Technology Life-Cycles
And
Technological Obsolescence

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Abstract

Traditional mortality studies alone are insufficient to assess the depreciation of utility property that is subject to technological obsolescence. There are two principle reasons for this. First, technological obsolescence is having a more profound impact on the future economic life of utility property today than it had in the past. Second, the current mortality analysis process, i.e., using a single mortality survivor curve for all vintage for all future years, grossly understates the true impact of technological obsolescence. Several writings, published in the early 1980's, document this fact; yet, the current process, developed in the first half of this century, remains unchanged today.

> W.C. Fitch and F.K. Wolf in their paper, titled *Conceptual Framework for Forecasting the Useful Life of Industrial Property*, Iowa State Regulatory Conference, 1984, recognized the need to enhance the Prescribed Projection Life process and conceptualized on how forward-looking impacts such as technological obsolescence could be modeled to give better life estimates.
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> K. A. Kateregga, Department of Industrial Engineering, Iowa State University, concluded in his paper *Technological Forecasting Models and Their Applications in Capital Recovery*, that "there is a justifiable need to incorporate technological forecasting in the overall life analysis framework especially in those industries experiencing fast technological changes."

This paper presents a methodology that will allow the influences of technological obsolescence to be reasonably assessed and reflected in the economic life and depreciation of the plant. It proposes that the analyst use Historical Mortality Analysis to assess the influence of traditional forces of mortality, and an extension of Substitution Analysis to determine the impacts resulting from technological obsolescence. Each of these techniques is common practice and has proven accurate in the context of their use within this paper. The total mortality rate is then computed by statistically combining the influences from both traditional mortality analysis and technology substitution analysis. Finally, the life, value and/or depreciation of the property can be determined using commonly accepted life-cycle techniques.

Background

Depreciation is a measure of the loss in service value incurred in connection with the consumption or prospective retirement of the property[1]. In the context of capital recovery studies, the goal is to book depreciation expense commensurate with the consumption of the asset. To determine depreciation adequately, the influence of all factors that measurably contribute to depreciation must be determined. Failure to adequately account for any significant contributor will understate the magnitude of depreciation, and overstate the true value of the asset.

In practice, separately quantifying the depreciation contribution of all potential influences is not practical and, luckily, not required. Depreciation generally results from two principle classes of loss: traditional mortality forces and technological obsolescence.[2] Assessing the mortality characteristics of just these two classes of forces can capture most, if not all, significant influences on the depreciation of utility property.

For most of this century, Historical Mortality Analysis (HMA) provided a reasonable estimate of the economic lives and loss in value of utility property. Before the 1970s, the overwhelming drivers of mortality for utility property were traditional mortality forces: wear and tear, deterioration, etc. These forces are typically a constant function of the age of the asset and do not change with the passage of time. For example, 5 years ago, 10 year old assets may have had a 3% retirement rate; today, 10 year old assets would still have a 3% retirement rate; and 30 years from now, 10 year old assets would still have a 3% retirement rate. This concept is fundamental to HMA.

When used to model traditional forces of mortality, HMA has proven reasonably effective. Some assets, like utility poles, still exhibit characteristics consistent with HMA. With the onslaught of rapid technological obsolescence, however, experience has proven HMA ineffective. The reason for this is simple: when technological obsolescence is present, mortality rates increase with the passage of time. Reliance on past mortality experience as the basis for future mortality patterns understates the true mortality of utility property, understates the depreciation requirement, and overstates the remaining life and value of the assets.

Because of HMA's inability to model mortality forces that change with the passage of time, another technique must be used to assess technological obsolescence. HMA should still be used to assess traditional age-dependent forces of mortality, however, technological obsolescence must be separately addressed using techniques that account for its unique mortality characteristics. The technique presented in this paper to address the unique characteristics of technological obsolescence is an extension of *Substitution Analysis.*

[1] *Public Utility Depreciation Practices*, National Association of Regulatory utility Commissioners (NARUC), 1996, page 318.

[2] Different regulatory bodies and corporations may have specific local definitions for depreciation related terms, and may classify the forces contributing to an asset's loss in value differently than presented in this report. The state of Indiana, for instance, classifies wear and tear from usage as a form of obsolescence, whereas this report classifies wear and tear as a '*traditional*' force of mortality. How one classifies the different forces of mortality is a matter semantics and local custom, and not germane to the results. For the purposes of this analysis, mortality forces are classified in a manner thought to best promote their understanding.

Assessing Traditional Forces of Mortality

Traditional Forces of Mortality, in the context of this paper, refers to those forces of mortality that can be reasonably modeled as a constant function of the age of the asset. That is, the likely mortality of an asset in a given year and for a given age of plant (vintage) is constant. Traditional mortality generally results from usage and exposure to the elements. Specific forces of traditional mortality include wear and tear through usage, deterioration with age, accidental or chance destruction, and most requirements of public authorities.

