

# The Scientific Method and the Appraisal Process

---

The originators of the appraisal process proposed that use of the three approaches to value would minimize the variability of value estimates. The multimethod/multitrait approach described in this article emphasizes the importance of using independent data and analytic processes to improve the reliability and validity of statistical processes. If appraisers used the scientific method to apply independent data to the three approaches to value, the reliability and validity of value estimates would be improved.

---

Most appraisers would agree that the valuation profession would be advanced and its stature enhanced if appraisers were to strive for a higher degree of reliance on the scientific method, thus increasing the precision of value estimates.

According to Fred N. Kerlinger in *Foundations of Behavioral Research*, the scientific method is one of four ways of acquiring knowledge. These are 1) the method of tenacity, or beliefs that are held strongly because they have always been held strongly; 2) the method of authority, which signifies the tendency to believe in tenets established by outside sources such as the Bible; 3) the method of intuition, or knowledge that is self-evident or agrees with reason; and 4)

the scientific method, which has the following unique attributes.<sup>1</sup>

- *Self-correction*—The testing of alternative hypotheses. In appraisal, for example, various land-use options are analyzed quantitatively to determine highest and best use.
- *Skepticism*—The statements are tested. For example, the appraisal process is one of careful, thoughtful research; analysis; and conclusions.
- *Critical inquiry*—The educational program and the establishment of appraisal standards within the Appraisal Institute are good examples.
- *Objectivity*—The analytical process is anchored in reality,

---

1. Fred N. Kerlinger, *Foundations of Behavioral Research*, 3d ed. (New York: Holt, Rinehart, and Winston, 1986), 6.

**Bill Mundy, MAI, PhD**, is president and senior analyst at Mundy & Associates in Seattle, Washington. He received a BS in agriculture, an MA in urban economics, and a PhD in market research and urban economics, and has previously published in *The Appraisal Journal*.

*The validity of data is based on the meaning of the variables; that is, do the measurement techniques being used measure what they are intended to measure?*

unaffected by any analyst's personal beliefs, perceptions, biases, values, attitudes, or emotions. This characteristic is addressed in the Appraisal Institute's code of ethics and is also incorporated into the appraisal process.

Kerlinger defines scientific research as "the systematic, controlled, empirical, and critical investigation of natural phenomena guided by theory and hypotheses about the presumed relations among such phenomena."<sup>2</sup>

At certain periods the valuation profession has advanced toward closer adherence to the scientific method. For example, in the late 1960s and early 1970s computers made the use of large data sets and statistical methods such as multiple regression feasible within the appraisal process. In addition, there is evidence that appraisers are now further embracing scientific approaches and methods. For example, the National Association of Real Estate Investment Fiduciaries (NACRIF) currently applies statistical processes to the analysis of databases in their portfolio analyses. TRW, Inc., is developing a nationwide data bank and value-estimating capability for residential transactions. The Homer Hoyt Institute is testing the reliability and validity of independent approaches to the estimation of the demand for office space. Each of these is making use of the scientific method to derive reliable results.

Because appraisers must also account for human behavior, however, measurement techniques are prone to error. Reliability questions arise as a result of the difficulty of measuring human behavior in a dependable manner. Reliability can be evaluated based

on two characteristics: 1) the ability to obtain a consistent, predictable result repeatedly using either the same or different measurement techniques; and 2) the ability to obtain an accurate result with the measurement techniques or instruments used. Reliability is concerned with obtaining results from measurement instruments that are stable or predictable as well as accurate.

The validity of data is based on the meaning of the variables; that is, do the measurement techniques being used measure what they are intended to measure? As measures become more indirect, validity tends to decrease. For example, it is possible to feel confident that the value of a U.S. Treasury note for \$1 million is \$1 million. However, what degree of confidence can we have that a \$1 million value estimate of an apartment building is accurate? Further, does a method such as the income capitalization approach using an overall rate measure value based strictly on a property's income-producing ability? A key point is that while a measuring instrument may measure something quite well, it may not measure what the appraiser intended it to measure. Therefore, when validity is questioned the meaning of the measure is questioned. The measurement process itself and why variance may result are the issues that must be addressed when validity is a concern.

