Information Technology's Use in Measuring Service Quality: Case Study at Total System Services, Inc.

CHETAN S. SANKAR
NANCY DAVIDSON
MARC MILLER

AUBURN UNIVERSITY

WITH

STANLEY PIPES
TOTAL SYSTEMS SERVICES INCORPORATED

ABSTRACT

Total Quality Management is becoming increasingly important in the service industry. This paper reports the use of information technology to implement a quality information system to measure service quality in Total System Services, Inc. (TSYS), a credit card processing company. The effectiveness of developing the quality information systems is evaluated based on the four major elements used in the Malcolm Baldrige National Quality Award measures. We found that quality information systems have changed the focus of problem solving at TSYS from a reactive to a proactive mode. The analysis also leads to identification of strategies that could leverage investment in IT to improve the quality of service in a company.

PROBLEM AND RELEVANCE

The service sector, once second to manufacturing, now contributes more to the gross national product (GNP) than does manufacturing (Hackett, 1990). During the past decade, service sector companies spent $860 billion on information technology and received only a half a percentage point of productivity growth a year (Bulkeley, 1993).

Quality management is a strategic goal that is important to all industries and is receiving increased attention. Total quality management (TQM) primarily focuses on customer satisfaction, within a corporate culture that seeks continuous improvement of all processes and systems. One aspect of the continuous improvement focus concerns itself with the measurement of indicators that aid in identifying problem areas before and after the product or service reaches the consumer. Until the late 1980s, many managers in the service sector believed that services were intangible, and therefore not measurable (Schonberger, 1992). Most service companies could only track their customers' perceptions through customer complaints. This is a reactive means of quality management and therefore does not allow for proactive problem solving to avoid customer complaints.

Although information technology (IT)[1] has been a major factor in the success of the service sector in offering widespread services using shared databases and global networks, its use in measuring quality is not well documented. Service companies, such as banks, insurance companies, credit card processors, etc., are critically dependent on IT to offer superior services to their customers. However, recent competitive pressures are forcing service companies to cut costs and to emphasize quality (Berkley and Gupta, 1993). Information systems departments are being increasingly scrutinized for their ability to meet corporate quality goals. Can IT, the backbone of many service industries, go beyond operational systems and proactively measure quality dimensions and thus help solve problems before they reach the customer?

We had an opportunity to observe the implementation of quality information systems by Total System Services (TSYS℠) for a client, AT&T Universal Card Services (UCS). We report on TSYS's use of IT to measure service quality and meet customer expectations. We use the major elements of the Malcolm Baldrige National Quality Award in order to understand and relate the use of IT to measure quality. This

[1]Information technology is defined in this paper as encompassing information systems, telecommunications, and office automation.

leads to findings that could be used by managers of other service companies.

EVOLUTION OF QUALITY INFORMATION SYSTEMS AT TSYS

TSYS is a bankcard and private label card processing company based in Columbus, Georgia, which provides card-issuing institutions with a comprehensive on-line system of data processing services marketed as THE TOTAL SYSTEM℠ (TS[1] and now TS[2]). With a nationwide data communications network, TSYS offers customers a full range of services, from credit card production and statement preparation to customer service support. The company processes Visa, MasterCard, and diner's Club, as well as private label, debit, and corporate cards.

Informal Quality Information System

When TSYS was formed in 1983, it handled the credit card accounts of the parent organization, Columbus Bank and Trust Company and a few other banks across the country. At that time, TSYS had an employee base of about 120 people. Service quality was monitored by customer service representatives who called each customer bank daily Additionally, the banks were free to call Rick Ussery, Chairman and CEO, or Phil Tomlinson, President, directly if problems arose. The two executives gauged the service quality level by the number of calls received regarding customer complaints.

Formal Quality Information Systems

TSYS changed its method of quality management and control after it obtained the rights to process AT&T-Universal Card (UCS) credit cards in 1990[2]. Customer representatives at UCS's offices in Jacksonville, Florida access real-time information from computers in Columbus, Georgia. All information processing is done by TSYS at its facilities in Columbus, Georgia. TSYS, as part of the agreement with UCS, had to adopt formal service quality monitoring and measurement methods. Quality management had grown more important in TSYS as it had expanded to employ 1,500 people[3]. TSYS and UCS measure a set of quality indicators daily that they view as critical success factors. These quality indicators are related to the daily processing of customer credit card accounts. Not meeting the standard of one of these indicators means not meeting the daily quality goals of the companies. Of the ten indicators that TSYS shared with UCS daily in 1993, eight measure the overall availability of the system and two measure accuracy. Availability measures are computed for subsystems such as authorizations, collection systems, cardholder systems, credit bureau interface, and others. Accuracy is measured for production problem resolution and training systems[4].

