

“CROSS-TRAINING” MBA STUDENTS
IN
INFORMATION SYSTEMS AND FINANCE

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To: Participants in ICIS 1991

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Cc: Robert Mark, Capital Markets Sector, Manufacturers Hanover Trust/Chemical Bank
Abraham Seidmann, Simon Graduate School of Management, University of Rochester

Subject: Handout Materials for Panel Session on "IS in Finance -- Cross-Training MBAs in IS and Finance"

Date: December 16, 1991

During the last four years, Bob Mark, Avi Seidmann and I have made efforts to develop elements of a new course in IS that has now become a part of the mainstream of IS MBA education at our universities. The course, called "Financial Information Systems", was developed with three ideas in mind:

- * *The "democratization" of computing power in most firms today puts a new burden on the professionals in the functional areas of the business (accounting, finance, marketing, operations and strategy) to come up to speed on how to use and manage information technology to improve performance and profitability and performance. As a result, a new educational mission exists to get the word out to the functional areas as to what information technology can do for them. This is especially true in the financial services arena, and warrants wholesale re-thinking about what IS concepts need to be taught relative to finance.*
- * *In the last several years IS researchers have increasingly recognized the value of looking beyond the narrow confines of traditional IS research to other disciplines. We are closely involved in research that draws on theoretical foundations in accounting, finance, marketing science and operations management research to explore critical IS research problems. So it is natural that MBA IS curricula changes will parallel some of these developments. We believe that it is important to develop MBA courses along the lines of "IS in X" -- a new perspective for MBA education in IS -- to identify the newest ideas that IS managers in the 1990s will need to know about to effectively manage technology effectively in their businesses.*
- * *The job market (the demand side) that MBAs will face in the 1990s will be markedly different than that of the 1980s. To be competitive, a graduating MBA will increasingly need to demonstrate depth in a major area, and coherent breadth in other functional areas. In this context, MBA education (the supply side) needs to change to "cross-train" students in multiple disciplines.*

Our efforts have resulted in a model for a new MBA course at the interface of IS and Finance whose aim is to produce "technology triathletes" for the financial services industry. The idea of a technology triathlete, a description of the course that we offer at the Stern School, and samples of recent course outlines prepared by Prof. Avi Seidmann at the University of Rochester, and Bob Mark and me at NYU are included in this handout. We hope you will benefit from the panel session on teaching "IS in Finance", and look forward to talking with you about implementing cross-training courses like ours at your school.

**WALL STREET'S TECHNOLOGY TRIATHLETES:
'CROSS-TRAINING' A NEW BREED OF IS PROFESSIONALS
FOR THE FINANCIAL SERVICES INDUSTRY**

December 1991

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Acknowledgments

We wish to thank Ted Stohr, Chairman of the Information Systems Department at the Stern School of Business at New York University, for the initial go-ahead and encouragement to build a course based on a new concept: "cross-training" for IS professionals in systems, finance and management. The course we subsequently developed, entitled "Financial Information Systems", also benefitted from the initial involvement of Patrick Sweeney (Digital Equipment Corporation), feedback from James Foster (J. P. Morgan) and early support from Ram Akella and Ilker Baybars (Graduate School of Industrial Administration, Carnegie Mellon University). Several of our faculty colleagues at NYU also gave our efforts a boost. They include Maxine Rockoff, who has willingly shared with us ideas and materials that have made the course better, and Hank Lucas and Bob Schwartz, who edited the book we chose for the course -- *The Challenge of Information Technologies for the Securities Markets: Liquidity, Volatility and Global Trading* (Dow Jones-Irwin, 1989). Finally, these acknowledgments would be incomplete without recognizing the growing number of students who have completed the Financial Information Systems course. Their insights and eagerness to delve into the issues it explores makes our role as teachers very rewarding.

Corporate recruiters interested in obtaining additional information on 'cross-trained' MBAs in information systems and finance should contact Prof. Robert J. Kauffman at (212)-285-6079.

1. THE TECHNOLOGY TRIATHLON IN TRADING SUPPORT

It's a well known fact that Wall Street trading professionals run a pretty good race, day in and day out, forced to keep in shape by the unrelenting pace of changing markets and the pressures exerted on them to turn a profit. Traders perform best by choosing their distances -- taking very short, medium or long term positions -- and locking in their profits by running a "smart" race. But, by and large, it's not too far off the mark to think of them as "single event specialists": delivering profitable trades based on their understanding of specific market dynamics.

Traders are not a monolithic group in hot pursuit of their bonus. Instead, the trader who has deep knowledge of the foreign exchange markets has a knowledge base substantially different from one who has knowledge of the fixed income markets. A further segregation of knowledge takes place within the fixed income markets. The short-term fixed income bill trader operates quite differently from the long-term fixed income bond trader. The foreign exchange options trader's knowledge base is quite different from that of the foreign exchange spot trader. We would even find that the fixed income options specialist has different options trading skills than the foreign exchange option trader.

The information systems (IS) professionals that support trading operations -- developing trading analytics, deploying workstations and linking the trading platform to the rest of the firm and the market -- are faced with a different prospect. The race they run is a combination of events, a triathlon consisting of information technology (IT), finance and management knowledge. And, a sound understanding of the business is a prerequisite for being allowed to approach the starting line. Today, world class competitors in international triathlons engage in special training regimens to push their swimming, cycling and running abilities to the maximum. We think the time has come for Wall Street to adopt a similar attitude.

It is very costly and time-consuming to find and retain people with a broad enough perspective and the requisite skills to staff out the research and development, and implementation side of trading operations. Based on what we hear, few firms recruiting for these kinds of positions in today's market find it viable to look to the major business schools in the U.S., since current MBA education approaches tend to emphasize one of two extremes:

- * the management generalist, who lacks the depth in the required areas;
- * the functional specialist, who possesses depth in one area at the expense of sufficient training in the others.

What alternatives exist to improve the effectiveness of trading support personnel? What specific kinds of training needs to be provided? And, where can some new competitors be found that can be expected to rise to the top of Wall Street's trading technology triathlon? This article provides some answer for firms who may want to recruit MBAs in finance and information systems at the Stern School of Business at New York University (NYU).

