AITP NCC BI GIS COMPETITION: A BI CASE PERSPECTIVE

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ABSTRACT

A national competition problem in business intelligence (BI) is considered to provide an understanding of this competition and the case study problem used. This competition utilizes a commercially available, hosted software application that includes a rich econometric data set. The data are accessed using spatial queries and produce more than four dozen views of the data through predefined reports. Once the queries occur, the data can be analyzed further with other BI tools that include Microsoft Excel. The competition problem requires this analysis of external business data to furnish information for business decision making. This competition has been successful for the past four years. The experience of this competition can be applied to case-based, experiential learning in decision support systems and related information system courses that include a BI component. This usage of the competition problem has been found to work well in several of these courses and should be considered by others for similar courses.

Keywords: Business intelligence, geographical information systems, case problems, decision support

INTRODUCTION

What is AITP NCC BI GIS? The Association of Information Technology Professionals (AITP) is a leading worldwide society of information technology business professionals and the community of knowledge for the current and next generation of leaders. The purpose of the organization is to serve members by delivering relevant technology and leadership education, research and information on current business and technology issues, and forums for networking and collaboration. One of AITP's premier annual events is the National Collegiate Conference (NCC). The NCC has been held for each of the past 15 years. This conference continues to attract as many as 800 participants from various colleges and universities in North America. These students participate in a variety of competitions, attend a number of presentations on current and emerging technology, interact with businesses through a job fair, and meet students from other colleges. This is an excellent experience to broaden their view of information technology careers and opportunities.

The Business Intelligence (BI) Geographical Information Systems (GIS) competition is one of more than a dozen competitions held at the NCC. This competition has been included in the NCC for the past four years. Other competitions include PC Troubleshooting, Systems Analysis and Design, Database Design, and Programming Languages. BI GIS is the one competition with a primary focus on business analytics – the use of information to support business decision making. The primary software used currently for the BI competition is Business Analyst Online (BAO) from Environmental Systems Research Institute (ESRI). This hosted application features both a very rich set of GIS data and an interface that supports spatial queries of that data. BAO is a GIS tool, because it is designed for spatial or geographical queries. Frequently, business data is displayed on a map to show spatial relationships. BAO supports this with their rich econometric database. Other ESRI tools allow their customers to carry out different mapping applications. Results from BAO GIS queries are delivered in the Microsoft Excel file format, which readily supports additional analysis in Excel. Clearly, Excel is widely recognized as the leading software tool for end user BI analysis [3, 6], which underscores it use with BAO. The BI GIS competition brings together commercially available external information of BAO from ESRI and the Excel spreadsheet tool from Microsoft. Each is recognized as the leader in its support for BI analysis. The business analytics process is completed in Excel using the spatial query data from BAO. (See Figure 1)
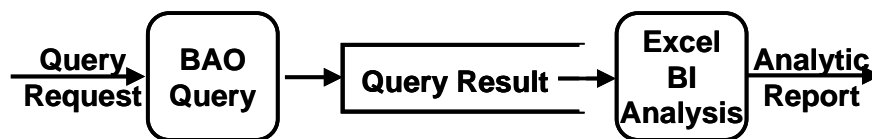

Figure 1: BAO processing and analysis

The purpose here is two fold. First is to increase knowledge of an available BI tool which also provides a robust set of commercially available external business-oriented data for decision making. Second is to provide an example case for potential course use of this by exploring the NCC competition problem. The desired outcome is to impart an understanding of how the case problem from this competition might be used in information systems course, especially those with a current or planned BI component, and to increase awareness of this competition to encourage future participation by emerging information technology professionals.

BACKGROUND

The concept of BI has been around since it was first coined by Hans Luhn in 1958 [5]. He defined it as: "the ability to apprehend the interrelationships of presented facts in such a way as to guide action towards a desired goal." According to Power [7], it was in 1989 that Howard Dresner proposed BI as an umbrella term to describe "concepts and methods to improve business decision making by using fact-based support systems." However, it was not until the late 1990s that this usage became widespread. So, BI is the latest new, new thing. SAP AG has a BI product, as do SAS, IBM, and others. It's the new label for that old idea that is now more readily supported with advances in information technology [2]. BI is the most recent label for many of the concepts of decision support systems (DSS), which have been around since the 1970's. DSS has gone through a number of "hot new names" to sell the latest version of software tools. This appears to be more of a software vendor marketing game of the evolution of software tools than truly break-through, totally new technology. On the other hand, this evolution of tools, in concert with the development of the Internet, now makes these tools more readily available. It is that availability which makes the BI GIS competition at the NCC a reality.

