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EDITORIAL

FUNDACION MAPFRE ESTUDIOS

Changes Brought by the New Year

1999 begins with two substancial changes of fixed chronology in its beginning and in the deadlines established for its application. One is the New Regulations for the Ordering and Supervision of Private Insurance coming into force on the 1st of January as Spanish national legislative adaptation to the EU directives. The other refers to the introduction of the euro as single currency in most EU countries.

The legal framework for the financial transfer that risk managers may need introduces new and more rigorous requirements for insurers who render said service. As regards the management of insurance programs, the acces to all EU national markets is finally open, wich widens the offer for the insurance buyer.

Besides, thanks to the solid solvency guarantees demanded from insurers and reinsurers, the industrial insured can feel more confident, although they should confirm if they have international programs implying the use of non-Community insurers. Other legal guarantees, essential for buying insurance from entities established outside the country of the insured's registered office require the recording of the necessary corporate data for the management of the normal commercial and operative exchange and for settling the potential differences arising in its development.

The financial and economical framework, which is defined in one of its essential parameters by the euro as common currency for the eleven EU countries integrated in the unified monetary system, including Spain, introduces changes in different spheres of the particular and business life, risk management among the latter. The main variation is configured by the use of the new currency in the bookkeeping and the financial entries from the first day of the year, together with the local currencies until they finally disappear in 2002, with its obvious administrative repercussion.

Certain aspects of Risk Management like the setting of values in the same currency within the European space, the constitution of insurance and reinsurance captive companies and financial funds in certain countries and the design of international insurance programs shall benefit from this new framework.

Apart from these scheduled changes, other transformations can be excepted in some variables of great influence on Risk Management. In this direction, the turbulence of the globalized financial markets must not be forgotten: social disturbances and conflicts, natural catastrophes, environmental disasters or little known risks entailed by certain technologies whose occurrence, faithful to the definition of risk, is now totally uncertain, in contrast with the sure changes brought by the turn of the year in relation to the new insurance regulations and the use of the euro.

In this new year that begins our best desires for your personal and professional success. ■

FUNDACION MAPFRE ESTUDIOS

HISTORICAL AND ACTUARIAL EVOLUTION OF PROTECTION AGAINST RISK IN THE ENTERPRISE: INSURANCE AND SAFETY

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The perception of risk by individuals along with its potential negative economical consequences is what has led to the search for safety since the far-distant past.

Insurance as a form of protection against risk offers that safety. In its origin and later evolution we find a good example of how man, either at individual or collective scale, has improved his protection instruments. As a result of the need for safety, the aversion for risk and the demand for protection constantly grow on the part of the economical agents and provoke the professional specialization of insurance.

In particular, any modern business organization needs to guarantee the integrity of its assets in order to continue with its productive activity in spite of unfavourable situations (losses) which hinder its normal working. This need spurs the development of an integral risk management where insurance contracts are an essential pillar for that purpose.

Origin and historical evolution of the insurance activity

Actuarial Science deals with the study of the basic and structural principies of the insurance activity from the financial, technical, mathematical and statistical point of view in order to attain the balance of results. If we go back to the origins of this branch of knowledge, we find the first contributions related to the operation of insurance.

These are quite belated, because the insurance technique does not appear until the 16th and 17th centuries. However, if we accept that insurance as such implies the idea of justice and a system that guarantees it, already in Roman Law as first legal system we can find instances of actuarial thought.

The thesis of economical history marking the scientific development in some fields admits less discussion when it refers to actuarial science: its progress, rather than depend on the scientific achievements, was fostered by the development of industrial and commercial populations whose need for insurance came to be urgent in the face of new risks other than those inherent to rural area. Thus the origin of ideas related tol insurance and, by extension, to Actuarial Science and Risk Management can be traced in England, Holland and the United States, the first industrial centers who needed operations allowing to reduce and transfer risks.

It follows that the birth of Actuarial Science is linked to statistics as quantitative knowledge of things and to probability as measurement of losses' likelihood to occur.

The profound change in Statistics takes place when it proves not only capable of describing reality but of representing it by means of models. With Kepler, Galileo and Paccioli, contingency is, if not introduced, at least suggested. However, Pascal is considered its precursor with his work on the games of chance. Successive contributions by Huygens, Bernoully, Leibniz, Bayes, Gauss, Laplace and later Markov, von Misses, Kolmogorov, de Finetty, Savage, among other, have configured the analysis of stochastic phenomena. The treatment of losses and the distribution of loss ratios as stochastic phenomena have its initial formal support here.

