Best Practices Discussion

Best Practices for the Measurement of Functional and Economic Obsolescence in the Cost Approach Valuation of Industrial and Commercial Property

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The consideration of both functional and external obsolescence is an important procedure in the application of the cost approach to value industrial or commercial property. Technological changes may cause industrial or commercial property in many industries to experience functional obsolescence. Changes in the subject industry economics may cause industrial or commercial property in many industries to experience the economic obsolescence component of external obsolescence. Taxpayer property owners should recognize the effect that such obsolescence may have on the value of their industrial or commercial property for property taxation purposes. This discussion summarizes best practices considerations for both the identification and the measurement of obsolescence in the cost approach valuation of industrial or commercial property.

Introduction

The identification and measurement of obsolescence is an important procedure in the application of the cost approach to value industrial and commercial property. This procedure is particularly important with regard to state and local taxation ("SALT") purposes. If the industrial or commercial property appraisal does not consider the impact of functional or external obsolescence, the taxpayer property owner may pay more than its fair amount of ad valorem property tax.

The existence of the various forms of obsolescence (including functional obsolescence and external obsolescence) may cause a decrease in the market value of many types of industrial and commercial property. SALT assessment authorities should consider these forms of obsolescence in the taxpayer's property assessment.

Taxpayer property owners should also consider these forms of obsolescence in their property tax filing and/or assessment negotiations.

In addition, independent valuation analysts ("analysts") should consider these forms of obsolescence in property appraisals performed for SALT planning, compliance, appeal, and litigation purposes. In fact, all property appraisers should consider the impact of current market conditions (and, thus, the effects of any economic obsolescence) in the application of the cost approach for the valuation of industrial or commercial property.

First, this discussion summarizes the various forms of obsolescence that should be considered in the application of the cost approach to value industrial or commercial property for SALT purposes. This discussion focuses on special purpose property. However, the valuation principles described

are generally applicable to any type of industrial or commercial property.

Second, this discussion summarizes the practical procedures that the property owner, the analyst, or the taxing authority can apply to (1) recognize the existence of any property obsolescence and (2) measure the amount of any property obsolescence.

Third, this discussion considers various analyst caveats related to (1) documenting the existence of any property obsolescence and (2) reporting the measurement of any property obsolescence.

And, fourth, this discussion suggests potential analyst responses to assessment authority objections regarding the recognition of obsolescence in the application of the cost approach in the industrial or commercial property valuation.

Forms of Property Depreciation

The forms of depreciation that should be recognized in the cost approach valuation of industrial and commercial property include the following:

- Physical deterioration
- Functional obsolescence (including the technological obsolescence component of functional obsolescence)
- External obsolescence (including the economic obsolescence component of external obsolescence)

Physical deterioration is a reduction in the value of the industrial or commercial property due to physical wear and tear, the impact of continued use, and the elements of nature. Typically, the value of the taxpayer's property is affected by physical deterioration in two ways:

1. The property's appearance deteriorates, and, thus, the depreciation decreases the property's value in its secondary market
2. The continued use or the effect of natural elements reduces the property's useful economic life ("UEL") and its anticipated remaining utility

Physical deterioration can be either curable or incurable.

Functional obsolescence is an impairment of the functional utility of the industrial and commercial property in comparison to current (i.e., as of the valuation date) design, construction materials, or operational standards. Functional obsolescence can be either curable or incurable.

The definition of curable depreciation means that it would cost the taxpayer less to cure the property (e.g., to modernize the real estate or tangible personal property) than the amount of the economic penalty associated with the deterioration or obsolescence. The definition of incurable depreciation means that it would cost the taxpayer more to cure the property than the economic penalty associated with the deterioration or obsolescence.

In many cases of incurable functional obsolescence, it may be physically impossible for the taxpayer to cure the causes of the obsolescence. Functional obsolescence represents more than the physical utility of the taxpayer's industrial or commercial property. Functional obsolescence may represent an inadequacy or a superadequacy in the design of the taxpayer's property.

In many cases, the property owner may experience the functional obsolescence related to either:

1. excess operating costs (as a result of the property inadequacy) or
2. excess capital costs (as a result of the property superadequacy).

Technological obsolescence is one component—or one category—of functional obsolescence. Technological obsolescence represents a decrease in the property's value due to improvements in technology that make the subject property less than an ideal replacement for itself. This form of obsolescence may occur, for example, when due to improvements in design or engineering technology, a new replacement property will produce a greater measure of utility or functionality.

There are two types—or categories—of external obsolescence:

1. Locational obsolescence
2. Economic obsolescence

Locational obsolescence involves a deterioration or other change in the neighborhood in which the taxpayer's property is located. One example of locational obsolescence would be the closing of the access to an interstate highway for an industrial facility that depends on such inbound or outbound transportation access.

Economic obsolescence is a reduction in the value of the property due to the effects, events, or conditions that are external to—and not controlled by—the current operation or condition of the taxpayer property. The effect of economic obsolescence is typically beyond the control of the taxpayer property owner. For that reason, economic obsolescence is typically considered to be incurable.

External obsolescence may be illustrated by a situation where the taxpayer's industrial or commercial property is not physically deteriorated, where it is performing exactly to its design specifications, and where its design specifications are still considered to be state of the art.

Even in this situation, the value of the property may be affected by the following external (i.e., external to the physical property) conditions:

- The use of the taxpayer property is affected by a legislative enactment, administrative ruling, or judicial precedent.
- An environmental agency or regulatory authority restricts the operation of the taxpayer property—or greatly restricts its use or productive output.
- An import duty, excise, value added, or other type of tax is imposed on the operation of—or the production output of—the industrial or commercial property.
- Changes in its surroundings make the taxpayer property physically inaccessible; or, alternatively, changes in local, regional, or industrial economic conditions make the operations of the taxpayer property less commercially attractive (i.e., generate a lower rate of return investment).

