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Recreational trail development within different geographical contexts as a determinant of income multiplier and local economic impact

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ABSTRACT

The development of recreational trails has gained popularity in recent years and therefore many scholars have studied various aspects of them. However, the recreational trail theoretical framework lacks an understanding of the relationship between the stage of trail development and income multiplier value. This research aims to examine this relationship and thus advance the traditional theory of recreational trail economic impact by providing an explanation of the relationship between the stage of trail development and the income multiplier. This study applied a combined approach of Recreation Opportunity Spectrum (ROS) to assess the stage of trail development and the Ad hoc model to estimate the income multiplier and economic impact. The results of this study reveal that there is a strong correlation between the stage of trail development and income multiplier and provide a novelty in traditional recreational trail management and economic impact theory thus enriching the topical literature.

1. Introduction

Trail-related recreation (TRR) has been viewed as an offshoot of nature-based tourism (NBT) and is a strategic focus area from a local and regional development perspective (Tyrväinen, Mäntymaa, & Ovaskainen, 2014). Recreational trails provide access to the largest array of nature-based activities in both urban and rural environments (Monz, Pickering, & Hadwen, 2013) and today are increasingly popular (UNWTO, 2019). The popularity of recreational trails has increased dramatically due to COVID-19 epidemic restrictions owing to perceived risk, social norms, authorities recommendations, health benefits, and lifestyle changes (Mateer et al., 2021). Hazlehurst et al. (2022) and Reid, Rieves, and Carlson (2022) showed that recreational trail areas are associated with various types of resilience during the COVID-19 pandemic as recreational trail usage is easily compatible with social distancing requirements while still facilitating social interactions, providing a family friendly environment and bolstering adolescents' resilience to stressors of pandemic restrictions (Jackson, Stevenson, Larson, Peterson, & Seekamp, 2021). According to recent studies, the increase in trail visitors in Italy, Spain, South Korea, Sweden and Japan was between 0 and 50% compared to the time prior to the COVID-19 pandemic, whereas the increase in park visits in the United Kingdom, Denmark and Canada was over 100% (Geng, Innes, Wu, & Wang, 2021).

The theory of Archer (1989) states that economic impact stimulated by tourists' expenditures in tourism-related sectors causes changes in income, employment, and output value. Nature-based recreation scholars have adapted it to TRR as an alternative recreation form to sun and sea tourism, postulating that it has the potential to boost local, and more importantly, rural economies and provided supporting evidence (Bowker, Bergstrom, & Gill, 2007; Fredman & Tyrväinen, 2010; Huhtala, 2007; Lukoseviciute, Pereira, & Panagopoulos, 2022a; Raya, Martínez-Garcia, & Celma, 2018). Consequently, trails became more important for NBT development resulting in more public and private investments by tourism providers, public agencies and landowners. At

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the European level, recreational trails have received a strikingly high share of the funds spent on tourism through co-financing programmes such as INTERREG (Stoffelen, 2018) and collaborations with private entities (Wilkes-Allemann, Ludvig, & Hogl, 2020). Meanwhile, outside of Europe, New Zealand recently launched a recreational trail development programme with a 10-year budget of €341 million (New Zealand Government, 2021).

With increases in trail funding and trail area developments, entrepreneurs see new business opportunities as trail visitors spend more money on purchasing their nature experiences, associated goods and services (e.g., safety, information, food and drink facilities, visitor centres, accommodation, guided tours, equipment rentals) and businesses can then benefit from such trends that best fit their local resources, location and skills (Bowker et al., 2007; Raya et al., 2018; Santarém, Silva, & Santos, 2015; Taylor, 2015). However, decisions about investments, trail area developments and applications of trail management strategies depend on a trail's geographic location, natural setting, and purpose of use. Recreational trail development has recently been growing worldwide due to a broad recognition that TRR might optimally contribute to economic growth, rural development and income diversification in line with environmental sustainability (Ahtikoski et al., 2011; Bennett, Tranter, & Blaney, 2003). There is a wide recreational trail network, encompassing developments of diverse scales, and stages, and including itineraries with diverse themes (All Trails, 2022; Greenway, 2018). The stage of trail development indicates that recreational trail construction and development may range from minimally developed to highly developed depending on tread and traffic flow characteristics, obstacles, constructed features and trail elements, signs, and the recreation opportunity spectrum (ROS) class (U.S. Forest Service, 2011). When it comes to the development of a recreational trail area, especially one that requires substantial investment, the most important indicators of successful trail implementation and development are the economic impact and income multiplier, which explain how the economic benefit attained is dispersed in the local region (Hsu, 2019). Previous literature suggests that the income multiplier of recreational nature-based activities and destination developments should differ primarily due to site development and investments in recreational opportunities provision (Banerjee et al., 2018). In the case of recreational trails, previous research by Drakakis, Papadaskalopoulos, and Lagos (2021) and Lukoseviciute et al. (2022a) estimating income multipliers of horseback riding trails and recreational coastal trails yielded significantly different income multiplier values of 0.57 and 0.72, respectively, but with no explanation as to whether it is due to different development stages or other factors. According to nature-based recreation and economic scholars, besides the market features such as trail visitor demand, their expenditure and the size of NBT and recreation industries, there are non-market features such as scenery, wilderness and weather, and geographic location; which cannot be altered by higher trail development; thus destination popularity and trail visitor expenses are also functions of non-market features (Archer, 1989; Fredman, Wall-Reinius, & Grundén, 2012; Lukoseviciute et al., 2022). Therefore, it remains unclear whether higher stages of trail development determine greater income multiplier. As such, the paradigm for developing recreational trails lacks information about economic performance and outcomes and if it can be improved and/or prevent financial losses. Unlike the sun and sea recreation research domain, there is a lack of prior research on recreational trails and their economic impact as nature-based activities. It wasn't until the beginning of the 2000s that NBT was considered as the primary economic impact drivers (Bowker et al., 2007; Cook, 2008; Raya et al., 2018). NBT practitioners and scholars have continued to express the need for an explanation of the dynamics between stages of trail development and the magnitude of income multiplier, which would explain the TRR economic performance, as well as allowing implementation of improved trail development strategies and balanced distribution of trail funds (Kelley, van Rensburg, & Jeserich, 2016). Using the traditional theory of recreational trail economic impact as a foundation, this study aims to examine the relationship between the stage of trail development and the income multiplier, and to expand the traditional recreational trail development framework by attempting to explain how the stage of development alters the income multiplier.

2. Theoretical framework

2.1. Recreational trail development framework

Travelling for outdoor recreational trail experiences has been connected to several factors such as nationalism, nature conservation, urbanization, environmental philosophy and well-being (Wall-Reinius, 2009). Among the most unique and famous ones, a Nordic *friluftsliv* tradition could be mentioned as a cultural practice or a form of TRR experienced as a philosophy of living of local Nordic people (Varley & Semple, 2015). Moreover, environmental philosophy and well-being trends further highlight an increasing appreciation among people that natural heritage can contribute to their sense of identity, leading them to connect more with nature through access to recreational trails and value their protection (Frost, Laing, & Beeton, 2014).

Countries rich in natural and cultural historic resources have shifted their tourism towards nature-based recreation and have adopted various strategies and policies in order to protect natural and cultural heritages, develop trails and increase the potential of local economic development through nature-based recreation in their local areas. For instance, the Irish Sports Council developed a strategy for recreational trail development "Building Sport for Life", which is focused on getting more people active and participating in all types of sport across the country (The Irish Sports Council, 2023). The "New Zealand Walking Access Act 2008" was established to provide access to the countryside for recreation whilst protecting the rights of landowners (New Zealand Government, 2021). In some countries, such as China or Sweden some products of NBT are viewed as an opportunity to commercialize the nature, consequently strategies and policies that have been applied, have led to the degradation of local ecological, economic, and social systems (Margaryan & Fredman, 2017; Wang et al., 2012).

