evaluate and optimize an urban green network in densely built urban areas. GIS functionality and its spatial processes modeling capabilities led us to choose the raster structure for our data analysis, although it is not as commonly used as its vector counterpart. The raster data structure, however, is the most appropriate in cases where there is a plethora of criteria involved and a need for successive layers overlay. Connectivity plays a prominent role in controlling and evaluating the structure of the generated network. This paper is based on the theoretical foundations of the theories of Landscape Ecology, Urban Ecology, Green Networks, Bioclimatology, Landscape Architecture, and the new discipline of Landscape Urbanism, combined with Spatial Analysis and GIS. Furthermore, we argue that the "square meters of green per capita" index is not satisfactory. The methodological framework proposes to take into account the overall effect of new green spaces over the wider region and service of the population, in order to draw conclusions.

Keywords: *Urban Green Network, Connectivity, GIS, Least Cost to User, Modeled Raster Analysis, Alpha Index, Gamma Index*

1. INTRODUCTION

Growth during the twentieth century (Heilbroner, 2000) and rapid urbanization caused serious problems (Romero-Lankao & Dodman, 2011) placing the way land-use distributes at the epicenter of urban planning and related research (Wang et al., 2012). Serious environmental damage, climate change (Harlan & Ruddell, 2011), the effect of urban lifestyle on health, physical, and psychological condition of people living in cities, makes research for open green spaces in urban areas more vital than ever (De Ridde et al., 2004).

Nowadays, sustainable development focuses on the "green network" (Conine et al., 2004) as a main strategic tool. This is for the integration of cultural and recreational uses in the urban fabric, and mainly for the maintenance and protection of nature. In other words, the intention is to achieve "*the reallocation of green spaces all over the city, fairly and democratically; thus each citizen has access in this good*" (Thompson, 2002).

Therefore, and in order to approach and analyze the urban planning process, there is a need to examine the following questions:

- Which spatial units of existing green spaces are suitable as structural elements of the green network and according to what criteria?
- Which new green spaces will be proposed and according to what criteria?
- Which connection of the green network will be realized and according to what criteria?
- Is the ratio m^2/ resident satisfactory in order to evaluate each proposal?

From the literature review, it appears that each of these questions has been examined, some of them in the context of Urban Planning, and most of them in the context of Landscape Ecology.

Based on these questions, a methodological framework is proposed in the present paper, which aims to show how Urban Planning can be organized from a holistic approach based on ecologic, service, and bioclimatic processes. These processes take place along the following three axes. The first is "the **initiating evaluation"**, which via ecologic criteria (the vegetation type, the area, and the number of birds) along with service criteria (the land use and the infrastructure network) and the bioclimatic criteria (Anthropogenic intensity and morphology), provides the process of least cost that in turn leads to the **weighting** of the initial study. This is one of the three basic urban planning components. In a similar manner, the second axis, "the **connectivity"** through biodiversity conservation criteria, the walking paths, and the Geometry via the new green areas, corridors, and their connections, provides the process of "**build a geometric network"**, which in turn leads to "the **optimization'** of space. Finally, the third axis, "the **green network"**, via connections between important spaces (Ecological network), Pedestrian network, Ventilation, Shading, and Dew, provides the process of map, tables, and indexes Alpha and Gamma that leads to the upgrading of the urban planning.

The steps of the proposed methodological framework are the following:
i) Definition of a new method for evaluating resident proximity to and accessibility of green spaces (based on their area and distance, normalized by block population density); ii) Formulation of a final cost raster, according to the entire set of criteria (e.g. ecological, environmental, urban planning, bioclimatic), along with the origins-destinations matrix produced by the "least cost path" algorithm. This will lead to the formation of linear links, not only of the major green spaces and green areas connections (existing and proposed), but also of smaller parts. iii) "Building" of a geometrical network from those links, whose structure is validated through the adaptation of the Alpha and Gamma indexes.

The main advantages of the proposed methodological framework are: i. It always selects the optimal path for connecting sources and destinations, instead of creating primary and secondary networks based on suitability. ii. The modeled processes allow many tests, although the methodology uses several criteria, parameters etc. iii. It is a tool for testing scenarios of urban planning in order to include bio-climatic and environmental criteria in planning projects. Of course, in order to be fully operational and utilized as a decision support aid newly updated non-spatial (temperature, humidity, air pollution, etc.) as well as spatial data are required. The next section is devoted to reviewing the basic planning components. The third section presents the proposed Methodological Framework, the necessary data collection, and their organization into geodatabases. In the last section, same thoughts based on the results are presented along with some conclusions related to Urban Planning.

2. THEORETICAL BACKGROUND – (CONCEPTUAL FRAMEWORK)

The basic principles of species and their habitat protection, biodiversity, soil, and aquifer protection as well as the rational allocation of land use in order to prevent its fragmentation are given by Landscape Ecology. This base theory offers the necessary structural elements; mosaic, corridors, and stepping-stones as connection components, and the matrix that contains them. According to Forman (1995, p.136), *«We may hypothesize that an optimum landscape has large patches of natural vegetation, supplemented with small patches scattered throughout the matrix. Alternatively, most of the small-patch functions can be provided by small corridors in the matrix»*. In other words, it offers the theories and approaches of evolving spatial patterns and the connectivity of these elements (Forman & Gordon, 1986; Turner et al., 2001; Van Dyck & Baguette, 2005; Forman, 2008). Certain methodological steps proposed by Forman are adopted in this paper.

It is also a fact that the contribution of Landscape Architecture is critical since it determines the model processes, in city scale, based on which green spaces are defined and allocated. However, Landscape Architecture does not focus on planning and design of green spaces separately any more, but it is rather established as a large-scale planning and land use organization discipline. It does not deal with the local solution, or the creation of beautiful sceneries, but instead provides solutions to the problems of urbanization and environmental degradation (Waldheim, 2006). However, an interesting approach offers the hybrid science of Landscape Urbanism, which establishes the importance of infrastructures concerning the landscape that surrounds them, for the growth of modern cities and planning of public space (Mossop, 2006).

Theories from microclimatology and bioclimatology are contributing to bioclimatic planning at city scale (Papangelis et al., 2012). The main factors that are documented are the existence of a marine forehead (Zerefos, 1984), the planting of trees (Hall et al., 2012), especially across main roads that follow the direction of prevailing winds. In this way, green corridors are used as filters of pollutant substances. An important bioclimatic factor that must be reviewed is the ratio of street width to building height (Ali-Toudert & Mayer, 2006).

An important role, in the step of decision-making, is evaluating or informing the public about city plans. These constitute Urban Environmental Indicators in

accordance with Cities Environmental Report on the Web (CEROI) and the United Nations Environment Report (UNEP). The main environmental indicators that are proposed for the sustainable operation and development of a city area are Green Areas, Proximity of Green Space, Accessibility - Public Access to Green Space, Availability of Public Open Areas, Urban Renewal Areas, and Protected Areas as a Percent of Total Area. Additionally, there are English Accessible Natural Greenspace Standards (English Nature, 2003) to express both accessibility and proximity with the quality of green space.

3. METHODOLOGICAL FRAMEWORK

The proposed methodological framework includes accessibility of residents to large green spaces, in relation to population density of blocks. It is important to identify the blocks that meet the fewer criteria, according to Accessible Natural Greenspace Standards (ANGSt), or those that are most populated and have less access to quality green, with an easy and quick way. At the same time, the output of initial evaluation can directly be used in the next step, as a criterion for the formation of the cost raster. In this way, blocks' degraded parts can be improved from the green corridors. The formation of a cost raster, which will include the whole number of the criteria (ecological, environmental, urban, and bioclimatic), will finally lead to the creation of connection paths; not only to the formation of green corridors but also green spaces (existing and new) and of the – necessary – stepping stones and to the interconnected smaller patches.

It must be made clear that through the proposed methodology, the optimal path is always selected, and so it is not necessary to create primary and secondary networks based on suitability (Drazic et al., 2014). Inasmuch as separate sections are created, which are consolidated based on source – destination routing process (and the least cost condition) – and not suitability, the formulated problem of urban green networks «*go nowhere and do little, except possibly for real estate prices*» (Turner, 1995, p. 269) is solved.

More specifically, the following are referred to:

- The necessary data collection and their organization into geodatabases.
- The model of the initial evaluation of the blocks based on the population density and the accessibility/proximity to the large green spaces according to ANGSt.
- The creation of the cost raster from each criterion.
- The solution of the least-cost algorithm with an appropriate choice of sources and destinations.
- The building of geometrical network and evaluation of its structure.
- The connectivity evaluation with Alpha and Gamma Indexes.
- Reevaluation of the blocks and comparison of the effect of space intervention.

According to our approach, a new methodological framework is proposed. The following diagram (Fig. 1) illustrates its basic steps.

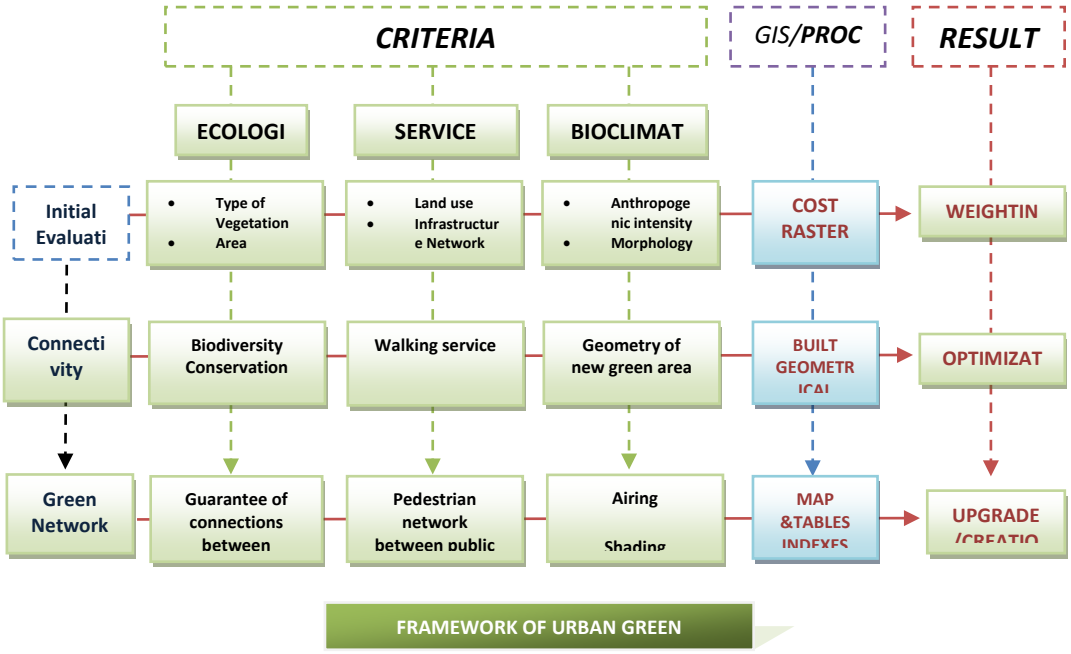


Figure 1. Methodological Framework

These basic steps are further analyzed in the following paragraphs.

3.1 Study area

The study area's overall institutional framework must be known as well as additional data such as population growth and activities, employment rates, and land use percentages. The main aim is a pre-evaluation of significance of existing green and open spaces, which probably will be considered as the pattern that must be enhanced and upgraded.

3.2 Data

The minimum data considered necessary are shown in Table 1.

Table 1. Data Collection

Type	Geometry	Attribute	*Comments*
Blocks	Polygon	Population	*It would be interesting to have the cadastral data and especially the parcels and the property data*
Green Spaces	Polygon	Vegetation Form Birds	*We could use also other quality data, concerning maintenance needs of the green spaces.*
Utility Sites	Polygon	Use	

Type	Geometry	Attribute	*Comments*
Buildings	Polygon		*It would be interesting to have the cadastral data and especially the height of each building.*
Unstructured Blocks	Polygon		*We produce it from the layers "Blocks" and "Buildings" with Select by Location*
Archeological Sites	Point		
Road Network	Polyline	Street Name Street Category	
Noise Pollution	Polyline	Noise Pollution Range in DB	*Relates with the Polyline layer of Road Network*
Traffic Load	Polyline	Traffic Load	*Relates with the Polyline layer of Road Network*
Sites Proposed for Relocation	Polygon		
Areas Proposed for Reformation	Polygon		
Obnoxious Activities Inside the Urban Fabric	Point		
Polluting Areas	Polygon		
Urban Neighborhoods	Polygon	Neighborhoods' Name Floor Area Ratio (FAR)	*The digitization must be done on the lines of the Road Network that separates the neighborhoods between them.*
Protected Areas Boundaries	Polyline		*Mountains, forests, reforestation areas etc.*
City Boundaries	Polyline		
Streams	Polyline		
Shoreline	Polyline		*Of course if there is another important wet element - such as a river or lake – it should be taken under consideration*

It is essential to collect data by the relevant agencies and organizations and their digitization if necessary. At the same time, techniques of Remote Sensing could be used. Some of the data must be collected directly from the field, or produced through pre-analytical procedures.

3.3 Geo-Spatial Data

Respective files, data, and tools must be organized in different spatial databases (GeoDatabases) each of which, in our case, will focus on the successive methodological steps of our framework (Table 2):

Table 2. Database Organization

GEODATABASES	FEATURE DATASETS	FEATURE CLASSES	TOOLBOXES	CREATED FILES (used in following steps)
1st Geodatabase: Initial Evaluation	VECTOR FEATURE CLASSES	i. Blocks (BL.) ii. Green Spaces (G.S.) iii. BL. – G.S. (erase) iv. BL. & G.S. (union)	TOOLBOX FOR THE INITIAL EVALUATION OF BL.	i. Initial Evaluation BL. Raster ii. BL. Raster based on the population
2nd Geodatabase: Analysis	DATA COLLECTION	All data, as they are described in the previous chapter, except BL. & G.S.	TOOLBOX FOR THE CREATION OF COST RASTER & TOOLBOX FOR THE CREATION OF (GEOMETRICAL) GREEN NETWORK	Cost Raster
	SOURCES & DESTINATIONS	Sources: Green Spaces over 12000m^2, mainly at the boundaries of the municipality.		Sources & Destinations

GEODATABASES	FEATURE DATASETS	FEATURE CLASSES	TOOLBOXES	CREATED FILES (used in following steps)
		Destinations: i. All the existing green spaces, in order to establish the connection of the **ecological network,** so that the populations can travel and reproduce. ii. The polluted areas **or** areas for relocation, **or** the utility sites. The purpose is to create a green network of **walking service path** for the residences.	& GREEN SPACES	
	GEOMETRICAL NETWORK	Build Green Network from Cost Raster - Sources & Destinations		Geometrical Network (Evaluation of connectivity using Gamma & Alpha indexes), Points, Lines and Polygons of New G.S.
	The intermediate data will be saved in the Geodatabase but outside the Feature Datasets			
3rd Geodatabase: Final Evaluation	VECTOR FEATURE CLASSES	New Green Spaces (New G.S.) Any other file that we want to include to the final results for purposes of comparison or digital deliverance		
Maps, Tables and other Quantitative & Qualitative Measurements				

Synoptically, organization in three geodatabases is proposed:

- 1st Geodatabase: Initiative Evaluation
- 2nd Geodatabase: Analysis
- 3rd Geodatabase: Final Evaluation

3.4 Block Initial Evaluation

For the initial evaluation of the distribution of green in the study area, it is recommended to be taken into account the general philosophy of Urban Environmental Indicators (CEROI) on accessibility, environmental protection, and proximity. The only modification is to make use of a combination of Accessible Natural Greenspace Standards and of the blocks' population density, instead of m^2 of green per habitant. The Accessible Natural Greenspace Standards (ANGSt) state "*No person should live more than 300m from their nearest area of natural green space"* and that there should be at least one of the following site types and distance criteria met:

- 20ha site within 2km;
- 100ha site within 5km;
- 500ha site within 10km.

After the conversion of the following geographic data-sets from polygon to raster format, an automated procedure is run through ArcGIS Model Builder, to evaluate the initial blocks:

- Green Spaces [area based];
- Blocks Except for the Green [area based];
- Blocks Except for the Green [primary key based];
- Blocks Except for the Green [population based].

From raster of area-based Green Spaces, regions with an area equal to 20.000 m^2, 200.000 m^2, 1.000.000 m^2, and 5.000.000 m^2 are selected. In fact, the distance raster from green spaces with area 5.000.000 m^2 represents the suburban green and the necessary connection to it. Subsequently, Euclidean distances from each cell are calculated and reclassified as follows (Table 3):

Table 3. Greenspace Area/Block Distance Reclassification

	Value = 1	**Value = 0**
A = 20.000 m^2	D ≤ 300 m	D > 300
A = 200.000 m^2	D ≤ 2000 m	D > 2000
A = 1.000.000 m^2	D ≤ 5000 m	D > 5000

The final values will eventually be 1, 2, and 3 counting how many criteria are met at the same time a raster for each non green block is depicted with values for the population density, and a respective Location Quotient is formulated. This technique compares the local variables to a reference region, in a process attempting to identify local specializations.

Using the appropriate sequence of Map Algebra operations (Divisions, Multiplications, etc.), population density raster is produced. The results are shown in Table 4.

The used scale is 1-9 with:

- 1: best value
- 9: worst value

Table 4: Initial Evaluation Score Table

	POPULATION DENSITY			
DISTANCE FROM G.S.	**0**	**1 - D**	**2 - M**	**3 - S**
3 - F	0	1	2	3
2 - M	0	7	6	4
1 - C	0	9	8	5

The produced raster datasets of Distances from the Green Spaces and Blocks' Population Density will also be combined through Map Algebra rules and functions and the above values will be assigned to the new raster.

Applying this evaluation method the result is visualized. The created raster is ready to be further exploited for analysis and to optimize the worst parts (cells) of the blocks. Vector input data are also needed, which can be obtained from respective professionals and institutions.

3.5 Cost Raster

Analysis through raster model data structure is proposed mainly due to the large number of overlaying layers and the mixture of discrete values (e.g. road network), continuous fields (e.g. bioclimatic influence and air pollution) as well as the large number of relative distance data (Verbyla, 2002, p. 119). Initially, all layers are converted to raster using a proper cell size. Finally, every criterion raster must have the same spatial extent. Moreover, all criteria have to be reclassified to the same scale, and a weight must be assigned to them.

The Cost Raster will define the routes drawn from the source to the destinations and backwards, after a cell by cell examination choosing each time the least possible cost to "walk that line". In our case, however, the cost is simultaneously examined from the point of view of the user and the environment. That is, the higher the value on a physical level, the lower the value on a logical level must be.

To clarify this, we consider the following examples:

Example 1st: If there is a large patch of green space, with rich flora and fauna, its protection and conservation would be certainly a goal. The relative distance from this

green space would be an important criterion. The cells closer to the patch should have less cost than others and the cost increases gradually.

Example 2nd: The overall optimization of residents' quality of life is a goal. A very important factor is noise pollution. Roads with heavy noise pollution are to be covered with green, so that a physical barrier to the noise can be formed. Therefore, as the values of reported DBs of noise increase, the cost at raster should decrease.

Similar sets of criteria are defined conceptually. These concern:

- Potential new and existing green spaces.
- Ecological improvement and environmental protection.
- City's bioclimatic performance, its ventilation and decontamination.
- Improvement of quality of life.
- Proximity and types of transportation networks.

Besides the increase of total city green and the connection of green spaces between them, a primary goal is optimization of blocks' status that in the initial evaluation was "judged as badly".

According to the above, every set of criteria will be present and analyzed separately.

3.5.1 Criteria: Ecological/Bioclimatic/Service

It should be noted that maps must have the same extent before their addition. This can be easily achieved with if – then – else procedures (e.g. combination of IsNull/Con).

i. Criterion of Initial Evaluation: The output – described in the previous paragraph (3.4) – is a raster showing the initial evaluation of the blocks. The lowest weight will be given to cells exhibiting the worst evaluation, in order to support an inclination for improvement (Fig. 2).

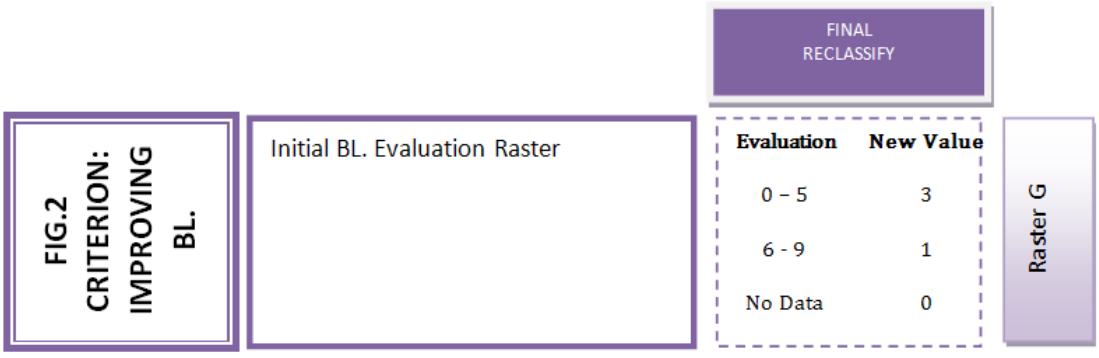


Figure 2. Blocks' Improvement

ii. **Criterion Land Use:** Initial selections and conversions from vector to raster must be performed in order to produce the dataset. The first step is the formulation of a land use mosaic, with large or medium patches or Greenways defining areas that may potentially be transformed into green spaces (Fig. 3). These kinds of areas, characterized "for Relocation", are Polluted Areas, Unstructured Parcels, and Green Spaces.

From a different point of view, and of significantly lower importance, is the aim to connect to public utilities (e.g. schools) and cultural areas (e.g. archeological sites). Undoubtedly, it is a way to improve the city, as well as the daily life of citizens and the promotion of cultural heritage.

If Regeneration Areas exist, where there is a serious lack in housing stock, unstructured parcels of these areas must not be preferred, and neither be excluded. Therefore, these areas should participate in this criterion, but with lower weight. Finally, the necessary reclassification of every raster will be on the logic of "Exist – Not Exist"

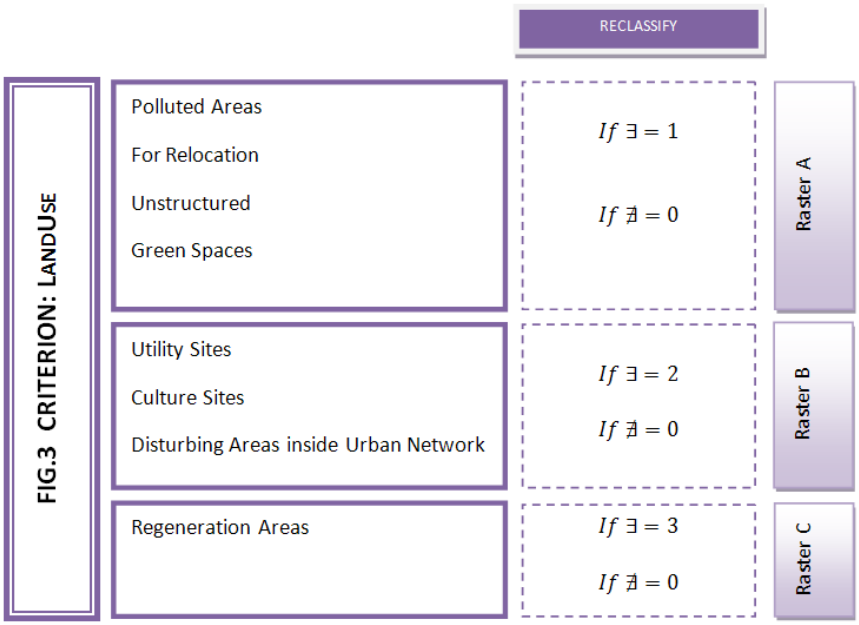


Figure 3. Landuse

iii. Criterion of Biodiversity Conservation: The green spaces' size, their form, and type of vegetation play a key role in environmental effect and impact (Huber et al., 2012). In this respect, green spaces must cover a minimum area of 10.000 m2 and the vegetation should be tall, dense, and irrigated (Fig. 4).

