PANDEMIC

ÁLVARO ÉCIJA

HOW TO MANAGE A NATIONAL AND PERSONAL CRISIS

IRL

PANDEMIC

HOW TO MANAGE A NATIONAL AND PERSONAL CRISIS

Álvaro Écija

Chairman of the Instituto de Riesgos Legales

Published by: IRL
Madrid

ACKNOWLEDGEMENTS

I will be eternally grateful to those who have guided me in the learning process during this short earthly life, a life that is both complex and real, and even virtual at times.

I would particularly like to thank:

My father. To a declared non-believer, this book is dedicated to the memory of my father, my guardian angel on this complex path of destiny. A man who left us too soon, leaving us a legacy and a wonderful surname.

To my mother, someone who is special, outstanding and wise. She has had a hard, unique life and her lessons set the path to be followed. A true example, a woman who has loved but one man: my father. And always remembering her mother, my grandmother Antonia.

To my little ones: Andrea, Clara and Alvaro.

To my friends and partners, in good times and in bad: Carlos and Pirata. Always together.

To Paz, the love of my life. Special, happy, intelligent, beautiful inside and out, unique. I'll always remember that magical moment and that place where our destinies met, marking the start of a partnership for eternity.

Thank you all for your help. But, above all, I would like to thank you, Pappa.

CONTENTS

ABOUT THE AUTHOR

ÁLVARO ÉCIJA

alvaro.ecija@ecixgroup.com www.alvaroecija.com Madrid, ESP

EXPERIENCE

Founding Partner
Ecix group

2012 - onwards — Madrid, Zaragoza, Barcelona, ESP

Founding Partner of the Ecix Group, a leading firm in Compliance and Cybersecurity

IBEX 35 Client

Innovative firm, responsible for projects such as "Cyberlaw" and "Legal Equations"

Development of in - house risk management tools. “ePrivacy", "eGRC", "eConsent", "eTPC", "eRadar"

Founding Partner
Écija Abogados (Lawyers)

1997-2012 — Madrid, ESP

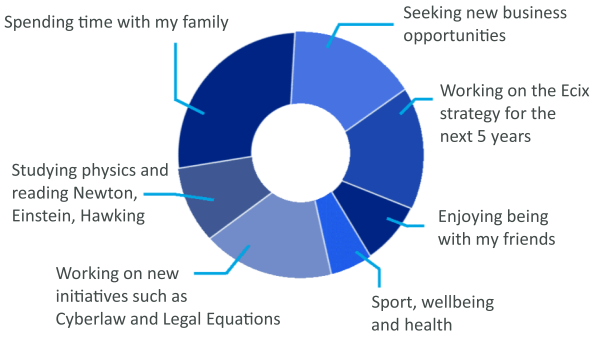
Founding Partner of Écija Abogados, a law firm that, over time, has successfully positioned itself among the top 15 in Spain.

Partner
The Beauty Concept

2013 - onwards — Madrid, ESP

Company dedicated to cosmetic medicine and beauty, with 3 establishments in Madrid

MY DAY TO DAY



PUBLICATIONS

Internet, Legal bases for enterprises (Civitas)

Internet contracts. Models and practical comments (Aranzadi)

Cyberspace, a lawless world (Círculo Rojo)

PHILOSOPHY

"A lawyer in my country, a cyberlawyer on the Internet"

ACHIEVEMENTS

National Security Expert
Expert member of National Cybersecurity Strategy 2019. DSN. National Security Department.

Advisor to the EU
Euro6ix Project, rollout and IPV6 protocol. Arbitrator Dominio.es

Chairman of the IRL Institute
Chairman of the Institue of Legal Risks

Speaker at TEDx
TEDx, Valladolid 2016, "Cyberspace, Cyber-impunity and anonymity"

Professional sportsman
Youth-team player at Real Madrid Basketball and professional in leagues 1991 and 1993

STRENGTHS

Worker 24/7 | Competitive | Creative | TCP/IP | Cyberlaw | Legal Equations

LANGUAGES

Spanish ●●●●●

English ●●●

EDUCATION

Graduate in Law
Universidad Autónoma de Madrid (UAM)

1992-1997 — Madrid, ESP

Diploma in IP communications and Internet
Skidmore College (New York)

1993 — New York, EEUU

A BRIEF HISTORY

The Elix project came into being in 2015 in the research and development laboratory of my company, the Ecix Group, for a twofold purpose. Firstly, to analyze, from a social and mathematical perspective, the risks that enterprises and countries are up against in the face of diverse global threats and, secondly, to seek a way to foresee such threats as effectively as possible.

The Elix project focuses on Data Mining and Analysis as a fundamental discipline to allow public organizations and private individuals to manage their future events and risks. The process is complex yet extremely exciting given that, through the collection, cleansing and analysis of millions of data collected from a range of internal and external sources, it is possible for anyone to obtain values that can be used to work towards a single purpose: to foresee their risk and the risk to which national and international organizations are exposed, across the globe.