The above examples are more representative of the impact of economic changes on a special purpose property. However, many types of economic obsolescence will affect just about any type of industrial or commercial property.

External obsolescence is considered curable if it is financially feasible for the property owner to cure the events or conditions that cause the property obsolescence. The cure is financially feasible if it costs less for the property owner to cure the obsolescence than the economic penalty (i.e., the decrease in property value) associated with maintaining the obsolescence.

External obsolescence is considered incurable if it is not financially feasible for the property owner to cure the events or conditions that caused the obsolescence. The cure is not financially feasible if it costs more for the property owner to cure the obsolescence than the economic penalty associated with the obsolescence.

By definition, the causes of external (and economic) obsolescence are external to—meaning outside of—the taxpayer's property. Therefore, it is often physically impossible for the property owner to cure the external obsolescence.

Since external obsolescence is external to the property, external obsolescence is often incurable no matter how much money the taxpayer is willing to invest in the property. Because external obsolescence is caused by factors external to the subject property, most external obsolescence is considered to be incurable. That is, the property owner cannot change the events or conditions that caused the property value to decrease.

Examples of the Indicia of External Obsolescence

The following discussion presents illustrative examples of the conditions that may indicate the existence of external obsolescence.

The first portion of the discussion provides illustrative examples of the conditions that may cause external obsolescence with regard to industrial or commercial real estate. The second portion of the discussion provides illustrative examples of the conditions that may cause external obsolescence with regard to industrial or commercial tangible personal property.

Real Estate

The following conditions may indicate the existence of external obsolescence related to industrial or commercial real estate:

- Changes in the property zoning or an increase in zoning requirements
- A significant increase in the number of comparable properties available for sale on the market
- Changes in pedestrian, vehicular, or other traffic flow patterns around the subject industrial or commercial property
- Increases in local or regional unemployment rates
- Increases in local or regional gas, electric, water, wastewater, or other utility rates
- Changes in the local or regional government policies regarding economic development

Tangible Personal Property

The following conditions may indicate the existence of external obsolescence related to industrial or commercial tangible personal property (and particularly with regard to special use tangible personal property):

- Decreased demand for the product output of the industrial or commercial personal property

- Increased production costs related to the product output of the industrial or commercial personal property
- Increased competition within the taxpayer's industry
- Decreased rates of investor returns associated with the operation of the industrial or commercial personal property

While not comprehensive, these lists present illustrative events or conditions that may indicate the existence of external obsolescence related to either real estate or tangible personal property.

Components of External Obsolescence

As mentioned above, external obsolescence relates to a decrease in the value of industrial and commercial property due to influences that are external to the property. There are two principal components (or categories) of external obsolescence:

1. Locational obsolescence
2. Economic obsolescence

Locational obsolescence occurs when the locational or neighborhood characteristics of the industrial or commercial property have changed, resulting in a decrease in the value of the property. An example of locational obsolescence would be a high-rise office building that originally has an unobstructed view of the city's lakefront.

Let's assume that another high-rise office building is constructed in the vacant lot between the subject property and the lakefront. Without the lakefront views, the rental rates in the subject property decrease significantly. That subject property has experienced locational obsolescence.

Economic obsolescence occurs when the taxpayer property owner is no longer able to earn a fair rate of return on an investment in the industrial or commercial property.

An example of economic obsolescence would be a special purpose manufacturing plant that receives all of its inbound freight and ships all of its outbound freight on a short-line railroad. When the short-line railroad discontinues operations, the plant's cost of goods sold and product freight expense increase materially. That special purpose manufacturing facility may have experienced economic obsolescence.

The following discussion summaries the identification and the measurement of obsolescence in the industrial or commercial property.

Identification and Measurement of Obsolescence

Industrial and commercial property may be valued by applying the three generally accepted property valuation approaches: the income approach, the cost approach, and the sales comparison approach. The measurement of all forms of obsolescence is considered explicitly in the application of the cost approach to property valuation. The measurement of all forms of obsolescence is considered implicitly in the application of the income approach and the sales comparison approach to property valuation.

Therefore, the identification and the measurement of the different forms of property obsolescence vary depending on the property valuation approach applied to value the taxpayer's property.

The following discussion summarizes (1) the implicit measurement of obsolescence in the application of the income approach and the sales comparison approach and (2) the best practices related to the explicit measurement of obsolescence in the application of the cost approach.

Implicit Obsolescence Measurement in Income Approach and Sales Comparison Approach

Income Approach

The income approach value indication for the taxpayer property may be estimated by applying a direct capitalization rate to a stabilized or normalized income measure related to the property. The consideration of functional obsolescence may be implied in either or both:

1. the estimation of a normalized income metric for the property and
2. the selection of the appropriate direct capitalization rate.

For example, the taxpayer property's normalized income measure may consider all of the excess operating costs associated with the design deficiencies of the subject property (e.g., the excess heating and air conditioning expense related to the excess amount of office space in a warehouse or manufacturing facility).

Certain components of the direct capitalization rate are sometimes derived from publicly traded company data. The selected publicly traded companies considered in the capitalization rate analysis

may not suffer the same level of functional or economic obsolescence as the taxpayer's property.

If the selected publicly traded companies do not experience the same level of functional or economic obsolescence as the taxpayer's property, then the market-derived capitalization rate may need to be adjusted. This capitalization rate adjustment for functional or economic obsolescence may be reflected when the analyst selects the property-specific risk factor in the cost of equity capital.

