Chapter 20
Computer-Assisted Assessment

Using Computer-Assisted Assessment Systems

Computers have been used to assess properties for several decades. The early systems were difficult to use and required special skill, knowledge, and ability. Today's systems are much easier to use because of sophisticated hardware and improved programming.

Although there have been important new connections between narrative and graphical data, the objectives of computer-assisted assessments remain the same.

Computer-assisted assessments/appraisals allow the following to occur:

- Full inventory of property characteristics
- Current listings of sales, cost, and income
- Error-free calculations throughout the assessment process
- On-time filing of reports
- Annual full market value assessments of all jurisdictional properties

Computer Valuation System Features

Although computer-assisted assessment systems vary, most systems provide a mix of the following features:

Cost Approach

Income Approach
- Building Residual
- Land Residual
- Property Residual
- Mortgage-Equity/Ellwood
- Discounted Cash Flow

Sales Approach
- Multiple Linear Regression
- Non-linear Regression
- Constrained Regression
- Adaptive Estimation Procedure (Feedback)
- Automated Selection of Comparable Sales

Miscellaneous
- Property Record Cards
- Municipal Assessment Report
- Sales Ratio Study
- Amortization
- Storage/Retrieval
- Documentation

Automated Assessment Systems

Computers

Computer Hardware

The capability of computers to perform large numbers of calculations in a small period makes them useful assessment tools. Computers quickly perform sales comparison reports, ratio studies, and various statistical computations. Using computers can help assessors in market analysis and help improve the level of equity in municipal assessments. The three main classes of computers are mainframe computers, minicomputers, and microcomputers.

Mainframe computers are room-sized machines requiring a controlled (air conditioned, dust-free) environment, an operational staff, and a programming staff. While some assessors have access to a municipal mainframe computer, other assessors use these machines through a service bureau. A terminal in the assessor's office provides access to the mainframe. Service bureaus charge for the computer time used with off-hour use (overnight and weekend) being less expensive than peak-time use. This rate difference may impose a restriction on use of the mainframe computer during normal office hours.

Minicomputers started as special purpose machines. They were often used to perform specific tasks-such as data maintenance-for a mainframe computer. Minicomputers do not require a controlled environment and have been adapted for many uses. Minicomputers continue to become more powerful and less expensive. Minicomputers are often purchased or leased directly by a municipality with all municipal officials having access to the machine. Microcomputers-like minicomputers-are desk top machines that have become very powerful and less expensive in the last few years. Microcomputers (called personal computers) provide assessors the opportunity to use computers in their assessment work. Many personal computers are designed to be ready to operate immediately right out-of-the-box. Even the novice can, within a reasonable amount of time, take advantage of the capabilities offered by personal computers.

Personal computers consist of a Central Processing Unit (CPU), memory, input devices, and output devices. The CPU contains electronic circuitry that is the “nuts-and-bolts” of the computer. The CPU executes the arithmetic and logical operations designated in computer programs. Main memory contains programmed instructions awaiting execution by the CPU. Secondary memory includes storage devices such as disks or magnetic tape. Personal computer programs are usually distributed on floppy disks. Disks (fixed or floppy) and magnetic tapes are used to backup data from personal computers. The keyboard, mouse, and optical scanners are input devices. The user enters data and interacts with the microcomputer via input devices. Monitors, printers, and plotters are output devices. The monitor is the computer's video display device while printers and plotters produce paper output.

Computer Software

Software is a computer program that controls the computer, manipulates data, and produce output. Operational software controls the functional aspects of the computer. Application software is designed to do specific tasks. Application software designed for assessing would perform tasks such as the following operations: data maintenance, parcel valuation, sales analysis, statistical calculations, and report writing.

Dedicated application software (referred to as hard-coded or canned software) has a predetermined data format. This software performs particular procedures and produces predefined output and reports. Several canned assessment software packages are available on the market and many are fast and efficient. However, users should compare their specific needs to the software design to determine if the software meets their needs. Because the revision of canned software is an expensive undertaking, the previous software users should also be contacted regarding program execution and vendor support.

General-purpose software allows the user to define and customize the data format, prescribe mathematical routines, and layout individual report formats. Generic software is written in a general form allowing the user to adapt it to a variety of data. It is unlike dedicated programs that are designed to perform specialized functions such as listing and valuing residential, agricultural, or commercial properties. Generic software is designed for maximum adaptability and user control.

Horizontal general-purpose packages include word processors, spreadsheets, and statistical packages because their functions are applicable to many vocations. Vertical general-purpose packages include assessment packages because their functions are applicable to a specific line of work. The following material discusses several broad categories of generic software that may be useful in the assessor's office.