Moore and Ross (1998) proposed that at least five broad types of recreational trails exist in the context of nature-based recreation: 1) backcountry trails, 2) recreational greenways, 3) multiple-use trails, 4) water trails and 5) rail-trails. The trail types can also be combined, or local trails can be networked to provide a mixed purpose trail. The theoretical framework of recreational trail development and its benefits incorporates five main pillars: 1) health, 2) environmental, 3) cultural, 4) social and 5) economic (Fig. 1). The health benefits associated with physical exercise and mental well-being due to presence of parks and trails are well established in literature (Cleary et al., 2019; Janssen & LeBlanc, 2010; Reiner, Niermann, Jekauc, & Woll, 2013; Saxena, Van Ommeren, Tang, & Armstrong, 2005; Warburton, Nicol, & Bredin, 2006; Wood, Hooper, Foster, & Bull, 2017). Trails can be an effective method of improving societal health as Wang et al. (2005) discovered that each dollar invested in trail development in the US state of Nebraska yielded healthcare-related savings of $3 per trail user. When assessing the literature from an environmental perspective, trails are recognized as a prominent form of low carbon travel (Chapman, 2007; Weston & Mota, 2012), and serve as an important means of protecting and conserving heritage (Tomczyk, Ewertowski, White, & Kasprzak, 2017). Culturally recreational trails provide a resource for people to experience and enjoy the heritage and culture of the local community and landscapes (Santarém et al., 2015). Social benefits such as interaction, socialization and encouragement of local community involvement have been well established in the literature and particularly during the COVID-19 pandemic time when trails have been studied as destinations to ensure social cohesion at the same time as social distancing (Geng et al., 2021; Keith, Larson, Shafer, Hallo, & Fernandez, 2018; Samuelsson, Barthel, Colding, Macassa, & Giusti, 2020). Finally, economic benefits of

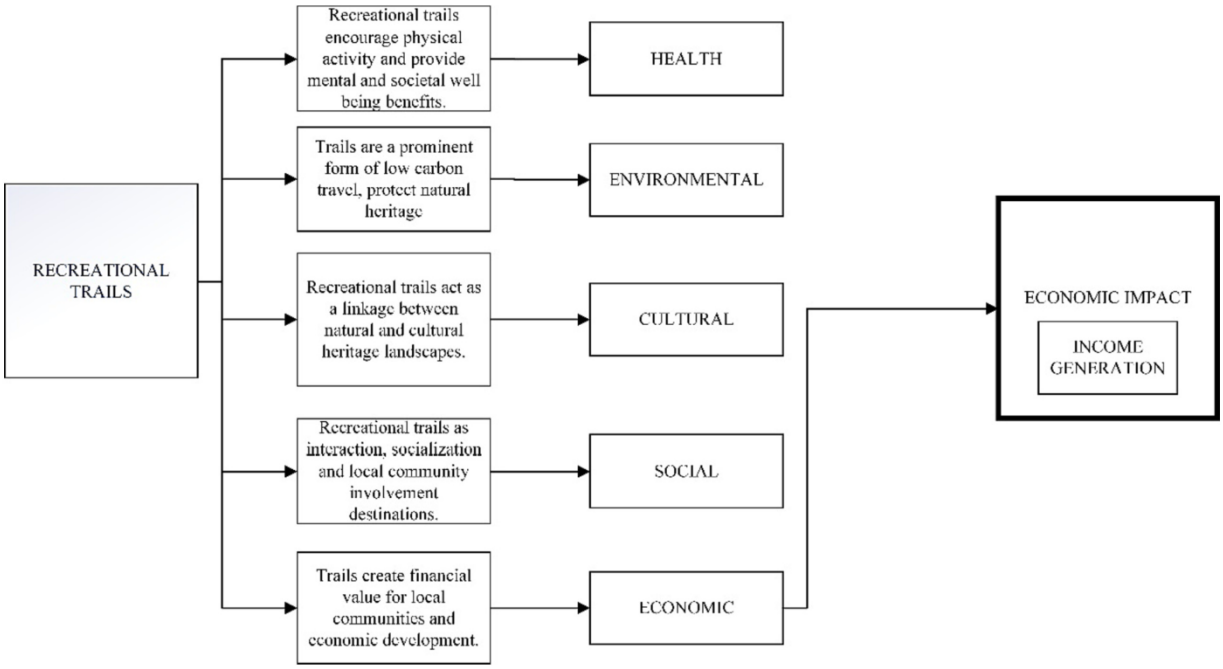

Fig. 1. Traditional theoretical paradigm.

recreational trails have been acknowledged as one of the most significant in tourism economy business models. For instance, the Camøno trail was developed to increase the economic value of Møn Island in Denmark and generated €1.6 million in economic value during its introductory year 2017 (Gyimóthy & Meged, 2018). Free walking tours have been provided as an element of a collaborative economy model in Barcelona, with notable success (del Londoño & Xavier Medina, 2018). Developing and maintaining trails can yield financial benefits for local residents – residential property near trails in the Denver, Seattle, and Minnesota areas of the United States have experienced property value increases in the range of 1% to 6.5% (National Park Service, 2000) and construction of the High Line in Manhattan raised adjacent housing values by 35% (Black & Richards, 2020).

2.2. The economic impact of recreational trails

Published literature on recreational trails has recently tended to focus on economic impact assessment and especially the multiplier effect, applying economic theories from Archer and Owen (1971) and Dwyer, Forsyth, and Dwyer (2010) that tourists´ expenditures on travel services cause short-term economic impact and adapting it to TRR, postulating that local or regional economic development can be stimulated through NBT products (Fredman, Haukeland, Stensland, Tyrväinen, & Wall-Reinius, 2021; Gyimóthy & Meged, 2018; Hall & Boyd, 2005; Lukoseviciute et al., 2022a). Different trail developments cover a wide range of physical settings and vary in terms of purposes of use, characteristics and their popularity, attracting different user profiles such as walkers, hikers, cyclists, off-road bikers, and birdwatchers (birders), with significantly varying trail-related expenses (Duglio & Beltramo, 2017; Hall, Ram, & Shoval, 2017; Mayer, Müller, Woltering, Arnegger, & Job, 2010; Molokáč, Hlaváčová, Tometzová, & Liptáková, 2022). Trail developments require special considerations when planning a trail to accommodate different visitor profiles and more importantly to encourage spending, especially when trails have been selected as a vehicle to develop local economies. Moreover, any trail development may also require technical and environmental considerations – for example, soil has limitations, and can be prone to erosion or degradation over time; trails which have demand for particular uses, such as equestrian, may require the installation of a suitable surface such as crushed stone or gravel (Marion & Leung, 2009). However, trail planning and management strategies may differ according to the purpose of application. For instance, multi-use trails located in protected areas are primarily planned and managed in a multi-use paradigm to reduce negative human impacts on protected natural areas and to allow the provision of both recreation and conservation (Tomczyk & Ewertowski, 2013). Trails passing through rural areas are primarily designed and developed to attract more visitors and thus improve economic and social well-being of local communities (Davies, Lumsdon, & Weston, 2012). Meanwhile, in some countries, trails may or may not developed to acquaint visitors with native wildlife, tribes and their culture (Miller, Kays, & Leung, 2020; Smith, Scherrer, & Dowling, 2009) or to build a national identity (Nordbø, Engilbertsson, & Vale, 2014). Referring to the magnitude of economic impact and multiplier effect, tourism economics pioneers state that the number of tourists, their expenditures, and circulation of these expenditures are the most critical factors in terms of the magnitude of the multiplier effect (Archer, 1982; Dwyer et al., 2010). Previous literature suggests that the magnitude of economic impact and income multiplier may differ due to several factors, of which one of the most critical is the stage of trail development, described by the ROS framework (Lukoseviciute et al., 2022). In TRR, the size of the trail area and intersectoral linkages with recreation industries as a consequence of development are the critical factors determining leakage and multiplier effect (Lukoseviciute et al., 2022). In the field of tourism, income generation is the most attractive indicator since it is the most useful from a policy viewpoint (Lindberg, 2001) and is prioritized in income maximization (Fennell, 1999). Consequently, the assessment of income multiplier has been widely applied in tourism studies since the 1990s (Archer & Fletcher, 1996; Hsu, 2019; Tafel & Szolnoki, 2020) and later in the field of NBT, including TRR (Hsu, 2019; Lukoseviciute et al., 2022a; Poudel, Munn, & Henderson, 2017; Rinne & Saastamoinen, 2005; Saayman & Saayman, 2006). With regards to various trail developments and management strategies, no studies have addressed the impacts on economic returns to the locality or region based on the stage of trail development, as most of the relevant literature has examined how various management strategies of recreational trails can control and reduce undesired environmental impacts (Evju et al., 2021; Figueras, Farrés, & Pérez, 2011; Park, Manning, Marion, Lawson, & Jacobi, 2008) or have studied recreational trail network design (Courtenay &

Lookingbill, 2014; Meadema, Marion, Arredondo, & Wimpey, 2020). This study applies the traditional recreational trail economic impact paradigm and expands it through the adaptation of the dimension for stage of trail development in order to evaluate the relationship between the stage of trail development and income multiplier (Fig. 2).

3. Study areas, materials, and methods

3.1. Study sites

Four diverse geographical trails within the European Atlantic area were selected for this study to reflect a diversity of recreational trail developments, trail access demand, and trail visitor behavior, resulting in diverse demand and expenditure on recreational services (Fig. 3).