The last five years of research and study have successfully concluded in various reports, predictive models and software programs to allow a person, acting either publicly or privately, to foresee, manage and mitigate the risks. This is all based on a formula that is simple in concept but extremely complex to apply to the real world. Risk is equal to probability time impact:

$$\mathbf{R = P \times I}$$

Where R is risk And probability can also be calculated by multiplying Threat by Vulnerability

$$\mathbf{P = T \times V}$$

And I is the impact. In the case of risk to life, the impact is death or serious illness. In the case of economic risk, the impact is loss of money. And, in the case of reputational risk, the impact is loss of reputation with regard to third parties.

For this purpose, together with an acclaimed research team at the faculty of Mathematics of the Universidad Complutense de Madrid university, I have developed a complex algorithm that makes it possible to perform the operations on which this simple equation is based, through the software tools and programs that we have developed at our laboratory, in order to help our customers (companies and countries) to assess and manage their risks.

This information makes it possible for countries and persons to plan action protocols and to design contingency plans to mitigate the risks detected and, where necessary, to manage the crisis for the fastest possible recovery.

This initiative offers the possibility of preparing Crisis Management, Mitigation and Prevention Manuals, with the certainty of being able to focus on those risks that are more probable or that have a greater impact on each person or country.

And today's pandemic is one such risk to be faced, even though we do not want to do so.

INTRODUCTION TO THE PRESENT CRISIS

We are witnessing an unprecedented global crisis. In a crisis situation, due to a number of biases and psychological emotions (fear and goodwill), it is difficult to discern the reality of what is happening, or to identify any errors that our mind may interpret. This is both due to the external information received by each person and that person's psychic readiness to face future problems.

Fear is an emotion that is difficult to manage. And, just like a "virus", fear is the emotion that has become established in the collective consciousness, to create a real epidemic of collective fear. However, fear is not the best ally to manage a crisis, which requires quite the opposite, namely courage and bravery.

In science, both with regard to its social and natural sides, a good way to distinguish real fear from erroneous fear is to follow the "model-dependent realism" approach. If the scientific model chosen, a mathematical equation for example, is repeated and tested with no errors, then the result is considered to be good.

In the world of risks, both in healthcare and in other economic or environmental areas, there is an underlying problem of future uncertainty that those persons who prefer to move in an environment that is either predictable in advance or inspires greater confidence, find it complicated to determine.

Most people wish and yearn for their own safety, yet the world, our world that is before our very eyes, is far more complex than that and never fails to show us that uncertainty and unexpected events are also part of our reality. This pandemic is a good example of this.

The current state of alert that is creating so much business and social insecurity, was set in motion by the declaration of international pandemic by the WHO. Governments across the globe acted upon this, to decree a state or emergency or alert, as provided for in their constitutions, with more countries likely to follow suit.

In this respect, we will look at how the WHO itself evaluates a pandemic, based on its own guide, entitled PISA, and how the member states must also do so. Likewise, we will study how a corporation must foresee and manage this crisis in order to give continuity to its business activity.

I leave for later consideration, by way of a legal opinion, whether or not the events to date deserve any scientific or legal criticism for failing to observe and comply with the applicable and mandatory regulations that have led to a restriction on the civil rights and freedoms of all citizens throughout the world and to the shutdown of most businesses.

All the information detailed below is based on the obligations established in the International Health Regulations (IHR) for all member states. Specifically, the IHR provides the applicable legal framework for the prompt and effective management of serious health risks.

The WHO Director-General is responsible for determining whether or not an event can be classified as serious, in the form of a pandemic.

1

FEAR

Does the stay-at-home premise respond to a voluntary act of responsibility or to an act motivated by fear? Let's look at what is understood by fear.

Fear is the response to imminent danger. This being so, it could be said that fear can be measured, given that we are dealing with a risk, that can be measured as high or low, and imminent, that is also a dimension of time, measurable in seconds or days.

Fear, in turn, is a basic human emotion that can be acquired through cultural channels and by learning. Fear also has its usefulness, as its serves to escape from this imminent danger. However, the fear of a pandemic, is this a fear of avoiding an imminent danger? Have you measured this danger? Is it imminent and really dangerous in the form of death or life threatening?

While fear is a useful emotion it can also be an emotion that prevents one from living life. In this latter case, fear may block one's actions, making it difficult to take decisions. Likewise, fear is an emotion caused by this danger, real or imaginary, present or future. It is a primary emotion derived from a natural aversion to risk or threat.

Real fear could be said to be the fear that is scaled in line with the scale of the threat. In turn, fear may have various perspectives. From a biological point of view, fear is an adaptive response and constitutes a mechanism of survival and adaptation to the milieu. From a neurological point of view, it is a way to organize the brain, activating the amygdala in order to face the imminent future.

From a psychological perspective, it is an emotional state like any other, happiness or sadness, and from a social and cultural point of view, it is a form of social organization or a personal characteristic. Finally, from the legal perspective, fear may be a form of exoneration from responsibility.

If you remember the "War of the Worlds" narrative by Orson Welles in 1938 on an alien invasion, you may like to consider whether the current collective fear is a social and cultural construction or, by contrast, it is a natural or other type of reaction.

