

Geo-knowledge Management and Geoconservation via Geoparks and Geotourism

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Abstract A geopark as a new tourism destination contains a number of geological heritage sites. Geoparks as an innovation for the protection of natural and geological heritage are a network of sites for the transfer of Earth knowledge and the popularisation of geosciences. Moreover, geoparks play an important role in rural development through local involvement in geopark and geotourism activities. This paper discusses the role played by geoparks in the conservation and geo-knowledge management. To this end, 25 geopark strategies were analysed (20 in Europe and three in Asia: Malaysia, Japan and Iran; one in Australia and one in South America: Brazil). The results indicate that finding, introducing and establishing geosites are the first steps for geopark creation. Furthermore, involving local communities in the conservation of geoparks and providing educational projects are key factors in the knowledge management and preservation of geoparks as new tourist attractions.

Keywords Conservation · Geoconservation · Geopark · Geotourism · Knowledge management · Local involvement

Introduction

The fact is that people have always been visiting ‘geographical wonders’ such as mountains, caves and canyons. However, only in recent times has there been a real challenge in this sector, and geological heritage has been developed into a market (geotourism) with very specific and novel characteristics. Geoparks as a new model of sustainable development in natural areas are the avant-garde for geotourism development. It can be said that geoparks on one hand preserve a unique geological heritage and introduce it as a tourist attraction and on the other hand try to popularise geo-knowledge. According to UNESCO (2006), geoparks follow three targets: conservation, education and development of the local economy through geotourism. Geoheritage, which draws attention to the geological and geomorphological elements of nature worthy of conservation, has for years been considered less vulnerable than other environmental values. Therefore, it has not received the same amount of attention from the conservationist movement as cultural and ecological heritage (Reynard and Coratza 2007).

In German-speaking countries, geotopes provide information on the evolution, properties of the Earth’s crust, structure and on the geological past (Röhling and Thomé 2004). In 1993, the term ‘geodiversity’ was used by Wiedenbien (1994) in relation to geotope conservation. Geodiversity is currently used in parallel with the term ‘biodiversity’ to indicate the natural diversity of the abiotic part of nature and its influence on both biodiversity and cultural diversity (Gray 2004). Moreover, Pereira et al. (2007) presented the various steps involved in the compilation of the inventory, selection and assessment of sites of geomorphological interest for

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promotion by the Montesinho Natural Park Board (Portugal), especially with regards to their educational value (Pereira et al. 2007). It is evident that the inventory, selection and assessment of geological and geomorphological sites are the first steps for the establishment of geosites and finally the establishment of geoparks. Geoconservation is a growing activity, with more participants and a greater profile now than ever before (Burek and Prosser 2008). It is noteworthy that geoconservation is very well established across Europe and Australia, and with the World Heritage List and especially the rapid growth of geoparks, it is now coming to importance in many other parts of the world (Burek and Prosser 2008). Establishing a geopark may be not only the best way to promote tourism marketing in these areas but also a strategy to preserve geological heritage (Johnson et al. 2010).

Since education can be a means of conservation of natural heritage (both biological and geological) and a technique for knowledge management, activities such as creating teaching resources, using the latest technologies, supporting field trips, building up a website presence, promoting school visits, conferences, exhibitions, supporting museums and disseminating information through major teaching associations can be good examples of how to popularise and preserve the geoheritage sites and geological features (Anderson and Brown 2010).

One of the key factors for sustainable conservation in geoparks is the level of awareness of stakeholders, particularly the local communities. Therefore, popularisation and universalisation of Earth knowledge and local involvement can be a strategy for sustainable development (Eder and Patzak 2004 ; GGN 2010).

The primary purpose of this study is to present a summary of strategies for geo-knowledge management in geoparks. This paper also investigates the work being carried out in geoparks for preservation of geological heritage as a new tourist attraction. In addition, the research also investigates whether the finding of qualitative and quantitative analysis confirms the expected results in literature reviews or not.

Geo-knowledge Management

According to the Oxford Dictionary (2012), knowledge includes facts, information, descriptions or skills acquired through experience or education. Knowledge is more comprehensive than sciences. It can be said that geo-knowledge not only comprises geosciences but also includes empirical and practical experiences regarding Earth preservation.