Sales Comparison Approach

A sales comparison approach valuation analysis depends on the level of comparability of the selected comparable properties relative to the taxpayer's property. This statement is true both for sales comparison approach property valuation analyses performed as part of a summation principle valuation or as part of a unit principle valuation.

If the selected comparable properties are not sufficiently comparable to the taxpayer's property with respect to functional or economic obsolescence, then the selected comparable property pricing multiples may need to be adjusted.

In all cases, the comparable property pricing metrics should be adjusted to make the selected comparable properties more comparative to the taxpayer's property. In other words, the taxpayer's property should not be adjusted to make it more comparable to the comparable properties.

Instead, the comparable properties should be adjusted to make them more comparable to the taxpayer's property. Such an adjustment should attempt to make the comparable property pricing metrics reflect the effect of the taxpayer property's level of functional and economic obsolescence.

Best Practices for the Obsolescence Measurement in the Cost Approach

Functional Obsolescence

For all industrial or commercial property, both real estate and tangible personal property, functional obsolescence is usually related to inefficiencies associated with the design, construction, or operations of the taxpayer's property. These inefficiencies often relate to either inadequacies or superadequacies.

An inadequacy occurs when there is not enough of the taxpayer property (e.g., the physical property is too small) for it to operate efficiently. A superadequacy occurs when there is too much of the taxpayer property (e.g., the physical property is too large) for it to operate efficiently.

The following metrics are typically considered in the measurement of functional obsolescence in an industrial or commercial property:

1. Excess capital costs
2. Excess operating costs

The amount of excess operating costs is often considered in the analysis of a property's inadequacy or superadequacy. The amount of excess capital costs is often considered in the analysis of a property's superadequacy.

The analyst considers both excess capital costs and excess operating costs in the measurement of functional obsolescence related to the industrial and commercial property.

This consideration of functional obsolescence is not only a factor in the cost approach valuation of real estate and tangible personal property. It is also a factor in the cost approach valuation of intangible personal property.

This consideration of excess capital costs and excess operating costs can also be used to measure any functional obsolescence related to the superadequacy in intangible personal property. Examples of such intangible personal property include computer software, engineering drawings and product designs, a trained and assembled workforce, laboratory notebooks, training manuals, technical documentation, and many other "backroom" or "contributory asset" types of intangible personal property.

The consideration of excess capital costs and excess operating costs can also be used to measure functional obsolescence related to any intangible personal property inadequacy. In such situations, the functional obsolescence analysis would consider the capital costs or operating costs that would be required to cure the intangible property's inadequacy.

The costs to cure intangible property inadequacy may be considered by the analyst in the measurement of functional obsolescence. This is because a hypothetical willing buyer would reduce the price paid to a hypothetical willing seller for, let's say, software if the buyer will immediately have to incur capital (or operating) costs to cure the inadequacies in the software.

Another procedure to quantify functional obsolescence involves the classification and measurement of excess operating costs. In this measurement procedure, the analyst estimates the amount of the annual expense associated with operating with the deficient (inadequate or superadequate) property—as compared to the

amount of annual expense associated with operating the ideal replacement property.

With regard to the obsolescence measurement based on excess operating costs, the analyst typically estimates the time period over which that excess operating cost is expected to last. Typically, that time period is measured by the UEL of the property.

Often, the analyst calculates the present value of the excess operating cost over the property's expected UEL. This present value of the expected future excess operating costs measures the amount of functional obsolescence associated with the industrial or commercial property.

External Obsolescence

This discussion focuses on the economic obsolescence component of external obsolescence. That focus is appropriate because economic obsolescence more generally affects special purpose industrial and commercial property.

The economic obsolescence analysis is typically the last procedure in the application of any cost approach analysis. This statement is true for a real estate or tangible personal property valuation. And, this statement is also true for an intangible personal property valuation.

A principal objective of the economic obsolescence analysis is to determine if the taxpayer (i.e., the property owner/operator) can generate a fair rate of return on the investment in the industrial or commercial property.

If the taxpayer can earn a fair rate of return on the investment in the property, then the unadjusted cost approach estimate (before an economic obsolescence allowance) provides a value indication for that property. However, if the taxpayer cannot earn a fair rate of return, then the cost approach estimate has to be adjusted—by the amount of the economic obsolescence allowance—in order to provide the property value indication.

In other words, the cost approach estimate should be adjusted to the level at which the taxpayer can earn a fair rate of return on the ownership or operation of the industrial or commercial property. That cost approach estimate adjusted for economic obsolescence provides the property value indication.

Often, it is relatively easy for the analyst to identify either physical deterioration or functional obsolescence (if any) in the industrial or commercial property. This is because these forms of depreciation are inherent in the property.

In contrast, economic obsolescence is often more difficult to identify than either physical deterioration or functional obsolescence. This is because the causes of economic obsolescence are external to the industrial or commercial property.

The economic obsolescence analysis typically involves a two-step process:

1. Identify the existence of economic obsolescence
2. Quantify the amount of economic obsolescence

Procedures to Identify the Existence of Economic Obsolescence

It is appropriate for the analyst to consider the existence of economic obsolescence in every cost approach property valuation. There are several conditions affecting the industrial or commercial property that may indicate the existence of economic obsolescence. The analyst should particularly consider (i.e., look for) the existence of economic obsolescence if any of these conditions are affecting the property.

With regard to industrial or commercial property, these conditions may include the following:

1. The revenue generated by the property operations is decreasing in recent years
2. The profitability generated by the property operations is decreasing in recent years
3. Industry returns on investment are decreasing in recent years
4. Industry competition is increasing in recent years

These conditions are particularly relevant with regard to special purpose industrial or commercial property. In addition, these conditions are particularly relevant with regard to property that is valued by the application of the unit principle of property valuation. Nonetheless, the analyst should consider these conditions with regard to the cost approach valuation of all industrial or commercial property.