After reading this book, you will be the one to decide what type of fear you have, if any, with regard to facing the national and personal crisis created by the COVID-19 pandemic, as human beings and as society in general. But remember, fear can be measured and that is what we are going to try and demonstrate.

2

THE PANDEMIC

Past pandemics

The pandemic or avian influenza of 2009 revealed that the WHO and member states, including the most advanced countries in the world, did not have a robust and standardized method to evaluate the severity of a flu pandemic. In 2011, the World Health Assembly passed a resolution to support the implementation of the recommendations contained in the report of the Review Committee on the functioning of the International Health Regulations (IHR 2005) in relation to the avian influenza pandemic.

The Committee recommended that the WHO should apply measures that could be used to assess the severity of every influenza epidemic, whether seasonal or pandemic. Furthermore, it stated that an assessment of this nature must evaluate severity based on the scientific information required to determine the timing, scale, priority, intensity and urgency of the response measures to the pandemic.

In 2011, in its resolution WHA 64.10 entitled "Strengthening national health emergency and disaster management capacities and the resilience of health systems", the World Health Assembly urged countries to strengthen their health emergency programs in order to ensure pandemic preparedness. Likewise, in the same resolution, the Assembly called upon member states to allocate sufficient resources to the health emergency programs.

In the same vein, Assembly Resolution WHA58.5 observed that there were large gaps in knowledge with regard to the spread of influenza and for preparedness and responsiveness to a pandemic problem. In the face of this gloomy scenario, the WHO urged member states to develop national plans to limit the health impact and the economic and social disruptions that could be caused by a global pandemic.

This novel regulation issued by the WHO within the framework of the provisions of the International Health Regulations, distinguished two critical moments to address a pandemic. The initial, severity assessment phase and the subsequent crisis management phase.

According to the WHO, the framework to define the severity of an influenza pandemic is based on three indicators: transmission, seriousness of disease and impact. The use of this risk assessment method underscored the need for robust baseline data and for all member states to become familiar with the use of this assessment method in the event of a pandemic. In March 2017, all member states were encouraged to start to apply this method.

At present...

This history takes us to the present day, 2020.

At the beginning of this year, a new virus from the Coronavirus family started to become known and which was named COVID-19. This virus is now causing real global problems in many aspects of our daily lives.

As is widely known, the devastating effects of this virus are primarily affecting three distinct but interconnected areas. The actual healthcare area with

the loss of many lives and the collapse of the healthcare systems; the social area with lockdown and restriction of the movement of citizens; and the economic area with the interruption of business and international trade and its dire consequences on citizens' pockets.

In the midst of this global crisis phase caused by the pandemic, let us look at how this risk should be assessed in order to understand how this problem can be calculated in advance.

Assessing the severity of a pandemic: concept and definitions

Once a pandemic is declared, time and resources are limited. For this reason, countries need to become familiar with the tool and pandemic risk management method beforehand, during the so-called "seasonal" flu.

Although the method defined by the WHO is directed at public health professionals of each country, the aim here is to inform the vast majority of readers, who may not be professionals in the field, how they can understand and learn about the assessment of a pandemic.

At a national level, the assessment of the severity of a pandemic must be aimed at describing the epidemiological situation and assessing the severity of a pandemic based on the information available. Here, one of the major obstacles is the availability of information in the period prior to the event.

A further aim of the severity assessment is to substantiate the national risk assessments, and to substantiate the public health preparedness, responsiveness and recovery measures, as well as resource allocation.

Therefore, in order to assess the severity of a pandemic, the following three indicators need to be taken into account:

- Transmissibility of an influenza virus
- Seriousness of disease
- Impact

These three indicators are essential in order to define and calculate the degree of severity of a potential pandemic or, if already at the start of the pandemic phase, to be able to assess its development and risk over the following months.

Transmissibility, Seriousness of disease and Impact

Transmissibility or infectiousness reflects how easily the virus spreads between individuals and communities. Currently, based on the data published by the WHO and those published for each country, the infection rate is high.

The factors affecting this indicator are generally the ability of the virus to spread from person to person, the dynamics of the spread and the vulnerability of the host or exposed

population. On the other hand, the social and climatic factors of each particular country can affect transmissibility.

Unlike the indicator above, the seriousness of disease reflects the extent to which individuals become ill when infected by the influenza virus. For this purpose, this indicator must take account of the clinical symptoms, the complications of the disease and the consequences following infection.

The seriousness of disease also depends on the host, on the underlying health conditions that predispose a person to develop a severe attack, and on a person's age. Given that some sectors of society tend to be more susceptible to the disease than others, this indicator must also identify and take account of those groups that are most at risk of getting the virus.

This indicator is a key factor, given that it refers to the population that is most exposed to the risk of getting the virus. Or, to put it another way, it is the number of persons who, due to their characteristics, are more likely to die if infected by the virus.

By aggregating the clinical data published by the ministries of health for each specific country, it is possible, for example, to define the vulnerable populations as those elderly people who are normally over seventy years of age, with some prior medical condition such as COPD, heart disease, HIV and others. They are individuals who, once infected, may suffer a serious medical condition which they may not overcome, leading to subsequent death.