Software vendors have varying definitions of BI that match their particular tool and its unique capabilities. As a result, while there are similar views of what BI is, there are also these variations of BI. Many software tools are available in the BI software tool space. Each has different features that make it the "best" tool for different analysis. For purposes of the NCC BI competition, tools were considered that would not only support DSS and BI queries, but also provided a rich dataset of readily understood information. BAO by ESRI provides a number of features that make it an excellent tool to use with a NCC Competition.

BAO is a rich dataset that contains external data, which is of interest to a wide variety of different types of businesses. The econometric datasets in BAO supplies this information, while furnishing a user-friendly interface. Further, BAO is a hosted, web-based BI environment. This means that it is readily available to a large number of users without the need to create a separate hosting platform for both potential and actual contestants. Further, ERSI agreed to provide BAO for this contest at no cost to students or the Conference itself. The NCC Competition presented here provides an example of a case problem, and by extension, an example hands-on BI analysis that should be considered for inclusion in information systems courses.

BI AND DSS

The work of Gorry and Scott Morton [4] is a classic reprint of their original work written in 1971. They indicate the usefulness of a framework is that it … "allows an organization to gain perspective on the field of information systems and can be a powerful means of providing focus and improving the effectiveness of the systems effort." That framework provides a number of parameters (Table 1) that are DSS characteristics. Additional support for this framework is provided by Adam, Fahy, and Murphy [1], who, after considerable evaluation of multiple viewpoints, concluded that the Gorry and Scott Morton framework stands as it was originally developed in 1971. That framework continues to provide significant guidance in the study and application of BI. Largely External is an information characteristic for Strategic Planning. So, where do businesses obtain this Largely External information? That is, how does DSS concept meet analytical reality? BAO is one alternative with its datasets providing business data, which is a key focus for the Strategic Planning category in Table 1. BAO serves as a stalwart means of obtaining high quality external information to support decision making in strategic planning. For this reason, BAO is an excellent candidate software application for the NCC BI GIS competition. And, BAO changes the focus to business problem solving rather than the collection and maintenance of external data. Thus, the focus becomes one of selecting appropriate data for the problem at hand. A business maintains its competitive advantage not through its own storage and maintenance of this econometric data, but rather through the selection and analysis performed with the data. This is the analytical focal point of the BI GIS competition.

Table 1: Information Requirements by Decision Category

Characteristics of Information	Operational Control	Managerial Control	Strategic Planning
Source	Largely internal	⟶	Largely External
Scope	Well defined, narrow	⟶	Very wide
Level of Aggregation	Detailed	⟶	Aggregate
Time Horizon	Historical	⟶	Future
Currency	Highly current	⟶	Quite old
Required Accuracy	High	⟶	Low
Frequency of Use	Very frequent	⟶	Infrequent

DSS

SOURCE: Gorry and Scott-Morton [4]

BAO SPATIAL QUERY

Maps are used frequently to display spatial relation-ships of business data for many different types of businesses. As result, BAO uses maps in analyzing business data. A spatial query is a special type of database query supported by geodatabases. A geodatabase (also known as a spatial database) is a database designed to store, query, and manipulate geographic information and spatial data. Spatial queries differ from SQL queries in several important ways. Two of the most important are they allow for the use of geometry data types such as points, lines and polygons; and these queries consider the spatial relationship between these geometries.

Within a spatial database, data is treated as any other data type. Vector data can be stored as point, line or polygon data types, and may have an associated spatial reference system. A geodatabase record can use a geometry data type to represent the location of an object in the physical world and other standard database data types to store the object's associated attributes. Spatial databases are optimized to store and query data related to objects in space, including points and polygons. While typical databases can understand various numeric and character types of data, additional functionality needs to be added for databases to process spatial data types. These are typically called geometry or feature types.

