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Information Tools for Health Tourism's Sustainability and Safe Mobility

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Abstract

In this study the authors present information management solutions in health tourism facilities, in terms of mobility of goods, road design safety and management problems. Solutions to consumption of electricity or development of artificial lakes for waterways facilities as part of health tourism sustainable solutions in services and goods are also discussed. Furthermore, solutions for health tourism facilities that can recover their produced fermentable waste water quantities and water discharges for recreational activities and sports are also suggested. Finally, sustainable solutions for the application of polymers, safe mobility of people, goods and operation of efficient road design supporting eco-designs and road safety are presented too.

Keywords: health tourism; information management systems; mobility; biopolymers; composite polymers manufactures; sustainable development; public health

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1. INTRODUCTION

Nowadays, the growth of the medical tourism industry usually follows the one of the national and/or international economy as well as the trends of general tourism. According to international data, emerging markets in Asia, such as India, Malaysia, Singapore, Thailand, Europe and Latin America are some of the most attractive and low cost medical tourist destinations. Tourists in the rich countries started exploiting the possibility of combining tourist aspects with the medical ones [2].

However, medical tourism has a significant impact on countries' national economy as well as on the hospital budgets generating up to 10% of total revenue from international patients [3]**.** At the same time, USA and European hospitals especially in the UK as well as in Germany are able to attract foreign patients for high quality and specialized care [3]. Greece is one of the countries that has always invested in tourism.

The use of tourism distribution channels and marketing segmentation strategies is important for health tourism facilities so as to promote their services to tourists and stakeholders via the web. Proper web pages should demonstrate the innovative services and manufactures for the safe mobility and access that are operated at health tourism facilities.

Clean technologies, environmental management systems, sports facilities, other facilities like spa, water surface sports should be presented properly as content analysis on medical hotels' websites for qualitative and safe vacations of tourists that have selected a health tourism destination to meet their challenges [2,6,7,22,23,24,26,27].

In this working study the importance of information services is presented as marketing tool that promotes integrated sustainable health tourism facilities in order to be selected by tourists and stakeholders.

Spatial risk assessment and proper project management should be investigated for the exploitation of landfill emissions at health tourism facilities such as landfill gas treatment for electricity production, heating and leachate treatment for irrigation and support in waterways, water sports, water resources, water surface infrastructures and associated sustainable health tourism facilities.

Moreover, road design safety should be investigated taking into account topographic parameters for the sustainable mobility, project management of maintenance in emergencies, shipment of goods with low air pollutants' emissions and safety of goods to health tourism community facilities.

Furthermore, a framework on information tools for stakeholders about the sustainable development of health tourism facilities is important to be developed in terms of road access facilities, new materials in road safety, road designs that promote sustainability and public health protection within health tourism and associated infrastructure works. In this way health tourism facilities will be selected as tourism destinations as they support sustainable road access designs, mobility services and exploitation of their waste streams for energy production and water resources in health tourism's recreational activities minimising associated costs for tourists' accommodation.

2. SUSTAINABILITY OF EFFICIENT HEALTH TOURISM FACILITIES AND INFORMATION TOOLS

Nowadays, in an effort to meet growing environmental awareness, most companies in tourism sector include investments in their plans that are related to the production of eco-designs, efficient green chemistry technologies, recovery from landfill gas emissions, waste water units, treated leachate emissions and the sustainable development, protection of the environment. Environmental management is the discipline that is concerned with resources when society requires them. It is necessary to manage environmental resources in a sustainable way by minimizing the environmental impacts related to the operation of environmental systems.

Thus, improved monitoring and proper quality management of environmental systems is necessary. Also, useful applications of numerical modeling are necessary for the proper management of environmental landfill systems, monitoring schemes of landfill emissions for the safe road access mobility to health tourism facilities in emergencies, recovery of landfill emissions, road safety, efficient construction designs, project management, manufacturing, and sustainable economic development of resources [5,7,8,9,10,24,37,38].