Spreadsheets

This software processes information in terms of rows and columns, similar to an accountant's columnar pad. A completed application using a spreadsheet is called a template. Data is entered in rows and columns and each intersection is called a "cell." Data is usually "memory resident," which means that the entire file is contained in the active computer memory during use. Processing of the data is completed as a single entity and it is very fast. Memory resident programs may be a problem if the computer is turned off, if the computer "crashes" or is "locked up" (unable to function because of a systems error) or if the computer loses its active memory. In addition, very large data sets or files require additional memory, which increases the cost of the computer equipment. The standard for random access memory on most personal computers is a minimum of 256 million bytes (256 MB) with 512 million bytes (512 MB) being preferred. The more memory the computer has the more efficiently the new generation of operating systems will function.

The data entered into a cell location may be either numeric or literal (alpha or numeric combinations). However, the real power of the computerized spreadsheet lies in the built-in functions provided for data manipulation.

A "function" is a preprogrammed process that can be performed to a specified range of numbers. Typically, a spreadsheet program will provide mathematical, statistical, data base, logical, financial, and string (alpha) manipulation functions. For example, mathematical functions let the assessor add, subtract, multiply or divide data from a cell. Information can be manipulated and placed in other locations of the template for later use. An example of this would be an assessment/sales ratio where the assessment value in one cell is divided by the sales price in a second cell and the result stored in a third cell.

A template can be used to create an assessment/sales ratio report. The assessor would enter the parcel identification number, sales price, and assessed value, along with any other desirable characteristics. The template could then be constructed to divide the assessed value by the sales price to determine the sales ratio. The statistics necessary to determine the aggregate and mean ratio and the coefficients of determination and variance could also be calculated. An assessment/sale template example is included later in this chapter.

Spreadsheets provide routines to store, retrieve, and print the data in a variety of formats. The more complicated templates provide additional features such as the ability to perform multiple sorts of the data, advanced mathematical and statistical functions, and operational routines called macros. The adaptability and usefulness of the spreadsheets also come from the ability to make quick changes to the data and analyze the results; for example, sorting the previously entered sales information by neighborhood and then recalculating a sales ratio for each neighborhood. Once data is entered, the speed of the computer and the adaptability of the software allows multiple analyses in the time required to generate only one manual report.

Database

The database, another general class of software, is a collection of related information organized and presented to serve a specific purpose. A typical database organizes information into fields, records, and files. Each record contains different fields. For example, a property record card will contain areas on it for the parcel identification number, the property owner's name, and so forth; those areas can be called "fields." Each file contains different records; for example, a property record file would contain different property record cards for a particular neighborhood.

Databases contain traditional "flat" files or the more dynamic "relational" files. The database normally uses files from a disk or storage medium and processes them sequentially, that is, one record at a time. In contrast, the spreadsheet loads all records into the primary memory and processes them as a single entity.

An advantage of a database approach is that file processing is not limited to the available computer memory. Files are limited only by the capacity of the disk drive. This can be a major consideration when working with very large data files such as property records. Another traditional strength of the database is its ability to combine selected information from a file and generate a standardized letter for selected individuals or parcels on the file using the mail merge function.

Databases provide the following functions:

- Entering, displaying, verifying or editing data
- Formatting and printing reports
- Querying and finding information based on user specified criteria

The ability to search and extract fields for individual records or groups of records has been the primary use of this software. Today's advanced database software will perform most mathematical functions contained in spreadsheet software.

The assessment roll is an example of a typical "flat" database file. The assessment roll contains selected information fields, such as neighborhood number, style, story height, and exterior wall on individual parcels (records) that is accessed and displayed by an identification number or an address sequence (key fields). The assessment roll is not physically related or linked to other files.

A relational database is more than a database that links multiple files for processing. It is a relational model that emphasizes a disciplined approach to data management based on a sophisticated set of mathematical rules and on an enforcement of accuracy and integrity of the information stored in a database. The principles were first developed by mathematician, Edgar F. Codd, and identified as data-integrity rules. The relational database efficiency is gained by its structured use of multiple files and the elimination of redundant data. Once data is defined for one file it does not have to be repeated in other files. Updating and changing data is more efficient. Queries can also be made on data in multiple files that cannot be done in the normal flat file thereby increasing the adaptability of the system for the user.

The five types of integrity are entity, referential, column, domain, and user-defined. For example, a "declarative integrity" rule can be declared to the database and it is automatically enforced globally (for the entire file). These mechanisms provide security, accuracy, and synchronization of data between the multiple files used by the system. Cascading (referential actions) is also a primary feature that allows the user to add or delete a record from one data set. The relational database automatically updates all associated tables or files in one operation.

Word Processing

Word processing software deals with the manipulation of written and graphic information. It provides the ability to enter, store, and retrieve written materials. Also, word processing allows the editing of memorandums, letters, reports, and other written materials. The significant difference between typing and word processing is the ability to edit material once entered in the system by retrieving the material, and by combining text and graphic information from other files into the material.

Word processing includes the following capabilities:

- Inserting words and phrases in the document
- Reformatting using global commands
- Moving, copying, or replacing words or blocks of text

Advanced functions that deal with the printed output (document) are also incorporated in the software: underlining, bold printing, subscripting, superscripting, compress printing, and so forth. Most word processing software also includes a spelling checker process that matches the document's words with a file dictionary. Mismatched words are identified and spelling changes can be quickly made.

