**Paper 160-28**
**Using Information Effectively to Make More Profitable Decisions, "The 10 Letter Solution for Finance".**

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## ABSTRACT

This paper provides examples of the integration of SAS® analytics, ESRI geographic information systems, and IBM's data warehousing to deliver a complete solution for customer analytics for financial organizations known as the "The 10 Letter Solution for Finance". The data warehousing component aggregates data from existing systems, warehouses it in a logical structure, and enables end-users to analyze the information through proven data mart applications. To this initial look at customers, the analytics supplied by SAS, including the SAS OLAP and data mining products, are applied to define and characterize the best customers from a financial as well as a householding prospective. Finally, ESRI's thematic mapping is used to analyze these customers with respect to their relationships to each other and to physical structures such as branches and ATMs.

## INTRODUCTION

Financial institutions face strong competitive pressures in attracting the "right" new customers. Why? Because typically 10% of a bank's customers return 160% of the profit. Which means that the bottum 20-30% of a bank's customers are eating revenue and profit. These are the customers that a bank need to attract more of to grow profitably. Financial institutions need to clearly understand who their customers are, which customers they "should" attract, and how their products and services effect those customer relationships, and their overall profit to remain successful against the competition. Many companies are actively exploring new technologies in the realm of data management to gain much needed information about their own portfolios, their customers, and where they should be targeting their efforts in the market place. In today's environment, a solution that is end-to-end, quick to implement, scalable and easy to grow as customers identify more needs in the data management space is essential.

"The 10 Letter Solution for Finance" can drive results by analyzing:

- Profit tiers to determine source of growth or losses

- Drivers and reducers of profitability

- Effectiveness of sales and marketing activities

- Sales channel effectiveness

- Transaction and services costs.

After having determined these parameters on a customer centric basis the results can be used to look at cross selling opportunities within the current customer group as well as extension into opportunities with possible new customers. Once the elemental data about each customer is understood, then it is important to understand the geographic relationships between each customer, potential new customers, and to brick and mortar locations such as branches and ATM machines. This analysis allows for the determination of whether new ATMs are needed to service current or new customers as well as potential new branch locations. Using demographic profiling of current customers allows for the profiling of portions or whole zip code areas for the identification of targeted marketing either by phone or mail solicitation.

**Profit Tiers to determine source of growth or losses.**

Profit Tiers to determine the source of growth and losses is critical to the understanding of your top customers.  These customers should be the ones that show the least propensity for defaulting and the greatest potential for increased profitability.  An example of the importance of this parameter is the efforts that were undertaken to define profit tiers at the Credit Union of Texas (CUTX).  In the latter part of the 1990s, the executives with CUTX met to plan for their future growth and success.  They determined during this meeting that they had captured nearly all of their potential target market that consisted at the time of exclusively teachers in the Dallas area.  More specifically, they had exhausted the prospects that their charter (per the State of Texas) allowed them to serve.  A large number of these members were using only a single service from the credit union and were in the lowest profit tier.   It became apparent for the future health and success of the credit union there was a need to change their charter and technological capabilities.  This also presented challenges because with this change it would be necessary to expand and profitably grow their client base without increasing staff.  Only the use of more sophisticated technology would allow them to proceed in that direction.  The additional sophistication likely would lead to significant cultural changes in the staff from a product-centric to a customer-centric approach.  Technology would be critical to making this transition and would supplant decisions that were currently been driven by having a product focus tradition and decisions being made based upon "that is the way we have always done it".

After much discussion it became apparent that CUTX could utilize their knowledge of current customers who were primarily teachers to expand into eight additional counties based upon understanding the service to customers by credit unions that were located within school districts within these new counties.  If successful in its expansion efforts, the credit union's new target area would include consumers in the larger area that were other than teachers but with similar demographic, financial, and cyclographic characteristics and were currently not being served by a credit union.  Knowing that the competition in this market was stiff, however, decision makers at the credit union wanted to manage growth in a profitable manner without sacrificing their traditional small customer base look and feel.  CUTX prepared and presented a plan for this expansion using ESRI's ArcView Business Analyst product to the State of Texas Credit Union Licensing Board that showed the types of customers that existed within these new counties and how they compared to their current customers within their current service area based upon school district boundaries.  They also demonstrated that these prospective customers were not currently being served by a credit union.  This analysis and the resulting grant of an expanded charter for CUTX raised their potential customer base from approximately 250,000 to over 2,500,000.  In this way they were able to remove their primary barrier to growth, a limited customer base, through the use of technology to gain their charter expansion.  According to Jerry Thompson, CIO of the CUTX, the charter change approved in 2000 made the decision support tools that enabled the presentaion of the reasons for change worth the price. CUTX had preconceived notions about what customer segments were profitable and what credit union members desired as products and services.  In many cases, the most profitable customer segments had spatial and purchasing characteristics that they had not anticipated. The insight they gained about their customers and their ability to expand their services could not have been accomplished without the Business Intelligence and spatial analysis capabilities contained within the framework of the "10 letter solution for Finance".