"La Caldera de Taburiente" is a mountainous circular trail of 13 km, constructed within the National Park on the island of La Palma, located in the northwest of the Canary Islands archipelago. The entire island was declared a Biosphere Reserve in 2002, which is a recognized area of representative environments which have been internationally designated within the framework of UNESCO's Man and Biosphere Program for their value to conservation through providing the scientific knowledge, skills, and values to support sustainable development (Bridgewater & Cresswell, 1998). Complying with Biosphere Programme rules, the Canary Islands Government every year allocates funds for recreational trail maintenance and management, which are within the budget of "La Caldera de Taburiente National Park Management Plan". La Caldera de Taburiente National Park is one of the main attractions in the island since it is the largest erosion crater on this planet and is one of the most important destinations for hikers, trekkers, and mountaineers in Spain (Gómez-Martín, 2019). La Caldera de Taburiente is a hiking paradise for island visitors and the trail is the main tool to explore the park. Tourism and agriculture are the two main economic drivers on the island since the island has a tropical rainforest climate according to Köppen climate classification (Beck et al., 2018) with an annual average temperature of 26 °C and it is an excellent destination for walkers and nature lovers. Consequently, there is high demand for recreational trail access throughout the year.

"Seven Hanging Valleys" is a hilly coastal linear hiking path of 6 kms, constructed within public territory and located in the civil parish of Lagoa and Carvoeiro, in the southern region of Algarve in Portugal and faces the Atlantic Ocean. The parish is considered the most luxurious and excellent tourism destination in Algarve, while the Algarve region is a destination for >30% of Portugal's international tourists (INE (National Statistical Institute), 2021), mostly due to the unique coastal diversity which is reflected in a great diversity of landscapes. As a result, the economy in the region is driven by tourism (Antunes, 2000). Since the region has a Mediterranean climate with an annual average temperature of 17 °C, it is an excellent destination for walkers. The development of recreational trails in Algarve has been initiated due to approval of a "Rural Tourism Hotspot Sustainability Strategy" under the "National Strategic Plan for Rural Development 2007-2013", which aims to avoid destruction and protect and conserve the natural and cultural rural landscape by employing rigorous measures in the most vulnerable areas on-site (MADRP, 2007). Today there are over thirty themed recreational trails in Algarve, of which "Seven Hanging Valleys" is the most popular being recently nominated as one of the best hiking destinations in Europe (European Best Destinations, 2023) and acknowledged as a representative of the most successful coastal nature-based recreation setting development in the region of the Algarve (Lukoseviciute, Pereira, & Panagopoulos, 2021).

"Knocknarea/Killaspugbrone" is a 15 km loop trail which is both upland and coastal. The trail is located on a scenic part of the Atlantic Ocean and overlooks the famous surfing village of Strandhill in County Sligo, Ireland. The development of the "Knocknarea/Killaspugbrone" trail is part of County Sligo's recent investments in walking infrastructure in the county, where walking activities are among the most popular in rural areas (National Trails Office, 2023). The construction of recreational trails in Ireland has been initiated by the approval of "Irish Trails Strategy" aiming to create, nurture and maintain a world class recreational trail network that is sustainable, integrated, well utilized and enhance the health, well-being, and quality of life of all Irish citizens (Irish Sports Council, 2023). The "Knocknarea/Killaspugbrone" trail is

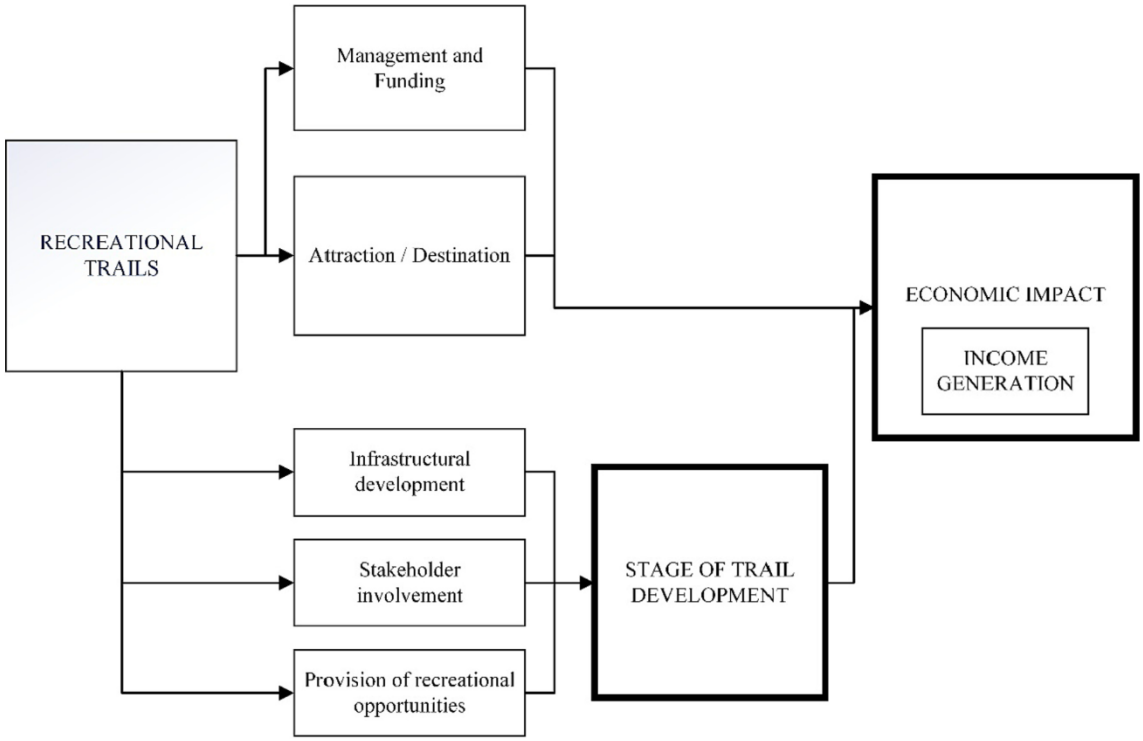

Fig. 2. New theoretical paradigm adapted here.