Monitoring works should be designed and inspections should be made frequently, especially in emergencies, not only to protect the optimum operational production works but also to support the management of complicated economic systems in a sustainable way [11,12,13,15,16]. The International Standards Organization (ISO) has published a series of certified systems including ISO 9001, 14001, and 18001, ISO 45001 for the protection and certification of quality management, health and safety and environmental management, respectively. The continuous life cycle analysis of an environmental system is essential [1,2,3,4,6,12,14, 17,19,22,23,24,25].

The effectiveness of an environmental system is heavily dependent on energy savings, recovery of waste emissions and their exploitation at health tourism facilities, minimization of costs and emis-

sions in shipment of goods, safe road design, road access and mobility to ecological sight-seeing, efficient manufactures - materials in road safety for tourists, effective road designs for logistics, taking into account the particular systems' characteristics, to manage our necessities better and conserve our natural resources [17,18,19,20,21,25].

Information tools are necessary for tourists to know safe road access and pathways to particular landscapes in the countryside close to health tourism facilities. Also, safe design is useful for the assessment of landfill emissions not only for the life cycle analysis of landfill gas, settlements, leachate production in management of development works but also for the quality assurance management and protection of any other production works which are operated next to landfill boundaries.

Based on the waste input material, the simulation of landfill emissions' risk numerical modeling software can be used in order not only to evaluate landfill emissions in time but also for the efficient lining and project management of eco-design development works, producing sustainable resources and protecting development works, public health on a specific health tourism's facility site supporting clean technologies, efficient sustainable designs and the local economic geographic sustainability. Sustainable works could be supported for the recreational activities, participation of tourists in sport tourism, agro-tourism and eco-tourism activities. It offers shared experiences and interaction opportunities for tourists' participation in group projects. Including tourists from all walks of life (ethnicities, beliefs and expectations) and people with disabilities would enhance their health and confidence. This would assist parallel society of minorities and disabilities in reaching a positive manner to the issues of ethnic minorities and disabilities [28,29,34,40].

Moreover, the specific flows of goods or waste-management stream characteristics over time in a given geographical area could be studied using system analysis and input-output theory so as to develop useful road designs for the mobility of tourists as well as shipment of goods within health tourism industry for stakeholders. Socioeconomic parameters should be taken into account to investigate investments in infrastructures of health tourism facilities that promote sustainability on given specific topographies and natural landscapes. Health tourism's activities could be combined with road access infrastructures to visit eco-tourism's landscapes, monument attractions, sport tourism supporting cycling, tracking, joking, biking, kayak, rafting and other similar sports activities [11,30,32,33,34,35,36].

However, the level of risk for powered two-wheeler (PTW) like bicycles or motorcycles selected by tourists is influenced by many factors. A main general factor is the intrinsic difficulty of driving a PTW, due to its lower friction capacity, the necessity to control the balance, and its greater sensitivity to environmental perturbations (gravel, wind, any change in road surface, etc.) which may destabilize the vehicle. PTW riders also have a higher risk of injury due to their greater vulnerability, resulting from a lack of protection compared to passenger cars. The necessity of efficient materials for safe biking of tourists by polymers are presented below, which could be a marketing tool at health tourism facilities that support such materials for safe cycling, motorcycling or other associated sports to tourists i.e. water cycling.

Moreover, car-driver and rider-related behavior factors are much more prevalent in PTW crashes, compared to vehicle and road infrastructures, associated environmental factors. Speeding is a bigger problem for PTW crashes, compared to other modes. Operating a PTW requires more co-ordination and balance than operating a car, which explains that impaired riding (e.g. by alcohol or drugs) or inappropriate driving behavior (e.g. speeding) is even more problematic for PTW riders. For safety reasons efficient materials from polymers should be used by tourists at powered two-wheeler manufactures i.e. bicycles with electric motors operated by batteries recharged by motion; motor-bicycles with small capacity in speed increase. Also, batteries for the bicycles could be recharged by renewable sources of energy i.e. electricity produced from landfill gas manufactures. Traffic signs should be located for speed limit as well as digital screens should exist to provide guidance to drivers during extreme weather conditions or traffic jams so as to have a safe trip [12,13,28,32,35,36].