**Drivers and reducers of profitability**

Drivers of profitability increase in a pyramid fashion from Customer and Product Profitability to overall Branch Profitability.  The different types of reports generated from the CUTX data warehouse and accumulated using SAS OLAP are shown below followed by a diagram and discussion that gives a look at how this process is completed.  In addition, with the use of SAS Enterprise Miner, segments of customers that either drive or reduce profitability can be identified.  A diagramatical way of looking at this portion of the solution is shown below.

The "10 letter solution for finance" integrates data sources so that customer relationships can be examined fully.  The data is stored in the data warehouse where it can be manipulated for additional analysis.
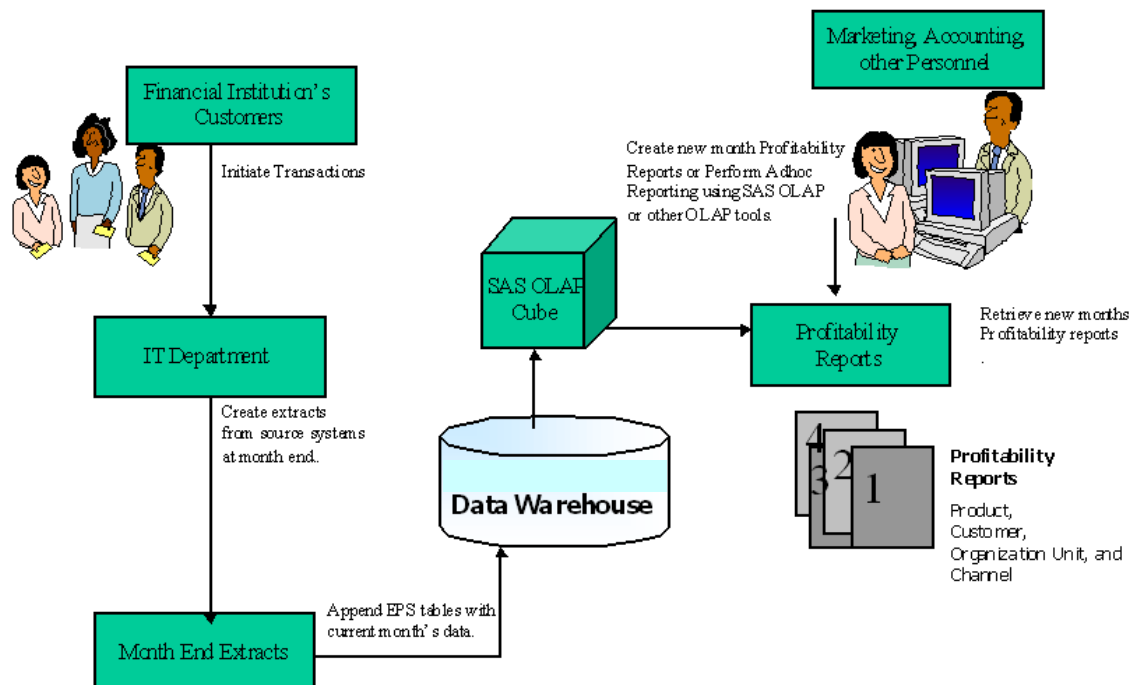


The customer profitability report gives the financial institution's executives an overview of how assets and liabilities are being accrued by age groups of customers.

