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TEGOVA
The European Group of Valuers' Associations

TEGOVA to assist the Ukrainian State Property Fund in developing a methodology for assessing war damage

At TEGOVA's General Assembly in Lisbon on 7 May 2022, Serhii Frolov, President of the Ukrainian Association of Bank Valuation Specialists (UABVS), gave a first-hand account of the war, having been accorded exceptional leave of absence from the army on the Eastern front in order to do so.

Iryna Ivanova (Ukrainian Society of Appraisers, USOA) and Oleksii Kalapusha (UABVS) outlined the plans of the Ukrainian government for the assessment of the war damage to property, including the costs necessary to restore such property (actual damages), and income that could have been obtained under normal circumstances if the rights of owners had not been violated (loss of profit) as a result of the armed aggression of the Russian Federation. An inter-governmental working group has been established to develop an appropriate methodology for such assessment. In this connection the Ukrainian State Property Fund, the body which regulates the valuation profession and practice, had earlier written to TEGOVA seeking its assistance in developing the methodology to be applied by local valuers.

The General Assembly gave its unanimous support to TEGOVA's European Valuation Standards Board (EVSB) to opine, in due course, on the draft proposals of the inter-governmental working group. Also, as requested by the Ukrainian delegation, the Assembly mandated the EVSB to advise on the extent to which the draft proposals are consistent with EU law, particularly in relation to environmental matters.

*Front row from left: Oleksii Kalapusha (UABVS, Ukraine), Nino Beraia (IVSG, Georgia) and Krzysztof Grzesik (Chairman of TEGOVA)
Back row from left: Serhii Frolov (UABVS, Ukraine), Iryna Ivanova (USOA, Ukraine)
and Paulo Barros Trindade (Chairman of ASAVAL, Portugal, and Member of the Board of TEGOVA)*

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EDITORIAL #1

New EU law on rapid deployment of rooftop solar installations

On 18 May, the European Commission launched a REPowerEU Plan including game-changers such as common purchase of gas, LNG and hydrogen and industrial transformation/acceleration of hydrogen and biomethane.

For buildings, the Green Deal revolution is intensified by higher renewables and energy efficiency 2030 targets:

- The target for the share of energy from renewable resources in the Union's gross final consumption of energy is raised to 45% from 40%.
- The target for reduction of energy consumption is raised to 13% from 9%.

If passed by the Council of Ministers and the European Parliament, these new targets will have major impact on energy regulation of buildings as buildings are the biggest component by far of EU GHG emissions and energy consumption. Higher overall targets mechanically create greater immediate pressure to goldplate the building-specific energy legislation currently under negotiation.

And the first building gold-plating is in REPowerEU itself: mandatory installation of rooftop solar installation by dates varying from 2027 to 2030. The only real estate exempted is existing residential and public and commercial buildings smaller than 250 m^2 or with low solar potential (limited access to light, etc.)

This comes with further EU regulation limiting the length of permitting for rooftop solar installations, including large ones, to a maximum of three months.

The catalyst is the war. The first and most urgent purpose of REPowerEU is to immediately compensate for what looks like permanent loss of Russian gas, oil, coal and uranium. That involves inter alia a return to EU coal extraction and use that will increase GHG emissions. The Commission calculates that because of that, the only way to reach the 2030 55% emission reduction target is to accelerate the transition to renewables.

And it sees roof-top solar as the "low-hanging fruit" with "huge untapped potential" that can "be deployed very rapidly, as they utilise existing structures and avoid conflicts with other public goods like the environment" [read 'windfarms']

Owners to foot the bill

The Commission previews that the bill for PVs will be €26 billion just from now to 2027 and – doubtless emboldened by the exemption of residential and small commercial – says up front that most of the financing will be private, although it does plan additional funding from the auctioning of allowances of the Emissions Trading System. It also plans for transfers from Cohesion and Common Agricultural Policy funding, but that's not new money. For instance, transfer of CAP funding to energy projects – even rural ones – means less payments for farmers.

EDITORIAL #2

European sovereignty made real

Let's consider TEGOVA's Valuation Standards and Qualifications from an angle that seems at first glance far removed from our professional concerns: the concepts of 'sovereignty' and her sister 'control'.

'Sovereignty' is a concept that has been bouncing around Europe for a long time, but until recently it was the preserve of Eurosceptics. National sovereignty' was about 'taking back control' from 'Brussels', that cosmopolitan, polyglot, ultra-liberal, rule-making, spirit-breaking capital of nowhere.

Only very recently has sovereignty become what the European Union is all about: power and freedom for Europeans to live as they see fit without any foreign power imposing its political and economic models or agenda.

It is the Europe that protects' and suddenly everything's coming together at the same time: military sovereignty, space sovereignty, digital sovereignty and now health and energy sovereignty expressed as solidarity, with all Europeans sharing their vaccines equally and manufacturing them at home, here, in the Union, and now plans to share gas supplies.

At its more modest level, TEGOVA got there first. TEGOVA started to take back European control a decade ago.

Ten years ago, TEGOVA had a clear vision of European sovereignty, and the first full-blown manifestation of that was EVS 2012: standards by and for Europeans in lock-step with EU law. We never looked back, and as EU law started to take an ever more important role in financial and real estate markets and in building sustainability, we had lots to work with.

European valuation qualifications must be seen in that same context.

Like EVS, the Recognised European Valuer designation is made by and for Europeans. I want to emphasise the 'by'.

Even ten years ago, when TEGOVA had half the members it has today, it already covered most of the EU and EU-candidate member states and every one of them had the opportunity to take part in the drafting of EVS and in the creation of REV and TRV.

TEGOVA is a democracy and it's inclusive. Even those who are not on a standards or qualifications Board get lots of opportunity to have their say.

Let's make this real with a practical example.

In the autumn of 2019 in Sofia, the TEGOVA General Assembly – a hundred people – scrutinised the future EVS 2020. Some of them were not happy with a Blue Book that laid down that "the Comparative Method assesses market value through an analysis of prices obtained from sales or lettings of properties similar to the subject property". They felt that such dogma is fine for certain 'developed' markets, but that there are plenty of countries where sales prices just don't cut it, because the local market is what it is, i.e. not necessarily all that transparent.

The draft EVS were adapted in consequence. EVS 2020 says that, ideally, sales prices are optimal, but that "valuers should also have regard to other relevant market information and data upon which they may need to place greater reliance particularly in those markets or situations where information about transactions is either unreliable or simply not available."

What chance do you think there is of achieving that result anywhere else than TEGOVA?

That's what sovereignty means in practice. It means you have control, and the same goes for qualifications.

The design of REV and TRV was a collective effort, and when it was done, implementation fell to the members. TEGOVA provides the educational and professional requirement framework, but beyond that, it's the member association that awards REV in its country. It's the member association that provides the continuous professional development and it's the member association that controls existing REVs and TRVs to see if they still merit the title.