Provided that the group of assets being studied is homogeneous[3], you can readily model traditional mortality as a constant function of age. For example: Accumulated usage of an asset is nearly a constant function of its age. Wear and tear of an asset resulting from accumulated usage is, therefore, also a constant function of age. Similarly, some forms of deterioration are a direct function of age, while others are a function of accumulated exposure to the elements, which in turn is a constant function of age. Accidental or chance destruction is more a function of the environment surrounding the asset and constant for all age groups. Incidental losses due to public requirements, such as a road move, are also included with traditional mortality forces. Given the incidental and random nature of such mandates, they too are reasonably modeled as a constant function of the age of the plant.

The commonly accepted method of assessing the impact of traditional forces of mortality is *Historical Mortality Analysis* (HMA). The HMA process typically involves developing the mean probability of loss (a.k.a. retirement rate) for each age of plant. Generally, this entails statistical analysis of past retirement experience. The resulting mortality patterns are then reflected in a mortality *survivor curve*, which plots the anticipated percentage of initial survivors still surviving as the age of the assets increases. Figure 1 illustrates a typical survivor curve.

[3] Homogeneous, in this context, indicates that the group of assets has similar life and mortality characteristics.

Figure 1 – Typical Mortality Survivor Curve

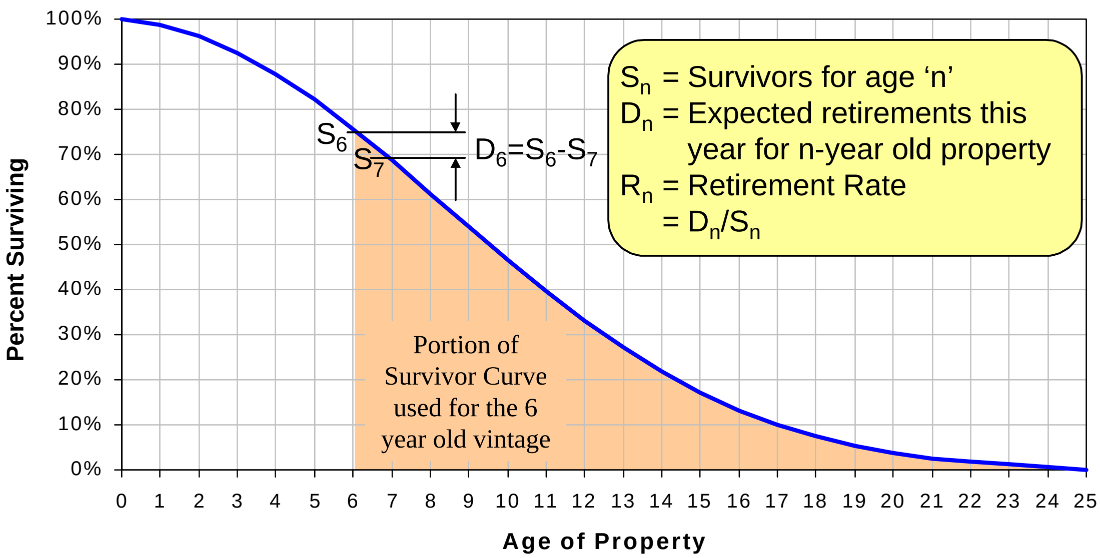


Figure 1 also illustrates how to use survivor curves to project the future mortality for a given vintage. Consider a six-year old vintage that has traditional mortality characteristics consistent with the survivor curve of Figure 1. From the survivor curve, the expected retirements for the current year equals the survivors for age 6 less the survivors for age 7 (S_6-S_7). The retirement rate for the current year, denoted as R_6, equals the retirements divided by the current survivors, or $(S_6-S_7)/S_6$. These calculations can be repeated for all subsequent years. For example, the expected retirement rate for the next year, for this vintage, is $R_7 = (S_7-S_8)/S_7$. Thus, the mortality survivor curve also gives us the future annual probabilities of loss (a.k.a., retirement rates) for each vintage.[4]

Additionally, it is common practice to estimate the remaining life of the vintage as the remaining area under the mortality survivor curve (the shaded area shown in Figure 1) divided by the surviving investment (S_6 in this case). This process can be repeated for each vintage and the average remaining life for all vintages is computed by investment weighting the individual vintage lives. This technique for estimating the remaining life is functionally the same as the *generation arrangement*[5] typically used in depreciation studies. In fact, the generation arrangement is simply a shorthand numerical algorithm for duplicating this more fundamental process.

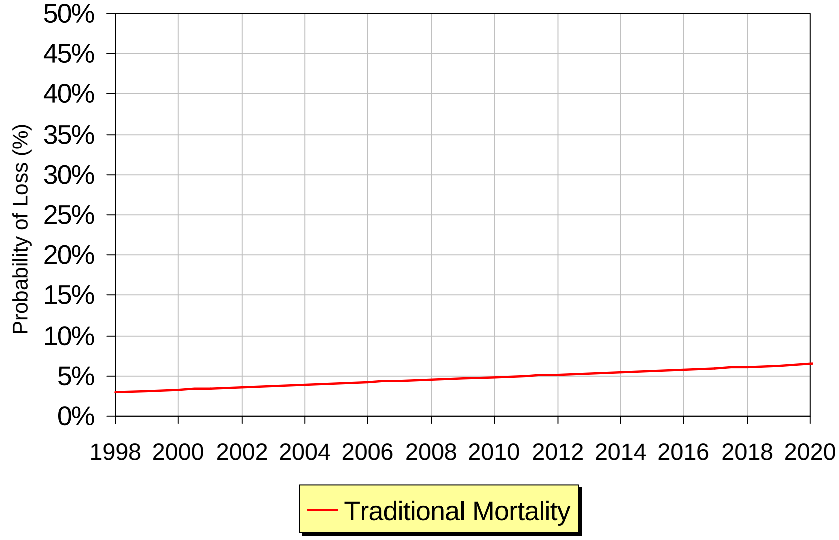
A useful form of the mortality characteristics is category-level retirement rates. These are computed as the investment weighted average of the individual values. Figure 2 illustrates the resulting retirement rates derived in this fashion. It is important to recognize that these retirement rates represent the statistical *probability of loss* for the category of plant. In other words, the retirement rates are the likelihood (*probability*) that an asset will retire (*loss*) in a given year. These category-level retirement rates can then be used to project future survivors for all vintages combined, which in turn can be used to determine the category average remaining life. This alternate approach is commonly