To be valid, a measurement process should have discriminant and convergent validity. Kerlinger notes that discriminant validity means "that one can empirically differentiate a variable from other variables that may be similar, and that one can point out what is unrelated to the variable. Convergence means that evidence from different sources

2. Ibid., 10.

gathered in different ways all indicate the same or similar meaning.”<sup>3</sup> In appraisal, discriminant validity can be illustrated by the discrete nature of the three approaches to value. The use of data from the income approach in the market approach, for example, would violate discriminant validity. Convergence can be shown by the assumption that data gathered by appraiser 1 in city X using method alpha has the same meaning to appraiser 2 in city Y using method beta.

The use of the scientific method in the practice of appraisal has a number of advantages. One such advantage is the use of statistical tests to determine the reliability of data; that is, the amount of confidence that can be placed in certain sets of information. For example, an appraiser may want to determine what an appropriate discount rate would be for an apartment project.<sup>4</sup> The appraiser could randomly select a subset of a particular investor type (e.g., investors buying apartments that range in price between X and Y in a specific geographical area) and ask them to provide the discount rate they use to analyze prospective apartment acquisitions. If a prescribed number of people are surveyed and the mean response is 15% with a standard deviation of 1.96, it is possible to be 95% confident that the true mean will fall within the range of 10% to 20%—or that by using 15%, the result will be approximately plus or minus 5% of the true mean 19 times out of

20. The scientific method thus also allows appraisers to determine what the probability of error is.

When an analyst uses the scientific method the credibility of his or her work product increases. Conversely, the likelihood of human error decreases. As professional appraisers and their clients become better educated, they will have a greater appreciation for data generated with scientific approaches rather than with ad hoc approaches. Further, a result developed using the scientific method is easier to defend, which should be helpful to appraisers who appear as expert witnesses.

### **THE MULTIMETHOD/ MULTITRAIT APPROACH**

The multimethod/multitrait approach is an important scientific technique for analyzing data. It is based on the premise that independent analyses of discrete sets of data will yield results that tend to validate one another. When multiple approaches are used with discrete sets of data the reliability of the result should improve. This technique should be relevant to the valuation profession because three separate approaches are used in valuing property.

### **HISTORY OF THE THREE APPROACHES**

Did the originators of the appraisal process intend that three independent approaches be used in the estimation of value? Research sug-

3. *Ibid.*, 421.

4. This particular example is used for several reasons. First, it puts forth the proposition that appraisers can obtain extremely important data, such as a capitalization or discount rate, objectively, thereby providing a statistically defensible basis for key assumptions. Second, it shows how prone to error we can be when appraising (e.g., a small change in the rate can have a major impact on value), which argues for using multiple independent approaches. And third, it demonstrates that the appraiser can obtain and use independent data in the various approaches. For example, obtaining an overall rate from investors directly rather than indirectly (*NOI/sale price*) which intermingles the income and market approaches.

gests that while early appraisal educators did not explicitly propose the use of three independent methods to achieve greater reliability and validity, they did recognize the advantages of using three approaches.

Harry Grant Atkinson points out in "Recollections of the Founding of AIREA," that in January 1928 "Appraisal was officially recognized as a significant branch of specialization as the National Association of Real Estate Boards (NAREB) authorized the creation of a separate appraisal division."<sup>5</sup> Before that time appraisals were performed primarily by real estate brokers. However, some appraisal theory was appearing. In 1924, Frederick Babcock proposed that the following processes could be used when valuing improved properties.<sup>6</sup>

- *Summation process*—Value of land plus value of building.
- *Comparison process*—Sales of similar improved properties.
- *Multiple of gross rental process*—"A short-cut method . . . which assumes the property to be worth five, six, or seven times the gross annual rental. Obviously, such a device has no place in the procedure of an appraiser."<sup>7</sup>
- *Capitalization of net income*—A process used when the property is improved to its highest and best use.
- *Appraisal by income analysis*—A process applicable to property not improved to its highest and best use.
- *Analysis of correspondingly*

*typical use*—Appraising a property "by analogy to typical commercial rent-producing property."<sup>8</sup>

- *Inferential income process*—A process in valuing a property in which only part of it produces income.
- *Sales percentage process*—Gross income is based on a percent of sales of the building occupant.

There are many similarities among the eight processes and the three approaches. These were formalized after the launching of *The Appraisal Journal*, which instigated appraisal education in earnest in October 1932.

