Tourism Geography: Emerging Trends and Initiatives to Support Tourism in Morocco

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Tourism geography: Emerging trends and initiatives to support tourism in Morocco

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Abstract:

In both the industrialized and the developing world, tourism is increasingly being seen as a potential source for rapid economic growth and prosperity, and as one of the development instruments of a region. This potential has been recognized by the Moroccan government, and is currently accountable for the second largest contribution to the country's GDP. In this paper, we provide an overview of international economic and sustainable standards to collect data on a national, regional, and local level. In addition, we highlight the importance of tourism geography and related emerging trends to address the objectives for marketing and operational management purposes. Therefore, we provide a state of the art on the utilization of spatio-temporal data to support tourism information needs. We especially emphasize the potential use of mobile phone data and social media feeds.

***Keywords**: Tourism geography, Big Data, Mobile phone data, Social media, Morocco*

1. INTRODUCTION

1.1 Tourism and economic prosperity

Tourism is often seen as an important source of revenue, a potential driver of rapid national economic growth, and is increasingly regarded as one of the development instruments of a region. Moreover, tourism is also one of the fastest growing economic sectors (Vanhove, 2005; Salish and Rodrigues, 2011; Schubert and Brida, 2011). Over the last century, tourism has become the world's largest business, surpassing defence, manufacturing, and the oil and agricultural industries (Lundberg *et al.*, 1995; Goeldner and Brent Ritchie, 2012). The tourist sector's total contribution to world GDP (taking direct, indirect and induced impacts into account) was €4.8 trillion, which is accountable for approximately 9.1 per cent of the world's GDP (WTTC, 2012), and employs more than 220 million people (Scheyvens, 2011). The tourist sector is defined, by the UNWTO (2010), as 'the cluster of production units in different industries that provide goods and services typically demanded by *visitors*[1]'. The tourist industry includes 'the provision of accommodation for visitors, food and beverage serving activities, passenger transportation, travel agencies and other reservation services activities, cultural activities, sport, and recreational activities, as well as other country specific activities' (UNWTO, 2010). Many countries depend on income generated by the tourism sector and the related businesses. We live in an increasingly shrinking world, with expanding horizons, and changing international spatial tourism patterns. As stated by Giaoutzi and Nijkamp (2006): 'Our world is becoming a global tourist village'. Over the past 60 years, tourism has gained a significant place in our modern society. Between 1950 and 2010, international tourist arrivals grew at an annual average of 6.2 per cent, from 25 million to 940 million travellers (UNWTO, 2011a, b). The number of destinations has also increased over time. While in 1950, the 15 foremost destinations absorbed 88 per cent of the international arrivals, by 2010 the top 15 destinations accounted for only 55 per cent of the total international arrivals (UNWTO, 2011a, b). Figure 1 depicts an overview of this significant global trend (UNWTO, 2013b).

[1] A visitor is a traveller taking a trip to a main destination outside his / her usual environment, for less than a year, for any main purpose other than to be employed by a resident entity in the visited country or place. A visitor is classified as a tourist if his / her trip includes an overnight stay, or otherwise as a same-day visitor (or excursionist) (UNWTO, 2010).

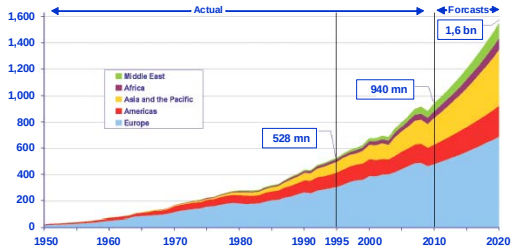

Figure 1: Actual trend and forecast of tourism 1950-2030
Source: UNWTO (2013b).

1.2 Data science and tourism geography

It is becoming increasingly important to measure, monitor, analyse, and predict, the detailed human dynamics of tourists. Such advanced information needs can be addressed with emerging technological trends, such as Big Data, collective sensing, and advanced spatio-temporal data. This has a strong relationship with the research field of tourism geography. Williams (2009) stated that: Tourism (with its focus upon travelling and the transfer of people, goods and services through time and space) is essentially a geographical phenomenon, and accordingly there are a number of ways through which a geographical perspective can illuminate the subject. The central themes in the research domain of traditional geography focus on three related topics: place, space, and environment. To include the temporal dimension, in the literature this is also identified as '*time geography*' (Shaw and Yu, 2009; Tian *et al.*, 2010), or '*space-time geography*' (Thrift, 1996; Batty, 2010; Becker *et al.*, 2011). Such analysis includes hourly, daily, weekly, monthly, or seasonal variability, and also has a spatial dimension (local, regional, national, or international) (Hall, 2003). Tourism geography covers a vast range of geographical research themes[2] which 'link the knowledge of the more traditional focus of geographers (on analysing why, how, and where people move), to engage in leisure, tourism and other forms of voluntary movement' (Hall and Page, 2009). Many regional areas and local municipalities continue to be managed with fragmented data which becomes available months or even years after the phenomenon they describe has occurred. Such data sets are usually too aggregated to be useful, and almost never predicts the future. They only describe the past, and therefore do not ensure adequate visibility of the flows of what is called the transient tourist population. In the absence of detail on the phenomenon they seek to influence, and without evidence that such influence is effective, tourism promotional strategies have often proved to be useless. In such a data scenario of structural inefficiency, even a small improvement could directly translate into a GDP increase, and has the ability to provide more jobs in the tourism industry. For marketing and operational management purposes, we therefore need more sophisticated tools and data. It is therefore important to place stronger emphasis on data science by utilizing the full potential of the vast variety of available data.

[2] e.g. tourism spatial attributes; interplay with the diaspora and migration; human mobility; visitor flows; transportation, planning and places; sustainability (e.g. Williams, 1998; Shaw and Williams, 2002; Hall and Page, 2006).

1.3 Aim and structure of the paper

The main objective of the present paper is to investigate the possibility of using new data sources and emerging technologies to facilitate the tourism sector. In other words, this paper aims to study whether and how research using fine-grained data can improve the economic benefits of the regional and local tourism sector. Morocco offers an interesting case, because of its proximity to European markets, the strong economic dependency of the tourism industry for economic growth (which can generate new jobs to effectively manage the high youth unemployment), and the relatively high technological knowledge level which can be seen as a stimulus to use advanced data analytics (see Benner, 2013). The starting point of our analysis is to provide a broad overview of the tourism sector. Therefore, in Section 2, we give a detailed description of the relevance of the tourism sector in Morocco. Section 3 is devoted to highlight the (economic) relevance of the tourism industry on a global, national, and regional scale. In addition, we present a concise overview of the related information needs and how they have been addressed by available international standards. Section 4 then focuses on the introduction of emerging trends in space-time geography and advanced data technologies. Section 5 provides a review of empirical studies which use space-time geography to support tourism. Section 6 includes the results of a case study with geo-located tweets to compare different metropolitan cities. Finally, in Section 7, we discuss the contributions and limitations of such data, and how they can contribute to advanced tourism management and planning applications.

2. TOURISM IN MOROCCO

2.1 Introduction

Tourism in Morocco has a long history and is an important source of economic prosperity. Morocco has several important advantages[3] that enable it to compete well on the international tourism market (see Porter and Ketels, 2008). Its rich culture is 'a blend of Arab, Berber (indigenous African) and also other African and European influences' (Stanić and Plenković, 2013). Morocco's relatively high amount of tourists has also been aided by its location, specific attractions, and relatively low prices. The well-developed tourist industry in Morocco is a powerful driver of economic growth and is, after the phosphate industry, accountable for the second largest contribution to the country's GDP (approximate 8 percent of the GDP), and employs around 500,000 people. Morocco is ranked 5th on the world list, in terms of government prioritization of the development of the Travel and Tourist industry (World Economic Forum, 2013). Morocco is a stable tourist destination, and was not much affected by the Arab Spring revolutions (Saeid *et al.*, 2012).

[3] Such as politically stable, highly diverse landscape (the extensive Atlas Mountains, the forests in the Rif, the Sahara dessert, the great diversity of fauna and flora, the vast stretches of Mediterranean and Atlantic coastlines), the imperial cities, progress on the road and transportation infrastructure, various natural and historical attractions (e.g. coastlines, beaches, old medina's, Roman monuments and ruins), rich traditional culture (art, music, and gastronomic tradition), and an extremely pleasant climate.

The long-term influence of tourism on economic growth has become known in the literature as the '*Tourism-Led Growth Hypothesis*' (TLGH) (Chen and Chiou-Wei, 2009). On the basis of this hypothesis, Bouzahzah and El Menyari (2013) have tested the causality between real tourism receipts, the real effective exchange rate, and economic growth in Morocco for the years 1980-2010. Their results showed that this hypothesis is only valid for the short-term. In the long term, there is a strong unidirectional causality from economic growth to international tourism receipts. Given these findings, they suggest that the adoption of policies of dominant mass tourism may not always benefit from economic growth, and therefore additional measures should be taken into consideration. Benner (2011, 2013), for example, highlights the importance of cluster policy and critically analyses several tourism policies for Morocco. Besides that, it is also recognized that this new growth sector has many adverse effects on landscape quality and environmental conditions, which directly affect the natural and human resources. In Morocco there are many such examples: tourism development and water resources management (Maasen, 2007; Tapper *et al.*, 2011; Tekken and Kropp, 2012; Tekken, 2013); residents' perception of tourist development (Ernoul, 2009); and markets for Moroccan argan oil (Lybbert *et al.*, 2011). The Moroccan government is heavily investing in the development of a sustainable tourism industry. The concept is highly relevant, in particular when considering the direct impact on the local environment (human safeguarding and preserving the natural environment) and the capability of a country to assure its long-term local attractiveness and its permanence over time. This calls for a long-run balance between the economy and the ecology (Ridderstaat *et al.*, 2013).