[4] To simplify the presentation of this material and to promote its understanding, the mortality computations presented in this paper do not assume the half-year convention. All retirements and losses in value are assumed to occur at the end of the year for numerical computations.

[5] The term *generation arrangement* is commonly used in depreciation/capital recovery studies to reference the numerical algorithm used to estimate the average remaining life.

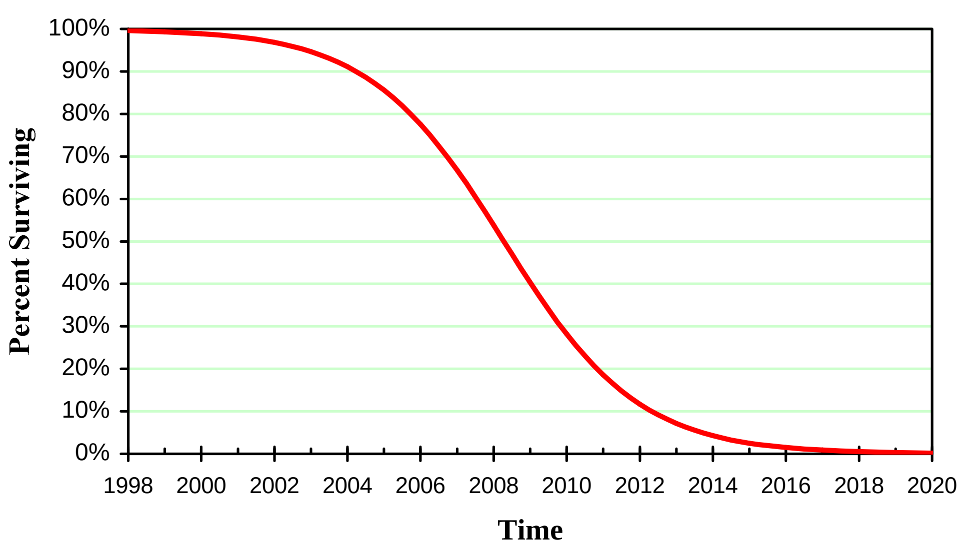
referred to as *Life-Cycle Analysis*, and produces the same resulting life as the two techniques described above.

Figure 2 - Retirement rates due to traditional mortality.



The combined mortality characteristics for all vintages of plant are often illustrated using a *Life-cycle* chart. Figure 3 illustrates a typical life-cycle chart. Here, the combined impact of all mortality forces on the entire category of plant is plotted going forward in time. The initial or starting value is typically reflected as 100% of the plant in service at the start date. As we move forward in time, the plot depicts the percentage of the initial property expected to still in be service. The life-cycle plot gives us a visual representation of the long-term impact that the mortality forces will have on the category of assets under study. The area under this curve is the expected average remaining life of the property.

Figure 3 – Typical Life Cycle Chart



While related, it is important to recognize that the life-cycle curve is very different from the mortality survivor curve. The life-cycle plots the survivors going forward in **time** for all vintages. In contrast, the mortality survivor curve plots the survivors as a function of the **age** for each vintage.

Some depreciation analysts incorrectly consider life-cycle analysis as different from the generation arrangement approach often used in life studies. The likely reason for this misconception is the fact that the generation arrangement does not directly calculate the future survivors; nor does it produce a life-cycle curve. Rather, the generation arrangement uses a shorthand numeric algorithm that, in effect, duplicates life-cycle analysis. The bottom line is that both techniques produce the exact same results when given the same mortality inputs.

The primary benefit of using the life-cycle approach to quantifying the traditional mortality characteristics is that it captures the net annual depreciation loss (retirement rate) as a function of time, rather than as a function of age. In this form, the mortality characteristics of traditional forces of mortality are more readily combined with other mortality influences that are not a function of age, specifically technological obsolescence.

Assessing Technological Obsolescence

Obsolescence is a measure of an asset's loss in value resulting from a reduction in the utility of the asset relative to market expectations. It should be noted that while the absolute usefulness of an asset may remain constant, if market expectations increase, the property may realize a corresponding reduction in value. Such a loss in value is said to be the result of obsolescence. There are two forms of obsolescence, *external* obsolescence and *functional* obsolescence.