2. CROSS-TRAINING THE FUTURE TRADING TECHNOLOGY TRIATHLETE

One alternative we are actively exploring at the Stern School is to recast a portion of our curriculum to support cross-training in finance, IS and management. We are doing this through a specially-developed advanced elective course for MBAs that has become increasingly popular with finance and IS students. And, it's also of interest to neophytes and Wall Street professionals alike. This course is called "Financial Information Systems" (FIS) and according to Professor Ted Stohr, chairman of the Information Systems Department at the Stern School, "this course is the first of its kind at any major business school in the country. Based on our success with this course, we are currently examining how to extend the 'cross-training' concept to manufacturing and marketing operations, too."

Our thrust is how technology has shaped the world of financial services, in such areas as treasury and credit management, commercial and investment banking operations, electronic banking, point-of-sale debit networks and other technology-intensive financial environments. What we hope our students will take away from the course, however, is the Wall Street technology experience. This includes understanding the architecture and performance of electronic trading mechanisms in the major American and international exchanges, and the design and management of the various technologies used on the trading platforms of firms that are center-stage in today's markets. The course we have designed enables our students to accomplish three primary objectives by the time they complete the course:

- * to understand and appreciate the state-of-the-art in financial technologies;
- * to be able to develop creative solutions to financial technology-related problems for presentation to senior management;
- * to gain substantive expertise in an area of special interest.

In the process, we cover a variety of issues that relate to trading technologies.

We deliver on the first goal by providing readings and lectures, as well as outside speakers who deal with the issues head on. The readings we chose for the course represent an even split between theoretical works and a review of practical technologies. We explain how technology affects the structure and performance of financial markets. We also include finance and management science articles which explain how to evaluate investments in trading and other financial information technologies, along with popular press articles which tell it like it is on the street.

A new book entitled *The Challenge of Information Technology for the Securities Markets: Liquidity, Volatility and Global Trading* (Dow Jones-Irwin, 1989) provides many key readings for the course. This book contains articles by many well-known Wall Street pros, and is edited by Henry C. Lucas, Jr. and Robert Schwartz, also professors at the Stern School. We especially recommend that our students keep abreast of the recent trends in information technologies by reading the industry periodicals read by professionals on the street. The *Wall Street Computer Review*, for example, is a good place for them to learn about the newest developments in trading support technologies first hand. They report that these publications deliver the technological and business background to round out their experience in the course.

The Stern School of Business has also hosted a number of knowledgeable financial information systems professionals to address students in the Financial Information Systems class. Some recent visitors include:

- * Donna Dodson and Vivek Wadhwa of the First Boston Corporation demonstrated and discussed their firm's new computer-aided software engineering tool called "High Productivity Systems" (HPS), and evaluated strategies for an information processing architecture to support "cooperative processing" in investment banking operations.
- * Jay Peake, a noted consultant, speaker and author, spoke on his proposal for a "National Market Trading System", and electronic trading architecture to improve liquidity, decrease volatility and promote fair access to national markets.
- * David Jeffrey, the founder of CapitaLink, discussed his failed attempt to create the first "Electronic Bond Issuance Market", a joint venture that he developed with Morgan Bank, and his more recent with Steven Wunsch to build SPAWORKS -- an electronic Single Price Auction electronic trading market.
- * Ed Peters and Craig Atkinson, members of the Strategic Technology and Research (STAR) group at Manufacturers Hanover Trust, have also visited. Ed spoke on the subject of information systems productivity and the bank's STAR-led effort to build a corporation-wide data architecture. Craig spoke on the theory and emerging practical applications of artificial intelligence.
- * Cynthia Wilson, previously with Merrill Lynch and now a corporate vice-president at New York Life Insurance Co., described and evaluated her firm's attempts to develop sound strategies for information management across the firm.

We train students to become creative management problem-solvers through a variety of case studies involving financial systems. This year we chose two cases involving technologies related to financial markets. One investigated the Big Bang experience at the International Stock Exchange in London, and a second described the problems the Securities Exchange Commission had in automating the process of reporting financial statement information with the EDGAR/ELOISE systems. Our students report that use of the cases helps them to focus on key technical, managerial, organizational, competitive and regulatory issues, and to develop a "senior manager's perspective". We also offer them demos of systems such as GLOBEX and DEALING 2000 so they can get a feel for how electronic trading actually works.

3. LAYOUT OF THE 'FINANCIAL INFORMATION SYSTEMS' COURSE

The Financial Information Systems course at the Stern School of Business looks at a broad array of interrelated topics, primarily in the securities, banking and insurance industries. Table 1 shows the major issue areas and the related topics we discuss in more detail. We open by covering the big issues in financial information systems management and introducing the uses of technology in the financial markets. We look at the arguments -- for and against -- made by market professionals and technology theorists about the role of IT in the October 1987 market crash. We also review the technological infrastructure of the important financial markets and carry out a critical theory-based evaluation of the extent to which the use of IT plays a role in the liquidity and volatility of market securities and instruments.

INSERT TABLE 1 ABOUT HERE

We also provide students with an in-depth look at trading room technologies, and some of the technical design and management issues associated with the deployment of trading automation. One lecture explores the new technologies and systems that are changing the face of trading activities in banks and brokerage houses today. We discuss the pros and cons of video versus digital data feeds of market-related information, and the special systems design problems that vendors such as Micrognosis and Reuters are solving with advanced technology. Students tell us that trading platform automation planning is one of the most interesting issues we cover, if only because they

can't find out anything about it elsewhere. Artificial intelligence and expert systems in financial services applications is another subject we discuss in some detail. These new approaches are increasingly of interest to firms who are seeking long-term competitive advantage in the financial markets by making an early push down the learning curve. The variety of AI applications we discuss includes pattern recognition systems for technical analysis of trading opportunities, expert systems for retail credit evaluation, and a capital budgeting expert system that was developed by a venture capital firm in cooperation with another major business school.

Financial Information Systems also investigates the new ways that financial services firms are using IT to improve their ability to manage the various kinds of risks (market, credit and operational) they experience. We show how this risk is a function of product mixes and customer bases. For example, we look at how you can use IT to manage intra-day and overnight market risk through a dollars-at-risk (DAR) approach. The DAR approach rests on IT's ability to capture volatility and correlation data to construct "risk measurement units". We also review asset/liability management (ALM) techniques and the new approaches to it made possible by comprehensive automation in banking and brokerage firms. This review shows how advances in IT are enabling the ALM function to move beyond 'static gap' analysis to more dynamic simulation models.

