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## TOO YOUNG TO HAVE A HISTORY? USING DATA ANALYSIS TECHNIQUES TO REVEAL TRENDS AND SHIFTS IN THE BRIEF HISTORY OF ACCOUNTING INFORMATION SYSTEMS

*Abstract:* Using several data-analysis techniques, this paper seeks to construct a brief history of Accounting Information Systems (AIS). In an effort to achieve some degree of comprehensiveness, this paper examines both AIS research and pedagogy. It begins by documenting and classifying topical foci of research papers in the *Journal of Information Systems*. It then compares the pedagogical emphases of AIS courses as identified in past research. By deploying multiple methods of analysis to identify patterns of hegemony or change in the topics of AIS scholarship and teaching, this paper highlights the use of two data-analysis techniques found to be useful in the historical research of accounting. Findings reveal signs of the assimilation of AIS scholarship into the wider world of accounting research and strong influences upon AIS pedagogy by oversight bodies and technological innovation.

### INTRODUCTION

This paper explores the history of Accounting Information Systems (AIS) research and pedagogy through the use of two data-analysis techniques – content analysis and exploratory data analysis. The objectives of this paper are three fold: 1) to provide some insight into the development of AIS research by documenting the extent to which it has become differentiated from other areas of accounting research over time; 2) to provide a better understanding of the chronological development of AIS

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by examining the topics that have been emphasized in this area of accounting pedagogy; and 3) to demonstrate the potential for both content analysis and exploratory data analysis as methods of inquiry in accounting history research. Thus, this study examines changes in both AIS research and pedagogy with the additional aim of determining the degree to which AIS research and education are interconnected. This bi-focal objective is partly motivated by the Association to Advance Collegiate Schools of Business' (AACSB) assertion that through intellectual contributions such as research, faculty members can remain current in their areas of teaching specialization (AACSB, 2011).

### DEFINING AIS

The origin of the history of AIS in large part depends on how AIS is defined. The Greek root of the word "systems" is *συστημα* which means "components standing together to form a whole." As can be gathered from this classical etymology, AIS has been defined as the union of various functional components interacting to produce information useful to financial statement users and firm managers [Kieso *et al.*, 2007]. This broad definition encompasses traditional manual accounting systems that start with transaction analysis and end with financial statements and would trace AIS back to 8,000 B.C. (See Kee, [1993] for an example of a longitudinal secular review of the interaction between data-processing technology and accounting, ranging from the era of clay tokens and pot-shards to the 20th century digital revolution.)

However, if AIS is defined more narrowly as the joint deployment of traditional accounting processes and computer and telecommunications technology for financial and managerial accounting purposes [Mock, 1999], then its beginning is much more recent. It was in the late 1920s, for example, when the term "systems" in reference to accounting began to crop up in the popular media. Wootton and Kemmerer [2007, p. 93] focus more specifically on technological changes in the late 19th and early 20th centuries. These changes transformed accounting into a profession "while deskilled, repetitive, task-based bookkeeping became a trade," and "[accountants] became responsible for...analyzing data and the way information was used" (p. 93). Their paper delineates a point in history where technology played a significant role in the evolution of the accountant's role from bookkeeper to professional. A similar idea is put forth by Abbott [1988, p. 154], which characterizes a profession as "a coherent occupational group with some control of an abstract

expertise.” For example, the rise of cost accountants is linked to the invention of calculating machines, such as the Hollerith device. According to Abbott, “the machines created, virtually overnight, the field of cost accounting (p. 228).” However, it was not until the creation and establishment of theoretical assumptions and conventions against which a firm’s actual cost data could be analyzed in order to make various decisions as to reengineering production, evaluating performance, and budgeting capital, that cost accountants were given professional status. Abbot (p. 232) states: “These conventions created the crucial judgments that made cost accountants real professionals. As long as cost accounting merely recorded costs it was just data processing... the invention of standard costs and the use of those costs for management decision making established the new jurisdiction.” Similar phenomena in the late 20th century, such as advances in computing, data modeling, and telecommunications, had significant implications for accounting broadly and for AIS research and pedagogy specifically. These phenomena also constitute the point at which this paper locates the origins of AIS.

Identifying the inception of AIS at the turn of the 20th century arguably limits its history and, thus, perhaps renders it too young to have much of a history. However, brevity and/or recency of events do not preclude its historical poignancy.

The remainder of this paper will examine whether over this relatively brief period, there have been significant trends and shifts in the scholarship and teaching of AIS as defined herein. The paper begins with an exploration of AIS research using content analysis.

### AIS SCHOLARSHIP

*Content Analysis:* The first step is an analysis of AIS research utilizing a taxonomic review of research published in the *Journal of Information Systems (JIS)*. The research method used is explicit (manifest) content analysis. This technique is used because of the nature of the data collected from research papers. It is a research method in which text is broken into its component parts (e.g., sentences, phrases, and words). Then, quantitative analysis is deployed on these components to make inferences regarding the intention, meaning, and significance of the text, as well as the characteristics of the author and of the milieu in which the text was created [Berelson, 1971].

Content analysis has been used in accounting research in several ways [Jones and Shoemaker, 1994]. Specific uses include tracing the development of government accounting [Previts and

Brown, 1993], investigating the information in CEO's letters to shareholders [Abrahamson and Amir, 1996], and analyzing discretionary narrative disclosures [Smith and Taffler, 2000].

In spite of content analysis' versatility and its adaptability for use in studying different types of written communication, it has its disadvantages and limitations. When done by hand, the analysis consumes much effort and time [Yen *et al.*, 2007], and where the object of study is latent meaning rather than explicit textual communication, reliability may be questionable [Krippendorf, 2004].

Due to advances in information technology, such as the advent of optical character recognition (OCR) and databases, the tedium and difficulty of content analysis has been largely obviated. Reliability, however, remains an issue to the extent that the text requires interpretation to uncover hidden meanings. To compensate, multiple analysts may be employed when working with latent content, or explicit or manifest content analysis may be employed. In the case of the Rutgers University Accounting Research Directory (ARD), which provides data for this paper, both compensating measures were used – the analysts were continuously supervised by one of the academicians who developed the classification scheme. Only manifest content was analyzed. Thus, the validity and consistency of the content analysis throughout the periods of study were assured and maintained.