## Customer Profitability

| Age Bucket | Group Type | Group Name | Number of Transactions Sum | Number of Accounts Opened Sum | Net Contributions Sum | Average Ledger Sum | Total Balance Sum | Fee Income Sum | Total Transaction Expense Sum | Percent Return Sum |
|---|---|---|---|---|---|---|---|---|---|---|
| 18-25 | Assets | Loans | 637 | 30 | $-33,172.88 | $11,784,586.84 | $12,834,239.17 | $415.06 | $0.00 | -0.26 |
| | Liabilities | Shares and Deposits | 2474 | 5 | $17,779.87 | $3,873,577.66 | $3,816,870.76 | $80.00 | $0.00 | 0.47 |
| | | Unknown | . | 0 | $-1,025.55 | $223,764.76 | $223,596.71 | . | $0.00 | -0.46 |
| 26-40 | Assets | Loans | 3706 | 92 | $-248,490.64 | $84,845,115.04 | $87,471,998.64 | $1,472.55 | $0.00 | -0.28 |
| | Liabilities | Shares and Deposits | 11781 | 9 | $113,379.85 | $24,656,086.74 | $24,687,332.64 | $541.50 | $0.00 | 0.46 |
| | | Unknown | 3 | 0 | $-22,449.54 | $4,918,289.39 | $4,881,052.45 | . | $0.00 | -0.46 |
| 41-60 | Assets | Loans | 7497 | 143 | $-424,415.31 | $152,755,337.71 | $155,166,081.68 | $1,876.90 | $0.00 | -0.27 |
| | Liabilities | Shares and Deposits | 10601 | 61 | $494,482.67 | $107,967,265.23 | $107,853,141.71 | $529.89 | $0.00 | 0.46 |
| | | Unknown | 3 | 0 | $-21,716.37 | $5,020,785.95 | $4,988,340.65 | . | $0.00 | -0.44 |
| Over 60 | Assets | Loans | 2546 | 31 | $-53,243.37 | $32,937,752.52 | $33,429,887.02 | $416.74 | $0.00 | -0.16 |
| | Liabilities | Shares and Deposits | 2660 | 66 | $847,679.27 | $185,442,144.39 | $184,775,775.15 | $109.69 | $0.00 | 0.46 |
| | | Unknown | 1 | 0 | $-2,833.55 | $630,212.29 | $628,942.14 | . | $0.00 | -0.45 |
| Under 18 | Assets | Loans | 8 | 2 | $-248.46 | $60,607.80 | $110,397.53 | . | $0.00 | -0.23 |
| | Liabilities | Shares and Deposits | 1325 | 5 | $31,537.93 | $6,883,355.12 | $6,875,139.57 | $34.00 | $0.00 | 0.46 |
| Unknown | Assets | Loans | 3 | 0 | $-104.43 | $37,239.65 | $35,883.56 | . | $0.00 | -0.29 |
| | Liabilities | Shares and Deposits | 10 | 0 | $19,250.73 | $4,222,976.73 | $4,307,779.81 | . | $0.00 | 0.45 |
| | | Unknown | . | 0 | $-20.03 | $4,370.02 | $4,370.02 | . | $0.00 | -0.46 |

The product profitability report shows the financial institution's executives a trend of how products are performing from month to month. The report is structured by grouping products into three hierarchical levels: group name, service type and product name.



The branch profitability report gives the financial institution's executives an overview of the activity that is being performed at each particular branch or organizational unit. The report is structured by grouping branches into two hierarchical levels: branch group and branch name.

