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The analysis of interdependence between corrosion, physical depreciation and market value in the evaluation process of special construction assets – pipeline transportation systems

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The objectives of this paper:

1st objective to establish an interdependence relationship between the market value – physical depreciation – the corrosion in the pipeline transportation systems evaluation process

2nd objective to identify and to translate into a mathematical relationship between **the CORROSION – like a factor that influence the value and the market value** - and to explain how it affects the value

Aim of study:

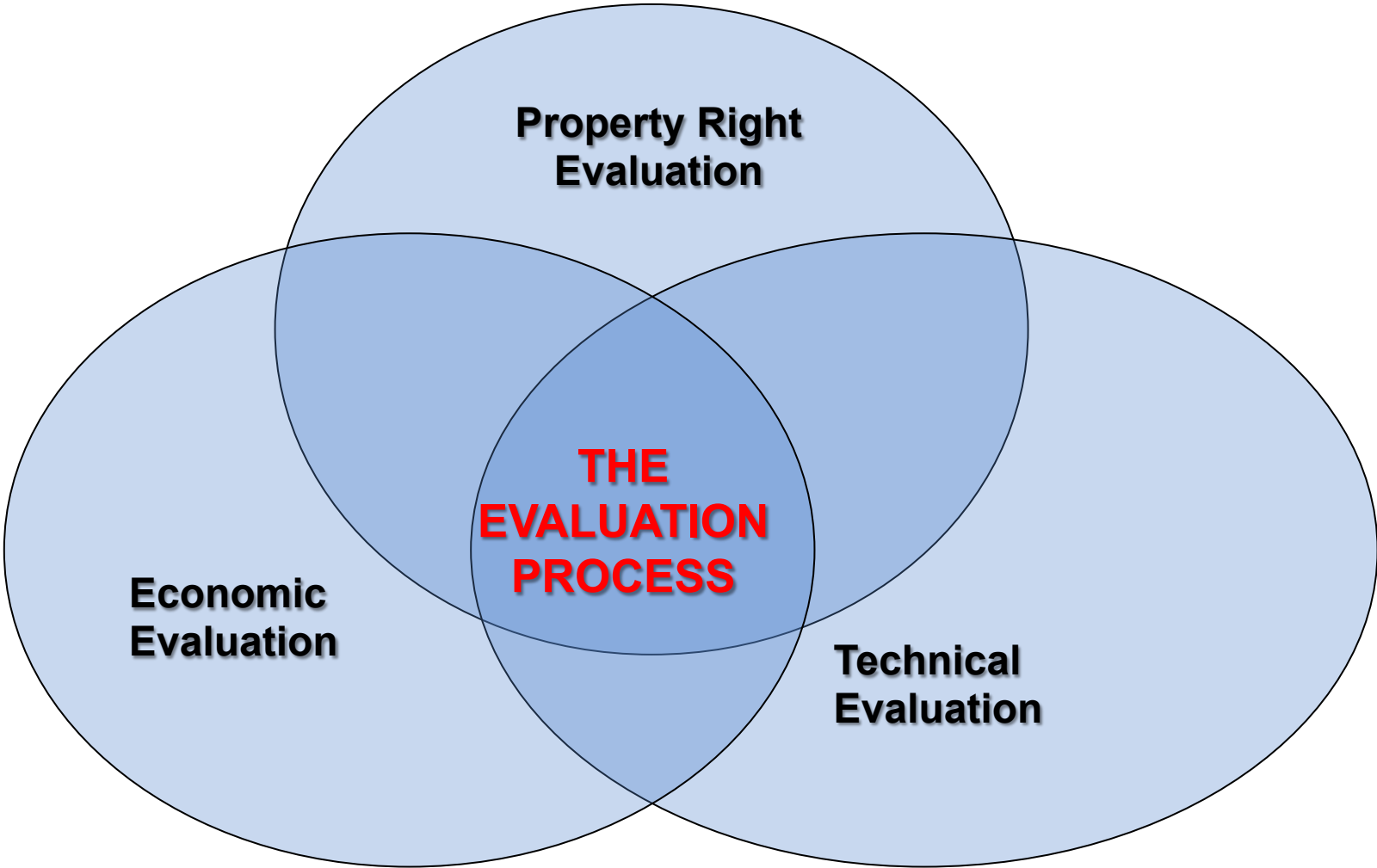
The correlation between the technical evaluation and the economic evaluation of the assets is little approached in the specialized literature.