The ten quality indicators are computed from over 340 function codes. These function codes present the information that is requested on-line by the customer service representatives of UCS. Of the 340 function codes, about 75 are retrieved extensively. For example, a typical function code would be the access and retrieval of a customer's current balance. The TS[2] continually measures the number of times these codes are accessed, the success of the access, and whether the response was accurate. At the end of each day, the quality of the ten indicators is computed in terms of a percentage.

Standards with UCS have been set so that the systems had to be available 99.5 percent of the time. This essentially works out to a maximum of seven minutes outage a day[5]. For example, Cardholder System Availability is an indicator composed of 306 function codes. For this indicator to meet the daily quality standard, none of the function codes could be unavailable for more than seven minutes a day. Some of these function codes are accessed as much as 190,000 times a day. Others may not be accessed for a month.

A final daily quality index is computed as the average value of the ten indicators. TSYS has set a standard that its daily quality index should be higher than 96.0 percent each day, implying that each indicator must be met. For example, if even one indicator is missed, the daily quality index will be 90 percent. The information technologies at TSYS help identify and document problems in meeting the objectives. If a function code is unavailable for more than the seven-minute maximum, the system automatically generates trouble tickets before any "human monitoring" system is aware that a problem occurred.

TSYS and UCS executives meet each morning (face-to-face or audio teleconferencing) to discuss the trouble tickets and the value of the daily indicators. They add names of responsible persons and reported cause to each trouble ticket. They also generate action plans daily that list the status of active trouble tickets, actions taken to close the tickets, and actions required for final resolution of the problems. The trouble tickets and action plans are available on-line to em-

[2]In response to the UCS operational demands, TSYS created a position of Senior Vice President-AT&T Relations and hired Stanley Pipes to fill that position.

[3]Currently TSYS serves 114 card issuers in 36 states, Puerto Rico, and Canada which represent 35.5 million cardholders and 260 merchant accounts.

[4]Accuracy is defined by TSYS as the correctness of the information appearing on a screen, when that screen is accessed.

[5]The measurement is based on all queries made to the system, not on a sample of the queries.

ployees working at TSYS or UCS. The trouble tickets become an automatic feedback system to the daily morning meeting, hence problems are addressed within 24 hours of their occurrence. Pipes states:

> Each trouble ticket has to be closed. To close one, you have to explain what happened and why it happened. The next step we take is to file an action plan to prevent it from happening again. We then put additional controls in place.

Thus, the information systems allow TSYS to be aware of a problem and usually fix it before a customer brings the problem to their attention.

Application of Quality IS to Other Divisions of TSYS

After the development and implementation of quality measures to track the UCS account, TSYS began exploring other areas of its business to apply the same techniques. During the past two years, TSYS has started measuring the quality indicators of many of its own internal operations. A central quality group works with each division to create new quality measures. The operations of each division are measured using these indicators and are reported to management and to other employees on a daily basis.

We interviewed various levels of executives and employees at TSYS in order to understand the use of IT to measure service quality. Our subjective evaluation was very favorable and we wanted to identify the elements that led to the use of IT to measure quality in TSYS. We used the major elements of the Malcolm Baldrige Award Criteria for this evaluation.

IT'S USE IN MEASURING QUALITY

Malcolm Baldrige criteria consists of four basic elements that embody a set of core values and concepts that are critical in enhancing quality in an organization. These elements are the driver, the system, measures of progress and the goal. The driver refers to senior executive leadership and their creation of the values, goals, and systems, and their guidance in the sustained pursuit of customer value and company performance. The system encompasses the set of well-designed and well-defined processes used by the firm for satisfying performance, quality, and customer requirements. Measures of progress produce a results-oriented foundation for directing actions required to deliver continually improving company performance and customer value. The goal is the primary objective of the quality process, that is to deliver continually improving value to the customer (Award Criteria, 1993). We will discuss below how the use of the computer-based formal IS (TS^1, TS^2), telecommunications networks, and newly created quality information systems are used to meet the quality expectations of each basic element of the Malcolm Baldrige Criteria.