The course examines electronic payment systems at both the retail (e.g., automated teller machines and point-of-sale debit systems) and wholesale (e.g., the U.S.-based FedWire and CHIPS, and the international SWIFT network) levels. The key issues we cover are how they should be designed, developed and managed to meet current operational and strategic goals, and position a firm to play ball in an uncertain future. We also consider the strategic aspects of network membership, and some of the regulatory issues that have arisen due to the new capabilities made possible by IT (such as "network duality", in which VISA and MASTERCARD credit purchases would not require a merchant to have installed the proprietary links to a vendor's card operations). The course also includes a discussion of the rationale for integrated decision support in the corporate treasury function and the current state-of-the-art of decision support treasury services made available to corporations by their high-tech clearing banks and third part vendors.

Finally, we advocate providing training for IS professionals so they can communicate with a firm's financial staff. Today, an issue of key concern across the financial services industry is how to evaluate the business value of investing in IT. There is much debate among senior managers, top-notch consultants and academic researchers

about the extent to which these investments really pay off. As a result, the IS staff has to be on its toes in order to make the business case for investments in new and risk-laden technologies that may influence the ways in which business is conducted in the future.

Electronic data interchange (EDI), ISDN and supercomputers represent the tip of the iceberg of future technologies that our technology triathletes will have to evaluate. We also examine the brave new world of CASE (computer-aided software engineering) technologies, which many Wall Street firms are investing in to drive down the cost of systems development and maintenance, and improve their quality and functionality. We subject hypothetical investments in these technologies to evaluation from the perspective of several different and competing approaches. By illustrating the strengths and weaknesses of these approaches, we hope our students will learn to use the right analytic approaches in the right contexts, to identify the value of IT in improving operational productivity, affecting market share shifts and creating dramatically new opportunities for revenue.

4. NEW IDEAS FOR WALL STREET: COURSE PROJECTS ON FINANCIAL TECHNOLOGIES

In order to gain expertise in an area related to the course, students are required to undertake a semester long project. We think this provides them with a depth of experience that can pay off for those interested in careers on Wall Street. A sampler of project titles from recent terms includes:

- * A Financial Information System for Fixed Income Security Brokerage
- * An Overview of the Development and Operation of an Electronic Security Research Delivery System
- * CASE Technology in Investment Banking: Measuring Business Value
- * Understanding Global Risk Management Systems
- * IT Investment Strategies at the "Big Four" Japanese Securities Firms
- * Risk Management System Design and Architecture
- * UNEXUS: A Market Architecture for a Unified Exchange in the U.S.

We encourage students to work individually or in groups, as their project ideas require. We also support their working in concert with other programs at the Stern School, for example the Management Advisory Program (MAP). Two groups of students were particularly successful in developing projects with us which help us to identify

them as future technology triathletes.

Measuring the Business Value of Trader Workstations

One group (including full-time students Inger McCrorey, Barbara Osborn and Ralph Herdman, and Steve Raff, a vice president in the Information Systems organization at Kidder Peabody) undertook a project entitled "Measuring the Business Value of Trading Support Systems." Their work was divided into two phases. In Phase 1, they attended a special training session on "function point analysis", an increasingly popular technique which many firms are using to measure the size of software applications. Then they applied the method to provide software size metrics for two investment banking systems.

In Phase 2, the group's goal was to develop a method to estimate the business value of workstations that are used to support trading professionals in investment banking operations. First, the group interviewed traders at two different firms regarding the reasons they use digital and video feeds such as Quotron, Telerate and Knight-Ridder. Based on their interviews and other fact finding, the group then developed a "business value linkage" for trading workstations. This consisted of a set of hypothesized impacts on operating costs, new revenues from enhanced marketability of services and increased market share from improved responsiveness to changing market conditions. The group also proposed a set of "impact metrics" to go along with each hypothesized impact.

Since some of the hypothesized impacts are quite hard to measure in practice, the group sketched out an "experiment" to capture the business value of "low functionality" versus "high functionality" trader workstations. Standard digital feeds are examples of "low functionality" workstations. "High functionality" workstations, on the other hand, provide analytics, graphics and other information that may not be available via other more traditional platforms. The group measured functionality by conducting function point analyses of a well-known digital feed product and an integrated trading workstation, and found that the integrated trading workstation had about one-third more functionality.

The group's experiment, had there been time to conduct it, would show the marginal benefit of the additional functionality available to traders to make better decisions. These benefits could then be matched to the required development costs to determine whether "high functionality" workstations provide the desired returns. Such work is representative of the high quality management science projects that students can undertake in our course.

A Prototype Arbitrage Decision Support System (PADSS)

The Financial Information Systems course also combines with other programs at the Stern School to carry out projects for outside firms which fund them. An example is a MAP project called "PADSS", an acronym for the "Prototype Arbitrage Decision Support System." Marine Midland Bank, N.A./Hongkong Shanghai Bank Corp. sponsored six NYU students (Carlos Blanco, Doreen Davidow, Thomas Keresztes, Fabian Prados, Phillip Toop and Ralph Weezenbaum) and the team was advised by Stephen Figlewski, a professor specializing in finance at the Stern School.

Marine Midland Bank was investing in a prototype trading system that would allow it to use real time digital market information. The Financial Information Systems course offered core members of the MAP team insight into three areas: technological issues, particularly other firms' experiences with trading systems; organizational factors that affected how Marine Midland could take advantage of the new technology; and applications for PADSS within the bank, inclusive of hedging, risk management and arbitrage.

To understand the bank's opportunities, the project team carried out a comparative study to determine how the competition was leveraging off the advantages and dealing with the problems posed by integrating this digital feed technology into their trading operations. Their study looked at Micrognosis and Rich deployed in about eight organizations and also two others which had neither. Their study also involved site visits to see the technology in action, meetings with key personnel responsible for risk management and trading systems, consultation with industry experts and a review of the available literature on digital feeds. Marine Midland Bank was investing in a prototype trading system that would allow it to use real time digital market information. The Financial Information Systems course offered core members of the team insight into three areas: technological issues, particularly other firms' experiences with trading systems; organizational factors that affected how the bank might take advantage of the new technology; and applications for PADSS, inclusive of hedging, risk management and arbitrage.