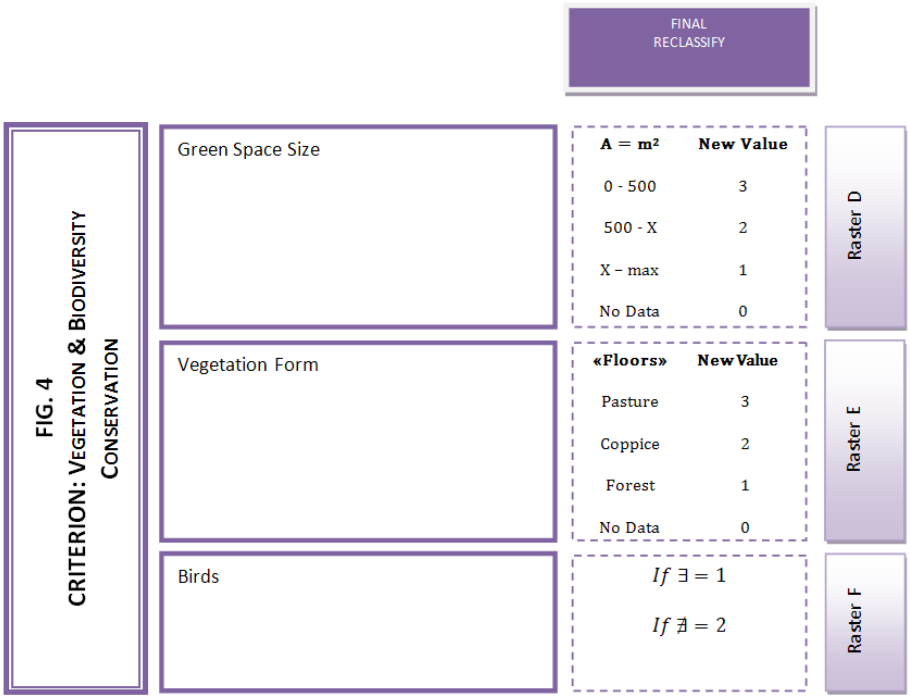


Figure 4. Vegetation & Biodiversity Conservation

iv. **Criterion of Bioclimatic Improvement – Road Air Ventilation**: It is necessary to place tall green vegetation next to roads with intense noise problem as a barrier to sound. An intense air pollution problem is indicated at roads with high average traffic, especially at the layer of air near the ground. On these roads, Greenways and their connection to large patches are crucial for the improvement of the city (Fig. 5). It is most effective if these Greenways are placed on major roads in the direction of prevailing winds.

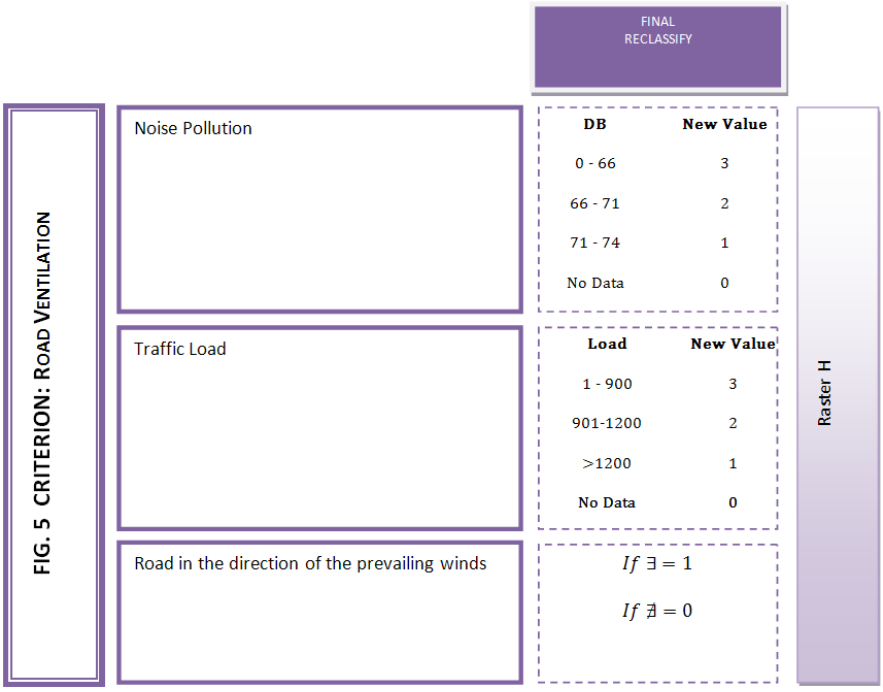


Figure 5. Road Ventilation

v. **Criterion Ratio Building Height/Road Width (H/W):** A very important bioclimatic index is the ratio Building Height/Road Width (H/W). When this ratio is 1, the road's ventilation is not proper. The best ratio is 0.5.

In most cases, floor area ratio (FAR) for each neighborhood as well as the building's area is given.

In this case, the buildings will be treated as groups and their height will vary in every urban neighborhood.

$$\mathbf{H} = \frac{(\mathbf{h1} + \mathbf{h2})}{\mathbf{2}}$$

In order to estimate the Building Height (H), the following formula can be used:

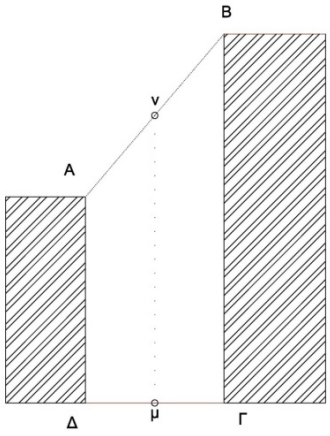


Figure 6: General Case of buildings with different heights (H = Arithmetic Mean)

$$\text{Building Height} = \frac{100 \times \alpha \times \text{FAR}}{C}$$

C: Coverage

a: average height of every floor (m)

FAR: Floor Area Ratio

Equation 1: Building Height (H)

Through Map Algebra and specifically Line Statistics, it is possible to produce a raster that represents the height of the buildings.

Also, the width from building to building and not from one parcel to the other is needed. This might be a continuous value. To overcome this problem, the "aggregate" procedure can be used. Combining Line Statistics and Euclidean Distance procedures, properly parameterized, the road width raster can be calculated with a fine approach.

Finally, the bioclimatic index H/W has to be calculated (Fig. 7). Through Map Algebra, the two raster datasets have to be divided, and the output reclassified, as mentioned below.

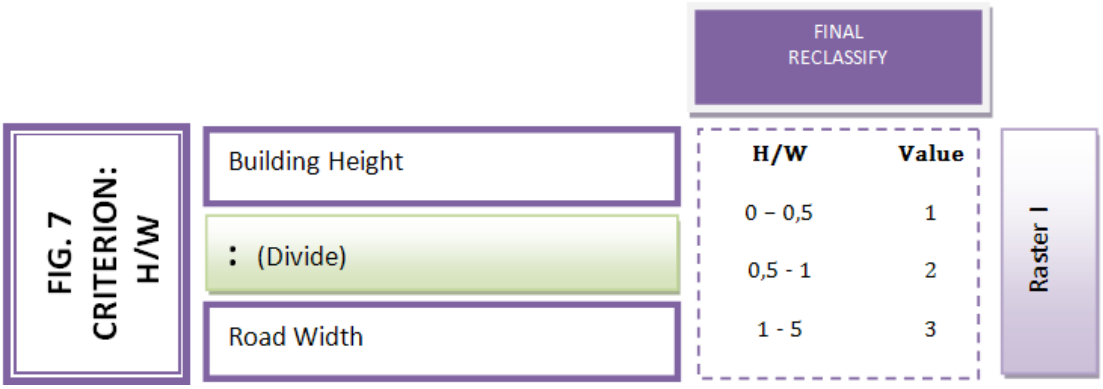


Figure 7. Index H/W

vi. **Hydrographic Criterion:** The region's hydrographic elements must be taken into account. If rivers or streams exist, Greenways should be created along them; these are called blue-ways by Turner (1995). In the case that the city under examination has a waterfront, or a big lake, the distances from these water elements are calculated.

vii. **Criterion of Travel Networks Use:** The existing travel networks are appropriate to create Greenways along them, with a scalable suitability. The scale used below (Fig. 8) is taken from Lionatou (2008).

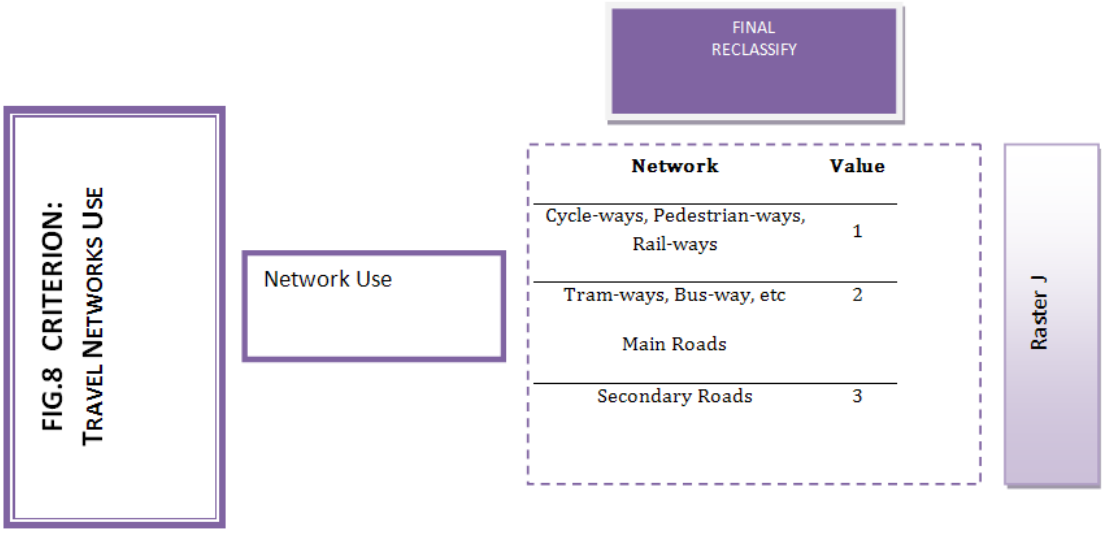


Figure 8. Travel Networks Use

viii. Criterion of Proximity – Service: It is very important that residents have easy access to green spaces and to connecting nodes, especially to a local level. It is necessary to create a raster of Euclidean Distances from the road network (Fig. 9). The lesser the distance of the green space from the road is, the lower the weight.

Figure 9. Distance from Roads

ix. Slope Criterion: Some of the Planners consider that areas with small slopes are of higher suitability for sitting connectivity Greenways, because they can easily be used as pathways for residents' movement. At natural banks with steep slopes, the problem of erosion is primary and more important than the movement of inhabitants, so the criterion of suitability should be reversed (Viles & Rosier, 2001, p. 23). Also, Forman (2008, p. 157) states that *«more than half of the cities with nearby hill-slopes or mountain-slopes facing the city have 90–100 % natural vegetation cover on the slopes»*, which obviously must be protected. At the same point, Forman (2008, p. 157) notes that *«cities with more surrounding city-facing slopes generally have a greater percentage cover of natural vegetation on them, whereas few nearby slopes near a city tend to be much built up»*. The natural vegetation there needs to be protected and enhanced to stop the urban sprawl. This theoretical controversy predisposes to further research. Slope is a very

important factor and may need to be treated case by case. Obviously, if it is a mountainous region, the criterion of the slope must take special care.

3.5.2 Ranking

According to Nyerges and Jankowski (2010, p.139), *"Ranking is the simplest of all weighting techniques"*. Decision Maker starts from criteria arrangement, using the straight importance ranking. Rank Sum is used to compute weights for each criterion as follows:

$$w\text{j} = \frac{n - rj + 1}{\sum_{k=1}^{n}(n - rk + 1)}$$

Equation 2: Rank Sum

Where:

w_j: Normalized weight for the criterion j, ranging in value from 0 to 1

n: The number of criteria under consideration

r_j: The rank position of the criterion

3.5.3 Create Cost-Raster

Finally, the weighted cost values for each cell at the same location must be added to produce the one and only raster, the cost raster.

3.5.4 Geometrical Network

The first step in the analysis based on least cost is to determine areas of sources and destinations (Kong et al., 2010, p.4). To "build" an ecological green-network, patches of green with an area over 12.000 m2 can be used as sources, mostly at city borders.

There can be two types of destination:

- All existing green spaces for the connection of the ecological network [population movement].
- Polluted areas, or areas "for relocation", or utility sites [creation of a green network as a service to residents].

3.5.5 Least-Cost Path

Landscape representation as a graph, a set of nodes and links, is well established among different disciplines, as well as in Landscape Ecology, and still has much to offer (Urban & Keitt, 2001). As Rudd et al. (2002, p. 368) note, *«connectivity has*

been an accepted goal in ecological restoration of wilderness areas for some time, but it is a relatively new approach in urban areas». The aim is to connect the sources to the destinations with the least possible accumulative cost (Xiang, 1996). Through the Cost Weighted Distance procedure (Verbyla, 2002, pp. 127-133), the algorithm of Shortest Path twice will be used; one for the Ecological Network and one for the Walking Network.

3.5.6 Connectivity

At this point, it is necessary to create a modeled procedure to unify these two separate networks automatically, in order to check their overall connectivity, to simplify, and correct (repair) their geometry. The outputs of this model will be the simplified connection lines and the polygon feature of final Greenspace areas.

As long as the network is built, its structure and connectivity must be evaluated through the utilization of Alpha and Gamma indexes (Forman & Gordon, 1986, pp. 417-419; Turner et al., 2001, p. 111) and their formulas are:

$$\gamma = \frac{actual\ number\ of\ links}{\max.number\ of\ links} = \frac{\sigma}{\sigma_{\max}} = \frac{\sigma}{3(\kappa - 2)}$$

$$\alpha = \frac{actual\ number\ of\ circuits}{\max.number\ of\ circuits} = \frac{\sigma - \kappa + 1}{2\kappa - 5}$$

Equation 3: Gamma and Alpha indexes

3.5.7 Maps, Tables, Alpha, and Gamma Indexes

The importance of connectivity has already been mentioned, so it will be the first and the most important factor to be evaluated. Comparing the results with the range of values, we can identify whether the network is Minimum, Medium or Maximum Connected Network (Koutsopoulos, 2006, p. 230). The results can be considered satisfactory if indexes' values are close to the upper limit of the range of Medium Connected Network, or close to the lower limit of the range of Maximum Connected Network.

Measurements that concern the m2 green/habitant would be useful, for purposes of comparison with other studies and statistics. Also, a check of blocks' new condition is performed, concerning the initial evaluation of the "worst" cells, for improvement.

In the following, the steps of the Methodological Framework will be implemented in the municipality of Keratsini, in Greece.

3.6 Case Study

We apply the steps of the methodological framework in a real case. Graphically, these steps are shown in Figure 10.

Figure 10. Methodological Steps

All databases are structured, and the proposed automated process models are tested, to determine how realistic the "running" times are. The results are visualized to see whether it actually shows improvement from the proposed methodology.

3.6.1 Study Area

The municipality of Keratsini in Greece is selected as a study area, because it is considered a privileged area in terms of place and morphology (i.e. green space per capita is double the average in the Athens area). However, the green areas of the municipality are inappropriate, spatially dispersed, and isolated. Thus, Keratsini is an appropriate study area for checking the proposed methodological framework.

3.6.2 Data

We collected the data primarily by geo-reference and digitization of the maps of the General Urban Plan of Keratsini and by updating existing data (mainly road network) from the aerial photographs of "KTIMATOLOGIO SA" and "GOOGLE EARTH". Also, we digitized adequate information from maps of the Athens Urban Transport Organization, namely, pavements, noise data, and traffic data.

3.6.3Processing

In order to implement the proposed Methodology, we used the software ArcGIS and Autocad. We followed step-by-step the Methodological framework, previously presented, starting with the Blocks' Initial Evaluation. Then, the mentioned criteria were taken into account, ranked according to Table 5, to create the cost raster (Map 1).

The Shortest Path algorithm is used twice. Two networks are created that connect the sources to the destinations through least-cost path, one Ecological and one Walking network (Map 3).

3.6.4 Case Study Results

The Application results showed obvious improvement. More specifically:

i. The network structure as shown by the connectivity (indices are desirable given that their values are) with values as shown below:

   Alpha Index: 47.6%

Gamma Index: 65.08%

ii. The *green per capita* increased from 24.37m^2 to 32.71m^2

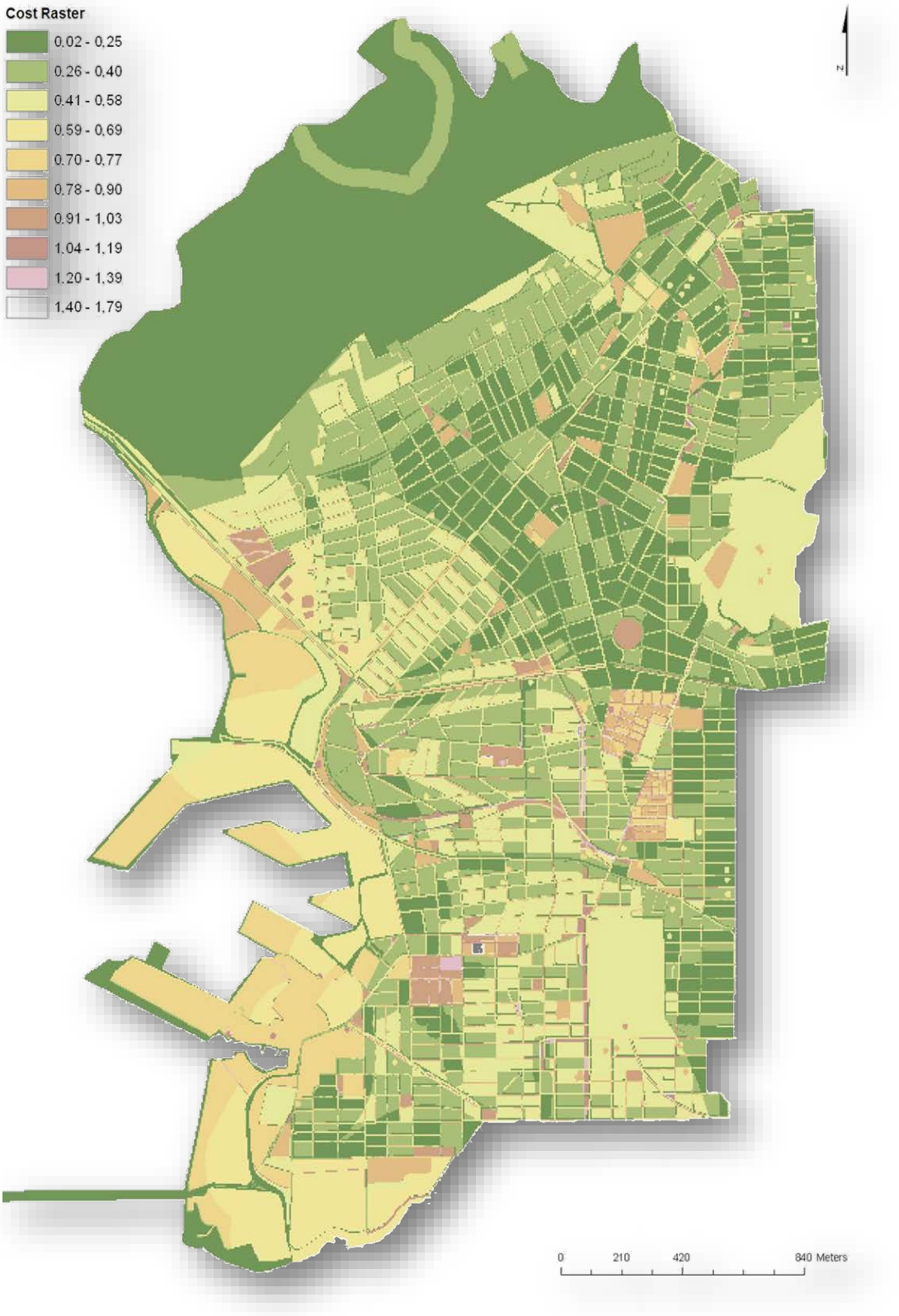
iii. All areas with the worst score in the initiating evaluation, in the proposed methodological framework, are located close to the new large area of green (within 300m).

It is noteworthy that the new large patch of green (790.000 m2) – sited at the sea front – has a significant contribution in the blocks' evaluation. This is illustrated in Map 4.

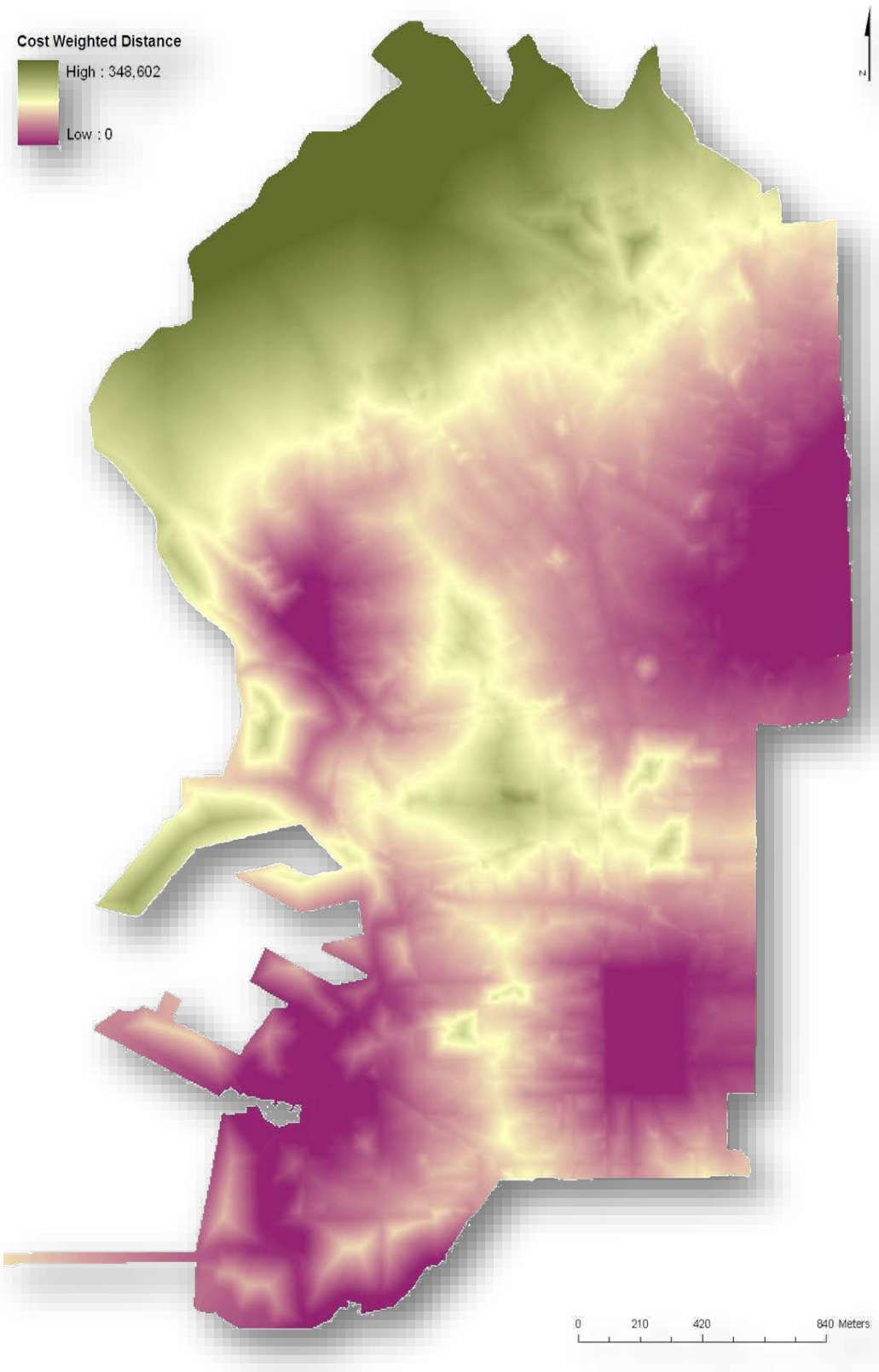
Table 5. Criteria Ranking & Weight Calculation

Criteria (n)	**Hierarchy (r_i)**	**Score (N + 1 - Ni)**	**Weight (w_j)**	**Weighting (Times)**
Land Use	1	10	10/55	0,18
Green Space Size	2	9	9/55	0,16
Blocks Initial Evaluation	3	8	8/55	0,15
Bioclimatic Improvement	4	7	7/55	0,13
Bioclimatic - Roads	5	6	6/55	0,11
Type of Vegetation	6	5	5/55	0,09
Birds Existence	7	4	4/55	0,07
Hydrographic	8	3	3/55	0,05
Travel Network	9	2	2/55	0,04
Transportation Proximity	10	1	1/55	0,02