How IT is Used in the Driver Element

The driver element specifies that senior executives create the values, goals, and systems for the organization, and guide the sustained pursuit of customer value and company performance improvement (Award Criteria, 1993). TSYS's executive management are committed to the concept of TQM and have made major efforts to spread TQM concepts in the company. Phil Tomlinson, President of TSYS, states that:

> It is our objective to create an environment at Total System where continuous improvement can flourish and we can exceed customer expectations every day.

A major step in achieving this objective is through a monthly meeting of the company's top executives from each functional area. Quality indicators are computed for each measure that has been devised and a daily quality index is computed for the company based on these. The executives review a binder that has detailed statistics measuring the performance of each functional area. These meetings require each executive to explain the impact his or her part of the organization has on the company's efforts toward meeting the customer needs.

Through the daily quality index, senior executives have a microscopic view of those areas of the company that have a direct impact on the strategic goal of client satisfaction. This allows the executives to continually evaluate that division's progress toward the goal until the objectives are met. As the business operations change, and the position of the microscope shifts to other divisions and processes. Without such information, the leadership of TSYS could not focus attentions on evaluation of progress toward the goal. Rick Ussery, CEO and Chairman of the Board of TSYS, states

> We have changed the way our management does business. We have become more sophisticated in using measurements on a daily basis in order to improve quality.

The expectations of the senior managers on tracking quality measurements has been satisfied by the development of information systems and telecommunications networks in TSYS.

How IT is Used in the System Element

The system element is the operational IS (IT^2) and telecommunication networks that are in place in TSYS to meet customer needs. They encompass the set of processes used by the firm for satisfying performance, quality, and customer requirements and provide a flexible set of services to meet the differing needs of the clients of TSYS. The IS is structured as modules — each module relates to a different area of bankcard service, such as authorizations, collections, report-

ing, new account evaluations, customer service, and security. Clients can select, from numerous choices, the features they want within each module. They also have the ability to custom design screens down to the smallest detail to suit their particular operation. In short, with TS², clients can literally create their own individualized system. This flexibility represents a major breakthrough since, with other competing card processing systems, it is difficult for clients to choose anything other than standard features or to customize the presentation of their data. In spite of its complexity, TS² provides a user-friendly environment that is easy for operators to learn and use. For example, the customer representatives at UCS use a Universal Windows application that displays customer information in an intuitive, graphic format. Each screen is made up of information from more than half a dozen TSYS databases of pertinent customer records.

Clients also appreciate the ability of TS² to track the profitability of their bankcard business and to identify which types of cards are profit leaders. What is more, the system can provide demographic profiles of cardholders, enabling the clients to develop marketing and promotional plans targeted to their customers' interests.

The telecommunications network is the backbone of the relationship between TSYS and its customers. The combination of satellite, terrestrial microwave, fiber, and copper lines provides the medium through which TSYS databases can be accessed by customer representatives of TSYS's clients. The network provides fast and responsive service to TSYS's ultimate consumer, the cardholder. TSYS's IBM ES/9000 mainframe handles more than six million CICS transactions per day, which come through the 36,000 on-line terminals on its nationwide network (Pound and Dillard, 1993). Two networks support these operations. A wide area data network handles six million CICS transactions, 1.2 million authorizations, and 1,200 batch transmissions containing payments and drafts valued at $250 million on a daily basis. Voice service is provided by BellSouth's ESSX service and supports 1,600 voice mailboxes. On a monthly basis, 236,000 local calls are made and 150,000 calls to the 800 number are generated.

Rick Ussery states:

> Another advantage of TS² and the networks is the system's continuous availability — 24 hours a day, seven days a week —and its extensive flexibility which enables clients to create new products and varied credit terms. Furthermore, the system is adaptable to the international market. These examples are only a few of the hundreds of features and options that set TS² apart — and only a few reasons why we believe this powerful system will place TSYS well ahead of competition. Because of updates and improvements that will be made on a continuing basis, we believe that TS² will secure our position of leadership over the long term.

Effective integration of TS² and the telecommunication networks provides TSYS an ability to build flexible systems for its multiple clients. Quality indices keep track of the ability of these systems to meet customer expectations.