*Literature on AIS Scholarship:* Papers, such as Haseman [1978], Vasarhelyi *et al.* [1988], and Fleming *et al.* [1990, 1991, 2000] provide additional insight into how accounting scholarship evolves. Haseman [1978] compared research in managerial accounting in the 1920s and the 1970s. The comparison revealed that the rate at which research was produced had increased, and that “the literature...covered a considerably wider range of topics (p.78).” Vasarhelyi *et al.* [1988], using the Rutgers University ARD taxonomy to characterize accounting research, found increased use of economics, finance, and psychology as theoretical bases for papers, as well as increases in behavioral topics and quantitative methodologies. Finally, the trilogy of papers by Fleming *et al.* [1990, 1991, 2000] analyzed the research in *The Accounting Review* and found that the literature had evolved from a practice orientation to a more empirical one. As will be seen later, several of these developments, particularly the increased proliferation of research, the migration towards behavioral studies, and increased focus on economics and finance, are true of AIS research as well.

A number of retrospectives on AIS research were written towards the close of the 20th century and the first decade of the 21st. These include David *et al.* [1999], Murthy and Wiggins [1999], Stone [2002], and Steinbart [2009]. Murthy and Wiggins [1999] provide a definition of AIS research similar to the one provided in this paper, characterizing it as the intersection between accounting, which focuses on providing information for economic decision making, and management information systems, which is concerned with the design, implementation, and maintenance of those technological artifacts that make information provision possible. The paper also calls for increased attention to behavioral research as being appropriate for AIS, citing auditor behavior, decision making, and group behavior as specific foci of inquiry. As will be seen later, there is evidence that AIS scholars have responded to this call. David *et al.* [1999] propose a framework for AIS research, defining several archetypal AIS research questions, as well as suggested research methodologies appropriate to them. Like Murthy and Wiggins [1999], the paper recommends a behavioral emphasis for AIS, suggesting such behavior-oriented research methods as laboratory experiments, field studies, and surveys. Also, reminiscent of Kee [1993], David *et al.* [1999] frame AIS, and consequently AIS scholarship and pedagogy, as primarily concerned with facilitating and tracking the flow of data through transactions and business processes. This stance also has implications for AIS education.

*Data for AIS Research:* Content analysis may be deployed in order to find both explicit and latent content. However, in order to simplify data gathering and maximize analytical validity, only explicit data was considered in this study. The data used to characterize AIS research consisted of papers published in *JIS*, the American Accounting Association's (AAA) information systems section journal. Its editorial policy defines its primary criterion for publishing a paper as contribution to AIS [*JIS*, 2011]. A similar approach for identifying distinctive research areas was used in Brown *et al.* [1987]. Therefore, this research outlet may arguably be considered an appropriate representation of AIS scholarship within the academic accounting research network.

In order to characterize the topical emphases in AIS research, only papers consisting of at least five pages published between 1986 and 2003 in *JIS* were inspected. The start of this time period, 1986, corresponds to the year in which *JIS* published its first volume of research. It also represents a period of time when PCs were becoming more common and accessible

and portable computers were being introduced to the market [Computer Hope, 2011]. Many universities were beginning to establish computer labs and students were able to work on PCs rather than mainframes. The end of the period, 2003, corresponds to the end of the coverage of *JIS* research by the Rutgers University ARD. The time period analyzed in this study may also be considered pre-Sarbanes-Oxley as little time had passed since its passage in the summer of 2002 for the impact to show up in research or the classroom. While it would have been better to have had access to more recent data, the limitations of the ARD coverage precludes analysis beyond 2003. However, much accounting history research has focused on discrete periods leading up to or following certain events. For example, Fleischman and Radcliffe [2005] focuses on accounting history research leading up to the 21st century, while Fleming *et al.* [1991, 2000] trace the development of research in *TAR* through the first three decades after World War II. These discrete periods provide an opportunity to compare accounting practice and research before and after certain important historical inflection points. As discussed in the conclusion, this time period implies future avenues of research on the development of AIS scholarship.

The ARD taxonomy contains several classification categories for research topics and methods. Among these are five topical taxons: school of thought, information, treatment, accounting area, and foundation discipline. Each of these five taxons may be used to describe some topical emphasis of research artifacts. School of thought describes what broad accounting-related issue is investigated by the research, such as behavioral research, accounting theory, accounting history, or accounting institutions, among others. The information taxon is more specific, defining which particular account, transaction, or procedure serves as the research piece's dependent or response variable. It may be thought of as the action or result that the research is trying to predict. The treatment taxon is similarly specific in that it is the account, transaction, or procedure that is employed as the independent or predictor variable. Hence, it may be defined as the causal or influential factor being investigated by the research. Accounting area describes the accounting function to which the research contributes, such as financial accounting, tax, auditing, managerial accounting, or information systems. Finally, foundation discipline establishes the underlying subject or body of knowledge upon which the research depends. These may include such obvious disciplines as accounting, finance and economics, or management, or others

less germane, such as the humanities, mathematics, or telecommunications and information systems.

Counts of papers falling under the several different categories of every one of these taxons were tallied for each of the 17 years under consideration. Then, a ratio was computed by comparing the counts in each category to the total number of research papers in each year of the study. Finally, statistical analysis was carried out in order to see if there were significant differences in the topical emphases between *JIS* papers in the first half of the period (1986 to 1994) and those in the second half (1995 to 2003), thus dividing the time period into equal halves of nine years, respectively. The *JIS* research data were subjected to the Mann-Whitney nonparametric test, a form of quantitative statistical analysis used to detect significant differences between data distributions.

*Significant Differences in JIS Research over Time:* Among 45 topical taxonomic classifications, seven classifications exhibited significant differences between the frequencies in which they had been studied by *JIS* researchers from 1986 to 1994 (period 1) and 1995 to 2003 (period 2). These were: (1) school of thought-human information processing, (2) information-mixed topics, (3) treatment-other financial accounting, (4) treatment-other topics, (5) treatment-mixed topics, (6) accounting area-mixed, and (7) foundation discipline-telecommunications.

The human information processing school of thought is concerned with studying how people absorb data and use them to arrive at conclusions or decisions. *JIS* researchers have significantly increased (sig. = .014) the proportion of research devoted to this topic from 8% to 23%.

The information taxon classifies what the dependent variable (y-variable) is in a particular research paper. Significant differences (sig. = .001) are revealed between the proportion of papers having multiple dependent variables in period 1 (37%) and period 2 (5%).

The treatment taxon indicates what the independent or predictor variable (x-variable) is. Significant differences are revealed in the usage of three treatment classifications between research in the two periods. Predictor variables related to financial accounting were absent in period 1 research, but make up 7% of later research, a difference significant at the .029 level.