'All' that TEGOVA does is periodically inspect each REV-awarding Member Association's processes to ensure that the procedures are working properly. That way, we have harmonised quality control throughout Europe, but each association has the flexibility to adapt to local conditions.

The result has been a resounding success with thousands of highly qualified REVs and TRVs all over Europe and with a new boost now coming from the candidate-awarding associations that had to wait for the end of lock-down for TEGOVA inspectors to be able to visit.

But for most of us, sovereignty is not an end in itself. It has to work. It's 'just' an enabler.

Why have so many TEGOVA member associations and thousands of professionals taken up REV? To feel sovereign? More likely because it works.

It works because it is highly price-competitive. TEGOVA works for its member associations, leaving them enough margin to benefit their individual valuers by charging a reasonable price.

It works because governments and banks are asking for the title from those who do their valuation work.

And above all, it works because clients of all kinds increasingly recognise it and value it. In many countries it has given TEGOVA valuers a chance to compete for a certain kind of big international property investor client that used to be the preserve of the big international valuation firms.

Just one example: Ireland.

Not only are government departments and banks giving work to what the Irish call 'Blue Book valuers': REVs and TRVs.

But better still, Blue Book Valuers now occupy bank valuation panels that check to make sure that all valuers employed and commissioned by the bank have the necessary qualifications.

The dissemination of TEGOVA qualification culture helped to professionalise the profession, and many estate agents now have separate valuation sections with REVs and TRVs in their office.

In Ireland, gone are the days when only a few big firms in Dublin got all the good work – even in the provinces!

The story of how this was done is in the next article. But for all the talent and doggedness of Pat Davitt and his IPAV colleagues, none of this would have happened without EU imprimatur.

Respect for TEGOVA's qualifications flows from respect for EVS. EVS was recommended to the Member States in the Mortgage Credit Directive and above all, the European Central Bank in its Asset Quality Review manual has repeatedly given EVS precedence over all other standards.

TEGOVA worked hard with its members to develop high standards and qualifications, but it's the EU that gave us our chance.

EVS, REV and TRV are European sovereignty made real, with positive outcomes for the valuation profession and its clients.

REV and TRV have permeated the Irish real estate economy like veins of fat in good beef.

RECOGNISED REV EUROPEAN VALUER

RECOGNISED TRV RESIDENTIAL VALUER

Michael MacBrien, Editor

#01
The Road to Irish Blue Book valuation

In the late 2000s as concerns grew about a property crash, those in positions of power assured the Irish public that there would be a soft landing. When the full extent of the fallout emerged, 57% on average had been wiped off the market value of properties, with assets like development sites losing up to 90% of their value. There were no national valuation standards in Ireland at the time. The crash of 2008-2012 proved to be the catalyst for the introduction of European Valuation Standards, initiated, not by the State but by the IPAV.

Patrick Davitt

What a difference a year makes – How the Irish Central Bank tilted to EVS

The Irish Central Bank in its draft report: 'Valuation Processes in the Banking Crisis – Lessons Learned – Guiding the Future' (Draft 11 December 2011) stated in relation to valuation standards:

"From the perspective of the Central Bank, The Royal Institution of Chartered Surveyors 'Red Book' of valuation standards is consistent with the principal rules of International Valuation Standards and is considered to be appropriate practice and compliant with the Capital Requirements Directive (CRD)."

There was no mention whatever of the Blue Book, no valuer in Ireland was using the Blue Book valuation methodology at the time.

IPAV which then had 750 members, including 300 valuers, decided it was time to seriously examine what would be the best approach to take towards the introduction of standards. Some felt the only way to go was to join RICS and use the Red Book standards.

However, we carefully studied the valuation standards available and concluded that the European Valuation Standards (EVS, the Blue Book), compiled by TEGOVA since the early 1880s would best serve Ireland. Part of our deliberations involved consideration of the fact that the UK was then threatening to leave the EU while Ireland was committed to Europe. The decision in favour of EVS was not just prescient, it marked a progressive move for IPAV Ireland.

The Central Bank of Ireland's final report was due out in December 2012. IPAV met with the bank and proposed that the alternative EVS standards be considered. They became persuaded of our arguments on the importance of EVS and their depth and breadth. The CBI gave us 12 months to get the Blue Book to Ireland and to train valuers. It was no mean task in such a short time frame.

IPAV was awarded membership of The European Group of Valuers Associations (TEGOVA) in May 2012. The Blue Book standards were quickly introduced with the Recognised European Valuer (REV) scheme rolled out to members. 120 valuers were trained before the end of September 2012.

We again met the CBI in October 2012. They were suitably impressed with progress, their final report - for which IPAV was looking for the inclusion of the Blue Book - was published in December 2012 and did not disappoint.

The 'Valuation Processes in the Banking Crisis – Lessons Learned – Guiding the Future (Final 18 December 2012) states in relation to valuation standards:

"Examples of *valuation standards consistent with the principal rules of International Valuation Standards and considered to be appropriate practice include the Royal Institution of Chartered Surveyors (RICS) 'Red Book', the European Group of Valuers Associations (TEGOVA) 'European Valuation Standards 'Blue Book', and The International Valuation Standards Council's 'International Valuation Standards White Book'.*

This was the confirmation IPAV had been waiting for - recognition of the Blue Book as one of the preferred valuation standards that could be used by Banks in Ireland.

We owe a great debt of gratitude to the TEGOVA chairman at the time, the late Roger Messenger, Michael MacBrien and the secretariat and to the full Board of TEGOVA for the huge support and great willingness to help us succeed in getting the EVS set up in Ireland.

Meanwhile the recriminations started, questions were being asked and answers sought for the causes of the property crash. A Joint Committee of Inquiry into the banking crisis was set up by the Houses of the Oireachtas [Ndir Parliament], the (Inquiries, Privileges and Procedures) Act, 2013.

> "This was the confirmation IPAV had been waiting for - recognition of the Blue Book as one of the preferred valuation standards that could be used by Banks in Ireland."

I had the unenviable distinction of being the sole representative of the Irish valuer profession called to give evidence to the Inquiry. Over three hours, eleven Oireachtas members probed the whys and why nots of property valuations and their role during the property crash. Among the many questions posed was one in relation to a Dublin residential site valued at €429 million in September 2008; at €325 million in November 2008 and at €45 million in November 2011. I was able to confirm that IPAV valuers were now using EVS and all market valuations were spot valuations completed at a point in time.

As professional valuers will appreciate, there is an enormous difference between spot valuations or market valuations and future valuations, seemingly what the Oireachtas members though valuers should have been supplying.

The recognition of the high standards of the Blue Book recognised by the European Central Bank, for which they held default status in the event of a dispute, while rewarding, was just the first step. The task now was to get EVS recognised, used and required in valuation instructions and a huge amount of work still remained to be done so they would receive due recognition of their status by Government Departments and Banks.

We knew the European Mortgage Credit Directive was going to be a big help as it would insist on the Irish Government deciding on national valuation standards.

