Geographic information systems (GIS) applications in retail tourism and teaching curriculum

Rachel J.C. Chen*

Retail, Hospitality, and Tourism Management, University of Tennessee, 247 Jessie Harris Building, Knoxville, TN 37996-1911, USA

Abstract

Geographic information systems (GIS) have been adopted as a useful tool by a wide range of disciplines. This study used the ESRI’s ArcView system, tourism-retail trading decisions, attraction allocations, and visitor demographic data to demonstrate the value of GIS to decision makers and planners of tourism destinations. Results suggest that the analyses of the GIS provide comprehensive access to the database, query features, and create themes, layouts, and reports.

© 2006 Elsevier Ltd. All rights reserved.

Keywords: Geographic information systems; Tourism

1. Introduction

Geographic information systems (GIS) have been adopted as a useful tool by a wide range of disciplines such as environmental planning, property management, infrastructure siting, emergence planning, automobile navigation systems, urban studies, market analyses, and business demographics. Analyses from GIS can determine both threats and opportunities for development. For business planners, the GIS consider the prospects for a large scale or multiple regions and then narrow the developmental focus to relatively small and specific sites (Joerger et al., 1999). As technology has expanded and improved, both consumers and businesses have benefited. For example, consumers expect ease of accessibility at all times, and through GIS technology, businesses can provide consumers with convenience of shopping experiences.

Site selection: GIS could be used to identify specific developmental sites based on a set of criteria using economic, social, environmental, and business-related data. At the very core of the business information is an address, a service boundary, a sales territory, and a transportation system that can be illustrated on a map. Most recently, GIS has become more widely used among commercial real-estate firms. By using the mapping tool, real estate firms can help locate appropriate areas that will enable a business (e.g., lodging and/or eating places) to remain successful. Businesses use GIS technology to solve problems, find solutions for marketing, delivering better services, and making good decisions. Woodbury (1996) noted that 85% of all computerized databases in the world have a location component, such as street address, a zip code, a census tract, or a legal description. GIS can bring all that data together quickly and let users analyze and visualize information in a way people value it.

GIS in service management: The GIS technology has been implemented in service management for displaying large volumes of diverse data pertinent to various local and regional planning activities. In the United Kingdom (UK), fifty-three percent of the major retailers had adopted GIS by 1998 (Hernandez et al., 1999). Brick and mortar businesses can use GIS application to compete with the convenience of Internet retailing. A retailer can develop a map of its store using GIS software to calculate the actual dimensions of a store. This can even handle multilevel stores and shelf depths. When a retailer has the store mapped, a consumer can view the map on a live website, and know the exact location of the item within the store. While using the virtual map, the consumer can see how...
many items are in stock, detailed information about the product, and any associated items that are on sale or available for purchase.

Currently, a GIS application used inside high-tech retail establishments is the smart cart. The smart cart is a computer-enhanced shopping cart that can be found in some retailers today. This cart is designed with a map or database of the store in which a customer can query a specific item as they walk through the store. The smart cart will locate the item within the store, direct the customer to that specific item as they walk through the store. The smart cart will locate the item within the store, direct the customer to that item using a map, provide additional information about the item, and offer supplementary items needed and their locations (GIS Frontiers, 2001). It is predicted in the future that the smart cart can also be used to check out consumers faster. The smart cart would run through an X-ray type machine that would identify and checkout all items in the cart at once. This would allow businesses to accommodate more consumers in a shorter amount of time.

GIS applications in tourism: Determining the ideal tourism modeling for a prospective tourism region involves a complicated set of criteria. Even though tourism development is a distinctly geographical activity with serious implications for destination areas, few researchers have applied GIS to tourism planning and management practices. The following are a number of opportunities for GIS applications in tourism planning (Farsari and Prastacos, 2004):

1. Visitor flow management: This involves the use of GIS to identify principal tourist activity spaces within a destination and the flows among destinations. Authorities may implement strategic plans for superior infrastructure (e.g., building public transportation systems linking various tourist activity spaces).

2. Facility inventory and resource use: This involves the use of GIS in connection with the issue of environmental justice (namely the fact that tourism may not benefit all segments of society equally). It also involves developing an inventory of resources in order to identify conflicting but also complementary land uses and activities, available infrastructure, and natural resources.

3. Assessing impacts of tourism development: GIS can be used to demonstrate tourism impacts on various industrial sectors in a time-series and spatial format (Chen, 2006). Within this category, analysts can use all or several of the previous categories by employing the “what-if” tool of GIS. This tool allows the development of scenarios for predicting what the effect of a change in a certain variable(s) will be in the destination.