Functional Obsolescence

Functional obsolescence results from a *flaw* in the structures, materials, or design that diminishes the function, utility, and value of an asset. The term '*flaw*', in this context, refers to any deficiency in the asset which negatively impact its ability to perform the desired function. Flaws are relative to need; this is, if the need evolves over time and the asset can no longer meet the need, then the asset's value is impaired. Customer expectation is a typical example: New and more powerful generations of personal computers increased customer expectations for personal computing power. While the power of older PCs remain constant, consumer needs increase. Relative to customer expectations (needs) older PCs have a flaw or relative deficiency. The loss in value resulting from this deficiency is a form of functional obsolescence, called Technological Obsolescence.

Technological obsolescence is one form of functional obsolescence. With the rapid pace of technological change, technological obsolescence is the principle cause of functional obsolescence today. In fact, when technological obsolescence is occurring, it generally overshadows all other causes of obsolescence. In this paper, *technological* obsolescence is the principle focus of the obsolescence analysis.

For consumer products, technological obsolescence often has an immediate and drastic impact on the value of older products. Take PCs, for example: the introduction of a new, faster, and more robust model often results in a significant reduction to the purchase price of the previous model. Overnight, the price can drop 20% or more. Such immediate affects of technological obsolescence are not typical of utility property.

Because of the large base of utility assets, typically thousands or tens of thousands of units, and the diverse environments in which they are used, the effect of technological obsolescence does not occur instantaneously. Typically, the property values begin to decline slowly with the introduction of a superior technology. As acceptance of the new technology grows, its costs drop and its usefulness increases further. Consequently, the pace of adoption of the new technology increases; and the pace of obsolescence of the older technology increases proportionally. Eventually, the rate of obsolescence levels off and typically remains relatively constant for the remainder of the life-cycle of the affected assets.

Because the process of obsolescence occurs over time and follows characteristic patterns, its long-term impact can be reasonably modeled from actual experience. The method of determining the impact of technological obsolescence is straightforward. First determine the pace of adoption of the new technology. Assess how rapidly new technology is actually displacing the use of the older technology. Then, equate the technological displacement of the older technology into annual probabilities of loss.

Substitution Analysis

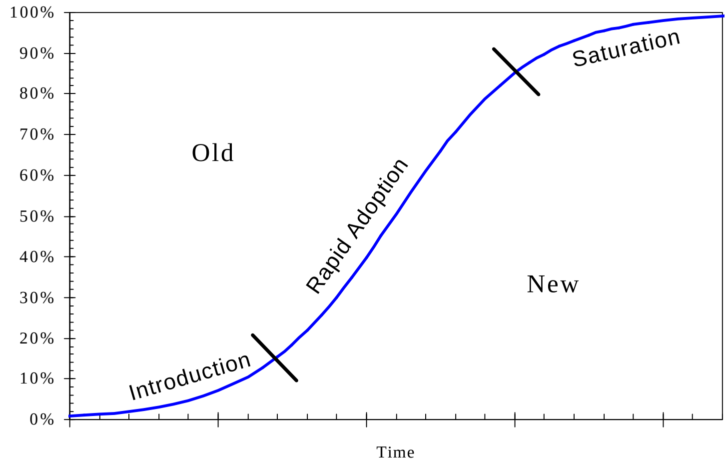
The common method for assessing the adoption of new technology is *substitution analysis.* Substitution analysis is a technique that has proven effective in projecting the adoption of new technology. Substitution refers to the displacement of an established technology by a newer technology because the new technology provides improved capabilities, performance, and/or economies.

With substitution analysis, we examine patterns of technology substitution. The pattern is remarkably consistent from one substitution to another, and is characterized by an S-shaped curve when the market share of the new technology is plotted over time.

Figure 4 shows the S-shaped curve for the Fisher-Pry model. Of several substitution models available the Fisher-Pry model, and its extensions, notably, multiple substitution models[6], is the most useful in assessing the rate of substitution of telecommunications assets.[7]

Figure 4 – The Fisher-Pry Model

[6] Multiple substitution occurs when the substitution of one technology for another is in progress and a third technology enters the market. For example, digital switching was introduced before analog electronic switches had completely replaced electromechanical switches, so both analog and digital switches were substituting for electromechanical.
[7] More information on substitutions and be found in L. K. Vanston and J. H. Vanston, *Introduction to Technology Market Forecasting*, (Austin, TX: Technology Futures, Inc., 1996)



The adoption of a new technology starts slowly because, when it is first introduced, a new technology is usually expensive, unfamiliar, and imperfect. The old technology, on the other hand, has economies of scale and is well known and mature. As the new technology improves, it finds more and more applications, it achieves economies of scale and other economic efficiencies, and it becomes generally recognized as superior. The old technology, because of its inherent limitations and falling market share, cannot keep pace with the new technology. The result is a period of rapid adoption of the new technology, beginning near the 15% penetration level. This corresponds with a period of rapid abandonment of the old technology. Toward the end of the substitution, adoption of the new technology slows down again as the last strongholds of the old technology are penetrated[8].