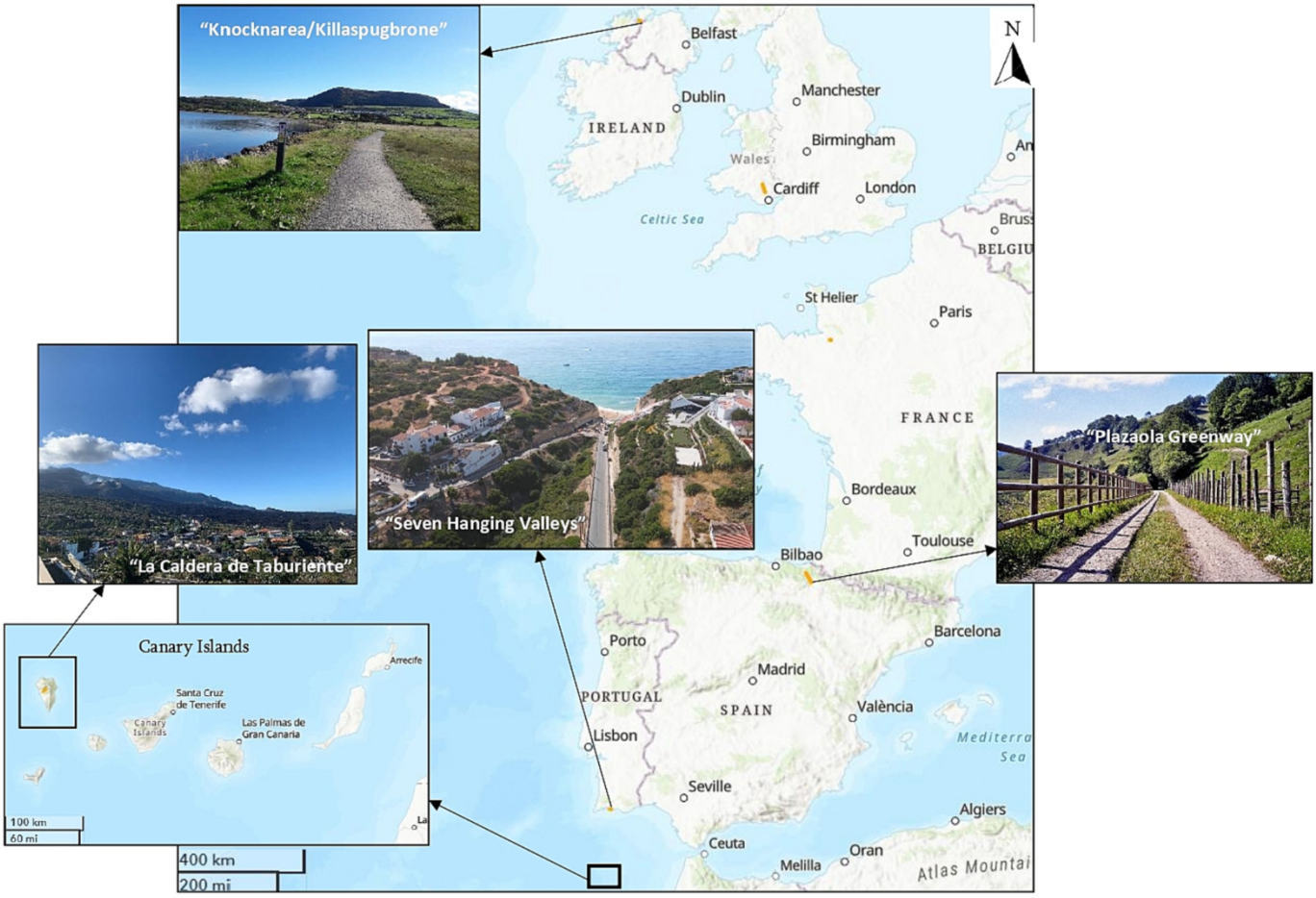

Fig. 3. Location map of study case trails.

the central attraction in the Sligo area, which provides a clearly waymarked looped walk with breathtaking scenery combined with cultural and archaeological heritage. The trail's central visitor attraction is Queen Maeve's Cairn, a 5000 stone mound which is located on the summit of Knocknarea mountain, and which is one of Ireland's most important Neolithic structures. County Sligo is considered rural and well known for walks and surfing since it is characterized by the oceanic climate with mild summers, cool winters and rapidly changing weather conditions including cloud cover, mist, and high winds. Consequently, the demand for recreational trail walks in Sligo is dynamic throughout the year. Nevertheless, the national tourism agency "Fáilte Ireland" has recently cooperated with Sligo County Council to develop the National Surf Centre at Strandhill, underlining the area's excellence as a surfing venue, and strengthened by its great natural beauty and outstanding outdoor recreation space. It is estimated that the new surf center will bring an extra 70,000 visitors to Sligo in its first year and will increase spending by outdoor recreationists in the region.

"Plazaola Greenway" trail is a 45 km linear mountainous rural hiking and cycling path. The trail is in the region of Navarra in northern Spain and runs through the Imotz, Larraun, and Leitzarán natural sanctuary valleys. The "Plazaola Greenway" is a rail trail running through the old Vasco-Navarro railway that joined Pamplona and San Sebastián and is characterized by a spectacular landscape, a route of uniform slopes and the considerable number of tunnels that are crossed. The Cycle Master Plan for Navarra initiated the revival of the railway to develop an internal cycle network infrastructure and to link up with the EuroVelo Network. The region of Navarra is characterized by oceanic climate with mild summers, cool winters, and rapidly changing weather conditions, therefore Navarra is not a very popular tourism destination and has a high tourism seasonality index (Manuel López, Bonilla, Miguel López Bonilla, & Sanz Altamira, 2006). Nevertheless, local authorities try to boost economic development based on tourism and dedicate funding for NBT development, especially restoration and creation of new paths (Raya et al., 2018). The "Plazaola Greenway" management is conducted within the framework of the Nature Trails Program of the Spanish Ministry of Agriculture and Natural Environment with a stable budget allocated for trail constructions, maintenance, and sustainable development.

3.2. Stage of trail development assessment

To describe the range of outdoor recreation opportunities, present in landscapes and determine the stage of trail development, the Recreation Opportunity Spectrum (ROS) framework was applied in this study (Clark & Stankey, 1979). The framework was adopted by the US Forest Service as a management tool to identify the range of outdoor recreation settings present in landscapes. Moreover, the framework allows one to determine the stage of trail development based on the range of outdoor recreation opportunity class along a spectrum ranging from primitive (P) to urban (U) present in landscapes and trail attributes (US Forest Service, 2011).

Initially, to determine the ROS class, a matrix consisting of three types of settings with its own key performance indicators (KPIs) is considered. The selection of three settings was based on the original framework and previous research in outdoor recreation site classification (Harshaw & Sheppard, 2013; Oishi, 2013). The physical, social and managerial settings, which include qualities provided by nature (access, remoteness, naturalness), qualities of recreational use (user density) and conditions provided by management (facilities, visitor management)

(Driver, Brown, Stankey, & Gregoire, 1987) were conceptualized by American academic and Forest Service researchers (Clark & Stankey, 1979) with the purpose to classify recreational sites along the spectrum. Knowing the ROS class, the stage of trail development is further assessed, following the matrix, consisting of the following trail attributes with their own KPIs: tread and traffic flow, obstacles, constructed features and trail elements, signs and ROS class. The ROS classification and stage of development matrixes with KPIs can be found in Lukoseviciute et al. (2021).

The assessment of each trails' stage of development was performed by the following stakeholders: local trail managers, governmental and municipal delegates, NBT experts and academics in the field of economics and tourism management from European Atlantic area countries: Spain, Northern Ireland, Ireland, Scotland, Portugal and the Spanish Canary Islands. The selection of stakeholders was based on their experience, professional knowledge, and familiarity with study case trails, ensuring accurate assessment, trail development and management issues identification and recommendations (Coban & Yildiz, 2019). Assessments were made by four governmental and six municipal delegates, six academics, three NBT and economics experts, three environmentalists and four local trail managers. In total, 26 stakeholders were involved. Stakeholders assessed each trail's ROS class and stage of development based on their professional knowledge, personal observations at each trail site and use of secondary source data such as technical reports and scientific publications. Initially, each stakeholder was asked to rate the performance of each KPI of each setting of ROS class using a 5-point Likert scale (1 = very low performance, 5 = very high performance). The highest rated KPI of each setting was selected for the final ROS class determination, applying a round average function, where each ROS class was assigned an integer between 1 and 6: primitive (P) = 1, semi-primitive non-motorized (SPNM) = 2, semi-primitive motorized (SPM) = 3, roaded natural (RN) = 4, rural (R) = 5, urban (U) = 6. Then, each stakeholder was asked to rate the performance of each KPI of the trail attributes matrix, using a 5-point Likert scale. The highest rated KPI for the final stage of development was selected to determine the stage of trail development, applying a round average function, where each stage of development was assigned to the following quantitative numbers: minimally developed = 1, moderately developed = 2, developed = 3, highly developed = 4, fully developed = 5. The final stage of trail development was determined by calculating the average value of each individual stakeholder assessment.

3.3. Economic impact assessment

The Ad hoc multiplier model was chosen for this study, which is the most suitable for short and long-distance trails due to ease of model application and the use of primary source data (Lukoseviciute et al., 2022b). The model estimates economic impact from a change in tourist expenditure and calculates the income multiplier based on information obtained from surveys applied to the following populations: trail visitors, local tourism business operators, and residents. To consider the degree of money leakage and accuracy of economic impact estimation (Archer, 1982), administrative boundaries were used to delimit the study area and define the local area. In this study the smallest administrative units such as parishes and municipalities which each study case trail falls within, covering major NBT activities and attractions were defined as study areas. The income multiplier is calculated using the following formula adjusted by Hsu (2019) and recently applied by Lukoseviciute et al. (2022a). The technical income multiplier calculation process with all parameters and statistical data required is presented in Lukoseviciute et al. (2022a):

$$m = \sum_{i=1}^{N} K_i V_i \times \frac{1}{1 - L\sum_{j=1}^{n} Z_j V_j} \quad (1)$$

where i refers to different business sectors of economic activity ($i = 1, \ldots, N$); j defines household consumption categories ($j = 1, \ldots, n$); K_i is the proportion of tourists' expenditure spent in the i-th business sector; V_i is the proportion of revenue left in the local area in the i-th business sector; L is the average propensity to consume; Z_j is the proportion of household consumption in the local area in the j-th category; and V_j is the proportion of household consumption in the j-th category (obtained from a secondary data source – the European Classification of Individual Consumption according to Purpose).