SAS Enterprise Miner allows financial institutions to find hidden relationships in the data to perform segmentation, predictive modeling and lift analysis.  For example, this product has been used to determine what products should be promoted to what customer segment. Enterprise Miner identifies the customer segments and the underlying attributes that help measure profitability.  The figure below shows the Enterprise Miner process flow.
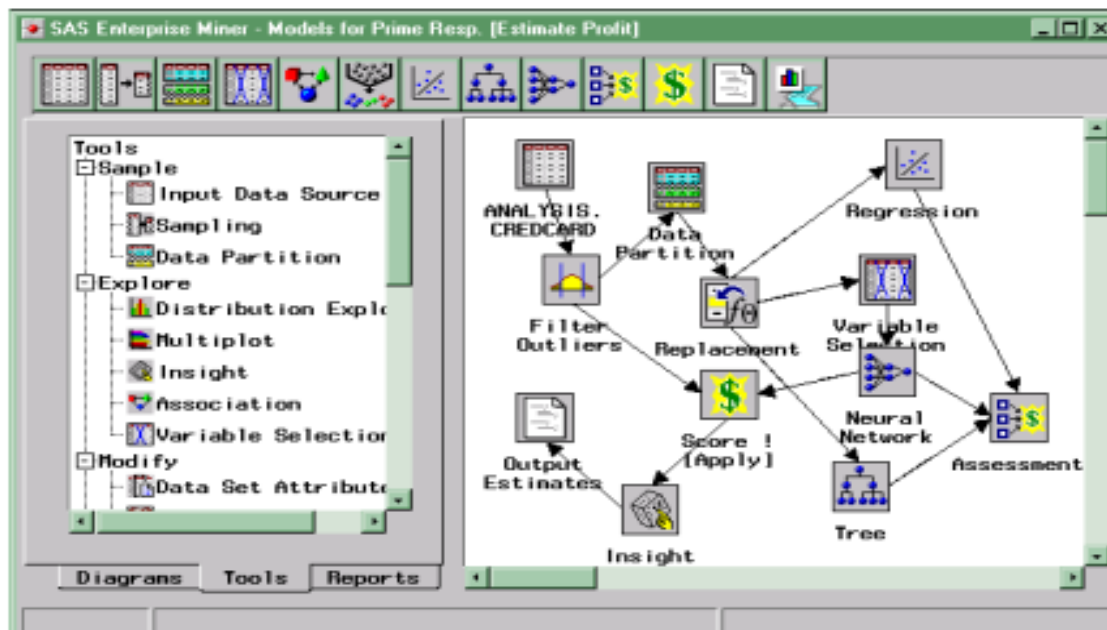
To determine profitability, the minimum average square root error criteria can be used.  The lower the error, the better the model is at predicting potential customer profitability.  Based on the criteria mentioned above, and as illustrated in the graph generated below by the assessment node, the best model to use in analyzing profitability is the neural network.
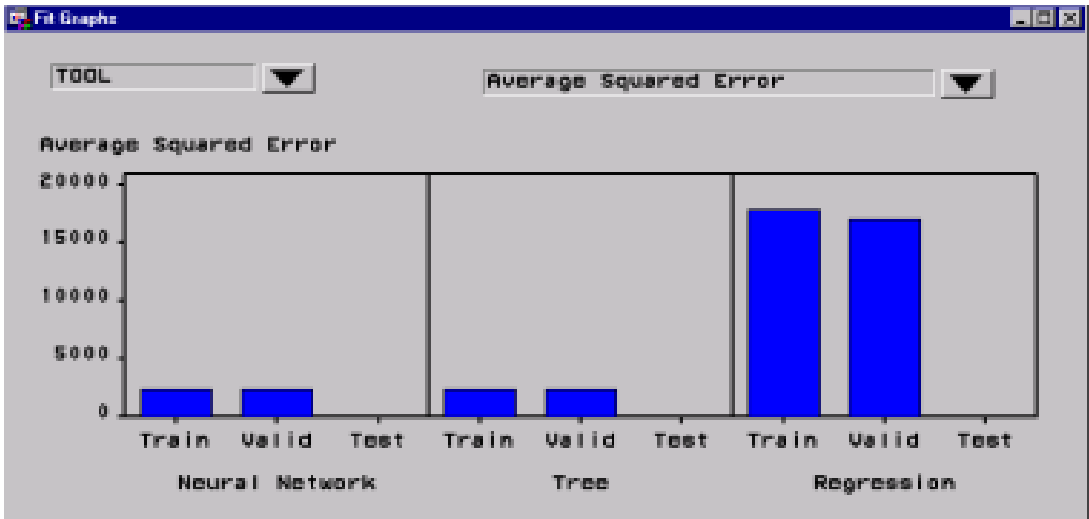


After determining the customers to target, you can then segment those customers.  According to models commonly used in the financial industry, segments can be based on thresholds of risk to profitability.  These thresholds are obtained by modeling the target customers using decision trees as shown below:
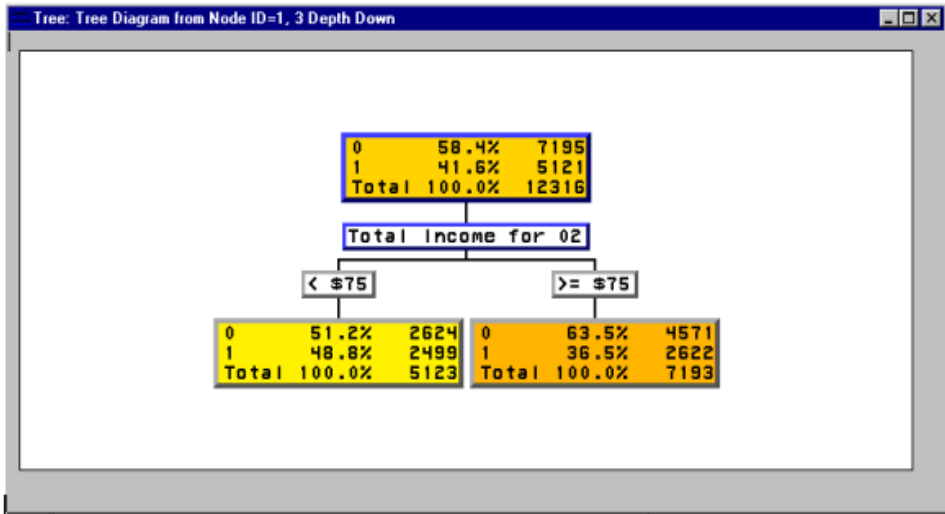