Since the pattern of how a new technology replaces an old technology is consistent, we can apply the pattern to a technology substitution in progress, or one just beginning, to forecast the remainder of the substitution. We can apply substitution analysis even in cases where the substitution has yet to begin by using appropriate analogies, precursor trends, and evaluation of the driving forces. Although no forecasting method is perfect, the experience with substitution models has been excellent.

The actual obsolescence of an asset occurs roughly proportional to the decline in market share of the old technology. During its introduction phase, new technology is often deployed primarily for new applications and as a replacement vehicle for equipment being replaced due to traditional mortality forces. Thus, technological displacement of the old technology is initially low.

Gradually, the new technology matures and its deployment accelerates. Consequently, it begins to trigger the displacement of older technology that otherwise would have remained in service. This form of displacement is technological obsolescence. As the new technology reaches the rapid adoption stage, technological obsolescence accelerates. Then, as the new technology saturates the market and its deployment slows, the rate of obsolescence of the old technology decreases. Finally, total obsolescence is achieved when the market share of the old technology reaches zero.

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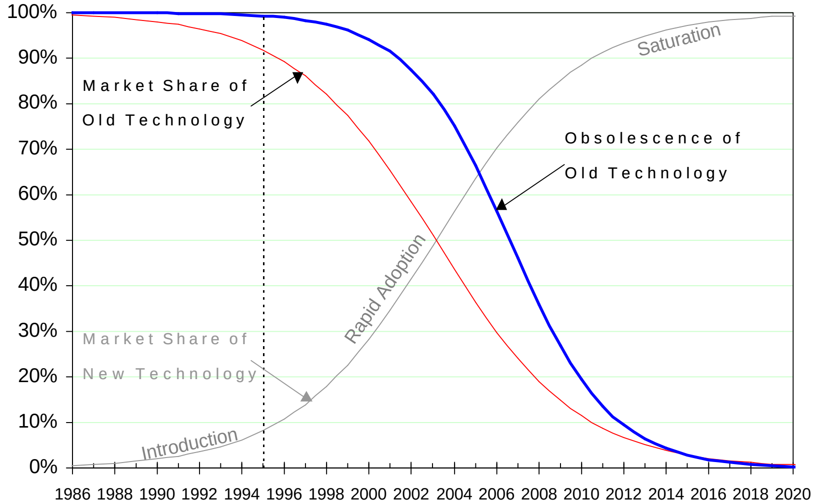
[8] For some technologies, adoption of the new technology may actually accelerate near the very end of the substitution. This is generally due to the increased operational savings associated with the complete removal of the older technology.

Figure 5 shows the relationship between new technology adoption and old technology obsolescence. As can be seen from the figure, the old technology looses very little, if any, value during the introduction phase (1986 to 1995) of the new technology. During this period, obsolescence is virtually non-existent and traditional mortality forces drive the mortality of the property almost entirely.

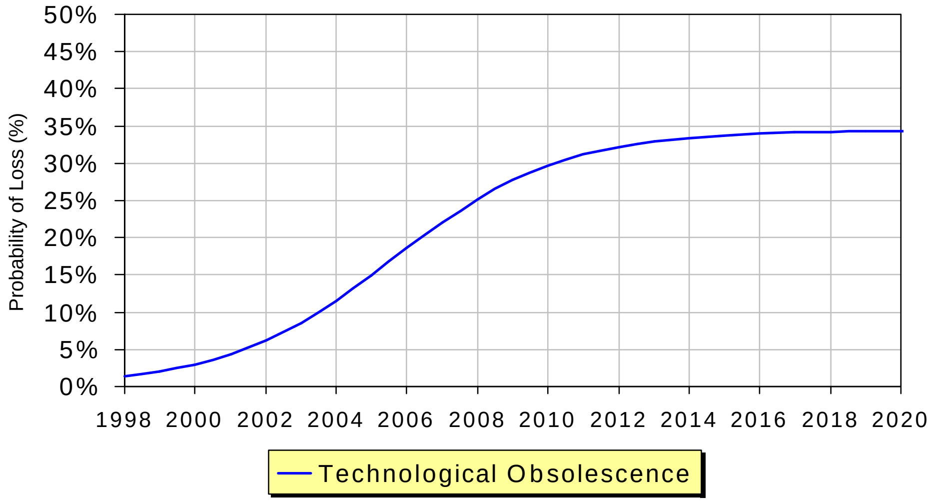
Figure 5 – Typical Obsolescence Chart



As the new technology enters its rapid adoption phase, the obsolescence of the old technology becomes noticeable. This point in time is indicated by the dotted line and occurs near the year 1995, and continues through 2001. During this period, obsolescence gradually increases. As adoption of the new technology continues to increase, the rate of obsolescence tends to stabilize; however, the loss in value due to obsolescence is often dramatic. Then, as we near the end of the substitution, the loss in value due to obsolescence generally slows until the value of the old technology diminishes to zero.

Given the ongoing substitution of an old technology by a newer technology, and given the nature of the initial deployment, the obsolescence of the old technology can be defined in terms of its remaining value, as depicted in Figure 5. In this form, the analyst can readily compute the annual probabilities of loss attributable to technological obsolescence using the same retirement rate formula used for traditional mortality forces (see Figure 1). Figure 6 plots the annual probabilities of loss corresponding with the obsolescence given in Figure 5.