None of these conditions specifically measures the amount of economic obsolescence. Further, the above list of conditions is not exhaustive. However, the existence of one or more of these conditions may indicate the existence of economic obsolescence related to the industrial or commercial property.

In order to actually measure (i.e., quantify) any economic obsolescence related to the property, the analyst should consider both of the following factors:

1. Taxpayer-specific factors
2. Property-specific factors

Procedures to Measure Economic Obsolescence

Most of the analyses to quantify economic obsolescence are performed on a comparative basis. One comparative basis to measure economic obsolescence may be:

1. the property's actual operating results "with" the effects of economic obsolescence in place compared to
2. the property's operating results "without" the effects of economic obsolescence in place.

The "without" operating results often relate to a historical period before the current economic obsolescence conditions developed.

The comparative basis to measure economic obsolescence may also be:

1. the property's actual operating results "with" the effects of the economic obsolescence compared to
2. one or more sets of benchmark operating results "without" the effects of the economic obsolescence.

The analyst may review the property-related financial documents or operational reports in order to quantify different measurements of economic obsolescence. These types of property-related documents may include the following:

- Financial statements or financial results of operations
- Financial budgets, plans, projections, or forecasts
- Production statements, production cost analyses, or operating cost variance analyses
- Material, labor, and overhead cost of goods sold (or services delivered) analyses
- Fixed cost versus variable cost operating statements
- Raw material or other component costing analyses
- Cost/volume/profit analyses
- Unit/dollar sales or volume analyses or product price analyses

The analyst may analyze the property-related data and documents on several comparative bases, including the following:

- Actual results versus historical results
- Actual results versus prospective results
- Actual results versus specific comparative benchmark results
- Actual results versus specific competitor (or competitors) results
- Actual results versus industry average or benchmark average results
- Actual results versus the property's practical or normal production capacity

The analyst may analyze the property-related financial data in order to identify the causes of the economic obsolescence. The analyst may analyze property-level or unit-level profit margins, property-level or unit-level returns on investment, industrial/commercial production unit average selling price, industrial/commercial production unit cost of goods sold, or industrial/commercial production unit sales volume.

The analyst attempts to identify the external factors that cause the taxpayer to earn less than a fair rate of return on an investment in the industrial or commercial property.

The Industrial or Commercial Property Cost Approach Value Indication

By this point in the cost approach valuation analysis, the analyst has performed each of the following procedures:

1. Concluded that the application of the cost approach is appropriate for the industrial or commercial property
2. Confirmed that adequate current cost information is available to perform a cost measurement (e.g., replacement cost new or reproduction cost new) analysis
3. Selected the appropriate current cost measure for the industrial or commercial property
4. Included all appropriate cost components in the current cost measurement
5. Identified and quantified any necessary allowance for physical deterioration
6. Identified and quantified any necessary allowance for functional obsolescence
7. Identified and quantified any necessary allowance for economic obsolescence

The only remaining procedure is to subtract all of the depreciation and obsolescence from the cost metric in order to indicate the industrial or commercial property value based on the cost approach.

Ideally, the analyst will also have developed income approach and sales comparison approach value indications. In that case, the final value conclusion for the industrial or commercial property can be based on a synthesis and reconciliation of all of the property valuation approaches.

Illustrative Example of an Intangible Personal Property Cost Approach Valuation

As an example, let's consider the application of the cost approach to value the intangible personal property of an industrial taxpayer. The industrial taxpayer is the Omega Railway Company ("Omega"), a class I railroad.

Let's assume that the taxpayer's property is assessed based on the unit valuation principle in this particular taxing jurisdiction. Further, let's assume that intangible personal property is exempt from property taxation in that taxing jurisdiction. Let's assume that the statutory definition of value for SALT purposes in this taxing jurisdiction is fair market value.

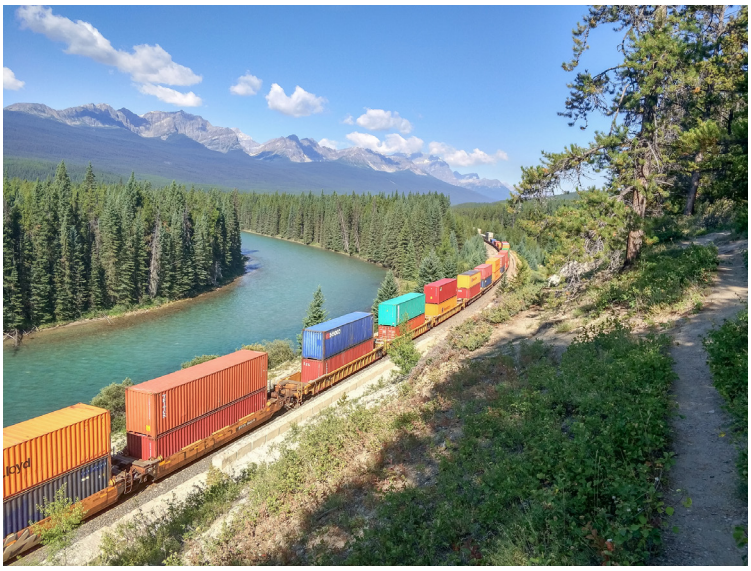
Let's assume that the analyst is asked to value certain intangible personal property. That intangible property is exempt from property taxation. The valuation date is January 1, 2020. Omega management requires the valuation of its internally developed software in order to extract that intangible personal property value from its total unit value for SALT purposes.