How IT is Used in the Measure of Progress Element

The measure of progress element provides "real-time" information for evaluation and improvement of quality system processes and practices. TSYS has developed quality indices and connected the computation of these indices with information from TS². By having the information system identify problems before the customer realizes that a problem occurred, the company can address and solve problems proactively. This also enables the company to focus its attentions on continuous improvement of the processes that create these problems. Pipes says, in relation to the quality information system, that:

> From a management point of view, quality indicators are the best things that have ever happened, as far as directing management effort. You have a process in place that allows you to focus your associate level workloads in the direction you want. You are achieving your overall strategic objective. If you measure the output of a process, then you will improve that process. You have a benchmark of where it is going.

Quality indicators and measures are computed based on the formal TS² system. Each division meets to discuss its goals and arrive at the quality measures. Daily quality indicators are computed. These daily quality indicators are reviewed to identify root causes of the problems. By measuring and focusing on the root cause of the problem, attention is given to the issue which then gives management the ability to resolve the problem. The daily information is encapsulated into daily reports, weekly summaries, and the executive monthly summaries. Pipes reiterates:

> Once a month we have a business review, where we put together a summary of all the events that occurred for the month. We present that to senior management. The focus of this meeting is on quality indicators. These meetings allow each division to understand what divisions they impact.

The quality indices change periodically. The indicators used with UCS have varied from 10 to 20 depending on the period and the urgency of the problems. The quality indicators put pressure on everyone to perform well. For example, the trouble ticket system which alerts employees to problems on a real-time basis created an environment of proactive and team-oriented problem solving. This created the following flow of information:

1. The information system automatically identifies a problem as it is happening.
2. The trouble ticket is generated identifying the respon-

sible functional areas that need to address the problem.

3. The problem is addressed in a cross-functional way that searches for the root cause of the problem A Continuous Improvement Team (CIT), an ad-hoc group of employees, is created to focus on a particular problem and strive to rebuild the process so that the problem does not reappear.
4. The problem is solved across functions and the improvement provided by the solution is tracked by the information system.
5. If there are no more problems in this area for a reasonable period of time, this quality indicator is discontinued. New ones are created as needed.

Thus, this process identifies and solves problems in an area of focus before the customer realizes that a problem has occurred. Once the problem is solved, this team is disbanded, and attention is brought to bear on other problems.

How IT is Used to Obtain Customer Satisfaction: The Goal

The goal element is designed to deliver continually improving value to a customer. TSYS has been focusing on quality improvement strategies in order to provide continuous improvements to its customers. For example, based on customer feedback, TSYS is using imaging technology to scan cardholder correspondence and other documents and store them in computers. These can be retrieved for on-screen viewing. With imaging, documents can be quickly brought up on screen during conversations with customers. This reduces paper handling and greatly increases efficiency for card issuers who often have rooms packed with customer files.

The quality information systems at TSYS have improved the ability to meet customer needs by encouraging proactive problem solving and cooperation among divisions. For example, when statement production area sends out duplicate bills to a bank's credit card customers, a trouble ticket is automatically generated by the system. The employees in the statement production area now become responsible for identifying the root cause of the problem. Therefore, customers would be sent another note asking them to ignore the second bill, before they call the banks and complain about the duplicate bill. In this instance, the quality measure cannot prevent a problem from occurring for the first time. However, the trouble ticket will not be closed until the root cause of the problem is identified and corrected. Information technology identifies the problem, then the employees find the cause and work toward its solution. As stated earlier, the mere act of measuring a process provides focus on the process. And the attention brought to bear by focusing on the process tends to improve the process. Pipes states:

> Working with UCS executives, we determine the quality measures and the performance standards. The information system tells us whether the standards have been met and not met. We can also query the system early in the morning to check whether any trouble ticket has been created so that we can discuss the resolution of that ticket during the morning meeting.

The emphasis on quality measures has led to improved cooperation between TSYS and UCS and within functional divisions of both companies. Many times a trouble ticket identifies problems that are of concern between functional areas between the two organizations or within an organization. By identification of cross-functional problems, employees can see how their performance affects other functions. Pipes explains how use of quality measures has improved cooperation between the companies and within TSYS:

> Availability of quality measures on an on-line basis puts pressure on everyone to perform well. For example, I have had people from UCS come up to me and say, "Why was your system down for 22 minutes yesterday? I couldn't get out all my mail and I missed my quality indicator." This really fosters a team spirit. You can't have one department doing something at the expense of another, since it will result in missing quality indicators for the company.