The impact indicator generally shows how the pandemic is affecting society. It covers the effects on the healthcare sector and on the use of medical services, that could be affected and collapse, and on society in particular, with excess mortality.

The impact of the pandemic detailed herein refers to the impact on the health of each citizen and on society as a whole, leaving for another chapter the economic and social impact that the pandemic may have on that part of the population that does not suffer the disease or only slightly.

Table 1. Summary of the indicators used to describe influenza severity

INDICATOR	DESCRIBES	INFLUENCED BY	INFORMEDBY
Transmissibility 	How many people in a population get sick from influenza on a weekly basis	• Ease of movement of virus between individuals (virus shedding, viral replication, and viral binding) • Immunity and vaccination status • Age, contact patterns and healthseeking behavior • Climatic factors	Routine surveillance parameters
Seriousness of disease 	How severely sick Individual people get when infected with the influenza virus	• Virus factors • Host factors • Context (e.g. access to healthcare and availability of ventilators)	Hospital-based surveillance parameters
Impact 	How the influenza epidemic or pandemic affects the health-care system (and society)	• Public health interventions • Health-care use • Public concern	• Hospital-based surveillance • Vital statistics (e.g. death records) • School and work absenteeism

Parameters

Each indicator detailed above is calculated from various parameters provided by virological and epidemiological surveillance, and by medical sources. These parameters are often systematically collected by each country's public health surveillance systems. In other words, they must be collected by each country's Ministry of Health.

There are four steps for assessing the severity of

influenza: 1. Selection of parameters

2. Determination of the thresholds for each parameter, using **historical data**. 3.

Application of the thresholds.

4. Reporting the findings.

The selected parameters are used to determine the three indicators (transmissibility, seriousness of disease, and impact). The parameters must be indicative of influenza activity, so part of the samples must be analysed in a laboratory.

The samples must also be reliable and come from a surveillance system that is stable over time. And, finally, they must be timely. That is, to put it clearly, the data must not be one hundred years old. The parameters must also be based on historical data on earlier seasonal epidemics or pandemics and, whenever possible, parameters should be available to calculate representative proportions or rates.

The parameters to be taken into account for the transmissibility indicator include the weekly cases. For the seriousness of disease, the parameters to be used are the cumulative mortality rate and the cumulative ICU admission rate. And, for the impact indicator, the number of positive cases, the weekly excess mortality , stratified by age, and the weekly number of cases admitted to ICU.

Table 2. Useful parameters for assessing severity

INDICATOR	PARAMETERS (examples)*
Transmissibility 	• Weekly ILI or MAARI cases as a proportion of total visits, or incidence rates • Composite (product) of weekly ILI or MAARI rates and weekly percentage positivity rates for influenza
Seriousness of disease 	• Cumulative death: hospitalization ratio (ideally confirmed influenza cases and cases with outcome or discharge data) • Cumulative ICU: hospitalization ratio (ideally for confirmed influenza) • SARI: ARI or SARI: ILI ratios
Impact 	• Weekly number or proportion of SARI cases, with percentage of SARI cases that are influenza positive • Weekly excess P&I or all-cause mortality (ideally stratified by age) • Weekly number of confirmed influenza cases admitted to ICU, or weekly number of confirmed influenza cases admitted to hospital

ARI: acute respiratory infection; **ICU:** intensive care unit; **ILI:** influenza-like illness; **MAARI:** medically attended acute respiratory illness; **P&I:** pneumonia and influenza; **SARI:** severe acute respiratory infection

* Other possible parameters that may reflect the impact on the society are school closures, hospital beds occupied, work absenteeism and school absenteeism. These non-health-care-related parameters might not be reported to the disease surveillance units in a country; rather, they might be captured by the ministry of education or social security systems. Such parameters were not tested during the pilot period.

Furthermore, for the analysis, these parameters should be divided into three age groups: under 15 years; 15 to 64 years; and 65 years and over. With regard to the seriousness of disease and impact indicators, the parameters must also reflect the presence or absence of underlying chronic diseases or conditions known to be associated with unfavorable outcomes for influenza such as asthma, AIDS, pregnancy, COPD, heart or lung diseases.

Surveillance systems differ widely from one country to another. And this is being observed in the management of this global crisis. The data published by the surveillance systems for each country differ substantially. Although the causes of this will be analyzed in detail later on, they include incorrect data collection due to a lack of sufficiently effective material, such as faulty test kits, and also the intent to "fake" the data in order to avoid undesirable macroeconomic impacts and the geopolitical weakness of a country in relation to other countries.

However, in the same country, it is possible to compare a parameter with values from previous seasons. Therefore, using historical data, each country can describe the activity of an epidemic or pandemic by comparing it with previous years, through qualitative descriptions such as: no activity or below the seasonal threshold; low; moderate; high; or extraordinary. These qualitative assessments can then be compared within that same country or with other countries.

To define the start, which is of vital importance, the following methods are used: either the calculation of the epidemic threshold using the MEM (moving epidemic method) or the use of the weekly positivity rate.

To define these thresholds, the MEM method, the WHO method, or the country-specific statistical or empirical method are used.