More sophisticated programs can interact directly with database files and spreadsheet files. Moving a graph or table from a spreadsheet into a work-processing program can be as easy as naming the graph or table in the spreadsheet and "retrieving" it by file and range name in the word processor. More adept and sophisticated word processing software called "desk top publishing" packages provide almost unlimited formatting and graphic printing options.

Graphic Packages

This software provides visual charts, graphs and typical table reporting of data. The input can either be by the graphic package or transferred from other compatible programs. The visual display of data is an extremely useful tool in the analysis of large files or complex data because trends and variation in the data can be more easily recognized than interpreting pages of statistics and detail. Most graphics' software will create, display, refine and print simple graphic illustrations. These illustrations normally include line, bar, and pie charts, as well as XY and scatter diagrams. When working with taxpayers or local officials, presenting valuation issues and other changes can be more effective with charts and visual displays.

Computer-Aided Design (CAD)

CAD software requires large amounts of computer memory and faster central processing units because of the complexity of the graphics' functions. These programs are designed to allow the assessor to enter coordinate information (grid) for the lot or improvements and it will generate scale drawings and sketches. The capability of this software is measured by the quality of its "primitive entities." Primitive entities are basic geometric figures such as straight lines, regular polygons, parallel lines, smooth curves, multiple point curves, and wide lines. Most programs also provide routines for freeform sketching.

The usefulness of the software is the ability to add or modify the existing parcels without completely redrawing the sketch manually. Once the file is created, it may be manipulated and modified at will. These packages are complex and more difficult to learn. File building may also require an extensive amount of time if the current property records are not complete or accurate. CAD programs generally require a drawing device, such as a mouse or a graphic tablet.

Geographic Information Systems (GIS)

According to the publication, *Implementation of Land Information Systems In Local Government*, the definition of a geographic information system is a "system of hardware, software, data, people, organizations and institutional arrangements for collecting, storing, and disseminating information about areas of the earth." Besides including CAD software as explained above for drawing and mapping, the GIS focus is on "spatial analysis." This

software provides methods for creating, editing, linking, analyzing, and displaying data from maps and spatial oriented files and other text or property records.

GIS can be seen as a series of multi-layered databases and files linked to a common spatial framework. The independent layers can include soils, land cover, wetlands, flood plains, zoning areas, parcels, or governmental districts such as schools, townships, villages, cities, and so forth. Each system layer may be "owned" and maintained by a different institution, agency, or department; for example, parcel layer by the assessor, water & sewer mains by municipal utilities, or highways by the Department of Transportation (DOT). Once linked, all users could find and incorporate information from all other layers. This idea minimizes data duplication and emphasizes distributed responsibility (separate agencies/ custodians) for the distinct layers. Access to the data will be less expensive for all users and more accurate.

Every County in the State has established or designated a Land Information Office at the county level as suggested by the Wisconsin Land Information Board. Many counties are developing GIS systems, but accurate base coordinates need to be established first because all attribute files (like the property record database) will be linked to this system. The property record database is a major part of the graphic information system. The incorporation and definition of each GIS layer is very important. The assessor should be actively involved in this process to insure the assessment records and functions will have access to, and be supported by, the other GIS layers in this system.

Communications

This software class deals with the exchange of information between computers. Information exchange is especially important to the assessor in instances where data is kept on several different systems or at different locations where disks cannot be easily shared.

The most common programs in this area relate to the use of telephone modems. A modem is an electronic device that converts computer files and processes to a form that can be sent to another computer. The "modulator/demodulator" converts the digital language of the computer to a series of high and low pitched tones for transmission over standard (analog) telephone lines or cable. A communication package with appropriate modem equipment will allow the transfer of standard text files and data between computers, including computers not usually compatible. However, though "data and files" may be exchanged, the specific programs that are designed for one computer may not run on other computers.

The exchange or sharing of data within a municipality can ensure that all departments have access to the most current data and provide other users, such as the planning or engineering departments, access to valuable information. The electronic data exchange can also be important if a community is considering a change in valuation systems. Using some current files may be possible when building a new system's database.

Networks and Workgroup Software

The new network communication technology is also allowing people to share information with greater ease within and among organizations. The increased use of local area networks (LAN) and wide area networks (WAN) is causing a re-engineering of the traditional office. A local area network is a collection of personal computers (PC's) or servers and minicomputers that allow each user access to any resource on the network usually within a building or agency. A WAN is typically more expansive and includes the connection of mainframe, minicomputers and PC's including long distance use of telephone lines to reach remote or distant sites.

Workgroup or Groupware software is an evolving software class designed to function over a network and optimized to allow several people to work together on documents and files. Groupware is more than just electronic mail (E-mail) and distributing files among employees. It is a variety of programs that are specifically designed to allow individuals to work together on separate documents and files.

Workgroup software is also a specialized type of spreadsheet software that allows multiple users to update particular ranges over a network and it automatically tracks who, when, and why the changes were made.