Figure 6 - Annual Loss due to Obsolescence



In this form, obsolescence can be readily combined with the life-cycle plot resulting from traditional mortality. This combined life-cycle then becomes the basis for developing the remaining economic life and remaining value taking into account both traditional mortality and technological obsolescence.

Combining Multiple Forces of Mortality

When forces of mortality are expressed in terms of the probability of loss, they can be readily combined using simple statistical procedures. Typically, forces of mortality are mutually exclusive in that, while all the forces are present simultaneously, only one of them can actually cause the mortality of an asset. For example, each time you leave your house there exist a small probability that you will be killed by lightning and a small probability that you will be run down by a car. While both probabilities of loss are present, you can be killed by only one of them. Such forces are said to be mutually exclusive. The combined probability, P_T, resulting from two mutually exclusive probabilities, P_1 and P_2, is given by the following equation:

$$P_T = P_1 + ((1 – P_1) * P_2) \text{ or alternately } P_T = P_2 + ((1 – P_2) * P_1)$$

Thus, if you had a 10% chance of being killed by lightning and a 15% chance of being killed by a car, the combined chance of being killed by either one is 23.5%.[9]

$$0.235 = 0.15 + ((1 – 0.15) * 0.10)$$

When combining forces of mortality, it is imperative that the forces be represented in common terms. A retirement rate expressed as a function of age, for example, can not be combined with one that is expressed as a function of time. All forces of mortality can be equated to annual probabilities of loss over time.

In the case of traditional mortality forces, the age-dependent retirement rates are taken directly from the mortality survivor curve. These vintage values are then applied to the

[9] If such probabilities are applicable to you…Stay Home!

vintage investment, combined, and the resulting annual probabilities of loss over time for the entire category are computed (typical values are illustrated in Figure 2).

In the case of technological obsolescence, the substitution curve is used to first define the loss in market share of the old technology. Growth and usage trends and other factors that may influence the actual technological displacement of the assets are considered, resulting in a projection for the loss in value over time for the category of property (see Figure 5). From this, the annual probabilities of loss, over time, are readily computed using the traditional retirement rate formula. In this form, the mortality characteristics resulting from both traditional mortality forces and technological obsolescence are combined using the formula for mutually exclusive probabilities. Figure 7 illustrates the results of this process.

Figure 7 - Combining Multiple Forces of Mortality

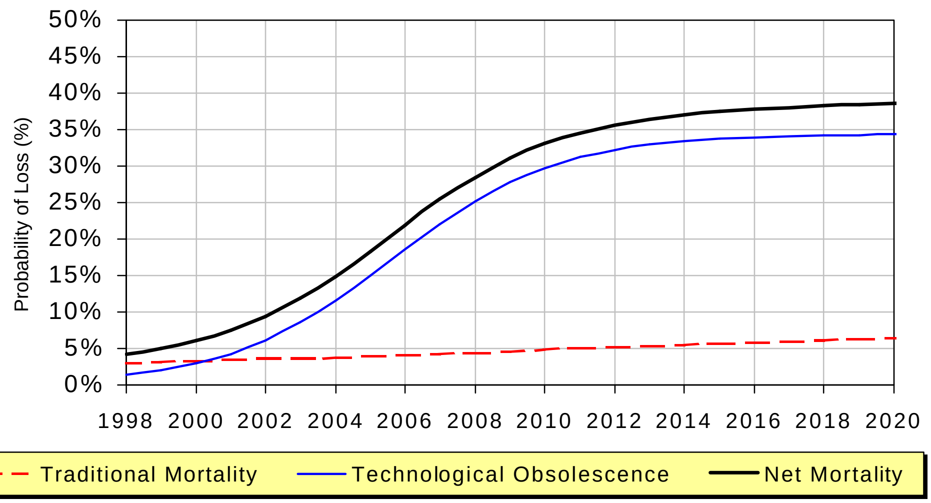


Figure 7 was developed from actual mortality and obsolescence data for telecommunication company (telco) metallic feeder cable from over 40 jurisdictions. Telcos began placing significant quantities of metallic feeder cable with fiber cable around the year 1984. As we can see from the figure, traditional mortality forces are still the dominant driver of mortality, 14 years later. Technological obsolescence does not become the dominant force of mortality until after the year 2000. This figure also illustrates that relying exclusively on either obsolescence or traditional mortality would understate the true mortality of these assets.

When combining the influences of traditional mortality forces and technological obsolescence, it is important to develop the traditional mortality using mortality experience that predates significant influence from technological obsolescence. To do otherwise may distort the results. It is not necessary to used mortality data that predates the introduction of the new technology, as material obsolescence typically lags initial deployment by several years or more. In the example of Figure 7, retirement experience from the early 1980's was used to determine traditional mortality experience. Specifically, a Bell #1.5 mortality survivor curve was used with a life indication of 25.7 years.