**TABLE 1**  
**Proportions of JIS Research that Various Taxonomic**  
**Classifications Comprised, and Mann-Whitney Significance**  
**of Differences between 1986-1994 and 1995-2003**

Taxons and Sub-Classifications	Average Annual Percentage each Classification Comprised of JIS Output		Significance of Differences
<i>Schools of Thought</i>	<i>1986-1994</i>	<i>1995-2003</i>	
human information processing	(4 of 52) 7.69%	(15 of 65) 23.08%	0.01
other behavioral	(4/52) 7.69%	(2/65) 3.08%	0.46
efficient markets hypothesis	(0/52) 0.00%	(1/65) 1.54%	0.32
accounting theory	(1/52) 1.92%	(1/65) 1.54%	0.94
accounting history	(0/52) 0.00%	(1/65) 1.54%	0.32
institutional	(2/52) 3.85%	(3/65) 4.62%	0.63
other	(37/52) 71.15%	(39/65) 60.00%	0.17
expert / information systems	(0/52) 0.00%	(1/65) 1.54%	0.32
agency theory	(4/52) 7.69%	(2/65) 3.08%	0.5
	100.00%	100.00%	
<i>Information</i>			
financial accounting	(0/ 52) 0.00%	(3/65) 5.26%	0.07
internal information	(3/52) 6.12%	(0/65) 0.00%	0.15
performance measures	(1/52) 2.04%	(2/65) 3.51%	0.54
personality measures	(2/ 52) 4.08%	(1/ 65) 1.75%	0.73
auditor behavior	(10/ 52) 18.37%	(6/65) 8.77%	0.94
manager behavior	(6/52) 12.24%	(1/65) 1.75%	0.6
decision making	(3/52) 6.12%	(9/65) 14.04%	0.11
costs	(4/52) 8.16%	(0/65) 0.00%	0.58
group behavior	(1/52) 2.04%	(0/65) 0.00%	0.07
other	(2/52) 4.08%	(39/65) 59.65%	0.32
mixed	(19/52) 36.73%	(3/65) 5.26%	0
	100.00%	100.00%	
<i>Area</i>			
financial	(2/ 52) 3.85%	(5/65) 7.69%	0.2
managerial	(4/52) 7.69%	(1/65) 1.54%	0.2
audit	(7/52) 13.46%	(13/65) 20.00%	0.1
information systems	(31/52) 59.62%	(46/65) 70.77%	0.38
mixed	(8/52) 15.38%	(0/65) 0.00%	0.03
	100.00%	100.00%	

**TABLE 1 (CONTINUED)**  
**Proportions of JIS Research that Various Taxonomic Classifications Comprised, and Mann-Whitney Significance of Differences between 1986-1994 and 1995-2003**

Taxons and Sub-Classifications	Average Annual Percentage each Classification Comprised of JIS Output		Significance of differences
<i>Treatment</i>			
inventory	(1/52) 2.17%	(0/65) 0.00%	0.32
other financial accounting	(0/52) 0.00%	(4/65) 6.67%	0.03
risk	(1/52) 2.17%	(0/65) 0.00%	0.32
analytical review	(1/52) 2.17%	(0/65) 0.00%	0.32
internal control	(3/52) 6.52%	(0/65) 0.00%	0.15
EDP audit	(5/52) 8.70%	(1/65) 1.67%	0.3
transfer pricing	(1/52) 2.17%	(0/65) 0.00%	0.32
cost allocations	(2/52) 4.35%	(0/65) 0.00%	0.15
other	(6/52) 10.87%	(42/65) 65.00%	0
auditor behavior	(1/52) 2.17%	(2/65) 3.33%	0.59
decision aids	(3/52) 6.52%	(10/65) 15.00%	0.29
organization and environment	(2/52) 4.35%	(1/65) 1.67%	0.54
mixed	(25/52) 47.83%	(4/65) 6.67%	0.04
	100.00%	100.00%	
<i>Foundation Discipline</i>			
psychology	(6/52) 11.76%	(12/65) 18.46%	0.24
sociology, political science, philosophy, history	(0/52) 0.00%	(5/65) 7.69%	0.07
economics and finance	(1/52) 1.96%	(5/65) 7.69%	0.2
engineering, communication, computer science	(40/52) 78.43%	(34/65) 52.31%	0.05
math, decision science, game theory	(1/52) 1.96%	(5/65) 7.69%	0.25
other mixed	(1/52) 1.96%	(1/65) 1.54%	0.94
accounting	(0/52) 0.00%	(2/65) 3.08%	0.15
management	(2/52) 3.92%	(1/65) 1.54%	1
	100.00%	100.00%	

The proportion of research using multiple predictors decreased from 48% to 7%, a decrease significant at the .004 level. Finally, “other” predictor variables, which are so exogenous to accounting research that they do not readily fit into the existing treatment classifications, were shown to have significantly increased (sig. = .042) from 11% to 65% of research.

Although 15% of early *JIS* research was comprised of mixed accounting areas, this study did not reveal similar papers in later research. This constitutes a decrease significant at the .029 level.

The final taxon, foundation discipline, reveals a significant decrease (sig. = .049) in the proportion of papers using telecommunications and computer science as a theoretical basis from 78% in period 1 to 52% in period 2.

The findings show that AIS research is significantly different between its earlier years and later years. There has been a significant increase in the study of human information processing (HIPS) topics and in the research related to financial topics and a significant decrease in dependence upon telecommunications as a foundation discipline. These results suggest an increasing integration of AIS research into the broader realm of accounting scholarship.

The finding that AIS scholarship has developed a behavioral niche as evidenced by the significant increase in HIPS topics since the early 1990s appears consistent with a wider behavioral movement in accounting research observed by Vasarhelyi *et al.* [1988] and Flesher and Flesher [2006]. It also provides evidence that AIS scholars heeded calls for behavioral research encouraged by David *et al.* [1999] and Murthy and Wiggins [1999].

Further signs of assimilation include a significant increase in financial accounting variables being included as treatment factors in AIS research. This implies an increased appreciation for the possible ways by which traditional accounting constructs predict or influence AIS-related phenomena and is consistent with the increased attention to economics and finance issues recorded in Vasarhelyi *et al.* [1988]. Nevertheless, the significant increase in “other” treatment variables indicates that AIS research is still distinctive in that it uses predictors that are so different from those normally used in accounting research that they cannot be classified using the ARD taxonomy. This is true even as the actual topics studied begin to resemble those in mainstream accounting scholarship.

Finally, results of this study evince that AIS is broadening its theoretical bases rather than drawing narrowly from

telecommunications. It is reaching out to other foundation disciplines used in accounting research. Once again, this may be considered a symptom of assimilation.