Let's assume that Omega owns and operates 10,000 software applications. These applications control all of the operations of the railroad. The analyst is retained to estimate the fair market value of the Omega internally developed software. The analyst decides to apply the cost approach and the replacement cost new less depreciation ("RCNLD") method to estimate the fair market value of this intangible personal property.

The analyst begins the RCNLD analysis by estimating the replacement cost new ("RCN") for the Omega internally developed software. The total RCN measurement will indicate the cost for the taxpayer company to replace all of its software applications with new applications of comparable functionality and utility.

The cost metric (however measured) will typically include four cost components:

1. Direct costs
2. Indirect costs
3. Developer's profit



4. Entrepreneurial incentive

The direct cost component of the RCN may be estimated based on the total amount of compensation paid to taxpayer's software engineers who would replace the subject software.

The RCN would consider all of the other expenses that the taxpayer company would incur related to these software engineers. Those costs are typically considered to be indirect costs. Those indirect costs may include the following employer-paid expenses:

1. Payroll taxes
2. Employee benefits
3. Continuing professional education
4. Other company-related perquisites

The total of the direct and indirect costs that the taxpayer company pays for an employee is often referred to as the full absorption cost. This full absorption cost typically includes the following:

1. The compensation paid by the employer to the employee
2. The expenses paid by the employer to others so that the employee can perform his or her job

The direct costs and indirect costs that the employer would incur to replace the existing software with new software may include the following:

- Expenses related to the use of any third-party contractors that would be used to replace the software
- Training, supplies, and travel expenses of internal software engineers

- Facilities and other overhead expenses related to the development of the replacement software

In addition to the direct cost and indirect cost components related to replacing the internally developed software, there are two other cost components to be considered in the RCN analysis:

1. Developer's profit
2. Entrepreneurial incentive

The analyst should consider developer's profit in the RCN analysis. In this example, the developer's profit may be measured as the profit margin that an independent software development company would earn if the railroad retained such a company to replace the taxpayer's software.

Such an independent software development company would incur $1 billion in out-of-pocket (i.e., direct and indirect) costs. Of course, that development company would expect the willing buyer of the software to reimburse it for such out-of-pocket costs.

In addition, the software development company would also expect to earn a profit margin on top of its direct and indirect cost investment. Otherwise, the software company would never accept the assignment to replace the taxpayer's software.

The analyst should also consider entrepreneurial incentive in the RCN analysis. This cost component would be required to motivate the taxpayer company to develop the intangible property—instead of pursuing some other investment opportunity.

There are alternative analyst procedures for measuring entrepreneurial incentive. One procedure is for the analyst to estimate the opportunity cost that the taxpayer would experience during the intangible property replacement period.

This opportunity cost relates to the profits that would be lost by the taxpayer because it would not operate the to-be-developed software. When applying this procedure, the analyst should be careful to appropriately allocate the lost profits opportunity cost to all of the taxpayer's intangible property.

Another entrepreneurial profit measurement procedure is to calculate a fair rate of return on the subtotal of the intangible property cost components (i.e., direct costs, indirect costs, and developer's profit). The principle of this entrepreneurial profit measurement procedure is that the taxpayer would not develop the replacement intangible property if it did not expect to earn a fair rate of return on its development investment—during the development period.

After summing the direct costs, indirect costs, developer's profit, and entrepreneurial incentive cost components, the analyst next estimates the amount of depreciation (including obsolescence) related to the software. In other words, as in any cost approach analysis, the analyst has to consider if there is any deterioration or obsolescence related to this intangible property.

In this illustrative example, intangible personal property is not subject to property taxation in the taxing jurisdiction. And, Omega is subject to the unit principle of property valuation in this taxing jurisdiction. Therefore, Omega management has to identify and value any intangible personal property included in the taxpayer's total unit value.

Related to the application of the cost approach and the RCNLD method, the analyst may request taxpayer-specific data related to the software. These data may include the following:

1. The estimated period of time until the actual software will be retired (i.e., replaced)
2. Any indications of the software's inability to perform the functions for which it was designed

These two RCN adjustments relate to (1) the software's age (and its expected retirement date) and (2) the software's inability to perform the function for which it was intended (i.e., the software's inutility). These two RCN adjustments are considered in the analyst's measurement of depreciation and obsolescence.

These depreciation and obsolescence adjustments are appropriate because a willing buyer would not pay the willing seller (i.e., the taxpayer) for the RCN of (1) software that is nearing the end of its UEL and is expected to be replaced soon or (2) software that is unable to perform the function for which it was developed.

In this illustrative example, the RCNLD indicates the price that a hypothetical willing buyer would pay to a hypothetical willing seller for the taxpayer's software. That price estimate is based on the current cost to replace the functional utility of the taxpayer's software.

That current cost is adjusted for physical deterioration (if any) and for functional obsolescence. In addition, the analyst still has to consider economic obsolescence (before reaching a final value estimate).

To illustrate the functional obsolescence measurement, let's assume that Omega operates a particular software application that was written in COBOL (a third-generation programming language).

All of its other customer records software and administrative systems software are written in JAVA or C++ (or other fourth- and fifth-generation programming languages).

Omega management plans to replace the software application (let's say it's the billing and receivables application) with a new customized software application. However, the Omega information technology department does not have the resources to complete that new software development project for the next five years.

In the meantime, Omega has to employ a COBOL programmer solely to maintain the billing and receivables application that is written in an obsolete programming language. When a new billing and receivables application is installed, this COBOL programmer position will be eliminated. The full absorption cost of the COBOL programmer is $100,000 per year.