While trying to segment and determine how to increase the profitability of the credit card customers of the financial institution, it is interesting to look at potential cross-selling opportunities among the financial institution's existing customers who aren't using their credit cards.  Enterprise Miner association node can be used to determine which products are applicable and when the financial institution should target their customers for various cross-selling opportunities.  Here are the results of that endeavor: The report below is an example of this type of analysis.  In this case there is a definite relationship between having a check card and checking.  This might be obvious to the most casual observer but the relationship that might not be quite as apparent is the one that is illustrated between having a trust account and checking that also has a rather strong

correlation.  This relationship indicates that when one sets up a trust account that they are prime customers for checking as well and should also be approached about obtaining a check card and or credit card with the organization.

| | Relations | Lift | Support(%) | Confidence(%) | Rule |
|---|---|---|---|---|---|
| 1 | 2 | 1.17 | 11.30 | 100.00 | CKCRD ==> CKING |
| 2 | 2 | 1.17 | 16.47 | 100.00 | HMEQLC ==> CKING |
| 3 | 2 | 1.14 | 7.27 | 97.81 | MTG ==> CKING |
| 4 | 2 | 1.12 | 14.85 | 95.96 | CCRD ==> CKING |
| 5 | 2 | 1.11 | 4.67 | 95.64 | TRUST ==> CKING |
| 6 | 2 | 1.10 | 36.19 | 94.11 | ATM ==> CKING |
| 7 | 2 | 1.07 | 8.52 | 91.78 | AUTO ==> CKING |
| 8 | 2 | 1.04 | 15.58 | 89.31 | MMDA ==> CKING |
| 9 | 2 | 1.02 | 54.17 | 87.56 | SVG ==> CKING |
| 10 | 2 | 1.14 | 7.97 | 70.54 | CKCRD ==> SVG |
| 11 | 2 | 1.09 | 11.15 | 67.71 | HMEQLC ==> SVG |
| 12 | 2 | 1.08 | 25.69 | 66.81 | ATM ==> SVG |
| 13 | 2 | 1.07 | 6.14 | 66.17 | AUTO ==> SVG |

Finally, the results are presented in a Web-based OLAP report.

As part of the "10 letter solution for Finance" offering, financial clients are provided with an interface-feed specification document, which outlines how the "10 letter solution" expects to receive initial data from existing client online transaction processing (OLTP) source systems, as well as the refresh or updates from the source systems. If the data is in a financial industry-standard format, such as Ultra Data, Jack Henry, Siebel, Sanchez or other formats, this solution can provide extract, transform and load (ETL) "plug-ins" or software application modules.  These

can extract and prepare the source data into the format expected by the solution.  The ETL portion of the "10 letter solution" includes the required scripts that perform the following operations:

- Checks for the existence of the required IBM Banking Data Warehouse (BDW) tables and creates them accordingly
- Extracts the raw information from the flat source files
- Transforms the information and summarizes it to accommodate the SAS IBM BDW profitability report templates
- Loads data into target tables
- Refreshes data based on client requirements (replace rows, update rows or both)