The transposition of the Mortgage Credit Directive into Irish law finally came in 2016 and involved the issuing of a Statutory Instrument by the Department of Finance. IPAV worked with the Department in drawing it up.

> "It is very important for all TEGOVA member associations looking to go down the IPAV route to foster good relationships with all financial houses, even very small lenders"

Section 201(3) states: "A creditor shall use reliable standards, such as those developed by the International Valuation Standards Council, the European Group of Valuers' Associations or the Royal Institution of Chartered Surveyors, when carrying out a property valuation of residential immovable property for credit purposes."

IPAV members were now confident beyond any doubt of the elevated status of the Blue Book.

IPAV immediately built on local relationships with lenders and decision makers in government departments, financial houses and banks to brief them on the legislation and ensure their valuation templates and instruction letters included the Blue Book as well as the Red Book. It meant existing templates had to be amended. In some cases, banks needed board approval to get the necessary agreement. It is very important for all TEGOVA member associations looking to go down the IPAV route to:

a) foster good relationships with all financial houses, even very small lenders to the large Pillar banks, and

b) have the EU/national legislative knowledge to be able to persuade them to amend their valuation templates.

Patrick Davitt.
FIPAV REV is CEO of IPAV and immediate past Member of the Board of TEGOVA.

#02

An alternative method for determining the capitalisation rate in countries with less developed capital and real estate markets

Igor Pšunder

Jure Kern

Klemen Kavšek

Samo Javornik

Abstract

The build-up method is one of the key methods for determining the capitalisation rate In countries with less developed capital and real estate markets. A procedure that methodologically follows the one used by the American Society of Appraisers has been used so far, but it is extremely difficult to determine individual variables in a reliable and accurate way.

This paper deals with the deriving of the build-up method from the market equilibrium model. On this basis a three-variables model has been obtained that is at least equivalent, from a professional point of view, to the procedure used in the past, and therefore the use of this model has been suggested. Due to a small number of variables, the determination of these is easier, and the possibility of errors is also reduced.

In the empirical part, the results have been tabulated on the basis of reference sources and empirical tests to provide guidelines for determining the individual variables.

KEYWORDS:
real estate appraisal,
direct capitalisation method,
capitalisation rate, build-up method, three-variables model.

Introduction

The Slovenian Institute of Auditors is an institution that educates, supervises and provides professional support in the fields of auditing and valuation, including real estate appraisal. In the course of supervision of valuation, the members of the Slovenian Institute have found that the appraisers use an unusually large dispersion of capitalisation rates in their valuations (Pšunder, 2013). As a result, an expert group was set up to reformulate the build-up capitalisation rate model and provide guidelines for setting the risk premium.

1.Theoretical background

The build-up method, which has been used in Slovenia since 2018, is based on the market expectations of real estate market participants, as described by Hendeshott (1997) with the market equilibrium model. The basic market equilibrium model is based on the assumption that risk-adjusted expected returns are the same across different investments, which means that the required return on real estate is equal to the return on risk-free investments increased by a risk premium (including an illiquidity premium and an investment management premium). The return on real estate investments consists of the rental yield and the change in the real estate value. Therefore:

$$R + a = f + p \quad (1)$$

where:

- R is the rental yield,
- a is the change in the real estate value,
- f is return on risk-free investments, and
- p is risk premium (including illiquidity premium and investment management premium).

The equation (1) can be rearranged to give:

$$R = f + p - a \quad (2)$$

The relationship between thechange in the real estate value and the capital recovery premium is as follows:

$$-a = d \quad (3)$$

where:

- a is the change in the real estate value, and
- d is the capital recovery premium.

A model for calculating the capitalisation rate by means of build-up is obtained by derivation:

$$R = f + p + d. \quad (4)$$

2. Calibration of variables

In the three-variables model, only three variables need to be specified, two of which are analytically calculable – the return on risk-free investments and the capital recovery premium. In addition to these variables, the capitalisation rate depends on the risk premium, which can only be determined empirically. The risk premium also includes an illiquidity premium and an investment management premium.

2.1. Risk premium

The risk premium mainly depends on:

- type of property,
- location (this affects the possibility of loss and changes in rent), and
- to a lesser extent, other factors (e.g. the functional characteristics of the property).

The type of property influences the type of tenant. For example, it is well known that tenants of flats are very reliable rent payers, whereas the opposite is true for tenants of small commercial premises. For the latter, there is a slightly higher degree of uncertainty regarding the permanence of the tenancy as well as the reliability of rent payments.

The location of the property is also important. In more attractive locations close to centres of interest, vacancy rates for particular property types are certainly lower than in peripheral locations.

Based on a review of the theoretical background, several comparable studies in Slovenia and elsewhere, as well as empirical data and the actual requirements of investors in real estate investments, the collected and systematised data have been classified according to the type of property and the level of risk stemming from the location, the economic environment and the functional characteristics of the property (Table 1).

"In recent years, the straight-line method has been increasingly replaced by methods which take into account that the capital recovery premium accounted for yields a return over the period until the property's useful life expires."

Table 1:
Risk premium for real estate investments

	LOW RISK	
TYPE OF PROPERTY	FROM	TO
LAND*	2.5%	3.0%
FLATS	2.2%	2.7%
HOUSES	2.4%	2.9%
COMMERCIAL PREMISES	5.0%	5.5%
OFFICE PREMISES	5.3%	5.8%
TOURIST REAL ESTATE **	5.4%	5.9%
INDUSTRIAL REAL ESTATE	6.0%	6.5%
	NORMAL RISK	
TYPE OF PROPERTY	FROM	TO
LAND*	3.0%	3.5%
FLATS	2.7%	3.2%
HOUSES	2.9%	3.4%
COMMERCIAL PREMISES	5.5%	6.0%
OFFICE PREMISES	5.8%	6.3%
TOURIST REAL ESTATE **	5.9%	6.4%
INDUSTRIAL REAL ESTATE	6.5%	7.0%
	HIGH RISK	
TYPE OF PROPERTY	FROM	TO
LAND*	3.5%	4.0%
FLATS	3.2%	3.7%
HOUSES	3.4%	3.9%
COMMERCIAL PREMISES	6.0%	6.5%
OFFICE PREMISES	6.3%	6.8%
TOURIST REAL ESTATE **	6.4%	6.9%
INDUSTRIAL REAL ESTATE	7.0%	7.5%

* Car terminals, landfills, platforms, open-air storage areas or land where no change in use is foreseen and/or expected in the long term.