### AIS PEDAGOGY

*Exploratory Data Analysis:* Exploratory data analysis (EDA) is comprised of several, mainly graphical techniques designed to summarize data quickly and identify trends and patterns therein. While EDA often provides quantitative metrics to characterize the data, the results are commonly reported graphically in order to give a quicker, more intuitive characterization of the data. EDA may be said to operate on the principle, “a picture paints a thousand words.”

In the U.S., the development and widespread use of EDA can be traced to Tukey [1962] and his landmark paper, “The Future of Data Analysis.” In it, Tukey issued a call for the recognition of data analysis as a legitimate branch of statistics distinct from mathematical statistics. Shortly thereafter, he began the invention of a wide variety of new, simple, and effective graphic displays under the rubric of “Exploratory Data Analysis.” Tukey’s stature as a statistician served to legitimate this informal, graphical approach to data analysis. Adding to the momentum for the use of EDA, Bertin [1967] published in France the monumental *Semiologie Graphique*. Computer processing of data had begun and offered the possibility to construct old and new graphic forms via computer programs. True high-resolution graphics were developed but would take some time to achieve common use.

By the end of this period, significant intersections and collaborations would begin. Computer science research (software tools, C language, UNIX, etc.) at Bell Laboratories [Becker, 1994] and elsewhere would combine forces with developments in data analysis (EDA, psychometrics, etc.) and display and input technology (pen plotters, graphic terminals, digitizer tablets, the mouse, etc.). These developments would provide new paradigms, languages, and software packages for expressing and implementing statistical and data graphics. In turn, they would lead to an explosive growth in new visualization methods and techniques [Colorado State University, 2011].

*AIS Pedagogical Literature:* The AIS pedagogical literature includes Wu [1983], Davis and Leitch [1988], Heagy and Rakow [1991], Smith and Bain [1993], Murthy and Groomer [1996], Bain *et al.* [2002], Fordham [2005], and Badua [2008]. Several

of these papers, such as Wu [1983], Davis and Leitch [1988], and Bain *et al.* [2002], were undertaken in order to elicit from faculty and industry a set of topics or issues to form the basis for a classic AIS curriculum. Others, such as Groomer and Murthy [1996] and Badua [2008], were concerned with documenting the AIS curriculum as it existed at certain points in time. Taken together, these works represent what topics various stakeholders in AIS pedagogy considered important to include in the curriculum. These works will also constitute a portion of the data used in the analysis of AIS pedagogy. As discussed in greater detail later, they reveal an evolving focus on modeling transaction cycles of firms in support of systems analysis and design.

*Methodology and Data:* Analysis of AIS pedagogy was implemented by a review of both faculty's and overseeing institutions' initiatives at AIS curriculum formation. In order to be able to trace the longitudinal development of AIS teaching topics as embodied in faculty efforts, past literature on AIS pedagogy was reviewed. The literature was comprised of the eight papers discussed in the literature review. These papers were chosen because they offer data from the last 25 years and because their data were gathered in different ways, including faculty surveys (Wu, 1983; Davis and Leitch, 1988; Heagy and Rakow, 1991; Smith and Bain, 1993; Groomer and Murthy, 1996); case studies (Fordham, 2005); and content analysis of syllabi (Bain *et al.*, 2002; Badua, 2008). Therefore, the temporal dispersion of these studies and the triangulation provided by their different populations and research methods provide the basis for an analysis that is longitudinally comprehensive and enjoys high external validity. The lists of topics mentioned in these works were analyzed using EDA in order to determine which topics faculty emphasized the most and how these emphases may have changed over time.

In order to describe the evolution of AIS teaching topics as envisioned by overseeing organizations, topic recommendations of the 1987 Mock Committee, the 1999 American Institute of Certified Public Accountants (AICPA) Core Competencies Committee, and the 2009 AICPA Emerging Technologies Committee were compared. These lists of recommended topics were chosen because they were prepared towards the end of the 1980s, 1990s, and 2000s, respectively. Once again, these lists were compared to see how overseeing institutions may have emphasized different topics over time.

The data from past AIS pedagogical literature were sum-

marized using box-plots, a form of EDA that identifies outliers in data distributions; in this case, topics most frequently taught or most highly ranked by AIS faculty. Box-plots take the form of a box, one of whose horizontal edges is the third quartile of a distribution, whose other horizontal edge is the first quartile, and which has a line drawn across the box at the median of the distribution. Thus, extreme outliers, such as very high or very low numbers in the distribution, would be above or below the edges of the box, respectively.

The topics whose frequencies lie above the third quartile may be considered to have received greater curricular coverage than others. Similarly, topics whose ordinal rank lies below the first quartile may be deemed to be more greatly esteemed by those doing the ranking. These emphasized topics were then compared across studies to determine patterns and trends. Finally, content analysis of the list of topics drawn up by oversight institutions was done to detect differences among them.

*Results of EDA of Faculty Initiated Pedagogical Topics over Time:*

The data in the various past pedagogical papers measured different things, such as the number of faculty surveyed saying they teach a particular topic [Wu, 1983], the percentage of class time devoted to a topic (Davis and Leitch, 1988; Groomer and Murthy, 1996), faculty rankings of various topics (Heagy and Rakow, 1991; Smith and Bain, 1993), and the proportion of syllabi that include a particular topic (Badua, 2008). Thus, direct comparisons of their data distributions would not be valid.

However, using box-plots allows the identification of outliers embodied by topics that are most important to faculty regardless of how that importance was measured. It is the set of outliers that emerges in each paper's data set that can be compared to those in other papers in order to find how pedagogy has evolved over time.

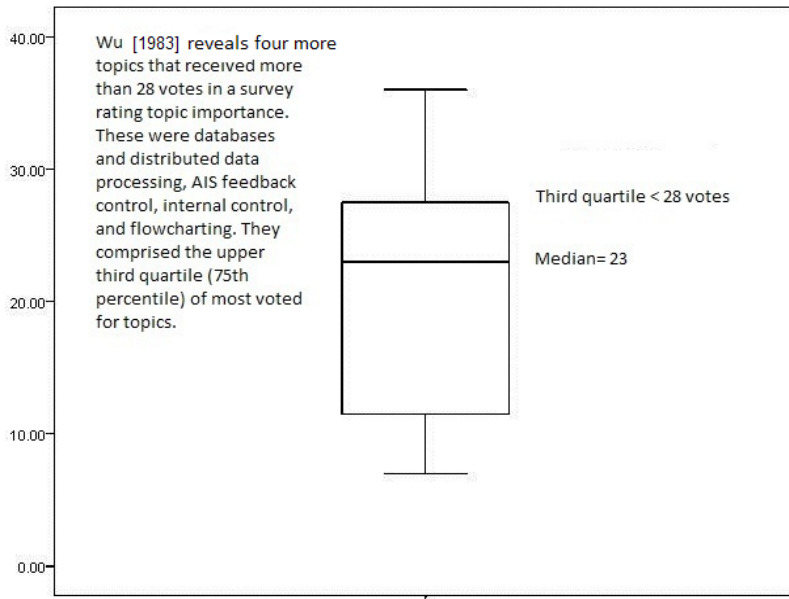
The following table reveals the topics comprising the third quartile (75th percentile) of the data distributions in the sample papers. Hence, these topics are those that each of the papers reveals to be most emphasized by faculty.