2.2 A Moroccan framework for strategic activity

Although travellers had already visited Morocco during the 19th century, real tourism began after 1912 during the period of the French Protectorate. Due the colonial relationship, Morocco was positioned as a tourism destination mainly for the French. In 1953, near the end of this period, there were around 250,000 tourists a year. From an institutional perspective, during the French Protectorate, there were several initiatives, such as the establishment of the '*Tourism Central Committee*' in 1918, the creation of the '*Cherifian Office of Tourism*' in 1937, and the '*Moroccan National Tourism Office*' in 1946. However, despite these initiatives, the impact on the Moroccan tourism industry during this era was limited. With the creation of the '*Ministry of Tourism*' in 1965, Morocco officially entered the international tourism market. The Ministry defined several '3- year plans', which successfully increased the number of tourists, rising to 2.2 million tourists in 1985 (see the report of the Ministere de l'ecomomie et des finance, 2008). For an extensive historical review of the tourism sector in Morocco, we refer to Stafford *et al.* (1996), Brault (2004), Royaume du Maroc

(2007), Porter and Ketels (2008), and Henkelman (2013). The main important milestones, in the period from 1918 to 2020 (approximately one century), are presented in Figure 2.

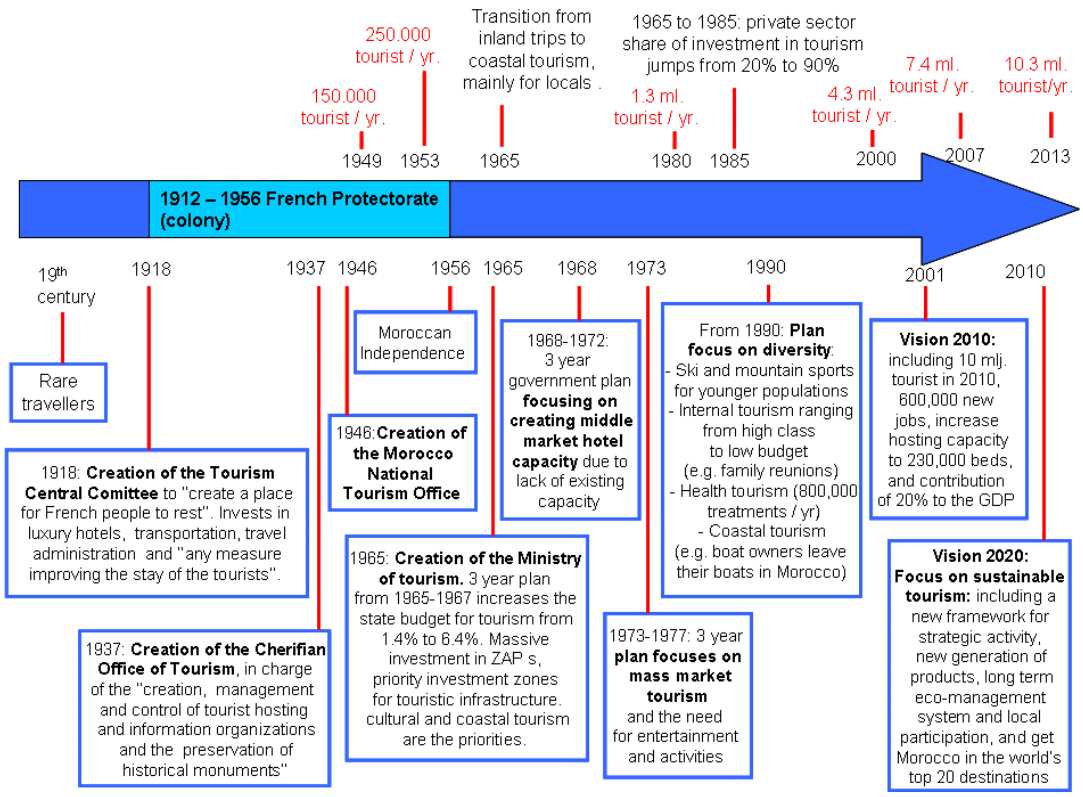

Figure 2: History of the Moroccan tourism sector
Source: Based on Stafford *et al.* (1996); Brault (2004), Royaume du Maroc (2007); Porter and Ketels (2008).

Just after King Mohammed VI acceded to the throne, in 1999, he took the initiative to create, in close cooperation with the private sector, a new strategy on tourism called '*Vision 2010*' (Ministry of Tourism of Morocco, 2001). This vision was formally signed in 2001 and had two primary goals: 1) to serve as a roadmap for the tourism sector until 2010, and 2) to allow the Moroccan tourism cluster to compete effectively with other tourism clusters in the Mediterranean region. The main target was that Morocco would have 10 million visitors by the year 2010. With an increase from 4.3 million tourists in 2000 to 9.3 million tourists in 2010, 97 percent of this target was reached, which can be considered as a major achievement. Based on this success, in 2010, Morocco defined a new policy '*Vision 2020 for tourism in Morocco*' (Ministry of Tourism of Morocco, 2010), which seeks to expand the country's appeal to include its rich variety of countryside, such as its mountains and deserts. This can be considered as the national framework for strategic activity. The main goals of this new vision include: 1) getting Morocco into the world's top 20 destinations; 2) doubling the industry's size by creating 470,000 new jobs, whereby the share of tourism in GDP will rise by 2 per cent, and the number of tourists will more than double, to reach 140 billion MAD in 2020; 3) implementing a policy of improving Morocco's offering to tourists; 4) providing a new institutional arrangement

(governance); and 5) developing sustainable tourism. Moreover, an important pillar of this new vision is a territory-based policy, with the introduction of eight tourist territories, including structuring programmes for a diversified product portfolio. They are also heavily investing in new accommodation, training facilities, seaside resorts (the Azur Plan), and transport accessibility. Morocco's approach is based on a new generation of tourist products, a long-term ecosystem management, and local public participation, to become a model of tourism sustainability in the Mediterranean area. This is both a challenge and an opportunity. One of the key elements is putting more emphasis on institutionalization of sustainable tourism by: 1) establishing special instruments for monitoring and evaluating sustainability indicators for the industry (to ensure compliance with tourist density thresholds, water consumption, the condition of the natural cultural attractions) by means of regional monitoring arrangements; and 2) strengthening the sustainability criteria in legal and regulatory standards, to distinguish model establishments and those that make particular efforts in this direction. As well as a range of marketing strategies and other strategic measures, advanced data management is one of the tools to monitor and manage tourist dynamics and other indicators (e.g. policies, regulations, sustainability, tourist experience and satisfaction, socio-cultural aspects).

2.3 Morocco's demographics and tourist statistics

Morocco has an estimated population of over 32 million and has an area of 710,850 km^2. In line with the world's population growth, rising in 2011 to around 7 billion people, more than 50 per cent of whom live in urban areas (United Nations, 2009), this population growth and urbanization trend is also clearly visible in Morocco. There, the urbanization rate was below 10 per cent in the early 20th Century, reached 29 per cent in 1960 (according to the first Census carried out in post-independent Morocco), and then grew to 55.1 per cent in 2004. In the mid-1990s, there were more people living in urban than in rural areas. By 2030, the High Planning Commission expects that 28.4 million inhabitants will live in cities, that is, 68.5 per cent of the total Moroccan population (see Figure 3).

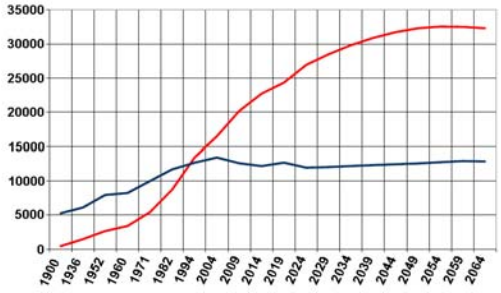

Figure 3: Urbanization trend in Morocco
Source: Lehzam (2012). Note: Blue = rural areas; Red = urban areas.

This mega-trend in urbanization is also demonstrated in another study (see MENAPOLIS, 2011). Table 1 provides an overview of the projection per agglomeration for the ten largest cities in Morocco.

Table 1: Population estimates of the 10 largest cities in Morocco (in ml.)

City	2010	2020	2030
Casablanca	3.3	3.9	4.7
Rabat	1.8	2.1	2.4
Fez	1.0	1.2	1.3
Marrakech	0.9	1.0	1.2
Agadir	0.8	1.0	1.1
Tanger	0.8	0.9	1.1
Meknes	0.6	0.7	0.7
Kenitra	0.4	0.5	0.5
Oujda	0.4	0.5	0.5
Tetouan	0.3	0.4	0.5

Source: MENAPOLIS (2011).