The team also evaluated whether the bank's risk management system would benefit from the use of the new system. The task at hand was to see if PADSS could monitor certain arbitrages via its real-time digital information, make sophisticated calculations, and alert traders to market opportunities. It was hoped that PADSS would be able to suggest arbitrages leading to potential profit increases and earnings volatility decreases, as well

as improve trade control and reduce errors.

The team found that "the preferred system sets position limits according to the volatilities and correlations between the underlying traded instruments. This system improves on the traditional fixed-dollar limit approach to risk management, because it enables the risk manager to assign limits to each instrument adjusted for its riskiness." As a result of the team's plan, Marine Midland found itself in a better position to respond to growth and technological advancement on its trading floor.

5. 'UP CLOSE AND PERSONAL': NYU'S TECHNOLOGY TRIATHLETES MAKE THEIR MARK ON WALL STREET

The Stern School's Information Systems Department was recently ranked among the top five in the nation by a *Computerworld* survey. The ranking reflects the first-rank research, breadth of innovative courses and quality instruction available at NYU. One of the greatest assets of the school, however, is not reflected by the rankings: its students. In the two years since we have offered Financial Information Systems, more than 200 have completed it, and many have used this background in their search for interesting jobs in Wall Street's money market and trading operations.

Who are these new trading technology triathletes? What kind of skills do they possess? What have they been doing with the training they received in Financial Information Systems? We identified three people who represent the NYU's technology triathletes at their best: John Furlong, Melinda Kramer and Charles Wright.

While he was a student in the MBA Program at Stern, John Furlong also acted as a Systems Engineering Manager for IBM's New York Wall Street branch office. He managed a group of nine IBM systems engineers who consult on application architectures and the design of information systems. In his six years supporting application development on Wall Street, John has become an expert on the integration of back office systems and on-line operations. Through John's organization, IBM consults on the re-engineering of back office operations, the integration of on-line trading systems, the effects of globalization on clearance and settlement, and the distribution of information services to IBM's retail brokerage sales force. In addition, John advises IBM's largest customers on the application of innovative technologies (e.g., image and vector processing, RISC, etc.) to achieve attractive returns on their IS investments. Today he is heading up a new effort that IBM has undertaken to provide

technology and strategy consulting services to senior managers on Wall Street.

John earned a B.S. in Computer Science from the State University of New York at Albany in 1983 and completed an MBA in Finance from New York University in 1990. John claims that NYU provides the right combination of course focus and projects to significantly enhance his personal effectiveness with his customers. "The finance department's focus on capital market forces and global economics is right in touch with the development issues facing IS professionals on Wall Street. Complementing these courses, the Financial Information Systems class focuses specifically on the use and justification of information technologies for financial market systems. All of the hot issues I see daily -- automated markets, risk management, globalization issues such as multi-currency support, CASE-based development and software cost justification, are addressed head-on by this course."

John believes the composition of the student body is equally important as course content, and ranks his own education at NYU as "leading edge". He comments that the people make "a significant difference. I'm meeting and working at NYU with the people who make it happen on the street -- bankers, brokers, traders, and IS professionals. They add a degree of reality to the program that is often absent in MBA programs outside of New York. Through NYU, I have gained the skills and contacts necessary to meet the competition as a consultant on Wall Street."

Melinda Kramer earned her B.S. in Computer Science from Northeastern University in Boston, where she was also a scholarship athlete on the Women's Crew Team. Melinda moved to New York in 1983 to work for the Morgan Bank, where she completed the Systems Training Program. In 1986, she joined Leverage Technology, a firm which specializes in management and technology consulting for financial services firms. In her role as a consultant, Melinda has worked with firms such as Merrill Lynch, Goldman Sachs, and Telerate, Inc. She has also helped Macy's develop sophisticated financial reporting systems. Based on her contribution, in 1988 Melinda was invited to be a principal at Leverage Technology, where she now takes a more active role in marketing the firm's consulting services.

Melinda had the following comments about her experience: "The beauty of the course was that it taught two important things: the requirements throughout the entire systems life cycle, from proposal cost justifications to design and implementation, and the real-life complexities of building a financial instrument modeling and trading system. Very few people know how difficult it is to implement these kinds of systems properly." During her years

at NYU, she consistently enrolled in courses that were related to her consulting roles in order to offer clients the best-informed and up-to-date advice. It's clear that Melinda, who recently completed her MBA at the Stern School, is a technology professional who has already begun to make mark on Wall Street.

Charles Wright's office is located at Kidder Peabody, almost next door to the American Stock Exchange in New York City. He received an MBA in Information Systems from Stern in 1989, where he was also a recipient of the Society for Information Management's award for academic excellence. He participated in the Financial Information Systems class, and got interested in EDI as a strategic implementation problem for the companies which choose to invest in it. His work resulted in a paper that will be published in a book on treasury management and information technology.

Charlie is also a graduate of West Point who possesses significant management experience from his military career. He is currently involved in CASE technology implementation consulting as an employee of Seer Technologies. His work at Kidder Peabody has involved performing a major portion of the business analysis and design of Kidder Peabody's futuristic Online Automated Trading System (OATS). In the past, Charlie has been involved in pathfinding research that attempted to make the business case for making a large investment in integrated CASE technology which supports the software development process for trading operations at the First Boston Corporation, a New York City investment bank. His most recent accomplishment involves participating in the design of a CASE tool-based facility called the "Integral Tool," which automates function point and software reusability analysis, and provides a mechanism to automate evaluation of repository based "software assets."

Charlie comments that "there are three major factors which are reshaping the financial services landscape today: new information technologies (such as CASE and (EDI), deregulation, and new managerial processes. These factors, when combined, offer companies opportunities to provide new financial services products, to drastically improve efficiencies of current products and to improve existing product features. For example, the implementation of CASE, along with the centralization of company databases, will allow for rapid new financial product development at only a small incremental cost. I expect financial products to become increasingly customized and have shorter life cycles. Meanwhile, with the emergence of EDI, banks' product offerings will become more closely tied to their customers' billing cycles. As EDI matures, these customers will have more accurate and longer projections of future cash flows. The banks which tie into these customers will be in a position

to offer a new range of cash management services. Since these new information technologies are more complex to implement than previous ones, there will be a growing emphasis on the development of large scale project management skills in the IS staff."