3.3.1. Data collection

In economic impact analysis it is crucial to define the time frame and the total trail visitor population from which the economic impact is estimated (Archer & Fletcher, 1996). Based on previous studies in the field of economic impact assessment of tourism (Archer & Fletcher, 1996; Bowker et al., 2007; Hsu, 2019), a one-year timeline was chosen to ensure the inclusion of four seasons as well as low and high tourism periods thus reflecting the consistency of trail visitation and visitor expenditure dynamics which are highly susceptible to weather changes (Gatti, Brownlee, & Bricker, 2022; Verbos & Brownlee, 2017).

Data from trail visitors, resident and local businesses was collected over the periods of 2020–2021 in "La Caldera de Taburiente", "Seven Hanging Valleys" and "Plazaola Greenway" trails and 2021–2022 in "Knocknarea/Killaspugbrone" trail. Data collection questionnaires were approved by the ethics committee of the University of Algarve (CEUAlg Pn°52/2021). The following administrative units of each study case were chosen: El Paso municipality with a population of 7745 residents in La Palma, Carvoeiro and Lagoa parish with a population of 9987 residents in Portugal, Killaspugbrone parish with a population of 1812 residents in Ireland and Imotz, Laraaun and Leitza municipalities with a total population of 4357 residents in Spain.

To estimate the total number of trail visitors during the study periods, the following footfall counters recommended by Madden, Ramsey, Loane, and Condell (2021) were installed: 'pressure slab' type sensors in "La Caldera de Taburiente" trail, wireless bidirectional 'SensMax' sensors in "Seven Hanging Valleys" trail, a dual inductive loop sensor to directionally count bicycles and a 3D Stereoscopic Camera to count people in "Plazaola Greenway" and one directional PIR (Passive Infrared Detector) Break Beam sensors in "Knocknarea/Killaspugbrone" trail. All sensors were installed at different trail locations at a sufficient distance from a trail entrance/exit to avoid counting passing tourists without intention to use the trail for recreation and ensure continuous data collection.

To gather socio-demographic characteristics of trail visitors and their expenditure behavior, a structured questionnaire designed by Lukoseviciute et al. (2022a) was applied (see Appendix A). The target trail visitor population was defined as trail visitors not living in the study area. The population sizes of trail visitors obtained from footfall counters (N = 30,579 of "La Caldera de Taburiente", N = 45,992 of "Seven Hanging Valleys", N = 24,597 of "Knocknarea/Killaspugbrone" and N = 42,485 of "Plazaola Greenway") was used to estimate representative sample sizes applying a simple random sampling formula for quantitative variables of interest (Bryman, 2015), using a 95% confidence level and a 2% margin of relative precision. We obtained a sample size of 395 trail visitors for "La Caldera de Taburiente", 454 trail visitors for "Seven Hanging Valleys", 211 trail visitors for "Knocknarea/Killaspugbrone" and 461 trail visitors for "Plazaola Greenway" trails. For the purposes of this research, face-to-face surveying in the form of a guided questionnaire was deemed the most suitable approach to capture data concerning trails' users. To obtain an unbiased and representative sample of the population of the trails, a systematic sampling strategy was adopted, choosing every fifth trail visitor. Two or three interviewers on the premises of each trail conducted the data collection. Surveys were conducted in all seasons as well as on different days of the week to increase the representation of the samples. To facilitate the interviews, the

questionnaire could be accessed both on mobile devices and in paper-and-pencil format.

To gather data from local residents, a questionnaire designed by Lukoseviciute et al. (2022a) was applied (see Appendix B). The target resident population was defined as people who lived within the defined administrative unit of each study area for a continuous period of at least 12 months before the time of sampling. Resident population of each study case administrative unit was considered to obtain a representative sample, applying a simple random sampling formula for quantitative variables of interest, using a 95% confidence level and a 2% margin of relative precision. A sample size of 123 residents was estimated for "La Caldera de Taburiente", 62 residents for the "Seven Hanging Valleys", 63 residents for "Knocknarea/Killaspugbrone" and 27 residents for "Plazaola Greenway" trails. Residents were interviewed face-to-face applying the random route sampling technique (Bauer, 2014).

To gather data from local businesses, face-to-face and phone interviews were conducted with business owners/managers asking for information about the final net profit as a proportion of the final monthly gross revenue and total monthly expenditures. Seven business sectors from which a subset matches a given study cases visitor expenditure categories were selected: accommodation, transportation, restaurants, local products, rentals, guided tours, and water sports. Due to a considerable risk of businesses refusing to participate in the survey, the convenience sampling technique was applied (Oberholzer, Saayman, Saayman, & Slabbert, 2010). To ensure that at least one business of each sector provided the required information, local municipalities, and business associations participated in the surveying process. In total, 31 businesses were interviewed in La Palma, 14 businesses in Spain, 18 businesses in Portugal and 23 businesses in Ireland.

Finally, a bivariate correlation analysis was run between the measures of the income multiplier and the stage of trail development to test if there is a relationship between these variables.

4. Results

4.1. Stage of development

The ROS classification and stage of development of each study case trail are presented in Tables 1 and 2, considering the timeline after the local managing municipality has made initial investments in each trail's construction and development.

Each trail falls within a different ROS class and stage of development, representing various recreational opportunities. The "La Caldera de Taburiente" trail was classified as "SPM" and "highly developed" stage with the provision of semi-natural recreational opportunities. Such results were mainly because the trail has full access through primitive roads and motorized trails since it is distant from human activities and almost half an hour walk from any motorized road. With regards to naturalness, there are only a few subtle modifications and a low user density. The path is continuous and uses native materials, however obstacles are common. The trail has signage where it is needed for user reassurance.

The "Seven Hanging Valleys" trail was classified as "R" and "highly developed" stage with the provision of semi-natural recreational opportunities. The trail has full access and a high degree of remoteness. There are several 'legs' where users can enter and exit, while the two main access points are interconnected with popular recreational sites, such as beaches or cultural heritage. In relation to resource modifications, there are natural and artificial elements. However, the trail has a high user density and therefore overcrowding occurs frequently. The trail has a wide and smooth tread, infrequent obstacles, cleared vegetation around the trail with frequent and substantial trailside amenities, a wide variety of signs, and a modified recreation environment.

The "Knocknarea/Killaspugbrone" trail was classified as "SPNM" and at a "moderately developed" stage with the provision of natural and unmodified recreational opportunities. The trail has access through primitive roads and motorized trails, and it is half an hour walk from human activities and any motorized road. With regards to naturalness, there are only a few subtle modifications and a very low user density on the trail. In addition, there are only rustic and rudimentary trail facilities and limited information provision. The path is continuous and narrow with minor allowances constructed for passing, however with frequent obstacles. The trail's constructed features are of limited size, scale, and quantity. Nevertheless, the trail has signing as needed for user reassurance.

The "Plazaola Greenway" trail was classified as "RN" and "developed" stage with the provision of semi-natural recreational opportunities. The trail has full access hence a low level of remoteness. With regards to naturalness, the trail's modifications are in harmony with the natural environment and a low user density on the trail. The local municipality invested in the provision of rustic facilities for user comfort, site protection as well as on-site regimentation and controls.

4.2. Economic impact

4.2.1. Trail visitor characteristics

Table 3 shows the socio-demographic characteristics of trail visitors. It is evident that the share of men and women visiting trails in all four destinations is more or less equal. There are marked differences in the split between international and national visitors. Predominantly international trail visitors were in La Palma (91%) and southern Portugal (81%) with very small shares of national visitors, while the Ireland and northern Spain trails are visited by predominantly national visitors, respectively 91% and 64%. The main mode of access transportation across all trails was a car. The second most popular transportation choice to reach the trail was walk/run in southern Portugal, Ireland, and northern Spain, while in La Palma a taxi/rideshare option was the most popular.

Mean group size ranges between 1.74 persons in Ireland, 2.01 persons in southern Portugal, 2.42 persons in La Palma and 2.81 persons in northern Spain. The most frequent group size is two persons, which accounts for 59% ("La Caldera de Taburiente"), 66% ("Seven Hanging Valleys"), 44% ("Knocknarea/Killaspugbrone") and 52% ("Plazaola Greenway") of visitors. The majority of "La Caldera de Taburiente" and "Seven Hanging Valleys" trail visitors were first time users since those trails are visited by international visitors, while "Knocknarea/

Table 1
The results of the ROS class of each study case trail.

Recreation Opportunity Spectrum evaluation								ROS class
Settings	KPIs	P (1)	SPNM (2)	SPM (3)	RN (4)	R (5)	U (6)	SPM ◊
Physical	Access			◊, ▼		□, Δ		R □
	Remoteness		◊	▼	Δ	□		SPNM ▼
	Naturalness		◊, ▼		□, Δ			RN Δ
Social	User density		▼	◊, Δ		□		
Managerial	Facilities		▼		◊, □, Δ			
	Visitor management		▼	◊	□, Δ			

Note: Symbols assigned to each trail were (◊) for "La Caldera de Taburiente"; (□) for "Seven Hanging Valleys"; (▼) for "Knocknarea/Killaspugbrone" and (Δ) for "Plazaola Greenway".