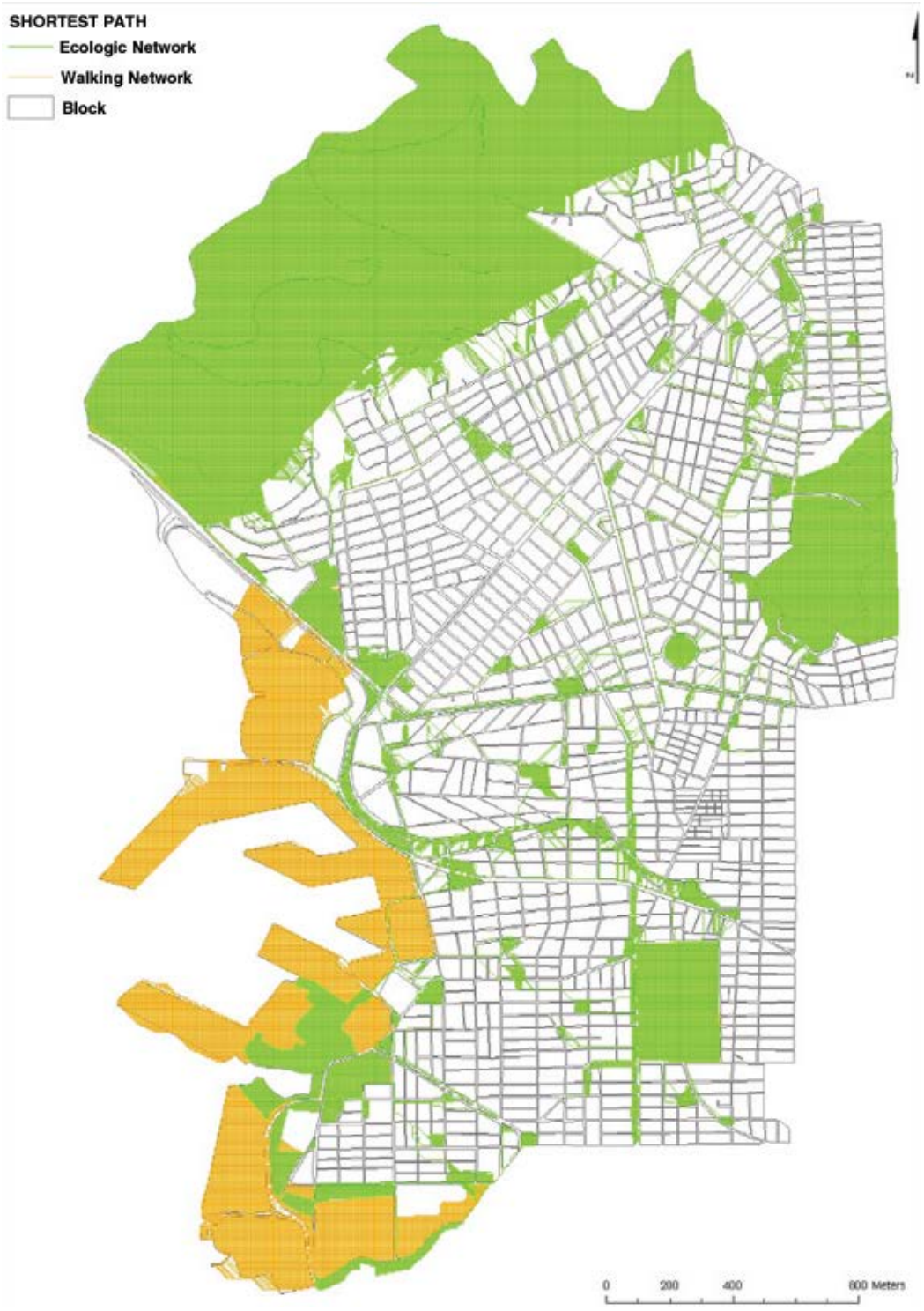
The Weighted Cost Distance was subsequently created (Map 2).



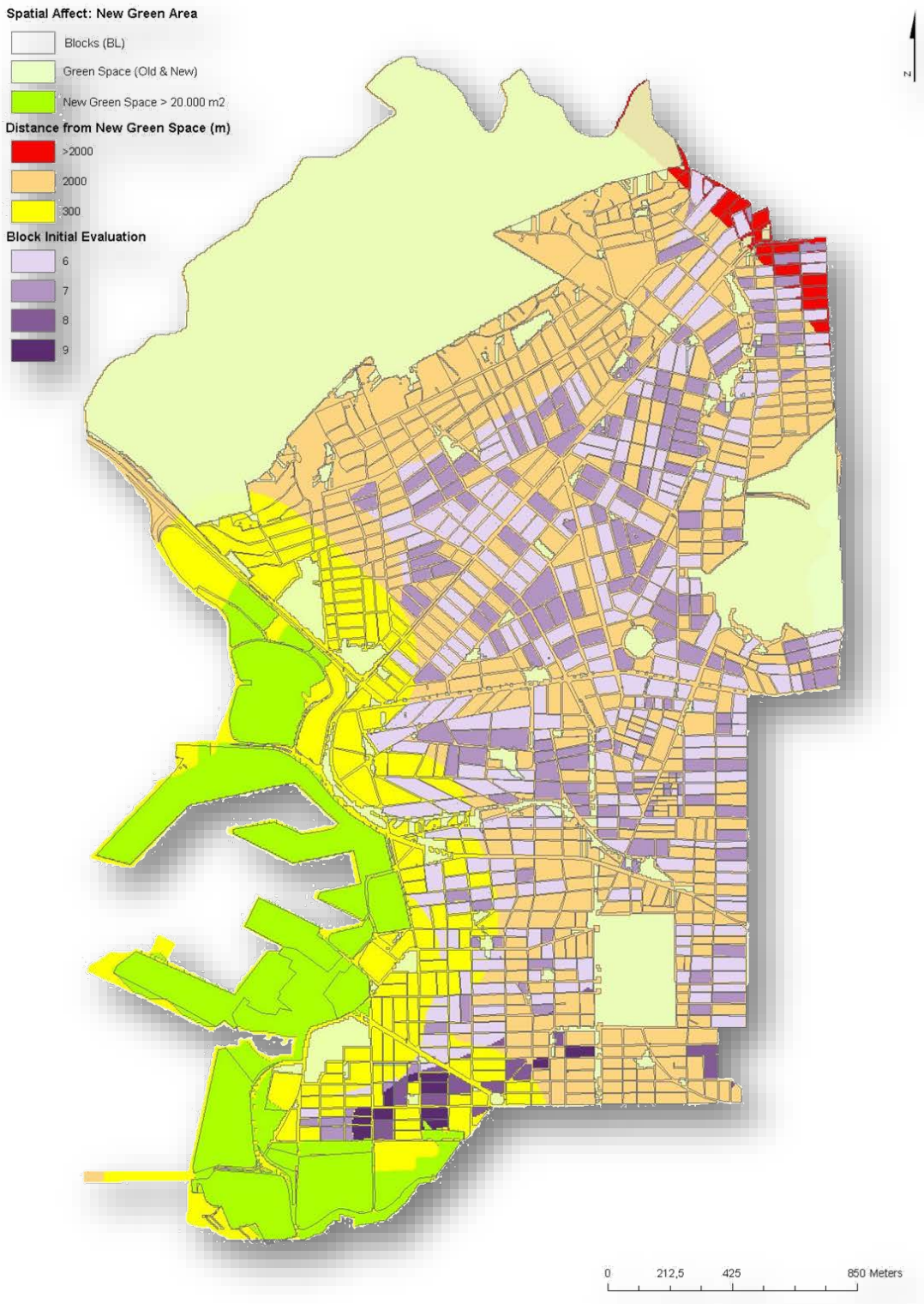
Map 1. Cost Raster



Map 2. Cost Weighted Distance



Map 3. Shortest Path Algorithm Results



Map 4. New Green Area Affect

The advantages of locating a unified park with direct access to the coastline are numerous. We can note also that smaller spaces of green are created, either as

stepping stones or as wedge formations, which is a highly positive event that helps the network's connectivity.

3.7 Conclusions

The objective of this paper is to establish a Methodological Framework, with universal use, in order to evaluate and optimize an urban green network in densely built urban areas. The GIS use and the ability to model procedures make it feasible to choose the raster structure of data for analysis, although it is not as commonly used among users as vector structure. Nevertheless, raster data structure is the most appropriate in cases where there are many criteria involved and continuous overlay of layers. Connectivity will play a prominent role in controlling the structure of the generated network.

This paper is based on the theoretical foundations of Landscape Ecology, Urban Ecology, Green Networks, Bioclimatology, Landscape Architecture, and the new discipline of Landscape Urbanism, combined with Spatial Analysis and GIS. The steps of the Methodological Framework are the following:

- A newly proposed method for evaluating the accessibility of the residents and the accessibility of green spaces (based on area and distance, combined with the population density of the blocks).
- Creating a cost raster, which includes all the criteria (ecological, environmental, urban planning, bioclimatic), along with the appropriate sources and destinations and the use of the algorithm "least cost path". This will lead to the formation of linear links, not only of the green spaces and green areas connections (existing and proposed), but also of smaller parts and stepping stones.
- The geometrical network is "built" from these links, and its structure is checked by the indexes Alpha and Gamma. This paper claims that the index *square meters of green per capita* is not satisfactory. The methodological framework proposes to take account of the overall effect of the new green spaces over the wider region and service of the population.

The main advantages of the proposed methodology are:

- Always selects the best possible path for connecting a particular source and destination, instead of creating primary and secondary networks based on suitability.
- The applied processes allow many tests, using several criteria, parameters, etc.
- However, the most important contribution is that it is a tool for testing scenarios of urban planning, which includes bioclimatic and environmental criteria. As a result, its main advantage – outside of modeling – is the use of vector input data, which are created while applying these projects. In order, however, to use it as an instrument of operation and implementation, the unhindered access to updated information (temperature, humidity, air pollution, etc.) as much as to spatial data is a prerequisite. At the same time, Delfi analysis could "fill in the gaps" with experts' opinions (Eycott, 2011).

- Finally, the proposal of a methodology in the form of modeling procedures of the most common GIS software, enables specialists (landscape architects, planners, etc) and non-specialists (residents, clerks, etc.) to control the proposed solutions and to document proposals more effectively.

3.8 Further Research

It is crucial to find ways to inform the community about the benefits of green networks (Krummenacher et al., 2008), so that they trust the design, and participate in it actively. Citizens can take part in various stages of design (Sharma et al., 2011) through different ways, including the Internet (WebGIS) (Lwin & Murayama, 2011). This is technologically feasible (Boroushaki & Malczewski, 2010), but much less adapted as a process of participatory decision-making from the corresponding structures of bureaucracy and state structure, as well as in terms of public education in new technologies. However, the most important deficit is in the culture of participation. Programs and processes of learning and educating all citizens in new technologies and GIS are developing in the right direction. Knowledge and understanding of society is the only way to protect the environment and safeguard the future of cities and the whole planet.

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CHANGING WATERBUS ROUTES AND INCREASINGLY DIVERSE BOAT DESIGNS IN THE TOKYO RINKAI (WATERFRONT) AREA

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Abstract

Recent years have witnessed a growing interest in the Tokyo waterfront, which includes the Sumida River and Tokyo Rinkai areas. This research investigates the changing waterbus routes and increasingly diverse boats operating in the Tokyo Rinkai area. The history of waterbuses in Tokyo began during the Meiji Period; business declined during the period of rapid economic growth because of deteriorating water quality. New waterbus operators were inspired to enter the market when water quality improved during the waterfront boom of the 1980s. In the 1990s, there were wide-area routes on the Arakawa and Kyu-Edogawa rivers, but these were replaced by routes on the Sumida River and near Odaiba in the 2000s. In recent years, the variety of different boats has increased due to the introduction of small boats that travel on small and medium-sized rivers, as well as new model boats with unique designs. This has enhanced the role of waterbuses as tourist attractions.

Keywords*: Tokyo Rinkai area, waterbus, route, urban tourism, tourist attraction*

1. INTRODUCTION

1.1 Research background and objective

In recent years, interest in the Tokyo waterfront, including the Sumida River and Tokyo Rinkai area, has been growing due to factors such as the construction of the Tokyo Skytree (May 2012) and Tokyo's successful bid to hold the 2020 Olympic Games (September 2013). Law (1993) described the advantages of cities with waterfronts, indicating that these physical environments create deeply impressive scenery in tourist zones. Tokyo's waterbuses are targets of attention, reflecting the growing interest in Tokyo's waterfront in recent years. Many of the special features of waterbuses have been showcased in commercial magazines from the late 2000s. In addition, Tokyo's waterbuses have also been featured in travel guidebooks (Dodd and Richmond, 2008; Yanagihara, 2009). In the travel guidebook *Lonely Planet*, Yanagihara (2009) wrote, "In addition to enjoying the fresh air, waterbuses are a means of transportation that allow you to experience Tokyo's legacy that was born from its rivers." In this way, he encouraged the use of waterbuses on the Sumida River as a form of transportation between Tokyo's sightseeing spots. The charm of waterbuses is described as allowing passengers to enjoy the waterside scenery while traveling throughout the city.

Prior research includes studies on the role of water transport as a form of transportation for urban sightseeing. Pearce (1995) argues that riverboats serve as a form of transportation in cities, indicating that boat cruises complement regular sightseeing bus tours in urban tourism. Citing a similar example of waterbuses complementing congested land transportation, Tanno (2004) discussed the waterbuses on the Seine that make it possible to enjoy sightseeing in Paris from boats covered by transparent hoods. These research projects claim that waterbuses complement land transportation in urban tourism, enabling tourists to enjoy waterside scenery while traveling. Because waterbuses are a type of urban transportation, research has focused on waterbus routes. Kurihara et al. (2008) and Shiobara et al. (2009) mentioned route profitability and the existence of tourist facilities at waterbus ports as the primary factor determining waterbus routes in recent years. Routes are important topics in waterbus research, as described above, but no one has studied how these routes have changed over time.

Moreover, based on the higher profile of waterbuses in recent waterfront tourism, there is a need to focus on the operators and patrons of the waterbuses as tourist attractions, while considering points that have not been given sufficient attention in past waterbus research. Therefore, the objective of this research is to explore Tokyo's rivers and the Rinkai area, studying how the waterbus routes have changed, and also how the functionality of waterbuses as tourist attractions has changed, due to the increasingly diverse nature of boats and operators.

1.2 Research subjects and methods

The Ministry of Construction's River Bureau (1997) divided normal water transportation into three categories: 1) sightseeing and passenger transport in major cities, 2) freight, and 3) sightseeing. Within these categories, waterbuses represent a form of "sightseeing and passenger transport in major cities." Due to the development of land transportation, today's waterbuses are mainly used for sightseeing; they no longer serve as a method for commuting to work as they did before World War II. Waterbuses function as urban pleasure boats for sightseeing and transporting passengers between sightseeing spots in cities. In this way, they differ greatly from mere attractions, such as boat tours, which are classified under "sightseeing." "Waterbus" is a nickname used by the various operators, rather than a term regulated by law. This research targets business operators using the name "waterbus" (the subject of this research) to clarify the history of waterbuses in Tokyo and to see how their routes have changed.

The research methodology used materials obtained through a survey of current waterbus operators and a survey that investigated the current state of routes and boat types. Past routes were identified by referring to the literature, travel magazines, and special feature articles on waterbuses among other sources.

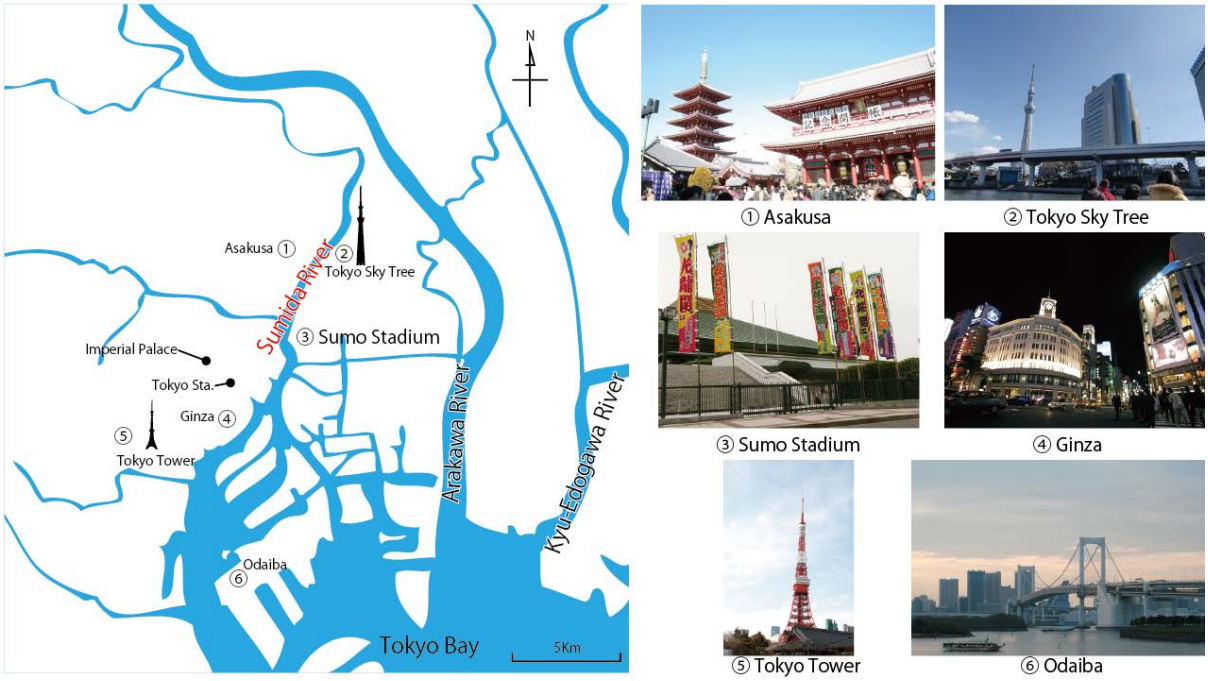

Figure 1. Rivers in Tokyo and the distribution of principal tourist facilities

2.THE HISTORY OF WATERBUSES AND THEIR CHANGING ROUTES IN TOKYO

2.1 Waterbuses from the Meiji Period until the period of rapid economic growth

According to Tanaka (1988), the regular operation of the first waterbuses in Tokyo began in 1885 between Asakusa and Ryogoku. In those times, there were few bridges on the Sumida River and land transportation methods were undeveloped; a zigzag route was established between the eastern and western banks of the Sumida River. During World War II, boats were requisitioned for use in World War II and damaged in air raids, and the pre-war waterbus business was destroyed. In 1950, during the period of postwar recovery, the Tokyo waterbuses were revived. Waterbuses served as a means of transportation within the city for residents during the period of postwar recovery, but during the period of rapid economic growth, the construction of towering, vertical concrete embankments and expressways completely changed the scenery along the Sumida River waterbus route. Furthermore, the Sumida River had become so polluted that passengers had to cover their noses with handkerchiefs to avoid the bad odor (Jinnai 1993). Water pollution caused the number of passengers to fall, and the waterbus business was in a decline in the 1960s (Tanaka 1988).

2.2 The revival of Tokyo's waterbuses

As described above, the waterbus business in Tokyo slumped because of water pollution in the Sumida River. In the mid-1970s, the water quality of the Sumida River gradually began to improve and the number of waterbus passengers to increase (Tanaka 1988). In 1974, the Tokyo Cruise Ship company, in addition to its traditional Sumida River route, began to operate a new Museum of Maritime Science line connecting Hinode Pier and Odaiba (Osawa 1997).

The waterbus revival also received a boost from the waterfront boom of the 1980s. New waterbus businesses operated by public works contractors and private sector business operators entered the market. Table 1 shows the year in which each waterbus business operator entered the market, as well as the year it closed down. The first public institution to launch a waterbus business was in Koto Ward in 1985. In 1991, the Tokyo Mizube Line was opened by the Tokyo Metropolitan Park Association. The Saitama Waterbus, a Saitama Prefecture business linking Kasai in Edogawa City and Akigase in Saitama Prefecture, was launched in 1994. The private Tokyo Ship Service followed in 1996. Although the Tokyo Ship Service was a ferryboat operator in the Port of Tokyo, it entered the waterbus business in anticipation of marine transport to the Rinkai Fukutoshin area, which was scheduled to be the venue for the World City Expo Tokyo '96.

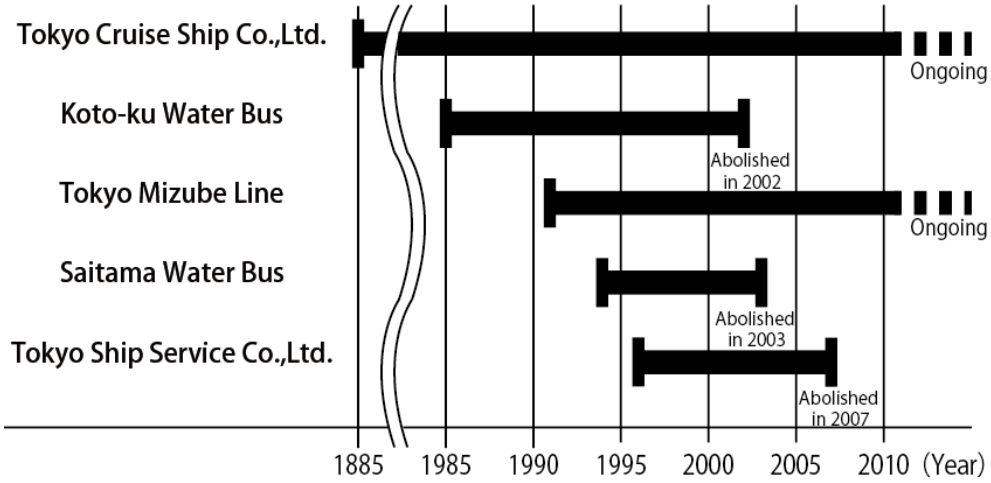

Figure 2. Changing waterbus business operators in Tokyo
Source: Shiobara et al. (2009)

2.3 Changing waterbus routes from the 1990s

As shown in Figure 2, waterbuses were operated by five business operators in the 1990s. In the 2000s, however, the Koto-ku Waterbus, Saitama Waterbus, and Tokyo Ship Service all closed down in quick succession.

This paper will plot waterbus routes from the 1990s onwards, to clarify how waterbus routes have changed in recent years. The waterbus route maps from 1997 and 2003 shown below were organized and plotted based on prior research by Koike (1997) and Manabe (2003). The 2011 route map was plotted based on fieldwork and pamphlets published by each of the waterbus business operators.

2.3.1 Routes in 1997

Figure 3–a shows the waterbus routes in 1997. These routes can be grouped into two major categories: routes centering on the Sumida River and Odaiba, and routes involving the Arakawa and Kyu-Edogawa rivers. The Sumida River and Odaiba routes were controlled by three business operators: Tokyo Cruise Ship, the Tokyo Mizube Line, and Koto-ku Waterbus. In contrast, there were wide-area routes in Tokyo's surrounding regions that included Koiwa, Akigase, Shinagawa, and other locations. The longest route was the 36.7-kilometer link between Kasai and Akigase (Figure 3–a). One characteristic of these 1997 routes was the inclusion of the new destinations of Arakawa and Kyu-Edogawa as well as the Sumida River

and coastal areas near Odaiba, locations that had been part of the network before World War II.

2.3.2. Routes in 2003

In 2003, there were many changes, including the abolition of the longest route linking Kasai and Akigase. The route between Kasai and Koiwa was closed (Figure 3–b). Consequently, the wide-area Arakawa and Kyu-Edogawa Rivers route was also abolished, and 2003 waterbus transportation was limited to Tokyo, including the Sumida River, Arakawa River, and the coastal areas near Odaiba (Figure 3–b). In 2003, the Tokyo Ship Service introduced waterbuses linking Hinode Pier with the Odaiba area. Because Tokyo Cruise Ship and the Tokyo Mizube Line also operated routes between Hinode Pier and Odaiba, three waterbus business operators were competing in 2003 to provide marine access to Odaiba.