The political capital of Morocco is Rabat (Wagner and Minca, 2014), although Casablanca is the largest city which can be considered as the '*cosmopolitan, industrial and economic heart*' of the country. Fès is Morocco's oldest imperial city[4] and is now on the list of UNESCO's world heritage sites. It is perceived as the '*symbolic heart*' of Morocco. Marrakech, the exotic medieval-style city with a reputation for high cultural authenticity (also known as the '*Red City*'), is the most important Morocco's imperial city, and attracts the highest number of tourists (Minca, 2006; Wagner and Minca, 2012). In 2011, there were about 2.05 ml. recorded tourists, which ranked Marrakech 68th in the world's most visited cities (see Euromonitor[5]). As stated by Demerdash (2009), 'Marrakech vitality depends on its tourism industry and its orientalizing marketing schema'. In her thesis '*Mapping the myths of the Medina*', she provides a critical review (from a historical perspective) on how 'the myths of the medina are being adopted, appropriated, and reinvented to satisfy foreign demand' in a form she called '*oriental brandscape*'. As a result, she stated that "Marrakech has become more of a product than a place". As noted by Minca and Borghi (2009), tourists in Morocco can experience some kind of '*oriental exoticism'*. Agadir is a major, and the most important, tourist coast city, which features a combination of sea and sand tourism with luxury beach resorts. Economic indicators for tourist visits vary widely. The most commonly used variables are: tourist arrivals (air, sea, and land); overnight hotel stays; and occupancy rate by bedrooms or revenue. Table 2 provides an overview of the 12 most important cities in terms of overnight hotel stays. We can conclude that Marrakech and Agadir are the most popular tourist locations, with a total market share of 60 per cent.

Table 2: Overnight hotel stays of the 12 largest cities in Morocco

City	2000	2010	2011	2012	Var 12/11 (%)	Rel. share
Marrakech	3.786.467	6.357.891	5.754.482	5.917.921	3	34
Agadir	4.292.065	4.806.694	4.487.243	4.498.628	0	26
Casablanca	1.136.826	1.600.871	1.524.649	1.674.782	10	10
Tanger	612.638	818.379	815.886	862.564	6	5
Fez	720.983	820.725	643.790	644.323	0	4
Rabat	527.374	635.233	613.153	602.360	-2	3
Oujda	50.250	356.108	475.901	471.044	-1	3
Essaouira-Mogador	102.343	309.608	350.682	399.166	14	2
Tetouan	356.215	293.434	286.490	340.038	19	2
Ouarzazate	591.838	420.577	332.317	337.549	2	2
El Jedida-Mazagan	50.834	267.252	281.817	317.974	13	2
Meknes	192.002	249.020	211.101	200.505	-5	1
Totals	**13.539.567**	**18.020 065**	**16 867 222**	**17 484 130**	**4**	**100**

Source: http://www.tourisme.gov.ma/

[4] The imperial cities of Morocco are the four historical capital cities of Morocco: Fès, Marrakech, Meknes, and Rabat.

[5] http://blog.euromonitor.com/2013/01/top-100-cities-destination-ranking.html

Another indicator is the number of tourist arrivals. Morocco has an excellent road and rail infrastructure that links the major cities and tourist destinations with ports and cities with international airports, which makes it easy for tourists to travel safely between places. Aviation has long been recognized as a key driver of international tourism (Button and Taylor, 2000). In recent extensive work of Dobruszkes and Mondou (2013), they analysed the impact of the liberalization of the airline market. This provides new insights on how the open-sky agreement, signed between the EU and Morocco, has affected both the provision of air services and leisure travel. This has led to significant developments, including the launch of many new low-cost services, which offer cheap flights to the country. Border controls give the Moroccan authorities the opportunity to collect information on virtually all arriving passengers and their travel purposes. They conclude that: 'The liberalization of air transport has not led to more balanced tourist geography and that the spatial pattern of tourist destinations within Morocco has remained rather constant as seaside tourism has not really expanded'. Table 3 provides an overview of the main locations. We can conclude that travel by air is the most popular. It is remarkable that the international airport '*Mohammed V*' in Casablanca is responsible for the largest number of tourist arrivals. However, most tourists seem to spend their holidays in Marrakech and Agadir. Also, new infrastructure, such as the recently built sea port '*Tanger Med*', has created a shift in tourist arrivals.

Table 3: International Tourist arrivals (Air, Sea, and Land)

	2000	2010	2011	2012
Air Transport	**2,109,579**	**6,136,024**	**6,254,252**	**6,018,566**
Casablanca Mohammed V	793,702	2,264,905	2,109,598	2,072,133
Marrakech Menara	591,142	1,703,885	1,761,100	1,704,466
Agadir Almassira	414,844	706,619	673,949	620,892
Tanger ibn Battoeta	95,523	448,731	519,875	520,313
Laaroui	16,357	255,165	359,536	335,068
Fes-Sais	38,837	332,967	352,469	308,680
Oujda	53,015	186,228	227,520	201,287
Rabat Sale	49,611	166,578	167,513	165,599
Ourzazate	29,320	23,390	22,062	20,692
Sea Transport	**1,612,177**	**1,923,723**	**1,902,184**	**1,941,411**
Tanger Med	-	810,365	1,171,020	1,283,665
Tanger	1,299,159	797,636	437,656	453,297
Nador	292,718	278,368	275,402	173,138
Road Transport	**556,364**	**1,228,591**	**1,185,697**	**1,415,179**
Bab Sebta	454,864	778,080	778,854	955,716
Beni Anzar	101,422	422,963	371,733	423,511
Bir Guendouz	-	27,548	34,913	35,952
Total	**4,278,120**	**9,288,338**	**9,342,133**	**9,375,156**

Source: http://www.tourisme.gov.ma/

The overall growth in the international tourist arrivals and the tourist receipts is visualized in Figure 4. Dobruszkes and Mondou (2013) stated that: 'This apparent success should be put into perspective because official statistics merge both foreign tourists and Moroccans living abroad.' According to Henkelman (2013), the total number of 9.3 ml. tourist arrivals in 2010, includes 4.4 ml. Moroccans who live abroad. That is approximate 47 per cent of these arrivals. Moreover, the Moroccan economy also owes a lot to the remittances provided by the total of 6 million Moroccans living abroad. These financial transfers, in fact, represent the second source of hard foreign currency after tourism receipts. According to the Centre Marocain de Conjoncture (Morocco's Economic Center, 2011), these transfers amounted to 54 billion dirhams in 2010. Moroccans who live abroad thereby

fund 8 per cent of the GDP. We therefore can conclude that Moroccans living abroad have a significantly higher impact on the Moroccan economy than the remaining 53 per cent of foreign tourists.

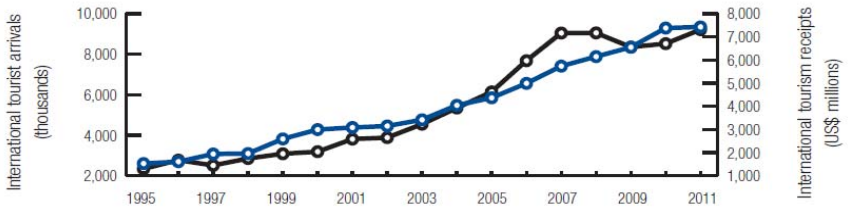

Figure 4: International tourist arrivals (thousands) and tourism receipts (US$, millions)
Source: World Economic Forum (2013). Note: Blue = International tourist arrivals; Black = tourism receipts.

3. INFORMATION NEEDS FOR TOURISM

3.1 Introduction

To identify the information needs for tourism, we first provide a brief overview of five important international initiatives: 1) the Travel & Tourism Competitiveness Index (TTCI); 2) the Tourism Satellite Accounts (TSA); 3) the Global Sustainable Tourism Council's destinations criteria (GSTC-D); 4) the European Tourism Indicators System (ETIS) for sustainable management at destination level; and 5) the Regional Tourism Information System (R-TIS). Therefore, we critically analyse the specific goals and usefulness of these initiatives in terms of how they address the information needs on a different geographical scales, and in particular for tourism in Morocco. These are summarized in Appendix 1.

3.1.1 The Travel & Tourism Competitiveness Index

On a global level, The World Economic Forum carries out yearly an in-depth analysis of the Travel & Tourism competitiveness of economies around the world (World Economic Forum, 2013). The '*Travel & Tourism Competitiveness Index*' (TTCI) aims to measure the factors and policies that make it attractive to develop the T&T sector in different countries, and is based on three broad categories of variables that facilitate or drive T&T competitiveness: (1) the regulatory framework sub-index; (2) business environment and infrastructure; and (3) human, cultural, and natural resources. On the overall index score, Morocco ranked 71st in 2013 (having ranked 78th in 2011, improving by seven places since the last edition of the *Report*). Morocco is ranked 9th on the regional index of the Middle East and North Africa. Thereby, it has improved in almost all areas of the Index, receiving good evaluations for various aspects of its cultural resources, and is notably ranked 22nd for its many World Heritage cultural sites. In addition, Morocco is prioritizing the development of the sector (ranked 26th) and is characterized by a strong affinity for Travel & Tourism (22nd). Moreover, the government is seen to be making efforts to develop the T&T sector in a sustainable way. In order to improve the industry's competitiveness further, it would be necessary to progress on some of its long-standing

shortcomings, such as health and hygiene (104th) and education and training (96th), as well as making additional improvements to the transport and tourism infrastructure. Safety and security also remain an area of concern. The T&T can thus be considered as a global barometer, for a range of (economic) variables of tourism competitiveness, in order to compare countries' accomplishments, and is thereby very useful for countries like Morocco, which give high priority on tourism, to identify where significant improvements in their policies can be made.