Case Study

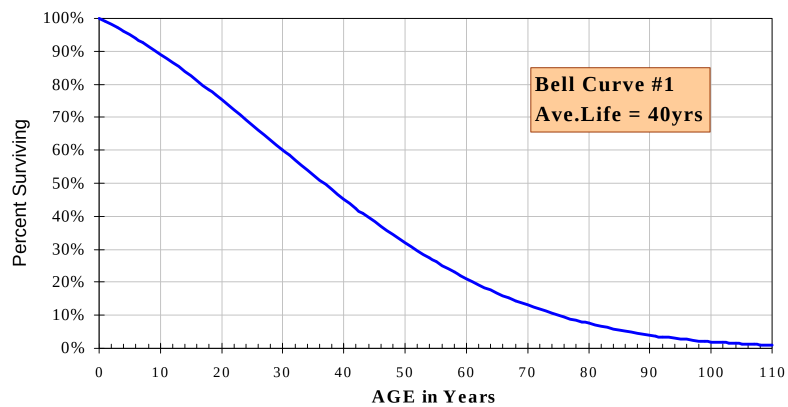
To illustrate the application of the techniques presented in this paper and to demonstrate the reasonableness of the results, the following case-study was developed. This study assesses the economic life of metallic underground cable in the Interoffice (IOF) network for a single LEC, and single state jurisdiction. The LEC is referred to as LEC-A.

The case-study shows that application of the techniques presented in this paper provides a reasonable and accurate estimate of the economic life. It demonstrates that if one were to rely solely on historical mortality characteristics, they would grossly overstate the life. Conversely, if one were to rely solely on technological obsolescence, they would again overstate the life, but to a much smaller degree.

Traditional Mortality

After review of mortality experience for the activity years 1978-1980, predating the deployment of fiber, the standard Bell Curve #1 was chosen as the mortality survivor curve. Life indications were generally high during this period. A projection life of 40 years was chosen, however, life indications tended to be somewhat higher. The resulting mortality survivor curve is shown in Figure 8.

Figure 8 - Mortality Survivor Curve



Applying LEC-A's vintage investment to the selected mortality survivor curve yields the life-cycle chart shown in Figure 9.

Figure 9 - Life-Cycle Resulting From Traditional Mortality Only.

This figure illustrates what the life-cycle of IOF copper would have looked like in 1986 if it were to follow traditional mortality patterns. From the figure we see that absent additional influences on the mortality of IOF copper cable, it would take about 70 years for 90% the copper in service on 1/1/86 to be displaced. Today, we know that it actually took just over 11 years (1986 to 1997) to displace 95% of IOF copper cable. Clearly, forces other than the traditional mortality forces are influencing the mortality of these assets. That missing force is technological obsolescence.

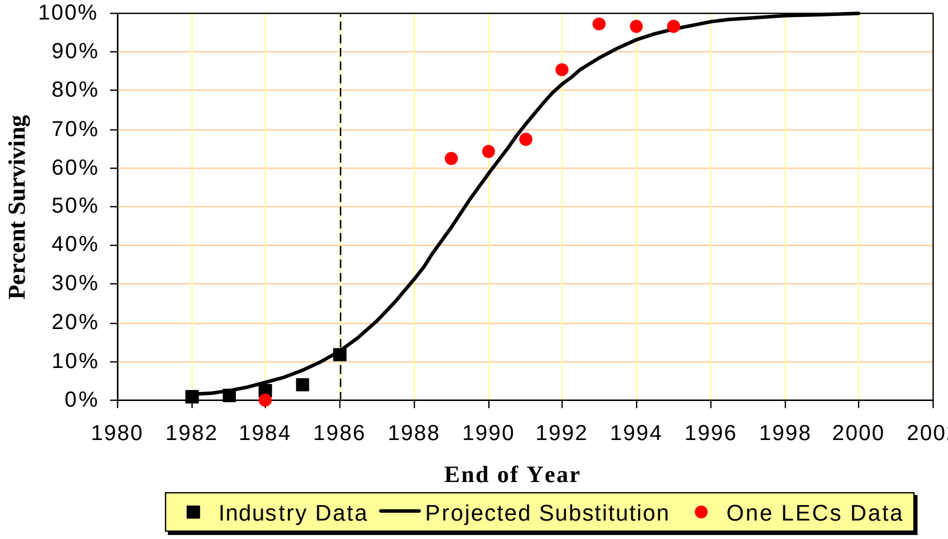
Technological Obsolescence

The case study uses industry fiber deployment data, through 1985, as the basis for projecting the substitution for subsequent years. Prior to 1986, there was very little fiber deployed; and many experts were skeptical about its long-term potential. At that time, there was little empirical data on fiber deployment; nonetheless, there was sufficient industry data to make a reasonable projection of the substitution.

The pre-1986 industry empirical data and the resulting substitution is shown in Figure 10. Also shown, is LEC-A's empirical data. From the graph, we see that a substitution projection made in 1986, while not exact, did provide a rough approximation of fiber's subsequent deployment for LEC-A[10].