The ETL refresh cycle can handle daily, weekly and monthly updates.  Once the data has been extracted, cleaned, and loaded into the IBM DB2 data warehouse, it becomes available for analysis by the SAS data mining and OLAP reporting tools.  This process is diagramatically illustrated below.
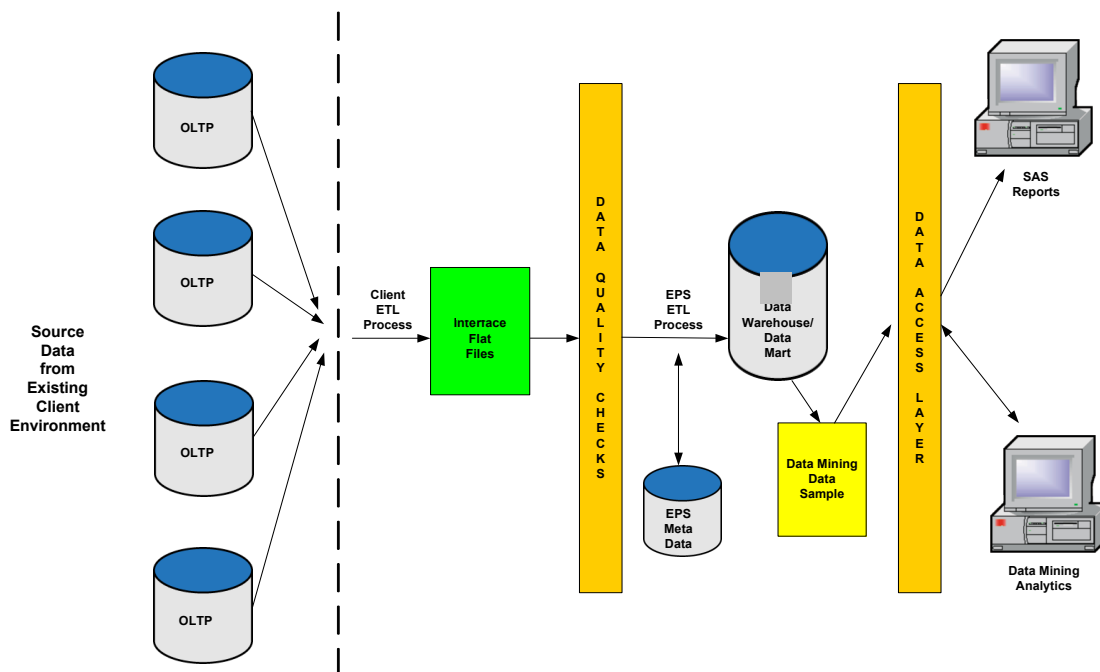


Now that customer profitability is understood, it is time to look at sales and marketing strategies that involve cross-selling to current customers and acquisition of new customers.  In order to do this, effectiveness of sales and marketing activities must be understood.

Both positive and negative aspects of marketing to customers of the institution must be considered.  Therefore, an important question to answer is how should a financial institution handle unprofitable customers?

There are basically three ways of dealing with unprofitable customers:

- Encourage the customer to maintain higher balances in their accounts to exceed the cost of serving them by motivating customers to increase their profitability, some financial institutions have provided tiered programs that feature incentives for higher balances.

> For example, these incentives may include lower fees and a greater number of 'free' ATM transactions.
> - Increase the cost of services for account balances below the profitable level.
> - Use fees to encourage them to take their banking business elsewhere.

To summarize, financial institutions have to be able to answer the following kinds of questions in much the same way as the CUTX proceeded:

- What factors such as behavior, demographics, economics, and product line characteristics determine customer profitability and trigger profit shifts in our financial institution?

- Does my organization understand the model of customer profitability in our business?
-
- What tactics will enable my organization to secure and develop the most profitable customer relationships?

- How can we change break-even /unprofitable customers to profitable ones through changes in terms and conditions, investment levels, or other dimensions of the relationship?  If we fail to do so, how can we channel existing unprofitable customers to our competitors?  With our new understanding of the model of customer profitability in our business, how can we acquire the right next set of profitable customers?

High quality, clean data housed in an organized and tuned data warehouse is the key to providing the information to answer these questions through the use of SAS, IBM, and ESRI technology.

**Effectiveness of sales and marketing activities**

Financial institutions' marketing approach to consumers can be described as determining loose segmentation followed by concentration on specific areas. For example, suppose a financial institution wants to concentrate on private financial customers. It will not define or target these using objective criteria. Rather, it will develop a strategy for dealing with high-value customers. For example, all high-valued customers will be given a special call center number and calls will be routed to specific operators for quicker more personalized service. Additionally, high net worth customers are assigned personal bankers who always handle their in-branch transactions. But there are significant exceptions of companies that demonstrate a more strategic and focused approach. For example, Midland Bank, based on market research, targeted their First Direct service to people it believed would prefer telephone banking.