3.1.2 The Tourism Satellite Account

The tourism industry has become an increasingly important factor in terms of economic development, and often provides new opportunities for upgrading the local environment. As identified by several scholars (e.g. Briassoulis, 1995; Frechtling, 2010), the tourist sector compromises a complex set of interlinked activities (e.g. travel, car rental, public transportation, accommodation, catering, shopping, cultural attractions, and theme-park tickets, etc). Historically, there has been an ongoing debate about the validity of treating tourism as an industry (e.g. Tucker and Sandberg, 1988; Leiper, 1990; Smith, 1998; Tremblay, 1998; Wilson, 1998). Giaoutzi and Nijkamp (2006) conclude that 'Consequently, in a strict sense, tourism can not be considered as a specific sector or industry – given the multi-activity and multi-sectoral nature of tourism, the various sectors that constitute tourism make their own different contribution to the production and consumption of the tourist product'. In 1993, for the first time in the development of new standards for the '*System of National economic Accounts*' (SNA), the United Nations (UN), in cooperation with four other major international organizations[6], identified tourism as 'a specific area of economic activity' in terms of a '*satellite account*' (Eurostat, 1993). This compromises an additional framework, which is especially designed, to describe, in more depth and detail, several aspects of certain economic areas that remain hidden in the accounts of the central framework. In 1993, the World Tourism Organization together with the United nations also began to develop the concept of a *Tourism Satellite Account* (TSA) based on the principles of the SNA. In 2000, the OECD published a manual called '*Measuring the Role of Tourism in OECD Economies*' (OECD, 2000). In 2001, the UN points to the *Tourism Satellite Account* (TSA)[7] as an 'appropriate tool for deriving key aggregates and internationally comparable indicators on the macro-economics of the sector world wide' (United Nations, 2001). Finally in 2008, the UN adopted the updated methodological framework of the TSA (United Nations, 2008) and a set of recommendations on tourism statistics (UNWTO, 2008). So the year 2008 can thus be seen as major milestone in the history of international tourism statistics, which makes the TSA now a

[6] The Commission of the European Communities, the International Monetary Fund (IMF), the Organization for Economic Cooperation and Development (OECD), and the World Bank.

[7] In the United States, TSA is called Travel and Tourism Satellite Accounts (TTSA), which is essential the same as TSA.

globally-accepted accounting method to measure the tourism as an industry. Therefore, the TSA compromises five aggregates[8], which describe the size and economic contribution of tourism. These five aggregates are defined and measured to be comparable to the macroeconomic aggregates that characterize the overall economy. The most widely-used indicator to measure the size of an economy is the *Gross Domestic Product* (GDP). The aggregate '*Tourism direct GDP'* used in the TSA, provides an equivalent for the size of the tourism sector. The TSA allows tourism to be seamlessly integrated into macro-economic analysis, which makes it possible to incorporate tourism policy within the general national macro-economic policy. For an extensive historical review of the TSA, we refer to Frechtling (2010). However, only collecting the national TSA aggregates is not sufficient for establishing an effective local and regional policy on tourism.

3.1.3 The Global Sustainable Tourism Council's destinations criteria

Today, sustainable tourism plays a significant role in government policies and it has become a high priority to find a balance between economic growth and the negative impacts on the environment. For example, the tourism sector has already acknowledged that 'without sustainability, there cannot be development that generates benefits to all stakeholders, solves serious and urgent problems, and preserves the precious natural and man-made resources on which human prosperity is based'. The *World Tourism Organization* (WTO) in cooperation with the *United Nations Environment Programme* (UNEP) has developed a guide, which provides a blueprint for governments to formulate and implement sustainable tourism policies (UNEP-WTO, 2005). In 2012, they defined a new set of guidelines: the '*Global Sustainable Tourism Council's destinations Criteria*' (GSTC-D). Thereby, destinations must take an interdisciplinary, holistic and integrative approach which includes four main objectives: to (1) demonstrate sustainable destination management; (2) maximize social and economic benefits for the host community and minimize negative impacts; (3) maximize benefits to communities, visitors and cultural heritage and minimize impacts; and (4) maximize benefits to the environment and minimize negative impacts. The criteria are designed to be used by all types and scales of destinations. The GSTC-D are the result of a worldwide effort to develop a common language about sustainability in tourism, and are based on existing initiatives, such as the United Nations' Millennium Development Goals, the UNWTO destination level indicators, GSTC for hotels and tour operators, and other widely accepted principles, guidelines, and indicators. Focusing on social and environmental responsibility, as well as on the positive and negative economic and cultural impacts of tourism, the criteria are organized into four topics: sustainable management; socio-economic impacts; cultural impacts; and environmental impacts.

[8] Internal tourism expenditure; Internal tourism consumption; Gross value added of the tourism industries; Tourism direct gross value added; and Tourism gross domestic product (United Nations, 2008).

3.1.4 The European Tourism Indicators System

In 2013, the European Commission (2013) defined the '*European Tourism Indicators System*' (ETIS) for sustainable management at destination level. It is a set of 27 core and 40 optional indicators grouped into four sections: 1) destinations management; 2) economic value; 3) social and cultural impact; and 4) environmental impact. The aim is to evaluate and monitor the progress towards the more sustainable management of tourist destinations. The ETIS has the strength of being developed as a result of the lessons learned from previously-existing indicator system initiatives. Research was undertaken on 35 indicator systems from across the world, boiled down to 20 systems and those most relevant to the EU analysed in depth. The ETIS includes a process and methodology, rather than just a list of indicators. Furthermore, it is important to mention that this EU initiative also seeks to cooperate with certain Mediterranean countries (Egypt, Morroco, Tunisia) by establishing a dialogue to exchange best practices and reinforce cooperation in sustainable tourism.

3.1.5 The Regional Tourism Information System

Merely collecting the TSA aggregates on a national level, such as counting the number of arrivals at international borders, is not sufficient to formulate an effective regional economic policy on tourism. This has recently been recognized by the International Network on Regional Economics, Mobility and Tourism (INRouTe) and the World Tourism Organization (UNWTO). In July 2011, they signed an agreement to design a set of guidance documents on the measurement and analysis of tourism from the sub-national perspective (UNWTO, 2013a). Their objective is to set up of a '*Regional Tourism Information System*' (R-TIS) with basic statistical information for regions and other sub-national territorial aggregations. They distinguish four hierarchical territorial levels: 1) nation; 2) region; 3) specific destinations (e.g. coastal zones, local municipalities and communities), and; 4) key tourist use sites (e.g. protected areas, beaches, historic districts within a city). This new perspective is crucial for a better understanding of the spatial distribution of domestic tourism. They have identified five[9] research areas that are relevant in the endeavour to measure and analyse tourism at sub-national levels. They conclude that 'The measurement and analysis of mobility and tourism (visitors and trips) have their own conceptual background, expertise and focus. Different technologies (e.g. number plate recognition in road transportation, deriving transport data from cell phones, the Global Positioning System (GPS), sub-samples in household surveys) would be crucial for expanding the measurement and analysis of resident visitor activity.' Finally, we can conclude that there is an overlap with sustainable indicators as identified by the GSTC-D and the ITES. Moreover, the GSTC-D project mainly focuses on countries with a higher level of statistical development. This is the case for

[9] Tourism as an economic sector; tourism and the environmental dimension; non-economic contributions and impact; tourism's economic contribution and impact; tourism development and territorial cohesion; and supporting destinations' key stakeholders.

the G.20 countries and several members of the European Union. However, these guidelines could be an excellent contribution to the efforts Morocco has already undertaken.

3.2 The usefulness of existing standards for Morocco

The approval of the TSA exercise was motivated by the need for countries to complement the traditional *physical data*[10] with *new monetary data*, measuring both the expenditure of visitors and the production of the tourist industry. In 2010, a total of 60 countries, including Morocco, had been identified as have already undertaken a TSA exercise. Uniform data measurements and appropriate data analytics are necessary to establish an annual evaluation system on a global level. Morocco is ranked 69th on the world list for the *comprehensiveness*[11], and 7th for the *timelines*[12] of Travel and Tourist data (World Economic Forum, 2013). Based on these figures, we can conclude that Morocco still faces some major challenges to deliver all the data items of the UNWTO compendium, but that the scores for the timelines of the two key indicators (international tourist arrivals and tourism receipts), are relatively high. Morocco has recognized this weakness. In the evaluation of the '*Vision 2010*', they plan to create a '*Tourism Observatory'*, to professionalize the publication of statistics and studies. However, measuring the aggregate macro-economic-driven data is very relevant to characterize the overall tourism economy and to make a comparison between countries, but it is not sufficient for the effective daily operational management of tourism. Therefore, we need additional information to address new fine-grained questions. Although, the several examples described in this section provide a good basis in the ongoing efforts to improve the methods to collect tourist aggregates, there are two major limitations. On the one hand, the timelines are rather limited. The TTCI and the TSA provide annual data. The GSTC-D, ETIS and R-TIS provide annual, quarterly and monthly data. In formulating an effective tourist management policy, in order to analyse tourist dynamics, daily or even hourly data are highly recommended. In addition, there are also different scales at which the data is collected. The TTCI and the TSA provide data at the national level. The GSTC-D, ETIS and R-TIS focus more on a regional and local scale. More fine-grained spatial data would certainly help to answer more sophisticated and detailed questions concerned with tourist dynamics.