**TABLE 2**  
**AIS Teaching Topics Identified by Faculty**

<i>Wu [1983]</i>	<i>Davis&amp;Leitch 1988]</i>	<i>Heagy&amp;Rakow [991]</i>	<i>Smith&amp;Bain [1993]</i>
databases and distributed data processing	management of information systems	internal control	internal control
AIS feedback control	systems analysis and design	transaction cycles	systems analysis and design
internal control	database design and management	file organization and access	revenue cycle
Flowcharting	quantitative methods	introduction to systems	purchase cycle
	computer software applications		
<i>Groomer- Murthy (1996)</i>	<i>Bain et al. (2002)</i>	<i>Fordham (2005)</i>	<i>Badua (2008)</i>
Spreadsheets	introduction to systems	spreadsheets	Controls
internal control	internal control	spreadsheet design	transaction cycles
computer controls	systems documentation	design of accounting applications	resource-entity-agent
systems documentation	purchase cycle	databases	flowcharts
revenue cycle	revenue cycle	database design	databases
purchase cycle	systems analysis and design	transaction cycles	data flow diagrams
introduction to AIS	databases	flowcharting	e-commerce
	transaction cycles	internal control	systems analysis and design
	telecommunications	AIS vs MIS	fraud
	reporting cycle		AIS auditing
	computer fraud		enterprise resource planning
	production cycle		databases
			spreadsheets
			risks

Wu [1983] surveyed AIS faculty to elicit from them what topics they considered essential for the AIS course. Box-plots reveal that four topics (databases and distributed data processing, AIS feedback control, internal control, and flowcharting) elicited faculty votes in excess of the third quartile threshold (27.5 votes).

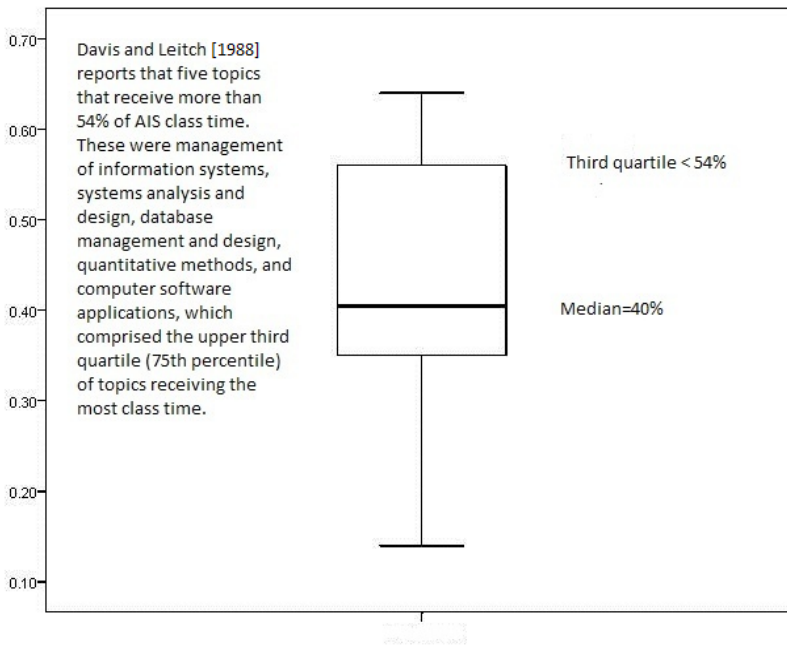
**FIGURE 1**  
**Box-Plot of the Distribution of Faculty for AIS Topics in Wu [1983]**





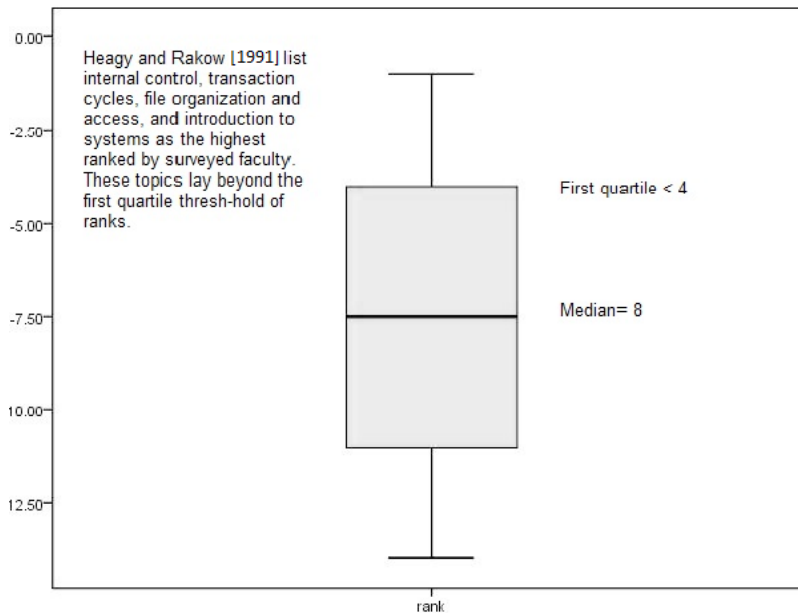
Davis and Leitch [1988] measured the importance faculty ascribe to a topic by the proportion of class time devoted to it. Box-plot analysis reveals that five topics (management of information systems, systems analysis and design, database management and design, quantitative methods, and computer software applications) took class time beyond the third quartile threshold of 54%.