** Apartments, multi-apartment buildings, apart-hotels, small hotels.

The level of risk is a subjective assessment of the appraiser, determined and reasoned appropriately based on the knowledge of the location and the market conditions prevailing in that location at the time of valuation. Functional factors, such as specific architectural solutions that are interesting only for a limited range of users, may also increase the risk. In any event, the main guideline for determining risk remains the appraiser's assessment of the potential for vacancy and illiquidity of the property being valued in the local market

2.2 Capital recovery premium

As real estate deteriorates over time, a capital recovery premium should (as a rule) also be taken into account. Until recently, the straight-line method has been most often used by appraisers, probably because it is the simplest. It assumes a steady deterioration of the property over time, which often does not correspond to the actual situation. The capital recovery premium is calculated by dividing the remaining useful life of the property equally over the number of years, which can be written as:

$$P_{ok} = \frac{1}{n} \quad (5)$$

where the variable P_{ok} represents the capital recovery premium and the variable n the number of years of useful life of the property. It should be noted, however, that for deferred recovery (lower replacement reserve), the actual useful life is significantly reduced compared to the declared one, which is also the case for all methods of the capital recovery premium.

In recent years, the straight-line method has been increasingly replaced by methods which take into account that the capital recovery premium accounted for yields a return over the period until the property's useful life expires. These methods are more technically sound and are based on an index of accumulated depreciation adjustments. Thus, in the model presented, the capital recovery premium is usually calculated according to the following equation:

$$P_{ok} = \frac{r_r}{(1+r_r)^n - 1} \quad (6)$$

where rr is the return on reinvested funds.

Irrespective of the method used, the market analysis and the impact of real estate market movements and the related capital recovery premium have not been the focus of real estate appraisers in practice to date. Such an analysis could, in the extreme, also show that it is not even necessary to charge a capital recovery premium.

A border case of a ground-floor bar on the Tromostovje in Ljubljana (a central point in the Slovenian capital) should be considered here. Even if the building is 100 or more years old, if it is properly maintained, the value increases in the long term. This raises the question of the appropriate level, or even the reasonableness, of the capital recovery premium.

The opposite is the case of an insufficiently and deferred maintained property where the share of the location premium in the value of the property is small. In such cases, the property will experience a higher-than-average fall in value, hence the need for a higher capital recovery premium.

The declared useful lives for each type of property are shown in Table 2, but it should be emphasised that the determination of the useful life for a property under assessment depends on the level of maintenance of the property in question and the expected growth in properties of the type assessed in the local market. Therefore, the useful life for a particular property may deviate significantly from the declared useful life for such property. The stated useful lives should be regarded as indicative only and in practice the useful life should be assessed on a case-by-case basis.

Table 2: Useful lives of property

TYPE OF PROPERTY	USEFUL LIFE IN YEARS
LAND	-
FLATS	80-100
HOUSES	80-100
COMMERCIAL PREMISES	40-80
OFFICE PREMISES	60-80
TOURIST REAL ESTATE	30-50
INDUSTRIAL REAL ESTATE	50-80
INDUSTRIAL REAL ESTATE	6.0%

5. Conclusion

Determining the capitalisation rate using a three-variables build-up model is a simplification of valuation based on the direct capitalisation method and will certainly reduce the dispersion of the results of the capitalisation rates for individual property types.

The guidelines given in the form of a table of research results (Tables 1 and 2) are indicative only. Properties should be judged on a case-by-case basis, but major deviations from the results given should be justified and supported by evidence. Historically, it has been shown that capitalisation rates do not change significantly or instantaneously.

The results of the present study were subsequently verified by a pilot study carried out by the Slovenian Institute of Auditors and the Surveying and Mapping Authority of the Republic of Slovenia. In the study, the available market data on prices and rents were initially statistically processed, their quality checked, geographically segmented, and then a method of determining the market capitalisation rate based on paired sales prices and rents for offices was developed and tested. The results of the study showed the consistency of the results of the market capitalisation rate method and the three-variables model presented above.

We see a wider European relevance of the presented method and believe it is worth considering for incorporation into the Methodology section in the next edition of European Valuation Standards.

Disclosure

The present paper is summarised and adapted from the article Determining the capitalization rate (Pšunder, Kern, Kavšek, 2018).

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Igor Pšunder PhD is a civil engineer and certified real estate appraiser. He is a member of the Management Board of the Sava pokojninska (Pension Company) and professor at the Faculty of Civil Engineering, Traffic Engineering and Architecture of the University of Maribor.

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Klemen Kavšek, is a partner in the valuation and financial consulting company KF Finance d.o.o.. He is an expert in valuing cash flow generating properties. and in the valuation of NPLs secured by real estate. He participates in the formulation of professional guidelines for valuations of trade related properties (TRPs) at the Slovenian Institute of Auditors.

Samo Javornik PhD is a certified company valuer, lecturer and author of software packages for corporate valuation. President of the Board of the Section of Certified Valuers and President of the Expert Council at the Slovenian Institute of Auditors, he has chaired numerous boards and investment committees and led many project teams from various fields.

It's hard not to notice the pig the world around us is charging at an unprecedented pace, and impacting the valuation profession with much more yet to come.

AI – friend or foe?

Martin Malinom

TEGOVA started the debate on Automated Valuation Models (AVMs) in a short report on our profession several years ago. Two AVM specialists contributed an article and academics pointed to the limited usefulness of statistics in single-property valuation assignments. Not only do I share these views, but also endorse EVS 2020's (EVS 7 embracing (not denying) AIMs as useful tools for valuers, which however enable to assess Market Value without the human element of a valuer's intuition.

Despite the balanced position expressed in EVS7 the atmosphere of technological revolution has fuelled an exaggerated trust in computers leaning toward the replacement of blow and expensive walking-talking surveyors, perceived as standing between loan origination procedures. Forgotten are the warnings of regulation commentators and institutions pointing to the abusive use of AIMs as one of the reasons for the financial crisis 14 years ago following the collapse of Lehman Brothers.[1]

Yes, banks are less willing to rely on valuers as alibis, at least as long as relatively cheap insurance premiums suggest the risk of any potentially serious AVM valuation errors. No, we feel helpless, though. A possible solution for the profession is specialisation in the areas where predictive machines are less useful as in the case of the valuation of specialist properties or even commercial properties.

> *"Nowadays the difference between Market and Fair Value is hardly evident."*

Nevertheless, we should not neglect the need to educate the public, AIM-throughs to public attention the dangers of AIM domination. Can it lead to the end of an open market? Already in some residential markets it has been observed that AIMs focuse on the asking prices for their properties after checking their value as an internet based AIM. Potential buyers do the same and arrived with this information between the parties easily agree upon a transaction price. Even ignoring the non-transparency of providers of such tools, one may easily conclude the advent of internet based market prices. We experienced this in Poland during the communist era and only we would not like to see a revival of the past.

At the same time, artificial intelligence is the key to accelerating the technological revolution.

Actually, AIMs are just a sign of this wider process, which however does not necessarily need to be a bad thing, encouraging such clearly emerging events as the shorter reporting periods. What matters is the potential of human/machine interaction to better encompass the complex and science of valuation. In this light, relying blindly on overpricing simple (not to say primitive) statistical methods of valuation may be a dead end.

In valuers we trust

Whilst the world has still not overcome the pandemic, it was further shocked by Russian aggression against Ukraine. Such extraordinary tragedies contribute to the longer factors due to lack of market data for comparative-based valuations and the unprecedented outcomes of such disasters. Appraisers however do not only valuers have sold more services during these tough times. This was also the case after the collapse of Lehman Brothers.