3.3 Regional initiatives in Morocco

In Morocco, the Ministry of Tourism, in cooperation with the Ministry of Environment, has recently set up a regional pilot project in Marrakech for 2014, as an integrated mechanism for the collection

[10] Arrivals, overnights in hotels and similar establishments, number of accommodation establishments, etc. (UNWTO, 2010).

[11] This indicator shows how much of the yearly data provided by national administrations, on 30 different concepts from the UNWTO Compendium of Tourism Statistics, are available. It covers the 2007 to 2010 period for all the 30 concepts in all of the four years taken into consideration.

[12] This variable shows the availability of two key T&T indicators (international tourist arrivals and tourism receipts) on a monthly or quarterly basis, covering the period from October 2011 to September 2012.

and production of indicators for monitoring sustainability at multiple scales (national, regional, and local). The aims are: 1) to create insights into which dimensions should be given top priority; 2) to measure the impact of the implemented actions, and 3) to provide an objective assessment of sustainability. The tourism indicators were selected on the basis of available international standards.

Table 5: Sustainable tourism indicators for Morocco (Marrakech pilot project)

Environmental Pillar	Socio Economic Pillar	Social / Cultural Pillar
• Tourism pressures on the natural resources • Efficiency in the use of the water and energy • Pressure on natural areas (sites) • Pressure on resources • Exposure to climate risks (floods) • Consideration of alternative resources when designing and constructing assets • Creation of green spaces • Efficiency of resource consumption • Level of use of alternative resources • Efficiency in the management of releases and wastes • Environmentally-responsible programme • Tourism's contribution to the promotion and preservation of natural assets	• Engagement of the stakeholders in sustainable approaches / social responsibility • Tourism contribution to the local economy and employment development • Seasonal trends of tourism • Use of local companies in the design and the construction of the product • Participation of tourism in the development of the local economy and job creation in the region • Employing local people in the construction of tourism assets • Existence of sustainable development offers (labels, specialized travel agencies, etc.) • Promotion of Morocco as a green destination to the institutional and private sector	• Tourism pressures on the host communities • Pressures on the local population (nuisance, tourist density, etc.) • Local population's access to the equipments/ infrastructure and tourist attractions • Integration of buildings in the urban local style • Nuisance resulting from construction • Stability and quality of tourism jobs • Contribution of tourism to the renovation of cultural monuments • Contribution of tourism to the valuation of intangible heritage (local culture, gastronomy, etc.)

Source: Roudies (2013).

The identified indicators, as presented in Table 5, are based on three pillars (Roudies, 2013). These indicators are selected based on different criteria, such as feasibility (availability of information and ease of implementation) and impact (comparability, and clarity and importance of the perception among stakeholder). In addition, a range of other indicators measuring the tourist satisfaction and their experience has also been identified.

As is clearly visible in Table 2, Marrakech and Agadir are the main tourist locations. Morocco strives for more diversity. In 2010, the plan '*Azur*' was changed and downsized, and the implementation was delayed to 2016, by which time only two of the planned six destinations were to be completed. If tourists visit only a small number of locations, this means that large parts of the country are excluded from economic growth and job employment. Morocco is, for example, very popular for long weekend stays and multiple city tour (round-trip) visits. To be able to understand detailed tourist dynamics, more fine-grained space-time data is necessary. In Table 6, we provide an overview of advanced tourist information needs which could be answered on a more fine-grained scale to provide new insights into tourist dynamics.

Table 6: Advanced geographical tourism information needs

Basic facts	**Patterns**	**Events**	**Communities**
How many tourists are in this town now? Where do they come from? How long will they stay? What is the hottest spot in town?	What is the evolution of patterns of tourism through time at a range of geographical scales? What is the spatial diffusion of tourism, both within and between countries? How do tourists arrive and move about? Which nodes do they use? What cluster of places do they visit? What are the effects of distance on patterns of tourist movements? How are the patterns of their motivation related to their characteristics?	How many people visit this event? How does an event change tourism? What is the tourism signature of an event? Do different events generate repeat visits? Are those repeat visits caused by destination loyalty towards the country where the event was taking place, or are those repeat visits caused by destination loyalty towards the event itself?	How do national and international tourists differ? What are the typical time-space patterns of a certain nation? What is the language diversity in a city? Which types of events attract national or international tourists? Is there a difference between nationalities regarding which locations and events they visit?
Perception	**Places**	**Evolution**	**Signatures**
Which topics do tourists talk about? How are places and facilities perceived How does this change across communities and time? How do they respond to promotions? What are the motivations of tourists? How do characteristics and motivation influence satisfaction and loyalty?	Which places define the tourist experience or what is the most popular landmark? How are they connected? How much do they weight in their tourist experience? Where are they located?	How does this change over time? What makes it change? What are the visible trends? What is the development of hierarchies of resorts and tourism places?	What are the signature experiences? What are the signature moments and places?

How can we leverage the socio-economic potential of tourism without precise answers to these questions? With Big Data, collective sensing, and spatial data analytics we can make large-scale phenomena like tourism transparent. We can measure the attributes of tourism where traditional models fail, or we can do the same at a fraction of the costs and complexity. Due to the diversity of different forms of travel and the motivations behind travelling, there is a lack of border statistics and data concerning individuals' space-time mobility (in many countries and regions). This prompts the need for new methodologies (tourism geography) and data for generating advanced tourism statistics. In other words, how we can gain more value from the available spatio-temporal data.

4. DATA SCIENCE TO SUPPORT TOURISM INFORMATION NEEDS

4.1 Tourism geography

The research field of geography is wide ranging, and has a long relationship with tourism, with a contribution of over 35 years of scientific papers. The geographical approaches to studying tourism have moved through a number of evolutionary phases (see Debbage and Loannides, 2004). For the main review papers on '*tourism geography*', we refer to Pearce (1979), Mitchell and Murphy (1991), Butler (2004), and Hall and Page (2009). To address the identified information needs from Table 6, which are, in general, questions relating to geography, we need new advanced data analytics and information concepts. Hall (2005) stated that 'By placing mobility at the heart of our understanding of tourism, the geography of tourism may also be able to make a greater contribution to human geography'. For a better understanding of the effects of human movement, characterizing human mobility patterns is crucial (Phithakkitnukoon *et al.*, 2010, 2011). Such studies analyse how individuals, such as tourists, populate and move through (urban) space (Mateos and Fisher, 2006; Shoval, 2007). In the literature, this is also called '*Tourism geography*'. A related term is '*Time geography*'[13], which can be suggested as a potential framework to analyse complex spatio-temporal patterns of individual activities and interactions (Shaw and Yu, 2009; Tian *et al.*, 2010). For example, Saarinen (2014) gives a critical overview of the role and nature of tourism geographies in relation to human geography, and also highlights the issue of responsibility (production and consumption) in relation to tourism sustainability. Dickinson *et al.* (2013) conclude that: 'Time is central to travel demand management and individual travel mode choices, both in tourism and everyday life, and is conceptually important to tourism and is experienced in multiple ways'. Including the time dimension in tourist mobility studies is crucial in understanding destination-based travel and transport behaviours. Until recently, the understanding of the basic laws governing human mobility patterns was limited due the lack of tools to monitor the movements of individuals (Gonzalez *et al.*, 2008).

[13] Time geography is a powerful conceptual framework for understanding human spatial behaviour, in particular, constraints and trade-offs in the allocation of limited time among activities in space. The space-time path is one of the most important concepts in time geography. It traces the movement of an individual (Hägerstrand, 1970).

Traditional planning and geography have understood space as a dead, fixed, immobile and 'un-dialectic' entity (Soja, 1989). This is based on passive measurements instead of actions and meanings. Massey (1992) criticizes the traditional research, by pointing out that space and time are conceptualized in classical physics as independent objects. However, there is only the joint effect of *space-time* (Thrift, 1996). In the past few years, a number of innovative approaches have emerged to satisfy a growing demand for precise, timely, and accurate spatio-temporal information, especially on urban dynamics (see Becker *et al*., 2011).

In general, space-time geography provides a better way to understand the urban environment and its dynamics. Such data can serve to reveal how tourists relate to urban and rural contexts. In this sense: data analysis (*usually enabled by data visualizations*) can empower a city with smartness and intelligence by helping us to identify mobility patterns, providing citizens, tourists, and decision bodies with tools that support better decision making, discovery, exploration, and explanation of the tourist environment. The use of space and time data enables the research community to analyse and model the dynamic *pulse* or *heartbeat* of a tourist landmark, transportation hub, city, region, and country, and even the relationships between these entities (e.g. Batty, 2010).