Besides networking the assessment/appraisal staff, an assessment office may be networked with the treasurer, clerk, engineering and planning department. All could get to, and work with, the data from the others' files if given clearance to do so.

Increasingly, communication technology is moving towards wireless information distribution networks by linking with cellular telephones, notebook computers, and other hand-held devices. Staff members may call up and use the central assessment files while in the field doing viewings and listings. They could update new construction records, modify sketches, value parcels, select comparables, review values, and print property record cards from outside their office and have the output waiting for them when they return to their office.

Elements of an Automated Assessment System

From a process stand point, computer assessment systems typically contain specific functions or processes: data management, sales analysis, valuation, and administration. Users must match their specific needs with available software and hardware to decide if it will meet their needs at a reasonable cost.

Data Management

Data collection and maintenance are the most important elements for a successful automated assessment system. The first step in data collection is to not mass-load parcel information into the computer. The old computer axiom of "garbage in, garbage out" is very applicable in an automated assessment system. Whatever "bells and whistles" are included in the assessment software become ineffective if the database is incomplete or inaccurate.

Data collection should begin with an analysis of a cross section of properties. The assessor should consider the following questions:

- What data is needed to predict parcel value?
- What data is necessary to satisfy statutory requirements?
- What information is useful to apprise property owners of the completeness or accuracy of the data file?

All components of the assessment software are tested with this representative sample of properties. Actual data collection and computer entry can then occur with a high degree of confidence that the information was properly formatted.

Data management, whether in an automated or manual environment, involves certain elements:

- All parcels need to be accounted for in the mapping system and data file.
- All maps need to be current and maintained.
- All property record cards (PRC) need to be current and maintained.
- All PRC accessibility needs to be controlled.

Many automated computer assessment systems verify data upon entry. The data's validity is checked before being added to the file. Data failing hard edit checks (edit checks written into the program itself) are rejected. Checking parcel identification numbers for valid characters is a typical "hard edit" (that is, edits that include all alpha characters, alpha and numeric characters with or without a required format). Data failing "soft edit" checks are not rejected, but the field is marked and possibly a warning is displayed regarding possible data error. Other edits may be "range checks" (above or below a lower or upper limit). For example, an entry of a year that a structure was built before an established period flags that record for review. Edits can also involve "cross checks" between fields; for example, if coded colonial, the structure must have a second story.

Canned software allows little user involvement in establishing edit limits. In pre-written programs data checks are usually defined along with the file format. Some assessment programs allow the user to establish limits in tables referenced by the data entry routine. User input, when setting edit limits, is an important consideration in evaluating a dedicated application or canned program. Sufficient edits should be available to insure the accuracy and integrity of the data.

Stratification is an important aspect of data maintenance. An automated assessment system simplifies working with subsets of records in data maintenance and analytical routines. An automated system allows the user to designate or manipulate the desired records.

Examples of data subsets the assessor might work with are the following:

- A list of colonial style properties within a designated neighborhood.
- Land values on all corner lots that need to be adjusted.
- The last two year's vacant land sales that need to be analyzed.

Many systems allow the importing and exporting of data to other software like spreadsheets or statistical packages where additional analysis can be performed. This feature is important since it allows the user to migrate to other programs as other generic programs become more powerful and easier to use. It is also very important to be able to retrieve or move data from an existing system to a new system depending on the user's choice to update or change the specific software being used.

Sales Analysis

Assessment software uses the computer's number crunching capabilities to help the assessor in statistical analysis, ratio studies, and comparable sales reports. The goal for using statistical techniques is to value property. We can use statistics to summarize, confirm, discover, inform, test, and explain value. Most statistics can be broken into two categories: descriptive statistics and inferential statistics.

Descriptive statistics describe, measure and display numeric information about a sample or population. Its purpose is to reduce the collection of data to a simpler form without distorting or losing much of the available information. Descriptive statistics includes graphics such as histograms, scatter plots, numeric raw data lists, tables, and summarized averages and percentages. Descriptive statistics focus on measures of central tendency (mean, median and mode) and measures of dispersion (range, variance, standard deviation, coefficient of variance, and coefficient of dispersion).

Inferential statistics are mathematical processes used to estimate or predict information about a population based on a sample taken from that population. Typical estimates can be "point" estimates or "interval" estimates. A multiple regression analysis is an example of inferential statistics. It uses samples of parcels that have sold to predict the value of parcels that have not sold based on the characteristics of the parcels.

Ratio analysis compares the assessed value to the market value of parcels that have sold. According the *Uniform Standards of Professional Appraisal Practice*, the definition of market value is the most probable price which a property should bring in a competitive and open market under all conditions requisite to a fair sale, the buyer and seller each acting prudently and knowledgeably, and assuming the price is not affected by undue stimulus. Implicit in this definition is the consummation of a sale as of a specified date and the passing of title from seller to buyer under conditions whereby:

1. Buyer and seller are typically motivated;
2. Both parties are well informed or well advised, and acting in what they consider their own best interests;
3. A reasonable time is allowed for exposure in the open market;
4. Payment is made in terms of cash in U.S. dollars or in terms of financial arrangements comparable thereto; and
5. The price represents the normal consideration for the property sold unaffected by special or creative financing or sales concessions granted by anyone associated with the sale.

