

A COMPARISON OF INFUSION OF GIS AND SPATIAL ANALYSIS CONCEPTS AMONG AACSB AND NON-AACSB BUSINESS SCHOOLS

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ABSTRACT

Geographic information systems (GIS) are being increasingly integrated with mainstream information technology to facilitate place-based decision-making and spatial analysis (SA) by businesses. This creates value and generates competitive advantage. However there is evidence in the literature that geographical literacy – incorporation of concepts involving geography such as place-based decision-making using tools available in commercial GIS software is substantially lagging in business school curricula. Using a comprehensive survey, this paper examines, compares, and reports findings regarding the current status of GIS and SA infusion in AACSB- and non-AACSB accredited business schools. Findings of this research have implications for curricular innovation and possible reform in business schools and can help business and academia assess the needs to close the gap between current trends in business GIS practice and education.

INTRODUCTION

A Geographic Information System (GIS) can integrate business data with socio-economic data and any form of geographically referenced information such as demographic data to enable data management, visualization, and analysis by a combination of hardware and software to facilitate decision-making. Spatial analysis (SA) is frequently facilitated by sophisticated statistical techniques and allows decision-makers to look beyond traditional maps. O’Sullivan and Unwin [8] have noted that the term SA comes up in the context of spatial data manipulation, spatial data analysis, spatial statistical analysis, and spatial modeling. O’Sullivan and Unwin [8] further note that most current GIS’s typically include spatial data manipulation and analysis capabilities using maps. However sophisticated statistical analysis of geo-referenced data and modeling involving the prediction of spatial outcomes is still outside the scope of most current GIS’s. SA lets decision makers analyze patterns, understand relationships and underlying phenomena possibly embedded in geographically referenced business data, derive knowledge, and use the knowledge for the purpose of decision-making. Approximately 80% of business data can be potentially geo-referenced, i.e., be attached to a spatial location (Bossler [3]).

The use of GIS and SA is evident in many industry sectors such as banking and financial services, insurance, retail, real estate, transportation and logistics, media and press, and utilities and communication (Keenan [5]; Pick [9]). In most of these sectors, GIS is used for a variety of purposes including but not limited to regulatory compliance, operations management (OM),

market and customer analysis, site selection, risk analysis and assessment, logistics, routing and scheduling, territory optimization and planning, and supply chain management. Tangible benefits of GIS and SA include reduction in annual operating cost, distribution cost, etc (Blakeley [2]), reduction in fleet size, number of routes, travel distance, etc (Begur, Miller, and Weaver [1]), improved load balancing and capacity utilization (Gayialis and Tatsiopoulos [4]), reduction in time window violation resulting in improved customer satisfaction (Weigel and Cao [11]), and improved customer/service coverage (Murray, O’Kelly, and Church [7]).

Given the diversity of industries and organizational functions which can use GIS and the nature of benefits, it is intuitive to argue that business school graduates potentially need training in the concepts and technologies of GIS and SA to capitalize on the inherent spatial dimensions of businesses and then analyze those geographic/spatial elements to improve business decision making. Employment opportunities in business GIS have been discussed by Miller, Mangold, and Holmes [6]. In this context, this exploratory research surveys the degree of GIS and SA infusion into traditional business school disciplines – in AACSB- and non-AACSB accredited business schools. We also attempt to gain an insight into faculty perspective of the facilitators/inhibitors of such infusion by addressing the following research questions:

1. How much infusion of GIS and SA currently exists in business schools? Are there differences in infusion among different business disciplines?
2. What is the perceived need among business school faculty to integrate GIS and SA concepts and/or tools in disciplinary courses? Are there differences among different business disciplines?
3. What are some of the facilitators and inhibitors of infusion of GIS and SA concepts and/or tools in business courses?
4. How much infusion of GIS and SA exists in current leading texts used in business schools?
5. What technological resources are available to faculty in business schools to infuse GIS and SA concepts and/or tools in their courses?
6. Has the infusion of GIS and SA in business school curricula been successful?

In this paper, each of above research questions is analyzed and results are compared for AACSB- as well as non-AACSB accredited business schools. Note that for the purposes of this research, “infusion” of GIS and SA in business school curricula is considered valid when a course is either a dedicated offering involving GIS and SA, or, GIS and SA concepts and/or applications constitute a part of a course. In the remainder of this paper, we will describe our study, the methodology and findings, followed by some brief concluding remarks. A detailed review of the literature that informs this study can be found in Ramakrishna, Sarkar, and Vijayaraman [10].