2.3.3. Routes in 2011

The Tokyo Ship Service was abolished in 2007, and by 2011, there were only two waterbus companies, Tokyo Cruise Ship and the Tokyo Mizube Line. It is believed that the Tokyo Ship Service was pushed out of business by land transportation when the Rinkai Line was opened in 2002 (Shiobara et al. 2009). One characteristic of the route changes that took place between from 2003 and 2011 was the further reduction of wide-area routes. The link between Hinode and Shinagawa was abolished on September 29, 2008. Accordingly, the only waterbus routes in 2011 were those on the Sumida River and towards Odaiba (Figure 3–c). Consequently, Tokyo Cruise Ship's scope of operations was limited to a portion of the Sumida River and the coastal areas near Odaiba, concentrating traffic in those areas to an even more remarkable degree.

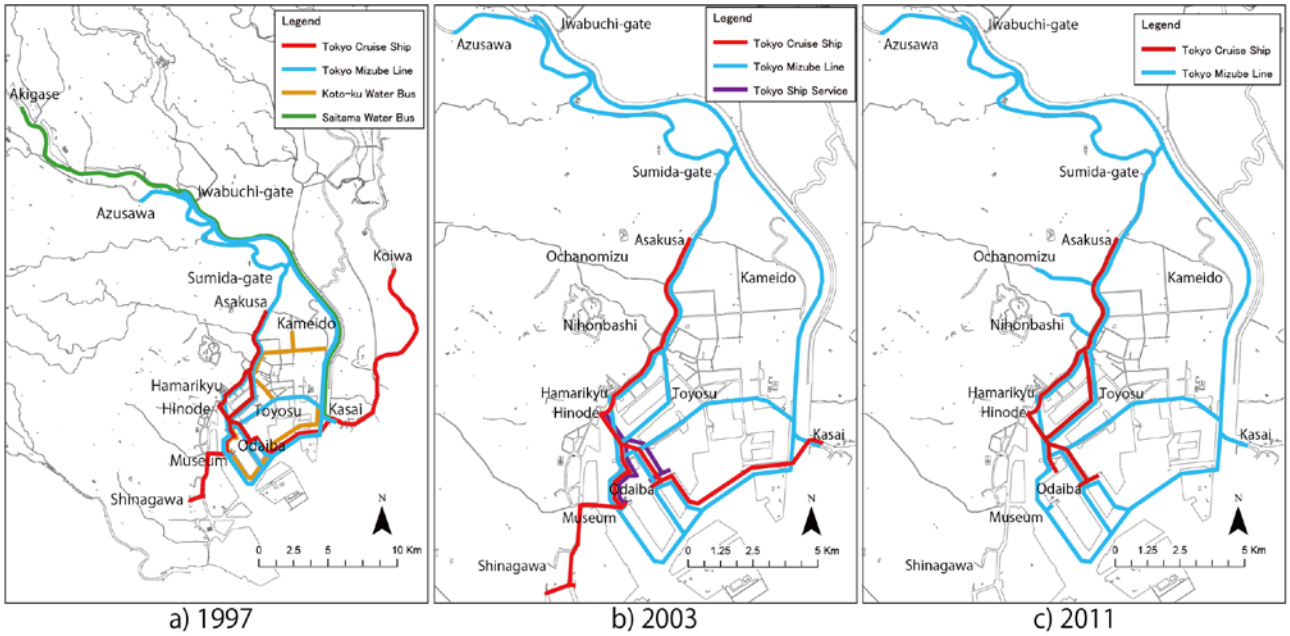

Figure 3. Changing waterbus routes in Tokyo
Source: Koike (1997), Manabe (2003), https://www.suijobus.co.jp/, and http://www.tokyo-park.or.jp/waterbus/

3. CHANGING ROUTES AND INCREASINGLY DIVERSE BOAT OPERATIONS AS SHOWN BY THE NUMBER OF WATERBUS PASSENGERS

3.1 Changing routes as shown by the number of waterbus passengers

So far, this paper has looked at temporal and spatial changes in waterbus routes in relation to particular business operators. From this point on, it will focus on route changes as shown by the number of waterbus passengers, considering how waterbus routes changed along the Tokyo waterfront. A unique event in 1997 was the establishment of wide-area routes stretching more than 30 kilometers inland from Tokyo Bay. These wide-area routes had been abolished in 2011, when all waterbus traffic was restricted to Tokyo's rivers and the coastal areas near Odaiba. Waterbus business operators tried to optimize resources by eliminating wide-area routes with few passengers.

Next, Figure 4 shows the number of Tokyo Mizube Line passengers by port, based on the *Tokyo Metropolitan Park Association Business Report* (1997; 2003; 2011). According to this report, in 1997, Tokyo Mizube Line passengers were concentrated in Kasai in the Rinkai area and Ryogoku on the Sumida River (Figure 4–a). In addition, there were close to 4,000 passengers at Asakusa and ports further north, including Azusawa, Kamiya, and Arakawayuen (Figure 4–a). Incidentally, the number of passengers at Asakusa and ports further north (including Azusawa, Kamiya, and Arakawayuen) declined in 2003 (Figure 4–b). On the other hand, the number of passengers at ports in the coastal areas (such as Hamarikyu and Odaiba Marine Park) increased. This trend became more pronounced in 2011, when the number of passengers at Ryogoku and stops further north (including Azusawa, Kamiya, and Arakawayuen) fell even further. At the same time, the number of passengers drastically increased at ports on the Sumida River and in the coastal areas, including Ryogoku, Etchujima, Hamarikyu, and Odaiba. In this way, the annual total of passengers at Ryogoku and Odaiba increased to roughly 60,000 and 50,000 respectively (Figure 4–c).

Figure 5 compares the number of foreign tourists in Japan with waterbus passengers, suggesting a connection. The banks of the Sumida River are dotted with places that are popular with foreign tourists, including Asakusa, Tokyo Skytree, Ryogoku, and Odaiba (Figure 1). It therefore makes sense that the increased number of foreign tourists would be related to the increasing number of waterbus passengers on the Sumida River. Looking at the elimination of wide-area routes and the number of passengers using each port, as described above, it is clear that waterbus routes in Tokyo are increasingly centered on the Sumida River, where there are many tourist facilities. The number of passengers using each route and the presence of foreign tourists are thought to be factors contributing to route changes of this sort.

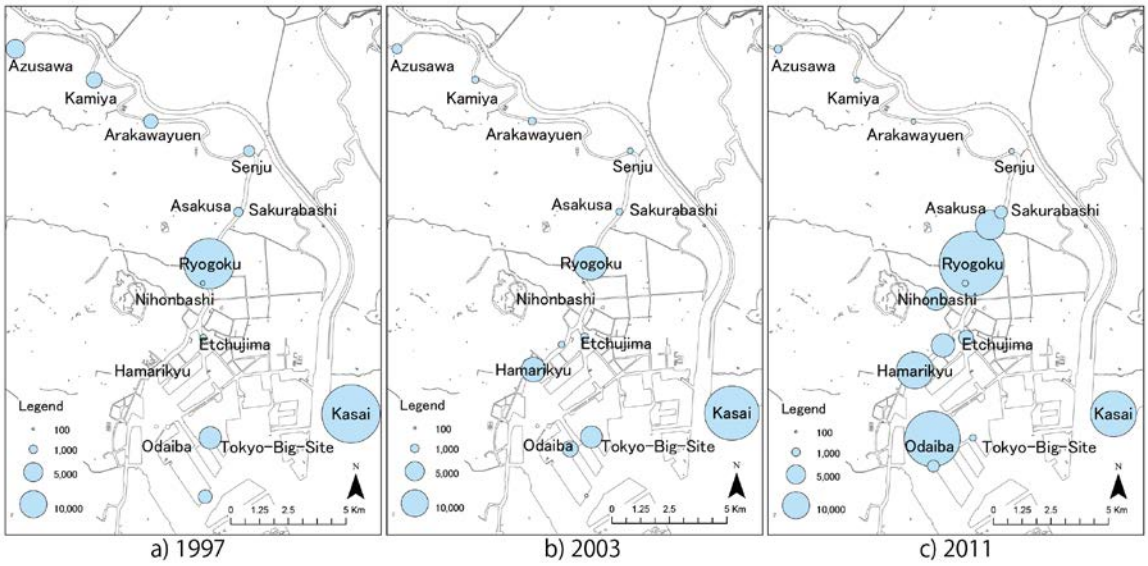

Figure 4. Number of passengers by waterbus stop
Source: Tokyo Metropolitan Park Association Business Report (1997; 2003; 2011)

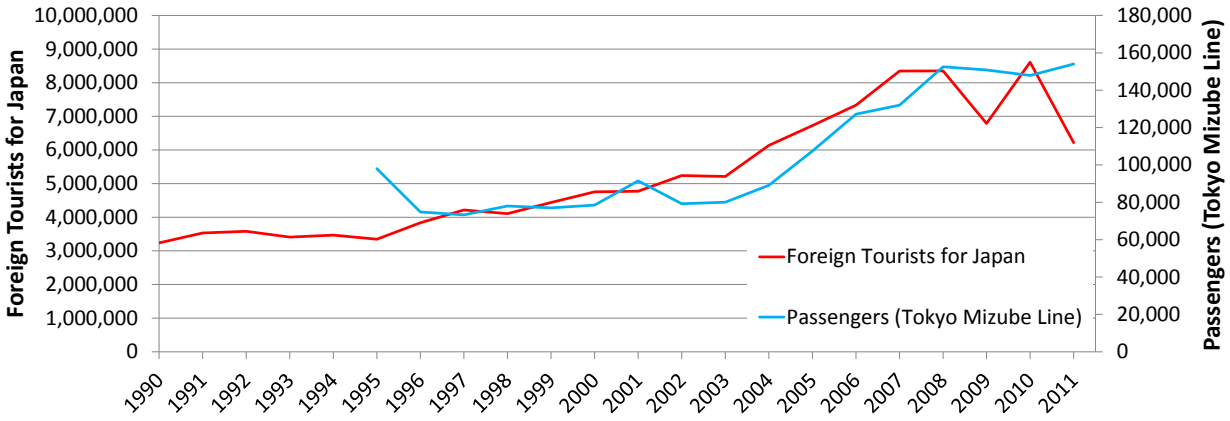

Figure 5. Number of foreign tourists to Japan and waterbus passengers
Source: Tokyo Metropolitan Park Association Business Report, and Japan Tourism Marketing Co.

3.2 Increasingly diverse boat designs and patronage of waterbuses as tourist attractions

In July 2011, the Tokyo Mizube Line introduced *Kawasemi*, a smaller waterbus model, and established new routes (Figure 6–a). Conventional waterbuses generally required 150 to 300 personnel but *Kawasemi* had only 70. Accordingly, *Kawasemi* could be used on small to medium-sized rivers, such as the Kanda and Nihonbashi rivers. In this way, waterbus routes on narrower rivers, unused since the abolishment of the Koto-ku Waterbus in 2002, were reestablished. The *Kawasemi* had its own port on the Nihonbashi River, and was used by approximately 7,000 passengers in 2011 (*Tokyo Metropolitan Park Association Business Report*, 2011). As a result, boat operations, which had focused on large waterbuses navigating relatively wide waterways, such as the Sumida and Arakawa Rivers, became more diverse. The introduction of the small *Kawasemi* waterbuses into Tokyo's smaller rivers, made it possible to view the bridges on the Nihonbashi and Kanda Rivers (small to medium-sized rivers) from the rivers themselves. In addition, the *Kawasemi* category included excursion boats that returned to their points of departure without passing through other ports.

Since 2013, excursion boats departing from and arriving at Asakusa have become tourist attractions for viewing the Tokyo Skytree from the Sumida River.

Boat decoration and design have also changed since the 2000s. Tokyo Cruise Ship commissioned designs for the *Himiko* (2004) and *Hotaruna* (2011) from a manga artist called Leiji Matsumoto. The *Himiko* and *Hotaruna* have uniquely futuristic designs and differ greatly from traditional waterbuses (Figures 6–b and 6–c). The introduction of new model ships with unique designs enhanced the appeal of waterbuses as urban tourist attractions. The *Himiko* and *Hotaruna* are operated on Sumida River routes linking Asakusa and Odaiba. Furthermore, the *Atakemaru*, modeled after the pleasure boats used exclusively by feudal lords during the Edo Period, was put into regular operation in 2011 (Figure 6–d).

As described above, the introduction of smaller waterbuses and boats with unique designs into small and medium-sized rivers is thought to have added new enjoyment to waterbuses, which are unusual vehicles. This is in addition to the traditional role of waterbuses within urban transportation as an urban tourist attraction, allowing tourists to enjoy waterside scenery while traveling (Pearce 1995; Tanno 2004). The introduction of boats including the *Kawasemi*, *Himiko*, *Hotaruna*, and *Atakemaru* has increased the number of passengers who patronize waterbuses as tourist attractions; this has been achieved through corporate efforts to diversify boat designs by waterbus operators. For this reason, the number of passengers has drastically increased at ports served by the new-model boats (Odaiba and stops on the Sumida River such as Asakusa, Ryogoku, Etchujima, and Hamarikyu).

Figure 6. New waterbus designs in recent years
Source: https://www.suijobus.co.jp/, http://www.tokyo-park.or.jp/waterbus/, Photo by K.O.

4. CONCLUSION

The waterbus business in the coastal areas of Tokyo slumped because of water pollution during the period of rapid economic growth and was then gradually restored in the 1980s due to a range of factors, including the entry of new business operators and the opening of wide-area routes by existing business operators. Wide-area waterbuses travelling inland more than 30 kilometers from Tokyo Bay were steadily eliminated between the 1990s and 2000s, and this trend became more pronounced in the 2010s. Consequently, routes on the Sumida River and in coastal areas near Odaiba came to serve as the central waterbus routes. In recent years,

waterbuses have increasingly become tourist attractions because of their increasingly diverse designs. New boats with unique designs, such as the *Himiko*, *Hotaruna*, and *Atakemaru* have been introduced.

This research clarifies how waterbus routes have changed along the Tokyo waterfront, and examines the increasing diversification of the boats in operation. Routes on the Sumida River and the coastal areas near Odaiba are the central waterbus routes in Tokyo, and are also routes in which rival business operators compete for customers. Therefore, it is difficult to obtain recent data on management matters, such as route establishment and passenger usage. In the future, the author hopes to research the decision-making process of waterbus business operators in relation to route establishment and management.

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VISUAL QUALITIES OF FUTURE GEOGRAPHY TEXTBOOKS

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Abstract

The capacity for spatial orientation and associated faculties are closely related to visual competencies. Consequently, the practice and acquisition of visual competencies are vital prerequisites to successful learning and teaching of geography. Today, geography can be understood as a visual discipline and as such may develop strong links to visual communication. In geography, textbooks may establish this link in an everyday context. This Ph.D. project aims to build the bridge between subject content and design. The result will be a visually convincing geography textbook prototype. Fifty-six geography textbooks from different European countries were analysed, focussing on the design concept. Furthermore, double-page spreads of current German geography textbooks were evaluated by observing students' textbook usage via eye tracking. Eye tracking monitors students' reactions to varying contents and designs. Findings from both analyses form the basis for the textbook concept, which is to be developed.

Keywords*: geography education, visual communication, geography textbook, textbook analysis grid, eye tracking research, visual competencies*

1. GEOGRAPHY AS A VISUAL DISCIPLINE CULTIVATING VISUAL COMMUNICATION

Today, geography can be understood as a visual discipline and as such may develop strong links to visual communication. As Rose (2003:212) says: *„With the exception of anthropology, geography is unique in the social sciences in the way it has relied and continues to rely on certain kinds of visualities and visual images to construct its knowledges."* But while philosophy, psychology, cognition studies, communications science, visual studies and art history explicitly study the typology, use and functions of images, *geography is primarily a discipline that uses images* (Schlottmann, A., Miggelbrink, J., 2009).

Analysing, decoding and providing visual input is a key part of visual communication. The creation of effective image/text combinations as well as the use of iconography and visual language could be named as basic tools in communication design.

Or as Schlottmann/Miggelbrink say about images: *"Viewed critically, these are not an image of the world but are powerful means to create worlds."* (Schlottmann, A, Miggelbrink, J., 2009:2).

In geography, textbooks may establish the link between geography education and visual communication in an everyday context.

The capacity for spatial orientation and associated faculties is closely related to visual competencies. Consequently, the practice and acquisition of visual competencies are vital prerequisites to successful teaching and learning in the field of geography. Spatial orientation may be seen as one aspect of visual literacy. This includes the ability to analyse, decode and interpret visual input. Or as Thornes says: *„Visual literacy is an important new skill that geography as a whole needs to embrace for both constructing and deconstructing images. The creation and interpretation of visual images has always been important to geography and is what makes geography unique.*" (Thornes, J. E., 2004:793).

A strong focus on visual factors can be found in geography textbooks, where visual input is provided in many different forms. Geography teachers and textbooks make use of visual information e.g. from satellite images, GIS, GPS, maps, photographs, illustrations, paintings, diagrams and statistics. In current geography textbooks, varying visual information is applied to guide students in analysing, decoding and amplifying text input to solve research questions or to complete tasks from the exercise section.

2. STUDY OF EUROPEAN GEOGRAPHY TEXTBOOKS ACCORDING TO A DEVELOPED DESIGN BASED ANALYSIS GRID

2.1 Analysis of selected European Geography textbooks

After considering the theoretical implications, an investigation of the current state of European geography textbook design and conceptualisation built the first step towards a possible new approach in geography textbook design.

Fifty-six selected Geography textbooks from 12 European countries (Western Europe, Southern Europe, Central Europe and Scandinavia) were analysed with regard to innovation in their approach to design and conceptualization. The focus was on books published after 2005, and in certain cases after 2001 (especially innovative in design).

The goal was to analyse the exact design structure of each textbook. What exactly is the concept behind the design? How is the book organised(systematic structure, inner logic, appendices, materials)? Exactly how – using precise and conceptual means – is the textbook design realized? Are typical national traits evident? How are they expressed?

A textbook analysis grid was developed to analyse the design concept of geography textbooks in relationship to communications design and geography education.

2.2 Design and structure of the design based textbook analysis grid

The grid (see fig. 1) was used to systematically analyse the textbooks based on criteria ranging from their external characteristics and general structure to the more specific points of their design and conceptual details. The conclusion of each analysis consisted of a short (subjective) summary of overall substantive and aesthetic qualities of the textbooks. Topic selection and editing of topics were also researched.

Bibliographical information	**country, title, authors, date of publishing, number of pages, information about the authors, contributors, medial interlacing, format, paper, cover**
Structure	**outline, chapters, special sections, additional materials**
Key factual and conceptual aspects	**themes and topics covered, internal structure**
Design and structural elements	**teaching and learning aides, support systems (type and function)**
Layout and typography	**organisation of the layout, page grid, columns, typographical hierarchy, colour concept, picture to text ratio, font mixtures**
Use and type of design for …	**photos, captions, graphics, tables, charts, maps, illustrations**
Practical and aesthetic overall impression	**brief summary + cultural characteristics (if detectable)**

Figure 1. Developed design based textbook analysis grid

2.3 Further research

A preliminary conclusion of the analysis clearly revealed typical national characteristics as well as typical distinctions regarding design and thematic choices. Reciprocal influences are evident. A detailed analysis and research results will be published in the dissertation. The results of this analysis provide additional support for the planned geography textbook.

The further research conducted to the following questions:

Which design elements and which kind of learning aides are used to support learning? How is the image/text relationship? How is information (visual input and text) visually linked in geography textbooks?

3. EYE TRACKING: A VISUAL METHOD OF DATA COLLECTION AND ANALYSIS

The textbook analysis led to the research question: How exactly students link different visual inputs on a geography textbook page? Eye tracking as a visual method of data collection and analysis precisely monitoring the eye movement, thus revealing which parts of a page attract attention to which degree. With this method, two kinds of eye movements (saccades and fixations) were recorded and analysed. Saccades are rapid eye movements from one area of interest to another. Saccades range in duration between approx. 10 ms and 100 ms. Fixations are eye movements that stabilize the retina over an area of interest. The duration of a fixation ranges between approx. 200 ms and 250 ms (Duchowski, A. 2007). By means of these eye movement measurements it can be calculated, in which chronological order and with which intensity the test subject observes different elements on a textbook spread for example.

Eye tracking is used as a data collection method in the neurosciences, perceptive and cognitive psychology, cognitive and clinical linguistics and reading research. As a commercial research method, eye tracking is also used in usability studies of websites; to improve way

finding systems of public buildings; or in optimizing the effectiveness of promotional material to name but a few. Eye tracking as a research method is relatively new to the field of textbook research in Germany.

3.1 Eye tracking research on geography textbooks (research design)

The research was conducted with the help of an EyeLink® 1000 (desktop mount) at the eye lab of the University of Potsdam, Germany. Pupil movements of test subjects were measured at a frequency of up to 1000 times per second (www.uni-potsdam.de/en/eyelab). The eye movement recording was monocular. The test subjects observed a screen displaying double-page spreads of a textbook. The test subjects' head was supported by a chin and forehead rest in order to avoid head movements. The operator ran the test on a control screen, calibrating test subjects pupils, observing test subjects eye movements and recording data (see *EyeLink® User's Manual.* 2007). An additional assistant supported the test subject throughout the entire test procedure.

Although the test setting does not reflect how students naturally work with textbooks, it allows a highly accurate recording of eye movements while a textbook is observed. It is therefore likely that eye movement in the test setting will differ from eye movement while reading a textbook lying on a table. However, the alternative of a student observing the textbook with eye tracking glasses causes less exact measuring results due to a lower frequency of measurement as well as to head movements.

After having evaluated data from pilot tests, tests were carried out with 20 students of 15 years and older from secondary school and university students. No Geography students were tested. A two-stage test was developed.

3.1.1 Objects of research

The objects of the research were double-page spreads of current German geography textbooks covering an identical topic and taken from five separate textbooks (A – E). On each of the selected double-page spreads the content is explained using similar textual and visual elements but with different designs (see fig. 2).

The topic "nutrient circle in tropical rainforest" was selected on grounds of the following criteria:

1. The topic is covered in the current curricula and in all prevailing geography textbooks for secondary schools in all federal states of Germany.
2. The topic had already been taught in the geography lessons of the test subjects (students aged 15 and over).
3. The topic is presented using similar elements, such as photographs, graphics and text, and does not include supplementary visual inputs such as satellite images or illustrations to explain the content.
4. The topic is developed by similar tasks.

The listed criteria aim to ensure the greatest possible comparability of the textbook spreads regarding the content comprehension of the students.

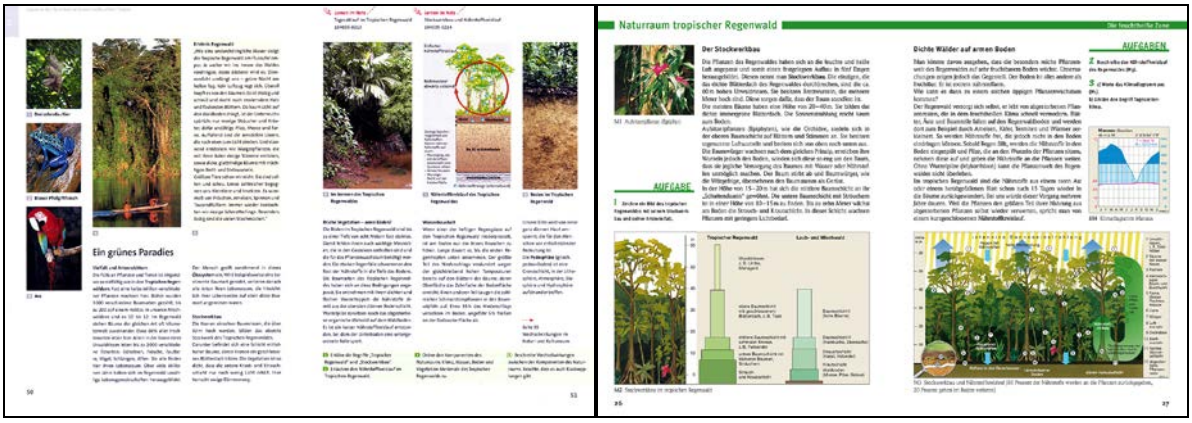

Figure 2. Test spreads (selection)
(2a Krause, K., Werner, S. 2013) (2b Heit, E., Ernst M. (ed.) 2012.)

Areas of interest (AOI) from each page were identified (see fig. 3). AOIs are defined as those elements of textbook spread that are required to solve the set task. Fixation-based data from each selected AOI were recorded to provide exact analyses (fixation count, total dwell time and proportion of fixations and dwell time relative to the trial totals (see *EyeLink® Data Viewer User's Manual, 2007*).