Chapter 21 of the *Wisconsin Property Assessment Manual* (WPAM) contains a section that addresses arm's-length sales. Assessors should review this section when they have questions about whether a sale is arm's-length or not.

For mass appraisal purposes, the sale price is the market value. The sale price may be adjusted for time of sale, financing, personal property or other considerations.

Ratio studies measure assessment performance in terms of level (central tendency) and uniformity (dispersion). Computer based analysis can compare the uniformity within similar groups (within a neighborhood, but based on value). Also, computer based analysis can compare the uniformity between property groups (neighborhoods, size, age, and so forth). These measures of horizontal inequities and vertical inequities can be seen in statistics such as the price-related differential (PRD). The price-related differential shows vertical inequities.

The following table shows an assessment/sales ratio report generated on a personal computer using a generic spreadsheet program. It is created as a "template" which can be used repeatedly simply by inputting various sales groups. Stratification is the sorting of parcels into homogeneous groups based on location or other characteristics. This process can be effectively used in the annual market equalization process discussed in WPAM Chapter 14. The sales ratio study can also be used to establish reappraisal priorities, to help in planning and budgeting, and to adjust cost tables to market value.

Assessment/Sales Ratio Worksheet
Sample Community (2002) Sales

Price related differential = 0.9945	14.20 Standard Deviation - biased
Aggregate ratio = 0.6772	14.03 Coefficient of dispersion
Mean Ratio = 0.6735	21.08 Coefficient of variation -- biased
Median = 0.7050	22.11 Coefficient of variation: n-1 unbiased method
Coefficient of concentration = 72.73%	

No	Parcel ID	Assessed Value	Sales Price	A/S Ratio	Ab Val A/S Median	Sq of A/S Mean
		$395,987	$584,700	7.4089	1.0881	0.2217
1	600208	13,173	33,000	0.3992	0.3059	0.0753
2	639013	19,473	46,500	0.4188	0.2863	0.0649
3	600207	67,993	106,000	0.6414	0.0636	0.0010
4	605186	62,153	95,000	0.6542	0.0508	0.0004
5	615546	18,537	26,700	0.6943	0.0108	0.0004
6	608299	31,727	45,000	0.7050	0.0000	0.0010
7	613057	27,002	38,000	0.7106	0.0055	0.0014
8	613058	29,069	40,000	0.7267	0.0217	0.0028
9	630050	29,225	38,000	0.7691	0.0640	0.0091
10	605187	51,136	65,000	0.7867	0.0817	0.0128
11	613059	46,499	51,500	0.9029	0.1978	0.0526

Comparable Sales Reports are used to estimate and support parcel valuation in the mass appraisal environment. The computer allows the easy selection and adjustment of sale parcels. The Courts have said that the sale of a parcel is the best evidence of its market value. However, if a particular parcel (subject parcel) has not sold, then the sale of a comparable property is also considered good evidence of value for that subject parcel. Comparable properties are selected based on the similarity to the subject property and then adjusted for differences.

Valuation (Model Building)

A valuation model is a mathematical representation or simulation of economic forces in the real estate market. Models can be very basic or complex and are used in the problem-solving process.

In research there are typically seven steps in the problem- solving process:

1. Defining the problem
2. Collecting data
3. Analyzing the data
4. Building a model by setting specifications
5. Testing and validating
6. Calibrating and refining the model
7. Applying the model

In the assessment environment, the difficulty is to assess all parcels at full market value in a fair and equitable manner from the best information available using professionally accepted appraisal practices.

The traditional models we use are the cost, sales, and income approaches to value. A good model structure for the assessor is developed from the following:

- **Understand how the market works**
  (Psychology of buyers and sellers, social trends and attitudes)

- **Know fundamental economics**
  (Competition, supply and demand, surplus/marginal utility)

- **Know valuation principles**
  (Consistent use, substitution, contribution, progressive, regressive, and so forth)

A good model's result is accurate, rational, decomposable, and explainable. A rational model is one that is sensible, is useful over time, and is used for a variety of properties. A decomposable model is one built on analytical methods; each component can be broken down and verified through analysis and observations; it can be updated and has repeatable characteristics.

Computers now allow users to test, refine and calibrate our traditional models as well as develop custom models from available sales data. Computers provide a great opportunity to localize general models. However, this opportunity is offset by the requirement that users fully understand the relationships within the model before making changes.

Cost Approach

In mass appraisal a cost approach can provide stable and consistent values. The cost approach works best on newer buildings and can be applied to all property types. A cost manual, such as *Wisconsin Property Assessment Manual Volume II*, represents a cost model in a look-up table format. Most cost manuals are based on actual construction costs and are easy to update and use. Most manuals contain a standardized depreciation table and mechanisms to adjust for physical, functional, and economic obsolescence. All cost manuals must be adjusted to the local market. This can be done by comparing the cost tables to local new construction or by adjusting for local labor and material costs in the base model itself. Most manuals provide a time and location modifier.