**FIGURE 2**  
**Box-Plot of the Distribution of Percentages of Class Time**  
**Allocated to AIS Topics in Davis & Leitch [1988]**

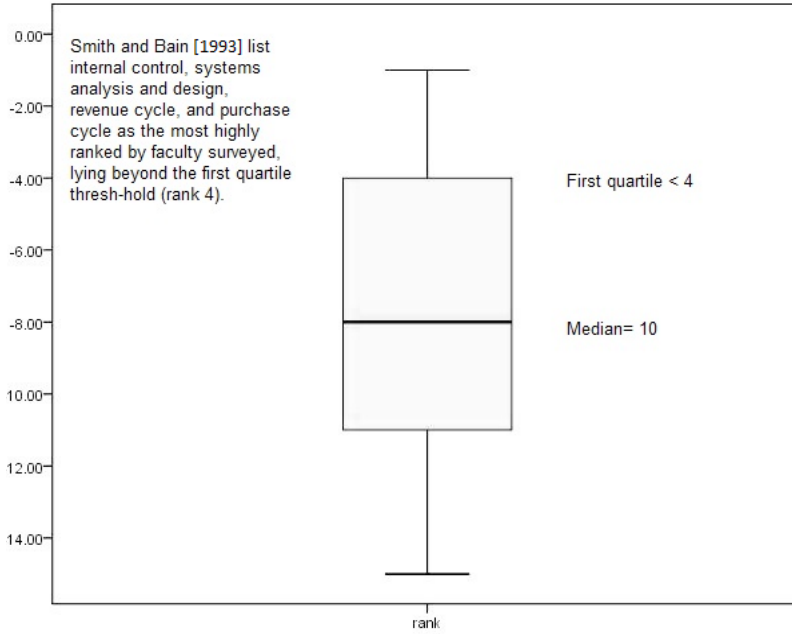


Heagy and Rakow [1991] and Smith and Bain [1993] asked faculty to rank topics in order of importance. Here, the closer the number is to 1, the higher the rank and the more important the topic. Therefore, box-plot thresholds for topics below the first quartile (as opposed to above the third quartile) were used to screen topics for importance. Heagy and Rakow [1991] revealed that faculty ranked four topics (internal control, transaction cycles, file organization and access, and introduction to systems) as the most important. Similarly, Smith and Bain [1993] generated a list of four highly ranked topics, consisting of internal control, systems analysis and design, revenue cycle, and purchase cycle.

**FIGURE 3**  
**Box-Plot of the Distribution of Faculty Rankings of AIS Topics in Heagy & Rakow [1991]**

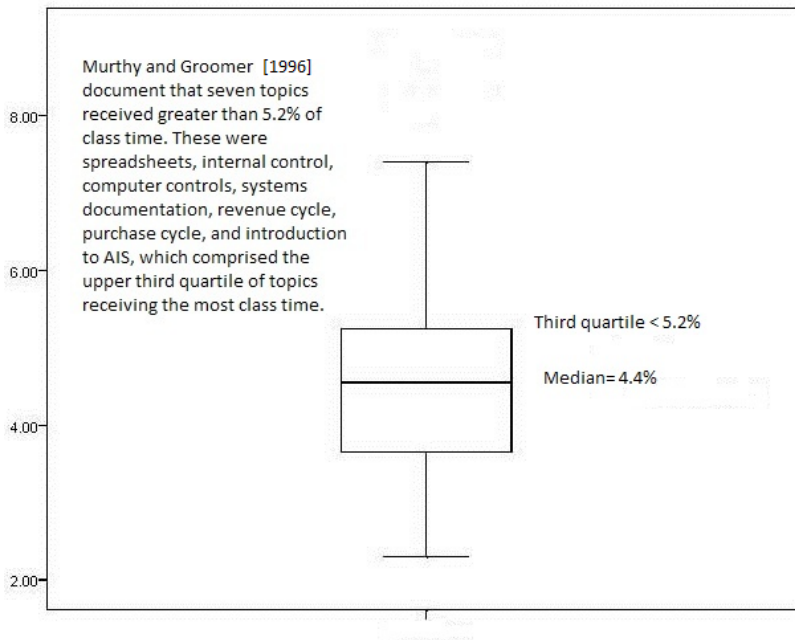


**FIGURE 4**  
**Box-Plot of the Distribution of Faculty Rankings of**  
**AIS Topics in Smith & Bain [1993]**



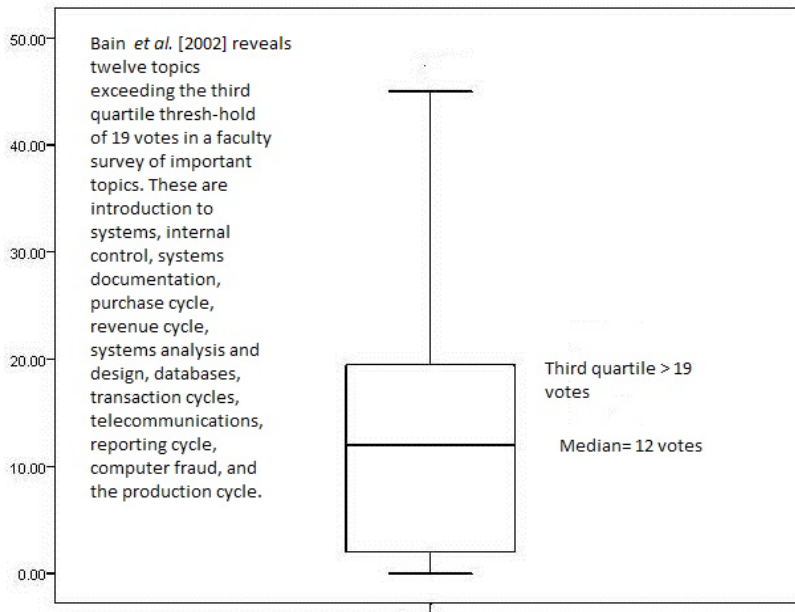
Murthy and Groomer [1996], like Davis and Leitch [1988], operationalized percent of class time as a measure of importance. Seven topics (spreadsheets, internal control, computer controls, systems documentation, revenue cycle, purchase cycle, and introduction to AIS) were shown to be above the third quartile class time threshold of 5.2%.