Another characteristic of safe system approaches is the consideration of interactions between effects of different interventions and different elements of the system. Some aspects of this are well recognized, for example, the influence of road design on chosen travel speeds. The challenge is to optimize

the protection by combining the components of safe separate traffic lanes for cyclists acting as tourists in interactive sightseeing activities and the road traffic system. Road access designs for efficient mobility of goods to health tourism facilities should be designed with small inclinations in terms of good visibility of drivers in order to avoid accidents as well as decreasing air pollutant emissions from the fuels of driving motors. With efficient road designs there is good mobility to secure services for tourists; safe supply chain of goods to health tourism facilities; good visibility in maneuvering and taking right driving measures in emergencies in extreme weather events i.e. floods, fires, hurricanes, leakage of landfill leachates, landfill gas explosions etc.

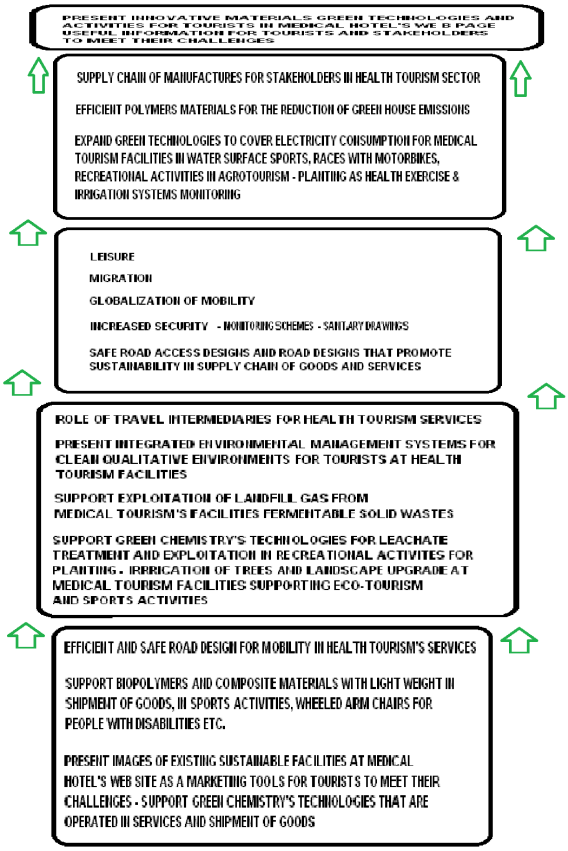

Fig. 2.1. Operational framework utilizing efficient information tool for the tourists and stakeholders within the health tourism sector.

Therefore, health tourism facilities should promote their quality of safe designs for tourists in interactive activities for their qualitative health, enjoyment during their vacations with sports (i.e water cycling, kayak etc.); agrotourism activities; eco-tourism activities; learning efficient irrigation systems operated by treated leachates; greenhouse heating by treated landfill gas etc.; eco-friendly materials that promote sustainability minimizing greenhouse emissions and associated public health's risks due to their operation, support mobility for people with disabilities, guarantee health and safety as a safe manufacture in cycling, water sports and other associated interactive activities for tourists [28,30,32,33,34,36].

Figure 2.1 presents a health tourism operational framework which can be used as a tool for efficient information flow by all the tourism stakeholders. The relative information should be presented in details in the web page of a health tourism facilitator. The aim of the suggested framework is to serve the marketing goals of health tourism facilitators in order to be selected by tourists seeking information in health tourism websites, looking for an appropriate health tourism destination that matches their needs.

Safe materials should be presented as being selected in operational management of medical tourism's services. Also, green clean technologies should be supported for biogas exploitation and leachate treatment for a medical tourism facility's wastes. Sustainable road designs should be supported in terms of efficient road access for shipment of goods and mobility of people with disabilities. In this way a good information in a web page of a medical tourism facility will assist tourists in selecting the right medical tourism destination for them so as to meet their challenges i.e cycling, kayak, water bikes, planting activities, eco-tourism combined with sports activities, agro-tourism combined with recreational activities etc.

Safe materials made by efficient composite polymers should be used for the mobility of tourists, especially for people with disabilities in health tourism's activities where such materials during their operation present lower environmental air pollutants greenhouse emissions and associated costs in fuel consumption than the metallic ones i.e. light weight of manufactures made by composite materials compared to metallic ones. Hence, the relative environmental and operational costs are becoming lower for health tourism facilities that are using such materials for the mobility of tourists. Such composite polymers materials are becoming more competitive than

past preferred designs in manufactures in transportation of associated goods and services.