The measurement and posting of the quality indices make it possible for individuals to realize how they are not doing isolated jobs, but are contributing to the success of the company. In a meeting to discuss the impact of IS and quality on TSYS, an executive in charge of a division at TSYS stated:

Quality measurement makes it possible to thread through very many different functions that otherwise will never sit in the same room. It makes it possible to trust others and relationships between managers and employees have improved.

Pipes states how TQM implies being a team player:

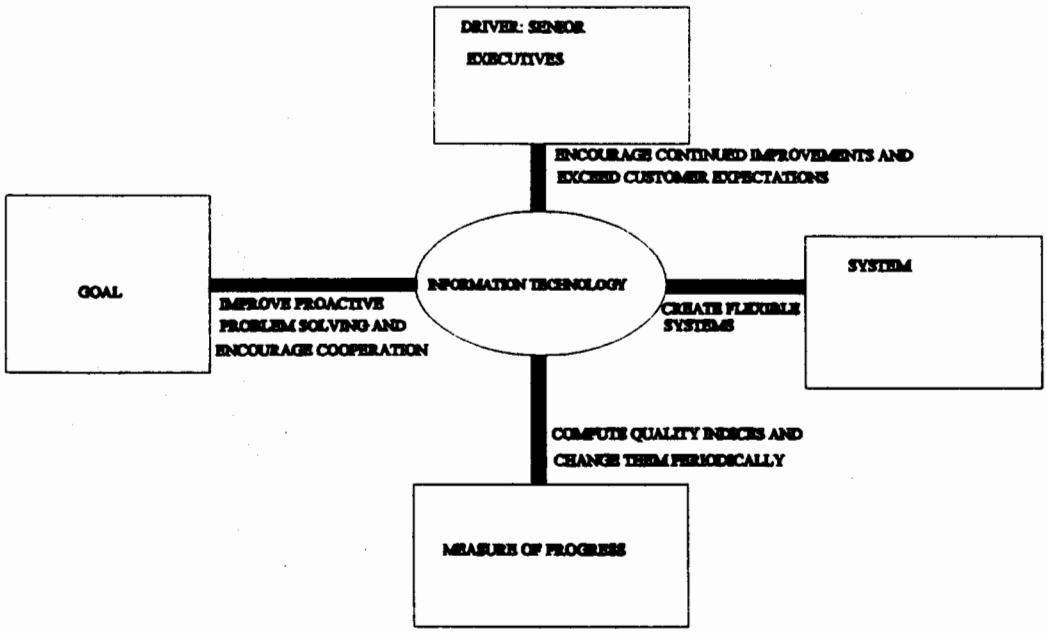
> We talk not about "cowboys" but "champions." A champion leads a group that goes out and attacks the problem and solves it. It comes back to the joint development environment where you get everyone into the process that the process affects.

The goal element represents the end result, but is also the starting point for continual improvement of the systems, measures, and senior executives focus. Quality measures provide an ability for an employee to gauge his/her contributions to the goals of the company on an on-going basis. Pipes states:

> You take pride in the accomplishment of the goals that have been set up. It's not a continuous flow of processes that have no beginning and no end. Your quality measures give you a kind of "here's today; I made the day" feeling. So, there is a little task that you accomplished

Figure 1

IT's Use in Measuring Service Quality



that you can hold onto for today. The quality mandate relates to a specific task, a specific goal, and a specific reward.

Implications for Other Service Companies

The quality information systems developed within TSYS have been responsible for measuring and monitoring the quality of TSYS's performance. TSYS developed quality information systems using employees of the operational divisions, not the MIS division. Employees in the divisions who understood the operations were placed in charge of reporting the quality measures and devised simple information systems to compute the statistics. They pulled data from TS[2], but devised their own heuristic in computing the quality measures. Having employees within the divisions compute the measures provides a better acceptance of the results. Also, the local employees were able to discard measuring some quality indicators and start measuring new ones very quickly. They were part of the local division culture and felt included.Thus, making quality measurements as a staff service within each division might be more advantageous to TSYS and other service companies rather than having a central division compute these statistics.