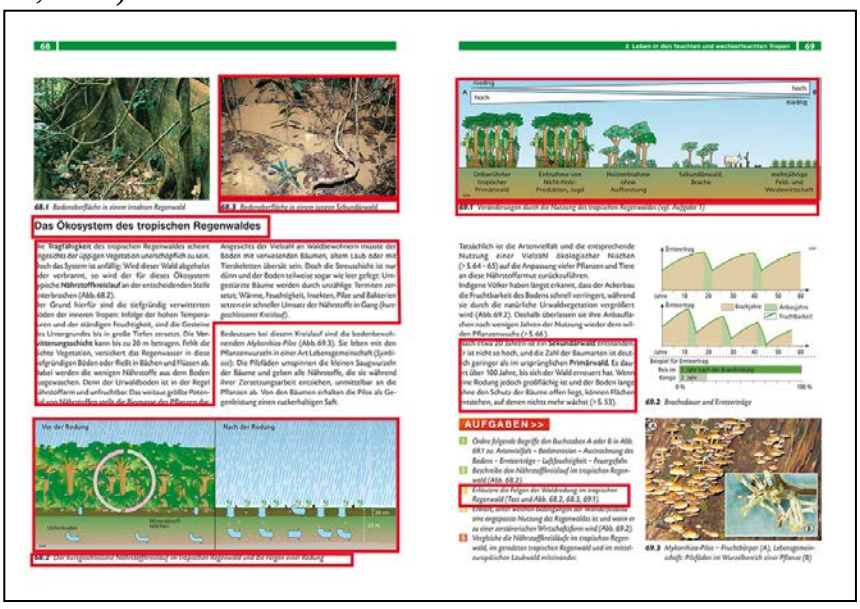

Figure 3. Defined AOI (Example Spread) (Felsch, M., Heß, H., Marth, U. 2012)

The test sequence was randomized. Each test subject viewed the double-page spreads in a different order to disperse the learning effect of each test spread. The focus of the study was on recognising strategies for content comprehension of the two-page spread. Subsequent to the eye tracking test, an evaluation took place by means of a short questionnaire (see fig. 4) and also an additional written evaluation of content comprehension.

Leading questions were: On which page was the information most quickly absorbed? Were all relevant aspects of the information understood? Which path did the test subject's eye take across the two pages? How much time did the test subject require to comprehend the relevant contents?

Which elements of the textbook spread drew the main focus of attention? How exactly the test subject visually linked the provided information in order to solve the test task? Does the textbook design contribute to content comprehension? Which preferences in textbook design do students have? Can correlations be recognised between preferred textbook design and content comprehension?

3.1.2 Test procedure

Each test subject was given the task of first looking at the entire textbook spread in order to determine what exactly was being explained on the pages. The eye movement was recorded (first stage). After finishing the first task, the test subject pressed the stop button and the recording stopped.

At the second stage, the test subject was asked to solve one of the tasks from the exercise section of the double-page spread. The same spread appeared a second time. The eye movement recording started a second time. After completing the task, the test subject pressed the stop button again. The student was asked to write down the answer in short keywords on a prepared evaluation sheet, while the same textbook spread appeared a third time and the eye movement was recorded third time. After completing the task the test subject was asked to pass the evaluation sheet to the assistant. The next test phase started and the next textbook spread appeared on the test screen.

Overall, every test subject observed five different textbook spreads (A – E); every spread was shown three times (a total of 15 eye movement recordings per test subject). Every test subject was asked to complete five test tasks (one per test spread) by observing the page on the screen and additional in written form. After completing the eye tracking test every test subject was asked to complete a questionnaire (see fig. 4).

Assign points from 1 point (best) up to 5 points (least) for each of the following questions. Each number may only be used once per question.	**Spread A**	**Spread B**	**Spread C**	**Spread D**	**Spread E**
Which double-page spread was most appealing visually?					
On which page was the topic easiest to understand?					
Which page had the most understandable graphics?					
On which page could the text be most easily understood?					
On which page did you find the information for completing the exercises quickly?					

Figure 4. Questionnaire

3.2 Test evaluation

The eye tracking test provided three different kinds of data to analyse and to interconnect: the written form (questionnaire and written test evaluation), visualisations (heat maps as jpg-files, trains of vision as jpg-files, trains of vision as mp4-animations) and numerical data sets (eye movement data e. g. trial duration, data from each AOI).To generate the optimal analysis precision, all collected data was separated into two groups, university students and secondary school students. In addition to the individual analysis, an overall analysis summarised the results.

3.2.1 Questionnaire and written test evaluation

Every question from the questionnaire (see fig. 4) was evaluated individually. Furthermore the questionnaire was evaluated under the following research questions: Which spread reached the best marks altogether? Which spread received the best evaluation from university students, which from secondary school students? Which correlations between favoured spreads and eye movement can be established, if any?

By means of the written test evaluation was analysed which spread enabled students to complete the task with the best results, which with the least. Could correlations between test results and eye movements (data sets, trains of vision and heat maps) be ascertained?

Can correlations between most popular spreads and the results of the written test evaluation be determined?

3.2.2 Visualisations of test subject eye movements

The heat map shows the main areas of attention while the test subject was observing the textbook spread superimposed on the background image of each page (test spread). Fixation duration is depicted with different colours. The heat map reveals what attracted a given test subject’s attention to which degree (see fig. 5).

Heat maps were produced for every test subject (three test stages, five test spreads, in total 300). In addition, sample heat map averages combining all test subjects were produced for each of the five test spreads in each of the three test stages (in total 15).

The heat map visually demonstrates which parts of test spreads were observed most, which of the provided materials a student focussed on in order to solve the set task and which materials the test subject ignored. During both test phases, different areas of main attention were visible, showing individual strategies to solve the set task.

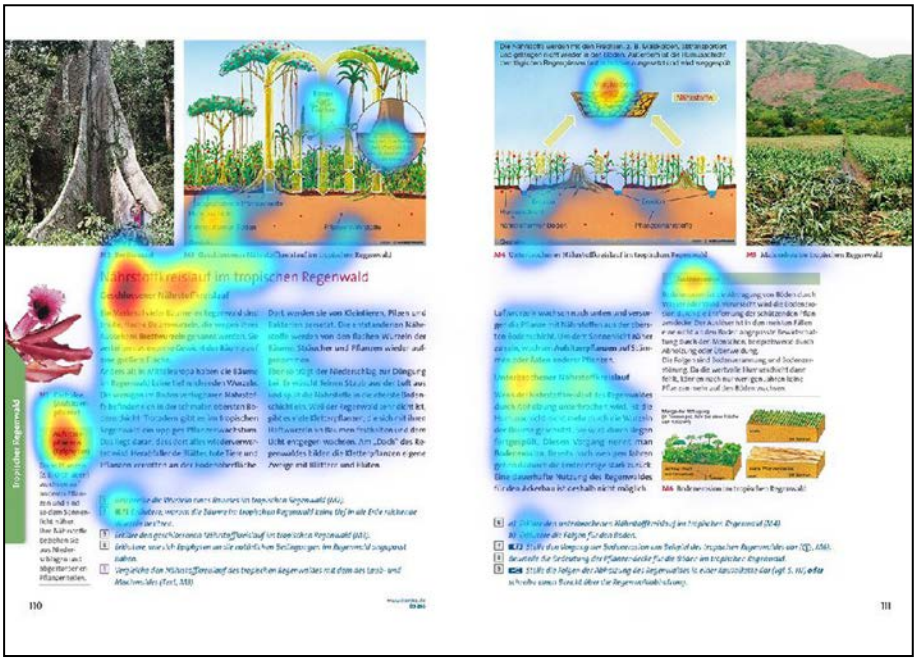

Figure 5. Heat map (example) (Bahr, M., Frambach, T., Hofemeister, U., Lüdecke, T., Teschner, H., Wendorf, M. 2013)

A test subject's train of vision is expressed in two different types of jpg-images and animated in mp4-video. The train of vision is superimposed on the background image of each page (test spread). Saccades are displayed as lines. Fixations are displayed as dots. In one form, the train of vision is illustrated in dark blue (see fig. 6). In a second version, observance time is colour-coded (from blue to yellow, yellow to red) and AOIs are marked in light red.

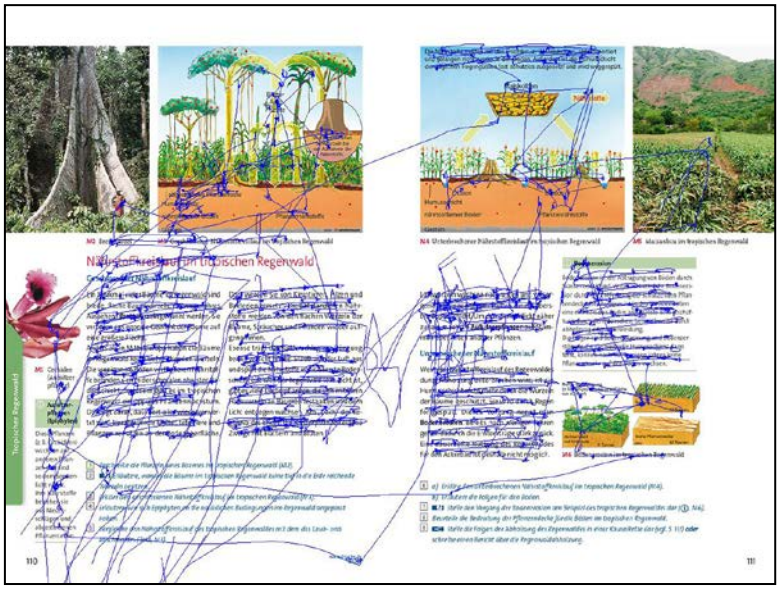

Figure 6. Train of vision (example)
(Bahr, M., Frambach, T., Hofemeister, U., Lüdecke, T., Teschner, H., Wendorf, M. 2013)

The train of vision shows the time, quantity and the order in which the test subject passed every single AOI. The animated mp4-file shows the path of a test subject's eye movement over the textbook spread in 2,4x speed.

Trains of vision depict students' strategies for collecting and interconnecting textbook spread information. They illustrate conclusively whether all relevant aspects of the provided information were found on the spread or not.

3.2.3 Data sets of recorded eye movements

The eye tracking test provided four different sets of eye movement data from every test subject: one data set on the trial duration and three data sets on the AOIs (order of actuated AOIs, proportion of time in the AOIs, duration of focus in the AOI).

The trial duration data (five test spreads, three test stages) shows the time (in seconds), which every test subject needed in order to solve the test tasks (*stage 1* what exactly is explained on the textbook spread, *stage 2* completing one task from the exercise section).

Interconnected research questions were: On which textbook spread was the information most quickly absorbed? How much time did the test subject require to comprehend the relevant contents?

The order of actuated AOI shows in which order the test subject activated every single AOI. Only a length of stay of over 500 ms was recorded. The data set also shows when each AOI was actuated for the first time. The data set may show strategies of content comprehension depending on the task: Which page element comes first and in which exact order were the AOIs activated to collect all relevant information?

The proportion of time spent in the AOI provided a data set average for all test subjects. It shows the distribution of time spent in every single AOI in percentage of the trial duration. An additional data set shows the average duration of stays in seconds for every single AOI. The time based AOI data sets show how much time every test subject spent collecting relevant information from every single AOI.

Research questions that arose were as follows: Are there clear correlations between the number of AOIs activated and the results of the written evaluation? How much time did students spend on a textbook spread, how much time exactly on which page element? Which kind of information (photographs, graphics, and text) did students prefer solving a task or answering a research question? Are there discernable strategy differences between secondary school students and university students in the recorded eye tracking data?

3.3 Conclusions thus far

The eye tracking test showed that many students had difficulties to interlink complex image-text-relations in geography textbooks in order to solve tasks from the exercise section.

The research task is now to analyse all collected data in view of content comprehension and correlations between main areas of attention (heat maps), written test results, numerical data sets (AOI, trial duration) and trains of vision. The recorded eye movement data are currently being analysed.

A key aspect of geography education is working with, describing and analysing visual inputs such as maps, photographs, diagrams and modern media as much as GIS, GPS and satellite

images as well as to relate visual input and text to each other. Acquiring and implementing visual competencies is important to successful learning and teaching of geography. Consequently, the ability to decode and analyse visual inputs as well as interconnecting different forms of information (visual inputs and texts) should be trained more often.

When teachers are aware of students' strategies for absorbing textbook information, they are better equipped to give targeted assistance for completing tasks or answering research questions.

The detailed analysis of all collected data and final conclusions will be published in the dissertation.

4. CONCLUSION

The design quality in textbooks may contribute to students' learning success. Functionality and relevancy from the student's perspective should be given more consideration in geography textbook design.

In future textbook concepts, the design of visual information and the interrelationship between visual inputs and text should be improved. Various forms of information should support one another in greater efficacy.

Analysing and interrelating assorted visual input with text requires a capacity for abstraction and systemic thinking. Systemic thinking is also vital to understanding complex global relationships and should also be a factor in the conceptualization of a geography textbook. As Lambert says: "*Thinking geographically allows young people to make connections from the personal to the global scale.*" (Lambert, D. 2009:4). The guiding principle for geography textbooks should be encapsulated in the concept of geography as it contributes to a better understanding of the world (see Taylor, Liz. 2011).

The research results form the base for the development of design based strategies to improve students picture text comprehension, which could be applied in geography textbooks.

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CULTURAL HERITAGE AND EDUCATION. INTEGRATING TOUR MAPS IN A BILATERAL PROJECT

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Abstract

History and Geography as school subjects are inter-related in formal or non formal liaisons in European national curricula. This paper presents the case of a primary school from Greece and two secondary schools from Portugal and Sweden that collaborated in a bilateral European project under the title "Mapping our city monuments". After the selection of significant monuments and bibliographical research, students organized guided tours using GPS devices and digital cameras. Following the field trips Maps Tours were created on ArcGIS Online, myHisto website and Google Maps, integrating collected photographs and data from the site. The use of digital maps in education designed by students leaded to the rediscovery of historical and archaeological monuments in urban settings linking spatial thinking to cultural recognition. Thus the suggested didactical approach promotes spatial citizenship and cultural preservation through innovative pedagogical practices.

Keywords: *Geography education, heritage education, ArcGIS Online, myHistro, Google Maps*

1. INTRODUCTION

Cultural heritage is a group of resources inherited from the past which people identify, independently of ownership, as a reflection and expression of their constantly evolving values, beliefs, knowledge and transitions. It includes all aspects of the environment resulting from the interaction between people and places through time (Council of Europe, 2005).

The definition adopted by the Faro Convention differentiates from the concept of cultural heritage as a traditional notion of protection or conservation of single monuments, archaeological sites, group of historical buildings, landscape or historic town centres. The Convention promotes citizen participation in decision making and management processes related to the cultural environment. This consideration was adopted by the 2014 Conference "Heritage First! Towards a Common Approach for Sustainable Europe" organized by the Hellenic Precidency of the Council of the E.U. It is suggested that heritage should be enhanced and promoted as a driving force for active engagement and social responsibility

while consisting a resource and prerequisite for a Europe of "smart, sustainable and inclusive growth" (Hellenic Presidency of the Council of the European Union, 2014)

Formal education addresses the aspect of public participation and involvement. The cultural heritage dimension is suggested to be included at all levels of education, not particularly as a core subject but through interdisciplinary actions (Faro Convention, Article 13). Furthermore the Faro Convention fosters multilateral co-operations for the recognition of the common heritage of Europe (Faro Convention, Article 17).

Raising awareness and promoting the value and role of cultural heritage is integrated in several European curricula of History and Geography. In the Greek Curriculum for Primary Education among the general goals for the lesson of History the following are inter-related with heritage education: a) experiential learning of aspects of culture such as traditions, customs etc., b) contact with cultural heritage, c) appreciation of cultural heritage, d) identification of the contribution of the Europe to the world culture and of the value of world peace and collaboration (Official Gazette, 2003a). For the lesson of Geography the general goals that are linked with heritage education are: a) study of the interaction between physical environment and people and b) cultivation of attitudes and behaviours that allow regular and creative integration to the natural and socio-cultural environment (Official Gazette, 2003b).

According to the new programs for Geography, emphasis is given to research through school projects that focus on local issues with the use of GIS and ICT (Klonari, 2013). In Portugal the heritage concept is dealt with in depth mainly in History. However we can find some references in Geography´s curriculum such as "*pupils must be able to interpret and analyse critically the geographic information and understand the territorial identity, cultural, heritage and regional individuality, allow him to strengthen the sense of belonging to his country and the capacity of civic action*" (DEB, 2002).

In History we can find a clearer heritage learning sequence. Pupils between six and nine years old are expected to recognize and valorise expressions of the cultural and historic heritage on their region. Pupils between ten and eleven years old must be able to explain and valorise the elements of the Portuguese historic heritage. Finally, pupils between twelve and fourteen years old must be able to integrate and valorise the elements of the Portuguese historic heritage in the context of world historical heritage (DEB, 2001).

The development of geographical media and ICT offers new possibilities to teachers to create engaging contexts for learning. Cloud computing has expanded educational resources providing the opportunity for sharing maps, Figures, video, data, visualizations (Donert, 2014). In a recent publication of the Digital-Earth E.U. Network, on-line GIS were applied in examples of geo-media implementations in different ages and subject areas including heritage education (Donert and Parkinson, 2013).

ETwinning is a European program supported by the European Commission that promotes collaboration and school networking with the use of ICT. The eTwinning portal is a multilingual website that offers collaboration tools and services to teachers to create partnerships and collaborative projects in several subject areas (EACEA, 2013). Therefore the eTwinning platform fosters multilateral co-operations in the field of heritage education and geo-media and offers opportunities for the creation of a European identity. European identity does not occur by itself; rather it is a result of positive experiences, a sense of belonging and acceptance in a common European area (Resnik Planinc, 2013).

Taking under consideration the possibilities that on-line GIS offers for the promotion of cultural heritage and the active engagement of students in inquiry based learning activities the Intercultural Primary School in Alsoupoli, Greece along with Hjortsbergskolan from Sweden and Escola Básica Integrada de Santa Maria in Beja, Portugal decided to collaborate on the development of an eTwinning project under the title "Mapping our City Monuments". The purpose of the project was mapping historical and archaeological monuments of our cities

with the use of on-line GIS, re-discovering their importance and establishing an active "dialogue" between citizens and cultural heritage. The project was recognized as one of the best practices of the use of GIS on schools by Digital-Earth network and was awarded an eTwinning Quality Label. This project was also selected to be part of the GIS book "The Curriculum with Digital-Earth – Geo Media Case Studies in the curriculum" (Donert & Alan, 2013).

2. METHODOLOGY

Participants

The participants were primary and secondary school pupils and teachers from three different public schools from Greece, Sweden and Portugal. The pupils were from middle-class families and in the case of Greece and Sweden from a range of ethnic backgrounds. 48 pupils attending fourth and fifth grade aged 10 and 11 years old participated from the Intercultural Elementary School in Alsoupoli, Athens, 22 pupils from 5D in Lungby aged 11 years old and 106 pupils aged 11 and 12 years old from Escola Básica Integrada de Santa Maria, in Portugal. The project involved four teachers from the Greek school, four teachers from the Portuguese school and one teacher from the Swedish school.

3. RESULTS

Map making process

At the first phase of the project the participants identified the historical and archaeological sites of the research and selected the most relevant monuments. The criteria of selection were the historical and archaeological importance of each monument, its state of preservation and accessibility and security issues. Communication and exchange of teaching materials was conducted through eTwinning space, e-mails, Skype and a Dropbox shared folder.

During the implementation phase students from the Greek school followed an initial presentation of the project demonstrating the location of Kerameikos in various maps, important historical and archaeological information and 3D representations of the monuments. The purpose of the project, the course of action and the anticipated outcomes were analyzed. An introductory lesson about coordinates and the use of Geographic Information Systems was presented. Pupils watched relevant documentaries, selected monuments of interest and created short texts. During the visit to the archaeological site of Kerameikos pupils used compass, photographed significant monuments and completed worksheets (coordinates of monuments, distance estimations, relative position) with the use of GPS devices. A total of seven monuments were selected. Students of the fifth grade were situated in the selected monuments while their peers from the fourth grade were divided into groups and with the use of maps visited the suggested monuments, heard short presentations and answered to a quiz in order to obtain a piece a puzzle they had to complete.

After the visit pupils created a Tour Map on ArcGIS on-line. They were first introduced to the ArcGIS on-line interface, they identified the location of Kerameikos using the "find address or place" tool and then they experimented on different basemaps. They suggested applying as basemap the Open Street Map driven by the level of analysis and the use of the Greek language. They placed map notes on the locations of the monuments and they added point symbols. The text of the description of the monuments was created during the previous phase of the research for the guided tour. They uploaded Figures using Figure URLs. A

reference on map symbols (point, line and area symbols) followed and pupils decided to use flag point symbols and the symbol of target at the entrance of the archaeological site. They experimented on the size of the symbols in terms of visibility. They used the measure tool to find the distance between the selected monuments. After discussing about the appropriate unit of length, they measured distances and compared them with distance estimations reported on the site. They also observed the bar scale on the bottom of the map and made references to different scales. Finally they saved their map (Figure 1). The map can be viewed at http://bit.ly/1hAPZyv

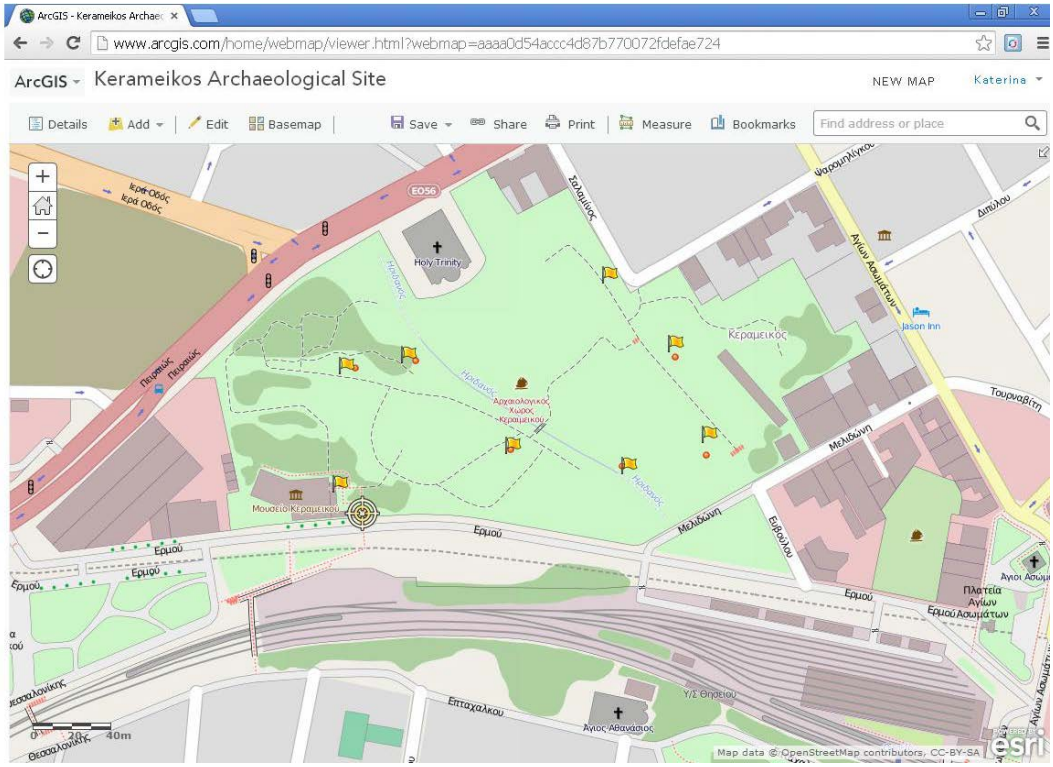

Figure 1: Web map of Kerameikos Archaeological Site on Arc-GIS on-line

In the next phase of the project pupils were introduced to the creation of web mapping applications. After browsing the templates of web mapping applications they decided to use the Map Tour template. Using the "Switch to builder to mode" they edited the point symbols of their map and regulated sequence of the archaeological Tour. Pupils made references to the original web map they have created and navigated through the application (Figure 2). The map can be viewed at
http://www.arcgis.com/apps/MapTour/index.html?appid=b2302279dc7349ffab5f7e23a99c174a&webmap=aaaa0d54accc4d87b770072fdefae724