Table 3. **Cut-off points by method for threshold setting for transmissibility and impact**

RANGES OF ACTIVITY	MEM	WHO
No activity or below seasonal threshold	**Below the seasonal threshold** as set by MEM	**Below the seasonal threshold** as set by the WHO method (annual median value)
Low	**Between the seasonal threshold and the upper limit of the 40% one-sided** CI of the geometric mean	**Between the seasonal threshold and the upper 40%** CI of the mean peak value[a] of the average curve
Moderate	**Between the upper limit of the 40% and 90%** one-sided CIs of the geometric mean	**Between the upper limit of the 40% and 90%** CIs of the mean peak value[a] of the average curve
High	**Between the upper limit of the 90% and 97.5%** one-sided CIs of the geometric mean	**Between the upper limit of the 90% and 97.5%** CIs of the mean peak value[a] of the average curve
Extraordinary	**Above the upper limit of the 97.5%** one-sided CI of the geometric mean	**Above the upper limit of the 97.5%** CI of the mean peak value[a] of the average curve

CI: confidence interval; **MEM**: moving epidemic method; **WHO**: World Health Organization

[a] When the peak values are very different from one season to another, it is best to use the geometric mean of the peak values instead of the arithmetic mean.

The key points to apply the thresholds are:

- Assess current data for each indicator. Transmissibility and impact indicator data can be assessed on a weekly basis.
- Examine the data, looking for differences between age groups or risk groups.
- Use the findings from the assessments as a basis to support the national risk assessment.
- Document the parameters and thresholds used, those that were the most reliable, how the interpretation was made and how the information was combined to issue a judgment on each indicator.

Table 4. Example of threshold setting for seriousness of disease

RANGES OF ACTIVITY	
No activity or below seasonal threshold	**< Mean outside of the epidemic period**
Low	**< Mean**
Moderate	**Mean to mean+1SD**
High	**Mean+1SD to mean+3SD**
Extraordinary	**> Mean+3SD**

ICU: intensive care unit; **SARI**: severe acute respiratory infection; **SD**: standard deviation

Once the qualitative risk assessment has been made with the above-mentioned indicators, this must be reported to the WHO, on a weekly basis and at least at the midpoint and at the end of the epidemic. Whenever there are differences between the estimates by age groups or groups with underlying conditions, then the final assessment should be based on the aggregated data (all the age groups).

The WHO is obliged to monitor the three indicators and to provide mid-season and end-of-season reports describing the severity in terms of transmission, seriousness of disease and impact. Likewise, the WHO must provide situation updates in the event of a pandemic. Therefore, on a daily basis, the WHO publishes figures and indicators for the evolution of a pandemic, primarily through its website.

3

DATA AND INFORMATION

Few now question that the 2020 pandemic is bringing unprecedented social change. A new pattern of interaction and relationship with the future is emerging, which is creating uncertainty and is proving difficult to handle for those who do not understand what is happening before their eyes.

So, let's see how the data and information available can be used to gain a new understanding that could help them to open their eyes and to start seeing the future from a different perspective. The new world of risks, where the policy of risk anticipation, management and mitigation aims to be an effective and useful tool to avoid undesirable future events that could have an adverse effect on society in general.

With this new vision, the countries and their organizations and, specifically, leaders, healthcare professionals, business directors and public authorities, are obliged to be aware of the risks that could occur at a particular time within a defined area. This form of management gives these persons, as well as the crisis and surveillance centers, an effective and methodical control tool.

If any conclusion can be drawn from the data published by each country in relation to the lethality and mortality rates, number of cases, number recovered, it is that the figures appear to give different, contradictory information on the reality of the pandemic. Doubts arise as to how the number of deaths is so low in a country such as China, compared to Europe or the USA. There are also doubts with regard to the differences between continents for the lethality and mortality rates.

These contradictions appear to stem from the collection, analysis, compilation and publication of data that do not appear to be reliable and robust. This could be due to a number of factors. Firstly, there is a need to know whether the death certificate of each infected person states the cause of death as COVID-19 or, by contrast, it indicates that the death was caused by the prior underlying disease. In other words, whether the certificate states death **by** Coronavirus or death **with** Coronavirus. Another reason for the data discrepancy could be that each country may be "faking" the data to be published to avoid economic and reputational damage in the future.

Consequently, and due to the disparity between unreliable data, this chapter aims to provide the necessary knowledge with regard to the interpretation of the risks and to propose a methodological risk management model. The following pages provide definitions, formula, examples and methods to learn to:

- Identify the risks, based on the analysis of the different regulatory frameworks.
- Assess these risks.
- Apply subjective and objective assessment methods, the latter being based on mathematical analysis.
- Learn to make a risk program by applying an approximation method for future risks.

These data and how they are applied, could prove useful not only for health-related matters but also to anticipate economic and reputational issues. Unquestionably, this chapter is primarily directed at providing the basic knowledge to understand how to apply the risk approximation in personal and business activities, showing the key elements required to be successful and using the necessary scientific and practical method.

Risk approximation forms part of the changes that technology and human intelligence are provoking in this revolutionary decade that has just begun. Welcome to risk approximation.