It is common knowledge that highly professional services sell more when uncertain times people place trust in humans rather than machines. This was noted during the Polish national valuation conference in 2021. When all participants were asked how more valuation assignments despite the pandemic, or rather due to it. Clients have remarked that they perceived qualified valuers as trusted partners in times of the value of their properties, whilst in more stable times they would typically rely on opinions of brokers or just asking prices. Therefore, quite surprisingly leading challenges may also constitute opportunities.

Market Value versus Fair Value

Increasing globalisation has led to a need for unification of accounting. Therefore there seem a similar trend taking place in our profession in which the definition of Market Value is a visible sign of such successful unification. Valuation is both an art and a science and despite the obvious differences between these two whole they need to coexist. However, with increasing demand for valuations for financial reporting purposes, the concept of Fair Value is coming to the fore. Moreover, our understanding of Market Value is being well assimilated by the world of finance, resulting in the definitions and interpretation of both the bases of value becoming ever more similar. Nowadays the difference between Market and Fair Value is hardly evident. Now more than the further regarded valuation authority, Joint Work Friends predicts that Market Value will disappear and be completely replaced by Fair Value[2].

Value of Standards Unification

Have warmly welcomed the EVS1 statement that valuation of real property is an art. Whilst this may be obvious to many valuers, it

> *"[...] unification of European valuation practice is the main challenge faced by contributors to future editions of European Valuation Standards."*

may be harder to accept by scientific-minded accountants and auditors. Therefore, there is a need for wide ranging dialogue between respective professional bodies in the interests of connecting these two worlds and to promote common language relating to not only valuation bases but also methodologies.

One of the platforms for such communication could be the European Valuation Standards as a single source of best valuation practice. Also, it is worth remembering that apart from regulating our profession the standards also have an educational element for real estate market stakeholders.

Still, unification of European valuation practice is the main challenge faced by contributors to future editions of European Valuation Standards. The first step has already been made with the publication of a major section on methodology. However, it is a tough decision as where to draw the line between standards and a textbook, albeit for new methodology information where attention with the addition of more content to EVS.

I have already had an opportunity of writing in European Valuer about the importance of clarity in terms of different types of yields and how much a common sense of understanding may affect valuation results. This has been left unnoticed by many valuers but is much more, including the way valuers construct their cash flow. Real estate, switching from annual cash flows to monthly ones without applying relevant adjustments leads to value overestimated. This is not commonly appreciated by the recipients of our valuation reports and quite probably even among some valuers. Thus, is for the role of a leading professional body to provide its members and the public with some guidance on nuances which may have such serious consequences. Perhaps we should not convert EVS into a textbook, perhaps we should at least signal such issues and provide references to reliable external sources. With time, TEGOVA could even start publishing its own textbooks.

New areas

Again, our future profession must be built on trust. Also, we should not only go providers of valuation reports but rather clients' advisors with a much more multidisciplinary outlook. I welcome TEGOVA's recent involvement in setting standards for business valuation and the imminent publication of European Valuation Standards in respect of Plant, Machinery and Equipment. I also appreciate TEGOVA's decision not to confuse the audience by creating one-size-fits-all valuation standards but to deal with each asset class in a stand-alone set of standards.

But this accelerating world opens up new frontiers requiring TEGOVA's attention. For example, ESG (Environmental, Social, Governance) will become one of the most important talking points in the real estate market in the years to come. EU legislation, rising cost-effectiveness of the capitals and reputational calculations have already convinced many stakeholders to establish their ESG strategies, start measuring carbon footprints and reduce carbon. I feel that we will our profession be ready to assist clients in their ESG-related tasks, including valuation? During the TEGOVA General Assembly in Brussels in Autumn 2021, these questions were raised by several speakers but found no answers except for the idea of EU regulation of energy performance of buildings.

I believe we embrace this topic with greater urgency to make valuers the natural destination for anybody seeking advice on real estate ESG. And there is no better place to start than in the enhancement of EVS guides through the application of the well ahead of the next edition of EVS. In particular a chapter on valuation and sustainability should include guidance on the "D" and "E" elements of ESG.

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#04

Valuers and AVMs– from adversaries to Dream Team

Too often the 'debate' about AVMs is Manichean, Good or Bad, Black or White.
The authors of this article break that mold, building a bridge between man and machine that fosters excellence. Their central thesis is that truly 'stand-alone' AVMs are simplistic, limited and curiously outdated. They hold that the increasing complexity of modern phenomena shaping real estate markets puts the qualified valuer's independent judgment centre-stage … on the condition of understanding, managing and building upon the essential data that AVMs can provide.

Małgorzata Renigier-Biłozor

Marek Walacik

The authors:

- Get a handle on what an AVM really is
- Set out the conditions for optimal AVM outputs stressing the several levels requiring valuer involvement
- Suggest the curricula and CPD programmes needed for valuers to make the best of AI and AVMs

An AVM is a simplification, a kind of abstract reflection of a reality which, apart from its complexity, also undergoes dynamic, often unpredictable changes. The models in which the input elements and rules of transformation are defined, provide an image of the analysed phenomenon that gradually begins to replace the analysed reality in the recipients' perception, often unconsciously.

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These days, the creation of various types of automation models is so natural and common that one ceases to think of the consequences when these are either too simplified, which leads to a distortion of reality, or excessively complex, which makes it difficult or even impossible to interpret the analysed reality.

Although there are no universally agreed definitions of automated valuation, one can find a number of clarifications provided by organisations involved in property markets and the so-called real estate industry, but the clarifications don't focus on the same criteria. See Picture 1.

Automated Valuation Models (AVM) remain in conflict with ingrained valuation methods, instead of being treated as an opportunity to increase their efficiency. Reluctance to adopt and use automated valuation applications can result from both lack of awareness of these solutions, their application rules and justification of the results. Such situations predominately result from stereotypical, often incorrect understanding of AVM concepts, usually leading to their inconsistent use and becoming a source of antagonism between valuers and their clients and within the property valuation community.

"Automated Valuation Models remain in conflict with ingrained valuation methods, instead of being treated as an opportunity to increase their efficiency."

There is a clash between two opposing approaches. The opponents underline the advantages of traditional valuation methods and approaches and faith in the competence and objectivity of property valuers who carry out personal inspection on the property. On the other hand, automated solutions' proponents emphasise a wide range of possibilities opened up by modern technologies imitating human reactions and advanced automatism in data processing and collection development. In extreme cases, valuation clients argue that valuers undermine their opinions by manipulating their results. Nor is this issue always clearly perceived by appraisers who on the one hand would like tools to support them during the valuation procedure but on the other fear earnings reductions and loss of work through replacement by automats. Some property valuers fear not keeping up with learning new applications of technological solutions as well as mathematics and IT techniques that seem to be "black box". The IT industry may also have negative impact if its developers lack direct experience of valuation.