BAO provides spatial queries in three popular, easy to use arrangements – rings, drive times, and donuts; however, other more specialized areas can also be used. The three popular arrangements are the ones that comprise the focus of the competition problem. Each of these query types is considered next. .

Rings – the most widely used for market-area analysis, are circles generated on a map around a specified point. It is possible to choose up to three rings and indicate the radius, in miles, of the rings around the point. Report data will be summarized for the area contained within each ring. That is, each of the outer rings includes the data from the rings inside that outer ring. It is cumulative for the entire area from the specified location point to the outer ring. (See Figure 2)

Drive Times - represents how long it takes a customer to drive to a specific location. These areas represent the distance traveled from the specified point on the map in a given amount of time. For example, a store's ten minute drive-time area defines the area in which drivers can reach the point in ten minutes or less. Travel time consideration is taken using posted speed limits per street segments. Here, each outer area includes the data from the area inside of it. That is, it is cumulative or an overlap of the internal areas. This is the same approach as that for rings. (See Figure 3)

Donuts – study areas in a donut shape have no overlap and provide the traditional ring study area but without duplication of overlapping areas. That is, the query data for each area is mutually exclusive. Donuts are useful for understanding the incremental market changes as you move away from a center location. For example, specifying donut values of 1, 3, and 5 miles will result in reports being generated for data from 0-1, 1-3, and 3-5 mile bands from the center. (See Figure 4)
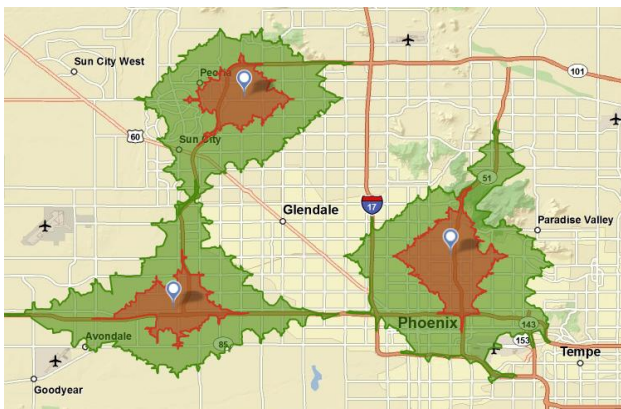
Figure 2: Ring spatial query
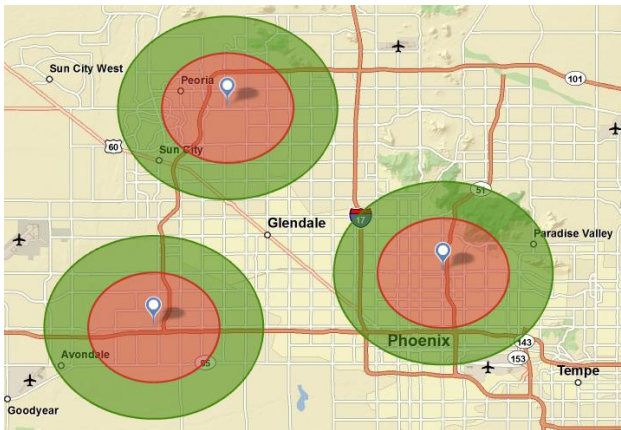

Figure 3: Drive time spatial query

Figure 4: Donut spatial query

BAO DATA

Why is BAO data appropriate for this NCC competition? BAO provides data that is readily understood by many people without an in-depth understanding of a particular business or industry. That is, it is relatively industry non-specific. BAO data is commer-

cially available, which indicates its value to many different businesses in a variety of industry sectors. BOA contains extensive demographic data especially census data as well as other econometric data on industry sectors. Using their well development methodologies, ESRI provides updated census data projections every year. They provide a projected estimate for the current year and for five years in the future.

So, why BI GIS through BAO? Yes, this is a limitation of the approach presented here. It is acknowledged there are other approaches to data marts for data warehouses that support other, different approaches to BI analytics. However, BI is a concept with many different facets. Clearly, BI GIS presents one of those views. A view that uses a widely and readily available tool with a rich data set, which contains data easily understood by students with a variety of backgrounds with minimal effort.