**FIGURE 5**  
**Box-Plot of the Distribution of Percentages of Class Time Allocated to AIS Topics in Murthy & Groomer [1996]**



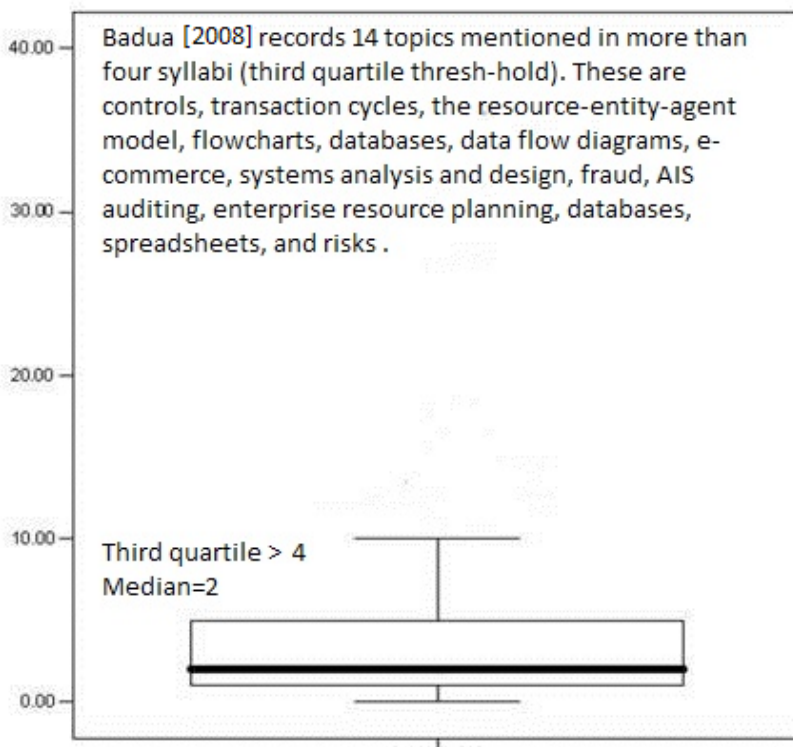
Bain *et al.* [2002] surveyed faculty to see how many favored a certain topic. Twelve important topics (introduction to systems, internal control, systems documentation, purchase cycle, revenue cycle, systems analysis and design, databases, transaction cycles, telecommunications, reporting cycle, computer fraud, and the production cycle) were identified as being favored by a greater number of faculty than the third-quartile threshold (19.25 faculty votes).

**FIGURE 6**  
**Box-Plot of the Distribution of the Number of Faculty for an AIS Topic in Bain *et al.* [2002]**



Finally, Badua [2008] counted the number of times faculty syllabi mentioned teaching a particular topic. The distributions of topic frequencies generated a third-quartile threshold of four syllabi mentions, exceeded by 14 topics (controls, transaction cycles, the resource-entity-agent model, flowcharts, databases, data-flow diagrams, e-commerce, systems analysis and design, fraud, AIS auditing, enterprise resource planning, databases, spreadsheets, and risks).

**FIGURE 7**  
**Box-Plot of the Distribution of Syllabus Mentions of AIS Topics in Badua [2008]**



The first four papers have an average of about four outlier topics, while the last three papers have an average of 11 topics. This may imply that pedagogy has changed in that there has been a growth in the number of topics considered by faculty to be essential to the course [Doost *et al.*, 2003]. Another noticeable change is the emergence in the 1990s of transaction cycles, either taught as a group or individually (revenue cycle, purchase

cycle, etc.). This observation is buttressed by those in Kee [1993] and David *et al.* [1999] which document the increased importance of transaction cycles in accounting practice and advocate increased research of the topic in AIS scholarship.

However, database-related topics and controls remain important throughout the studies. This is because computerized AIS applications are essentially databases with accounting specific interfaces to allow for input of transaction data and output of financial records [McCarthy, 1982]. Similarly, controls remain an important feature of AIS education because the integrity of transactions and custody of assets are an issue whether or not a firm's accounting system is electronic.

*Results of Content Analysis of Oversight Committee Topic Recommendations over Time:* While faculty initiatives are probably the best indication of the current state of pedagogy at any given moment, recommendations by overseeing organizations should also be considered. This is because the role of these bodies is to provide guidance for faculty and educational institutions and, hence, to take into consideration various interests and perspectives. Thus, their pronouncements are an indication of a wider range of AIS education stakeholders, such as industry, government, students, and a wider cross section of faculty than would be represented in any individual pedagogical study. Also, to the extent that faculty heeds these overseers' recommendations, the pronouncements of such boards are a leading indicator of the future of AIS pedagogy.

The table below summarizes the recommended topic emphases from three different oversight committees over the last three decades. These include the AAA Mock Committee Report of 1987, the 1999 AICPA Core Competencies Committee, and the 2005 AICPA Top Technologies Committee.

**TABLE 3**  
**AIS Teaching Topics Recommended by Oversight Bodies**

<i>Mock Committee [1987]</i>	<i>AICPA Core Competencies [1999]</i>	<i>AICPA Top Technologies [2005]</i>
auditing of AIS	systems analysis	information security management
management use of information systems	systems design	privacy management
managing information systems	output design	secure data storage
use of systems technology	systems implementation	transmission and exchange of data
AIS applications	project management	business process improvement
systems analysis and design	systems strategy and decision making	work flow and process exception alerts
technology of information systems	technology implications of security, risk, and controls	mobile and remote computing
database concepts	data modeling	technology training and competency
internal control		identity and access management
		improved application and data integration
		knowledge management and electronic data retention strategy

The “leading” nature of these oversight boards becomes apparent when comparing them to Table 1. The earliest oversight body, the 1987 Mock Committee, includes internal control as one of its recommended topic emphases. The six subsequent pedagogical studies consistently mention it as one of its most important topics, and in five of them, controls are ranked first or second in importance. However, internal control is absent in the last two committee recommendations lists. It is possible, but highly unlikely, that this omission is due to these committees coming to believe that controls are no longer important, especially in the light of recent events surrounding the late 20th century accounting scandals. A more plausible explanation is that earlier oversight boards were highlighting a lack of controls coverage, but that the last two boards, noticing the increased curricular attention in more recent years, omitted controls from their “wish list” as faculty had already complied.

The same could be argued for systems analysis and design



which was recommended by the oversight bodies in 1987 and 1999, but not in 2005. Analysis of the AIS pedagogical literature that makes up one-third of the data in this paper shows consistent reference to “transaction cycles” and “systems analysis and design.” These two terms are interconnected. All systems design flows from the types of transactions a firm routinely has. Conversely, systems “analysis” entails the “breaking up” of a firm’s information systems applications into the component functional groups of transactions that comprise them. This emerging emphasis on systems analysis and design may be considered as a response to the changed role of the accountant, no longer merely a recorder of data and information, but an analyst and designer of data and information flows [Wootton and Kemmerer, 2007].

With this in mind, the latest round of recommendations, which include emerging issues such as privacy, security, mobile computing, and identity management, may be expected to engender a proliferation of curricular coverage. These initiatives could be considered a response to current or recent technological innovation and is perhaps appropriate for a subject as technology driven as AIS.

AIS pedagogy is characterized as maintaining a consistent emphasis on database-related topics and controls from its earliest days. However, recent pedagogy has exhibited an increase in the number of topics covered and a growing emphasis on transaction cycles. Both findings are consistent with previous research [Doost *et al.*, 2003; Badua, 2008]. AIS faculty have also been shown as responsive to oversight institutions’ recommendations. These oversight bodies, in turn, have been shown to be responsive to technological change.