This chapter could be started by stating that, in the world of risks, it is important to plan, implement, audit and improve the program or system to manage these risks, including that of the public and private health systems. ISO itself (International Organization for Standardization) establishes a classic PDCA (Plan-Do-Check-Act) model that reflects the need not only to implement the system as a milestone that has been satisfactorily completed but as an ever-improving process.

But, what actually is PDCA? This question can be answered by defining it as a simple work method. The PDCA method aims to divide an individual's activity into four clearly distinct phases. The first is the P, which refers to the planning. The D is for doing the things that have been planned. The C refers to checking whether the results of D are as planned or are different than expected. And, finally, the A is for correcting any deviations between what was planned and what was actually implemented.

If a person divides his or her activity over time, for example over a one-year period, then this person is ready to re-start the PDCA cycle in the second year. Let's look at a simple example.

A person thinks that he has a weight problem that could affect his health and also his social reputation. And this person would like to manage his future risk by avoiding health problems such as diabetes and also social relationship problems due to his weight.

This person learns about and trains in the PDCA method to assess and manage, over the next year, the risks to be avoided. The first step is to prepare a plan. This could be "I want to weigh twenty kilos less and to lose fat by around ten percentage points". He defines the plan with four basic tasks. Eat fifteen percent less, do sport three times a week, cut out alcohol and avoid sweets. He now has a plan.

The second step is to start following his plan. This phase is the most complicated part, given that the written plan has to be put into action. The third step would be to compare, after a period of six months, his weight on the first day to the weight on the first day of the seventh month. And compare the fat percentages. If he has lost weight and the fat percentage has dropped, then this means that he is on the right path. The final thing to do is to correct any aspect that is not working well in his risk management. Any deviation between P and D.

It's as simple as that, at least on paper. But it could also be asserted that the primary aim of the risk program is to prevent an incident or event from having a reputational or economic impact or to prevent the loss of human lives in a country. And this is more complicated.

To avoid these undesirable events, these risks need to be managed in order to assess (and measure) the probability that a threat can take advantage of a prior disease in order to cause a death. Which, in the end, is what this COVID-19 aims to do. But to achieve this ambitious objective, a core premise first needs to be considered:

§

" If you can't measure it, you can't manage it"

§

And this is the basic premise, both for you as a person, if you want to lose weight, and for a government facing a pandemic crisis such as this present one. If a government does not measure the crisis and the measures taken, how does it know whether it is taking the right action?

It is no use saying that lockdown is the best measure to avoid infections or deaths. This is because, although the measure is morally praiseworthy (avoiding deaths), there is no way of knowing whether it is the most effective measure. The reasonable doubt arises as to what it is being compared against. What is more, a government that has no model with which to compare the risks would say that, due to the infection, there has been an upward curve until a given time and, from that time onwards, there was a downward trend thanks to the measures adopted by the government itself. But how can one thing be measured and the opposite?

Taking the weight loss example to avoid future problems, it is like saying that a person does not consider himself to be overweight given that he is feeling well, he looks in the mirror and is happy. Yet if you get an understanding of this person, and the measurements of his chest, thighs and body fat percentage and you compare it with the internationally-recognized standard model, you can then say that a person is above these healthy parameters and can conclude with an assessment that this person is overweight.

Or, to put it another way, 100,000 deaths are a lot, but compared to what? If the world has approximately 1,500 million citizens and there are 100,000 deaths each year for seasonal influenza, then are the deaths in 2020 for the same number as above considered to be a lot? Most people would say no. However, if 1,000 persons die each year as a result of seasonal flu,
1.1 we would reply that 100,000 deaths are a lot, if they occur in the year following the previous year.

In other words, measurement and the measurement unit are key to the management of a pandemic. In this way, we have something to compare against, in order to decide whether or not the occurrence is acceptable. Or, to put it another way, in order to manage a health risk, it is first necessary to establish metrics and indicators that specify and determine the level of the said risk. This allows a country to have a risk measurement system in place, helping to take decisions with regard to the allocation of the technical, human and economic resources to be assigned to the mitigation of these risks associated with a given period of time.

Yet, what should be measured? what measurement system should be used? In order to answer these questions, it is advisable to start by analyzing what is understood by metrics. To do so, a few definitions need to be made.

The Data. Data are information represented in a format that permits their storage, treatment and automated processing.

Measurement. Measurement is the process by which numbers or symbols are assigned to real events, making it possible to describe such events in accordance with some pre-defined rules. In the overweight example, it would be 90-60-90.

Measure. Measure is the number or symbol assigned to an event as a result of the measurement process. In the example mentioned, it would be overweight by 110.100.110.

Metric. Metric is the unit of measurement. A tool to understand reality and to facilitate decision-making. In the example it would be the actual weight.

Indicator. The indicator is the instrument used to monitor the operation or condition of a meter or gauge which, in line with the example, would be the weighing scales and is generally in the bathroom.

Dashboard. This would be the set of indicators to summarize the performance of a risk program. It would be the weight in kilograms during all the weeks of a year.