6. CONCLUSION

An MBA that is 'cross-trained' in information systems, finance and management can bring tremendous value to Wall Street. The Financial Information Systems course has proven to be a successful vehicle to help sharpen students' skills to meet the challenges the financial industry experiences. In order to continue to meet the changing needs of a dynamic financial and technical environment, we continue to reshape the course to best meet the goals we have set out. Since the class offers a theoretical and practical orientation toward training future technology triathletes, we welcome the participation and suggestions of firms that are interested in recruiting MBAs from NYU. As we enter the 1990s, we expect our graduates will continue to be much in demand.

TABLE 1. FINANCIAL INFORMATION SYSTEMS: CONTENT OVERVIEW FOR TRADING OPERATIONS

ISSUE AREA	SPECIFIC TOPICS DISCUSSED
<i>Securities Industry:</i>	
Designing Electronic Markets	* IT and the Structure of Financial Markets
	* Securities Markets Under Stress: IT and the Black Monday Crash of 1987
	* Computer Architecture at the New York and International Stock Exchanges in London
Designing Trading Systems	* Overview of Trading Floor Technologies and Market Data Feeds
	* Systems Development and Integration for Trading Operations
Hot Technology Topics for the 1990s	* Managing Risk: Methods from Finance Applied to High Tech Trading Environments
	* Measuring the Value of Investments in Trading Workstation Technologies: The CFO's Perspective
	* Trading Strategies with AI and Expert Systems
<i>Banking Industry:</i>	
Financial Operations	* How to Leverage IT in the Corporate Treasury
	* Decision Support Systems for Check Clearing and Vehicle Routing for Branch Check Collection
	* The Role of Technology-Based Approaches to Asset and Asset and Liability Management (ALM)
Strategic Issues	* Computer Aided Software Engineering: Build or Buy?
	* Electronic Data Interchange (EDI) and Strategic Investments in the IT Infrastructure: Do Firms Underinvest?
	* Mergers and Acquisitions in Electronic Banking Networks Machine Networks from a Network Externality Perspective
<i>Insurance Industry:</i>	
	* Imaging Technologies to Improve the Efficiency and Effectiveness of Claims Processing
	* IS in Support of Insurance Product Marketing

APPENDICES

Two appendices are attached to assist people who are interested in developing a new course on "Information Systems in Finance" in business schools at other universities.

The syllabus presented in Appendix 1 was developed by Professor Abraham Seidmann at the Simon Graduate School of Management. The course represents a state-of-the-art treatment of many of the issues discussed in this paper. It goes farther in one particular area -- offering the students the opportunity to get hands-on experience in using spreadsheets and simple computer-based analytics tools that are useful in option pricing and other financial optimization contexts.

The syllabus presented in Appendix 2 was developed at the Stern School of Business at New York University by Robert J. Kauffman and Robert Mark.

WILLIAM E. SIMON GRADUATE SCHOOL OF BUSINESS ADMINISTRATION
UNIVERSITY OF ROCHESTER

FIN/CIS 480: FINANCIAL INFORMATION SYSTEMS

Professor Abraham Seidmann

WINTER 1991
COURSE OUTLINE

3 Credits

COURSE OBJECTIVE

This course examines the role of information systems in the management of domestic and international financial service organizations. Topics include: critical evaluation of issues associated with the use of computer-based trading systems; specification and implementation of dynamic portfolio management software; practical computational methodologies for valuating complex financial instruments; asset, liability and cash-flow management from an information systems point of view; and the use of artificial intelligence and expert systems in program trading or mergers & acquisitions. Prerequisites: CIS 401 and FIN 402.

The weekly homework assignments, case discussions, and projects motivate business applications and facilitate the prominent role of computers as financial management tools.

NOTE: Some homework assignments will require the use of an IBM PC. The homework assignments and the course projects are done in study group of up to four students each.

TEXT:

1. *Computer Aided Financial Analysis*, by R. M. Miller, Addison-Wesley Publishing Co., 1990. (Required)
2. *Financial Information Systems Manual*, by J. D. Willson and J. F. Duston, Warren, Gorham & Lamont Publishers, Boston, Mass., 1989.
3. *Managing Financial Risk*, by C. W. Smith Jr., C. W. Smithson, and D. S. Wilford, HarperCollins Publishers, 1990.

GRADES: 25% Assignments, 20% Class Participation, 15% Term Project, 40% Final.

INSTRUCTOR Abraham Seidmann, Dewey 229 275-5694
Secretary: Pat Robinson, Dewey 231 275-0739

OFFICE HOURS Monday, Wednesday 17:00 - 18:00 (or by appointment)

OUTLINE

1. The value of and demand for information.
2. Representation of and design of financial models.
3. Data structures for complex instruments.
4. Valuing fixed income securities.
- 5, 6. Computerized option adjusted analyses (OAA) of mortgage backed securities (MBS) and of collateralized mortgage obligations (CMO's).
7. The "BATTERYMARCH FINANCIAL MANAGEMENT : INFORMATIONS SYSTEMS AND TECHNOLOGY," case.
8. Computer models for option valuation.
9. Using position indicators $\{\Delta, \Gamma, \Theta, \rho, \dots\}$, arbitrage and implicit volatility information.
- 10, 11. Implementation issues in dynamic portfolio strategies and program trading.
12. The "CHEMICAL BANK : THE PRONTO SYSTEM," case.
13. Identifying and measuring financial risks.
14. Automated asset and liability management systems.
15. Global capital markets trading technology. The "BIG BANG AT LONDON," cases.
16. The impact of exchange automation and program trading on volatility and liquidity.
17. Financial expert systems and business supercomputing.
18. The "TEXAS INSTRUMENTS CAPITAL INVESTMENT EXPERT SYSTEM," case.
19. Information systems controls and auditing.
20. Field projects presentations.