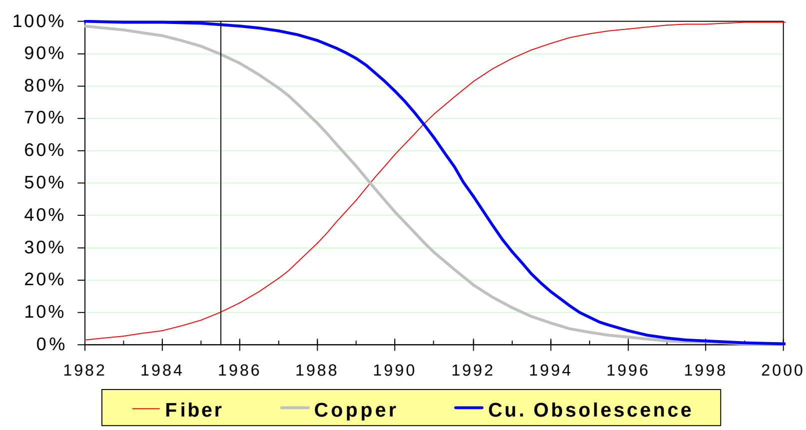
[10] One reason this particular LEC was selected for this study was precisely because the industry substitution trend only roughly approximated the LEC's subsequent fiber deployment. Generally, other LECs and jurisdictions more closely followed the projection. Thus, if the results of this study produce reasonable life estimates, then it further demonstrates the vitality and appropriateness of this process.

Figure 10 - Projected Substitution for LEC-A



From the substitution trend, the percent market share of IOF copper was computed. In the IOF, at that time, new fiber cables were generally placed parallel to copper cables. The trigger for the fiber placements was generally to accommodate future growth. Over time, copper circuits would migrate to the fiber cables as turnover in the network presented opportunity to do so. To account for this situation, it was assumed that the obsolescence of copper would be negligible until fiber penetrated about 10% of the network. Then as fiber moved into the rapid deployment stage of the substitution, copper obsolescence would track with fiber penetration. The resulting projection for IOF copper obsolescence is provided in Figure 11.

Figure 11 - Obsolescence of IOF Copper



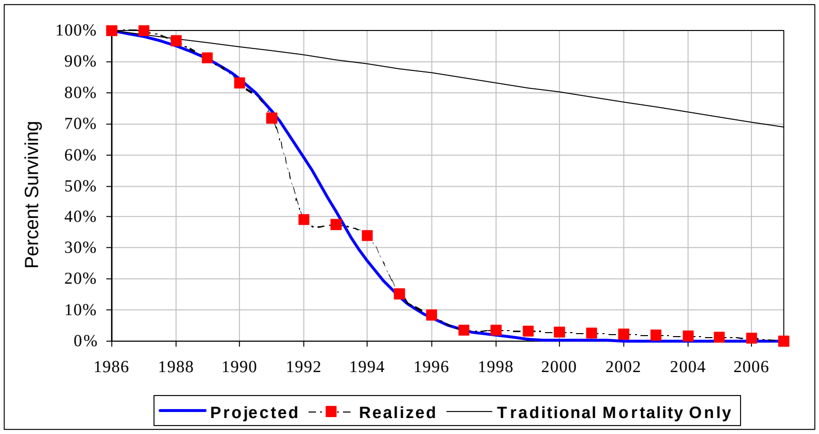
Resulting Economic Life

The remaining life, based solely on <u>traditional mortality forces</u>, was 36.95 years. This life is computed as the area under the life-cycle curve provided in Figure 9. The remaining life, based solely on <u>technological obsolescence</u>, is 6.83 years. This life is computed as the area under the obsolescence curve provided in Figure 11.

To estimate the actual remaining life of IOF copper that was realized (as of January 1, 1986), we must first make an assumption regarding the remaining IOF copper that exists today. For the purpose of these calculations, it was assumed that the remaining IOF copper in LEC-A would be displaced with fiber over the next ten years. While this assumption, by most experts' account, is a very conservative estimate, the volume of remaining copper is so small as to have minimal, if any, impact on these life calculations. The resulting average remaining life realized by LEC-A is 6.49 years.

Figure 12 compares the projected life-cycle to that which was realized, and to what would likely have resulted if only traditional mortality was considered. Clearly, the combined life-cycle, taking into account both traditional mortality and technological obsolescence produced the more accurate estimate of the economic life.

Figure 12 - Resulting Life Cycle



As these plots demonstrate, the industry substitution did not precisely project the life-cycle of LEC-A's IOF copper, however, it did provide a reasonable estimate. The techniques presented in this paper, if applied in 1986, would have accurately projected the life of IOF copper. And done so, at a time when the potential of fiber to displace copper was not fully appreciated; and traditional HMA techniques suggested that the life would be 40 or more years.

Conclusion

Both technological obsolescence and traditional mortality factors affect the useful life, and they do so simultaneously. As such, both should be taken into account. Ignoring technological obsolescence and its unique mortality characteristics will result in a gross overstatement of the life.

The process presented in the paper provides a reasonable and practical method to accurately assess the economic life of property subject to technological obsolescence.

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Steve has over 20 years experience in the telecommunications industry. He is a registered Professional Engineer, a Certified Depreciation Professional, and has over 15 years experience assessing technological change, economic lives and property valuation. Steve has negotiated for adequate economic lives with federal and state regulators on behalf of his clients, and has testified as an expert witness in numerous valuation and rate cases in the areas of economic lives, technological change, depreciation methodology, and telecommunications network technology, methods and procedures. Steve is the Founder and President of BCRI Inc. and can be contacted at ~~(205) 943-6710~~ or sbarreca@bcri.com.