Market Profile

The Market Profile report (Figure 5) emphasizes population data. This includes data from the last census, a current year estimate, and a five year projected estimate. These estimates are provided by ESRI and use their methods of estimation. Population data is provided by age group and by race or ethnicity. Household data includes number of households, median income, and income by category. Other data includes per capital income, median age, employment by industry, employment by occupation, and spending by category.

Retail Goods and Services Expenditures

The Retail Goods and Services report (Figure 6) contains current year estimates, five year projected estimates, a comparison to a national average index, and more detail of spending by category than the Market Profile report. In Figure 6, 2009 Consumer Spending shows the amount spent on a variety of goods and services by households that reside in the market area of the spatial query. Expenditures are shown by broad budget categories that are not mutually exclusive, so consumer spending does not equal business revenue. The Spending Potential Index represents the amount spent in the query area relative to a national average index of 100. This provides a quick analytic comparison of relative expenditures.

Retail Market Place Profile

The Retail Market Place Profile report (Figure 7) contains data by industry groups. The data are provided for the Retail Demand, the Retail Supply, the

Supply/Demand Gap, and the Supply/Leakage Factor. The factor is a percent measure of the retail gap divided by the sum of the demand (retail potential) and the supply (retail sales), where the retail gap is the difference between the demand and supply. These differences are used to produce a chart of the Supply/Leakage Factor (Figure 8) to compares graphically the various industry groups.

Market Profile

Site Type: Rings Pad 1		10050 W Mcdowell Rd	10050 W Mcdowell Rd
Latitude: 33.46487		Avondale, AZ 85392-4803	Avondale, AZ 85392-4803
Longitude: -112.27583		Radius: 3 Miles	Radius: 5 Miles
2000 Total Population		53,867	164,124
2000 Group Quarters		3	222
2009 Total Population		97,836	272,571
2014 Total Population		117,978	323,118
2009 - 2014 Annual Rate		3.82%	3.46%
2000 Households		15,963	47,942
2000 Average Household Size		3.37	3.42
2009 Households		28,781	79,449
2009 Average Household Size		3.40	3.43
2014 Households		34,631	94,124
2014 Average Household Size		3.41	3.43
2009 - 2014 Annual Rate		3.77%	3.45%
2000 Families		13,203	39,150
2000 Average Family Size		3.64	3.71
2009 Families		22,555	62,394
2009 Average Family Size		3.76	3.78
2014 Families		26,612	72,685
2014 Average Family Size		3.79	3.80
2009 - 2014 Annual Rate		3.36%	3.10%
2000 Housing Units		16,781	50,381
Owner Occupied Housing Units		78.4%	70.0%
Renter Occupied Housing Units		17.2%	25.1%
Vacant Housing Units		4.4%	5.0%

Figure 5: Market profile population data

Retail Goods and Services Expenditures

Pad 1				Latitude:	33.46487
10050 W Mcdowell Rd				Longitude:	-112.27583
Avondale, AZ 85392-4803	Site Type:	Drive Time		Drive Time:	5 Minutes
Top Tapestry Segments:		Demographic Summary		2009	2014
Up and Coming Families	80.2%	Population		29,647	35,684
Industrious Urban Fringe	9.3%	Households		9,139	11,065
Milk and Cookies	5.5%	Families		7,101	8,409
Sophisticated Squires	4.2%	Median Age		31.2	31.6
Inner City Tenants	0.7%	Median Household Income		$71,485	$74,756
	Spending Potential Index		Average Amount Spent		Total
Apparel and Services	80		$2,012.09		$18,388,455
Men's	76		$366.06		$3,345,440
Women's	70		$603.79		$5,518,036
Children's	91		$376.13		$3,437,465
Footwear	55		$236.96		$2,165,567
Watches & Jewelry	120		$255.54		$2,335,392
Apparel Products and Services (1)	171		$173.60		$1,586,554
Computer					
Computers and Hardware for Home Use	119		$238.41		$2,178,855
Software and Accessories for Home Use	121		$34.57		$315,933
Entertainment & Recreation	115		$3,737.73		$34,159,070
Fees and Admissions	121		$753.82		$6,889,117
Membership Fees for Clubs (2)	117		$200.51		$1,832,469
Fees for Participant Sports, excl. Trips	124		$136.88		$1,250,948