The categories listed above are not mutually exclusive and it is more than likely that any application of GIS in a tourism scenario will involve a contribution of more than one of these. Unfortunately, as Farsari and Prastacos (2004) reported, most applications of GIS in tourism relate to identifying suitable areas for developing tourism activities in the future (land suitability analysis) while the use of GIS in already developed (mature) tourist destinations has been avoided. They suggested that there are a number of ways in which GIS can benefit the study of tourism and implementation of sustainable practices in destination areas.

GIS applications in retail tourism: It has been well documented that tourists shopping is a major activity. According to Travel Industry Association of America (2004), 63% of tourists in the year 2004 included shopping during their trips, and the average expenditure was $333. In today’s economic climate, the tourist customer base has become increasingly important to the survival and growth of Mall properties. For instance, General Growth Properties and the Mills Corporation of Chicago reported tourists as constituting 31% and 25% of their mall visitors respectively (Gentry, 2001). According to Littrell et al. (1994), most tourists are seasonal or one-time customers rather than regular year long clientele. Typical shopping environment tourists may encounter include small independent retailers of local crafts as well as larger retail malls. In line with other anecdotal evidence, academic research also revealed that many consumers are apt to make a decision regarding where to shop based upon attitude toward a mix of stores and the mall or shopping center environment (Finn and Louviere, 1990, 1996; Gentry and Burns, 1997; Chen, 2004). Therefore, it is imperative for the shopping mall industry to develop and practice methods to attract customers to their site for an initial shopping trip as well as develop strategies to encourage repeat visits to that site.

2. GIS in tourism, hospitality, and service management: a case study and teaching curriculum development

GIS technology is one of the hottest new research tools in academia today and one of the fastest growing high-tech careers for students. Maps are basic tools used to present and analyze information on the spatial distribution of business sectors, resources, and people in need of services. The author has developed GIS courses that provide an overview of the conceptual, analytic, and technical issues involved in working with geographic databases and GIS software. Presentations, case studies, and participatory discussions were used to illustrate the use of the information technology in market applications. This course was designed to equip students with (Appendix 1):

- knowledge of the concepts of GIS,
- ability to discuss and examine the basic data models,
- awareness of the historical development of geographical data and GIS,
- ability for basic spatial analysis,
- capability to understand the keys to successful GIS implementation, and
- skills necessary for graduate study and professional practice in GIS.
This paper demonstrates a case study assisted by service management graduate students who attended the introductory and advanced GIS application courses in the years of 2002–2003. All students (M.S. and Ph.D. levels) learned about modeling with GIS and the value of making spatially informed decisions to improve the fit between resources and needs. Students collected the basic demographic data while the instructor created the maps for lecturing purposes.

Several types of information were employed in this case such as map coordinates expressed in longitude and latitude; city, county, and national boundaries and names; and transportation routes. The GIS enable graphic users to employ buffer and logistic functions, derive new information from existing data, analyze, classify grids and themes, and map locations of attributes. The US Census Bureau and the Department of Tourism Development in Monroe County, Tennessee provided data for this study.

The following figures employed the tourism-retail trading decisions, attraction allocations, and spatial spread functions to demonstrate the value of GIS to decision makers and planners of tourism destinations in the surrounding counties of the Great Smoky Mountains National Park. The main objectives of developing the maps were to (1) illustrate the existing resource allocation, and (2) provide information for better understanding, planning, development, and site selection for the adjacent communities to the Great Smoky Mountains National Park.

Selection and assessment for a new tourism-oriented retail store: Specifically, the tourism retail establishment used in this case is a clothing store for women called “The Boutique”. It will be a middle-range retailer that will cater to the consumer in between the “Goody’s” client and a “Clothes by Mertie” or “Lilly Pad” client. The merchandise will be trendy yet affordable with accessories, clothing, and shoes. The store will require easy accessibility for the consumers, a location that is visible to the consumers, and easy logistics for transporting of goods. The demographics of the targeted customers are women between the ages of 18 and 45. The tourism-oriented retail store will cater to most income levels, with the possibility of later expanding into men and children’s wear.

Evaluation of the site selection: Monroe County is approximately 662 square miles, one-third of the county is encompassed with the Cherokee National Forest. Located in this area are several highly visited tourist attractions including the Cherohala Skyway, the Lost Sea, Fort Loudon State Park, Sequoyah birthplace museum, and the former Cherokee town (Figs. 1–4).
Monroe County in Tennessee is an easily accessible area that can be reached by air, railroads, highways, and navigable waterways. For example, the highways accessible through Monroe County are I-75, state highways 68, 72, 322, 444, 165, 360, 39, US highways 411 and 11. There are more than 14 trucking companies serving the County with both national freight and parcel shipping available (Fig. 2) (Fogle and Chen, 2003).