At present, the Earth faces problems such as global warming, air pollution, unsustainable activities, unsustainable tourism etc., most of which have occurred due to a shortage of strategies for the popularisation of earth sciences (geology, geography, geomorphology and geoconservation); as well as the weakness of practical strategies for geo-knowledge

transfer and unsustainable performances of governments at diverse levels according to their economical benefits.

Construction, embodiment and dissemination are elements for managing and sharing knowledge (Demarest 1997). Some authors (Nonaka 1991; Liebowitz 1999; Sveiby 2001) introduced knowledge management as an art of creating value from intangible assets. It is evident that geology and geomorphology comprise of complex and intangible scientific concepts which are not user-friendly for the public in general and schoolchildren in particular. In recent decades, geoparks and geotourism strive to make tangible products from the intangible concepts and ideas in geosciences. In addition, geoparks and geotourism attempt to transfer geo-knowledge from professional levels to public levels. Generation and use of new knowledge to feed innovation and product development play a pivotal role in competitiveness of both tourism destinations and enterprises (Hjalager 2002). For example, the combination of geology and geography sciences with tourism and local communities allowed the creation of a new niche market now widely designated by 'geotourism' which includes innovation and new concepts and products in tourism such as geotours, geo-products, geo-restaurants, geo-sports, geo-festivals etc. It is noteworthy that the tourism product is a complete experience, encompassing everything from the time a tourist leaves his home to the time he returns back (Weiermair 2006).

Knowledge transfer occurs in four ways: (1), tacit to tacit, achieved through a process of socialisation via meetings and team discussions; (2), tacit to explicit, externalised through brainstorming and the use of developers, which is a priority for tourism; (3), explicit to explicit, by moving knowledge around a network from one organisation to another, which is relevant for destinations and (4), explicit to tacit, taking explicit knowledge such as a report and generating new ideas. Explicit knowledge is transferable and easier to codify than tacit knowledge (Nonaka 1991). Thus, it is usually the focus of an organisation's interest and is found in such forms as documents, databases and files. Furthermore, tacit knowledge and its owners are difficult to manage (Cooper 2006). This is more developed in the following examples. For instance, organising the European Geoparks Conferences, the European Geoparks meetings and the UNESCO Conference on Geoparks are examples for tacit to tacit knowledge transfer (e.g. through simply exchanging ideas) or tacit to explicit (e.g. registering those ideas in a systematised way in the proceedings).

Moreover, the publication of the Global Geopark Network (GGN) newsletter and European Geopark Network (EGN) newsletter and circulating them through internet and social networks are examples of explicit to explicit knowledge flow.

Organising geotours for blind tourists by *Greenwalk Tours*, Lisbon, Portugal (Tavares 2011) (Fig. 1), constitute other good examples regarding explicit to explicit knowledge transfer.



Fig. 1 Tactile diorama for blind people during field trips for accessible tourists organised by Greenwalk Tours (source: photo by Greenwalk Tours)

Generating new ideas, innovation and developing new concepts associated with the emergence of geotourism activities and geoparks such as geo-products, geo-sports, geotours, geo-play parks, geological gardens, geo-cookies and geo-desserts (Fig. 2) can be considered as examples of transfer of knowledge from explicit to tacit.

Network activity can help to maximise the sustainability of employment, stimulate processes of social innovation and provide an opportunity for knowledge management and exchange of knowledge (Lowe et al. 1995; Day 1998; Murdoch 2000; Sobels et al. 2001; Lee et al. 2005; Chris et al. 2005; Hall 2005; Romeiro and Costa 2010). Technology is an enabling tool for knowledge management and knowledge transfer (Standards Australia 2003). Hence, ICT and network activities can eliminate the borders and unite the world. There is no doubt that technology as a key driver accelerates knowledge transfer and reduces the price of transfer (Buhalis 2003).

Knowledge maps or storyboards are also commonly used and act as visual directories pointing a person in the right direction to access sources (Cooper 2006). For instance: geotouristic maps, creating animations for schoolchildren (e.g. Palaeozoic Era animations); preparing online games