Figure 6: Retail goods and services expenditures by industry group

In Figure 7, Supply (retail sales) estimates sales to consumers by establishments. Sales to businesses are excluded. Demand (retail potential) estimates the expected amount spent by consumers at retail establishments. Supply and demand estimates are in current dollars. The Leakage/Surplus Factor presents a snapshot of retail opportunity. This is a measure of the relationship between supply and demand that ranges from +100 (total leakage) to -100 (total surplus). A positive value represents 'leakage' of retail opportunity outside the trade area. A negative value represents a surplus of retail sales, a market where customers are drawn in from outside the trade area. The Retail Gap represents the difference between Retail Potential and Retail Sales. ESRI uses the North American Industry Classification System (NAICS) to classify businesses by their primary type of economic activity. Retail establishments are classified into 27 industry groups in the Retail Trade sector, as well as four industry groups within the Food Services & Drinking Establishments subsector.

Retail MarketPlace Profile

Pad 1				Latitude:	33.46487
10050 W Mcdowell Rd				Longitude:	-112.27583
Avondale, AZ 85392-4803	Site Type:	Drive Time		Drive Time:	5 Minutes
Summary Demographics					
2009 Population	29,647				
2009 Households	9,139				
2009 Median Disposable Income	$56,320				
2009 Per Capita Income	$24,992				
Industry Summary	**Demand** (Retail Potential)	**Supply** (Retail Sales)	**Retail Gap** (Demand - Supply)	**Surplus / Leakage** Factor	**Number of** Businesses
Total Retail Trade and Food & Drink (NAICS 44-45, 722)	$282,308,397	$418,119,963	-$135,811,566	-19.4	144
Total Retail Trade (NAICS 44-45)	$239,195,337	$372,929,373	-$133,734,036	-21.8	93
Total Food & Drink (NAICS 722)	$43,113,060	$45,190,590	-$2,077,530	-2.4	51
Industry Group	**Demand** (Retail Potential)	**Supply** (Retail Sales)	**Retail Gap**	**Surplus / Leakage** Factor	**Number of** Businesses
Motor Vehicle & Parts Dealers (NAICS 441)	$63,162,983	$228,328,794	-$165,165,811	-56.7	12
Automobile Dealers (NAICS 4411)	$54,088,947	$221,464,059	-$167,375,112	-60.7	7
Other Motor Vehicle Dealers (NAICS 4412)	$4,372,853	$4,952,232	-$579,379	-6.2	2
Auto Parts, Accessories, and Tire Stores (NAICS 4413)	$4,701,183	$1,912,503	$2,788,680	42.2	3
Furniture & Home Furnishings Stores (NAICS 442)	$9,887,253	$7,704,303	$2,182,950	12.4	10
Furniture Stores (NAICS 4421)	$6,439,379	$6,664,341	-$224,962	-1.7	7
Home Furnishings Stores (NAICS 4422)	$3,447,874	$1,039,962	$2,407,912	53.7	3

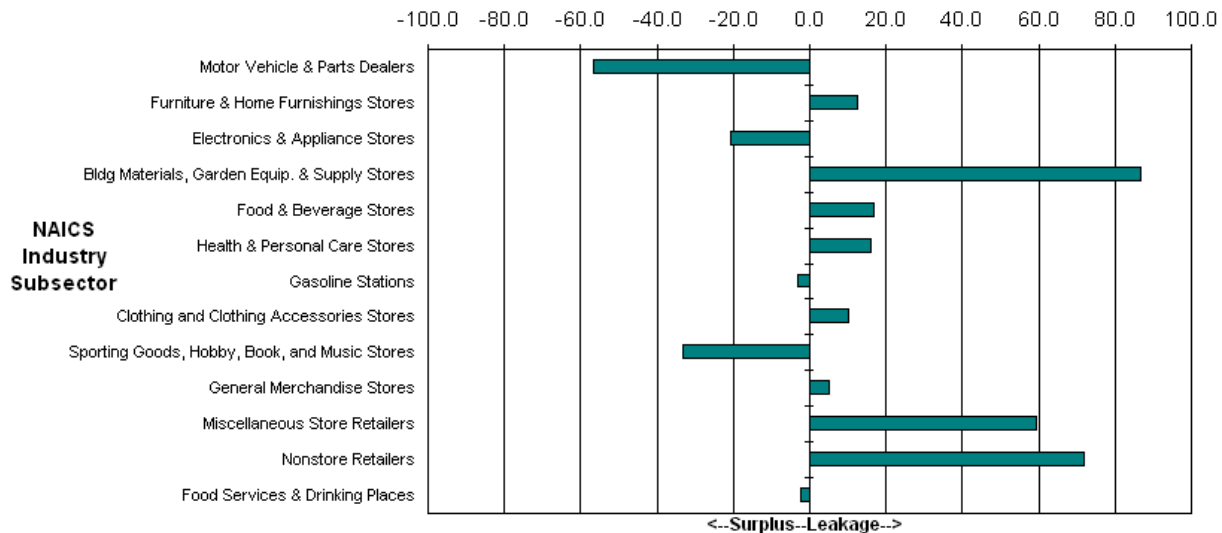Figure 7: Retail market place profile industry data