The property valuation profession and its clients are at a turning point in the development of valuation methodology and the acceptance of its pandemic-accelerated transformation. This process has been accelerated (in many situations forced) by the COVID-19 pandemic and all the consequences of the imposed restrictions, provoking speculation about "the future of automated real estate valuations" (Baum A. et al., 2021). The arguments for and against their use stem from scientists and valuers are presented in Table 1 below.

Picture 1. Comparison of the automated valuation terminology. Source: own elaboration on the basis of IVSC, EEA, EMF&EEA, FAO, OPA, IAAO, MDoR

Table 1 – Arguments for and against the use of automated solutions

	IN FAVOUR	AGAINST
SCIENTISTS	• quality improvement of property valuation models • similar properties selection support • market similarities selection support • large datasets information delivery • minimise time consumption • valuation cost reduction • allow judgments to be validated (arbitration/disputes resolutions) • credibility for results verification	• statistical knowledge requirements • large dataset requirements, remote data collection challenges • substantial barriers in the application and interpretation of results • unsuccessful attempts to "suppress uncertainty" • problems with the standard distribution identification
VALUERS / CLIENTS	• valuation objectification • valuation process acceleration • work efficiency increase • used in many countries • possible temporary use by professionals with physical disabilities	• specific property features exclusion • lack of reflection on investor behaviour • difficulty in interpreting the results (black box) • high data requirements • reducing fees for valuations

Source: own elaboration

The principal arguments against the use of automated solutions for property concentrate on the uncritical use of valuation results by entities without mathematical and valuation knowledge and fears of job and income losses by property valuers. **We, however, would emphasise the key emerging role of the qualified valuer in interpreting AVM results and complementing them with added analytical value addressing new market/client trends and needs.** It must be emphasised, however, that an AVM process is understood as consisting of several stages of which only some may be automated in support of valuation procedures, therefore one should consider the justification for extending the role of AVM's results for several important reasons. One is the changing awareness of property valuers' clients, who are becoming ever more conscious of market value phenomena and long-term property investment strategies that require advanced market analysis taking into account many socio-economic factors and real estate value forecasting criteria. Another is that, whilst modern technologies and systems enable the acquisition of information from many data sources and facilitate the search and selection of real estate and comparable markets, **the wide access to information on big data platforms creates ever-greater 'information noise'. The louder the noise, the more problematic it becomes to interpret the AVM results, hence the need for didactic professional analysis**.

In our opinion, now is the time for qualified valuers to work with and build on modern technology that increases cognitive skills in a complex world, decreases subjectivity and increases valuer efficiency. Recognised associations can help valuers distinguish and choose between automated solutions.

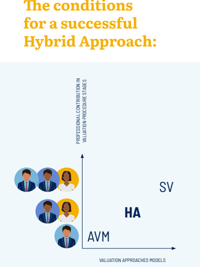
Below, we propose solutions for increasing the acceptance of automated solutions as well as greater appraiser efficiency and valuation accuracy. One specific issue to be addressed for international standards is the variability in definitions. The conditions for the use of various types of automatic solutions, both in terms of the participant's involvement, data sources and the outputs, should be defined in detail. Currently there is too much use of semantic shortcuts, with any automated solution to assist valuation being called "AVM" for simplification.

We propose the Hybrid Approach (HA) acceptance as the way to reconcile automated solutions' opponents and proponents by synergistically combining human intervention with computer use.

The Hybrid approach is based on understanding the synergy in combining aspects of new automated solutions (AVM) and traditional components (SV) that are developed in the agile mode system creation (Picture 2).

In a Hybrid Approach, the valuer understands/assists the inputs, calculation procedure and outputs, and takes responsibility for the final results. For this to happen, both the definitions and the functionality of the valuation models supported by the automated tools need to enable valuer activity at these stages of the valuation procedures through understandable, user-friendly disclosure of the calculation procedure.

The conditions for a successful Hybrid Approach:



Picture 2. Professionals' contribution under the Hybrid Approach.
Source: own elaboration

1. Each **automated solution should have a clearly specified origin, type and scope of data**: the mathematical method with the most important assumptions, the criteria for the selection of representative properties (similar) to the property valued, the analysis result (possible range of values) from the degree of confidence. **It should be clearly specified at what stage the appraiser should be involved in order to consider the automatic solution as a real estate appraisal.**

2. **Extending the scope of classical statistical methods selection** (such as linear regression analysis and descriptive statistics) with advanced analyses that should take into account the specificity of the property markets and insufficiency of data or information. We claim that the commonly used statistical methods are relatively less effective in nonefficient ('disabled') real estate markets. The pragmatic problem inherent to using classical theory of data is that they were designed for 'perfect phenomena' of data exploration in real estate markets– real estate markets that do not exist in reality. Moreover, property assessment based on a separate property attribute analysis is an inappropriate simplification in terms of real estate market modeling in that it deviates from reality, whereas recognition of synergic (inseparable) attribute coexistence provides a more reliable and trustworthy result. An additional problematic simplification common in real estate market analysis is the a priori reference (often justified only by the expert's experience) to a specific important attribute influencing the property's value (e.g., location or attractiveness), without a more refined, differentiated and granular analysis of the 'human factor'.

"It is necessary to indicate and make valuers aware of the simplifications resulting from the assumptions of statistical methods"

Due to the specificity of the real estate market and of the information on which the analyses are based, the most important task is to choose methods and develop a methodology (application procedure) that "understands specificity of information and participants decisions" on the real estate market. The applied method should be kept in mind:

- imitation of the workings of human minds / reactions,
- no limitation on the ability to run the algorithm related to the quantity of the dataset,
- robust nonlinearity in data relationship,
- tolerance of inaccurate and "fuzzy" character of real estate data,
- tolerance of non-homogenous functional dependencies between real estate attributes,
- implementation possibilities in terms of IT and efficiency of the created numerical algorithm (Renigier-Biłozor M. et al., 2019).

One of the most important components giving results corresponding to reality is the inclusion of AI analysis methods. AI methods characterise the attempt to emulate human behaviour that has direct influence on the property market. The term "artificial intelligence methods in valuation" considers human-inspired and nature-inspired informatics algorithms that mimic "cognitive" functions that humans associate with other humans, such as "learning" and "problem solving". This is the chance to introduce advanced technology and methods that can help with the most troublesome issues e.g.: genetic algorithms, neural networks, fuzzy logic, computer vision, machine learning or virtual reality. It should be open list on condition of providing the methodological detail.

3. **Defining the comparability of real estate and markets** - making it real - must be more flexible and adapted to the possibilities offered by new technologies, new data sources and big data processing. Consideration should be given to the thesis whether "homogeneous" transactions are a strict (categorical, precise) set or rather an approximate set consistent with the adopted (achievable) level of similarity. This would allow the selection of similar transactions not only in the spatially closest neighborhood - which is not an absolute condition of similarity (Renigier-Biłozor M. et al., 2019). It is necessary to indicate and make valuers aware of the simplifications resulting from the assumptions of statistical methods, e.g., fitting the data to the model, model falsification, ceteris paribus adjustment.