DATA COLLECTION, ANALYSIS, AND RESULTS

Data collection

The data to address research questions 1 through 6 were collected using two methods – a survey to address questions 1, 2, 3, 5, and 6, and an analysis of leading textbooks in each of the disciplines/areas of business schools to address question 4. To conduct the survey a questionnaire was developed with the initial set of substantive questions driven by the discussion in the literature, as they pertain to the following: motivators of infusion, inhibitors of infusion, areas of

current infusion, and tools that are infused/used. Additional questions were developed through several successive discussions between the authors. A web-based online questionnaire was then developed and verified independently for its accuracy by the three researchers. For the analysis of textbook coverage, two faculty members per discipline in two business schools (a total number of 16 faculty members for eight disciplines) in the US were consulted to identify two leading textbooks for the required first course at graduate and undergraduate levels for their discipline. A search of the subject index of each book thus identified was performed using keywords “GIS”, “Geographic Information Systems”, and “spatial analysis.” Following the search, the coverage of GIS and SA in each book (in terms of the number of pages) was noted.

With a sampling frame consisting of about 37,000 faculty members in 467 AACSB accredited schools and about 1150 non-AACSB accredited schools, we decided to collect the data using a single stage cluster sampling – i.e., selecting a certain number of schools/colleges (i.e., clusters) using a simple random sample and then using all the faculty members from the selected schools/colleges in the sample. The first set of 20 AACSB schools were randomly selected from the list of 467 schools (the number of AACSB accredited schools in September 2008) and the second set of 20 schools from a list of 447 schools (after eliminating the 20 schools from the first sample). One simple random sample of 100 non-AACSB schools was selected for data collection. For the samples for each time period of sampling, the complete list of full-time faculty names and e-mail addresses was then compiled from the websites of each of the schools. The faculty members in the list (about 2,800 for AACSB schools and about 2,100 for non-AACSB schools) were then sent an e-mail request to complete the online questionnaire (a link was provided in the e-mail). 118 responses were received from AACSB schools and 77 responses from non-AACSB schools (an overall response rate of approximately 5%).

Analysis and discussion of results

Descriptive statistics were developed from the questionnaire items to answer research questions 1, 2, 3, 5, and 6. Those statistics reveal that the faculty sample exhibits a considerable diversity along many dimensions – disciplines, faculty ranks, tenure status, academic experience, gender, age, and size of student population among others. Thus, we believe that the samples are most likely representative of all AACSB and non-AACSB accredited schools/colleges in the US. It is also interesting to note that the faculty are very comfortable with computing tools in general, i.e., IT savvy, but are not nearly as comfortable with GIS and SA tools.

Infusion and disciplines

The results from the questionnaire data to address the question “How much infusion of GIS and SA currently exists in business schools?” and “Are there differences in infusion among disciplines?” are briefly discussed next. Nineteen faculty members (out of 117) from AACSB accredited schools and 21 from non-AACSB accredited schools (out of 77) indicate some degree of infusion. It is clear from the results that a higher percentage of Marketing, DS & OM, and IS faculty (between 24-56%) have infused GIS and SA concepts in their courses as compared with faculty in other business disciplines (9-10%). This is consistent with discussions in prior research. Results also indicate that the infusion is taking place in 18 undergraduate and 11 graduate courses in AACSB schools and in 26 undergraduate and 12 graduate courses in non-

AACSB schools. Assuming an average of four different courses taught by faculty members in their schools, infusion is taking place in about 8% of the courses (67 out of 776 courses). Software/tools for GIS and SA are used in three courses, i.e., in about 10% of the courses (3 out of 29 courses) in AACSB schools and in 32% of the courses (12 out of 35 courses) in non-AACSB schools. The results indicate a higher level of infusion and higher use of GIS software/tools, on average, in non-AACSB schools.

Potential for infusion and disciplines

Given the meager level of infusion of GIS and SA concepts and tools, we were interested in learning about the potential for infusion. We have also examined whether there are differences among disciplines. It appears that faculty members, in general, are indifferent regarding the need for infusing GIS and SA concepts and tools in their area courses. Marketing, and DS & OM faculty members perceive a higher need than the other groups of faculty. Most faculty members do not perceive a need for infusion five years into the future. Results again indicate a higher level of perception (of the need for integrating GIS and SA concepts and tools) for non-AACSB faculty. To understand some potential reasons for the perceptions, we posed four more questions to the faculty members. Results indicate that faculty members in all disciplines consider the coverage of GIS and SA concepts in their area textbooks to be somewhat inadequate. The perception regarding adequacy of supplemental materials for GIS and SA infusion appears to be similar to that of textbooks. All groups of faculty appear to be neutral to the question about the “difficulty in learning the GIS tools”. DS & OM and marketing faculty appear to agree that gaining spatial insight is crucial to addressing many problems in their respective disciplines. Overall, faculty do not seem to perceive a strong need to integrate GIS and SA concepts/tools in their courses, now or five years in the future. The results do not show significant differences in perception between AACSB and non-AACSB school faculty.

