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Scientometrics and patent bibliometrics in RUL analysis: A new approach to valuation of intangible assets

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A new approach to valuation of intangible assets

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Abstract

Purpose – This article aims to show the application of scientometrics and patent bibliometrics in remaining useful life (RUL) analysis for evaluating the value of intangible assets.

Design/methodology/approach – Technology innovation management is strictly related to the RUL. The RUL concept is defined as the time remaining until the reliability drops below a defined minimal operating threshold. The RUL analysis of certain intangible assets (patents and know-how licence agreements, industrial designs, trade marks, logos, customer base) is done through different methodologies and various different approaches. The key subject in all these methodologies is the life cycle of the technology. The analyst tries to approach the foresight of the life cycle of technology to establish its value in use. Different life measure systems are considered in RUL analysis depending on different typologies of technology life: statutory, contract, judicial, economic and functional. Data used in life cycle estimation may be used in RUL analysis. Typically, these data include scientific articles, registration documents (patent applications, trade marks and copyright applications), commercial contracts, judicial orders, financial statements and technology data.

Findings – The analysis of the life cycle allows the incorporation of qualitative considerations (legal, contractual, physical, technical know-how, functional, economic) related to the conduct of future technologies. But technology development is conditioned by trends in scientific research and by the changes in the marketing dynamic, today and in the future. Qualitative methods provide a valuable information service that relates to the intangible assets over time. The "typical survivor curve" shows the released, remaining and probable life span of a certain technology by taking into account factors such as technological changes, marketing acceptance, and other exogenous and endogenous factors. Quantitative analysis of scientific production, applications for patents, industrial designs and trade marks, developed in scientometrics and bibliometrics, provide an unbiased guide to R&D and business trends.

Originality/value – The original purpose of the paper is to emphasise how the technology life cycle is influenced by changes in technology but also in scientific research evolution. Scientific research life analysis must examine the historical emergence or decay of a certain intellectual interest in the scientific community through the study of what is and what is not published in scientific journals.

Keywords Intangible assets, Product life cycle, Patents

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1. Introduction: intangible assets

1.1 Concept

International Accounting Standards Board (IASB) in IAS38 section of the International Financial Reporting Standards (IFRSs) (IASB, 2008) defines an intangible asset as an identifiable non-monetary asset without physical substance.

The definition of an item as an intangible asset requires some identifiability and recognition criteria. Identifiability criterion says:

> An asset is identifiable if it either (a) is separable, if is capable of being separated or divided from the entity and sold, transferred, licensed, rented or exchanged, either individually or together with a related contract, identifiable asset or liability, regardless of whether the entity intends to do so; or (b) arises from contractual or other legal rights, regardless of whether those rights are transferable or separable from the entity or from other rights and obligations.

IAS38 also specifies that the recognition of an item as an intangible asset requires meeting the following recognition criteria:

> An intangible asset shall be recognised if, and only if (a) it is probable that the expected future economic benefits that are attributable to the asset will flow to the entity; and (b) the cost of the asset can be measured reliably.

IASB in IFRS3, has divided the intangible assets into five different categories (Table I).

Intangible assets include patents, copyrights, franchises, goodwill, trademarks, trade names, etc. Organisations monitor the purchasing, upgrading, servicing, licensing, and disposal of intangible assets, and control them through a financial accounting.

1.2 Asset valuation

In finance, valuation is the process of estimating the market value related to a financial asset or liability. Valuations are required in accounting, economical transactions or investment analysis reports.

Over the last few years of valuing businesses and their assets there has been a large number of valuation texts that have provide different methodologies for valuing assets. But historically, there has been a lot of difficulty valuing intangible assets such as patents and trademarks. As we will see, the origin of these difficulties can be found, on the one hand, in the associated models of valuation methodologies. Secondly, the

Category of intangible assets	Examples
Marketing-related intangible assets	Trade marks, trade names, internet domain names, trade dress, newspaper mastheads, non-competition agreements
Customer-related intangible assets	Customer lists, order or production backlog, customer contracts and the related customer relationships, non-contractual customer relationships
Artistic-related intangible assets	Plays, operas, books, magazines, newspapers, musical work, pictures, photographs, videos, television programmes
Contract-based intangible assets	Licensing, royalty, advertising, service or supply contracts, lease agreements, construction permits, franchise agreements, operating rights, use rights (such as drilling, water, air, etc.)
Technology-based intangible assets	Patented/unpatented technology, computer software, mask works, databases, trade secrets

Source: Adapted from Lundqvist and Marton (2006)

Table I.
IFRS3, illustrative examples

conversion of intangible factors into financially meaningful terms, through methods of applied economics, is very complex. And thirdly, the "value" concept can mean different things depending on the purpose of the appraisal.