The efficient materials of manufactures that can be applied in mobility of goods and services at health tourism facilities are introduced from polymers and bio-composites where they could be provided as additional utilities to tourists for their safe mobility. Materials from composite polymers can assist in safe mobility services for tourists and promote sustainability in health tourism's operational activities. In this way, not only sustainability in mobility of tourists from hotel to specific sites for recreational activities of health tourism like planting, water sports, climbing can be achieved but also in the shipment of goods with low air pollutants' emissions and consumption in fuels (i.e. wheels in automotive industry for the logistics of goods; mobility of health tourism's services; light wheeled arm chairs for people with disabilities; manufactures of not heavy bicycles; compact small scale constructions for the shipment of goods like food, batteries, other equipment; light accessories not heavy ones in automotive manufactures).

Also, sustainable road designs are necessary for low inclinations and bio-polymers manufactures in the shipment of goods, supporting the associated operational activities within health tourism facilities. Periodic maintenance should exist in health tourism's facilities especially in emergencies. Future research is necessary for the optimization of the robustness of polymer materials in vibration and other parameters that should be investigated [5,21,39].

Nowadays, companies have merged forces and decided to have an impact on the worldwide mass production of composites. The partnerships in automotive industry designed the light innovative battery pack module carrier (see figure 2.2) [16]. They developed a carbon fiber strengthened composite part for an electric vehicle made completely from polymer composite without any metal reinforcement. In this material carbon fibers strengthen the PA6 polyamide and form the compact element. In comparison to element made of steel, this solution offers [16]:

• Weight reduction by 26% (from 35 to 24 kg, 77 to 53 lb);

• Higher driving distance per single charge of the electric vehicle;

• Enhanced driving performance due to the weight reduction;

• Cost reduction by direct compounding (no intermediate operations);

• No need for anti-corrosion painting;

• Function integration, number of elements reduced by 91% (from 35 to 3 per vehicle);

• Superior recyclability.

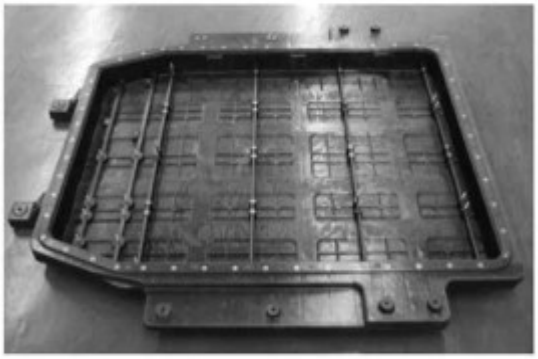

Fig. 2.2. Efficient carbon composite for battery pack module carrier developed by LG Hansys, Hyundai Motor and Shinhan Mold companies

Source: [16]

Lower weights mean lower air pollutant emissions in logistics and supply chain of goods and services within the health tourism sector. Therefore, green chemistry's modern materials applied in the design of the means of transportation should contribute to the so-called the 'three cuts' principle: relatively small manufacturing costs, decrease of fuel consumption and simultaneously decrease of CO2 emission. The energy-efficient polyurethane materials like the Bayflex RIM have been introduced in the automotive industry. Since the general direction of development in the automotive industry is focused on lightness of vehicles assuring the required electric mobility, the application of such polymers products ensures the above mentioned goals. Bayflex RIM is a high-grade polyurethane with special fillers characterized by a remarkable heat stability, low moisture absorption, low thermal expansion, great impact resistance, excellent surface and paint adhesion qualities. The application of this material lowers the element weight by 30%. [16].

Moreover, natural / biofiber composites, known as biocomposites, can be of great importance to the world of materials not only due to the alleviation of

the uncertainty of the petroleum supply but also as a solution to growing environmental threats. Eco-friendly biocomposites from crop-derived polymers (biopolymer) and plant-derived fiber (natural/biofiber) are novel materials all-time great. Biocomposites consist of natural fibers and a polymer matrix. They can be used as a replacement for synthetic fiber reinforced polymer. Due to their comparable strength and stiffness, biocomposites are used in applications ranging from building construction materials to automotives applications. [5].