Facilitators and inhibitors for infusion

Given the lack of infusion, and perceived potential for infusion of GIS and SA concepts and/or tools, we were interested in identifying “some of the facilitators and inhibitors of infusion of GIS and SA concepts and/or tools in business courses” -- research question 3. In the questionnaire, we had included a list of 11 facilitators and had listed 3 facilitators as inhibitors by modifying the wording. The results indicate that if an issue is not a facilitator then it is also not an inhibitor. Most of the possible facilitators appear to be somewhat of a factor (i.e., an average score around 3 where 1 indicates “to a considerable degree”, 3 “somewhat” and 5 “not at all”) with none of the 11 issues standing out as a strong facilitator (or inhibitor). When asked to add to the list of facilitators included in the questionnaire, three issues were identified – two of them pertain to recognition, from the discipline and from the administration, and one is related to demand, from students. All three issues were identified as facilitators to a “considerable degree.” To further understand the role played by faculty in promoting infusion of GIS and SA in business courses, we asked each respondent to identify a specific discipline that should champion the cause. The respondents identify the IS and DS/OM faculty as most appropriate for championing the cause (selected by 16 out of 69 respondents). This may point to a modeling and tools bias in the thinking of the respondents as it relates to GIS and SA.

Infusion in textbooks

One of the inhibitors for infusion could be the availability of discipline-specific (such as marketing, finance etc.) textbooks with coverage of GIS and SA. An analysis of coverage in textbooks in the typical disciplines in a business school was performed to understand the issue, research question 4. It is clearly evident from the results that, in textbooks typically adopted by business schools, the coverage of GIS and SA is virtually non-existent. It can be argued that non-specific keywords may have refined our search process; however the impact on the results (in terms of number of pages) would be marginal. This addresses research question 4.

Technological resources available

Availability of easy-to-use tools/software for GIS and SA could also influence the degree of infusion by business faculty. The respondents were presented a list of common resources available and were asked to identify the technological resources available to them (in their school/college) to infuse GIS and SA in their courses – research question 5. The most commonly available (and used) tools appear to be the free ones – Google Earth/Map, MapQuest, Rand McNally, and others. Tools/software that are often prohibitively expensive due to hardware requirements, licensing renewals, etc. are not that readily available -- ArcGIS, MapPoint, and others. It is possible that the lack of investment in expensive tools could indicate a lack of a critical mass of users.

Success of current infusion

Finally, to address research question 6, regarding the success of the infusion of GIS and SA in business school curricula, we asked the respondents to answer the following question: “In your assessment, how successful do you believe your business school/college has been with the infusion of GIS and SA concepts/tools into the curriculum?” The respondents were asked to use the following scale: 1 indicating “to a considerable degree, 3 “somewhat” and 5 “not at all.” Success of the infusion appears to be reasonable for those respondents who have infused GIS and SA in their courses – reflected by an average score of 2.14 and 2.88 for AACSB and non-AACSB faculty respectively. However, the assessment of the success of infusion in their school/college appears to be low, an average score of 3.98 and 4.36 respectively. Results indicate a slightly higher level of success for AACSB schools.

CONCLUSIONS

The purpose of this study was to examine the current status of the extent of infusion of GIS and SA concepts and/or tools in AACSB and non-AACSB accredited business schools in US. Also, we wanted to identify the business disciplines that have infused GIS and SA more than others and the business school disciplines that should be championing the integration of GIS and SA in their curriculum. To meet these goals, we surveyed faculty from both AACSB and non-AACSB accredited business schools. We surveyed faculty from 40 AACSB accredited and 100 non-AACSB accredited business schools in the US.

The results of the survey indicated that there was very little infusion and very few business schools were integrating GIS and SA in their curriculum. Among the schools that are integrating, a higher percentage of Marketing, DS & OM, and Information Systems faculty have infused GIS and SA concepts in their courses as compared with faculty in other business disciplines. The results indicate a higher level of infusion and higher use of GIS software/tools, on average, in non-AACSB schools compared to AACSB accredited schools. Given the meager level of infusion of GIS and SA concepts and tools, faculty members are indifferent regarding the need for infusing GIS and SA concepts and tools in their area courses. Most faculty members do not perceive a need for infusion five years into the future. Faculty members consider the coverage of GIS and SA concepts in their area textbooks to be somewhat inadequate. DS & OM and marketing faculty appear to agree that gaining spatial insight is crucial to addressing many problems in their respective discipline as compared to other disciplines. This research confirms findings from earlier studies that the infusion of GIS and SA in business school curricula is still at an initial stage due to lack of availability of easy-to-use tools, resources, training, and faculty expertise. The conclusions presented in this paper could be the results of a limited response rate. Other reasons as indicated in the survey is that GIS is not considered as a major area of instruction or scholarly research at many business schools, and consequently faculty are simply unaware of the potential of GIS and SA in business curricula.

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Note – This is a considerably summarized version of a more detailed paper (about 25 pages long) which can be made available upon request to any of the authors.