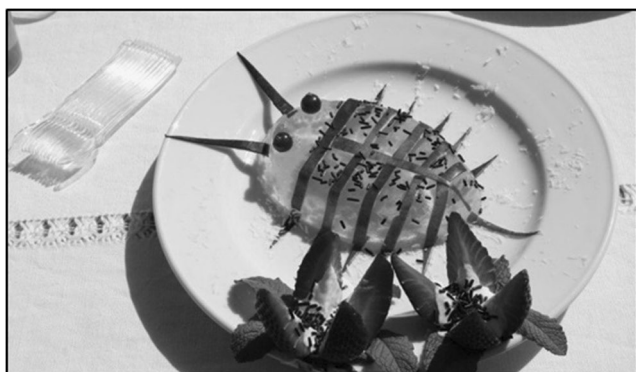


Fig. 2 Geo-dessert of a trilobite which is the symbol of Arouca Geopark, Portugal (source: Arouca Geopark webpage in Facebook)

about our Earth for children and exhibitions (e.g. dinosaur exhibition in the Naturtejo Geopark or the Paleozoic Era exhibition in Arouca Geopark, both in Portugal in 2010) can be strategies for the popularisation of geo-knowledge.

Higher education institutions play a vital role in knowledge management. Higher education through research, teaching and services can transfer knowledge into practice (Hawkins 2006).

Since the study of geotourism is classified in interdisciplinary sciences as well as tourism marketing, so collaborations and network activities between specialists in related sciences such as geology, geography, ecology, tourism, biology, agriculture, environment etc., can be a useful instrument for the development of geotourism in the present and future (Farsani et al. 2012). Thus, geotourism is an interdisciplinary area of knowledge and organising a mandatory course or university degree in geotourism for students who are studying in science-related degrees such as tourism, geology, geography etc., can be a strategy for geo-knowledge transfer and preservation of our Earth in the future.

The new Missouri State University (USA) offers a Bachelor of Science Degree in Geography-Geotourism, and this degree explains geotourism and its components (Iantria 2011). In addition, in Iran, at Payame Noor University, Bachelor's degree courses on geology offer an optional geotourism unit.

For an optimum dissemination of geo-knowledge, courses in geotourism should be organised in higher education institutions as well as universities.

Consequently, in recent decades, geoparks and geotourism through innovative strategies and network activities try to transfer geo-knowledge from the professional level to local level and strive to make tangible products from the intangible geoscientific concepts.

Methodology

This paper focuses on two targets of the establishment of geoparks (conservation and education) and involvement of local communities in geopark activities. Moreover, the study aims to discover strategies and innovation which are applied in geoparks to preserve geological and natural heritage.

By comparing 25 different geoparks as geotourism destinations in Europe, Asia, Australia and South America, we accessed key concepts in the conservation of geological heritage. This study has two major purposes as below

- To introduce strategies for geo-knowledge management
- To investigate the key concepts for the conservation of natural and geological heritage in geoparks as geotourism destinations

The research methodology includes both primary and secondary researches. The first phase consists of an extensive literature review of existing reports on geotourism and geoparks. The second phase is focused on the geoparks registered in UNESCO and the comprehensive collected information. As geoparks and geotourism are new concepts, there were not enough related references. An electronic questionnaire-based method was developed for evaluating geopark activities. Data for this study were collected from March 2009 to January 2010.

According to some authors (Strasser et al. 1995; Wimbledon 1996; Reimold 1999; Heitzmann et al. 2006; Reynard and Coratza 2007), establishing geosites and geoparks are key components in geoconservation. In addition, educational activities are the best means of preservation of geological heritage (Catana and Rocha 2009; Anderson and Brown 2010). Moreover, involving local communities in geopark conservation projects can be a strategy for the preservation of geological and geomorphological heritage (Richardson and Shakespeare 2009; Geraldés and Ferreira 2009).

Pursuant to geopark activities and the literature review, it is evident that geoparks play an important role in the conservation and popularisation of geo-knowledge. Regarding this, the following hypotheses will be tested in this paper:

- H1: Geoparks involve local communities in conservation activities.
- H2: Geoparks contribute towards increasing geological knowledge and employment of local communities in rural areas and geopark territories.

Two open questions were designed for geopark authorities: the first question investigates conservation activities in geoparks, and the second question evaluates the number of people involved in geopark conservation activities.

Organising workshops managed by fully trained local volunteers and authorities of geoparks for schoolchildren, tourists and local communities is the next strategy of geoparks for conservation and knowledge management. Concerning this strategy, three closed questions were designed: the first question evaluates whether geoparks organise workshops or not; the second and third questions ask whether organising workshops in geopark territories promotes the local economy.