We would also like to draw attention to other factors connected to homogenous areas or representative properties that ought to be included in the determination of comparable markets:

- the object's influence in space is not limited to a given space projection, but also includes buffers reflecting the strength of its impact,
- "homogeneous" transactions are not strict but a rough set with the assumed definition of similarity,
- homogeneous transactions do not have to be located only in the nearest neighborhood,
- the measurement of factors should be consistent with their real meaning and impact (e.g. bus stop - access time, forest - view, road side access, etc.),
- classification of the attribute's significance by measuring capacity of information in data - there is no final and time-stable set of features for each type of market property,
- representative properties used in valuation models should be the real (existing) ones on the market (not created by calculations),
- real estate description consisting of three types of features: technical-legal, locational and emotional.

"An open question is whether the adoption of modernised market analysis and real estate valuation tools might require modification of the concept of market value or the introduction a new type of value."

4. To enable valuers to face **modern challenges**, the following topics and skills should be included **in educational curricula and continuing professional development programmes**. Detailed recommendations that enable real estate valuers to effectively face modern challenges on a rapidly evolving market have been introduced, among others, by Źróbek, Kucharska-Stasiak and Renigier-Biłozor (2020):

- the influence of external factors (political, economic, financial and social) on the performance of real estate markets to enable valuers to interpret and predict market changes in the process of assessing investment risks and their impact on the value of property,
- various methods for analysing the real estate market, including statistical methods, in order to be able to handle large quantities of market data. Valuers should be able to analyse the market in two dimensions: 1. sale or lease of property (traditional approach), where appraisals are made based on the prices of real estate transactions and rents, and 2. division of the real estate market into the market of property users, financial market, developer market, and the land market. Valuers should be able to assess the risks associated with investment in each of the above segments,
- acquire skills related to innovative valuation techniques and decision support systems to increase valuers' effectiveness and competitive advantage. Automated Valuation Solutions involving modern tools such as artificial intelligence (AI), machine learning and geocomputation are among the most popular systems that rely on decision algorithms on the real estate market,
- standard valuation procedures may not be applicable under extraordinary circumstances, which is why valuers should be familiar with modern techniques for collecting information on property attributes, in particular geolocation methods where the relevant data can be collected without direct contact.

5. An open question is therefore whether the adoption of modernised market analysis and real estate valuation tools might require modification of the concept of market value or the introduction a **new type of value**. The new type of value, if required, should reflect the most significant "neuralgic points" in the assumptions or even contradictions formation and indication of solutions enabling wider use of automated solutions. The main issues to be considered include:

- basis of value obtained from automated solutions according to current approaches,
- basis of value from hybrid approach (that are to be obtained),
- all existing bases of value obtained in the process of valuation for different purposes and databases.

Conclusion

The proposed new solutions related to the **Hybrid Approach** may create a more objective perception of the approach and its productivity-enhancing use among real estate valuers and investors. The proposed solutions must fulfil the following conditions and approaches to achieve these aims: rigorous standards of transparency; "mapping" of reality and predictive ability, defensibility for the "appraisal industry".

In estimating market value, valuers must reflect the property market's complex reality, bearing in mind its dynamically changing nature and randomly occurring dependencies. The rapid development of technology should be viewed optimistically as a tool for qualified valuers to obtain a better reflection of the property market.

'Stand-alone' AVMs are not the future. Extensive simplification of market relations and artificial reduction to a strictly deterministic phenomenon that is only perfect in theory do not solve complex and multidimensional problems. Therefore, valuers need to look for approximate, blurred, indistinct and fuzzy solutions that can provide optimal and satisfactory results that cannot be obtained from the use of a categorical deterministic model).

If valuers can train themselves to understand automated solutions well enough, they can build on the machine's 'results' to provide analysis that gives the client a clearer, more refined and useful understanding of the socio-economic forces shaping the determination of value.

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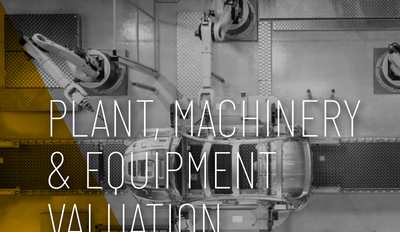

#05

Functional obsolescence in plant, machinery & equipment valuation

1. Introduction

Marko Popović

When valuers use the cost approach in valuation of Plant, Machinery and Equipment (PME), they need to analyse physical deterioration and external obsolescence and determine whether there is functional obsolescence. If so, the valuer must determine such value and apply it in the valuation process. This paper gives an overview of the main factors determining the functional obsolescence of PME, and of the approaches based on which the extent of this obsolescence can be determined.

2. Types of functional obsolescence

In accordance with the draft European Plant, Machinery & Equipment Valuation Standards[1] functional obsolescence is defined as "Loss in value resulting from differences in performance between new PME and the subject PME".

For PME, functional obsolescence can be operational or technological. Operational obsolescence is a loss in value resulting from differences in performance between new PME and the subject PME. Technological obsolescence is a loss in value resulting from differences in design, materials and technology between new PME and the subject PME [1], [5].

Functional obsolescence represents a form of PME depreciation that is manifest, not visibly, as in physical deterioration, but rather in the efficiency of the PME in relatively invisible ways [2]. Functional obsolescence is manifested in different ways, among which the following two are of key importance [4]:

a) *The increased or relatively higher costs* that occur during PME operation in comparison to present-day PME

b) *Excessive capital cost* that results from a difference between the reproduction costs of the analysed PME and the costs of replacing the present-day PME with PME of equal utility

The basis for functional obsolescence is that the "correct amount" is better than "not enough" or "too much" [4]. In accordance with capability, utility and quality of PME, there are two types of functional obsolescence:

- *Inadequacies* (or deficiency, imperfection, shortage, defect, etc.) are basically the lack of capabilities, utilities or quality that other PME on the market have
- *Superadequacies* are capabilities, utilities or quality, that exceed what is typical for the PME in the market, and do not contribute to the market value by an amount equal to their cost

For both types of functional obsolescence hypothetical solutions can be:

- *Curable* (or repairability) – the functional obsolescence can be fixed or repaired in an economically acceptable way. The investment for 'cure' is lower than the benefit from the increase in market value.
- *Incurable* (or irrepairability) – the functional obsolescence cannot be corrected at all or cannot be corrected in an economically viable way.

It is important for the valuer to know whether the functional obsolescence is curable or incurable. If it is curable, rational investors will make the investment, because eliminating the observed deficiencies, gives them an economic or other benefit. Conversely, incurable functional obsolescence requires analysis not only of the value of functional obsolescence, but also of possible consequential limitations on further use of such PME which, if confirmed, may give a scrap or spare part value, rather than market value.