B20.3350 -- FINANCIAL INFORMATION SYSTEMS

MBA Program
 Stern School of Business
 New York University
 1991-1992 (REVISED)

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1. COURSE OBJECTIVES

This course has several educational objectives:

- * To provide the student with an introduction to state-of-the-art application of information technologies (ITs) in the financial services industry (lectures, class discussions, speakers and readings);
- * To offer the student some 'hands-on' experience in making design decisions and solving management problems regarding IT in financial services settings (lectures, case writeups);

2. REQUIRED MATERIALS

The following books are required:

- (1) H. C. Lucas, Jr. and Robert A. Schwartz (1989), *The Challenge of Information Technology for Securities Markets: Liquidity, Volatility & Global Trading*, Dow Jones-Irwin, Homewood, IL.
- (2) T. Steiner and D. Teixeira (1990), *Technology in Banking: Creating Value and Destroying Profits*, Dow Jones-Irwin, New York, NY.
- (3) Harvard Business School Cases:
 - * Big Bang and the London Stock Exchange (A/B)
 - * Securities Exchange Commission
 - * Banco Santander: El Banco in El Casa
- (4) Packet of assorted photocopied articles

3. COURSE REQUIREMENTS

Grading in the course is straightforward. It consists of:

- * 3 write-ups/presentations of Harvard Business School cases: 45% (15% each)
- * Midterm exam (given 2/3 of the way through the course): 40%
- * Class participation -- quizzes, case discussions, critiques of readings, etc. 15%

4. OTHER COMMENTS TO THE STUDENT

This syllabus, and the course development behind it, represents a joint effort. However, each of us will be teaching his own section(s) of the course. Thus, students should expect that although the readings and syllabus are identical, the treatment of the material may not be the same. In addition, students may find that our expectations differ as to what represents acceptable and unacceptable work in the course. However, we do our best to create a uniform grading curve across all sections of the course. We take a similar attitude regarding the similarity of the requirements for the course as it is taught in the regular MBA Program and the Executive MBA Program in Finance.

For the regular MBA program, **the prerequisites for this course are an MBA-level course in finance and an MBA-level course in IS.** Our experience in delivering the course suggests that it is more appropriate for second year students, however, we will consider first years who have already completed the prerequisite finance and IS courses. (If you have not completed them, and think you will still be able to handle the work in this class, feel free to speak privately with the instructor.) For the Executive MBA Program in Finance, this course fulfills the requirements of a core course in IS. Additional optional tutorial sessions will be held to help students who need additional background on the basics of computers and information systems. In addition, a glossary of basic terms in information systems from a book by Laudon and Laudon that is used in the regular MBA IS core course will be made available to students.

This course requires no computer programming, since greater emphasis is placed on the management of information technology than on systems development issues.

Students who have no background at all in financial services (banking, brokerage, insurance, etc.) are encouraged to participate in the course. You may be in a position to get the most from this course, in terms of incrementing your knowledge. In addition, we have designed it to meet students' learning objectives at a variety of levels, so students who have industry experience should also be able to come away from the course with a new perspective on financial information systems design and management issues.

Sample questions will be distributed during the semester to help students prepare for the midterm exam. A good study strategy for the exam is to master the material that would enable you to answer those questions well. The midterm will actually include a subset of the questions I distribute, although there may be some additional computational or problem solving questions that are not distributed in advance.

5. POLICY ON LATE ASSIGNMENTS

In fairness to all the participants in the class, we cannot accept late papers without penalty. Papers not turned in during the class they are due will be reduced one letter grade if they are received prior to the end of the next class. Papers turned in two weeks late will receive a two letter grade deduction. Papers more than two weeks late will not be accepted at all, and will be scored with a zero. In special cases where business travel requires you to be out of town, we request that you make every effort to hand in your case write-ups and midterm exam prior to leaving.

B20.3350 -- FINANCIAL INFORMATION SYSTEMS
SCHEDULE OF LECTURE TOPICS, READINGS AND STUDY NOTES

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Articles should be read prior to the lecture in which they are discussed. The instructors will be calling on participants to provide a brief verbal management summary or critique of some articles during the course of each lecture. So, it would be helpful to take some notes as you read. All students will be asked to be responsible for in class presentation of the ideas in one paper during the course.

Articles are marked with either 1, 2 or 3 asterisks with the following in mind:

- *** indicates an article whose content the student is expected to master for the midterm; focus on the techniques, theories or perspectives discussed in the article and be able to apply and extend them;
- ** indicates an article whose content supplements the main points addressed in the course; make sure you have a solid understanding of the primary arguments for the midterm, but don't expect to have to answer very detailed questions regarding the content;
- * indicates an article whose content is provided to offer the student introductory background or a further appreciation of the issues; it is unlikely that the content will figure very much in the midterm exam, though students are expected to reflect an awareness of the issues discussed in the article when writing up case studies.

I. Course Introduction

This lecture will present an outline of the course in terms of the big issues in financial information systems management, as well as some introductory material on uses of technology for competitive advantage in the financial services industry. The introductory readings listed below are meant to provide you with immediate access to some of the major ideas discussed in the course. Read to gain a sense of the area, rather than to absorb a lot of details.

- ** Lucas and Schwartz (1990), Chapters 4-7
- ** Steiner and Teixeira (1990), Chapters 1-3, 7
- * Lucas and Schwartz, Chapters 1, 8-12
- * Mark and Kauffman, "Wall Street's Technology Triathletes" (1990)

The main points that you should pick up from the lecture and readings involve:

- A. Definitions and scope of financial information systems and technologies
- B. Extent of financial services investment in IT, levels of success and examples of key areas of investment
- C. Descriptive background of Wall Street computing, including 1987 crash, hardware, software, integration issues, platforms, etc.
- D. Four waves of information technology investment on Wall Street, and imperatives for effective management of IT on Wall Street for the 1990s

II. Traditional IT Investment Evaluation Methods

How to evaluate the business value of investments in information technology is currently a topic of much debate among senior managers, top-notch consultants and academic researchers alike. In this session, we will review several approaches to gauging the impact of IT on productivity and firm value, including measures from finance, industrial engineering and accounting. We also set the stage for a followup discussion in the next class of some new approaches that are increasingly influencing the way financial firms carry out financial analysis of IT projects. (This class and several that follow will form the body of methods students are expected to learn and apply in the course.)