Electronic questionnaires were sent to all geoparks around the world registered by UNESCO in 2009 ($N=64$). Twenty-five questionnaire responses were received (39%). Thus, 25 geoparks (Table 1) were selected for this investigation. The majority of responses were collected in Europe (80%) and the others were from Australia, Iran, Malaysia, Japan and Brazil. The data handling tool used in this research is SPSS and NVivo software.

Table 1 Countries that replied to the questionnaires (2009)

No	Country	Geopark
1	Australia	Kanawinka Geopark
2	Austria	Nature Park Eisenwurzen
3	Brazil	Araripe Geopark
4	Croatia	Papuk Geopark
5	Czech Republic	Bohemian Paradise
6	France	Réserve Géologique de Haute-Provence
7	Germany	Vulkaneifel Geopark
8	Germany	Geo and Nature park TERRA.vita
9	Germany	Geopark Harz .Braunschweiger Land Ostfalen
10	Germany	Swabian Alb Geopark
11	Greece	Psiloritis Natural Park
12	Iran	Qeshm Geopark
13	Ireland	Copper Coast Geopark
14	Italy	Geological, Mining Park of Sardinia
15	Italy	Parco Naturale Adamello Brenta
16	Japan	Itoigawa Geopark
17	Malaysia	Langkawi Geopark
18	North Ireland	Marble Arch Caves Global Geopark
19	Norway	Gea Norvegica Geopark
20	Portugal	Naturtejo Geopark
21	Portugal	Arouca Geopark
22	Romania	Hateg Country Dinosaurs Geopark
23	Scotland	Lochaber Geopark
24	Spain	Sobrarbe Geopark
25	Spain	Parque Cultural del Maestrazgo

We draw attention to the fact that all countries except China filled in the questionnaires. Thus, if from a statistical point of view, we exclude the Chinese geoparks (22) from the population ($N=64$); we end up with 42 geoparks registered in UNESCO. Bearing in mind that 25 questionnaires were sent back to us, it means, therefore, that the final response rate is increased to 59.5%.

Results

Findings of the Empirical Study

Novel Strategies for the Conservation of Natural Heritage in Geoparks

As mentioned in the [Methodology](#) section, the NVivo software was used in this study to analyse the open question (Q1: What are the conservation activities in geoparks?). This open question introduced strategies for the conservation of geoparks. Applying NVivo software identified the terms

‘local, geosite, educational and project’ as key concepts in the conservation of geological heritage.

The Fig. 3 illustrates the percentage of coverage of the aforementioned terms in the analysed record and illustrates its most frequent terms. The term ‘local’ shows the highest frequency of usage and after that is ‘geosite’ with more frequency. Thus, locals play an important role in the conservation of geoparks, because no one knows the territory better than the local community. Moreover, finding, introducing and establishing geosites are other strategies for the conservation of geoparks and unique geological heritage. The word ‘educational’ has the third highest frequency, so educational programmes are known as a way to conserve geological or geomorphological heritage.

It is noteworthy that the results of the survey by means of NVivo software supported the expectations of the literature review.

It is obvious that every geopark includes some geosites, and finding, introducing and establishing geosites are the first steps for geopark creation. Thus, according to the results obtained by the NVivo software, involving local communities in the conservation of geoparks and providing educational projects are key factors in the preservation of geoparks which are explained in detail below.

Involving Local Communities in Geopark Activities

On the basis of the results of NVivo software analysis and the literature review, geoparks, in order to conserve natural and geological heritage sites, utilise the workforce and the knowledge of local communities in geopark territories.

As involvement of local communities in the conservation of geoparks can be a strategy to improve the local economy,

the majority (80%) of geopark authorities argued that the conservation of geoparks can create part-time and second job opportunities for local communities (Fig. 4 and Table 2). Among the respondents, only 15 geoparks replied to the question (How many people are involved in conservation activities?). Results illustrated that the establishment of a geopark in each territory engages an average of about 11 persons in geopark conservation activities in the form of volunteering, supplementary income, part-time, full-time, seasonal and second job opportunities (Mean=10.53, SD=14.78). In addition, respondents indicated their conservation activities as follows: Langkawi Geopark (Malaysia) has organised cleanliness programmes for schoolchildren and local communities, with the collaboration of environment-related non-governmental organisations (NGOs) such as the World Wild Fund (WWF), and Vulkaneifel Geopark (Germany) involves the locals in preventing sheep overgrazing. It is noteworthy that most geoparks employ locals in preservation activities such as park guards, park guides and site surveillance.