These are great approaches when they are working. Problems happen when different financial institution departments and programs that interact with customers do not interact appropriately with each other. Eg. When a high net worth customer's wife whose last name is different on a personal checking account bounces a check for a car payment. The corporate partner's college age son overdrawn checking account is closed and he was registering for classes. A mortgage payment on a married daughter's condo is late because the check had a five-day hold placed on it.  The potential examples go on and on.  The high-net worth system breaks down because business rules do not work across all channels of the business especially as the business expands its offerings and geographic coverage.  Therefore it is imperative to understand relationships that are used to define a household or family in order to avoid these costly relationship mistakes.  Many of these problems can be solved by the use of the address standardization and householding algorithms that are contained within SAS's DataFlux technology in combination with the geocoding (converting an address into a latitude and longitude location on the earth's surface) algorithms available in ESRI's ArcView Business Analyst product.

These efforts not only make query and reporting efforts more successful when attempting to extract by address but also avoid some of the unfortunate sales and marketing mistakes described above.

**Sales channel effectiveness**

Research by the American Banking Association shows that the move away from branch banking as a focus for financial transactions is continuing. By 1997, 57% of US banking was carried out by a channel other than a branch compared with 5% in 1970 and 39% in 1994. Telephone and on-line service channels have driven this change in addition to improved ATM functionality.   These changes to consumer financial  habits are rippling through to business practice.  With the introduction of the first business-to-business credit and debit cards, there will be increasing pressure from companies that suffer from late payment to persuade customers to use them. Today, checks are used for 80% of business payments, but electronic and card payments are expected to dominate in ten years' time.  The higher value the transaction, the more likely it is that the vendor wants to validate payment before transferring goods or services.

With these changes, it is becoming more and more urgent for financial institutions to understand which channels the customers prefer using and how these various channels can contribute to the profit of the organization.

The CUTX has been able to very effectively understand the utilization of these channels by analyzing every transaction that has occurred over the last 2 years.  This allows them to better understand their profit by understanding the profitability of each and every customer.  This is accomplished by capturing in the IBM BDW the applied cost factors for each transaction the member makes.  Once the cost of transactions is understood, marketing can be done to effectively move customers to either a preferred channel and/or a less expensive channel to conduct business.  This has been very effective particularily with loan approval.  Using the internet, as the loan application portal and analytics supplied by IBM and SAS, CUTX can approve loans of up to $50K without human intervention in less than 3 minutes including the deposit of the loan amount into the account of the customer.  Loan delinquency rates for these loans are less than 0.3%.  The industry average is between 2% and 3%.  Also, the cost per loan approval transaction is very low.  Through the use of these IBM and SAS technologies, the internet has become the channel of choice because of its low transaction cost for the issuance of car and personal loans.

**Transaction and services costs**

Transaction and services costs can significantly impact profitability of transactions.  For example at the CUTX the cost of a transaction at a window at a branch bank ranges from $1.75 to almost $3.00 whereas the same transaction over the web may vary from a fraction of a cent to 3 cents. This has driven, as mentioned above, their move to internet banking. Over the course of a year this can make a great deal of difference in the profitability of products as well as the identification of profitable customers.  The only way to ascertain these costs is by collecting the details of every transaction, whether successfully completed or not, in the data warehouse.  This then becomes a resource that can be analyzed on a daily basis to understand the cost of doing business and how it may vary not only by channel but also by product.  This data is an invaluable means of determining marketing strategies.

**Spatial analysis to determine geographic relationships**

Below are the details of some of the spatial analysis techniques that were very important to the success of the expansion of CUTX.  These operations were done in addition to the initial engagement designed to expand their base of customers as mentioned above.

**Branch Location Analysis**

An initial use of ESRI's ArcView Business Analyst used at CUTX was to analyze the trade area of each branch bank in order to select new branch and ATM locations. Of particular importance was the need to build a new branch to relieve overcrowding at some of their existing branches. The credit union developed a geographic model that was overlaid on a profitability database of existing customers. The intent of this exercise was to avoid taking too much business away from existing branches while identifying new locations that would reduce traffic at crowded branches by about 20 percent. The result was the selection of a new branch that resulted in a reduction of 22 percent of customers from existing branches.