The issues presented in this work represent a pertinent analysis of the specialized international literature and the databases.

Analyzing and commenting on the differences and similarities between valuation in accounting and assessment in valuation practice is a topic that is little approached in the literature, which is why the expressing of opinions and personal conclusions on them is an important contribution with wide applicability for both accountants and valuers .

Research methodology

The present study is based on fundamental scientific research by studying, analyzing and synthesizing existing bibliographic resources in the international literature and formulating own opinions on the issues of assessment of pipeline transport systems



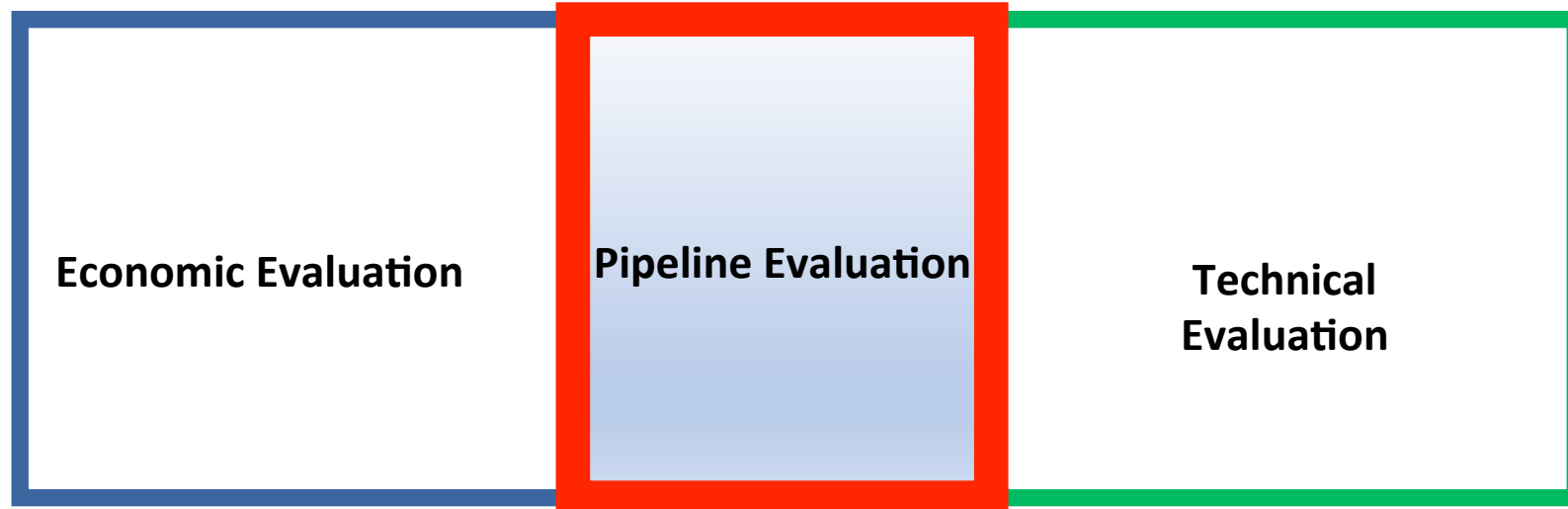
**Property Right
Evaluation**

**Economic
Evaluation**

**Technical
Evaluation**

**THE
EVALUATION
PROCESS**

Pipeline Transportation Systems Evaluation



The Investment Value may be different from the Market Value

In the book `` **About evaluation and verification assessment** `` Vascu, A., Ed. Iroval , Bucharest, 2015 in Chapter 7 – How many values has a good? :

`` *an asset theoretically has only one value* `` but there may be more values of the same good depending on the purpose of valuation, but between the values of the same good there should be no differences greater than 20%.

In practice valuation of the pipeline transportation systems the difference between market value and investment value is more than 20%

In my research work between 2014 - 2017 we analyzed several types of values in the pipeline evaluation process:

- Market Value
- Fair Value
- Investment Value

Fluid & Gas transportation by pipelines systems:

Advantages:

- pipeline transportation is the perfect tightness
- possibility of a continuous transportation (non-stop pumping)

Disadvantage:

- it requires very large investments

Evaluation of special construction assets like pipelines is a complicated process that does not use traditional approaches to evaluation, but rather a mixture of evaluation methods because each pipeline is unique in its own way, but also because its value is influenced by many factors. These factors, acting together, represent the influences the value of a pipeline from several points of view: the physical - chemical, technological and economical.