Meanwhile, some geoparks such as the Naturtejo Geopark, Araripe Geopark, Sardinia etc., believe that educational programmes play an important role in geopark conservation, and they try to involve and train locals in educational activities and organising workshops.

Thus, the next section will focus on educational activities and workshops in geoparks.

Educational Activities in Geoparks

Education as a fundamental prerequisite for the achievement of sustainable development is known as a conservation method in geology. Thus, holding workshops,

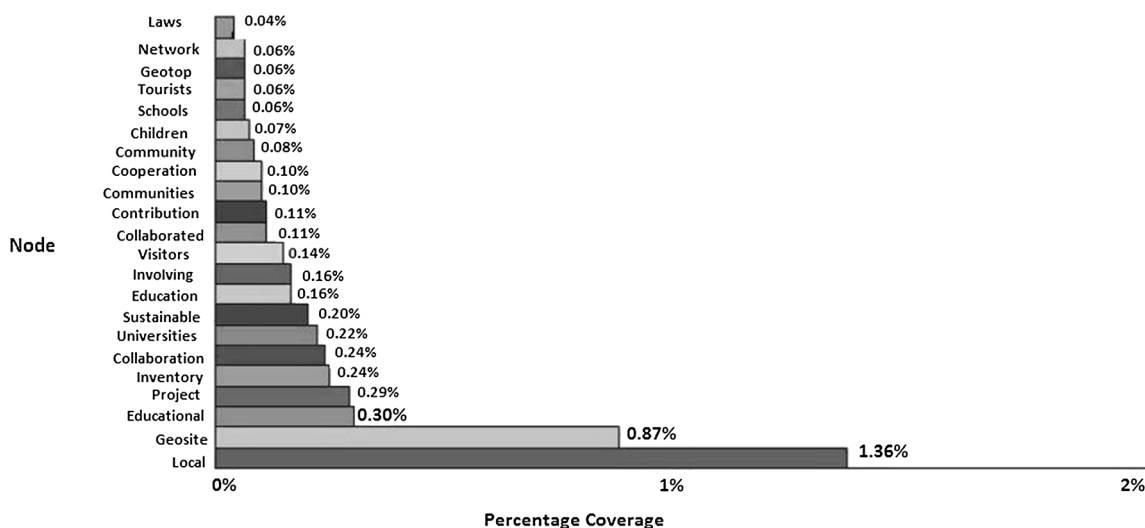


Fig. 3 Results of qualitative analysis of open questions regarding conservation

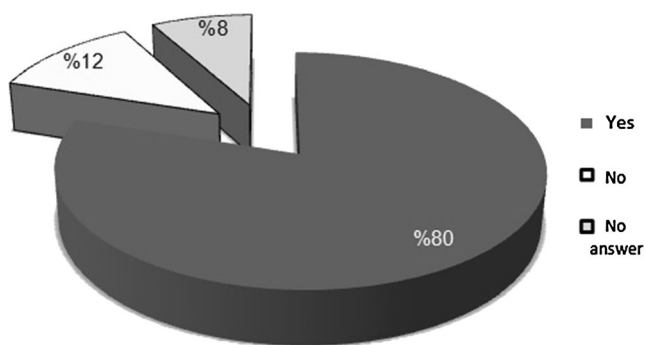


Fig. 4 Percentage of geoparks which believe that the conservation of geoparks improves the local economy

establishing museums, thematic museums, thematic networks, information centres, geo-trails, providing geotouristic maps, organising geological excursions, guided tours, school class excursions and outdoor laboratories, preparing maps, educational materials and displays, seminars, the annual conference of the European

Table 2 Names of the geoparks for each class of answers (2009) (the conservation of geoparks improves the local economy)

Geopark	Yes	NO	No answer
Kanawinka Geopark	×		
Nature Park Eisenwurzen	×		
Araripe Geopark	×		
Papuk Geopark	×		
Bohemian Paradise		×	
RéserveGéologique de Haute-Provence	×		
Vulkaneifel Geopark	×		
Geo and Nature park TERRA.vita	×		
Geopark Harz .Braunschweiger Land Ostfalen	×		
Swabian Alb Geopark	×		
Psiloritis Natural Park	×		
Qeshm Geopark	×		
Copper Coast Geopark		×	
Geological, Mining Park of Sardinia	×		
Parco Naturale Adamello Brenta	×		
Itoigawa Geopark	×		
Langkawi Geopark	×		
Marble Arch Caves Global Geopark		×	
Gea Norvegica Geopark			×
Naturtejo Geopark	×		
Arouca Geopark	×		
Hateg Country Dinosaurs Geopark	×		
Lochaber Geopark		×	
Sobrarbe Geopark	×		
Parque Cultural del Maestrazgo	×		