4.2 Several related trends

In this context, related emerging trends in information technology are Big Data, the Internet of Things (IoT), crowd-sourcing, and the use of new data sets (e.g. mobile phone data and social media). Big Data can be defined as 'datasets whose size is beyond the ability of typical database software tools to capture, store, manage, and analyse' or as 'large volumes of high velocity, complex and variable data that require advanced techniques and technologies to enable the capture, storage, distribution, management, and analysis of the information'. In general, this new data is also defined as the four 'V's': Volume (huge data sets with terabytes or peta-bytes of information); Velocity (time-sensitive); Variety (structured and unstructured data of all varieties), and: Veracity (quality and provenance of received data). In addition, as stated by Kitchin (2013), these new data sets are: *exhaustive* in scope (striving to capture entire populations or systems - n=all); fine-grained in *resolution* (aiming to be as detailed as possible and uniquely indexical in identification); *relational* in nature (containing common fields that enable the conjoining of different data sets); *flexible* (adding new fields is easy); and *scalable* (can expand in size rapidly). In other words: 'Big data consists of massive, dynamic, varied, detailed, inter-related, low cost datasets that can be connected and utilised in diverse ways' (Kitchin, 2013). This trend also implies: 1) New data-capture methods, suppliers, management tools, and analysis tools; 2) New customer relationships with product makers and data owners, and; 3) New skills and knowledge to model data, to shape the data opportunity, and to create data strategies. Another related trend is '*Collective sensing*', which is defined as 'the

ability to reconstruct collective human behaviour from individual anonymous digital traces which have a direct or indirect relationship to social collective phenomena'. Citizens and tourists create the dynamics of cities. Real-time data (e.g. from the telecom network and social media) is a *natural* candidate to sense these dynamics. It addresses the collective behaviour of the city, rather than the physical parameters. It provides a new layer of information for essential services, in the public and private sector, but also presents technical, ethical, and legal challenges.

4.3 Human dynamics, important activity places and mobility patterns

As stated by Butler (1980) 'Tourist areas are dynamic, and they evolve and change over time'. In his seminal work, he introduced a concept of a 'recognizable cycle in the evolution of tourist areas'. To address this evolution, it is crucial to understand tourist dynamics. The term *human dynamics* comprises the actions and interactions of personal, interpersonal and social (contextual) factors, and their effect on behavioural outcomes. Understanding the dynamics of the daily mobility patterns (e.g. citizens, commuters, and tourists) is essential for the management and planning of facilities and services, and can thus help managers to achieve the smart tourist objectives. One of the fundamental questions in social sciences is: *how can humans allocate time to different activities as part of a spatial, temporal socio-economic system?* (Jiang *et al*., 2011, 2012). The ultimate goal is to provide a clear picture of how groups of individuals interact with different places at different times of day.

Traditionally, this was the field of urban planners and social scientists. Recently, it has attracted a more diverse body of researchers (Foth *et al.*, 2012). Traces left by individuals are accumulating at an unprecedented scale (Zhang *et al.*, 2010). We can increasingly monitor what is going on. Along with the growing *ubiquity* of mobile technologies and *pervasive computing*, the logs produced in the course of their use, have helped researchers create and define new methods of observing, recording, and analysing environments, local municipalities, and their human dynamics (O'Neill *et al.*, 2006). In effect, these personal devices create a vast, geographically-aware sensor web that accumulates tracks to reveal both individual and social behaviour in unprecedented detail (Goodchild, 2007). For example, in the literature we find an increasing number of empirical studies which use mobile phone data, to identify important activity places (e.g. Ahas *et al.*, 2006a, 2008a, 2010; Gonzáles *et al.*, 2008; Kuusik *et al.*, 2008; Bayir *et al.*, 2010; Song *et al*., 2010a; Phithakkitnukoon *et al*. 2010; Huang *et al.*, 2010; Isaacman *et al*., 2011a; Csáji *et al., 2013;* Ranjan *et al.*, 2012; Louail et al., 2014).

Since 2006, a number of mobile-phone data case studies have been initiated to analyse human mobility patterns (Eagle and Pentland, 2006; Mateos, 2006; Shoval, 2007; González *et al.*, 2008; Liu *et al.*, 2009; Song, *et al.,* 2010a, 2010b; Huang *et al.*, 2010; Isaacman *et al.* 2011b, 2012; Calabrese *et al.*, 2011; Kang *et al.*, 2012; Tanashia *et al.*, 2012; Amini *et al.*, 2014). Huang *et al.* (2010) stated that these places and the routes between them are of significant value to effective network management,

public transportation planning and city management. After detecting, investigating, and understanding tourist locations, urban managers can identify specific measures for upgrading accessibility or attractiveness. The introduction of space-time data (e.g. social media and mobile phone traces), enables researchers to better understand human mobility patterns: it will allow us to better design infrastructure such as roads, transportation systems, and vital utilities so that social cost is minimized while location-based human activities are optimally supported (Um *et al.*, 2009).

5. EMPIRICAL EXAMPLES OF TOURISM GEOGRAPHY

In the age of low-cost flights, local authorities can never be certain about the volumes and nationalities of tourists. Knowledge about such numbers and deeper insights into the behaviour of tourists is the starting point in designing tourism and urban attractiveness policies (Kuusik *et al.*, 2010; de Jonge *et al.*, 2012). This is not a trivial task, as their trip routes are difficult to predict, and the same applies to the length of their stay, the actual places they visit, or the landmarks to which they are attracted. Moreover, the various nationalities may have different preferences (with regard to cultural interests, or natural landscapes), time schedules (due to country-dependent holiday periods), or even be influenced by seasonal variability. In this section, we highlight two promising directions of using fine-grained space-temporal data to support tourism objectives: 1) mobile phone data; 2) social media data. Therefore, we will use some illustrative empirical case studies, to demonstrate an innovative approach to address the advanced information needs discussed in the previous section. These concern basic facts, patterns, events, communities, perception, places, evolution, and signatures. Thereby, we now critically reflect on how both these direction can be further explored and applied for Morocco.

5.1 Mobile phone data

Knowledge about human dynamics, important activity places, and human mobility patterns, as described in Section 4.3, have a strong relationship with different types of tourist analysis. In the literature, we find several examples of using mobile phone data to support tourism objectives. Research about the use of mobile data to support smart city objectives started some ten years ago (Steenbruggen *et al.*, 2014), and has demonstrated extensive possibilities for a wide range of uses. A recent study from Eurostat (2014a) concludes that 'Tourism statistics is one of the domains in which the opportunities are rather clear as the properties of the data correspond to the nature of the tourism activities'. CDRs (Call Detail Records) can measure inbound, and outbound tourism data, as well as foreign (domestic) tourist information by using what is called 'roaming data' which contains the country code of the SIM card.

Human geographers, such as Ahas, have used mobile positioning data as a spatial distribution tool for monitoring the concentration of tourists in a certain area of attraction (Ahas *et al.*, 2006b, 2007, 2008b), the ability to identify repeat tourist visitation as an expression of destination loyalty towards a country (Kuusik *et al.*, 2008, 2010), and visits of tourist based on countries of origin (Raun and Ahas, 2013). These studies have resulted in interesting estimations of the number of visitors and visits, the (average) visit duration, the distribution of (repeating) visitors at the country level, and the geographical distribution of repeat visits in the Estonian counties. In a case study in Italy, Manfredini *et al.* (2011) showed how mobile phone data can help to monitor and map the spatial and temporal variability of visitors and tourists. These types of information can prove to be vital for more efficient tourism planning at different spatial scales. Girardin *et al.* (2009a, b), for example, identified the spatial distributions of locals and foreign visitors to estimate their relative density in relation to some specific locations. In the MIT real-time Rome project, they developed an illustrative application to show the density of people using mobile phones at different historic attractions (Calabrese *et al.*, 2011). This can be used as input in designing urban attractiveness policies, as such information could assist policy makers in targeting the most popular sites. For an extensive overview of initiatives in Europe, and the feasibility, opportunities, and benefits of such data, we refer to Eurostat (2013, 2014a, b, c, d, e).

The telecommunications sector in Morocco has undergone profound changes since the liberalization of the market in 1999. Mobile services are provided via a GSM network. The number of subscribers reached almost 39.016 million in 2012 (against 369,000 in 1999). Even the number of fixed lines has more than doubled between 2000 and 2012, but the number of subscribers stayed far behind, compared with the explosive growth of the mobile network. In Augustus 2000, the number of mobile subscribers overtook the fixed lines. The mobile network covers physically 97 per cent of the Moroccan population, and has a market penetration of 120 per cent, against 10.1 per cent for fixed lines (See Table 8). In 2012, the mobile network was accountable for 30 billion minutes of speech and 2 billion text messages, and the Moroccans spent together MAD 19.5 billion on phone calls.