Cost trend factors may work for several years, but cost manuals should be periodically updated item by item. New construction techniques and new materials need to be included. In addition, adjustments need to be made for labor and material costs that change at different rates. A good computer assessment system should provide a mechanism for updating the basic cost model and calibrating it to the local market.

Sales Comparison Approach

The sales comparison model determines market value by comparing the subject parcel to recent sold parcels based on similar characteristics of the parcels. The sold parcels are then adjusted for the differences between the subject parcel and the sale parcel. The adjusted sales price is then used to estimate the market value of the subject parcel. The sales comparison method is influenced by the type of data available, the comparable selection method used, and the individual adjustment mechanisms used.

In a manual system this process can be as simple as printing and reviewing a list of sold properties with significant characteristics for a specified neighbor-hood. In a computer environment the process uses sophisticated mathematical functions. The two most popular similarity functions are the “Euclidean distance” metric and the “Minkowski” metric. These functions measure the difference between the subject parcel and sale parcel for selected characteristics and applies a user-specified weight to determine a numeric similarity measure.

Three to five parcels that are the most similar to the subject parcel are then adjusted and used to set the subject parcel’s market value.

Property characteristics typically used for similarity selection are age, square feet, grade, condition, neighborhood, and so forth. Selecting the units for comparison and the attributes to be adjusted is called model specification. Selecting the weights for adjustment is model

calibration. Changing the adjustment weights changes the relative importance assigned to that characteristic. The selection routine is an iterative process where each sale is compared to the subject parcel until the parcels with the highest similarity are selected.

The power of an automated comparable selection process is the speed with which the computer can select, adjust and display the selected comparables. In addition, the computer allows the assessor to quickly modify the selection criteria, the adjustment characteristics, and the characteristic weights to fit a particular parcel. To effectively perform comparable selections a computer-assisted mass appraisal (CAMA) system must provide a method to store and use sales information. At the very least, the sale and its characteristics must be saved at the time of sale. Mechanisms to time adjust these sales should also be provided in order to use multiple year sales when analyzing.

Income Approach

The income approach provides for the analysis of income and expense data and the calculation of rates of return and income multipliers. This approach is based on the idea that the value of a property is directly related to the income it produces. It uses the ideas of the present value of future income to establish an estimate of value. The model uses the capitalization process where Value equals Income divided by Rate of return (V=I/R).

The determination of net operating income to be used in the capitalization process requires several steps; some of them could be the following:

- Estimating potential gross rents
- Estimating collection loss and vacancies
- Adding miscellaneous income

From this effective gross income deduct operating expenses to arrive at the net operating income. The capitalization rate is composed of three different rates:

1. Discount rate (return <u>on</u> investment)
2. Recapture rate (return <u>of</u> investment)
3. Effective tax rate (expressed as a percentage of market value)

Using a computer is only natural given the number of variables in the income approach procedure. A generic spreadsheet program can be used to set a model and each variable can be manipulated to determine the potential property value. Hand calculations would be very time consuming compared to the quick and accurate computer calculations.

Administration Report Generation

Computerized reports can be used to summarize and inform taxpayers, Boards of Review, and public officials of the status and equity of assessments in a jurisdiction. Simple listing of properties within neighborhoods with selected characteristics can be persuasive in educating the public about value changes within their area. This flexible sorting and selection of properties, which is not available in a manual records system, is a major advantage of a computerized database. Access to formatting and printing alternatives also improves the quality and usefulness of typical assessment reports.

The computer also allows access to names, addresses, and parcel information that can be combined with standard documents for taxpayer notification, verification of property characteristics, and so forth. The mail capability combined with the database selection and sorting make administrative functions much easier.

Property assessment change notices and tax bills can be prepared on most computers with access to current name, address and property record files using standard mail merge techniques. However, typically the tax roll and payment collection is handled in the clerk's office or at the county level on forms prescribed by the Department of Revenue (DOR).

Selection of a CAMA System

A municipality has two options when it decides to set up a computer-assisted mass appraisal system (CAMA): Buy a system or develop its own. Both processes are time consuming and difficult. Both processes may or may not also involve the purchase of computers, peripheral equipment, furniture, and the completion of a field review of all properties. The field review and valuation change may also involve statutory compliance dates and deadlines; therefore, careful planning is mandatory.

We recommend that any municipality considering the acquisition of an assessment computer system should review the published standards in the field. The International Association of Assessing Officers (IAAO) has many standards that provide useful information and guidance. *The Standard on Facilities, Computers, Equipment and Supplies*, January 1989, and the *Standard on Mass Appraisal of Real Property*, March 1984, will be particularly useful. (Note the current address in the bibliography). Whether the municipality develops a CAMA system or purchases a CAMA system, both processes should start with a detailed needs analysis. During this planning stage focus should be on the conceptual framework of the system and the detailed requirement analysis. If the assessor's office does not have the time or the specific skills needed to complete this detailed planning, then hiring a consultant with expertise in the field should be considered.