The main factors that should be taken into consideration when carrying out a modern, high quality evaluation, under specialty standards existing on the market are as follows:

- factors which depend on the material themselves (e.g. physicochemical characteristics and technological);
- factors that depend on the working conditions (e.g. temperature, pressure, chemical composition and properties of working environments-relax, streamline, corrosion etc.)

Types of impairment:

▶ **Physical impairment** is defined as a loss of value due to physical factors such as elements of the pipe not repaired in due time, changes in the structure of materials, the difference between the life span of the materials which the special construction is made from.

▶ **Functional impairment** is a loss of value due to the wrong dimensioning of the construction, due to deficiencies in design or usage.

▶ **External impairment** is that type of loss of value due to factors outside of the property (building), such as the presence of a pollutant in the area, a change in the request-offer ratio, the loss of income in an excess-supply market

In these types of impairments known in the literature, **corrosion** occurs as an important factor influencing the value of the pipes being in the physical depreciation.

The appraiser in the evaluation process has the mission to identify and translate into mathematical models of these factors and to explain how they influence the value .

Quantitative CORRELATION in the evaluation process



The market value of a pipeline transportation systems is influence by many factors:

Type of System: oil & gas, product, etc.

Size of pipe

Specification of pipe

Management (front and field office)

Date of Installation.

Maintenance of Property

Interconnects

Cathodic protection

Pipe coatings (vintage)

Environmental Concerns.

Demographics - urban or rural?

Chemical Content of Transported Product (H₂S, CO₂)

Market Diversity

Proximity to Markets.

Geography

The corrosion process is a complex mechanism that occurs during operation of all equipment and technological equipment in the refineries or pipelines systems or found in petrochemical installations and is done at oscillating temperature and pressure (high/low), in the presence of some work environments (type: crude oil, compressed gases, petroleum and petrochemical products, etc.).

Corrosion is defined as the destruction, in a certain span of time, of metals and metal alloys as a result of chemical and/or electrochemical actions of the technological environments and surrounding or due to physical dissolutions

“The assessment of specialized properties”,
 EstFalia Publish House, Bucharest,
 Romania, 2014,
 ISBN 978-606-8284-83-5



2014

In terms of evaluation process the **IMPAIRMENT** d is expressed quantitatively as the ratio of the effective age of the installation and the lifespan as to the cost of the new installation.

$$d = \frac{\text{Effective Age}}{\text{Lifetime}} \times \text{The Cost of New} \quad (4)$$

Applying and influence of corrosion on the devaluation can calculate depreciation according to the formula :

$$d = \frac{\text{Effective Age}}{\text{Lifetime}} \times \text{The Cost of New} \times \varphi \quad (5)$$

φ - the influence factor of depreciation due to corrosion

$$\varphi = \frac{M_n}{M_i} \quad (6)$$

- ▶ M_n – the pipeline at the time n when calculating depreciation;
- ▶ M_i - the initial mass of the pipeline at the initial time.

2015-2016

In real pipelines operation there are :

- corrosion processes with add mass material
- corrosion processes with lost mass material

I have reformulated φ - the influence factor of depreciation due to corrosion

$$\varphi = \frac{M_i + M_a}{M_i - M_p}$$

M_i – initial mass of the pipeline

M_a – mass added by the corrosion process

M_p – mass lost by the corrosion process

$$\Phi = 1 + \frac{Ma}{Mi} + \frac{Mp}{Mi} + \frac{Ma \times Mi}{Mi^2}$$

May be two ideal situations:

- We have no add corrosion and we only have corrosion loss: $Ma=0$

$$\Phi = 1 + \frac{Mp}{Mi}$$

- We have no loss corrosion and we only have corrosion add: $Mp=0$

$$\Phi = 1 + \frac{Ma}{Mi}$$

Conclusions:

- The relation between impairment (depreciation) and the influence factor of depreciation due to corrosion is the quantitative expression of the correlation between depreciation and corrosion and is a very useful tool for appraisers in predicting of the market value for pipeline transportation systems
- The value of this factor directly influences corrosion
- The smaller this factor is, the higher the amount of depreciation
- When this factor is closer to unity, which would be the ideal situation, there is a decrease in depreciation due to corrosion

As the value of depreciation directly affects the market value, it can be said that the factor of influence of depreciation due to corrosion φ directly influences the market value of the installation, namely the pipeline.

My next research field is to measure the level of corrosion of pipelines by traditional methods and development of correlation charts between corrosion and impairment