Monroe County is a growing area in the state of Tennessee. In 1990, the population was 30,541 and in 2004 the population grew to 42,070. The per capita income in 1997 was $16,139 and retail sales in 1998 were $246,270,782. The cities within Monroe County are Madisonville (the county seat), Sweetwater, Vonore and Tellico Plains (Fig. 4). Sweetwater was chosen as the possible site location because of population growth, economic demographics, and the current revamping of the historic downtown. Antique shops, gift shops and cafes have recently opened in this area.

3. Future GIS uses and challenges

The GIS technology evaluates complex spatial relationships that may not be readily apparent. It provides comprehensive access to the database, query features, and create themes, layouts, and reports. The relationship between geographic factors, marketing strategies, visitors’ behaviors associated with a visit to the region, visitor perceptions of various attractions, and the trip/traveler characteristics are also critical components for the managers and planners of the tourism-related businesses. On the other hand, maps are also an important component of tourists’ travel plans. Travel-related agencies may develop well-designed, informative and ready-to print maps to enhance visitors’ travel experiences. GIS may make it easier for visitors to find their way around their destinations. Using the Internet, it is possible to give prospective visitors a taste of a given destination. Combining photos, sounds and video clips with mapping technology, visitors can plan out their trips ahead of time.

In addition, using the GIS business analysis functions, several issues can be examined including “where are the visitors”; “where are the attractions”; “where are the trade areas of tourism/retailing stores”; “where are the best customers”; “what are their characteristics”; “where are other areas with people like them”; and so on. Using the network analysis tool, several network problems could be solved, such as: “how to find the best route”; “how to set up locations to visit”; “what is the closest facility”; “how to customize directions”; and “how to evaluate

Fig. 2. The transportation system in Tennessee, USA.
Fig. 3. Monroe County in Tennessee, USA.

Fig. 4. Sweetwater in Monroe, Tennessee, USA.
accessibility across destinations”. Future studies may employ both business and network analyses for further in-depth strategic planning.

In early 2002, there was a joint venture between MasterCard International and Symmetrical Resources called Transitional Data Solutions (TDS). This venture has the ability to benefit consumers and businesses, using a GIS application. TDS have found a way to cluster consumers based on their buying patterns. TDS tracks MasterCard aggregate transactions and analyzes the “consumer on what they buy, where they shop, how much they spend, and so on” (Lach, 1999). The consumer will benefit by being targeted correctly for appropriate retailers for their needs and wants. According to Waller and Ziliaskopoulos (2002), with evolving technology, a Java-based GIS has been available. Through a framework based on Common Object Request Brokerage Architecture (CORBA), modules are written in separate programming languages and can run on different machines over a network. With this program, a user can interface over the World Wide Web with zooming, planning, and query capabilities. Using this Java-based GIS, it will enable more use of spatial programs through Internet for the future.

As technology continues to develop, the cost of GIS hardware and software has decreased. GIS is seen used more frequently today in the retail, hospitality, and tourism industries. A future prediction is that GIS will become a common business asset in service planning (Joerger et al., 1999). In terms of a site selection, a challenge for the future with the use of GIS will be the mix of harnessing the power of GIS technology without losing the “entrepreneurial instinct” of past business decisions.

Appendix 1. Course syllabus

<table>
<thead>
<tr>
<th>Week</th>
<th>Lecture topic</th>
<th>Weekly lab topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Course introduction GIS overview</td>
<td>Introduction to Labs</td>
</tr>
<tr>
<td>2</td>
<td>Fundamental characteristics of spatial data</td>
<td>Learning ArcView</td>
</tr>
<tr>
<td>3</td>
<td>Components of data quality spatial data models: vector, raster, topology</td>
<td>Learning ArcView</td>
</tr>
<tr>
<td>4</td>
<td>Hardware and software for GIS applications</td>
<td>Learning ArcView</td>
</tr>
<tr>
<td>5</td>
<td>Review of attribute data management</td>
<td>Learning ArcView</td>
</tr>
<tr>
<td></td>
<td>Assignment due</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Data collection and quality</td>
<td>Basic spatial analysis</td>
</tr>
<tr>
<td>7</td>
<td>Mid-term</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Spatial analysis of markets implementing a GIS</td>
<td>Basic spatial analysis</td>
</tr>
<tr>
<td>9</td>
<td>Data/resource time</td>
<td>Data/resource time</td>
</tr>
<tr>
<td>10</td>
<td>GIS analysis functions</td>
<td>Basic spatial analysis</td>
</tr>
<tr>
<td></td>
<td>Assignment due</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>GIS application</td>
<td>Working with maps</td>
</tr>
<tr>
<td>12</td>
<td>GIS in business</td>
<td>Working with reports how to create a good map</td>
</tr>
<tr>
<td>13</td>
<td>Formal problems in establishing GIS</td>
<td>Working with reports/maps</td>
</tr>
<tr>
<td>14</td>
<td>Future of GIS</td>
<td>Presentations</td>
</tr>
</tbody>
</table>
References