According to Atkinson, Mark Levy, the first managing editor of *The Appraisal Journal*, commented on its process and accomplishments as follows:

Articles were followed by a number of critiques of the methods and thinking used by the author . . . . So well was this early phase of the program carried out that by the end of the '30s the appraisal process as we know it today with its approaches, methods, and techniques, had received general approval and acceptance.<sup>9</sup>

By 1936 the three approaches were established. K. Lee Hyder notes in "The Appraisal Process" that "We have reduced the appraisal process to a consideration of three basic approaches to the value estimate. Three of them, and here they are:

- The comparative approach;
- The reproduction of cost approach; and

5. Harry Grant Atkinson, "Recollections of the Founding of AIREA," *The Appraisal Journal* (October 1972): 492.

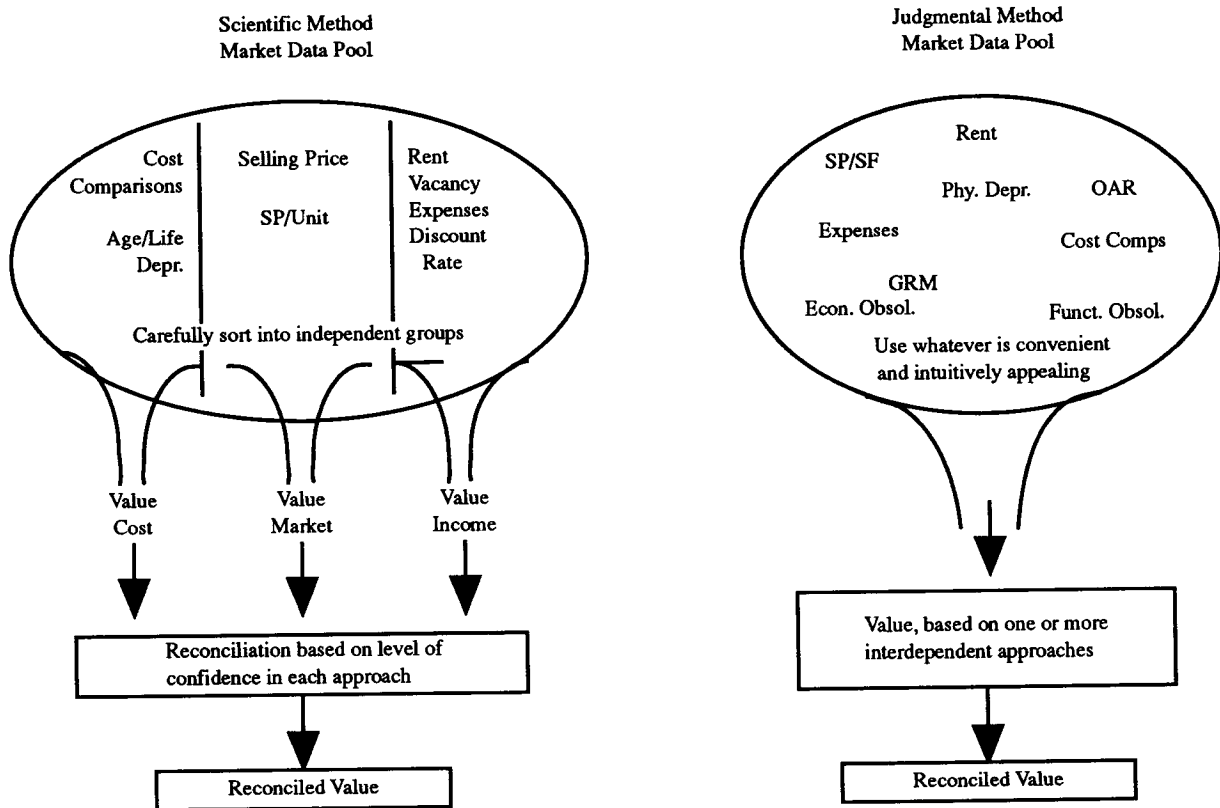
6. Frederick Morrison Babcock, *The Appraisal of Real Estate* (New York: MacMillan Company, 1924), 102.

7. *Ibid.*, 104. The significance of this statement will become clear later.

8. *Ibid.*, 106.

9. Atkinson, 499.

**FIGURE 1 Scientific Method versus Judgmental Method**



- The income capitalization approach.<sup>10</sup>

In the April 1936 issue of *The Appraisal Journal*, Atkinson states that if three appraisers valuing the same property each use just one approach, the deviation in value estimates would be much greater than if they each use all three approaches.<sup>11</sup> That is, the use of all three would produce a more reliable result.