- ** Berger, "Selecting Enterprise Measures of IT Value," in Berger, Kauffman, Kriebel, Strassmann and Swanson/ICIT (1988) (ON RESERVE)
- ** Kauffman and Weill, "Methods for Assessing IT Value" (1989)
- ** Berger, Kauffman, Kriebel, Strassmann and Swanson/ICIT, "Introduction" and "Case Studies" (1988) (ON RESERVE)

The main points that you should pick up from the lecture and readings involve:

- A. Broad problems involved in gauging the business value of information technology, especially "intangibles," the underinvestment problem, accepting status quo evaluations, etc.
- B. Defects of concepts and techniques from finance and capital budgeting, including risk rate, risk vs. uncertainty, weighted average cost of capital, net present value and discounted cash flow analysis, payback period, and internal rate of return
- C. Recent methodological responses to the critiques, including enterprise measures for IT value, business value linking, decision tree scenario analysis, consideration of dimensions of risk that are not captured in a discount rate
- D. Illustrations of IT valuation problems for various technologies in different financial services settings

III. IT Investment Evaluation Revisited: Methods for Technology Triathletes

Next we will examine new analytic approaches to the evaluation of IT investments: the first develops a framework called business value linking for arguing in favor of investments in new and hard to measure IT investments; the second involves the uses of basic microeconomics to distinguish and measure operating and competitive efficiency effects produced by IT investments; the last provides an improvement to traditional capital budgeting techniques for more speculative investments in new ITs. Each is illustrated using the ICIT cases and other appropriate financial services contexts.

- *** Banker and Kauffman, "A Manager's Guide to Business Value Linkage Impact Analysis" (1990)
- *** Kauffman and Kriebel, "Modeling and Measuring the Business Value of IT," in Berger, Kauffman, Kriebel, Strassmann and Swanson/ICIT (1988) (ON RESERVE)
- *** Dos Santos, "Evaluating Investments in New Technologies" (1990)

Note that the readings for this session are all marked with ***. This indicates that you need to master the techniques discussed in each article. You will need to know how to:

- A. Create and evaluate a business value linkage to support an argument for an investment in IT
- B. Create and evaluate an efficiency frontier using a productivity measure (OUTPUT/INPUT)
- C. Understand why new technologies are consistently undervalued: the option pricing perspective for second stage investment
- D. Evaluate an investment in a new technology using the option pricing framework, and interpret the "option derivative metrics" as they relate to investments in IT

IV. The New Technological Architectures of Financial Markets: Liquidity, Volatility and Access

In this lecture, we consider the technological infrastructure of important financial markets in the U.S. (NYSE, AMEX, COMEX), and carry out a more critical, theory-based evaluation of the extent to which the use of IT plays a role in affecting the liquidity and volatility of market securities and instruments. Three major proposals are presented and a demonstration of electronic trading will be made.

- *** PROPOSAL #1 -- Cohen and Schwartz, Chapter 2 in Lucas and Schwartz text
- *** PROPOSAL #2 -- Amihud and Mendelson, Chapter 3 in Lucas and Schwartz text
- *** PROPOSAL #3 -- Peake, Mendelson and Williams, Chapter 13 in Lucas and Schwartz text
- ** Malone, Yates and Benjamin, "Electronic Markets and Electronic Hierarchies"

You are expected to:

- A. Master the details of the three proposed approaches to electronic market architectures;
- B. Understand the definitions of the key terms related to electronic markets and electronic hierarchies (markets, hierarchies, asset specificity, etc.) and the perspective the authors offer for why a market or a hierarchy should emerge; think about how this perspective relates to markets for trading various financial instruments
- C. Evaluate the proposals in terms of multiple dimensions of electronic market performance, and develop a perspective for the strengths and weaknesses of the three proposals
- D. Understand the basics of SUPERDOT at the NYSE and how this market architecture should be evaluated in view of Black Monday, October 1987 and other market efficiency considerations

V. International Securities Markets and IT Architectures

The purpose of this session will be to investigate automation issues in international securities markets by focusing on the "Big Bang" at the International Stock Exchange in London. In addition to London, Toronto, Tokyo, New York and Chicago will also be considered, and we will briefly discuss a recently failed attempt to automate bond issuance by a company called CapitaLink, Inc.

- *** Kauffman and Kennedy (1991), "Markets for Electronic Debt Issuance: A Case Study of CapitaLink" (HANDOUT IN PRIOR CLASS)
- *** "Big Bang and the London Stock Exchange" (A and B)
- *** Lucas and Schwartz (1989) -- Chapters 17, 22, 25
- ** Lucas and Schwartz (1989) -- Chapters 16, 20
- * Lucas and Schwartz (1989) -- Chapters 18, 19, 21, 23

You should focus your reading efforts on the case materials. The readings from the book offer you useful descriptive background on comparative international markets, but the heart of the issues you will be asked to consider and present are related to implementation problems in electronic markets. Be prepared to present your solution to the case in class.

Your learning goals for this session and the accompanying readings are as follows:

- A. Gain a knowledge of international electronic markets, especially Big Bang (London), CATS (Toronto), CORES (Tokyo) and CapitaLink (New York)
- B. Understand a comparative framework for international electronic markets
- C. Evaluate the extent to which each of the three proposals discussed in previous lecture are applied
- D. Identify key implementation problems associated with Big Bang and CapitaLink, and recognize how they generalize to other kinds of situations involving information systems deployment

VI. Designing and Managing Trading Floor Technologies

The first portion of this session will be devoted to demonstrations of two electronic trading environments: Globex (DART 2000) and CapitaLink Electronic Bond Auction. We will then move on to a discussion of technical design and management issues associated with the deployment of trading floor automation. We will explore in some depth the new technologies and systems that are changing the face of trading activities in banks and brokerage houses today. The architecture of the trading floor systems of a major New York City money center bank will be discussed in some depth. We will also compare the "video" and "digital" data sources that are used by decision support and information systems supporting the trading activities.

** Mark and Roth, "Automated Decision Support in the Trading Room" (1989)

The learning goals for this session are as follows:

- A. Get a feel for how screen-based electronic trading works -- enjoy!
- B. Understand why trading technologies are strategic, rather than operational investments in IT
- C. Be able to distinguish between video and digital feeds, how they are used and how they are delivered to trader workstations
- D. Understand how digital feeds make possible real-time analytics, and automated trading decision support
- E. Recognize the value of an integrated platform approach in trading system design

VII. Methods for Managing Financial Services Risk with IT

In this lecture we will examine some new ways that financial services firms are using information technology to improve their ability to manage the various kinds of risks (trading risk, ALCO risk, investment portfolio risk and so on) they experience due to participation in financial markets, and varied product offerings and customer bases.