Valuation of assets can calculate through different models: determining the value of similar assets on the market prices (relative value model), estimating the expected future earnings from owning the asset discounted to their present value (absolute value model) or basing on the theoretical foundations and assumptions such as the geometric Brownian motion theory of stock price behaviour and risk-neutral valuation (the Black-Scholes model and the Cox, Ross and Rubinstein binomial model are the primary pricing models used).

There are different value standards, which could result in different numerical values: fair market value, investment value, fair value, and intrinsic value:

- *Fair market value (FMV)*. The classical and most widely used definitions of FMV is the adopted by the IRS in 1959: "The price at which the property would change hands between a willing buyer and a willing seller when the former is not under any compulsion to buy and the latter is not under any compulsion to sell, both parties having reasonable".
- *Investment value (InvV)*. InV is based on the opinion of a specific investor about the expectation of the benefits, the perception of risk, actions in making the investment, as well as such factors as the investor's tax status and overall investment portfolio. "InV of a property may be higher than its fair market value, providing the investor with an incentive to buy, or it could be lower, prompting the investor to sell. It is the composite of investment values, as reflected in the prices paid for comparable properties, that determines the fair market value of a property" (Ostrom, 2008).
- *Fair value (FV)*. FV is used in generally accepted accounting principles (GAAP), the standard framework of guidelines for financial accounting, mainly used in the USA, for financial reporting and in law in shareholder rights legal statutes. Financial Accounting Standards Board (FASB) has adopted FV as the standard of value for valuation in its SFAS 141-142 (Statement of Financial Accounting Standards). FASB defines FV as "the price at which an asset or liability could be exchanged in a current transaction between knowledgeable, unrelated willing parties" (FASB, 2004). FV is both a legal and an accounting concept. FV is a legal term that jurisdictions have chosen as the standard of value to apply in specific transactions, most often in the case of dissenting minority shareholder rights. The problem is that most jurisdictions have left it to the courts to interpret "value" in this context forcing appraisers to seek guidance from attorneys and others (Ostrom, 2008).
- *Intrinsic value (IntV)*. IV is a function of expected future earnings and includes other variables such as brand name, trademarks, copyrights, products business, market share, quality of management, expected growth, etc. IV is often difficult to calculate and sometimes not accurately reflected in the market price.

2. Methodologies and techniques to valuation

Main asset valuation systems boil down to four methodologies: the transactional method, the methodology of income and expenditure accounts, the replacement cost methodology cost and the binomial method.

The value derived of transactional method or "market approach" application is defined as the actual price paid for a similar intangible under similar circumstances. FMV is the most common valuation standards deriving from the transaction method. "Transactional methods are more difficult to apply in contexts where objectivity is critical such as financial reporting, tax, and litigation support" (Flignor and Orozco, 2006).

The methodology of income and expenditure accounts combines historical cost (all direct and indirect costs associated with the asset) in question, projected cash flows, economic life of IP, and the discount rate.

The asset value is the intrinsic value and it is based on the ability of the asset to somehow generate future outcomes: the ability to directly or indirectly generate a positive cash flow. The cash flow is forecasting the expected economic life of the IP. Estimation of remaining useful life (RUL) analysis tries to approach the foresight of the life cycle of technology to establish its value in use.

But the asset value is also the terminal value, which captures value beyond the years, can often represent a significant percentage of the total asset value. "The economic life refers to length of time that the IP will be able to command the price or cost premium" but technology is becoming "obsolete in as little as three years, often well before the patent expires. The discount rate refers to the expected cost of financing the asset in question. For IP assets, the discount rates are generally quite a bit higher than the cost of capital of a company and should be thought of as more similar to venture capital types of investments, with a corresponding discount rate from anywhere from 20-50 percent per year" (Flignor and Orozco, 2006).