Table 8: Fixed telephone subscription (versus mobile cellular subscription) in Morocco (2000 – 2012)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Mobile	234,2000	4,771,739	6,198,670	7,359,870	9,336,878	12,392,805	16,004,731	20,029,300	22,815,694	25,310,761	31,982,279	36,553,943	39,016,336
M/100	8.16	16.44	21.15	24.88	31.27	41.14	52.66	65.31	73.71	80.93	101.07	114.02	119.97
Fixed	1,425,000	1,191,335	1,127,447	1,219,213	1,308,569	1,341,156	1,266,119	2,393,767	2,991,158	3,516,281	3,749,364	3,566,076	3,279,054
F/100	4.96	4.11	3.85	4.12	4.38	4.45	4.17	7.81	9.66	11.24	11.85	11.12	10.08

Source: http://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx

We can thus conclude that Morocco has an excellent mobile infrastructure which has physically nearly full area coverage. Call Detail Records (CDRs) are the standardized way to extract useful information from the mobile network. To get access to this data, for research purposes, the telecom

operators need to be willing to share this data, and the Moroccan regulations need to be respected in terms of privacy. Such data could be a good starting point to further explore their potential use to support the tourism objectives in Morocco. Although CDRs contain a rich source of information, it is clear that this kind of research is still in its infancy, and requires a different approach than that of traditional data collection and analysis. For the main limitations of the use of mobile phone data to support tourism, we refer to Eurostat (2014a).

5.2 Social media data

The concept of Web 2.0 and the related new information services, such as social media, have proved to be a powerful tool in directing the mindsets of the tourists, and creating new opportunities for a variety of tourism services and consumer product industries. Thereby, tourists can be seen as co-creators of innovation in tourism services (Sfandla and Björk, 2013); destination images (Mansson, 2011); tourist activity (Miguéns and Mendes 2008); human dynamics (Hawelka *et al.*, 2014); mood analysis (Frank *et al.*, 2013; Mitchell *et al.*, 2013); and language diversity (Mocanu *et al.*, 2013). The social media are one of the most recent and rapidly growing phenomena (Facebook was launched in 2004, Panoramio in 2005, Twitter in 2006, FourSquare in 2009, and Instagram in 2010), and generates bottom-up information (e.g. through different social media channels, by users for personal or commercial uses). The interest in the social media stems from the nature of the data it captures, which is about the syntax of people's behaviour (where they are, when they communicate, who they connect to, etc.), but also about their emotional status. The social media generically provide an opportunity to capture the soft dimensions of human behaviour, such as mood, feeling, frustration, etc., which can be translated into citizens' attitude towards, opinion on, or satisfaction with, relevant subjects (e.g. policies). The social media are a dynamic, up-to-date data source available for most cities in the world, with constantly increasing volume and availability. It is an emerging public forum with the potential to be a communication platform between city and citizens. It can give city decision makers an insight into the needs of '*city users*' and their reactions to policies and decisions, in a form of collaboration feedback that is otherwise complex and expensive to realize.

The downside of the social media for assessing city smartness concerns the penetration and representativeness of the media, as well as their potentiality for being influenced and manipulated. The diffusion of social media platforms has been so rapid and viral, that some of these sites are nowadays larger than the population of most countries. Figure 5 presents a global overview of the penetration of different social media sources. We can conclude that the different social media maps show great geographical similarity, in terms of their global penetration level.

5a: Facebook

5b: Twitter

5c: Foursquare

5d: Flickr

Figure 5: Penetration level of the different social media sources
Note: All pictures represent the penetration level for 2010.

6. USEFULNESS OF TWITTER

To test the penetration level and the usability of social media feeds in Morocco, we considered a small case study of four metropolitan cities (Amsterdam, London, Milan, and Casablanca) and used the full 2012 global database of geo-coded tweets. Twitter, often referred as a micro-blog, enables users to send and read short text-based messages of up to 140 characters (See Table 9 for the basic city statistics).

Table 9: Basic statistics of geo-located tweets for 2012

	Amsterdam	London	Milan	Casablanca[1]
City area (km^2)	985	1572	1980	1613
Population	1,436,959	8,173,194	4,035,443	3,672,900
Number of tourist 2011 (ml.)	4.2	15.1	2.1	-
Tourist world ranking 2011	26	3	66	-
Life expectancy (years)	80	80.6	80.29	76.11
GDP per capita (USD)	47,000	51,978	37,940	9,210
Total # tweets during 2012	1,261,720	9,336,119	1,553,774	86,404
# tweets per inhabitant	0.88	1.14	0.39	0.02
Total # of users	76,439	329,845	58,276	4,471
# users per inhabitant	0.053	0.040	0.014	0.001
# of tweets per day	3456.77	25578.41	4256.92	236.72
# of users per day	1122.03	7460.54	1463.05	73.26

Note 1: Casablanca is not listed in the top-100-cities-destination-ranking (euromonitor.com). Marrakech is ranked 68th with 2.01 ml. tourists

Language can be treated as an approximation of identity (Mocanu *et al.*, 2013). Through language, we can attempt to describe the social composition of a city or a region. In the case of residents, language diversification has the potential to inform about areas of social and ethnic plurality. In the case of tourists, it indicates the external attractiveness of a city. Figure 6a depicts the top language of the tourist and Figure 6b provides the relative distribution of language diversity. The most language diversity is visible in London and Amsterdam, indicating a high level of cosmopolitanism and

attractiveness for external visitors. The smallest number of languages was recorded in Casablanca. Casablanca has a balanced share of English, French and Arabic tweets, reflecting implicit multilingualism and colonial heritage. English is the omnipresent language on Twitter, both among tourists and residents, and not only in London. This is a sign of the global character of the service and of the predominant demographics of the users. This also introduces an over-representation bias for English. Language analysis is sensitive to the accuracy of automatic NLP tools, which may decrease with the length of processed text (a very important factor for short Twitter messages). Potential misclassification has been limited with rule-based post-processing and aggregations. Sample manual analysis of language recognition has, however, demonstrated the high accuracy of the final algorithm in our project.

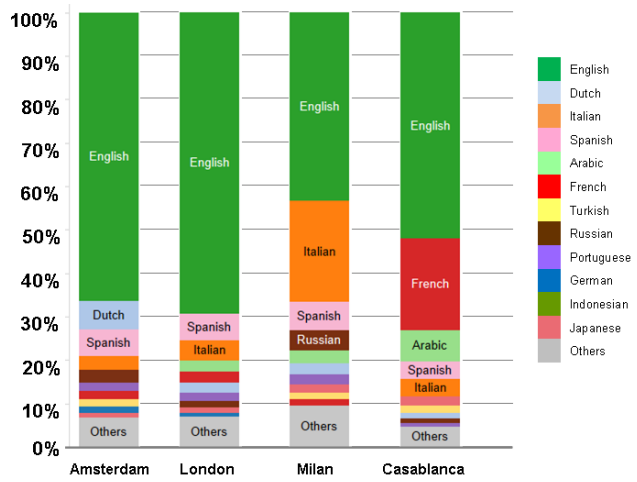

Figure 6a: Top language of tourists

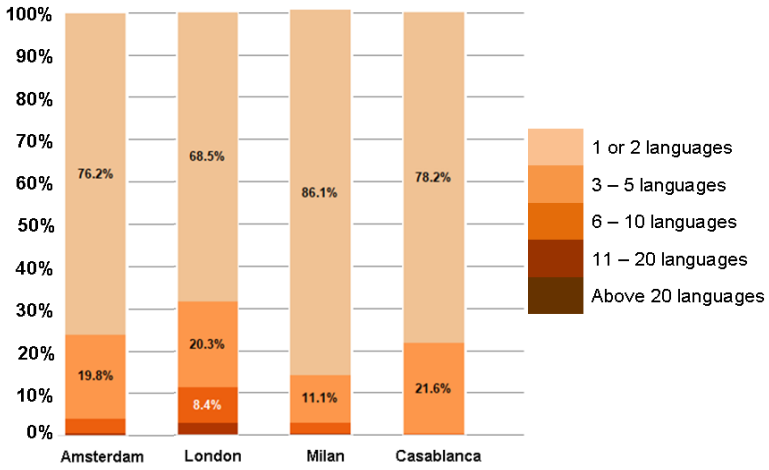

Figure 6b: Distribution of language diversity

Finally, Figure 7 indicates the spatial distribution of language diversity for tourists and residents. An interesting observation is that the number of language spoken by tourists is approximately twice the number of languages spoken by residents. This seemed to be stable for all the four cities.

The main conclusion of our case study is that the penetration of geo-located tweets for Casablanca is relatively limited. It would be interesting to further explore the use of other social media sources. Another interesting research path is to further explore the Twitter data for all Morocco, in terms of volume, temporal variation (monthly, weekly, daily, and hourly), scale effects (global, regional and local), spatial distributions of tourist phenomena, tourism impacts, planning for tourism, spatial modelling of tourism development, city comparison, mood analysis, identifying the most popular hashtags, and the related word clouds. Other examples of studies, related to urban attractiveness and user generated content, can be found in Rattenbury *et al.* (2007) and Girardin *et al.* (2008a; 2009a, b). They both used geo-tagged photographs in *Flickr*[14] to automatically detect interesting real-world events and draw conclusions about the flow of tourists in a city. Garardin *et al.* (2008b) explicitly analyze disclosed location information to understand tourist dynamics.