Table 2
Evaluation of trail development stage.

Trail development stage evaluation						Development stage
Trail attributes	Minimally developed (1)	Moderately developed (2)	Developed (3)	Highly developed (4)	Fully developed (5)	
Tread & traffic flow		▼	□, Δ	◊		Developed Δ
Obstacles			◊, □, ▼, Δ			Highly developed □, ◊
Constructed features & trail elements		▼	□	Δ, ◊		Moderately developed ▼
Signs			▼, Δ	□, ◊		
ROS class		▼	◊	Δ	□	

Note: Symbols assigned to each trail were (◊) for "La Caldera de Taburiente"; (□) for "Seven Hanging Valleys"; (▼) for "Knocknarea/Killaspugbrone" and (Δ) for "Plazaola Greenway".

Table 3
Socio-demographic profiles of trail visitors.

Variable Categories	"La Caldera de Taburiente" (n = 395),	"Seven Hanging Valleys" (n = 454)	"Knocknarea/Killaspugbrone" (n = 211)	"Plazaola Greenway" (n = 461)
Gender (%)				
Female	52	51	52	47
Male	48	49	48	53
Origin (%)				
International	91	81	9	36
National	9	19	91	64
Mode of transportation (%)				
Car	74	67	65	39
Walk/run	1	25	27	28
Taxi/rideshare	21	6	1	2
Bus	3	1	5	2
Cycle	1	1	2	29
Dimension of the trail visitor group in persons				
Mean ± *SD*	2.42 ± 1.27	2.01 ± 0.9	1.74 ± 0.8	2.81 ± 1.8
Frequency of use of the trail (%)				
First time user	82	74	24	35
Less than few times a year	0	2	8	31
Few times a year	16	11	22	2
Several times a week	1	12	33	17
Every day	1	1	13	15

Killaspugbrone" and "Plazaola Greenway" trail visitors were typically recurrent since majority of trail visitors were local.

4.2.2. Structure of expenditure

Table 4 illustrates that group visitors accounted for the largest part of the total sample of each destination, constituting 86% for both the "La Caldera de Taburiente" and "Seven Hanging Valleys" trails, 55% for "Knocknarea/Killaspugbrone" trail and 59% for "Plazaola Greenway" trail. The mean daily expenditure of solitary visitors varies between the minimum 3 Euro in "Plazaola Greenway" and maximum 11 Euro in "Seven Hanging Valleys" trail, while group visitor mean expenditures vary between the minimum 7 Euro in "La Caldera de Taburiente" and "Plazaola Greenway" trails and maximum 20 Euro in "Knocknarea/Killaspugbrone" trail. Spending for accommodation accounts for 50% of total visitor expenditures for "La Caldera de Taburiente" and 27% for "Seven Hanging Valleys" trails, constituting the largest visitor expenditure category for both destinations. This shows that high expenditure in the accommodation sector is attributable to the higher stage of both trails' development and to the international visitor profile, whose visit to trails is a part of longer holiday stay. Spending for food and drinks was the largest visitor expenditure category for "Knocknarea/Killaspugbrone" and "Plazaola Greenway" trails, accounting for 46% and 36%

Table 4
Structure of trail visitor expenditure (€) in each trail.

Trail name	"La Caldera de Taburiente"		%	"Seven Hanging Valleys"		%	"Knocknarea/Killaspugbrone"		%	"Plazaola Greenway"		%
Sample size (n)	SV	GV		SV	GV		SV	GV		SV	GV	
	55	340		65	389		94	117		187	274	
Mean expenditure, €	6	7		11	9		4	20		3	7	
Expenditure per category, €												
Food & drinks	6	12	18	14	12	19	7	37	46	7	19	36
Accommodation	21	10	50	22	17	27	4	25	30	2	16	28
Transportation	11	21	31	12	13	20	2	10	13	4	7	15
Rentals	0	1	1	16	11	18	1	9	11	5	8	18
Local products	0	0	0	8	8	4	0	0	0	1	2	3
Guided tours	0	0	0	2	3	12	0	0	0	0	0	0
Total %			100	Total %		100	Total %		100	Total %		100

Note: SV – solitary visitor; GV – group visitor.

respectively. Local products made up the smallest portion of trail visitor expenditures in "Seven Hanging Valleys" and "Plazaola Greenway" trails, while visitors to "La Caldera de Taburiente" and "Knocknarea/Killaspugbrone" did not have any expenditures on local products nor on guided tours.

4.2.3. Income multiplier

Table 5 gives an overview of the estimated economic impact, income multipliers and development stages of trails in our sample. The highest values of income multipliers were estimated for "La Caldera de Taburiente" and "Seven Hanging Valleys" trails, respectively 0.71 and 0.77, which means that each euro spent by trail visitors will generate €0.71/0.77 as local income. Such results were due to the high level of development of both trails resulting in significantly lower intersectoral linkages and leakages. In addition, since the "Seven Hanging Valleys" trail is the most popular in the region, visitor expenditures were recorded in the largest variety of touristic sectors compared to other sample destinations. As for the island of La Palma and the trail "La Caldera de Taburiente", a high-income multiplier was due to the presence of businesses to supply inputs and demand outputs from the TRR, resulting from obligations associated with national park status, the trail's development, maintenance, and conservation. In contrast, significantly lower income multipliers were estimated for "Plazaola Greenway" and "Knocknarea/Killaspugbrone" trails with values of 0.53 and 0.39 respectively due to the low level of development of both trails; resulting from an absence of local businesses around the trail, low availability of human resources and finally resident expenses outside the study area leading to a high money leakage.

Multiplying the total tourist expenditure by the income multiplier, the annual local economic impact of €2,148,937 was estimated in southern Portugal, €1,638,210 in northern Spain, €589,007 in La Palma and €485,337 in Ireland. However, higher economic impact does not necessarily translate to a higher contribution to the local economy and community development, as observed for the case of northern Spain with a relatively low income multiplier value, meaning that a high share of trail visitor expenses leaks out the local area.

The final part of the analysis examined the relationship between the stage of trail development and the income multiplier. Initially, a correlation analysis was applied between values of income multiplier and stage of trail development considering the non-parametric Spearman's correlation coefficient. As shown in the Table 4, there is a strong and statistically significant correlation between the income multiplier and the stage of trail development ($r_s = 0.949$, $p < 0.05$). Fig. 4 shows that stage of trail development is positively correlated with income multiplier and demonstrates that investment in recreational trails to achieve a higher stage of development stimulates larger income multiplier in the local area. As additional exploratory analysis, a linear regression model was estimated to understand to what extent the stage of trail development explains the income multiplier. Results revealed that stage of trail development explains 97.0% of income multiplier and the income multiplier of a trail increases by 0.18 ($p = 0.015$), on average, for each additional stage of development.

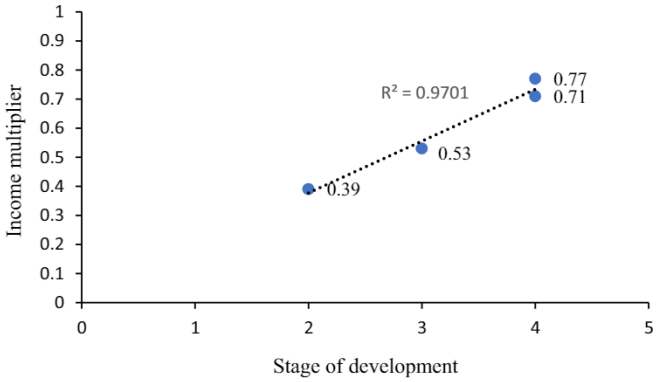

Fig. 4. Income multiplier by stage of trail development.