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3. The extent of the functional obsolescence of PME

The obsolescence adopted by the valuer needs to reflect the cost of bringing the original PME into line with a modern equivalent of equal utility or, if not possible, reflect the consequence of a continued operation at lower efficiency.

Functional obsolescence can only be identified after it has already occurred. The longer the estimated duration of functional obsolescence, the greater the feasibility of a cure or, in other words, the longer the functional obsolescence exists, the smaller are the effects of its cure [2].

The analysis of functional obsolescence is based on economic principles, viewed from the point of a rational investor. If the PME can repair or improve in an economically viable manner, then the amount of such investment represents the functional obsolescence. Otherwise, if it is not possible to make improvements, repairs or corrections to the elements causing functional obsolescence, or it is not possible to do so in an economically viable manner, then the cost or loss incurred due to perceived deficiencies is the amount of functional obsolescence [1]. The stated cost or loss lasts for a period equal to the remaining economic or useful life of the PME.

Identification and calculation of functional obsolescence encompass several steps:

1. Determining the comparative elements of the subject PME. The comparative elements are the main technical and economic factors for a particular type of PME. It is necessary to determine the technological processes for which the PME is intended, the main technical characteristics and modes of operation, applied design of PME, etc.
2. Determining the market equivalent of the subject PME, i.e., determining the values (or range of values) of previously defined comparative elements. Identification includes analysis of internal and external factors:
   a. Internal factors refer to the PME that is the subject of the valuation, but in the condition when new.
   b. External factors refer to the same (successor model) or similar type of equipment (equipment of the same utility, but from other manufacturers) which at the time of valuation is the standard on the market.
3. By comparing the market equivalent and the subject of valuation, the existence of the functional obsolescence is determined:
   a. Does the latest model of the subject PME or defined market equivalent constitute an improvement in the design, manufacturing, performance etc.?
   b. Is there any significant deviation between the subject PME and the market equivalent, in terms of operational, labour, maintenance costs or other defined comparative elements?
   c. Are there any defects or damage to the subject PME limiting its functionality in accordance with the main design characteristics?
   d. Does the equipment associated with the subject plant or machinery, necessary for its operation, limit its functionality and performance characteristics [6]?
   e. Are there any external physical or technological limitations that may affect the subject PME, causing it to work with limited capabilities [7]?
4. If it is determined that there is functional obsolescence, it is necessary to calculate its value. The value will depend on whether the functional obsolescence is curable or incurable, or a mixture, the main question being, can the subject PME be corrected, repaired or improved, that is, hypothetically, can it be brought to the level of the market equivalent?
   a. The extent of curable functional obsolescence represents the amount of investment (total cost) for cure of PME. This is derived by:
      - Defining the scope and type of hypothetical work (correction, reparation, maintenance, improvement, etc.) required to cure.
      - Calculating the total cost of realisation of the previously defined works.
      - Confirming whether functional obsolescence is curable or not. In this case, the valuer compares the calculated total cost and market value of the subject PME in the state after cure.
   b. The extent of incurable functional obsolescence represents the loss incurred due to perceived deficiencies, calculating:
      - *The time during which the functional obsolescence occurs.* This time represents a future use of the subject PME, requiring adoption of remaining useful life or remaining economic life.
      - *The costs incurred as a result of incurable functional obsolescence.* These costs can be constant or variable in the future, and depend of the type of functional obsolescence, the time of future use of the PME, the volume of production, operational, labour and maintenance costs etc.
      - *The extent of the functional obsolescence.* This is calculated under the income approach, by using previous adopted remaining time of use and calculated costs.

4. The main elements of the functional obsolescence of PME

There are four main categories of elements causing functional obsolescence of PME:

A. Design and manufacturing of PME

- Performance characteristics (capacity, speeds, strokes etc.)
- Weight and overall dimensions
- The quality of the built-in material
- Space and surface on the layout
- Number of technological operations
- Necessary accompanying equipment and device

B. Use and operation costs of PME

- Utilisation of raw materials
- Operating supplies and chemicals
- Energy and utility consumption (current, water, compressed air etc.)
- The amount of waste generated
- Generation of manufacturing scrap
- Quantity and type of waste and wastewater
- Environmental impact

C. Labour costs and PME

- Required number of workers
- Required labour qualifications and skills
- Work with hazardous substances
- Required health and safety procedures
- Work complexity

D. Maintenance costs of PME

- Frequency of necessary maintenance
- Complexity of maintenance
- Consumption of maintenance materials
- Duration of individual service
- Maintenance workforce qualifications

5. Example of curable and incurable functional obsolescence

Subject of valuation: "The line for the production of plastic parts has a nominal capacity of 100 pcs./h. However, due to damage to the compressor, which operates at reduced capacity, the line achieves a capacity of 80 pcs./h. The price of the new compressor is 3.000€. The share of compressor value in the value of the subject production line is about 4%. No damage or other irregularities were noticed on the subject line. The modern line of the same manufacturer, in its standard offer has a capacity of 100 pcs./h, with similar technical characteristics, but requires two workers less for operation. The useful life of the subject line is 18 years, and it can be concluded that the remaining useful life is 8 years. There is sufficient demand in the market for the subject plastic parts, so the subject line can operate at full capacity".

Analysis of functional obsolescence

FACTS	VALUER CONCLUSION	FUNCTIONAL OBSOLESCENCE	THE EXTENT OF FUNCTIONAL OBSOLESCENCE
"The line for the production of plastic parts has a nominal capacity of 100 pcs./h. However, due to damage to the compressor, which operates at reduced capacity, the line achieves a capacity of 80 pcs./h. The price of the new compressor is 3.000€. The share of compressor value in the value of the subject production line is about 4%."	*Since the compressor represents only a part of the value of the line (4%), all necessary conditions are met for the hypothetical replacement of the compressor so that the production line could be operational at full capacity.*	*Curable*	*The extent of the functional obsolescence is equal to the purchase cost of the compressor (3.000€), plus additional cost of transportation, assembly and commissioning.*
"Modern line of the same manufacturer, in its standard offer has a capacity of 100 pcs./h, with similar technical characteristics, but requires 2 workers less for operation. The useful life of the subject line is 18 years, and it can be concluded that the remaining useful life is 8 years."	*Since the new production line works need 2 workers less, the existence of functional obsolescence can be observed. The observed functional impairment cannot be corrected by additional investment, and because of that it will remain during the further operation of the subject line.*	*Incurable*	*The extent of the functional obsolescence is equal to the amount that derived from the income calculation. The income calculation is obtained from the cost of the additional 2 workers and the remaining useful life of 8 years.*
"No damage or other irregularities were noticed on the subject line."	*There is no additional functional obsolescence due to e equipment damage.*	*None*	*0%*

Table 1. Example of identification of curable and incurable functional obsolescence

After the individual elements of the functional obsolescence have been identified, they should be expressed in one value and as a percentage, in order to be applied in the value analysis using a cost approach.

1 To be released on 21 October 2022

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