Let's assume that the analyst estimated the RCN for the billing and receivables application to be $1.2 million. Let's assume that the analyst has concluded that there is no physical deterioration associated with the billing and receivables software. And, let's assume that there is no other functional obsolescence related to the current billing and receivables software.

By capitalizing the excess operating costs associated with the identified functional obsolescence, the analyst estimated the RCNLD of the actual (COBOL language) billing and receivables application as summarized in Exhibit 1.

The 2.99 times present value of an annuity factor in the example is based on (1) a five-year estimated UEL for the billing and receivables software and (2) an assumed 20 percent (pretax) present value discount rate.

In theory, if consistent valuation variables are used, the analyst should reach the same value conclusion for the software regardless of which functional obsolescence measurement method is used. That is, the software RCNLD should be approximately the same whether the analyst considers excess capital costs to measure functional obsolescence or excess operating costs to measure functional obsolescence.

In the above example, the preliminary value conclusion is presented before the analyst's consideration of economic obsolescence. However, the analysis of economic obsolescence is an integral procedure in every cost approach valuation analysis. The application of the cost approach to property valuation is not complete until the analyst considers the existence (if any) of external (typically economic) obsolescence.

Let's continue with the Omega intangible personal property example. Let's assume that the analyst estimated the RCN less physical deprecation and functional obsolescence indication for the billing and receivables software. In order to reach the intangible property final value indication, the analyst has to consider economic obsolescence.

Since Omega is assessed based on the unit valuation principle, the analyst decided to measure economic obsolescence based on financial and operational data for the Omega total unit.

Let's assume that the analyst accumulated comparative financial and operational data regarding the Omega total unit as of December 31, 2019. After considering these comparative data, the analyst decided to apply the capitalization of income loss method ("CILM") to measure any economic obsolescence affecting the Omega intangible personal property value.

Exhibit 2 summarizes the illustrative economic obsolescence measurement based on the CILM comparison of the taxpayer's financial and operational data.

Exhibit 1
Omega Railway Company
Billing and Receivables Software
Cost Approach Valuation
Replacement Cost New less Depreciation Method
Preliminary Analysis
As of January 1, 2020

Cost Approach Component		$
Software Application Replacement Cost New		1,200,000
Less: Functional Obsolescence	$	
Annual Excess Operating Cost	100,000	
× Present Value of Annuity Factor	2.99	
= Capitalized Excess Operating Costs	299,000	299,000
Equals: Preliminary Replacement Cost New less Depreciation		901,000
Preliminary Value of Subject (COBOL) Software Application (rounded) (before analysis of economic obsolescence, if any)		900,000

Exhibit 2
Omega Railway Company
Billing and Receivables Software
Cost Approach Valuation
Economic Obsolescence Analysis
Illustrative capitalization of Income Loss Method Comparison
As of January 1, 2020

Item	Intangible Property Financial or Operational Performance Metric	Actual LTM Ended 12/31/19	Benchmark Measure	Income Loss to Capitalize	Actual LTM Compared to Benchmark Percent Loss	Benchmark Comparison Reference Source
1	Average Salary per Software Development Engineer	$125,000	$100,000	$25,000	25%	2019 Class I Railroad Industry Average
2	Number of Software Applications Managed per Development Engineer	100	125	25	20%	2019 Class I Railroad Industry Average
3	Omega Return on Total Gross Assets—Based on Financial Accounting Data	5.5%	7.0%	1.5%	21%	Omega Actual Average (2014–2019)
4	Omega Return on Tangible Net Assets—Based on Financial Accounting Data	6.0%	7.8%	1.8%	23%	Omega Actual Average (2014–2019)
5	Omega Operating Profit Margin—Based on Financial Accounting Data	10.0%	12.0%	2.0%	17%	Omega Actual Average (2014–2019)
6	Omega Return on Replacement Cost New Investment in Tangible Assets	5.0%	6.0%	1.0%	17%	Omega Annual Property Appraisals (2014–2019)
	Economic Obsolescence Percentage Indication (rounded)				**20%**	

Based on the comparative financial and operational data, the analyst concluded that the Omega total unit is experiencing economic obsolescence of about 20 percent. The analyst's measurement of economic obsolescence for the software as of January 1, 2020, is calculated as (1) the RCNLD indication (before economic obsolescence) for the software multiplied by (2) the 20 percent selected economic obsolescence percentage equals (3) the economic obsolescence allowance indication for the software.

Exhibit 3 summarizes the final cost approach RCNLD analysis related to the illustrative billing and receivables software. Based on this cost approach valuation analysis, the analyst concluded that the fair market value of this Omega software intangible personal property, as of January 1, 2020, is $720,000.

Analyst Caveats for the Identification and Measurement of Obsolescence

Do Not Apply a Residual Method

An inexperienced analyst may believe that it is appropriate to measure economic obsolescence by reference to the property's income approach value indication. In other words, an inexperienced analyst may measure economic obsolescence by applying a residual procedure—that is, by measuring the difference between (1) the income approach value indication and (2) the cost approach value indication.

This residual procedure for economic obsolescence measurement is often referred to as the income shortfall method.

The inexperienced analyst may not understand why this residual calculation—or income shortfall method—is inappropriate and fundamentally flawed.

As an example, let's consider the valuation of a unit of special purpose industrial property. Let's assume the inexperienced analyst applies a cost approach RCNLD method analysis. Then, the inexperienced analyst applies an income approach discounted cash flow ("DCF") method analysis to estimate the total unit value of the special purpose industrial property.

From this income approach unit value conclusion, in order to conclude the value of the industrial property, the inexperienced analyst subtracts the value of (1) working capital and (2) exempt intangible property. If the value of the industrial property concluded by the DCF method is lower than the value of the industrial property concluded by the RCNLD method, the inexperienced analyst concludes that there is economic obsolescence.