The replacement cost methodology is a natural consequence of income and expenditure accounts. This methodology works with concepts as:

- The replacement cost of an IP asset defined as the cost to develop similar functionality to the subject IP outside the scope of the legal protection, for example, the cost to design a patent.
- The principle of substitution defined in the sentence "an investor would not pay more for an asset than the cost to obtain similar benefits from another asset".
- The cost of resources to create the new asset today, defined as the set of "today's costs and indirect cost related to the time required to build the replacement asset".
- Calculation of ordinary depreciation.
- Functional and economic obsolescence: the current useful state of the asset.
- Actual and expected age, present value and percent good factor approach.

Binomial methods are based on decision tree models and include real options, binomial models, and Monte Carlo simulations. Consider the conditional events required for the IP to generate value computing:

- the probability of the favourable event occurring that will make the IP valuable; and
- the payoff if the favourable event occurs.

Finally, the methodologies of innovation levers identification appear associated with decision support systems for the management of technological changes. The marketing methodology makes the asset valuation through comparison among different assets.

The key subject in all these methodologies is the life cycle of the technology. The analyst tries to approach the foresight of the life cycle of technology to establish its value in use.

Measurement after recognition

An entity shall choose either the cost model or the revaluation model as its accounting policy. If an intangible asset is accounted for using the revaluation model, all the other assets in its class shall also be accounted for using the same model, unless there is no active market for those assets:

- Cost model: after initial recognition, an intangible asset shall be carried at its cost less any accumulated amortisation and any accumulated impairment losses.
- Revaluation model: after initial recognition, an intangible asset shall be carried at a revalued amount, being its fair value at the date of the revaluation less any subsequent accumulated amortisation and any subsequent accumulated impairment losses. For the purpose of revaluations under this standard, fair value shall be determined by reference to an active market. Revaluations shall be made with such regularity that at the end of the reporting period the carrying amount of the asset does not differ materially from its fair value.

An active market is a market in which all the following conditions exist:

- the items traded in the market are homogeneous;
- willing buyers and sellers can normally be found at any time; and
- prices are available to the public.

If an intangible asset's carrying amount is increased as a result of a revaluation, the increase shall be recognised in other comprehensive income and accumulated in equity under the heading of revaluation surplus. However, the increase shall be recognised in profit or loss to the extent that it reverses a revaluation decrease of the same asset previously recognised in profit or loss. If an intangible asset's carrying amount is decreased as a result of a revaluation, the decrease shall be recognised in profit or loss. However, the decrease shall be recognised in other comprehensive income to the extent of any credit balance in the revaluation surplus in respect of that asset (International Accounting Standards Board (2008) in IAS38 section of the International Financial Reporting Standards (IFRSs)).

Foresight has a long tradition in the private sector; from here it was taken up by actors in the public sector. These methodologies as currently practiced in the private sector concern the recognition and observation of new technologies (also named "weak signals") or existing technologies, the evaluation of their potential and their importance for the competitiveness of the company, and the storage and the distribution of information.

The company's standards are high, but then so are the stakes. In today's competitive international business, strategic missteps are measured not just in market share, but in the millions of dollars. The objective of company is to add value from both a technical and business perspective so that clients can improve their competitive position and their ability to create interest for themselves. The company now has a much better understanding of how to establish and manage an in-house competitive intelligence program designed specifically to meet its unique needs.

3. Life cycle of technology and RUL

In this article we will consider both the technology-based intangible assets and the contract-based intangible assets. Technology innovation management is strictly related to life cycle of technology.

Different factors are important at different stages in the development of a technology but the correlation is not clear between model variable factors of technology evolution. Norman (1998) put in check the first evidence: "there is very substantial agreement that ease of use and understandability are important but why (...) if much of the computer technology today violates all these things, yet the companies prosper."

The agreement is obsolescence mark concerning the end-of-life cycle of technology. Technical when a product is no longer than other similar technically superior products. And functional when a product no longer functions the way it did when it was first purchased, because would be limited in its capability.

On the one hand, technology is associated to a product, and variables such as good industrial design, simple, short documentation, and convenient, pleasing products are crucial. As we will see:

> An important factor to consider is that most Intellectual Property (IP) (and intangible asset) is exploited in conjunction with other IP (e.g. technologies are often bundled with trademarks and/or trade secrets), and a careful consideration of the inter-relationships among all IP in the value chain and market life cycle is often important (Flignor and Orozco, 2006).

On the other hand, technology is also associated to management. That is why other types of obsolescence of the different technological obsolescence related, must be addressed.