- *** Bansal, Kauffman, Mark and Peters (1991), "Financial Risk and Financial Risk Management Technologies" (HANDOUT IN PRIOR CLASS)
- **/* Doherty, N. (1985) "Portfolio Theory and Risk Management," Chapter 5 in Corporate Risk Management (ON RESERVE)
- ** Binder and Mark, "Risk Points -- A Vehicle to Control the Effects of Price Volatility" (1988)

(You will note that the Doherty article is marked **/* and is quite long. You should focus on the main points and skim the portions that are especially technical or involve lots of mathematics. I will comment on the portions of the article that require mastery in class.)

In this lecture and readings related to this session, you need to gain an understanding of:

- A. Some basic concepts and formal definitions related to risk management
- B. How computers are used for financial optimization in a number of portfolio management and trading applications
- C. Information technologies, including supercomputing, neural network, object-oriented systems, distributed and client-server architectures, that are increasingly used to support risk management activities
- D. Three components of risk management systems, and the cost-benefit tradeoffs involved in making design decisions to support risk management
- E. Calculation and application of "risk points" in risk management information systems.

VIII. Retail Electronic Payment Technologies

Retail electronic payment systems include credit and debit card, and ATM networks. We will consider strategic aspects of membership, operating considerations related to managing the network link and some of the regulatory issues that have arisen due to the new capabilities made possible by IT. We will also examine Banco Santander's experiences with home banking technology and apply what we learn to similar experiments in the U.S.

- *** McAndrews (1991) -- Philadelphia Federal Reserve Bank article on shared networks
- *** "Banco Santander: El Banco in El Casa" *** CASE ***
- ** Steiner and Teixeira, Chapters 4-5 (1990)
- ** Clemons, "MAC -- Philadelphia National Bank's Strategic Venture in Shared ATM Networks" (1989)

You should develop an understanding of the following issues through the lectures and readings in this session:

- A. Major classes of retail payment technologies, growth and evolution and regulatory issues
- B. An operational perspective on the operation of an electronic banking network
- C. A strategic perspective on interorganizational sharing of retail banking technologies through regional and national level shared networks
- D. Externality analysis for network valuation
- E. Future directions in retail payment technologies

IX. Wholesale Payment and Treasury Management Technologies

In this lecture, we will discuss wholesale and corporate funds transfer operations, including CHIPS, FEDWIRE and SWIFT, as they are deployed, used and managed at major New York City money center banks. We will also consider the rationale for integrating corporate treasury management, funds transfer operations and the ordering/billing cycle through emerging interorganizational information systems known as electronic data interchange (EDI).

- *** Steiner and Teixeira (1990), Chapter 6
- ** Gentry (1986), "Management of Information, Competitive Advantage and Short-Run Financial Management Systems"
- ** Scott Morton et al. (1989) "Electronic Data Interchange"

The learning goals for this session include:

- A. Identify major classes and capabilities of wholesale electronic funds transfer
- B. Understand evolution and development of wholesale electronic funds transfer market
- C. Extend funds transfer IT concepts to short-term corporate treasury management systems
- D. Examine how computers are used to power up working capital management
- E. Appreciate logical order-payment transaction design; basics of interorganizational information systems; and design and implementation considerations related to electronic data interchange.

X. Artificial Intelligence and Expert Systems for the Financial Services Industry

Artificial intelligence and expert systems have recently been the topic of great interest for many kinds of applications in the financial services industry. We will examine two domains in some depth: capital budgeting, and analysis of market data to support automated trading. We will finish with an evaluation of an automated financial report filing capability that was implemented by the Securities Exchange Commission.

- *** "Securities Exchange Commission" ***CASE***
- ** Aronson, "AI and Pattern Recognition" (1988)
- ** Myers, "Notes on an Expert System for Capital Budgeting (1988)

Your learning goals are as follows:

- A. Understand what is meant by such terms as artificial intelligence, expert system, rule-based system, rule base and knowledge engineering, inference engine, case-based reasoning, etc.
- B. Recognize classes of decision problems that are automatable using artificial intelligence and expert systems approaches; also recognize areas in financial operations that are amenable to such approaches and why
- C. Understand the operation of simple rule-based systems in financial applications (capital budgeting and market price pattern recognition)
- D. Identify problems in justifying, developing, implementing, maintaining and extending expert systems in financial services settings, using a case example and the SEC

XI. High Tech on Wall Street -- Technology at the New York Stock Exchange

In this session, we will be visiting the New York Stock Exchange for a special briefing on electronic markets and recent developments in electronic trading at the exchange. Students will have the opportunity to go onto the floor of the exchange at the closing, and see the electronic display books used by exchange specialist firms to assist in price setting. Handouts will be made available to students when we arrive at the exchange.

XII. Midterm Exam

The midterm exam will be given during the class period. No makeup exams are given without prior arrangement by the student with the instructor.

XIII. High Tech on Wall Street -- Managing the New Technologies (Outside Speaker)

In this session, students will have an opportunity to hear about a range of topics representing the newest applications of IT in the financial services community (no readings required, however, handouts will be distributed in class). Topics discussed to date have included:

- * Computer Aided Software Engineering for Trading Workstation Software Development (First Boston Corporation and Seer Technologies)
- * Strategies for Mergers and Acquisitions in Electronic Banking (MAC/Metroteller and Yankee 24)
- * Developing Trading Analytics in a Microsoft Windows and OS/2 Environment (Tech Hackers)
- * New Wave Analytics -- Wall Street's Vector Processing and Supercomputing Applications (J. P. Morgan)

Firms on our list of future invitees include Merrill Lynch, Morgan Stanley, Booz Allen, Andersen Consulting, American Express, Micrognosis, Deloitte Touche, Bankers Trust, Chemical Bank, American Express and Core States Financial/Philadelphia National Bank.

OUTSIDE SPEAKER --
DETAILS TO BE ANNOUNCED EACH TERM

XIV. Course Wrap Up: Strategic Analysis for Financial Services Operations and Information Technologies

In this lecture we will explore ways to perform strategic analysis of financial services operations in order to determine new opportunities that information technology offers the firm to improve its competitiveness, change its operational economies of scale or broaden its product portfolio.

- *** Konsynski and McFarlan, "Information Partnerships"
- *** Steiner and Teixeira, Chapters 9-10