The inexperienced analyst concludes that the amount of economic obsolescence is equal to the differences between the industrial property value indications provided by the two property valuation methods (i.e., the DCF method and the RCNLD method).

The explanation that the inexperienced analyst may provide for such an economic obsolescence measurement procedure is that a willing buyer would not buy the industrial property for the value indicated by the RCNLD method unless the property generated sufficient income to provide a fair rate of return on the investment (i.e., RCNLD) in the property.

At the same time, when the value indicated by applying the DCF method is higher than the value indicated by applying the RCNLD method, the inexperienced analyst will accept the RCNLD value indication for the industrial property. In that case, the inexperienced analyst concludes that there is no economic obsolescence.

The following discussion summarizes some of the reasons why it is inappropriate to use an income

Exhibit 3
Omega Railway Company
Billing and Receivables Software
Cost Approach Valuation
Replacement Cost New less Depreciation Method
Fair Market Value
As of January 1, 2020

Cost Approach Component	$	Reference
Replacement Cost New	1,200,000	Exhibit 1
Less: Physical Depreciation	--	Text
Less: Functional Obsolescence	299,000	Exhibit 1
Subtotal	901,000	
Less: Economic Obsolescence at 20%	180,000	Exhibit 2
Equals: Fair Market Value of Billing and Receivables Software	721,000	
Fair Market Value of Billing and Receivables Software (rounded)	720,000	

"[E]ach property valuation approach should be analytically independent of each other approach."

approach value indication as any benchmark by which to measure the economic obsolescence component in a cost approach valuation of industrial or commercial property.

Using this residual procedure or income shortfall method, the cost approach loses its analytical independence from the income approach. In an industrial or commercial property valuation, all generally accepted property valuation approaches may consider the same set of market-derived or property-specific data. However, each property valuation approach should be analytically independent of each other approach.

If the cost approach value indication is "adjusted" to equal the income approach value indication, why should the analyst even apply the time and effort to perform the cost approach analysis? Why doesn't the analyst just consider the income approach value indication twice in the property value reconciliation procedure? When there is any evidence of economic obsolescence related to the industrial property, why bother to apply the cost approach at all?

If the cost approach value indication is "adjusted" to equal the income approach value indication, why not also "adjust" the sales comparison approach value indication to equal the income approach value indication? When the unadjusted sales comparison approach value indication is greater than the income approach value indication, why doesn't the analyst just "adjust" that sales comparison approach value indication to equal the income approach value indication?

In that case, the analyst can simply consider the income approach value indication three times in the property value reconciliation procedure.

If the cost approach value indication is "adjusted" to equal the income approach value indication, then none of the following cost approach components will actually affect the property value: property original cost, property age, property condition, property location, property replacement cost new, property reproduction cost new, property operating efficiency, property maintenance history, property type, property description, or even property existence.

Applying the income shortfall method, an old property may have the same value as a new property. And, that value will be determined by the conclusion of the income approach. Applying the income shortfall method, a well-maintained property may have the same value as a poorly maintained property. Further, that value will be determined by the conclusion of the income approach.

Applying this income shortfall method of economic obsolescence measurement, the property's RCN is irrelevant to the cost approach value indication. This is because the amount of economic obsolescence automatically adjusts the cost approach value indication to equal the income approach value indication.

This income shortfall method is counterintuitive to the fundamental economic principle of the cost approach (e.g., the principle of substitution). That is because, by applying this income shortfall method to measure economic obsolescence, the property's cost metric becomes irrelevant in the cost approach property valuation.

Do Apply the Unit-Level Economic Obsolescence Percentage to the Taxpayer Property

For property tax purposes, some taxpayer industrial or commercial property is valued based on the unit valuation principle rather than based on the summation valuation principle. That is, the industrial or commercial property is valued as a single "total unit" for property tax purposes.

Examples of types of taxpayers that are often assessed based on the unit valuation principle include railroads, airlines, other transportation companies, pipelines, cable television providers, electric generation and distribution companies, and other utility-type companies—such as local gas transmission companies, water companies, and wastewater companies.

In a unit principle valuation, the economic obsolescence measurement is typically performed on a total unit (or aggregate) basis, and not on a summation (or property-by-property) basis. For this reason, when estimating the value of industrial or commercial property in the context of the total unit, the total unit-level economic obsolescence percentage is typically applied to estimate the property value.

For example, in our illustrative example of Omega Railway Company, the economic obsolescence estimate of 20 percent would be applicable to all of the Omega industrial or commercial property—including the taxpayer's software intangible personal property.

Analyst Responses to Taxing Authority Objections regarding Obsolescence Measurements

The CILM Is Not the Income Shortfall Method

One generally accepted method for measuring economic obsolescence is the CILM. Inexperienced analysts sometimes confuse the CILM with the income shortfall method. As discussed previously, the income shortfall method is not a generally accepted method for measuring economic obsolescence.

The CILM "is applied in two steps. First, the market is analyzed to quantify the income loss. Next, the income loss is capitalized to obtain the value loss affecting the property as a whole."[1]

To apply this economic obsolescence measurement method in a unit principle valuation, the analyst may compare the property's profitability from operations during a recent period to a benchmark measure of profitability from operations. That benchmark measure of profitability from operations may be one of the following:

1. The level of profitability/return on investment earned by the property when there was no identified economic obsolescence
2. The level of profitability/return on investment earned by comparable companies or another industry benchmark measure
3. The level of profitability/return on investment based on the taxpayer's financial projections

The analyst may also consider alternate measures of profitability/return on investment.