Natural biofiber composites (biocomposites) are emerging technologies as a viable alternative to synthetic fiber reinforced composites, especially in automotive applications. Biocomposites and innovative technologies can reduce the widespread dependence on fossil fuel. They can deliver performance and strength with lower weight and can be stronger for the same weight of synthetic fiber reinforced composites. Exterior applications are more critical. The components must be able to withstand extreme conditions such as wet weather, and not splinter due to mechanical impacts (chipping). Like any other engineering components, proper design of structures made from this material is necessary to ensure successful application [5].

The carbon fibres, when added, strengthen the high-performance polymers and the properties are comparable to the light metal alloys. The carbon fibres are impregnated joined together with the epoxy resin properly processed. Therefore, the final composite material gives the opportunity of mass saving up to 150 kg (331 lb) per chassis [16].

Moreover, an emerging environmental technology is the application of polymer wheel rim (figure 2.3) for the mass production. The polymer wheel rim is made of the innovative high-performance material named ultramid structure. It consists of polyamide matrix reinforced with long glass fibers and is known for its excellent thermal and chemical stability, satisfying endurance, dynamic strength and good toughness.

Fig. 2.3. Emerging manufacture Smart Forvision polymer wheel rim from PA6 reinforced with glass fibres (BASF-Germany)

Source: [16]

The polymer wheel rim is 3 kg (7 lb) lighter than a metal alloy one, saving 12 kg (26 lb) of mass per car. Mass saving, in this case, also means that the car is relatively more environmentally friendly due to the lower fuel consumption. In comparison to conventionally powered cars, Smart Forvision materials will emit 1g/km (0.003 lb/mile) less CO2 less fuel and use 0.05 liters (0.01 gallon) per 100 km (62 miles) (see figure 3).

Furthermore, there are new trends for the application of composite materials in the field of sport and leisure. AX-Lightness GmbH (Germany) is the main supplier of polymer based composite materials in the Formula. One racing sector is currently developing and manufacturing structures of bicycles. Their innovative products present high-tech mountain bikes with wheels made of Umeco's woven carbon fibre as a reinforcement of the epoxy resin synthetic materials [16,21]. It appears that nearly all bicycles made of composites strengthened by carbon fibers are produced in China because of the complexity of the production process and therefore the necessity of large amount of manual labor. Manufactured parts from synthetic materials are cut out and cured in an autoclave, then bonded from two halves into a tube, filled up, smoothed and coated. The BRAID in Germany proposed new bicycle frame with innovative design. Instead of making a tube from two half shells, the innovative braiding technique when applied properly results in a frame that

exhibits higher strength and stiffness, using less material for the final completed product [16].

Moreover, cellulosic fibers have a high Young's modulus as compared to commodity thermoplastics. They contribute to the higher stiffness of the composites. The primary advantages of lignocellulosic fibers as fillers/reinforcements in plastics are: Low densities; Non-abrasiveness; High filling levels possible resulting in high stiffness properties; High specific properties [5].

Thermoplastic wood-polymer composites as a continuous phase can result in better water resistance and dimensional stability with low polymer content. They can be used to replace impregnated wood in many outdoor applications. The efficiency of the composite also depends on the amount of stress transferred from the matrix to the fibers. This can be maximized by improving the interaction and adhesion between the two phases and also by maximizing the length of the fibers retained in final composites. Natural fiber composites have potential ecological and economic advantages of lignocellulosic fibers. Efforts to understand their structure relationship and explore new methodologies for producing new materials are of commercial importance [5].