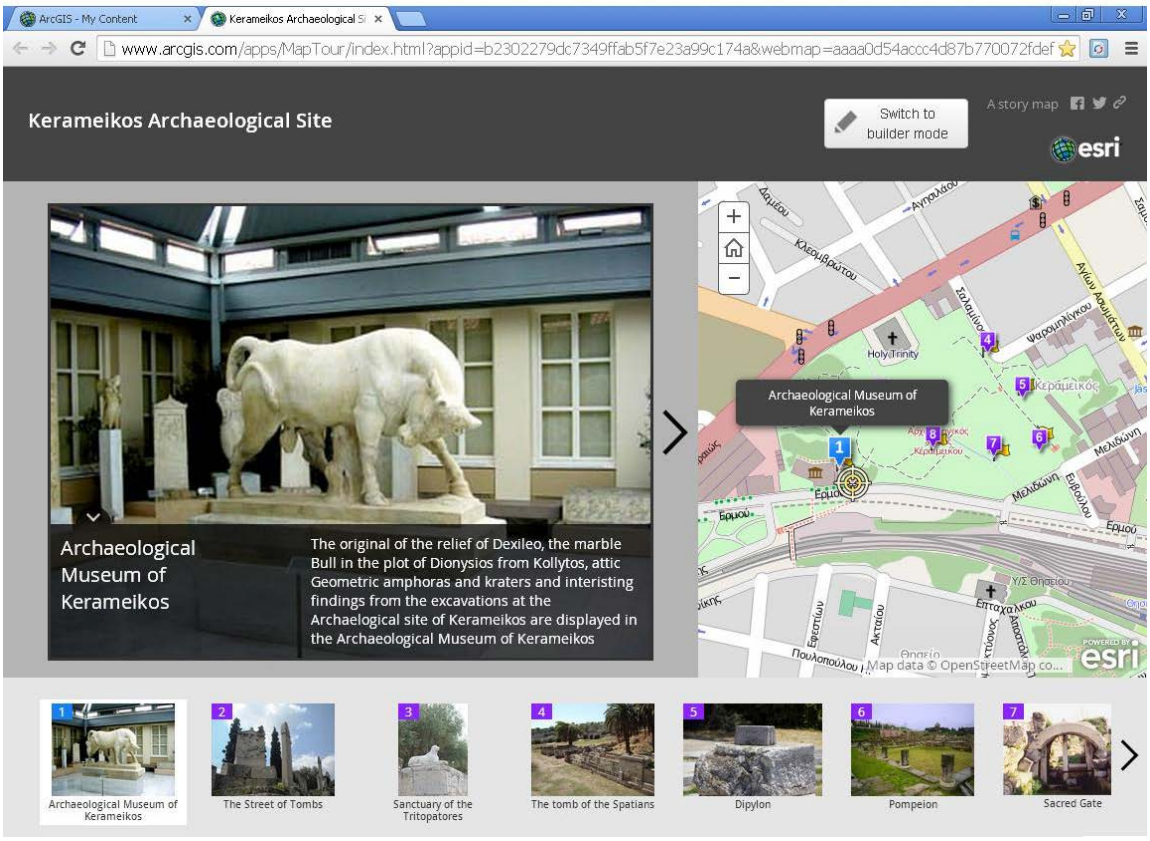

Figure 2. Tour Map of Kerameikos. ArcGIS on-line web mapping application

A third on-line digital map was created on My-Histro website. Pupils participated in inquiry based learning activities about the Labours of Theseus. They studied related

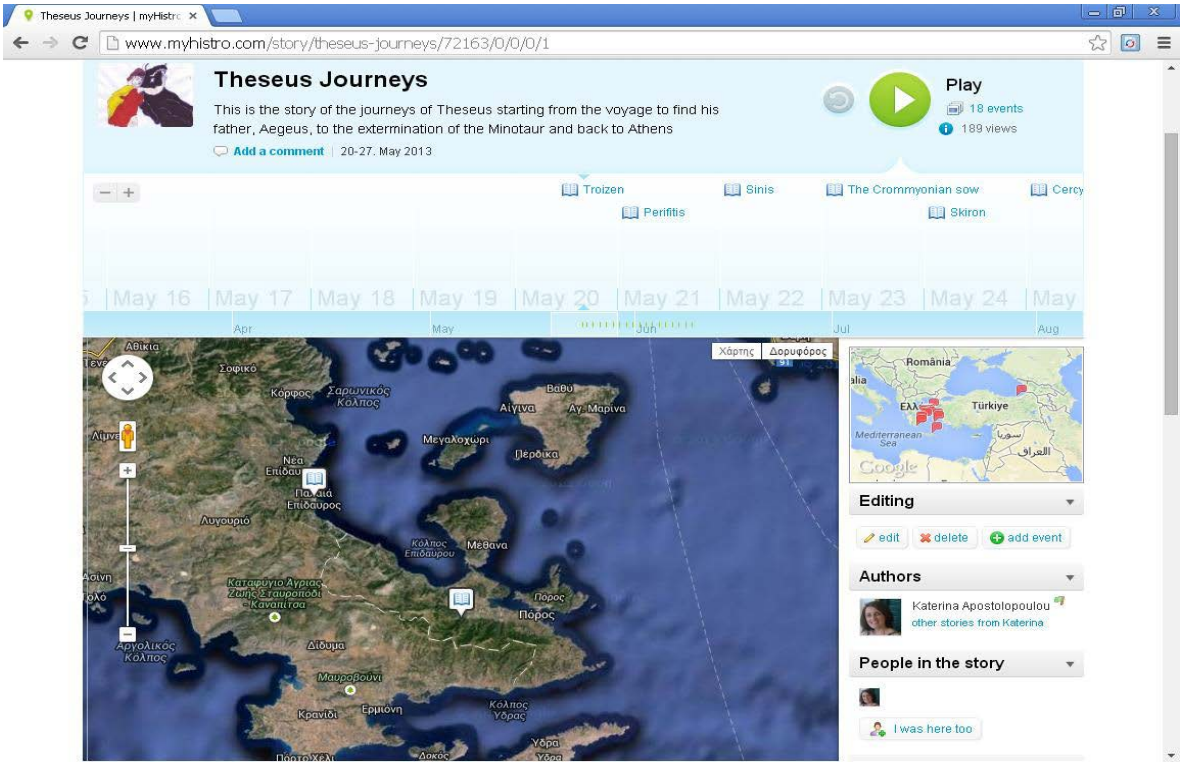

Figure 3. Theseus Journeys on myHistro story map

children's literature, they participated in a workshop on greek Mythology by the published author Nanina Sakka-Nikolakopoulou and created pictures and texts about the labors of Theseus. The purpose of the project was to establish spatial associations between myths and actual places, the names of which altered throughout the history (Clark, 2012).

A two-hour lesson was designed to introduce to the function of the myHistro website. Using a tutorial pupils working in groups created a timeline of the Journeys of Theseus from his homeland Troizen to Athens, Crete, the Black Sea and the Lower World (Figure 3). They identified the locations of Theseus Labours on Google Maps, they edited their story details by selecting a story name and added and managed story events creating texts and pictures (Figure 4). They imported photos and finally they watched the evolution of the story commenting on the contemporary names of ancient cities and connecting mythology with geography and geology. They produced explanatory frameworks for toponyms and mythological features relating them to the relief. One of the cases discussed was the action of the robber Skiron that functioned as an alternative framework for explaining the geological phenomenon of rock falls, very common in the area of Kakia Skala, due to slope-related factors (Rozos, 2014). Pupils also searched for newspaper articles that referred to rock falls in the region in recent years. The map can be accessed at
http://www.myhistro.com/story/theseus-journeys/72163/0/0/0/1

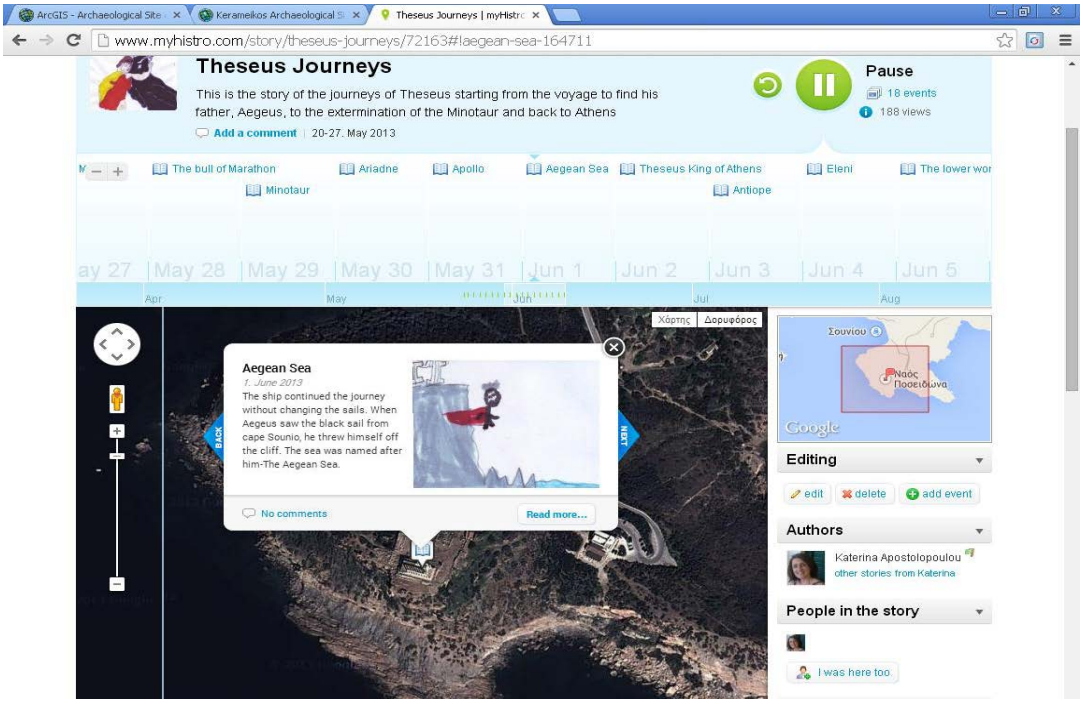

Figure 4. MyHistro story maps

Teachers and pupils from the Portuguese school organized three city walks with the aid of a tourist guide that provided historical information about the monuments. A total of nine monuments were selected for the research purposes. Using GPS devices coordinates were obtained for the mapping work. Pupils were organized in pairs. A member of the group was tasked to register the exact location of the visited monuments with GPS devices. In the classroom, pupils presented data from the site visits (photographs, notes, GPS coordinates and historical information) and using a tutorial created by the teachers, they placed the information collected on Google Maps (https://maps.google.com/maps/ms?vps=2&hl=pt-

PT&ie=UTF8&oe=UTF8&msa=0&msid=209284312810615279489.0004db3f553a155ecff5b) as we can see on the following example:

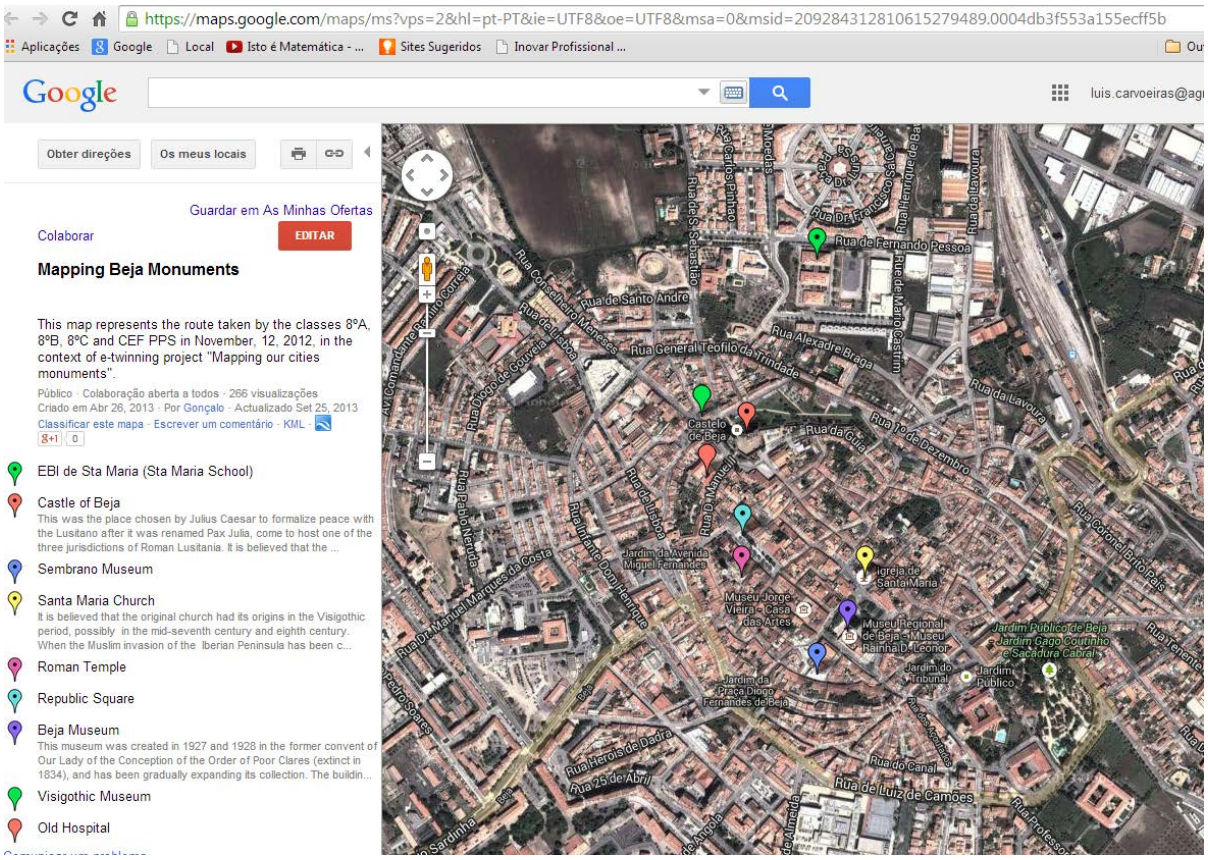

Figure 5.Web map of Beja Monuments on Google maps

On a second phase of the project the Portuguese pupils also worked on myHistro website (http://www.myhistro.com/story/mapping-our-cities-monuments/71738#!santa-maria-school-164274)

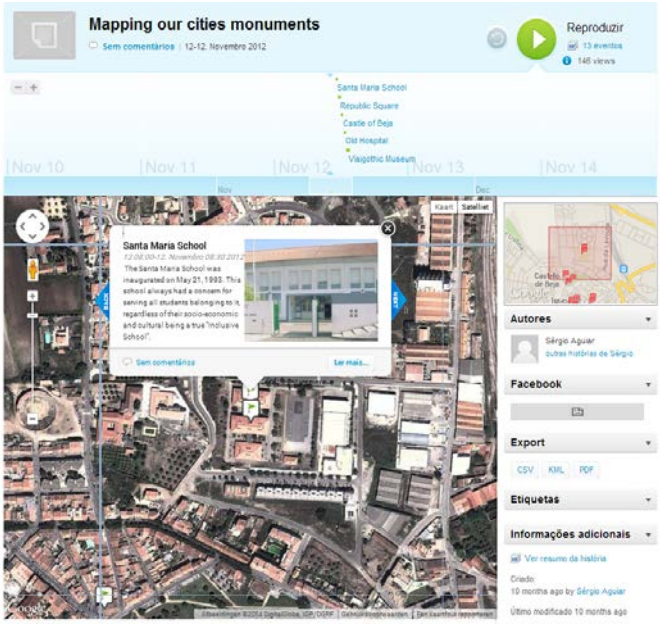

Figure 6. Tour Map of Beja on my Histo platform

The maps were made public to the school community at the end of the school year and shared on the school Facebook´s page. Last, the Swedish school organized a site visit to the city center and selected a total of six historical and archaeological monuments. After the site visit they placed their information on Google Maps and created a Power Point Presentation. The map of historical monuments of Ljungby can be accessed at https://maps.google.gr/maps/ms?msid=206521234197424490539.0004cb035b10b3b3cd01c&msa=0

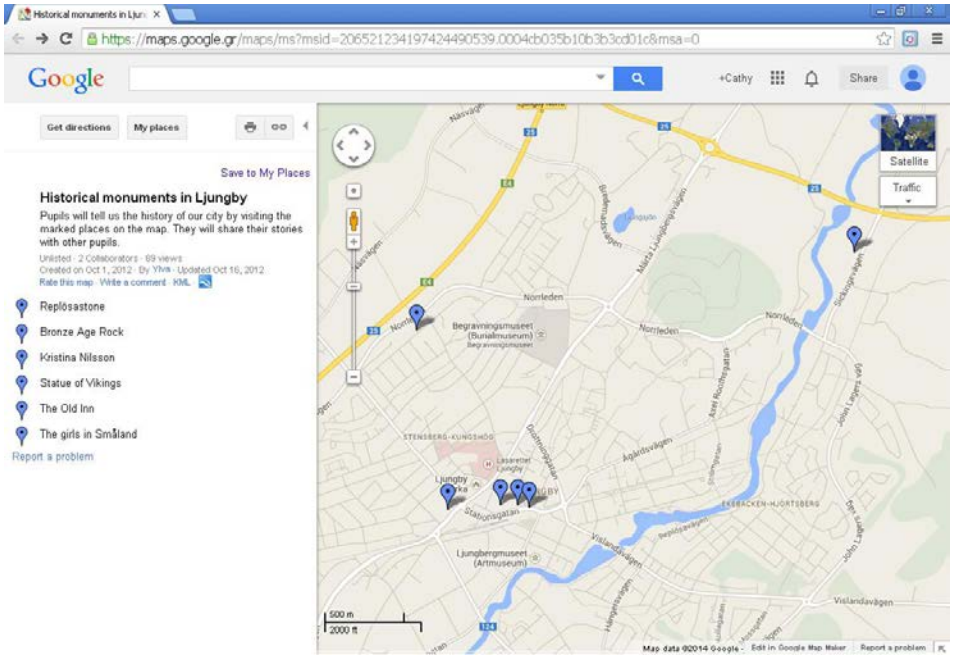

Figure 7. Map of Historical monuments in Ljunby on Google maps

Throughout the mapping process pupils from the three schools exchanged map-making experiences with their peers and finally presented their work to their partners. Teachers scaffolded the learning activity and provided useful guidelines. Tutorials were created to support the learning process. The learning procedures mentioned above resulted in the creation of a community of learners that offered support to teachers and pupils.

4. DISCUSSION

In this paper we explored heritage education with the implementation of on-line GIS. Pupils created authentic digital maps collecting data from their local environments during organized field trips. Field trips are part of geographic and history courses in primary school and depending of the level of planning, teaching and follow-up activities they offer the opportunity for knowledge and skills development additionally to class work and raise attainment among school students (Rickinson et al. 2004, Nundy, 1999). The findings of our projects support these conclusions as pupils actively engaged in real-life learning activities and acquired new skills and knowledge rediscovering their local environments.

This paper is in alliance with previous studies supporting the integration of GIS in primary education for the promotion of cultural heritage. Lambrinos and Asiklari (2014) implemented a program related to local history with the creation of a local digital map of Agia Paraskevi village indicating four points of interest with the use of GIS and GPS with pupils aged ten to twelve years old. My special place: Ljubljana project (Krevs, 2013 in K. Donert & A.

Parkinson) directed to older pupils (aged sixteen to nineteen) made use of online ArcGIS to present preferred places in their town linking local environment and geomedia. Local enviroment was also investigated in the project "Young researchers in countryside" where 5th and 6th grade pupils aged eleven and twelve years old, collected data during a field trip with the use of GPS devices and created digital maps of an environmental trail (Klonari & Tzoura, 2011).

During the projects pupils related time to space by constructing timelines of mythical journeys and virtual tours. This way they created between the past and the present links integrated in a geographical dimension. They explored locations, conditions, analogs, change, movement, diffusion and demonstrated spatio-temporal thinking (Gersmehl & Anthamatten, 2008). Heroes of the ancient Greek mythology were linked to geological phenomenon and pupils were lead to produce logical explanations and exercised careful observation and critical thinking. In other words they were urged to see and not just look, to make the evident apparent (Klonari et al., 2011). City monuments were observed through a different perspective and pupils familiarized with them beyond a distant "museum approach".

Through organized learning activities pupils became actively engaged with the local and European cultural heritage and created foundations for future spatial citizenship. The evaluation of the significance of European historical and archaeological monuments affects both the quality of life in the cities and the existence and conservation of the monuments. The protection of the monuments exclusively from the state is not sufficient if citizens do not consciously participate in their actual protection supports Vemi (1994). She continues by suggesting that the creation of a closer relationship between monuments and education- especially elementary education- will not only turn to the profit of the monuments, but also to that of the educational process.

The projects were based on an interdisciplinary didactical approach that facilitated the dialogue between multiple disciplines, such as History, Archaeology and Geography. The educational benefits of the approach is the development of high order thinking skills while students become more independent and confident of their learning developing lifelong learning skills (Duerr, 2008)

A variety of digital tools (ArcGIS on-line, Google Maps, myHistro) enabled the development of spatial thinking, in accordance with Liben (2006) who supports that spatial performance can be facilitated through educational interventions. The advantage of these tools was that they offered high quality digital maps with free access. Therefore one of the educational implications of this paper is that teachers should be aware of the effectiveness of using GIS on-line for the planning of didactical scenarios in upper primary school students.

The teaching methodology was inquiry based and promoted collaboration between pupils and teachers from three different European counties, Greece, Portugal and Sweden under the e-Twinning European program. The European dimension in educational projects is very important for the formation of European identity among school students. During the proceedings of the International Session of the European Youth Parliament held in Instambul, Turkey, in 2012 (EYP, 2012) participants underlined the clear need to provide young people with opportunities to experience active European citizenship, intercultural dialogue and diversity of European cultures. This approach leads to the construction of a new, common, inclusive and pluralistic European identity that according to Žagar (2010) shields from the dangerous uprizing phaenomena of intolerance, racism and xenophobia.

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GEOGRAPHY TEACHERS ATTITUDES TOWARD SELF-EVALUATION: THE CASE OF SERBIA

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Abstract

This study investigated how geography teacher perceived self-evaluation process in their teaching and learning activities. A total of 273 geography teachers in primary and secondary school in Serbia were surveyed using questionnaires. The findings suggest that geography teachers perceive self-evaluation as a positive and useful process. There is also evidence that geography teacher attitudes change in relation to their teaching experience and type of school. The results may be further explored by other researchers and education practitioners to future improve of self-evaluation process and outcomes.

Keywords*: self-evaluation, reflection, geography teachers, professional development*

1. INTRODUCTION

Teacher self-evaluation is a complex process that directly involves the teacher. To understand the process of self-evaluation, it is necessary to understand the substance of teacher reflection. Purpose of the self-evaluation process is to encourage continuing teacher reflection, to promote an innovative approach to teaching and to support teachers with approaches that will move students to higher levels of performance.

However, fundamental principle of effective self-evaluation is that teachers should see themselves as learners. It is also accepted as a key component and vital skill of teacher professional development (Bolton 2010; Costa and Kallick 2008; Danielson 2007; Eraut 1994; Ilic 2014, Kolb et al. 2000; Korthagen and Vasalos 2005). Pollard and Tann (1993, 4) "believe that the process of reflection feeds a constructive spiral of professional development and competence". The studies discussed in this research focused explicitly on teachers' self-evaluation in terms of acquires in teaching and learning competencies and professional development growth.

2. OBJECTIVES OF THE STUDY

The main objective of this study is to explore the perception and attitudes of the geography teachers from Serbia concerning self-evaluation as a tool for professional development growth.

The study also explored the perceived professional practice of geography teachers as it relates to reflective practice. The following are some of the major objectives associated with this research.

- To investigate the geography teacher motives towards self-evaluation process;
- To identify the effects in implementing self-evaluation process;
- To identify the barriers in implementing self-evaluation process.

2.1 Research Questions

RQ1: What are geography teachers' perceptions regarding the self-evaluation process?
RQ2: What motivates geography teachers to use self-evaluation process?
RQ3: What are the effects of using self-evaluation in learning and teaching activities?
RQ4: What are the obstacles to implementing self-evaluation process?