Research in the field of insurance still refers to the segment of life risk (death). The non-life segment is approached later. For instance De Moivre in *The Doctrine of Chances*, in order to determine the year value for life insurance, considers that the number of the dead in a group remains constant every year, the said year value for any age depending on the immediate superior age group. It is what we call life expectancy.

By that time, Dodson, influenced by the probabilists Fermat, Pascal and Leibnitz concludes that, for life insurance to have equivalence, calculations must be based on the age of joining the insured group. Dodson's contribution is very important because it defines a life insurance model. The risk factor in life insurance is the age at which an insured incorporates to the group, all the individuals of the same age being equivalent.

The technical development of Actuarial Science was spurred by the creation of associations that promoted research and the spreading of results: the Institute of Actuaries of Great Britain and Ireland started to publish a scientific magazine called *Journal of the Institute of Actuaries;* the Scottish version was *Transactions of the Faculty of Actuaries* by the Actuarial Society of Edimburg; in France, The Circle des Actuaries Français joined in with its *Bulletin de l'Institute Français*.

The intense activity of these associations brought about important advances especially in the field of billing and reserve estimation. Actuaries from the United States and Canada set up the Actuarial Society of America, and Italy saw the creation of the Instituto degli Attuari.

Recent evolution: casualty insurance

From the above picture it follows that until the present century Actuarial Science developed mainly through research in the field of life insurance, with special attention to the phenomenon of mortality and studies related to the maintenance of the insurer's soundness. For that purpose, work focused on the two chief variables at the moment: premiums and reserves. Consequently, all efforts attempted to establish billing systems which prevented the inadequacy of premiums, same as the studies related to the estimation of reserves.

It is in the course of this century that Actuarial Science undergoes its most important development. Studies in the field of life insurance advance and, in addtion, notable work is applied to property insurance, liability insurance and solvency analysis. By this time, the welfare economy theoreticians –Pigou, Marshall and Pareto– propose their ideas, oriented towards the maximization of the economical welfare and the concern for collectivity. In certain way, the transfer of risks from individuals to the group comprised by the insurer's portfolio represents a form of collective improvement.

The reports of the international congresses of actuaries are a faithful reflection of the resarch carried out. Among the subjects dealt with, those related to social economics (invalidity, accidents and their influence on mortality, unemployment insurance, old-age insurance) and management (reinsurance, premiums, reserves, investments, insurance rescue value, profit) stand out.

By the middle of the century ASTIN (Actuarial Studies in Bon Life Insurance) is created in order to promote the field of non-life insurance, less attended since the actuarial origins. The technical treatments had been very different: whereas life insurance was based on the probability of death as unique risk factor, the general or non-life class considered different factors of complicated determination. The parallel development of mathematical statistics helped to tackle with the most complex problems.

If the situation forbids the application of a reference value, standard marking tables can be used.

After adding the marks for the generating and the aggravating factors (X) and the marks for the reducing/protecting factors (Y) of the fire risk, the results from the formula are introduced and the final evaluation of the risk is obtained.

Evaluated factors

We proceed now to define and briefly comment on the factors evaluated by the MESERI method. The marks can be seen in the Calculation Format Sheet annexed at the end of this text.

A. Generating and aggravating factors

Building factors

- **Number of floors or height of the building**

As a function of the building's height, fire propagates more easily and it is more difficult to control and extinguish. The height of a building must be measured fron the lowest point built (underground levels count too) up to the top of the cover. In case different marks are obtained by number of floors and by height, the lowers value shall be taken.

- **Surface of the largest fire sector**

This factor implies that the fire resistence mark for the elements dividing the fire in sectors must be above 240. It shall be keenly secured for doors between sectors to get at least 120 as FR mark, same as the sealings of ductways, pipes, wire trays, etc which cross the dividing elements.

- **Resistence to fire of the building elements**

Reference is made here only to the elements which support the structure of the building, and the most relevant feature to be measured is the mechanical stability in case of fire.

The method considers that the resistence of concrete, masonry and similar elements is «high», whereas metallic bare elements –steel– present a «low» resistence. Protections like intumescent paints, insulating covers or screens shall only be taken into account if they protect the whole structure.

- **Draw slates and elevated floors**

Draw slates and elevated floors propitiate the accumulation of waste; in many occasions, they hinder the early detecftion of fire, cancel out the correct distribution of the extinguishing agents and permit the movement of smokes. For that reason, the mothod punishes the existence of said elements, regardless of their composition, design and finishing.

Location factors

- **Distance of firemen**

This factor evaluates the distance and the time it takes to get from the closest fire station to the burning building. Only stations with enough vehicles and staff and available 24 h a day, 365 days a year shall be considered. In case different marks by time and distance are obtained, always the lowest shall be taken.