Figure 8: Leakage/surplus factor by industry subsector

NCC COMPETITION PROBLEM

The BI GIS competition problem is an example of one approach to BI applications. It is not presented here as the only method or as the absolute "best" method. Rather, it is one example of a technique that has proven itself through the NCC competition over several years. This history is an indicator of the success of this approach to BI for competition among a diverse group of contestants. The success underscores a reason for also considering the competition problem as a case problem for information system courses with a BI component.

The NCC competition problem involves site selection decision making. Contestants are provided a case description which explains the details of the decision. (The 2010 BI GIS competition problem statement is available at http://my.mis.cmich.edu/BI/Problem.doc.) Site selection is for a retail business, which is a common business problem requiring decision making. The case statement provides a list of potential sites together with component costs of acquiring land and constructing a building. Contestants are provided suggestions for some data for their evaluation. This encompasses the industry sector, the expected service area of the business, and the expected share of the wallet for the business. Their task is to perform a financial analysis which includes a payback period and a revenue-to-assets ratio. Then, they provide a ranked list of the locations, which supports selecting the "best" sites, which may be within an indicated budget amount. That is, they must present the results for making a decision based on their analysis.

Contestants need to determine the BAO reports with the required data to obtain using spatial queries. That data is then analyzed using a set of primary key factors and relationships presented in the NCC problem statement. The purpose is to provide adequate direction for a common solution analysis and presentation, which can be judged readily. However, contestants must understand both the BAO data and the subsequent evaluation relationship in order carry out the case analysis. This stresses the need to do more than just retrieve the data for decision making. Clearly, the data require further analysis to provide the necessary context for decision making. This is a typical situation for business decision making, which utilizes the external information requirements as postulated by Gorry and Scott-Morton (1989).

Key Factors and Relationships

Key factors and relationships provide the necessary guidance to direct contestants towards a relatively common solution for the NCC competition problem. This is where the BAO BI GIS meets Excel for BI analysis. Here, the BI confluence is a balancing situation. Adequate direction is set forth to achieve a reasonably common analysis for judging the competition, while challenging contestants in their use of BAO to obtain data and then undertake an appropriate analysis of that data using the ubiquitous BI tool Excel. Several of these factors and relationship are considered here to provide an overview of this direction.

- Primary and secondary service areas are defined in miles and drive times with the data in these areas to be considered as non-overlapping data.

- A share of the wallet specifies a decrease in participation in the secondary area.

- The ring (or donut) and drive time service areas must support one another which is achieved by averaging the results for the different geographical areas. This requires contestants to do both queries in order to combine the influences on the results.

- The number of households and median disposable income are determined from the most recent estimates available within BAO.

- The NAICS classification of the business is provided.

- A table provides a mechanism for converting median disposable income into an expected amount spent for a location.

- A general description is outlined for each of the Location Summary Matrix items (Figure 9), which presents the averaged or summarized results that combine the two different query influences.

These factors and relationships indicate clearly that contestants must understand the BAO data to both perform the necessary spatial queries and carry out the subsequent analysis which leads to decision making.