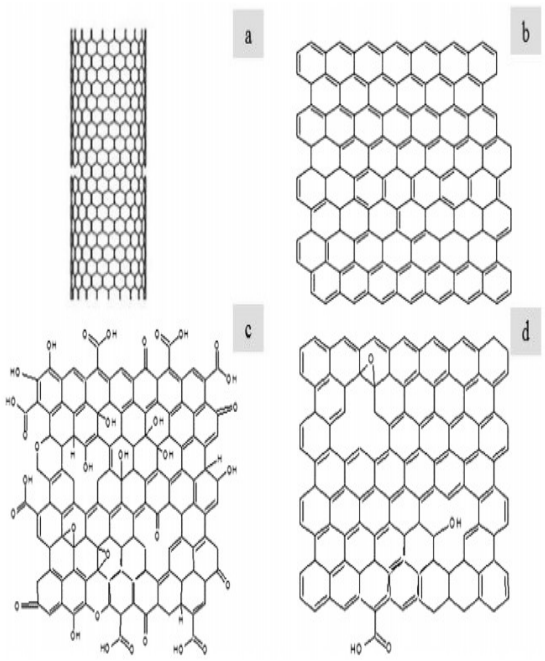

Fig. 2.4. Displays the structure of different forms of carbon (a) Carbon Nanotube (b) Graphene (c) Graphene Oxide (d) Reduced Graphene Oxide.

Source: [31]

However, polymer nanocomposites emerged out as a new ingenious complex based on layered nanomaterials such as nanoclay or silicates. These materials exhibits poor electrical and thermal conductivity. Carbon based materials could be used in associated manufactures that promote sustainability in health's tourism services. Carbon nanomaterials have proved to be an excellent candidate having high surface area, light weight, non-corrosive property. Although they have outstanding mechanical strength and can be used as a good absorbent; their utilization presents high production cost limits. In figure 4 the different structural forms of carbon based nanofiller material are displayed [31].

All the above facilities well presented in the internet in a web page of a health tourism facility will assist the marketing of the specific tourism facility as an attraction to be selected by tourists and stakeholders as semantic destination to meet their challenges in an integrated health tourism facility and its services.

3. CONCLUSIONS

The importance of road design at health tourism facilities in terms of safety, sustainable road designs and logistics, safe mobility infrastructures, interactive tourism's activities and use of efficient materials is fundamental not only for tourists but also for the occupational health of coaches in associated sports and other activities.

Moreover, the necessity of efficient materials for the health and safety of tourists and staff that participates in interactive activities like sports for tourists should be presented in relative web pages of health tourism facilities. The associated tools of health tourism facilities that are applied in their operational activities for the good health and safety of their tourists should be presented in their web pages as a key-information for all tourists that are interested in participating in such health tourism's activities. This could be a good case for the marketing to promote the competitive advantage of health tourism facilities that support such efficient materials for the health and safety of tourists in interactive tourism's activities.

Discussion from an energy perspective was made for the exploitation of treated landfill's fermentable solid wastes; produced leachates and treated waste waters quantities from health tourism facilities in terms of green chemistry's applications in sustainable development projects like energy recovery from landfill gas; treatment of leachates for irrigation; support construction designs in effective water ways, sustainable eco-tourism landscapes; artificial lakes as well as support in interactive activities for tourists like agro-tourism; eco-tourism and sports like cycling; motorcycling; water-cycling; kayak etc.

Under these conditions, exploiting landfill emissions (i.e. treated biogas, leachates, waste water quantities) from health tourism facilities will well recover electric energy from such renewable resources that could be generated to cover the particular health tourism's facilities necessities. These necessities in energy consumption could be the greenhouse heating of agricultural land uses; lighting for the installations of food productivity and pump the water for irrigations.

In the end, the necessity of information communication technologies as tools for tourists and stakeholders to select the right health tourism facilities so as to meet their challenges is presented as well. An area of future research would be to conduct a techno-economic study of the concept as well as a cost benefit analysis of integrated health tourism facilities from energy and produce perspective.

As it was described in the above paper the examples of application of polymer based composite materials indicate that the composite materials industry plays a significant, if not the most important, role in the development of the latest material technologies. Numerous applications of Polymer Matrix Composites elements show that they are the key factors for the development of all the above mentioned industries manufacturing means of transportation (land, air and marine), sport and leisure, military industry. The polymer-based composites are ideally suited to the needs of today's world, offering savings and convenience for the end-users. Composite materials can be easily adapted to the current requirements and the most demanding criteria. The polymer composites characterized by low weight and durability and the elements performance from polymer based composite materials show that they are able to successfully compete with metal alloys in terms of mechanical properties and price. In this way the costs of health tourism services for the mobility and leisure of tourists at health tourism facilities is minimized.

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