5. Discussion and implications

This study aimed to provide an explanation of the relationship between the stage of trail development and the income multiplier through the foundational theory of NBT local economic impact due to tourist's expenditure. To date, no studies have researched this relationship, therefore addressing this gap, the results of this study support the traditional nature-based recreation economic theory that recreational trail development creates value in alternative and sharing economies and is an important dimension to enhance regional/local economic impact (Gyimóthy & Meged, 2018; UNWTO, 2019). We extend knowledge by providing evidence that higher stage of trail development determines higher income multiplier in the local area. When referring to the economic impact, the framework of income multiplier describing the total direct and secondary effects resulting from additional tourist expenditure (Fletcher & Archer, 1991) has been widely applied by tourism scholars (Baaijens, Nijkamp, & Van Montfort, 1998; Drakakis et al., 2021; Hsu, 2019). Some trail scholars reported empirical observations that investing in recreational trails generates high economic revenues in rural and nature-based locations (Bowker et al., 2007; Raya et al., 2018). These assertions, however, are quite vague and do not provide a trail investment and development classification scheme and a link thereof to economic impact. This study contributes a well-defined framework for determination of stage of trail development and is unique via the correlation of that with income multiplier. Numerous scholars have concluded that the demand for trail recreation and its economic impact are related to trail infrastructure attributes and endowments, and as a consequence, are the most critical factors for increasing trail demand and visitor trail-related service spending (Kelley et al., 2016; Oswald Beiler, Burkhart, & Nicholson, 2015).

Building on these prior findings, this study contributes a well-defined framework for determination of stage of trail development and is unique via the correlation of that with income multiplier, providing evidence that higher stage of trail development determines higher income multiplier in the local area, and explaining the linkage with the income multiplier due to trail visitor spending. This finding is novel and equally relevant to any trail destination globally in enabling the accomplishment of more positive economically impactful outcomes.

The second novel addition to the theoretical framework is related to the size of trail catchment area, falling within the minimal available administrative unit; stage of development; trail length; and the magnitude of income multiplier. Previous recreational trail scholars assumed

Table 5
Correlation between the income multiplier and the stage of trail development.

	"Knocknarea/Killaspugbrone"	"Plazaola Greenway"	"La Caldera de Taburiente"	"Seven Hanging Valleys"
Economic impact, €	485,337	1,638,210	589,007	2,148,937
Income multiplier	0.39	0.53	0.77	0.71
Stage of trail development	Moderately developed	Developed	Highly developed	Highly developed
Spearman's correlation coefficient (r_s)	0.949*			

* p-value<0.05.

that developed trails encompassing large geographic areas usually offer comparatively numerous spending possibilities for trail visitors and higher economic impact (Božić & Tomić, 2016; Duglio & Beltramo, 2017; Pollock, Chase, Ginger, & Kolodinsky, 2012). Moreover, tourism economist Geoffrey Wall postulates that the size of the area is one of the most critical factors changing the income multiplier, in that the larger the area, the bigger the multiplier (Wall, 1997). However, based upon the main finding of this study, the mentioned assumptions cannot be applied to nature-based recreation and particularly recreational trails as the main results revealed that stage of trail development and not size of the area is the primary determinant of multiplier. This study found that less developed long-distance trails, covering large areas, which include several municipalities, exhibited one of the smallest income multipliers when compared to short-distance highly developed trails, covering smaller areas. This contrasting finding can be explained by the density of residents in the local trail area. If there is a very low resident density, absence of local businesses owned by local residents and a high dispersion of trail visitor expenditures throughout the municipalities, an elevated level of money leakage outside the local area occurs resulting in a very low multiplier effect. Improvement of understanding of the relationship between trail development stages and income multiplier magnitudes enables achievement of better trail development practices, effective selection of locations which are currently economically promising for trail development and strategies for revival of economically depressed and derelict rural areas through TRR. Thus, the findings facilitate optimal location selection for TRR development. It is especially important for places heavily reliant upon sun and sea recreation, which suffer from seasonality, high tourist flows and enormous congestion on sandy beaches, and where tourist volume dispersal towards recreational trails is critical in order to shift tourist expenditures and stimulate local economic impact while simultaneously protecting fragile ecosystems (Bramwell, 2004; Leka, Lagarias, Panagiotopoulou, & Stratigea, 2022).

Another novel addition to the theoretical framework is related to the definition of trail recreational opportunities, development stages and their respective KPIs; that shape not only economic impact but also profile of trail visitors, their trail-related experiences and expenditure patterns. This expanded framework equips one to consider all recreation opportunity attributes related to a trail's safety, design, remoteness, naturalness, facilities and service provision, and visitor management which leads to better economic trail performance and shifts the paradigm away from the traditional strategy of investments in recreational service provision only (Getz, 1993). Consideration of a trail and its surrounding infrastructural design, as well as recreational service provision are proposed by this study as important attributes to factor in when trying to develop more viable and economically successful trails. It was found that among the highest trail visitor expenditures were accommodation and food and drink services, which is in line with previous findings in Taiwan (Hsu, 2019), Portugal (Lukoseviciute et al., 2022), Germany (Mayer et al., 2010), Finland (Huhtala, 2007), and Spain (Raya et al., 2018). Nature-based visitors are usually day-trippers, who primarily seek various food and drink service establishments or overnight visitors, prioritizing the service of trail accommodation (Mehmetoglu, 2007), therefore, these service categories receive the highest share of visitor expenditure along with the highest share of income and are associated with high stages of trail development. While expenditures in other sectors were not frequent and significant, this could be explained by the nature of trail visitors, who focus on exploring nature's beauty and therefore expenditure is often limited to food and accommodation services. The results of this study provide a roadmap on how to develop profitable trails based upon the attributes described by the ROS framework and indicate that a highly developed trail with safety, constructed features and trail elements, minimum obstacles, proper signage, maximum recreational opportunities provision, easy access, naturalness, proper visitor management and facility provision; will ensure increasing trail visitor demand, satisfied visitors, increased user expenditures, and greater income multiplier. However, some previous researchers have argued that if recreational trails are developed for the purpose of training or for professional sports, the expenditure on buying or renting equipment locally would be among the largest spends (Hjerpe & Kim, 2007; Pollock et al., 2012). This implies that trails targeting high stage of development as derived from the ROS framework should emphasize certain attributes appealing to users with particular training or sport interests. This can be demonstrated by the cases of "Plazaola Greenway" trail, which is designed for cyclists and walkers, and "Knocknarea/Killaspugbrone" trail, developed to cater users interested in walking, cycling, running and water sports; since both trails have not yet achieved a high stage of development and currently perform with low income multipliers.

In countries or regions with large existing tourist influx, it is relatively easy to develop TRR with modest investments in marketing. In addition, tourism destination managers have privilege to decide at which stage to develop trails in order to gain satisfactory economic contribution to local economies depending on whether trails have been chosen as the main or alternative tourism products. However, rural and remote trail areas in non-touristic destinations mainly visited by locals, with very few international tourists and no existing tourism base to leverage, require much larger investments in the entire touristic infrastructure framework and higher stages of trail developments so that trails may function as main tourism products and local economic development tools. Furthermore, for effective trail development with the goal of creating significant local economic impact, the climatic element plays a vital role in forming and reinforcing the tourism base, as well as the demand for nature-based recreation activities (Falk, 2013). Countries with favourable climatic zones for sun and sea recreation have experienced advantages in facilitating destination image construction and the development of diverse tourism products (Gómez-Martín, 2005; Pike, 2002); therefore, trail developments in such places are much more likely to be economically successful than in places with climatic conditions unfavourable for recreation simply due to differences in visitor volume.

While expenditures by trail visitors may help stimulate local economies, trail community development practitioners should know that rural and underdeveloped areas may initially face significant money leakage due to a lack of trail-related services and low population density, as is demonstrated by moderately developed rural trails. Tourism demand models propose that a combination of attractions, promotion, adequate transportation networks, available information, and services drive the popularity of a destination and increase visitor expenditures (Gunn & Var, 2002). With regards to trail destinations, there are additional elements that play an important role in a visitor attraction system and economic impact generation such as safety and security (Keith et al., 2018), natural landscape quality (Dorwart, Moore, & Leung, 2009), and trail design (Davies et al., 2012) as is defined by the ROS framework. Furthermore, in order to stimulate local economic development through NBT products, a community-based model that involves local communities in guiding the development of recreational trails should be used (Alavalapati & Adamowicz, 2000; Kline, Cardenas, Viren, & Swanson, 2015), because the degree to which communities choose to embrace various trail destination strategies may shape the resulting economic impacts (Bowker et al., 2007). Therefore, the results of this study are relevant when having a dialogue with local communities to discuss and set a targeted stage of trail development based on specific trail attributes and recreational services that also benefits the local community through employment and local income generation (Oswald Beiler et al., 2015).