For example:

- style obsolescence (refers to products may eventually regain popularity and cease to be obsolete);
- planned obsolescence (when marketers deliberately introduce obsolescence into their product strategy);
- postponement obsolescence (where technological improvements are not introduced to a product, even though they could be); and
- obsolescence of customer life cycle (term used to describe the progression of steps a customer goes through when considering, purchasing, using, and maintaining loyalty to a product or service).

Obsolescence management refers to the activities that are undertaken to mitigate the effects of obsolescence, such as last-time buys, lifetime buys and obsolescence monitoring (Table II).

	Cycle	Obsolescence types
Obsolescence management	Technology life cycle	Technical and functional obsolescence
	Fashion life cycle	Style obsolescence
	Product life cycle	Planned, postponement obsolescence
	Customer life cycle	Customer obsolescence?

Table II. Some examples of obsolescence related to cycle

Life cycle of technological products is a set of factors in different ways at different stages. In Norman's words:

> In the early days, technology dominates. Who cares if it is easy to use? All that matters is better, faster, cheaper, more powerful technology. In the middle stages, marketing dominates. And in the end, mature stages – where the technology is a commodity, user experience and marketing can dominate.

The RUL concept is defined as the time remaining until the reliability drops below a defined lower operating threshold. RUL is a function of the component's overall life and the actual (used) life under the operating conditions of use (Mazhar *et al.*, 2007)[1]:

> RUL considerations influence intellectual property analyses performed for valuation, transfer price, license royalty rate, or other purposes. And, RUL analysis is an integral component of any intellectual property cost, income, or market approach analysis. When a cost approach method is used, RUL should be considered in the estimation of obsolescence. When an income approach method is performed, RUL should be considered in determining the term of the income projection period. When a market approach method is used, RUL is a factor (1) in assessing the comparability of the market transactions to the subject property and (2) in estimating any adjustments to make the guideline sale/license transactions more comparative to the subject property. (. . .) An analyst valuing a nine-year-old patent may project profits or cost savings (1) over the patent's remaining legal term or (2) over a shorter period, depending on various factors that affect the patent economic life (WMA, 2006).

As we have seen, the RUL analysis of certain intangible assets (patents and know-how license agreements, industrial designs, trademarks, logos, customer base) is done through different methodologies and various different approaches.

Useful life

An entity shall assess whether the useful life of an intangible asset is finite or indefinite and, if finite, the length of, or number of production or similar units constituting, that useful life. An intangible asset shall be regarded by the entity as having an indefinite useful life when, based on an analysis of all of the relevant factors, there is no foreseeable limit to the period over which the asset is expected to generate net cash inflows for the entity.

Useful life is:

- the period over which an asset is expected to be available for use by an entity; or
- the number of production or similar units expected to be obtained from the asset by an entity.

The useful life of an intangible asset that arises from contractual or other legal rights shall not exceed the period of the contractual or other legal rights, but may be shorter depending on the period over which the entity expects to use the asset. If the contractual or other legal rights are conveyed for a limited term that can be renewed, the useful life of the intangible asset shall include the renewal period(s) only if there is evidence to support renewal by the entity without significant cost.

To determine whether an intangible asset is impaired, an entity applies IAS 36 Impairment of Assets.

Intangible assets with finite useful lives

The depreciable amount of an intangible asset with a finite useful life shall be allocated on a systematic basis over its useful life. Depreciable amount is the cost of an asset, or other amount substituted for cost, less its residual value. Amortisation shall begin when the asset is available for use, i.e. when it is in the location and condition necessary for it to be capable of operating in the manner intended by management. Amortisation shall cease at the earlier of the date that the asset is classified as held for sale (or included in a disposal group that is classified as held for sale) in accordance with IFRS 5 Non-current Assets Held for Sale and Discontinued Operations and the date that the asset is derecognised. The amortisation method used shall reflect the pattern in which the asset's future economic benefits are expected to be consumed by the entity. If that pattern cannot be determined reliably, the straight-line method shall be used. The amortisation charge for each period shall be recognised in profit or loss unless this or another standard permits or requires it to be included in the carrying amount of another asset.