It was not until 1951 that the American Institute of Real Estate Appraisers published the first edition of *The Appraisal of Real Estate*, in which there are no direct references to the advantages of us-

ing multiple independent methods. When discussing the correlation of the three approaches, however, there are numerous references to the advantages of independence.

- The three approaches should not be averaged.
- Most weight should be placed on that approach that appears to have the greatest reliability.
- The appraiser tempers the estimate in accordance with his or her judgment concerning the reliability of the other two approaches.<sup>12</sup>

Between 1928 and 1936 an evolution thus occurred in appraisal

10. K. Lee Hyder, "The Appraisal Process," *The Journal of the American Institute of Real Estate Appraisers of the National Association of Real Estate Boards* (January 1936): 17.  
 11. Harry Grant Atkinson, "The Process of Appraising Single-Family Homes," *The Journal of the American Institute of Real Estate Appraisers of the National Association of Real Estate Boards* (April 1936): 150.  
 12. American Inst. of Real Estate Appraisers, *The Appraisal of Real Estate* (Chicago: Labesste Press, 1951), 84-85.

**TABLE 1 Example of Interdependent Data**

Input Assumptions	Value with Rent at \$320 per Month	Value with Rent at \$250 per Month
Units	20	20
Rent/unit	\$ 320 per month	\$ 250 per month
Rent/unit	\$ 3,840 per year	\$ 3,000 per year
Operating expenses	35%	35%
Gross rent multiple	6.5	6.5
Overall rate	10%	10%
Land value	\$120,000	\$120,000
Reproduction cost	\$450,000	\$450,000
Physical deterioration	10% age/life	10% age/life
Functional obsolescence	\$ 192 rent loss/mo.	\$ 150 rent loss/mo.
Percent of rent	5%	5%
Gross Income	\$ 76,800	\$ 60,000
Expenses	\$ 26,880	\$ 21,000
Net operating income	\$ 49,920	\$ 39,000
<u>Value</u>		
<u>Income approach</u>		
NOI	\$ 49,920	\$ 39,000
Overall rate	10%	10%
Value	\$499,200	\$390,000
Rounded	\$500,000	\$390,000
<u>Market approach</u>		
Gross rent	\$ 3,840	\$ 3,000
Gross rent multiple	6.5	6.5
Units	20	20
Value	\$499,200	\$390,000
Rounded	\$500,000	\$390,000
<u>Cost approach</u>		
Land value	\$120,000	\$120,000
Reproduction cost	\$450,000	\$450,000
Value, new	\$570,000	\$570,000
Physical deterioration	\$ 45,000	\$ 45,000
Functional obsolescence	\$ 23,040	\$ 18,000
Value	\$501,960	\$507,000
Rounded	\$502,000	\$507,000

methods that led to the three approaches, and since that time their independence has been stressed. It appears, however, that the benefit of using absolutely independent approaches was not fully understood by the profession's early educators, nor is it fully understood today. The difference between application of the three approaches to value in a scientific manner, as opposed to how they are currently applied, is shown in Figure 1.

In the scientific method illus-

trated in Figure 1, independent data are used in the three approaches. Stated another way, data from the income approach are not used as a part of the market approach. The following example shows the difference between independent and interdependent sets of data when applied to the three approaches.

Assume an appraiser is valuing a 20-unit apartment building with some functional obsolescence that rents for \$320 per month. To show the effect that interdependent data have on the three approaches, an

overall rate for the income approach and a gross rent multiple for the market approach will be used. Some functional obsolescence will be included in the cost approach. Given the set of assumptions in Table 1, column 1, the value resulting from the use of all three approaches is \$500,000. If only the rent amount is changed, the second set of assumptions (Table 1, column 2) reveals that all the values must change. The three approaches are thus not independent but interdependent. If an error is made in estimating rent, all of the approaches are affected.

When independent data sets are used, an estimation or other error in a variable affects only one approach. For example, if the rate were developed with a mortgage

equity technique in the income approach, with selling price per unit in the market approach, and with the age/economic life technique in the cost approach, an estimation error in calculating rent would affect only the income approach.

### CONCLUSION

Because the use of the scientific method enables appraisers to produce and replicate reliable results, and the amount of confidence that can be attributed to results is enhanced when they are developed using the scientific method, serious thought should be given to the advantages and the disadvantages of using truly independent approaches to value.

*When independent data sets are used, an estimation or other error in a variable affects only one approach.*