Geoparks Network and Global Geoparks Network and so on are strategies applied by geoparks to educate locals, children including schoolchildren and tourists. Holding workshops is not only a way to preserve the natural (geo and bio) and cultural heritage in geoparks but also promotes the local economy through involving local communities in these activities. Regarding this, some questions (Table 3) were designed to inquire into the awareness of the role of workshops, which are held in geoparks, in the local economy.

Results indicate that the majority of geoparks (72%) have been equipped with workshop facilities, and 56% of geopark authorities believe that workshops improve the local economy through involving locals, artists, geologists etc.

A geopark organises activities and provides logistic support to convey geoscientific knowledge and environmental and cultural concepts to the public. This is accomplished through protected and interpreted geosites, museums, information centres, trails, guided tours, school class excursions, popular literature, maps, educational materials and displays, seminars and so on. A geopark also fosters scientific research and cooperation with universities and research institutes, stimulating negotiation between the geosciences and the local population.

A plan for sustainable development in a geopark territory needs interdisciplinary studies and cooperation among universities, schools, kindergartens, museums, local authorities and different stakeholders.

Consequently, educational activities exist in the core of geoparks’ interests and operations; geoparks can contribute significantly to environmental and cultural education programmes, offering excellent examples for the interaction between the abiotic elements and biotic parameters in natural ecosystems. They constitute a kind of territorial laboratory where children can investigate earth sciences and their links with human beings.

Moreover, geoparks, by having locals participate in geopark conservation activities and workshops, attempt to improve the local economy of rural areas located near geoparks.

Table 3 The role of workshops held in geoparks in the local economy

Variable	Yes (%)	No (%)	No answer (%)	Missing
Geoparks have workshop facilities	72	28	0	0
Workshops are managed by locals	68	28	4	1
Workshops improve the local economy	56	36	8	2

It is obvious that preserving geological and natural heritage is not possible without tourists' and local communities' awareness.

Conclusions

This paper focuses on two targets of the establishment of geoparks (conservation and education, as a technique for Earth knowledge management). This study explores the role played by geoparks in the participation of local communities in the conservation of natural and geological heritage. The research was conducted with electronic questionnaires which were sent to all geoparks around the world in 2009. The results substantiate the importance of geoparks in employing locals in conservation and education projects.

According to the definition of a geopark, geoparks try to improve the local economy through geotourism, education and conservation activities. Regarding this, geopark authorities have taken some positive policies towards stimulating the locals to participate in activities leading to prosperity of the local economy and preservation of natural resources.

Firstly, geopark authorities involve the locals in conservation activities; creating geoparks in every territory engages locals in geopark conservation activities in the form of voluntary, supplementary income, part-time, full-time, seasonal and second jobs.

Moreover, the results indicate that the majority of geopark authorities believe that conservation activities improve the local economy in their territory. For instance, geoparks employ the locals in preservation activities such as park guards, park guides and site surveillance. These activities indicate a relation between the conservation of geoparks and tourism promotion; therefore, geopark creation as a model of sustainable development can be a solution to reduce the negative environmental impacts of tourism on landscapes and natural and geological heritage.

Educational programme is another strategy in geoparks. A geopark can create a framework, motivation and support to integrate research, education and training.

A geopark organises activities and provides logistic support to convey geoscientific knowledge and environmental concepts to the public. This is accomplished through protected and interpreted geosites, museums, information centres, trails, guided tours, school class excursions, popular literature, maps, educational materials and displays, seminars and so on.

A geopark also fosters scientific research and cooperation with universities and research institutes; stimulating negotiation between the geoscientists, and the local populations is another geopark activity for the popularisation of Earth knowledge. The results indicate that the majority of geoparks have been equipped with workshop facilities and authorities believe that workshops improve the local economy through

involving locals, artists, geologists etc. in workshops. Consequently, geoparks, by holding workshops by locals, not only preserve the natural, geological and cultural heritage but also develop the local economy.

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