- **Accesibility to buildings**

Accesibility to buildings refers to fire control and other emergency actions requiring entry. The elements which facilitate access are: doors, windows, openings on the façade, skylights on the coverings and the like.

Process/operation factors

- **Activation danger**

This capter deals with the evaluation of ignition sources used within the productive process, normally or as a complement of the activity. For instance, high temperatures (necessary in furnaces, reactors, or metal melting) and high pressures, open flames, exothermic reactions, etc., shall receive a «high» mark concerning activation danger. Ignition sources include smokers and lack of protecion against lightning.

- **Thermic head**

This capter deals with the evaluation of the amount of heat by surface unit that would produce the total combustion of the materials existing in the industrial site. If it is a building, both the movables –content– and the constructive elements –structures, dividing elements, finishings, etc– must be considered.

- **Flammability of fuels**

This factor evaluates the dangerousness of fuels present in the activity with respect ot their possible ignition. The physical constants which determine the higher of lower likelihood of a fuel to catch fire are, for a given ignition source, the flammability limits, the flaming point and the self-ignition temperature.

- **Order, cleannes and upkeeping**

This factor considers the order and the cleanness of the productive facilities, as well as the existence of staff in charge and periodical upkeeping plans for the service facilities (electricity, water, gas, etc) and the protection measures against fire.

- **Pile-up storage**

Pile-up storage above 2 m increases the risk of fire (higher thermic head, easier propagation, worse control of the fire). The nature of the stored materials is unimportant.

Factors related to the economical value of goods

- **Concentration of values**

The amount of the direct economical losses occasioned by a fire depends on the value of the container –buildings– and the content of an activity –production means (mainly machinery), raw materials, manufactured and semi-finished products, service facilities–. The consequential and profit losses are disregarded.

- **Destructibility factors**

In direct connection with the previous factor, the method evaluates the destructibility of the production elements, the raw materials and the manufactured or semi-finished products caused by the following damaging manifestations of fire:

– *By heat*

The first step is to determine the effect of the heat generated by the fire on the abovementioned elements. For instance, plastic industries, electronic industries or freezer storages may be affected in a «high» degree, whereas wood industries or the transformation of metals may be affected to a lesser extent by heat.

– *By water*

Finally, the damages occasioned by the water used for the extinction of the fire are assessed. For instance, textile and plastic industries shall in general undergo minor damages by this factor than paper and cardboard industries or warehouses.

Propagability factors

The propagation of fire is estimated in this chapter taking into account the spatial disposition of the possible fuels existing in the site –processes, machinery, goods, equipments–, that is to say, their vertical and horizontal continuity. The propagation speed of the flames and the combustion speed of the materials are studies in other chapters.

- **Horizontal propagability**

For example, if the process includes lineal production chains where the common elements offer continuity for the possible advance of flames, the propagability is deemed to be «high»; by contrast, cell dispositions, with spaces devoid of fuels or wide circulation ways, are assigned a «low» propagability mark.

- **Vertical propagability**

For instance, pile-up storages or structures, machinery or any kind of facility whose vertical disposition permits the propagation of fire towards levels above its origin shall obtain a «high» vertical propagability mark.

B. Reducing and protecting factors

This chapter includes the evaluation of the factors that contribute either to prevent the development of the fire or to limit its extension and consequences. Marking applies if the corresponding factor exists, if its design is adequate and if its working is guaranteed. When the company has organizative-human resources (fire brigades, emergency plans), the existence of registers, handbooks and procedures shall have to be verified which support the staff training, the practices and simulacrums carried out, etc.

Fire control systems

- **Automatic detection**

The method requires to ascertain whether there are automatic detection devices in all the buildings. Areas protected by automatic sprays shall also be considered as covered by this fire control measure.

- **Automatic sprays**

It must be ascertained whether there are automatic sprays covering the whole surface of the buldings and premises of the activity.

- **Protable fire extinguishers**

It shall be ascertained whether there are portable fire extinguishers covering the whole surface of the buildings and premises of the activity. It shall be checked that the extinguishing agents are suitable for the predictable classes of fire in the protected areas and that they are signalled. It is also recommended to check that there are spare devices (aproximately 1 by each 20 devices installed).

- **Equipped fireplugs**

It will be checked if there are equipped fireplugs covering the whole surface of the building and premises of the activity. A 25/45 mm fireplug facility is deemed to protect a site if the water jet can reach any of oits points; for that purpose it will be secured for the water post to supply the necessary pressure and flow to all the plugs and for the plugs to have all their elements (basically: valve, hose and nozzle).