Needs Analysis

The problem definition and needs analysis is very important. This stage defines the system limits including the goals and ideas that will be used to judge whether any system satisfies the communities' needs. All projected and wished for information needs should be included in the analysis. In addition, provisions must be made for expansion and enhancement. As Yogi Berra is reported to have said, "If you don't know where you're going, you will wind up somewhere else."

The needs analysis includes four major steps:

1. Reviewing the existing documentation
2. Observing the existing operation environment
3. Creating a need questionnaire
4. Interviewing the organization's key people

The needs assessment should start with a detailed review of the current process. It should identify the sequence of tasks currently performed and any existing data processing capabilities. The strength and weaknesses of any current process should be noted as well as any changes that staff may wish to make. Turning the attention to the current system may result in redesigning the process to meet important needs.

Data flow charts and structural analysis are useful tools in a requirement analysis. The analyst should be aware of the system's logical design where similar functions should be grouped. Identifying detailed data must also be accomplished. Data should also be organized to minimize redundancy. The volume of data and reports generated will have an impact on the speed with which a system functions. A "data dictionary" should be compiled. The dictionary should contain all forms, reports, tables, and definitions of all fields and data used in the current system.

A questionnaire or an individual interview process may be necessary to understand the assessment data uses of people other than assessment staff. Data needed by the assessment office that originates in another department should be noted; for example, building permits, planning and zoning changes, utility data, and engineering data. Access and coordination of data is becoming much more important especially if a local area network is being considered. This process also allows you to evaluate the potential training and support needs of the current staff. Support and training offered by a vendor may be a major consideration when purchasing a system.

A preliminary review of available software and hardware should be made once the analyst has defined the current needs and future desires from a system's standpoint. This will eliminate impractical alternatives. It will also provide insight into whether a system should be purchased or developed in-house. This study phase may also include a cost/benefit analysis of alternatives. The current system costs should be reviewed and estimates should be made of the potential system enhancements. This information can be used as the benchmark for comparing alternatives. The cost estimates should include all current costs, proposed costs, and identified benefits of the new system.

Alternatives (Purchase or Develop)

The planning stage should also consider alternatives to the setting up of the system. Should the full system be changed at once or is a phased implementation possible or desirable? Consideration of any statutory deadlines (sec. 70.05, Wis. Stats.) related to maintaining values is also an important factor. Attention could be focused to doing the residential, commercial, and personal property areas in different sequences depending on the needs of the municipality.

Purchasing an available commercial system typically allows for quick implementation because the system is already developed, tested, and reliable. It also allows the municipality to investigate current installations and ask about performance and reliability. Although the initial cost may be significant, it will be identified when the proposal is received and annual maintenance, updates, and system enhancements can be determined. When developing a computer system, the exact cost may be unknown because of the difficulty estimating the duration of the programming and development phases.

If the system being purchased is a new untested program, a pilot project should be considered. Using test data helps insure the software operates properly. Alternatives and options within the system should be explored. Deficiencies should be noted and comparisons to the current process and other systems can be made. Running parallel systems is time consuming and may more than double the work of staff employees.

A community may wish to develop its own system if it has unique needs that cannot be satisfied by using existing software. The development of a complete system using programming languages requires extensive data processing that drains staff resources. Developing a complete system should not be undertaken without a long-term commitment and an understanding that the assessment data files are moderately large and complicated. Some essential things to know are assessment data requirements, valuation methods, and report requirements. Many municipal data processing departments, because of their heavy workload, do not have the time or expertise to complete a major CAMA system.

An alternative to "writing" a new system is to adapt generic software to fit office needs. Modern database programs, sophisticated spreadsheets, and statistical software can perform many of the functions needed in an assessment office. These software packages are becoming easier to use and easier for developing customized applications. The generic applications development phase requires a knowledgeable staff with sufficient time to spend on the project. Just as the data processing staff workers must possess an extensive programming language background to run a complete CAMA system, so must the assessment office personnel possess an extensive background in the chosen software (with accompanying data) to run a generic software package. Understanding the complexity of designing a system for multiple users on a computer network is also important.

Developing a generic system offers the municipality the potential to program exactly what features are necessary and the flexibility to easily modify the features in the future. Many generic software packages are reasonably priced and regularly updated. Typically, the more sophisticated and capable the software, the longer the learning curve necessary to become proficient at operating the software. Computer program documentation is generally written well and usually contains examples for training purposes that can be modified. Although detailed support rests with the development staff, "user groups" may also be available to provide general support and assistance. Documentation of the local process also rests with the development staff.

Requests for Proposals (RFP)

Requests for proposals need to be developed after the systems and hardware needs analyses are completed. Each RFP must be customized to the individual needs of the community. The purpose of the RFP is to solicit proposals for system components that meet the design and needs requirement of the assessment office. The RFP should provide the vendors with all of the information necessary to evaluate user's needs and what is required. The IAAO, *Standard on Contracting for Assessment Services*, September 1986, may be useful for vendors. (Note the current address in the bibliography).