The indicators, metrics and risk dashboard comprise the essential decision-making tools when a country is facing a health crisis or when the reader of this book is facing a serious illness problem. Primarily because a dataset represents information. And, when this information is interpreted, it normally gives that person greater knowledge. And, finally because knowledge gives a person wisdom.

Countries, just like individuals, need to have in place a risk measurement system that makes it possible to achieve the set goals. Likewise, the public decision-makers or directors of an organization need to rely on a system or program that defines current status, management and improvement.

But, why does a Risk Program need to be measured? This question could be answered with the following responses. Because, as indicated above, if you can't measure it you can't manage it; because when you observe reality, there is a need to classify or measure what you observe, using a measurement system. This method could be called "observer and model dependent realism", because it is important to know whether or not it is functioning and effective; because it is advisable to allocate financial and human resources in order to improve it; because, by measuring the program, decisions can be taken in order to achieve the pre-established goals.

In turn, there are different types of metrics. The most common ones are as follows:

- **Compliance**: these are generally the indicators and metrics that measure compliance with the formal requirements or whether preventive measures and controls have been taken.
- **Effectiveness**: those referring to the performance of a certain function. The extent to which goals are being met.
- **Efficiency**: those relating to the performance of a function from the point of view of the consumption of resources.

- **Past or explanatory**: those that measure the past. They serve to explain what has happened in the past.
- **Future or probabilistic**: those that measure the probability of something happening in the near future. They serve to try and predict what could happen in the future.

The data, indicators and metrics of a risk program for a health system must be interpreted, in order to facilitate an understanding of the program and allow those responsible to make the right decisions that are in line with the set goal. To do so, simple indicators are commonly used, such as 1 to 10, percentages 0% to 100% and/or red, yellow and green colors.

Generally, in risk programs, the set goal must be close to 100% or to 10%, given that organizations normally wish to avoid impacts in the form of loss of life, loss of money or a loss of reputation and trust. However this goal will be followed by factual realities. There will most probably be a considerable number of measures to be met within the same organization. This will lead to the definition and creation of a System that establishes, in a clear and orderly fashion, the type and kind of metrics and indicators to be implemented, analyzed and improved throughout the process life cycle of an organization.

For an organization or country, it will also be extremely necessary to summarize and represent in easy-to-view "dashboards". These dashboards are used to aggregate and represent the key data and indicators to enable the organization to take the necessary decisions in order to prevent future hazardous events.

However, dashboards and the entire risk measurement program will only be useful if they are in line with reality. Given that the reality of events will determine the success or failure of one system or another. This is so because trust in a system will be determined by whether or not the reality of future events is in line with what has been pre-established in the risk system. If the opposite happens, then trust will drop, leading to the in-depth revision of the indicators and measures of the system itself. There would be no point in building trust in society, if a health crisis leader and the president of a country report that the curve of infections will continue to rise until an unknown time in the future and that it will start to fall once the beneficial effects of the lockdown measures start to be felt. Neither does it help that, based on the curve and its interpretation in relation to an indefinite measurement, further decisions are taken for stricter lockdown rules and greater restrictions on the freedom of movement.

As trust is a subjective concept that falls on decision-makers, this will be high if the indicator correctly represents the reality of events. If, as we have said, the events were not predicted by indicators, then trust will fall, leading to the questioning of the system itself. And here lies one of the issues of the new global paradigm. People stop believing in their representatives, given that the latter were unable to take measurements to be compared to some clear and objective indicators. To state that the aim is to save as many lives as possible and to keep the death rate as low as possible, does not generate a great deal of trust. It would be more honest and ethical to say that the death rate is expected to be four times higher than the one for the seasonal flu of the previous year, and that the lockdown measures are directed at endeavoring to reduce this rate by fifty per cent in order to achieve the praiseworthy goal of a death rate that is double that of the previous year. And the information provided and your understanding of the situation are of little help to you if your political leaders, in whom you trust, say that these calculations

are impossible to make given that the pandemic is an unforeseen event and is difficult to delimit. Because if that were the case, you would be told that the number of deaths are due to the pandemic and that the lives saved (without knowing whether many of few) are thanks to the measures taken by your government. If you would like to believe this, then you are free to do so, but ask yourself how the good is measured and how it is compared to the bad.

As mentioned above, indicators and metrics help an organization to determine and be aware of its situation with regard to risks. The fundamental quality of an indicator is to understand what needs to be controlled in order to achieve the set goal. For this purpose, it is important to understand how to develop and create indicators. In this respect, there are two basic methodologies: scientific and non-scientific.

When creating indicators and metrics, the scientific methods take account of theories, hypotheses and tests to check that they correspond to reality. These methods are generally represented through mathematical methods and formula.

Experimental scientists use hypotheses to predict the result of experiments: a prediction is made of what is expected to be observed so that, if this is in fact observed then this substantiates the hypothesis (real), while if something different occurs then the hypothesis is challenged (false). Both the prediction and the result are measured mathematically in order to determine whether both are equal and exact. For example, vaccines are developed following scientific methods.