- **Outside hydrants**

It will be checked if there are hydrants outside the buildings' perimeter which cover any point of the closings and covers. Same as with fireplugs, an outside hydrant facility is deemed to protect a building if it is checked that the water post supplies the necessary pressure and flow to all the hydrantes. The hydrants' elements and attachments shall be kept in sheds or cabinets arranged for that prupose (they include basically the tiller, adaptors and connection branches, hoses and nozzles) outside the protected building.

Organization of the protection against fire

- **Fire intervention teams**

This chapter evaluates the existence of first and second intervention teams (brigades).

- **Outside hydrants**

The implementation of a selfprotection or inside emergency plan for the target activity shall be verified. ■

MESERI METHOD CALCULATION FORMAT

COMPANY: ______ **BUILDING:** ______

			Coeficiente	Puntos
BUILDING FACTORS	**No FLOORS OF THE BUILDING** 1 or 2 3-5 6-9 10 or more	**HEIGHT OF THE BUILDING (m)** < 6 6-15 15-28 > 28	 3 2 1 0	
	SURFACE OF THE LARGEST FIRE SECTOR (m2) < 500 501-1.500 1.501-2.500 2.501-3.500 3.501-4.500 > 4.500		 5 4 3 2 1 0	
	BUILDING ELEMENTS' RESISTENCE TO FIRE High (concrete, masonry) Medium (protected metal, thick wood) Low (unprotected metal, thin wood)		 10 5 0	
	DRAW SLABS Without draw slabs With non-flammable draw slab (M0) With flammable draw slab (M4)		 5 3 0	
LOCATION FACTORS	**FIREMEN'S DISTANCE** < 5 km 5-10 km 10-15 km 15-20 km over 20 km	**ARRIVAL TIME** < 5 min 5-10 min 10-15 min 15-25 min > 25 min	 10 8 6 2 0	
	ACCESIBILITY TO THE BUILDING Good Medium Bad Very bad		 5 3 1 0	
PROCESS/ACTIVITY FACTORS	**ACTIVATION DANGER (IGNITION SOURCES)** Low Medium High		 10 5 0	
	THERMIC HEAD Low (< 1.000 MJ/m²) Moderate (1.000-2.000 MJ/m²) High (2.000-5.000 MJ/m²) Very high (> 5.000 MJ/m²)		 10 5 2 0	
	FLAMMABILITY OF FUELS Low Medium High		 5 3 0	
	ORDEN, CLEANNESS AND UPKEEPING High Medium Low		 10 5 0	
	PILE-UP STORAGE Below 2 m Between 2 and 6 m Over 6 m		 3 2 0	
VALUE CONCEN-TRATION	**VALUE CONCENTRATION FACTOR** Below 100.000 pts or 600 euros/m² 100.000-250.000 pts or 600-1.500 euros/m² Over 250.000 pts or 1.500 euros/m²		 3 2 0	

		Coeficiente	Puntos
DESTRUCTIBILITY FACTORS	**BY HEAT** Low Medium High	10 5 0	
	BY SMOKE Low Medium High	10 5 0	
	BY CORROSION Low Medium High	10 5 0	
	BY AGUA Low Medium High	10 5 0	
PROPAGABILITY FACTORS	**VERTICAL** Low Medium High	5 3 0	
	HORIZONTAL Low Medium High	5 3 0	

SUBTOTAL **X**:

PROTECTING FACTORS	**FIRE CONTROL FACILITIES AND EQUIPMENT**	**HUMAN SURVEILLANCE**				Mark
		WITHOUT		**WITH**		
	AUTOMATIC DETECTION	**Without AB** 0	**With AB** 2	**Without AB** 3	**With AB** 4	
	AUTOMATIC SPRAYS	**Without AB** 5	**With AB** 6	**Without AB** 7	**With AB** 8	
	PORTABLE FIRE EXTINGUISHERS	1		2		
	EQUIPPED FIREPLUGS	2		2		
	OUTSIDE HYDRANTS	2		4		
	ORGANIZATION					Mark
	FIRST INTERVENTION TEAMS (EPI)	2		2		
	SECOND INTERVENTION TEAMS (ESI) BRIGADES	4		4		
	SELFPROTECTION AND EMERGENCY PLAN	2		4		

AB: Alarm Bureau.

SUBTOTAL **Y**:

RISK VALUE, **P.** $= \frac{5}{129} X + \frac{5}{30} Y$:

RISK VALUE, P.	RISK MARK
Below 3	Very bad
3-5	Bad
5-8	Good
Over 8	Very good

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English Appendix

FUNDACION MAPFRE ESTUDIOS

EDITORIAL MAPFRE

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