The residual value of an intangible asset

The residual value of an intangible asset is the estimated amount that an entity would currently obtain from disposal of the asset, after deducting the estimated costs of disposal, if the asset were already of the age and in the condition expected at the end of its useful life. The residual value of an intangible asset with a finite useful life shall be assumed to be zero unless:

- there is a commitment by a third party to purchase the asset at the end of its useful life; or
- there is an active market for the asset and residual value can be determined by reference to that market; and
- it is probable that such a market will exist at the end of the asset's useful life.

The amortisation period and the amortisation method for an intangible asset with a finite useful life shall be reviewed at least at each financial year-end. If the expected useful life of the asset is different from previous estimates, the amortisation period shall be changed accordingly. If there has been a change in the expected pattern of consumption of the future economic benefits embodied in the asset, the amortisation method shall be changed to reflect the changed pattern. Such changes shall be accounted for as changes in accounting estimates in accordance with IAS 8.

Intangible assets with indefinite useful lives

An intangible asset with an indefinite useful life shall not be amortised.

In accordance with IAS 36 Impairment of Assets, an entity is required to test an intangible asset with an indefinite useful life for impairment by comparing its recoverable amount with its carrying amount:

- annually; and
- whenever there is an indication that the intangible asset may be impaired.

The useful life of an intangible asset that is not being amortised shall be reviewed each period to determine whether events and circumstances continue to support an indefinite useful life assessment for that asset. If they do not, the change in the useful life assessment from indefinite to finite shall be accounted for as a change in an

accounting estimate in accordance with IAS 8 Accounting Policies, Changes in Accounting Estimates and Errors (International Accounting Standards Board (IASB) (2008) in IAS38 section of the International Financial Reporting Standards (IFRSs)).

4. Elements of scientometrics and patent bibliometrics analysis for the estimated remaining useful life (RUL) in the valuation of intangible assets

Different life measure systems are considered in RUL analysis depending on different typologies of technology life: statutory, contract, judicial, economic and functional.

The technology life cycle is influenced by changes in technology but also in scientific research evolution. Scientific research life analysis must examine the historical emergence or decay of a certain intellectual interest in the scientific community through the study of what is and what is not published in scientific journals.

Data used in cycle life estimation may be used in RUL analysis:

- peer reviewed scientific articles in order to establish a scientific state of the art and identify networks of collaboration;
- registration documents (patent applications, trademarks and copyright applications) identifying gaps and IP strategy;
- commercial contracts for drawing the competitive landscape; and
- judicial orders, financial statements for business context.

The analysis of the life cycle allows incorporating qualitative considerations (legal, contractual, physical, technical know-how, functional, economic) positioning innovation, renovation or future technologies. But technology development is conditioned by trends in scientific research and by the changes in the marketing dynamic, today and in the future. Each source of information has own timescale and should be considered in the whole for creating competitive scenarios.

Qualitative methods provide a valuable information service that is related to the intangible assets over time. The "typical survivor curve" shows us the released, remaining and probable life span of a certain technology by taking into account factors such as technological changes, marketing acceptance, and other exogenous and endogenous factors. The unavoidable step and certainly one the most precious is the expertise of scientists on both quantitative and qualitative information as soon as possible. This active collaboration transforms information into intelligence and supports the business strategy.

Quantitative analysis of scientific production, applications for patents, industrial designs and trademarks, developed in scientometrics and bibliometrics, allows us to account for emergence of the R&D and business trends.

Bibliometric indicators are widely used to compare performance between units operating in different fields of science (Adams *et al.*, 2008).

An indicator citation per publication can be successfully applied in different studies to evaluate the impact of number of authors, countries, and journals. The mean value of citation per publication of collaborative papers can be higher than that of single country publications. In addition analysis of keywords plus in different period can be applied to indicate a research trend (Huang *et al.*, 2008).

Scientometrics is the application of those quantitative methods that deal with the analysis of science viewed as an information process. In practice, scientometrics is often done using bibliometrics that is measurement of (scientific) publications.

Analysed parameters can include document type, language of publication, page count, publication output, authorship, keywords plus, publication pattern, citation and country of publication.

In scientometrics, the analysis of information corpus can be applied to evaluate research trends. The analysis of information can indicate that the research interest changed remarkably about the use of specific words and their evolution. Examples of this approach can be found in different works, for example in Huang and Zhao (2008).

In scientometrics, can be proposed "methods to detect paradigmatic fields (...) through proximity metric between terms which provide insight into hierarchical structure of scientific activity (...) with a database made of several millions of resources" and "overlapping categorisation to describe paradigmatic fields as sets of terms that may have several different usages". Terms can also be "dynamically clustered providing a high-level description of the evolution of the paradigmatic fields" (Chavalarias and Cointet, 2008).