Figure 1 summarizes how IT has been used to measure service quality and improve operations in TSYS. The analysis of IT's use to measure service quality in TSYS shows that there are four steps to this strategy. These four steps are: (1) senior managers need to encourage quality measurements and review quality indices periodically to bring focus to the processes that are doing well and that need improvement, (2) IT division needs to create flexible systems in order to meet or exceed customer expectations, (3) each functional division needs to create and compute quality indices to measure the progress made in the use of flexible systems to meet customer needs, and (4) employees need to be encouraged to monitor the measures so as to proactively change the processes and prevent recurrences of problems. Other service companies could use a similar strategy to leverage their investment in IT to improve the quality of service. Lack of such strategies to improve quality could be disastrous to service companies according to Pipes:

> In the service industry, what else is there than better service! Banking services are no longer restricted geographically, people are beginning to have the option of going down the street to the bank or doing it at home using an 800 number and contacting a bank across the country. In order to improve service quality,we have to define the tasks, set standards, and measure them. The information systems track whether the tasks are performed according to standards or not. Service industries have to follow similar strategies to improve quality or they will perish due to loss of market share.

REFERENCES

[1] Award Criteria. (1993) *Malcolm Baldrige National Quality Award.* National Institute of Standards and Technology, Gaithersburg, MD.

[2] Berkley, B.J. and Gupta, A. (April 1994). Improving Service Quality with Information Technology, Wisconsin Working Paper 9-93-9, University of Wisconsin-Madison to appear in *International Journal of Information Management.*

[3] Bulkeley, W.M. (1993). *Computers Start to Lift U.S. Productivity. The Wall Street Journal,* March 1, p. B8.

[4] Hackett, G.P. (Winter 1990). Investments in technology — the service sector sinkhole? *Sloan Management Review,* pp. 97-103.

[5] Pound, J.K. and Dillard, F.L. (June 1993). Partnering for Network Performance. *Business Communications Review,* 23(6),1 pp. 19-20.

[6] Schonberger, R.J. (Spring 1992). Total Quality Management cuts a broad swath — through manufacturing and beyond. O*rganizational Dynamics,* 20, pp. 16-28.

AUTHORS' BIOGRAPHIES

Chetan S. Sankar *is an Associate Professor of MIS at the Auburn University's College of Business. He received his Ph.D. from the Wharton School, University of Pennsylvania. He has worked as an Assistant Professor at Temple University and as a Systems Engineer at AT&T Bell Laboratories. His current research interests include global telecommunications management, case study research, career progression of technologists to managers, and user interfaces. He is a senior member of the IEEE and a member of IRMA, INFORMS, and DSI. He has published more than 30 papers including those in* MIS Quarterly, Management Science, Academy of Management Executive, IEEE Transactions on Professional Communications, IEEE Transactions on Engineering Management, Journal of Database Management, International Journal on Information Management, Journal of Global Information Management, Decision Support Systems, Information Management Review, Telecommunications, *and* Naval Logistics Quarterly.

Nancy W. Davidson *is a Ph.D. candidate in MIS at Auburn University. She received the 1993 Outstanding Ph.D. Student Case Award presented by Richard D. Irwin, Inc., at the North American Case Research Association. She has held management positions for several years. Her areas of interest are information resources management and strategic management. Her dissertation topic concerns issues in MIS and quality control in service industries.*

Marc D. Miller *is an Assistant Professor at West Georgia College. He received his Ph.D. in MIS from Auburn University in 1994. His research interests include technology acceptance, innovation diffusion, and structural equation research methodologies.*

Stanley H. Pipes *is the Senior Vice President and Division Head at Total System Services, Inc. He is responsible for all bankcard processing services provided to AT&T Universal Card Services by Total System. His areas of responsibility include management of daily production, software development of new enhancements, and administration of the UCS processing agreement, including tracking and monitoring quality performance standards. Stanley was recruited from First Tennessee Bank where he was Corporate Retail Manager and Vice President responsible for the cardholder and merchant portfolios. Prior to First Tennessee Bank, Stanley served with Monogram Bank, a subsidiary of GE Capital, as a member of the Board of Directors with direct responsibility for cardholder marketing and growth. In total, he has over 13 years of management experience in the bankcard industry and data processing. Stanley attended Louisiana State University where he received the degrees of a Bachelor of Architecture, a Master of Business Administration, and a Master of Science in Finance.*