3. LITERATURE REVIEW

Many terms have been used synonymously with self-evaluation, including reflection, self-assessment, self-appraisal, self-monitoring, self-rating. Broadly, self-evaluation is a process whereby teachers collect the data on their own teaching effectiveness and analyse the information to consider improvement to that teaching. According to Airasian and Galikson self-evaluation refers to those process by which "a person can make judgments about the adequacy and effectiveness of performance for the purpose of self-improvement" (1997, 2)." Same authors state that "self-evaluation occurs when questions, thoughts and interpretations suggest teachers to decide on teaching performance" (Ibid, 3).

Close analysis of teacher practices and the literature on self-evaluation reveals that the primary focus of teacher self-evaluation learning (and learning for professional development) is reflection and the term "teacher self-evaluation" has been almost synonymous to 'teacher reflection' or "reflective practitioner", term which was coined by Schön (1987).

Reflection is the mental process of trying to structure or restructure an experience, a problem, or existing knowledge or insights by making it an explicit subject of thinking (Korthagen 2001). As Schön (1983) points out, reflection involves intuitive thinking: 'we exhibit it by the competent behaviour we carry out, but we are unable to describe what it is that we do.' On the other hand, reflection enables us to know what we are about when we act.

According to the Bolton (2010, 19) it involves "paying critical attention to the practical values and theories which inform everyday actions, by examining learning practice reflectively and reflexively. This leads to developmental insight."

An important aspect relating to systematic reflection concerns the moment of reflection. Schön (1983, 1988) makes a distinction between three types: (a) reflection-in-action, in which the learner reflects on an action past and engages in retrospective sense making; (b) reflection-in-action in which reflection occurs as an attempt to "stop and think" in the midst of action, a time during which action can be modified; and (c) knowing-in-action, the most tacit of reflective processes in which knowledge is embedded in the action itself, rarely considered at a conscious level.

According to Korthagen and Vasalos′ "onion model" (2005), there are six different levels on which reflection can take place: mission, identity, beliefs, competencies, behavior and environment.

Brookfield (1995) suggests that we employ four "critical lenses" through which to view and reflect upon our practice. These are: (1) our own view; (2) that of our students; (3) that of our fellow professionals; (4) and the various theoretical perspectives propounded in educational literature. Examining our own experiences as learners as well as teachers helps us "to uncover our most deeply embedded allegiances and motivations as teachers." (Brookfield 1995, 32)

4. THEORETICAL FRAMEWORK

This study is based on the framework of reflective theory. Donald Schön made a most significant contribution to our understanding of the theory of practice and learning. This theory helps "to reflect on action so as to engage in a process of continuous learning" (Schön, 1983).
The concept of reflection has been widely debated in educational circles for many years (Kreber, 2004). To advocates of reflective practice, deep-learning is dependent on individuals making meaning from their experiences through reflection (Sugerman et al, 2000, Kolb 2002). Moreover, reflection is enable learners to connect their previous experiences to the new behavior and acting. Most importantly active and strategic reflection involved in reflective learning indirectly enables teaching and learning processes to deliver some of the very important teaching skills (Danielson, 2007).

5. METHODOLOGY

5.1 Design

The study employs the quantitative approach using the survey method. In order to reflect geography teachers opinions effectively, descriptive analysis was realized and direct quotations are made by the researchers. The data has been analyzed using correlation (Pearson), t-test and ANOVA with the Statistical Package for the Social Sciences (SPSS 17.0).

5.2 Population and Sample

The sample consisted of 273 geography teachers, out of the 300 geography teachers who completed the questionnaire. All of the geography teachers were Serbian.

5.3 Instrumentation

The Self-Evaluation Attitude Survey (Cronbach alpha 0.87) by professor dr. Sait Kacapor (Ilić 2014) was modified to elicit responses and insights regarding the perception of self-evaluation process among geography teachers. The questionnaire included two parts. The first one was concerned with the background variables of the geography teachers: gender, teaching experience, educational background, type of school and the school's district area. In the second part of the questionnaire teachers were asked to present their perceptions on self-evaluation process (Q: 1), motivation, effects and obstacles (Qs: 2, 3, 4). It included one multiple choice question (Q: 1-teachers were asked to rate their opinion according to a 5-point Likert-type scale, 5=strongly agree, and 1=strongly disagree) and three open-response question.

5.4 Procedure of Data Collection

Data were generated via self-completion questionnaire administered to geography teachers, who were on "Annual Meeting of Serbian Geography Society" (April 2012, Belgrade) or were on "Serbian Geography Competition for Primary School" (May 2012, Pozarevac). Part of survey was administered by email (March-May, 2012). The data was elicited from 273 geography teachers. The statistical tests performed, included an analysis of frequencies, mean score, analysis of variance (ANOVA), t-test and Pearson correlation test. All findings reported were statistically significant to at least the 5% level.

5.5 Sample

Table 1. presents the demographic profiles of the teachers including gender, educational background, teaching experience, type of school and school district area.

Table 1. Demographic Profiles of the Teachers

Item	Frequency	Percent (%)
GENDER		
Male	84	30.8
Female	189	69.2
EDUCATIONAL BACKGROUND		
High school	9	3.3
Bachelor Degree	225	82.4
Magistrate	24	8.8
Master	15	5.5
TEACHING EXPERIENCE		
up to 10 years	81	29.7
11-20 years	108	39.6
21-30 years	54	19.7
more than 30 years	30	11
TYPE OF SCHOOL		
Primary	228	83.5
Secondary	27	9.9
Both	18	6.6
SCHOOL DISTRICT AREA		
Urban	183	67
Rural	42	15.4
Both	48	17.6

N=273

Regarding the background variables, female geography teachers (N= 189) outnumbered male teachers (N= 84). This is in line with European Commission′s (2013) study where illustrated that in all European countries female teacher are the majority. Most of the teachers (82.4%) have bachelor degrees, while 13.3% have magistrate or master degrees. Concerning their teaching experience, approximately a one third of the teachers (29.7%) have up to 10 years of teaching experience, 39.6% have between 11 and 20 years experience, while 30% of teachers have more than 21 years teaching experience. A majority (83.5%) of the teachers work at primary school, while 9.9% teach in secondary school and 6.6% teach geography in both types of schools. This is due to the fact that Geography is elective or one-year course in secondary school in Serbia. Most of the geography teachers work in the city school area (67%).

6. DESCRIPTIVE ANALYSIS RESULTS FOR THE ATTRIBUTES OF THE ITEMS

6.1 Research Question One

What are the perceptions of the geography teachers regarding self-evaluation process?
Table 1.2 represents the summary of means and standard deviations for items in the categories of perception regarding self-evaluation process. It was found that more than 90% of 273 geography teachers use self-evaluation process in their work. The mean scores are shifted at the high end of the distribution.

Table 2. Descriptive statistics for the Self-evaluation process

Questions	Min.	Max	Mean Statistic	Std. Deviation
Self-evaluation Areas	12	30	24.82	3.85
Self-evaluation Approaches	9	29	20.65	4.16
Total score	38	72	57.65	8.04

Most of the geography teachers stated that they use self-evaluation process in a different areas (mean = 24.82; SD= 3.85) and a different approaches (mean = 20.65; SD= 4.16). Generally, they are tend to use self-evaluation in their teaching and learning process (mean = 57.65; SD= 8.04). The highest mean score in perception is for item which state that they use self-evaluation in the area of students achievement and evaluation (mean = 4.23; SD= .787). Further analysis revealed that most of the geography teachers usually use self-evaluation as approach to assessment teaching documents - lesson planning, students portfolio, curriculum (mean = 3.98; SD= 8.27).

Comparing these results with the background variables we found significant differences between the geography teachers' perception and variables – type of school ($F=7.54$; $p< 0.01$) and teaching experience ($F=4.02$, $p< 0.01$). Geography teachers that work in both type of schools (SD=4.09) tended to use self-evaluation process more than their colleagues who work only in one school. Experienced teachers (21-30 years of teaching experience (SD=2.24)) use reflection in their work much more than the early stage career teacher (1-10 years experience (SD=4.03).

However, we did not reveal any statistically significant difference comparing these results perceived by geography teachers with the background variables - gender, education background and school district area.

6.2 Research Question Two

What motivates geography teachers to use self-evaluation process?
In the category of the geography teacher′s motives, the perceptions of motivation for self-evaluation were considerable. The result reveled that the most important motive of self-evaluation for Serbian geography teachers is personal needs for improving teaching performance which has a mean rating of 4.31, while effective teaching motive achieve score second with a mean of 4.21. Three other motives were data on actual practice, students′ need and upgrade professional competence (See table 1.3 for detail).

Table 3. Motives for using self-evaluation

Items	Min.	Max	Mean Statistic	Std. Deviation
Personal needs for improving teaching performance	1	5	4.31	.796
Effective and quality teaching performance	2	5	4.21	.909
Data on actual practice	2	5	4.03	.802
Students′ needs	2	5	3.97	.779
Upgrade my professional competence	1	5	3.89	.921
Lack of education policy	1	5	3.09	1.036

6.3 Research Question Three

What are the effects of using self-evaluation in professional development activities?
The majority of the teachers (29.7%) argued that the reflection had greatly effect to the improving teaching performance in their professional development activities. It is concerning that half of the teachers (47.3%) didn't respond or didn't state the most important effects which underpin their satisfaction in the self-evaluation (table 1.4).

Comparing this effect with the background variables, the results showed that significant differences existed between the data on actual practice and the teaching experience, since the junior geography teachers (χ^2=11.94; p< 0.01) was more likely to attribute greater importance to this effects than the senior teachers. In addition, secondary school teachers (χ^2=32.63; p< 0.01) indicated effect students motivation more than primary school teachers. The data also suggested that junior teachers (up to 20 years experience- (χ^2=9.14; p< 0.05)) teachers with master degree (χ^2=5.71; p< 0.05) and rural school teachers (χ^2=39.59; p<0.01) perceived reflection to be useful

in teacher engagement. Interestingly, results showed that enhancing teachers motivation as effect indicated only junior geography teachers (χ^2=22.06; p< 0.01), master degree holders (χ^2=20.85; p< 0.01) and rural school teachers (χ^2=51.19; p< 0.01). More educated teachers also underlined that the self-evaluation process ensures qualitative professioanl development growth (χ^2=5,71; p< 0,05). Analysing the observed results, secondary school teachers as an important factor of self-evaluation stated improving teaching performance (χ^2=33.79; p< 0.01).

Table 4. Effects of using self-evaluation

Items	**n**	**%**
No response	87	31.9
Improving teaching performance	81	29.7
Other	42	15.4
Improving teacher engagement	18	6.6
Professional development growth	18	6.6
Students' achievement	18	6.6
Data on actual practice	15	5.5
Dealing with future problems	15	5.5
Enhancing teachers′ motivation	9	3.3
Enhancing students' motivation	6	2.2

6.4 Research Question Four

What are the obstacles to implementing self-evaluation process?

This section highlights the statements about problems and difficulties in implementing self-evaluation process. It is important to note that a high percentage of teachers didn't answer (39.6%) or didn't perceive obstacles (24.3%). Lack of time and motivation took 3rd and 4th position (11%). Furthermore, lack of seminars (9.9%), education policy (7.7%) and financial resources (6.6%) were underlined as negative factors for the teachers' sense of self-evaluation process.

Table 5. Obstacles in self-evaluation process

Items	**n**	**%**
No response	108	39.6
Other	66	24.3
Lack of time	30	11
Lack of motivation	30	11
Lack of seminars	27	9.9
Lack of education policy	21	7.7
Lack of financial resource	18	6.6
Don't know self-evaluation methodology	18	6.6
Fear from results	15	5.5
Lack of a handbook/guide	9	3.3

The application of ANOVA revealed a significant differences between the lack of motivation and school district, whereas, geography teachers who work in the rural school district (χ^2=6.03; p< 0.01) stated this more than city school teachers. Rural school teachers (χ^2=19.12; p< 0.01) of Serbia also perceived a lack of Handbook to be more problem in teachers self-evaluation than the urban school teachers. A significant difference was also found between the lack of seminar and school district and the type of school. As a problem this indicated teachers who work in the city school (χ^2=7.46; p< 0.05) and their secondary school colleagues (χ^2=7.46; p< 0.05).

Research did not reveal any statistically significant difference comparing these results with the variable gender, education background and teaching experience.

6.5 The Correlation between Self-Evaluation and Teachers Motivation

In order to understand the interactions between the teacher motivations and self-evaluation process, Pearson product-moment correlation coefficients were computed. The size of correlations range from moderate to strong (.37 ≦ r ≦. 56) and all correlations were highly statistically significant (p < .001). Among these motives, relatively strong positive correlation exist between the motives ′data on actual practice′ (r = .56, p< .001) and 'upgrade professional competence′ (r = .52, p< .001). Motives ′effective and quality geography teaching performance′ and ′teachers and students needs′ predicts moderate correlations (r = .49, p< .001). Motive ′lack of education policy′ also has moderate positive influence on the self-evaluation process (r = .37, p < .001).

7. DISCUSSION AND CONCLUSION

The present study examined geography teachers' opinion and attitudes about self-evaluation process (reflection) in their professional development activities. Across all of the data discussed above, improving teacher performance, teacher achievements and professional development growth, appear to be the most important determinants to the implementation and decision of using self-evaluation, regardless of personal background followed.

One of the most significant findings that emerge from this study is that the self-evaluation is a positive perceived action for the most geography teachers. Important findings that also emerge from this study are that geography teachers indicated self-evaluation process as a very useful tool that effects both their and students motivation. Lack of time, lack of teachers' motivation and lack of seminars are considered as the most important obstacles for implementing.

Finally, as an exploratory study in a field that is under-researched, the questionnaire did achieve its aim of presenting a broad picture of geography teachers' views about self-evaluation process. Implication of these data includes the need to continue to provide effective support which helps teachers to identify gaps in knowledge about reflection that can be addressed in future professional-development activity.

Concerning the findings of the present study, following recommendation can be offered for further study: (1) A similar study may be conducted on the geography teachers in other countries; (2) A similar study can be conducted on primary and secondary school geography teachers separately; (3) The study can be conducted on junior and senior geography teachers separately; (4) The present study can be replaced with different gathering instruments.

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EXCURSIONS IN SCHOOL – PAST AND PRESENT FROM SWEDISH AND ANGLO-SAXON PERSPECTIVES

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Abstract

The purpose of this article is to present the results from a review of literature on geography excursions and field studies and to discuss their development over time, focusing on purpose, content, method, and execution. The scope was limited to Swedish and Anglo-Saxon literature, produced after the year 1900. The results show that excursions and field studies have since long been important methods in school teaching, not only in the subject geography. One of the purposes of using excursions and field studies in teaching is to facilitate the learning process of pupils and students. Several authors arguing that learning improved when the objects are studied in the real world. We can see that a continuous process of change has altered contents as well as conduction of the excursions. The previous instrumental orientation has moved toward more pupil-participating work methods. Today preparation is a keyword in most texts on excursions, and the perspectives have been broadened.

Keywords: *excursions, field studies, review of literature, Swedish, Anglo-Saxon*

1. INTRODUCTION

The current curricula of elementary and secondary school stipulate that field studies and excursions shall be part of the geography teaching (National Board of Education, 2011). Field studies and excursions in the geography teaching are however not a new phenomenon, but have since the curriculum of 1693 had a given position in the Swedish school (Skolöverstyrelsen, 1971a). During the 18th century, scientists and explorers increasingly used field studies as a method for surveying, observing, documenting, and collecting various objects from nature, one of the most renowned scientists being Carl von Linné, who in

collaboration with his students carefully documented his field studies (Hodacs & Nyberg, 2007). In the beginning of the 19th century, Sweden was marked by increasing nationalistic tendencies in connection with the loss of Finland 1809, which was reinforced around 100 years later by the union Sweden-Norway being dissolved (Molin, 2006, p. 37). Particularly the intellectual Sweden was filled with strong patriotism, which strongly affected the school. Education became increasingly important to the motherland, and by passing a by-law of the elementary school in 1842, a compulsory school was inaugurated.

With time this leads to school teaching becoming available for more children. Teaching the combined subject geography/history became a means to strengthen children's motherland identity. The compulsory school at the time comprised, besides these subjects, also reading, calculations, and religion. During the early 20th century, Helge Nelson (1913) wrote about how the teaching in home geography should be organized, and emphasized the value of excursions. However, home geography was not inaugurated as a separate subject until the school curriculum of 1919, when geography and knowledge of nature were combined into one subject from the third grade in the elementary school (Molin, 2006, p. 89).

During the late 19th century and the beginning of the 20th century, excursions grew into being an often-applied method in school. This has been substantiated by the Anglo-Saxon texts written by Marsden (1998) and Ploszajska (1998), who both carried out a comprehensive review of the British excursion history. Lewis (1910) presented his excursion experiences as text and pictures, showing which activities pupils carried out in the field at the time. Articles on the value of excursions have been produced in abundance by various pedagogues, one example being Nelson's work, published in *Geografiska Notiser* (transl. *Geographical Notices*, used from now on; *GN* 1944:2), where he claimed that well-planned excursions yield more real knowledge than traditional classroom teaching. During the inter-war period and the years directly after the Second World War, a number of instrumental excursion analyses described how excursions were structured (Larsson, 1950; Malmer, 1951; Marsden, 1998).

Sauer (1956) believed that excursions and personal observations improve pupils' motivation to learn, and thus can be deemed effective to apply on pupils studying geography. The preconditions for learning are developed by conducting field studies, as these provide the pupils with a genuine opportunity to use the knowledge they acquire in the classroom and in textbooks. Hence, Sauer (1956) emphasized field studies and excursions as good methods for geography teaching and referred to British literature in his account of the geography subject and its content. An abundance of material is available in Great Britain, particularly at the Royal Geographic Society. The society was founded in 1830 and has since been providing teachers with advice on how to carry out excursions. In 1933, the Royal Geographic Society formed a new organization for British geographers, with the purpose of arranging field studies (Marsden, 1998), and in the same year, the National Association for Geography Teachers initiated its operations in Sweden. Most pedagogic texts on school excursions were published in the journal of the National Association for the Geography Teachers during the period 1933-1952. During the 1940s, the National Association for Geography Teachers communicated with the Swedish National Board of Education, demanding clear instructions in terms of the scheduling of school excursions (Holm in Geografilärarnas Riksmöte, 1943, p. 2), but not until 1951 did the board publish directives for the execution of excursions.

The perspectives of current publications, discussing excursions and field studies, differ from those published in the middle of last century. The present literature on excursions put forth methods, the motivation of pupils, and how pupils perceive excursions. The modern IT-society and globalization have simplified communication, and have also made updated information about excursions more readily available. The older literature on excursions primarily treated the teacher's role, and the structure of excursions was conscientiously

discussed. Excursions and field studies are accentuated sections of the geography curriculum in elementary and secondary school in Sweden today.

The present article reviews the literature on geography excursions and field studies, focusing on purpose, content, method, and conduction. The scope was limited to Swedish and Anglo-Saxon literature, produced after the year 1900. The Swedish literature was narrowed down to *Geographical Notices*, and then further limited to the documentation produced by the school authorities. The concept *excursion* is in the Swedish literature used about a course moment where the pupils are active in the field. The word field study, although occasionally used about excursions, is not analogous to excursion. Caulfield (1955) defined school excursions as a journey or an activity outside the classroom, with a clearly expressed purpose to facilitate the pupils' learning. Field studies are a concept used within many different research areas, and the concept must therefore be combined with geographic expressions. In the English language, *field studies* are equivalent to excursions, and in certain articles the word *excursion* is thus used. Excursions must furthermore not be confused with the concept outing, which does not have learning as its main purpose. The beginning of the 20th century saw a number of different movements entering society, like the scout movement, school trips, holiday camps, and school camps. Pupils are defined as children in elementary or secondary school, while students constitute youngsters at university or a university college.

2. THEORY – THE LEARNING PROCESS IN EXCURSION CONTEXTS

Previous research on learning processes in connection with field studies stretches back more than a century. Dewey (1915, p. 90) pointed out that "If studying nature is turned into science, the real material of the subject must be at hand for the students; there must be a laboratory, with provision for experimentation and observation". Acknowledging the importance of an active learning process has strongly influenced later teaching and research. Several scientists have concluded that observations in the field improved learning in comparison with teaching in a classroom (e.g. Nelson, 1944; Sauer, 1956; Marvell, 2008).

Sauer (1956) also stressed the importance of "walking alone through unknown land and life", thereby becoming a participating observer, because geographical knowledge is primarily acquired through observations that later, by reflection and re-inspection, will lead to comparisons and syntheses. Reflection, however, requires time. Consequently, authors like Payne and Wattchow (2009) and Jonasson (2011) emphasized that excursions need to be carried out at a slow pace. Students given the time to reflect on matters are more likely to feel better motivated, and without motivation, learning will be significantly impaired. When students are introduced to new concepts within a topic, utilizing the area the students are most familiar with – like the neighborhood – facilitates reflecting right from the start. Nelson (1913), and later Sanderoth *et al.* (2009), emphasized the importance of the familiar neighborhood, because it provides opportunities for recognition, which in turn stimulates learning. Another advantage is that excursions close to home usually require less time, thus increasing the probability of all students being able to participate.

Excursions also provide an excellent setting for breaking the conventional teacher–student relation. By giving the students oral presentation tasks along the excursion routes, the teacher may take on the role as a fellow student, forcing the students to actively use their theoretical knowledge (see e.g. Jonasson, 2011). Most people can relate to such learning strategies. When you listen to something, you may remember and understand what was said; taking notes while listening increases the chance of remembering and understanding what was said; but being forced to lecture on the topic to other people, dramatically improves the ability to remember and understand.

Some conceptual models of the learning process may be applicable in excursion contexts. Of these, especially Bruner's (1960) and Kolb's (1984) may be useful, because they disclose how students' real-world experience, after studying the abstract concepts and ideas of textbooks, facilitate learning. Bruner's (1960, p. 52) *spiral curriculum* describes how learning develops in an upward spiral (Learning initiated – Learning through theory – Learning by doing – Feedback – Further learning). In essence, new knowledge is being added to previous knowledge in a continuous process. The students recall previous experiences, making new reflections, gaining new knowledge, and thus an incessant spiral is formed. Kolb's (1984) model comprises four stages. Applied on excursions, the first step constitutes previous experience, e.g. theoretical knowledge from textbooks, etc., which is utilized in the next step, when the students make reflective observations during excursions. In the third step, the students actively link the theory with their training in the field, thereby transforming their previous experience into a new dimension of understanding. Applying the knowledge acquired by active experimentation leads in a fourth step to an even higher level of knowledge.

Marvell's (2008) example of excursion procedure also relates to Kolb's model. Before the excursion, the students prepare themselves for the forthcoming oral presentation by studying the theory. On site, they carry out their observations/experiments, and report their findings for the fellow students. The students are instructed to take notes during excursions, and are on their return expected to reflect on their own performance in a written excursion report. In doing so, the students become aware of what they have, or have not, understood, as well as what they did well, and what could have been improved, in terms of fulfilling the *abstract conceptualization* in Kolb's model. Their next oral presentation completes Kolb's cycle (Marvell, 2008).

Besides Marvell's scheme (which focused on a specific excursion), student performance is often assessed by using Bloom's (1956) taxonomy, designed in the revised version by Anderson and Krathwohl (2001) as a two-dimensional graph. The vertical axis displays the knowledge dimension, comprising four different knowledge levels (*factual knowledge* followed by *conceptual* and *procedural knowledge*, and ending with *metacognitive knowledge*), while the horizontal axis shows the cognitive process dimension (*remember* followed by *understand, apply, analyze, evaluate*, and ending with *create*). Each learning outcome is expressed in terms of a noun denominating the knowledge dimension, while a verb specifies the cognitive dimension. In excursion contexts, such a system might be carried out as e.g.: "After the course, the student will be able to explain the difference between metamorphic and sedimentary rocks." A successful explanation carried out by the student, shows that the student has acquired an "understanding" of that particular "factual knowledge". Taking background and study level into account, such a system will facilitate the evaluation of different aspects of students' knowledge levels as well as their cognitive abilities.

3. METHOD

The present article was founded on studying Swedish and international literature, acquired in various data bases, primarily Diva, ERIC, the Geography Square, Google Scholar, and Libris. The search primarily focused on excursions with pupils. The key words were: *field studies*, *geography*, *outdoors*, *methods*, *school*, *excursions*, and *school excursions*, used in different combinations during the search. Libris was the primary source of information in the Swedish context. The National Association for Geography Teachers published their membership journal in *Geografiska Meddelanden* (transl. Geographical Messages, used from now on)

from 1933 up to and including 1942. Articles published in *Geographical Notices* from 1943 and to date are available online at the National Association for Geography Teachers' website, and those published after 2007 can be downloaded. During the years 1939-2006, 26 articles on excursions in various forms were published in *Geographical Notices*, discussing the conduction of excursions, or problems arising during school excursions, and these were included in the present study. Most excursions reported on in *Geographical Notices* aimed at teachers.