The scientometrics studies also maps condensed matter scientific research on other dimensions such as institutional productivity, nature of collaboration in research, and institutional specialisation. It examines highly cited papers, and lists prominent and productive scientists in all fields and also provides suggestions for accelerating condensed matter research in countries (Gupta and Dhawan, 2008).

Scientometrics techniques allow us "to explore and to visualise the intellectual structure and research fronts of multidisciplinary institutional domains. Special emphasis is laid on the identification of multilevel structures, by means of arrangements of subject categories cocitation analysis and journal cocitation analysis" (Miguel *et al.*, 2008).

Scientometrics and patent bibliometrics tools and techniques will play a critical part in the integration of technological information in business intelligence. These tools are used for business intelligence (BI), or competitive intelligence (CI) defined as the process of enhancing data into information and then into knowledge and actionable information.

To discern the intellectual structure of science, scientometric techniques is developed and used. Meanwhile, the term informetrics has come to replace the originally broader specialty of bibliometrics (Commission of the European Communities, Directorate General for Science Research and Development, 1997)

Besides this article focuses on helping R&D managers to make the most appropriate use of current and future technological resources. It aims to provide performance criteria of intellectual property rights, as a comprehensive support to technology management, based on an integrated understanding of scientific and patent production, engineering and business management.

Intellectual property rights management is a critical point for business. Currently the businesses are at risk in the performance criteria of invention right permissions and protection of product, design, process. Taking expert advice through reports of scientific production (including articles, books, thesis) and patent analysis (including patents, utility models, industrial designs, trademarks, copyright) at a very early stage can help the business orient and protect your position in dealings with third parties and protect against litigation.

5. Final considerations

Based on literature and observations, this article presents evidence that bibliometrics and scientometrics can contribute to have foresight view based on the methodology for

calculation of ordinary depreciation, functional and economic obsolescence and actual and expected age of a technology-based intangible asset with a great value.

Evaluating research trends and visualising the intellectual structure and research fronts of multidisciplinary institutional domains can be very useful for determining the intrinsic value of technological intangible assets. The reported information from scientometrics and patent bibliometrics studies can include critical factors related with RUL as:

> The existence of competitive patented or unpatented technology, market demand for products dependent on the patented technology, economic factors (that could affect the profitability of patent-dependent products), and the likelihood of the development of newer technology that could make the subject patent obsolete (WMA, 2006).

Consequently, scientometrics and patent bibliometrics techniques could be useful in the development of R&D and innovation in scientific and technological areas, especially for intellectual properties management.

Patent bibliometrics and scientometrics are two of the key methods to treat strategic information. Prospecting strategy based on Competitive Intelligence, Knowledge Management and evaluation of the business environment offers a range of opportunities to an examination of the conditions in which the future will unfold, and of the warnings and signs to be overcome in the globalised market.

Moreover, while patent bibliometrics and scientometrics refer to all quantitative aspects and models of printed media and sciences, informetrics is not limited to media or scientific communication. It is considered usable for tasks such as issue management, gathering of competitive intelligence and research evaluation. Thus informetrics is an emerging subfield in information sciences, which is based on the combination of advances of information retrieval and quantitative analyses of information flows.

The application of informetric methods to the field of electronic communication becomes more and more important and could provide a better overall of competitive environment to seize opportunities.

This article aimed to enhance the relevant articulation between scientometrics and patent bibliometrics useful for calculating the "remaining useful life" (RUL) in the valuation of intangible assets. Finally, the methods will be improved for an R&D intensive sector, its critical factors, actors and the understanding of the functions which impact it, and they will be proposed as a robust methodology to support decision-making.

Notes

1. Mathematically, where LR is the remaining useful life, LM the mean life and LA represents the actual life of components under given conditions of use. LM and LA represent two distinct perspectives – static and dynamic – and therefore they need to be addressed accordingly. LM basically represents the component's total functional life under stated conditions of use, and it is estimated by analysing time-to-failure data of a family of components operated under the same conditions of use. The accuracy and authenticity of the LM estimation becomes better with increasing amounts of available statistical data. On the other hand, LA is dynamic in the sense that it mainly depends upon the real conditions of use, and its assessment is based on the actual conditions of use.

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