As with the assimilation of AIS research, the increase in pedagogical topics is also a double-edged sword. While students benefit from a broader spectrum of information, their ability to absorb and retain these data may be strained. The optimum number of topics taught per AIS course, the number and sequence of AIS courses, and topics which ought to be culled or retained are all issues that warrant further investigation.

Indeed, the endeavor of determining topic inclusion and excision is one that entails a consideration of many factors. These include obsolescence of topics in a highly mutable, technologically driven field, behavioral and cognitive characteristics of faculty and students, and the provenance of concepts and topics to AIS as opposed to other accounting fields such as cost accounting, financial accounting, or auditing. Ultimately, such

a determination also entails a consideration of the essential nature of AIS, a question this paper helps address.

### CONCLUSIONS

This paper examines what is a brief 17-year period of AIS research and education. Despite the relative youth of AIS as defined in this paper, AIS has experienced major changes in its research agenda and a dynamic interaction between faculty and oversight bodies.

This study considered evidence from scholarly literature, previous studies documenting faculty pedagogical initiatives, and recommendations from overseeing bodies in an effort to identify patterns and detect changes in the topical emphases studied and taught by AIS academics. Results indicate two developments in AIS research. First, there appears to be an emerging behavioral emphasis, contemporaneous with a similar behavioral trend in accounting research beginning in the 1990s [Flesher and Flesher, 2006]. Second, there seems to be a process of assimilation of AIS scholarship into the academic accounting research network.

These findings may reflect both desirable and undesirable consequences. While increasing assimilation of AIS research contributes to an increasingly integrated academic accounting research network, with concomitant benefits of more facile scholarly dialogue, this may also imply that a “special” nature of AIS scholarship with its purported focus on the accounting applications of information systems modeling [McCarthy, 1982] and hardware and software technology [Stone, 2002] being lost.

Another finding of this study is the similarity between the professional legitimization of cost accounting outlined in Abbott [1988] and that of AIS. The advent of digital technology in the mid-20th century and the internet revolution of the late 20th and early 21st centuries would be analogous to the role played by the Hollerith machines, fostering the technical capability to process and communicate large amounts of data much more quickly than before. However, merely possessing the capacity for rapid data processing would not be sufficient to distinguish AIS as a distinct branch of the accounting family of professions. It would require the creation of the concept of transaction cycles based on routine accounting functions (revenue cycle, purchasing and production cycle, payroll cycle, etc.) and the adoption of information systems data-flow modeling conventions to portray these cycles to justify that distinction. Thus, AIS came about as a hybrid of traditional accounting and information technology

in order to facilitate the design, assessment, and implementation of internal controls to guide the development and deployment of new business technology and to assist in the making of business decisions that depended on any of these transaction cycles. As with the Abbott framework, merely possessing the hardware (and software in the case of AIS) would not be enough. It took the creation of rigorously developed, formalized, theoretical conventions and their application to practical business problems to establish the jurisdictions of cost accounting and AIS.

The trend in AIS research identified in this study is interesting given the focus of AIS teaching. The AACSB suggests that faculty make “efforts to learn about their specialty and how it is applied in practice [and] engage in constant learning activity to maintain currency with their fields’ developing research and theory” [AACSB, 2011, p. 48]. However, this study shows that while there has been an increased emphasis on systems design and implementation in the classroom, the focus of AIS research has shifted away from these towards financial and behavioral topics. Future research should investigate these trends and determine the causes of this divergence.

A major limitation of this study was due to data availability. Future research in this area should study the effect of the Sarbanes-Oxley (SOX) legislation on AIS research. This law was promulgated in 2002 and took effect in 2003, which corresponds to the end of the time period of AIS research considered in this paper. Many of the SOX provisions may have AIS implications, such as internal controls provisions in SOX Section 404. Recent research [Bradford and Bazel, 2007] has found significant changes in such AIS-related fields as systems documentation since SOX.

Additionally, although this paper reveals certain trends in AIS teaching and research, future research could study the influences behind those changes. A number of influences most likely have contributed to the shaping of AIS research and pedagogy, including advances in technology, more accounting faculty and professionals being trained in this area of accounting, as well as possible broader social and economic phenomena. This paper, by documenting shifts in research and curriculum, provides a critical basis upon which to explore the causes of such changes.

While there may be some doubts as to whether an area of accounting as young as AIS could possibly have accumulated a compelling history, the findings reported and analyzed herein seem to suggest that AIS has enjoyed enough of the vicissitudes

of time to deserve a mention in accounting history. The questions raised by these results imply that this story is far from complete.

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# Accounting History

## ANNOUNCEMENT

### The third Accounting History International Emerging Scholars' Colloquium

Paris, France

**11-13 JULY 2012**

*Organized in cooperation with* SKEMA Business School  
Université Paris-Sud 11

This international forum is designed for emerging scholars of all ages and career stages, including doctoral degree students, new faculty and other emerging accounting researchers who have an interest in accounting history research and publication, and who seek to obtain feedback from senior faculty members on their historical accounting research projects in an intellectually stimulating environment.

The third forum will be organized in cooperation with SKEMA Business School and the University Paris-Sud 11. The colloquium will be held at SKEMA Business School, Parisian campus at La Défense. La Défense is the major business district in Paris, situated on the Historical Axis of the French capital, near major sites like The Louvre, Champs Elysées, and The Arc de Triomphe. Please note that the event will take place on the eve of the French National holiday, celebrating the historic Bastille Day and featuring memorable festivities.

The forum will be led by Garry Carnegie of RMIT University and Brian West of the University of Ballarat, Australia who are the editors of *Accounting History*, the journal of the Accounting History Special Interest Group of the Accounting and Finance Association of Australia and New Zealand. Other senior faculty members participating are as follows: Lisa Evans, University of Stirling, UK; Elena Giovannoni, University of Siena, Italy; Delfina Gomes, University of Minho, Portugal; Marc Nikitin, University of Orleans, France and Henri Zimnovitch of the University Paris-Sud 11, France.

Expressions of interest in the third *Accounting History* International Emerging Scholars' Colloquium (3AHIESC) should be addressed to the editors, *Accounting History* and forwarded to Leona Campitelli: leona.campitelli@rmit.edu.au

Further information about the Colloquium will soon be available at the 3AHIESC website, hosted by the Lille School of Management Research Center: <http://www.lsmrc.com/>

Inquiries may be directed to the Colloquium Convenor, Mrs. Raluca Sandu, SKEMA Business School: [raluca.sandu@skema.edu](mailto:raluca.sandu@skema.edu)

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