Problem Solution

The summarized calculations for each Location (Pad or Site) for the project scoring parameters are shown in Figure 9. These are the results from which the Location Scoring Index values are calculated for each

parameter (Figure 10). The parameter indices are summed to provide the final, overall score for the location (site) in the Score column (column N). The Score values are used subsequently to rank the desirability of each location (Figure 11). Then, Figure 12 graphically compares the location index scores. For

commonality among solutions submitted for the competition, design sketches of Figures 9 and 11 are provided to contestants, but contain no data. This greatly assists in judging the submitted competition solutions.

	A	B	C	D	E	F
1	Location	cex Index Avg	NAICS Leakage	EBT	Payback	HH
2						
3	1	83	6.6%	176,020	44.1	49,128
4	2	85	-16.3%	366,371	24.9	94,311
5	3	98	-28.0%	279,164	26.0	69,700
6	4	62	-63.4%	310,773	20.1	92,320
7	5	73	6.9%	228,948	35.5	63,810
8	6	136	-85.0%	191,797	41.2	34,280
9	7	108	-66.5%	226,640	14.2	47,094
10	8	69	20.8%	382,709	20.6	108,540
11	9	68	-19.8%	365,682	17.3	44,116
12						
13	Total	781	244.7%	2,528,106	244	603,300

Figure 9: Summarized decision parameters

	A	H	I	J	K	L	M	N
1	Location	cex Index Avg	NAICS Leakage	EBT	Payback	HH		Score
2								
3	1	0.11	0.03	0.07	-0.18	0.08		0.10
4	2	0.11	-0.07	0.14	-0.10	0.16		0.24
5	3	0.13	-0.11	0.11	-0.11	0.12		0.13
6	4	0.08	-0.26	0.12	-0.08	0.15		0.01
7	5	0.09	0.03	0.09	-0.15	0.11		0.17
8	6	0.17	-0.35	0.08	-0.17	0.06		-0.21
9	7	0.14	-0.27	0.09	-0.06	0.08		-0.02
10	8	0.09	0.08	0.15	-0.08	0.18		0.42
11	9	0.09	-0.08	0.14	-0.07	0.07		0.15
12								
13	Total							

Figure 10: Location Scoring Index summary

Rank Sort by Score		
Rank	Location	Score
1	8	0.42
2	2	0.24
3	5	0.17
4	9	0.15
5	3	0.13
6	1	0.10
7	4	0.01
8	7	-0.02
9	6	-0.21

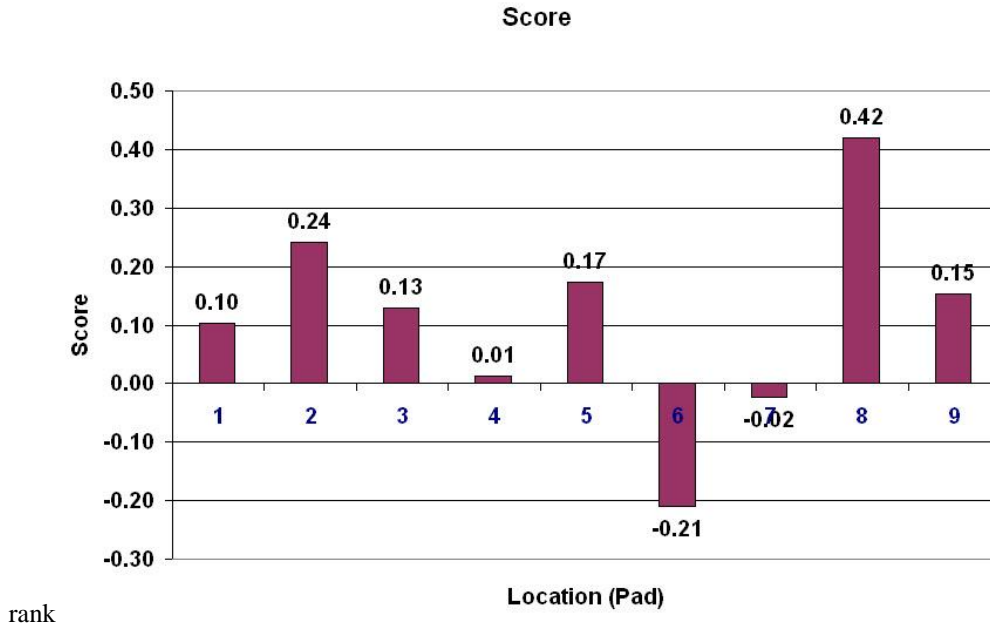Figure 11: Location Index Scores sorted by sorted by rank