The credit union has since analyzed all of their other branch offices to identify: branch profitability, loan delinquency, market penetration, competitor impact, profile members demographically, and portray product profitability spatially.  This analysis has resulted in three new branches being opened. Using ArcView Business Analyst the CUTX calculated how many customers were within certain distances of a proposed location and determined the likelihood that they would alter where they bank if the new branch were built. They created trade areas around each branch to identify where the revenue for each branch was coming from. Next they calculated drive times around each branch.  This analysis identified how far customers were willing to drive to bank at a particular branch or ATM and how that distance changes by product. Analysts saw there was a dramatic drop off at a seven to eight minute drive-time surrounding each branch and ATM for checking customers. Conducting time/distance studies identified areas where new branches could be opened and how they should market different new customers products based upon geography in addition to demographics and cyclographic characteristics.  In response to the results of spatial analysis the credit union is opening approximately two new branches per year and marketing specifically to these customers products that make sense based upon factors that inlcude geographic relationships.

**Billboard Siting**

Mapping branch and ATM locations with traffic counts helped the credit union identify new billboard locations. Identifying streets with large volumes of traffic would insure that new billboard messages would attract the largest audience to promote their name and attract new members to its branches. The credit union also maintains their customer's home and work addresses hence they can map out the routes they use to drive back and forth. This information is used as an input to billboard siting and messaging. Traffic counts can be overlaid on demographic maps showing areas of high income, number of households, or other demographic data to fine tune billboard locations.

**Direct Marketing Campaigns**

One of the features of ESRI's ArcView Business Analyst is its ability to profile existing customers using the demographic data that comes packaged with the product. Once customer data is geocoded it can then be profiled so that demographic characteristics of the customers can be obtained. The demographic data is then appended to the customer file and run through the data mining software to identify segments and clusters of individuals most likely to buy other products and services. At the block group level the credit union can identify the number of customers for both cross sell and upsell opportunities as well as identify specific geographic areas for future marketing campaigns and direct mail. Scoring the customer data base with various modeling tools can also identify specific areas for target marketing by building and then deploying geographic models.

**Customer Service**

To enhance its web site customer experience, the Credit Union of Texas has added a mapping component that identifies all branch and ATM locations. A customer can type in his or her location and get driving directions to the nearest branch or ATM machine. Customer service and one-to-one marketing are major objectives of the CUTX.  Better serving its customers and building loyalty is a major goal.

**CONCLUSION**

The return on investment in the "10 letter solution for Finance" that mates the best of data warehousing from IBM, the excellence of statistical modeling and data mining from SAS, and the "state of the art" GIS analysis from ESRI can be exemplified by the graph shown below.  The use of the DB2 data warehouse and the data model for finance that make up the IBM BDW as well as consulting services from IBM, combined with SAS OLAP and data mining, plus ArcView Business Analyst and LogisticsRoute IMS from ESRI can make a dramatic difference on the bottom line. As shown below, in two years time and a total investment of about $1.45M not only was there a return on that investment to match the cost but an additional revenue realization of $1.128M.

**An example of one customer's returns on the "10 Letter Solution for Finance."**
**(all numbers in K$)**
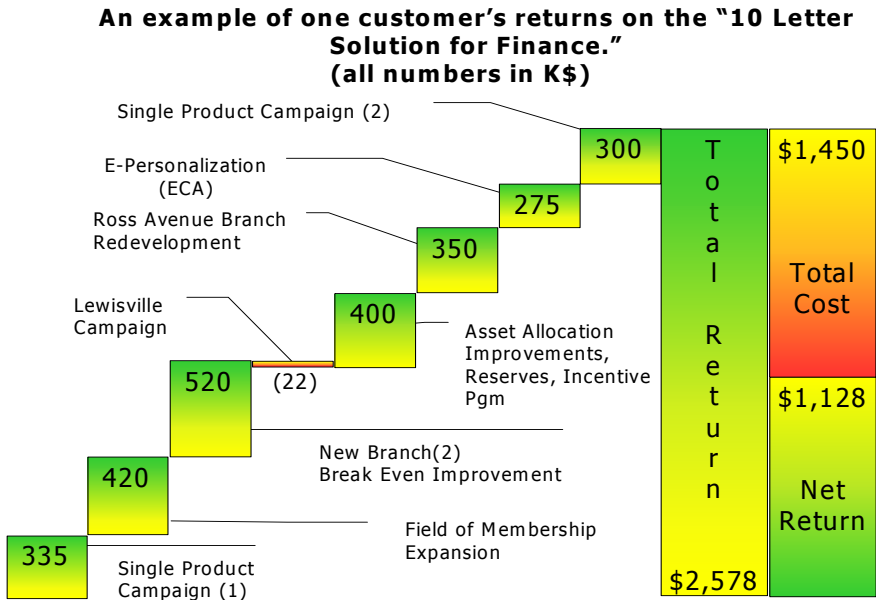


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