In a unit principle valuation, an analyst typically measures economic obsolescence for the total unit of taxpayer property. Then, the analyst applies the concluded economic obsolescence (typically on a percentage basis) to all of the taxpayer's property valued by the cost approach.

Measuring economic obsolescence at the total unit level (rather than at the individual property level within the total unit) is a generally accepted unit principle valuation procedure.

According to the textbook *Valuing Machinery and Equipment*, "Because economic obsolescence is usually a function of outside influences that affect an entire business (i.e., all tangible and intangible assets) rather than individual assets or isolated groups of assets, it is sometimes measured using the income approach or by using the income approach to help identify the existence of economic influences on value."[2]

One procedure that analysts often perform in the application of the CILM is to compare the property's actual rate of return measure (e.g., the actual return on investment earned on the property) with a required rate of return measure (e.g., the taxpayer's weighted average cost of capital, or "WACC"). The analyst may calculate the difference between the property's actual rate of return on investment and the property's required rate of return as a measure of the property's income loss. This income loss can then be converted into an economic obsolescence measurement percentage for the industrial or commercial property.

Returning to our Omega Railway Company illustrative example, the analyst could apply this procedure of comparing the actual return on investment to the required return on investment in order to measure the Omega economic obsolescence.

For example, the analyst could compare (1) the Omega actual net operating income ("NOI") return on the Omega total unit to (2) the taxpayer's yield capitalization rate (or WACC). In calculating the actual return on investment, the analyst could rely on the average NOI over a multiyear period or on the latest 12 months NOI. NOI is typically calculated as an after-tax income measure.

Therefore, the taxpayer after-tax NOI return on investment is typically compared to the taxpayer's after-tax WACC (as a measure of the required rate of return on investment).

The analyst may estimate the property's NOI rate of return on investment based on various investment measures. Then, the analyst may apply the same yield capitalization rate—or WACC—as the required rate of return on investment. That yield capitalization represents the required rate of return for all of the property included in the total unit.

If the property's actual return on investment (however measured) indicates a lower rate of return than the taxpayer's yield capitalization rate (or WACC), that comparison would indicate that economic obsolescence exists in the taxpayer's property.

For example, if the Omega actual rate of return on investment is 6 percent and the Omega yield capitalization rate (the required rate of return on investment) is 9 percent, that comparison would indicate economic obsolescence of 33 percent based on this application of the CILM

Obsolescence Measurement Typically Consider Some Type of Taxpayer Income Data

Some inexperienced analysts suggest that many of the generally accepted economic obsolescence measurement methods (such as the CILM) are inappropriate to apply in the cost approach. That is because these measurement methods rely on the taxpayer's income data. And, that same taxpayer income data may also be a component in either (or both) the income approach and/or the sales comparison approach. For example, the CILM may include consideration of the taxpayer's WACC to measure economic obsolescence. However, this inexperienced analyst's concern is misguided.

In the case of valuing industrial or commercial property, an analyst may apply a cost approach valuation method such as the RCNLD method. In the application of the RCNLD method, the analyst may compare (1) the property's actual rate of return on investment to (2) the property's required rate of return on investment (often measured as the taxpayer's WACC). This comparison is often considered in the application of the CILM to measure the property's economic obsolescence (if any).

The taxpayer's WACC is a valuation variable that may be considered in the application of the income approach. Nevertheless, the cost approach RCNLD method value indication is independent of the income approach value indication.

All property valuation approaches (and all property valuation methods) may rely on the same or similar underlying data, such as the property's financial and operational data. The reliance on the same or similar underlying data does not preclude an analyst from applying multiple valuation approaches and multiple valuation methods to value the industrial or commercial property.

However, each property value indication should be derived from a complete and independent valuation analysis of the subject property.

Each value indication should be independent from each other value indication. Each property valuation method—and each property value indication—should be able to stand alone. As a fundamental property appraisal principle, no value indication should depend on another value indication.

Summary and Conclusion

The identification and measurement of obsolescence in the cost approach valuation of industrial or commercial property is a fundamental issue in valuations performed for ad valorem property tax purposes. The various forms of obsolescence (including functional obsolescence and external obsolescence) should be considered in the cost approach valuation of industrial and commercial property.

This consideration is particularly relevant in cost approach valuations of special purpose industrial or commercial property. Further, this consideration of obsolescence in the application of the cost approach is generally relevant to both unit principle valuations and summation principle valuations.

Both taxpayer property owners and valuation analysts should consider the measurement of obsolescence in the cost approach valuation of industrial or commercial property for tax planning, compliance, and appeal purposes.

Tax assessment authorities should consider obsolescence in the assessments of taxpayer industrial and commercial property. In particular, assessment authorities should consider the impact of current market conditions (and, thus, the effect of economic obsolescence) in the application of the cost approach in the valuation of any industrial or commercial property.

First, this discussion summarized the various forms of obsolescence typically considered in the application of the cost approach to value industrial or commercial property for SALT purposes.

Second, this discussion presented the practical procedures that either the property owner or the taxing authority can apply to (1) recognize the existence of property obsolescence and (2) measure the amount of property obsolescence.

Third, this discussion considered various analyst caveats with regard to the measurement of obsolescence in the cost approach valuation of industrial or commercial property.

Finally, this discussion suggested taxpayer or analyst responses to taxing authority objections with regard to the measurement of any obsolescence related to the taxpayer's industrial or commercial property.

Notes:

1. *The Appraisal of Real Estate*, 14th ed. (Chicago: The Appraisal Institute, 2013), 635.
2. *Valuing Machinery and Equipment: The Fundamentals of Appraising Machinery and Technical Assets*, 3rd ed. (Washington, D.C.: American Society of Appraisers, 2011), 76.

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