Figure 12: Comparison of location index scores

NCC Competition Timeline

Each year, the NCC competitions are announced by posting them to the competition web site at the end of October (Figure 13, Announce). Although many of the NCC competitions continue from year to year, some new ones are added, and old ones dropped or replaced. These changes depend on student participation each year and competition revisions recommended to the NCC organizing committee. The October posting date provides student participants with time to determine in which competitions they will compete and to do their preparation for these competitions. For BAO, a guest access is available immediately when the competition is announced. This allows prospective contestants to explore and examine this software tool. Once a contestant has registered for the competition, they are provided an enhanced access (Figure 13, Enhanced BAO Access), which provides them access to reports beyond those available with a guest access and includes all reports used with the competition. With the cutoffs for NCC registration, the enhanced access usually occurs during the first week of March. This is done to limit the full access to the BAO report suite to only registered contestants of the BI GIS competition, and not to all 800 attendees of the NCC. The limitation is done at the request of ESRI and is because of the commercial value of the data available through the BAO application. The contestants use the enhanced BAO access setup at this time during the competition. The NCC competition then occurs at the end of March. Since

the second year of this competition, prospective contestants have been provided access to prior year competition problems. Contestants can begin their preparation of the contest anytime after the contest announcement. This allows them to better prepare for the competition and provides continuity of the access, which makes access available to them immediately at the beginning of the contest. That is, they have registered already for access, so that process occurs before the competition and provides additional time for the competition analysis. Then, the enhanced BAO access continues for contestants until a week after the completion of the competition at the NCC and permits them to go back and review their solutions.
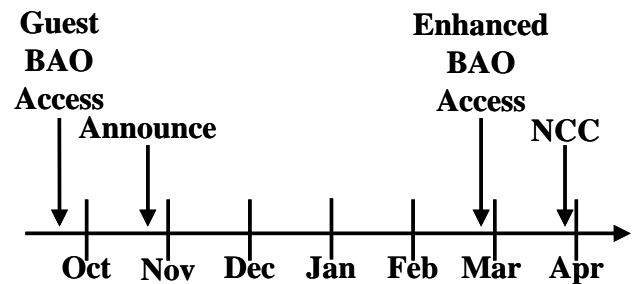

Figure 13: NCC Competition Timeline

Other NCC Problem Usage

NCC competition problems from prior years have been used in both undergraduate and graduate courses in decision support systems and business

intelligence at the author's university. The competition problem is used as an applied BI case for student analysis. Based on comments from students, the BI GIS case is well received. They appreciate the ability to use commercially available, leading-edge applications in BI to solve business problems. Also, course instructors, other than the author, have used the NCC competition problem as a case application in these courses. These instructors have reported they have found the case works well as a major case application in their course. Based on these experiences, other educators should consider using the NCC competition problems as case applications in their courses, which contain a BI component that can be demonstrated with the BAO GIS software application. Also, this can serve as preparation for the next year's NCC BI GIS competition.

CONCLUSION

The BI GIS competition at the AITP NCC provides a means for students to demonstrate their knowledge of BI using the ESRI BAO software, which is a BI tool with a rich set of econometric data. BAO is a commercially available, hosted software application that provides over 50 views of its data through a variety of reports. The BAO data are accessed through spatial queries that provide geo-coded data for business analytics. This permits contestants to work with this software that is readily available in the business environment to provide external data, which can be used to support decision making.

The NCC BI GIS competition problem provides a case application that can be considered for use in various business courses which contain a BI component. It furnishes a user-friendly environment for obtaining external data that are frequently included in decision support system applications. Problems created for the NCC competition have been found to work well in providing a hands-on, experientially-based case in decision support systems courses that include a BI component. A limitation of BAO is that it is a data mart which is oriented around spatial queries with geo-coded data, and, hence, is not a general

data mart. On the other hand, an advantage of BAO is the rich econometric data that is does provide and has application in a wide-variety of businesses. Overall, BAO with Excel have provided an excellent environment for the NCC BI GIS competition and does represent a strong, readily available candidate for experiential, case learning in decision support systems and related courses.

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