The findings of this study are beneficial to the recreational trail tourism sector, trail development bodies and investors because they assist in identifying target trails with a high income multiplier and local economic effect. Identifying stages of development which alter income multiplier could explain economic failures of trail investments and their management, leading to more balanced and effectively targeted trail funding. Therefore, investments in trails can be better distributed towards the attributes, as described by the ROS framework, which are

most efficient in achieving the desired stage of trail development within fiscal constraints. The results of this study can serve as a role model for a strategy for revival of economically depressed rural areas, which can be used by groups considering trails as a tool for rural economic development. This study provides a roadmap for trail managers, local planning authorities and broader tourism industry professionals of trail recreational opportunities and development stages with their respective KPIs, which facilitates improved trail development planning and more efficient modification of current trail development and management practices (Bowker et al., 2007; Neumann & Mason, 2019; Tyrväinen et al., 2014). An implication is that trail managers must consult with local businesses and entrepreneurs during the trail development process in terms of trail development attributes which lead to a higher stage of development and in particular recreational opportunities provision described by the ROS framework (to which process local businesses have a strong incentive to contribute since they are primary beneficiaries of trail developments) since a high stage of trail development is unlikely to result in a higher income multiplier in the absence of trail-related businesses. In terms of policy relevance, this study can serve to inform regional NBT developers and policy makers about the most optimal trail development location among the alternatives and whether it is sustainably profitable to invest in trail development there to achieve a highly developed recreational trail stage given limited available funds (Kelley, van Rensburg, & Yadav, 2013; Tyrväinen et al., 2014). In addition, stakeholders interested in timely and effective TRR development should focus more on short-distance trails since this study found that short-distance highly developed trails generate higher income multiplier and are therefore more likely to generate significant local TRR derived income.

6. Conclusions, limitations, and future research

This study is the first to advance nature-based recreation economic impact theory through the explanation of the relationship between the stage of trail development and income multiplier. Our study found a strong correlation between recreational trail development and income multiplier, revealing that higher stages of trail development stimulate greater income within local areas due to increased trail visitor expenditure.

From a theoretical perspective, the present study introduces a new paradigm in TRR and economic impact theory and enhances it through the cross-linking of concepts of economic effects and development of recreational trail opportunities, providing a clear understanding of how stage of trail development alters the magnitude of income multiplier. Our findings here show that recreational trail opportunities and provision of services through higher stages of trail development can increase trail visitor expenditure and influence local economic development via enhanced income generation.

From a methodological perspective, this research proposes using the comprehensive Ad hoc approach to estimate the local economic benefits in terms of income multiplier effect due to trail developments and recreation. This study used a combined approach of the ROS framework and the Ad Hoc model, considering a variety of trail settings. It is a useful approach for local-scale trail destinations due to the exclusion of sophisticated statistical resources, which are rarely available for local areas and are often out of date. The Ad hoc model approach can be applied to any type of trail and is easily replicable for any season when monitoring the magnitude of income multiplier since it uses primary data collected only by surveys. With regards to the ROS framework, it is a pioneering approach to assess the provision of recreational opportunities and stage of trail development, can be applied to any type of trail at any time of the year by individuals without expertise in tourism economics. The framework is highly accessible and can be easily combined with other approaches in particular incorporating the perceptions of local stakeholders in terms of trail development attributes. Finally, the combined methodology applied in this research facilitates more holistic assessment of trail developments in terms of economic impact and recreational opportunities provision, reflecting the level of recreational challenge provided by a trail.

While our overall research design is based upon a specific cases within the European Atlantic area using only four representative recreational trails in Portugal, Spain, Ireland and Canary Islands; our approach is valid since the goal was to extend the current theoretical framework of economic impact of recreational trail development via innovation regarding the relationship between the stage of trail development and income multiplier, and thus providing a footing for future TRR economic impact research. Nonetheless, our study has its limitations. In this study, the current stage of trail of development and economic impact was assessed by collecting data from the actual trail performance and trail visitor expenditure. However, future scholars should study and deepen understanding of trail development scenarios based on the ROS classification and the type of trail-related services preferred by potential visitors, applying behavioural contingency assessment. Collection of this data would facilitate trail design and development as preferred by trail visitors, and expansion of trail visitor volume, visitor loyalty, total trail-related expenditures and economic impact. Moreover, future scholars should study economic impact and income multiplier of highly developed trail networks in places with less tourism influx to boost regional or even national economic development. Also, this study investigated trails located in relatively socio-economically stable and prosperous countries; it suggests that future research can also explore the intriguing relationships between trail developments and their income multipliers within low GDP per capita unstable developing nations, trail visitor volume and a trail destination's security factor. Therefore, this study points to several important research directions that will likely help develop the methodological and theoretical foundations for recreational trail development and economic impact in nature-based tourism, local/regional development and beyond.

Declarations of Competing Interest

none.

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Appendix A. Trail visitor questionnaire

This questionnaire is anonymous, confidential, and will be used only for scientific research purposes. The questionnaire has been approved by the ethics committee of the University of Algarve with the reference number CEUAlg Pn° 52/2021. The aim is to get information about trail visitors' demographic profile and expenditures related to the trip and visitation of the trail in the local area. The collected data will help to investigate how trail-related tourism contributes to local economic development and how both trail-related tourism and its economic impact might be improved. Your answers are very important, and we would like to thank you for your willingness to participate.

1. **Where do you live?**

a) I am a local resident (I live in the local municipality/parish/county).
b) I am from another location (within the country, please specify) _____
c) I am from abroad (please, specify the country) _____

2. **What was your main mode of transportation to get to the trail?**

a) Car b)Bus c)Train d)Walk/Run e)Taxi/Uber f)Cycle g) Other (specify) _____

3. **How often do you use the trail?**

a) First time user b) Every day c) Several times a week d) Once a week e) Once a month f) Few times a year g) Less than a few times a year

4. **What is the composition of your group today including you?**

a) It's just me
b) Adults (please, specify number) ____

5. Children under 18 (please, specify number) _____
6. **What is your gender?** Female Male
7. **What is your main activity on the trail today?**

a) Walking/hiking b) Exercise/training c) Family activities d) Social activities e) Pet walking f) Wildlife watching g) Sightseeing h) Photography

14. If you are staying overnight to visit the trail, what is the type of accommodation?
Hotel b) Lodging c) Apartment d) Local accommodation (room, house, apartment and lodging) e) Caravan parks f) Private holiday home g) Other.
15. How much is your spend per person associated with the trail?

	Tourists´ consumption in Euros per capita (if a group is surveying)	Tourists´ consumption in Euros per capita (if individual is surveying)
Food & Drink (in restaurants)		
Accommodation		
Transportation (e.g.bus ticket, uber, other transportation service)		
Rental (e.g. car, bikes)		
Guided tours (e.g. boat tour, dolphin watch)		
Local products (e.g. handcrafts, souvenirs)		
Playing golf		
Water sports		

16. How many people do the figures provided relate to (including you)?
Adults ____ Children (under 18) _____.

Appendix B. Resident questionnaire

This questionnaire is anonymous and confidential and will be used only for scientific research purposes. The questionnaire has been approved by the ethics committee of the University of Algarve with the reference number CEUAlg Pn° 52/2021. The aim is to get information about residents' household consumption in the local area and calculate the ratio of income to total expenditure per month. The results will help to investigate how trail-related tourism contributes to local economic development and how both tourism and economic impact might be improved. Your answers are very important, and we would like to thank you for your willingness to participate.

1. **How much do you spend per month in each of the following categories?**

	Euros
01 Food and non-alcoholic beverages	
02 Alcoholic beverages, tobacco and narcotics	
03 Clothing and footwear	
04 Housing, water, electricity, gas and other fuels	
05 Furnishings, household equipment and routine household maintenance	

(*continued on next page*)

(*continued*)

	Euros
06 Health	
07 Transport	
08 Communication	
09 Recreation and culture	
10 Education	
11 Restaurants and hotels	
12 Miscellaneous goods and services	

2. **How much do you spend per month in each of the following categories in the local area?**

	Euros
01 Food and non-alcoholic drinks	
02 Alcoholic beverages, tobacco and narcotics	
03 Clothing and footwear	
04 Housing, water, electricity, gas and other fuels	
05 Furnishings, household equipment and routine household maintenance	
06 Health	
07 Transport	
08 Communication	
09 Recreation and culture	
10 Education	
11 Restaurants and hotels	
12 Miscellaneous goods and services	

3. **What is the proportion of your monthly income that you spend per month?** _____
4. **What are your total expenditures per month in Euro?** _____
5. **How many people do the figures provided relate to (including you)?** Adults ____Children (under 18) _____
6. **What is your gender?** Male/Female
7. **What is your age?** _____
8. **What is your occupation?**

a) Employed b) Self-employed c) Unemployed d) Student e) Managing household f) Retired

9. **How many people live in your household?** _____

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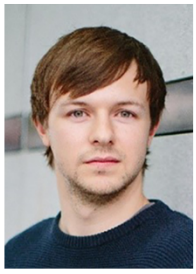

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