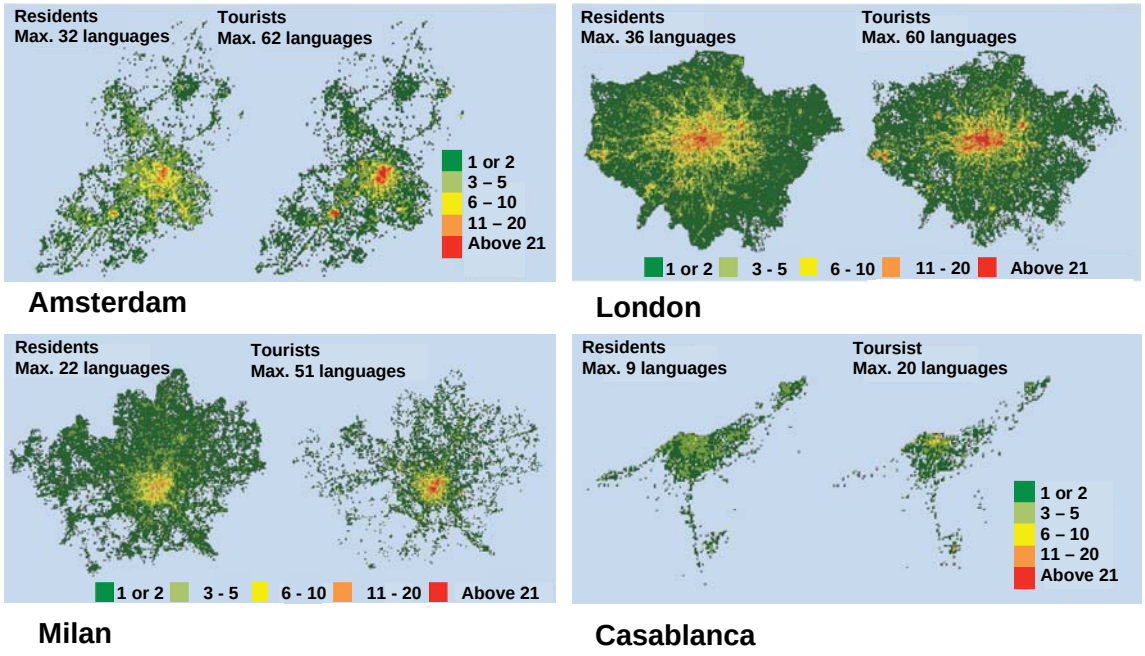

Figure 7: Spatial distribution of language diversity

7. DISCUSSION

On the basis of an extensive literature review, we have provided a 'state of the art' on emerging trends and the value added of spatio-temporal data, which can help to gain new insights to address tourism objectives. We have explored two innovative pathways, which highlights the applicability of such digital data to develop innovative applications for enhanced tourism management. A better understanding of tourist flows, and the spatial distribution patterns and movements of tourists between destinations and within a destination, can certainly help policy makers, transport geographers, and the tourism industry, to provide better services and facilities. For example, Csáji *et*

[14] www.flickr.com

al. (2013) observed that most people spend most of their time at only a few locations. González *et al.* (2008) and Song *et al.* (2010a, b) stated that human trajectories between these locations show a high degree of temporal and spatial regularity, and follow simple reproducible patterns. Despite the significant differences in the travel patterns, González *et al.* (2008) find a lack of variability in predictability, which is largely independent of the distance that users cover on a regular basis. In fact, despite people's deep-rooted desire for change and spontaneity, our daily mobility is characterized by a deep-rooted regularity. These conclusions also hold for tourist destination visits, which have a temporal rhythm of place, a pace (speed and tempo), and a flow that is characteristic for each specific location, and the travel patterns between these places (Haldrup, 2004; Germann Molz, 2010; Dickinson *et al.*, 2013). Moreover, new visitors also adapt to the movements which are encoded in each destination (Edensor, 2010) and can even become habituated to temporal patterns (daily rhythms and flows) of which they are unaware (Adam, 1995). These daily rhythms are both anticipated in tourists' imaginations of places and then enacted in the tourist consumption of a place, and, together with the availability of transport infrastructure, influence the transport choices available to tourists (Dickinson and Peeters, 2012). Furthermore, these patterns are also influenced by natural factors, such as the prevailing temperature and weather conditions, and human factors like special events. Since tourism destinations each have their own culture, environment, customs, and laws, data needs must be aligned to local conditions and supplemented by additional criteria for the specific location and activity.

Morocco has an excellent mobile phone telecommunication infrastructure. Therefore, this could be identified as a first promising research direction to gain a better understanding of the complexity of tourism dynamics. The expectations for the use of mobile phone data are rather high. However, it is perceived that such data sources are mainly complementary, and in some cases are also a potential replacement for existing data sources, tourism indicators, and methodologies (Eurostat, 2014a). In comparison, on a global scale, the penetration level of social media sources in Morocco still remains limited. Nevertheless, the results of the geo-located Twitter case study presented in this paper, has provided a first glance of how such data could be used. Spatio-temporal data and data science for tourism could therefore be a useful addition to our ongoing efforts to stimulate regional and local (sustainable) development; be an instrument for a better regional distribution of economic prosperity, creating new opportunities for a variety of tourism services; and also stimulate the development of data-driven decision making and predictive analytics for policy makers. This is especially true for countries like Morocco, which have a high governmental prioritization of tourism development, and are largely dependent on the tourism industry for increasing economic growth, in terms of its contribution to the GDP and job employment. This could make large-scale phenomena like tourism more transparent, and support governments with new tools for efficient policy making.

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Appendix 1: Overview of Tourism standards

Level / (Focus)	Standards and initiators	Areas / information focus
National (Economic, Political) **A**nnual	***'Travel & Tourism Competitiveness Index' (TTCI)*** • The World Economic Forum	• Regulatory framework sub-index • Business environment and infrastructure • Human, cultural, and natural resources
National (Economic) **A**nnual	***'Tourism Satellite Account' (TSA)*** • World Tourism Organization (UNWTO) • European Commission • International Monetary Fund (IMF) • Organization for Economic Cooperation and Development (OECD) • World Bank	• **Inbound tourism** (Arrivals, arrivals by region, main purpose, mode of transport, by form of organization of the trip, accommodation, expenditure, expenditure by purpose of the trip, indicators) • **Domestic tourism** (Trips by main purpose, mode of transport, by form of organisation, accommodation, indicators) • **Outbound tourism** (Departure, expenditure, expenditure by main purpose or the trip, indicators) • **Tourism industries** (Number of establishments, accommodation units, travel) agencies and other reservation services) • **Employment** (Number of employees, status of employment) • **Complementary indicators** (Demand, Macro-economic indicators)
National **Regional** **Local** **(Sustainability)** **M**onthly **Q**uarterly **A**nnual	***'Global Sustainable Tourism Criteria for Destinations' (GSTC-D)*** • The Global Sustainability Tourism Council • Rainforest Alliance • United Nations Environment Programme (UNEP) • World Tourism Organisation (UNWTO)	**Demonstrate sustainable management** • Monitoring • Sustainable destination strategy, sustainable standards, destination management organisation • Tourism seasonality management, planning regulations, access for all, property acquisitions • Climate change adaptation • Inventory of tourism assets and attractions • Visitors' satisfaction, promotion • Safety and security, crisis and emergency management **Maximize economic benefits/ minimize negative impacts** • Economic monitoring • Local career opportunities, public participation, local community opinion • Local access, support for community, supporting local entrepreneurs and fair trade • Tourism awareness and education • Prevention of exploitation **Maximize benefits to communities, visitors and culture and minimize negative impacts** • Attraction protection, cultural heritage protection, site interpretation • Visitor management, visitor behaviour • Intellectual property **Maximize benefits to the environment and minimize negative impacts** • Environmental risks, protection of sensitive environments and wildlife protection • Greenhouse gas emissions, energy conservation, water management, water security, water quality, waste water, solid waste reduction, light and noise pollution • Low impact transportation
National **Regional** **Local** **(Sustainability)** **M**onthly **Q**uarterly **A**nnual	***European Tourism Indicators System (ETIS)*** • European Commission	**Destination management** • Sustainable tourism public policy, sustainable tourism management in enterprises, customer satisfaction, information and communication **Economic value** • Tourism flow, tourism enterprise performance, quantity and quality of employment, safety and health, tourism supply chain, **Social and Cultural impact** • Community / social impact, gender equality, equality accessibility, protecting and enhancing cultural heritage, local identity and assets, **Environmental impact** • Reducing transport impact, climate change, solid waste management, sewage treatment, water management, energy usage, landscape and bio diversity protection, light and noise management, bathing water quality
Regional (Economic, Sustainability) **M**onthly, **Q**uarterly, **A**nnual	***'Regional Tourism Information System' (R-TIS)*** • International Network on Regional Economics, Mobility and Tourism (INRouTe) • World Tourism Organization (UNWTO).	**Tourism as an economic sector** • Demand, Supply (Industries and Employment), complementary indicators **Tourism and sustainable development** • Tourism and the environmental dimension (Renewable energy sources, CO_2 emissions, Water consumption, Generation of solid waste, Tourism pressure, Other environmental indicators) • Tourism and its impact on the social and cultural dimensions of the resident population (Population growth, Per capita revenue, Resident satisfaction, Tourists' use of essential services, Congestion and intrusion arising from visitors, Job creation, Other social and cultural indicators • Tourism economic contribution and impact: Quality of the destination, Tourism experience, Seasonality, Related infrastructure, Business demography, Other economic indicators **Tourism development and territorial cohesion** • Territorial protection and other indicators **Supporting destinations' key stakeholders** • Cooperation agreements between different stakeholders

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