The literature search revealed a spread over the different continents and countries, i.e. Australia, China, the Netherlands, and New Zealand. The greatest part of the literature originated in Anglo-Saxon countries. Selecting articles proved to be problematic, since the number of articles in some cases was of considerable size. A search, using the key word combination: *excursions, outdoor, school* yielded 64 400 hits in Google Scholar. Hence, the present study limited the selection to Swedish and Anglo-Saxon excursions, and focused in particular on historical excursion literature, where similarities and differences were identified. A considerable part of the Swedish literature survey also comprised curricula, syllabuses, and school regulations.

Comprehensive international articles published before 1920 were hard to acquire. Articles on early excursions primarily comprised second-hand information. Lewis (1910), one of the most influential excursion pedagogues during the first three decades of the 20th century, is the only author whose texts might hold up to a closer examination.

4. RESULTS

Excursions have a long history, and are, according to Matheson (2001), a tradition as old as the story about the Odyssey. Caulfield (1955), going even further back in time, argued that the oldest form of excursion goes way back to the time when humans were strolling freely around in nature. During the 18th century, Rousseau and Pestalozzi put forth thoughts about learning being facilitated and established through real experiences in nature. Excursions consequently became, already before the 19th century, a commonly utilized method in various educations, not least biology, where Carl von Linné was the most prominent scientist. Linné's excursions were purely biological field studies and field activities in terms of collecting various objects. The students collected everything they might come across on their way through nature during the summer season: plants, insects, and minerals (Hodacs & Nyberg, 2007). Mathewson writes that Humboldt's journeys and fieldwork around the year 1800 probably can be regarded as the initiation of geographic excursions in Europe.

In Sweden, teacher-led excursions were in reality not introduced until the time of Linné, but no material from school excursions exists from the first two centuries (counting from 1693). The National Board of Education (Skolöverstyrelsen, 1971a) has shown that excursions were carried out in a number of different schools around the year 1800, and were later inserted into the school organization of 1820 and also into the by-laws of the grammar school of 1878. They claimed that the reasons for arranging excursions should be viewed in the light of Sweden being a country at war. During the years 1812-1820, land measurement brigades, responsible for depicting the landscape with utter precision, constructed the Swedish reconnaissance map. They measured heights with the aid of triangulation, and completed the map by making drawings of the landscape (Lewan, 2004). Geography and biology excursions were important during the first years of the compulsory school. The Royal Grammar School Board issued directives for geography and biology excursions in 1906 (Kungliga Läroverkstyrelsen, 1906). The National Board of Education (Skolöverstyrelsen, 1971a) put forward the thought that a good contact between teacher and pupil is easier

established outdoors than in the classroom and stated that excursions were to be considered as an interdisciplinary method.

The summer of 1933 The National Association for Geography Teachers was initiated, Helge Nelson being its first chairman up to 1945. The first article on excursions in *Geographical Messages* was published by Ilien (1939), reporting on excursions carried out by grammar school pupils in Kristianstad. Significant guidelines for conducting experiments and excursions in teaching were, according to Ilien, those given by the Royal National Board of Education in 1933. In his article, Ilien cataloged all excursions he carried out with his early secondary school pupils during the years 1933-38, and the places visited during the excursions were e.g. industries and sites of geological and geomorphological interest. The map and the compass are important tools in geography studies, but Ilien argued that also the sports teacher had a duty to teach how a compass functions. Arranging excursions during the war (1939-1945) was for obvious reasons problematic. Pupils had enrolled for military duty, and certain means of transportation were used by the defense force (Skolöverstyrelsen, 1971a). Nelson (1944) claimed in *Geographical Notices* that well executed excursions yield better factual knowledge than several hours in the classroom. In the same issue, another message clearly emphasized the value of excursions, informing the reader that biology excursions are well structured, and that the geography teachers are requesting a similar excursion structure for their subject from the Swedish National Board of Education. The National Association for Geography Teachers (Geografilärarnas Riksförening, 1943) wrote to the National Board of Education, calling for firmer guidelines, particularly concerning how school excursions were to be planned into the operations of the grammar school on the background of the new school decree, effective from 1940. Their reply did not contain any directives, but suggestions as to how and when excursions should be introduced, i.e. during lessons or during field days. The National Board of Education also provided a clear sequence-structure for the scheduling role of teachers and the principal's decision-making rights.

Four years after the end of the Second World War, the National Board of Education (1949) sent a circular to principals and grammar schools stating that excursion activities again should be promoted. Field days were primarily the occasions available for excursions in biology, and were to be used for excursions in the geography subject as well (Skolöverstyrelsen, 1971a). In several issues of *Geographical Notices* this directive was clearly noticeable by geography teachers. Excursions, one teacher claimed, are the breathing air of geography, and should be incorporated into the geography teaching as a mandatory element (Malmer, 1951). *Excursion technique* and *Excursion methods* were two of the headlines in *GN* at the time (Larsson, 1950; Malmer, 1951). The two articles discussed excursion methods, but differed in that the article dated 1951 promoted the option of teachers organizing a simple excursion program in dialogue with the pupils.

The Royal Railroad Board contacted the National Association for Geography Teachers concerning excursions. An insert in *Geographical Notices* (1954:2, p. 15) by the editorial staff of the journal requested information from geography teachers on different excursion guides, in order to facilitate the Railroad Board's scheduling of bus routes and its adaptions of the railroad to reach "more peculiar nature areas". Later issues of *GN* displayed several examples of excursions, i.e. one-hour-excursions, a whole day, or two-day-excursions, in cultural as well as physical geography. These past excursions in physical geography show resemblance to current methods and excursion guides that school pupils are conducting today in their studies of glacial landscapes.

Between 1954 and 1976, pedagogic issues and methods related to excursions were no longer under discussion. The articles rather concerned journeys and excursions conducted by teachers at the end of school semesters, where geography teachers, coming from

universities and other institutes, reported on observations during their journeys or excursions at various places in Sweden or in Europe. Nils Lewan and Lennart Améen, two cultural geographers at Lund University, published a number of reports on excursions during the 1960s and 1970s. Améen wrote three articles on city excursions in Malmö and its surroundings, and he discussed the learning process as well. Tommy Book, cultural geographer in Lund, presented examples of city excursions in Berlin and Copenhagen, conducted by himself and his students. Anders Rapp, professor in physical geography, wrote in collaboration with other researchers in Lund articles covering objects of physical geography and geomorphology (Lidmar-Bergström, 1983). These reports contain pertinent facts on locations suitable for current excursion studies.

Excursions were incorporated into the elementary school curriculum of 1969 and in the secondary school curriculum of 1970, and were included in supplements and comments, and in the teacher guidance provided by the National Board of Education. When the curricular reform 1970 was accomplished, geography was not a subject in its own right in secondary school. Substantial parts of the physical geographic segment of the geography subject were however inserted into the curriculum of the science subject. Excursions were described in the methodology part of the curriculum (Skolöverstyrelsen, 1971b). The curricular reform 1994, for the secondary school, entailed the return of geography as a character subject within the social sciences program. Like in previous curricula, excursions and field studies were emphasized as important components for the development of pupils' proficiency and for capability practicing. Gösta Wennberg (1983) involved pedagogics, phenomena, and experiences in the field. Wennberg mentioned in the article three pedagogues, all of them involved in the phenomenology discussion: Säljö, Marton, and Svensson. By this, the phenomenology temporary entered the journal *Geographical Notices*. Excursions recurred as a subject in a few more articles. The National Association for Geography Teachers made in *GN* (1996:3) a request for information from schools about conducting excursions with no costs involved, which Sundberg (1996) later answered.

The National Board of Education (2011) wrote in their latest subject curriculum for the secondary school: "geographic knowledge has its origin in discovering and understanding the outside world". Field studies and excursions are to be incorporated into the geography subject, and this was emphasized in the subject curriculum of 2011. The preconditions of pupils may be improved by field studies, and field studies may also grant pupils a genuine opportunity to apply the knowledge they have acquired in the classroom and in textbooks. "Field studies, excursions, experiments, and practicing shall be part of the teaching, allowing pupils to observe, identify, categorize, and analyze events" (National Board of Education, 2011, p. 1). Though sustainable development and environment are included in the program goals of social sciences, nothing is written about field studies. Field studies are however included in the program goals of natural sciences (National Board of Education, 2011).

4.1. Excursions viewed from an international perspective

4.1.1. The first excursion period and the masculine explorers

In the early excursion material from Europe, three names are prevalently occurring in articles on excursions and field studies, and these are Salman, Gielke, and Lewis (Marsden, 1998). Salman was active during the end of the 18th century and in the beginning of the 19th century in Germany, and he conducted excursions primarily in biology. In Germany,

von Humboldt and Ritter both carried out geographic expeditions to foreign countries in order to document different geographical phenomenon. Most likely only men went on these expeditions, and they were probably of masculine nature (Bracken & Mawdsley, 2004). Marsden (1998) stated that excursions in modern time primarily started in Germany, where the organization Wandervogel was introduced in 1907. Originally aiming at boys, it has been described as military. Marsden (1998) also reported on how excursions expanded in England, based on notes about the number of excursions and where in the country they had been conducted. During the years 1898-1902 only two excursions were recorded, but during the following two years up to the First World War, approximately 200 excursions were carried out at various locations in England. One of the leading authors during this period was G.G. Lewis who described the activities undertaken during the excursions with titles like *The School Journey: The River, On teaching in open air* and *Nature Study in Town Schools*, which were published between 1905 and 1926. In an omnibus with the title *Typical School Journeys*, containing texts authored by Lewis (1910), photos disclose what the excursion participants looked like, and text as well as pictures provide examples of what a river bank looked like, or by which methods the streamflow velocity was measured. Lewis' photos show boys who threw colored corks into the river in order to measure the streamflow velocity.

4.1.2. The girls are also allowed to participate in excursions

In the beginning of the 20th century, when the allotted time for leisure increased for an increasing number of people, opportunities arose to spend time outdoors. The scout movement, with its activities in the field, allowed girls into their organization from the year 1912. Ploszajska (1998) also emphasized the importance of youth spending time outdoors. The purpose of arranging excursions was in many cases not primarily focusing on learning as such, but rather nurtured an ambition that children should spend time outdoors, first and foremost with a health perspective in mind, as emphasized by Marsden (1998).

A clear distinction has been made between Royal Geographic Society and British School Journey Association (SJA) (see http://www.sjatours.org/). The SJA was founded in 1911, and organized school journeys with the purpose of pupils getting out in nature and further out into the world. The pupils were accompanied by teachers, and these were often enthusiastic pedagogues, teaching geography, geology, and anthropology (Marsden, 1998), but there was a barrier between the Royal Geographic Society and SJA, and with time, the latter developed into a more explicit travel company, arranging school journeys that included anything that might be needed in connection with these.

In his article on the development of school excursions in the USA, Barton (2009) referred to the subject home geography, the subject that during the years 1890-1920 dominated school. Observations close to home or school were important, and the aspects to be observed expanded with increasing school grade of pupils. This nearby geography was a study form introduced by Rousseau and Pestalozzi, according to Barton (2009) and Dewey (1915). The Great Depression in the 1930s affected the feasibility of arranging excursions, and as the Second World War arrived, arranging excursions was not realizable, neither in England nor in large parts of the rest of Europe (Marsden, 1998).

4.1.3. Excursions everywhere, for everyone?

Among the most cited authors focusing on school excursions are Nairn, Dyment, and Stoddart. These authors proffer a broad spectrum of excursions in modern time, describing

methods, problems, and opportunities in relation to these. Stoddart (1986) stated, as did Nelson (1944), that pupils perceive and learn phenomena of nature better outdoors than in the classroom. Dyment (2005) carried out several analyses of how excursion operations of the schools might be executed, and which problems that exist in terms of time, competence, pupils' attitudes, and methods. Nairn (1999) on the other hand described excursions from a gender perspective. She argued that students might feel uncomfortable in nature for various reasons, such as physical activities, fear of heights, or inadequate equipment. Nairn (1999) showed how the students explain various matters by means of drawing and writing about their experiences. One of the students unveiled in a drawing what it entails to be dressed as a geographer, and the reader understands that it is not economically feasible to acquire all of the excursion equipment.

The British Royal Geographic Society contributes digital excursion methods for teachers not familiar with how to execute excursions. Fuller *et al.* (2011) emphasized that learning outside the four walls of the classroom yields experience-based learning. Such opinions were however formulated already by Rousseau, Pestalozzi, and Dewey, theorists often mentioned in texts about experience-based learning. The excursions mentioned by Wandervogel, the early German excursion movement highlighted by Marsden (1998), were directed toward boys or young men, who had to endure tough hikes with the purpose of fortifying the spirit, or – to observe and take notes of their observations of nature and its beauty.

4.2. Which excursion methods are being discussed?

The curriculum of the early secondary school in Sweden (1906) offered a schematic structure for excursions (Kungliga Läroverkstyrelsen, 1906). According to the curriculum, teaching about the compass was the sports teacher's responsibility, while the geography teacher was responsible for the conduction of the geographic assignments, involving the forms and phenomena of nature. This arrangement was based on pupils first studying the maps of the landscape. Learning about Nature (currently Science) is another subject where excursions were to be carried out and the curriculum described how the pupils should work during the excursion: by observing and noticing, taking samples, and studying plants in nature.

During the first two decades of *Geographical Notices'* existence, discussions revolved around excursion methods. Although Nelson (1944) argued that pupils learn better in the field than in the classroom, he provided no information on methodology. Nelson was the manager of a college in Västergötland, and wrote in this function an article in the yearbook of the Swedish colleges (Nelson, 1913).

He emphasized the need to escalate the frequency of executing excursions, and particularly highlighted the subjects of history and geography. He put forth the appropriateness of exploring the general forces behind landscape formation, i.e. water, frost, and ice, but also declared that the school's location is decisive in terms of what is feasible to carry out during the physical and cultural geographic excursions. The landscape should be examined with the purpose of clarifying to the pupils the cloudy concepts offered by the map, but also allowing them to acquire firsthand information about the various geomorphological formations of the region.

Nelson, furthermore, declared that if the first excursion has a physical geographic orientation, the following one should preferably be directed toward cultural geography, focusing on industrial economy. He maintained (1913, p. 25) that home geography teaching constitutes "authenticity and depiction", and proffered as an example when the

schoolchildren, together with their teacher, are creating a model of the landscape they had been wandering through. Conducting excursions in the vicinity was strongly suggested by Sanderoth *et al.* (2009), with the motivation that the area is more familiar to the pupils, thereby yielding a better perception of it and an increased ability to concentrate on the work at hand. The nearby area also holds a great potential, as does pleasurable learning, built on the theories of Bruner. Sanderoth *et al.* (2009, p. 73) in their discussion about pleasurable learning, insisted that learning needs to be perceived as meaningful and the teacher must concentrate on what stimulates learning, and thus the nearby environment, the everyday location, is potentially promising.

Various methodological examples were at the time published in *Geographical Notices* by a number of less well-known authors. Ilien (1939) described the excursion from an instrumental perspective, how the assignments had been divided between the sports teacher and the geography teacher, and also how transportation was arranged. During the 1940s and up to 1954, the articles mostly comprised descriptions of excursion methods and excursion techniques used by the authors.

Several authors recounted that the pupils are responsible for presentations or guidance at the excursion sites. This method has been mentioned in the literature from 1945, and is often applied today. The railroad authorities showed a societal interest, e.g. extra trains could be inserted, or letters were written to the National Association for Geography Teachers in order to acquire information about excursion targets, which would facilitate insertion of extra trains and time adaptations.

Sauer (1956) maintained that objects to be observed not necessarily need to be predetermined, but the pupils may well find objects on their own that interest them. Anderson (2004) as well as Jonasson (2011) emphasized the method where the pupils are allowed to walk around, talking to each other, rendering a *slow* excursion. During *slow* excursions, the pupils are able to acquire a different feeling for the location (Anderson, 2004). Gösta Wennberg (1983) brought phenomenology to attention in an article in *GN*, but this philosophical method has left no footprint in later articles. The *slower* excursion methods, brought forward by Anderson (2004), Jonasson (2011), and Sauer (1956), in which pupils make their own observations, constitute a sharp contrast to the early excursions, dominated by brisk walks or biological field studies.

The excursion methods used today have changed considerably since excursions were described in *Geographical Notices* during the first period and up to the 1950s. Various reports (Andersson, 1997; Higgins & Humbleston, 1999) describe the activities carried out by the pupils. The activities can be designed in a number of ways, like pupils guiding or leading presentations at the excursion sites, but to succeed with these assignments, the pupils need to be prepared. This can also be accomplished in various ways, such as writing a PM or a review, or by having lessons.

4.3. When should excursions be arranged during the school year, and for how long?

A recurring question (when the subject geography is discussed) is which time of the school year excursions should be conducted. Nelson (1944) argued that in the subject geography, excursions were superior to classroom teaching in terms of the pupils' learning process; this argumentation was however put forward in relation to the time spent. Time is important to discuss, not only in terms of the point in time for the activity, but also in terms of the extent of time needed for the excursion, as well as the time allotted to the pupils' assignments, the latter relatively often causing difficulties. Several authors discussed the

competition for time, and also which point in time to carry out excursions during a school year (*GN* 1944; *GN* 1950; *GN* 1952; Marvell, 2008).

The period having the best weather conditions and most flourishing vegetation often coincides with spring holidays, tests, and field days (Anderson, 2004; Bergquist, *GN* 1949; *GN* 1950; Marsden 1998). Only a few months of the year are adequately appropriate for excursions in nature, and consequently many subjects and activities compete for the most suitable time. During the Second World War, excursions competed for time with home guard practicing as well, since secondary school pupils and students were recruited during the years of war (Skolöverstyrelsen, 1971a). The dilemma concerning excursion time allocation and when to conduct excursions during the school year has been a recurrent issue in the correspondence between the National Association for Geography Teachers and the National Board of Education. In 1944, the National Association for Geography Teachers requested that the time for excursions should be put in writing in a regulatory system, in order to simplify documentation in a calendar. The National Board of Education responded that these structures would not be instituted, but the schools must themselves make a timetable for appropriate excursion days, in the process taking the field days into consideration. The National Board of Education emphasized that it was the schools' own responsibility to plan appropriate days for excursions, and that this scheduling preferably should be performed in association with the start of the semester.

The extent of time allocated for excursions has changed; Caulfield (1955) recounted that the excursions initially comprised only a few hours, but later expanded to whole days. In England, excursions lasting for four whole days became allowed for pupils that had turned 11. Dalton (2001) reported students participating in excursions lasting 1-11 days, and that excursions lasting several days were the norm. The problems arising when pupils are not allowed to go on activities, should they entail an over night stay, are mentioned in several reports (Dalton, 2001; Nairn, 1999).

Dyment (2005) deliberated over the predicament of time shortage in terms of arranging as well as conducting geography excursions. Sauer (1956) maintained that excursions must be allowed to take time, since the pupils learn by observing and taking notice of nature by walking around in a slow pace. Anderson (2004) also mentioned the value of pupils having enough time to walk around unhurriedly, or as he writes, *bimbling around.* Ranging is rarely an option during one-day-excursions traveling by bus, or when many excursion locations are to be visited. Malmer (1951) pondered over this problem arguing that pupils moving in and out of buses might result in excursions losing their purpose, turning them into field days instead. Barton (2005) reported that pupils might fail to arrive for activities outside school, since they believe that the Internet and TV provide more information than reality.

5. DISCUSSION

The purpose of the present article was to review the literature on excursions and field studies in geography, and to discuss their development over time, focusing on purpose, content, method, and execution. The literature disclosed a large number of articles on excursions and field studies, often covering method and location. Articles having a starting point in phenomenology when discussing excursions and field studies are however at want. The present review shows that excursions and field studies have since long been important methods in school teaching, not only in the subject geography. Biology and science have also incorporated excursions and field studies to a considerable extent.

One of the purposes of using excursions and field studies in teaching is to facilitate the learning process of pupils and students. Several authors (Nelson, 1944; Stoddart, 1986; Dyment, 2005) have over time been arguing that learning is improved when the objects are studied in the real world (on site). The justification of the early field studies was that pupils and students carried out assignments for the good of society, and observing, categorizing, and collecting material were common tasks given to the participants.

Excursions and field studies in the early days had a military purpose as well, where the participants were to observe and write down their observations. The excursions were aimed at boys or young men, who had to endure tough walks in order to strengthening the spirit. Using excursions and field studies as a method evolved in parallel with geography being established as a subject at the universities in Europe, where Germany was the pioneering country. During the second half of the 19th century, new ideas unfolded about the purpose of excursions, i.e. the reason behind conducting excursions. The fascination of discovering and exploring new areas was a strong incentive that emerged concurrently with the colonialism. Many of the early field studies are in the literature described as sheer expeditions to foreign countries. Masculinity, discovery zest, and nationalistic perspectives characterized this period.

After the year 1900, school excursions were motivated from a pedagogic perspective, but were also arranged for the pupils' own benefit. Social and health-oriented reasons were also important, since many children grew up in urban environments, and needed to get out in nature. As their role gradually became fortified, girls were increasingly allowed to tag along. From the 1950s, when traveling was simplified, excursions began to stretch to distant countries. In many countries, excursions extended over a week or more, but might of course also be arranged over shorter time, at a micro-level, or as a one-day-trip in the region (Bracken & Mawdsley, 2004).

In step with industrialism and urbanization, moving people even further away from nature and the countryside, excursions and various activities in the field became increasingly important, and it was from this perspective that the first excursion pedagogues initiated their operations. In the beginning of the 20th century, the organizations *Wandervogel* in Germany and SJA in Great Britain were formed. The societal interest in excursions was great in Sweden and Finland, which was underlined in the two countries' curricula, and several Swedish curricular texts were influenced by the English writings. Home geography evolved as a subject during the latter part of the 19th century, and was directed toward younger children, with the purpose of children learning about the area close to home. School excursions are from the year 1906 clearly mentioned in the Swedish curricula. Nelson (1913) stressed the value of home geography to the pupils – the everyday environment must not be underestimated as an excursion site, which has been shown also by later research (Sanderoth *et al.*, 2009).

Content and method have changed considerably since the mid-19th century, when the excursion activities in school took off. Most contemporary authors as Barton (2009) and Marvell (2008) have discussed how to execute excursions, and they all agree about the importance of pupils being well prepared before the excursions, and that the work during the excursions must be well structured. Several of the early articles in *Geographical Notices* discussed the excursion methods, and the attitude of pupils during the excursions. Marsden (1998) highlighted pupils' needs of social training, and put forth a health perspective, which in the British school system was taken notice of already during the 1930s. Directly before the First World War, excursions became reality for both boys and girls.

In the middle of the last century, organizations also outside the school authorities engaged in the school's excursion activities, as British as well as Swedish literature shows.

The Swedish railroad authority adapted for instance the train timetables in order to facilitate the school's scheduling, something that enabled the arrangement of large-scale excursions with more than 200 pupils participating. During such a large-scale excursion, the pupils travelled with extra-inserted trains, and the media participated in the journey (*GN*, 1954:2). Today, bringing a school class on the bus might be problematic.

Time is an important variable in excursions as time is a matter that complicates the execution of excursions, since nature, or the local area, takes on the function as classroom. The duration of an excursion can vary from just hours to, at least for higher education, a week or more. The time problem persists when longer excursions are arranged. Wandering around on ones own, observing natural phenomena, is not feasible if the pupils must visit many sites. Shortage of time may not only exist during the excursions, also time is needed for successful planning.

A continuous process of change has altered contents as well as conduction of the excursions. The previous instrumental orientation has moved toward more pupil-participating work methods. Pupils who participate in excursions today must on their own prepare themselves to lead presentations, or improve their understanding of the excursion content. Preparation is a keyword in most texts on excursions, and the perspectives have been broadened. The content of excursions of today is expressed much more comprehensibly than previously, most likely due to purpose, content, method, and conduction having been discussed and evaluated in a large number of articles. Excursions of today are furthermore exposed to competition. Pupils might be under the impression that the Internet can replace outdoor activities, and that it is better to stay home and participate in an excursion or a field study by means of the computer.

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