The RFP should provide the vendor with suitable information to respond to the request. The reasons for considering a new system should be identified. Present methods and systems should be fully explained. These systems should provide sufficient detailed reports and the extensive data volume necessary to allow the vendor to make adequate estimates of the resources required. (The needs analysis and data dictionary may be useful as supplemental material). Any constraints or mandatory requirements should be identified and clearly marked in the RFP. Specific contact staff should be identified and these individuals should have adequate detailed knowledge of the system to answer questions.

The RFP vendor response format should request sufficient detailed information about the vendor along with their solution to the problem. This format will allow the different vendors to be compared. The vendor's organizational structure and staff experience should be fully described in the RFP. Any hardware equipment features needed to implement their solution should be described. Performance standards for any computer and needed peripheral equipment should be clearly identified. Any computer language requirements or utility programs required to run the solution software should be identified and be available to the municipality. Costs of any equipment or software needed should be included for the municipalities' review.

A RFP section should be provided for the discussion of the vendors' specific software solution. Any special functions for data base management, parcel sketching, parcel or land valuation methods, management information and report features, or programming aids should be detailed. Systems security and backup procedures should be noted and evaluated. The delivery dates of product or software modules should be specified.

If possible, a test data file should be used to evaluate all vendors' proposals. These tests should be compared with the current system as a benchmark. Valuation capabilities and ease of use should be evaluated. Any requirements for the new system to interact with existing programs or equipment should be fully explored.

The RFP should identify any vendor support requirements. Response times for the correction of system errors and warranties on the system and equipment should be clearly stated. Staff training on the system and its software should be provided. Provisions should be made for additional training and support if necessary. Any annual training and its costs should be evaluated.

The vendors' proposals should first be evaluated on their technical merits. Cost should be a lessor issue. If a system doesn't meet the municipalities' needs, then the fact the system is affordable is not relevant. The municipality may wish to hire a local consultant to evaluate the vendors' proposals if internal staff skills are limited. All vendor references should be checked to verify the vendors' reputation and service support history.

Summary

As computer hardware and software becomes more capable, affordable, and easier to use, the typical assessment office will benefit from the technology. As a rule of thumb, computer capacities will double every eighteen months. With this emerging capability, assessment offices need to be adaptable. When considering any computer system, the resourceful assessment office will plan for change and growth.

The computer system must also have analytical and statistical power. It should have the ability to perform regression analysis, non-linear regression, constrained regression, adaptive estimation, and other advanced forms of analysis. These methods should be available with the computer system whether they are used for all parcels or not. The advanced analytical and valuation methods should be available for unique properties or problem analyses. The computer system should be easy to use regardless of the training, research, or production process currently being used by the municipality. The computer system should have the ability and capacity to allow growth into the more advanced valuation methods. The system should remain independent of specific hardware requirements and be able to be used on new and updated equipment.

Whether purchasing or developing a computer-assisted assessment system, the assessment office has to learn to incorporate this new technology. Care must be taken with the selection and implementation of any system; therefore, by adapting and planning for the certain changes in computer technology, the successful assessment office will know where they're going and will wind up where they want to be: not somewhere else.

Bibliography

1. Joseph K. Eckert, "Generic Model Building the Emergence of a New Appraisal Specialty", *Assessment Digest* (May/June 1989): page 9-11.

2. Jonathan Mark & Michael A. Golberg, "Multiple Regression Analysis and Mass Assessment: A Review of the Issues", *Appraisal Journal* (January 1988): page 89-109.

3. Stephen J. Venura, *Implementation of Land Information Systems in Local Government - Steps Toward Land Records Modernization in Wisconsin*, Wis. State Cartographer's Office, April 1991.

4. *Improving Real Property Assessment*, Chicago, International Association of Assessing Officers, 1978.

5. *Standard on the Application of the Three Approaches to Value in Mass Appraisal*, International Association of Assessing Officers, August 1989, 130 East Randolph Street, Suite 850, Chicago, IL 60601.

6. Norman Draper and Harry Smith, *Applied Regression Analysis, 2nd Edition*, 1981, John Wiley & Sons, Inc.

7. Alan Agresti and Barbara Finlay Agresti, *Statistical Methods for the Social Sciences*, 1979, Dellen Publishing Company.

8. Michael J. Miller, "The Changing Office", *PC Magazine*, (June 14, 1994): page 112-145.

9. *Standard on Contracting for Assessment Services*, International Association of Assessing Officers, August 1989, 130 East Randolph Street, Suite 850, Chicago, IL 60601.

10. *Standard on Facilities, Computer, Equipment, and Supplies*, International Association of Assessing Officers, August 1989, 130 East Randolph Street, Suite 850, Chicago, IL 60601.

11. Nancy Von Meyer, *Database Design Primer: An introduction to Database Concepts*, May 1990, Fairview Industries, 8616 Fairway Place, Middleton, WI 53562.