Non-scientific methods take account of policies, set goals and whether or not the indicators are more or less in line with the compliance level set as a goal. In this way, it will be possible to know whether the level of satisfaction is closer or further away from the pre-established level in the policy. These methods do not need to be mathematically represented, neither do they need to be based on hypotheses or experimentally refuted.

Regardless of the type of methodology employed, whether this be scientific or non-scientific, most risk systems must set the following questions: what indicators, metrics and measures will give responses that are more or less distant from reality? The questions are generally of the type: WHAT, WHO, HOW, WHEN and HOW MUCH.

The building of a risk system constitutes a key tool to obtain the necessary real-time information with regard to the compliance status of an entity and the risk level associated with non-compliance. In this way, the Risk Officer and the President of a nation, will have a dashboard, either at a local, national or international level, that is intended to underpin and support the decision-making of a country. For this purpose, it will always be preferable to have the use of a risk program or application that automates the processes and helps to optimize the achievement of the pre-established goals.

4

THE CRISIS

Albert Einstein himself appears to have predicted the key factors to manage and overcome a crisis. He should be remembered, not only for his famous equation E=mc2, but also for these wonderful words:

> "We can't expect things to change, if we continue doing the same things. Crisis is the greatest blessing for people and nations, because crisis brings on progress. Creativity is born from anxiety like the day is born from the dark night. It's in crisis that inventive, discoveries and great strategies rise. He who overcomes a crisis overcomes himself without being "Overcome". He who blames his failures and difficulties to crisis, rapes his own talent and gives more importance to problems that to solutions. The true crisis is the crisis of incompetence. The inconvenience of people and Nations is the laziness in searching for solutions and exit routes. Without crisis there aren't challenges, without challenges life is a routine, a slow agony. Without crisis there is no merit. It's in crisis that the best of us emerges, because without crisis all the winds are but slight breezes. Talking of crisis means incrementing it and hushing in crisis means exalting conformism. Instead, we work hard. Let's stop it once and for all with the only dangerous crisis, which is the tragedy of not wanting to fight to overcome it."

This chapter sets out the national and international indicators and measures established by the WHO itself in order to manage a pandemic crisis. Just like the risk assessments, the management of the crisis also requires prior planning. This ensures that, during the pandemic itself, there is no need to improvise with regard to the healthcare, organizational and legal measures to be implemented. All these measures must be prepared during "peace time", in other words before the actual crisis or pandemic phase, given that improvisation in risk-related matters is neither an effective nor efficient way of managing the crisis itself. And examples of poor management have not been lacking in the media.

Specifically, the risk management guide approved by the WHO itself, entitled "WHO guide to inform & harmonize national & international pandemic preparedness and response", approved in 2017, highlights some interesting guidelines.

The actual Guide defines pandemics as unpredictable but recurring events that can have consequences on human health and economic well-being worldwide. **Preparedness and planning,** it states, are critical to help mitigate its consequences.

The avian influenza pandemic of 2009 was the first to occur following the adoption of the International Health Regulations, approved in 2005. Member States had prepared for an extremely severe pandemic and they found difficulty in adequately responding to a **more moderate event.** This demonstrated the need to provide **risk assessments.**

The approach adopted in this standard, in the form of a guide, consisted in applying the principles of Emergency Risk Management for Health (ERMH). The objectives of ERMH are to strengthen capacities to manage the health risks from all hazards, to incorporate comprehensive emergency risk management in the health sector, and to enable and promote multisectoral linkage and integration across the whole of government and society.

This guide describes the method for the management of risks related to a pandemic and encourages countries to develop flexible plans based on national risk assessments. This guide was prepared in accordance with the legal framework established in the International Health Regulations (IHR).

The purpose and scope of the IHR are to prevent, protect against, control and provide a public health response to the international spread of disease in ways that are commensurate with and restricted to public health risks. Avoiding at the same time, any unnecessary interference with international traffic and trade. (art. 2 of the IHR)

Likewise, the implementation of these Regulations shall be with full respect for the dignity, human rights and fundamental freedoms of persons.. (art. 3 of the IHR) The IHR provided the WHO with the mandate to perform health surveillance and risk assessment, support the countries and coordinate the international response.

According to the IHR, the health measures in the face of a pandemic should be commensurate with, and restricted to public health risks while avoiding at the same time any unnecessary interference with international traffic and trade.

The phases of an influenza pandemic are a reflection of the risk assessment made by the WHO. These assessments are made at the beginning and are updated on the basis of the evolving virological, epidemiological and clinical data. The global phases are interpandemic, alert, pandemic and transition. As the phases vary in time from one country to another, each country must make its own risk assessments.

The implementation of the risk-based approach is represented as an ongoing process. The interpandemic phase is the period between pandemics. The alert phase, is when the virus is identified in humans and is characterized by increased surveillance and careful risk assessment at a global and national level. The pandemic phase is the period in which the virus spreads across the world. The transition phase is the period in which there is a reduction in the calculated global risk.

It should be underscored that the Director-General of the WHO is responsible for declaring a pandemic, according to article 12 of the IHR. But it is also important to note that the declaration of a pandemic must be based on a risk assessment.

Likewise, actions at national level to be taken by local or national governments should also be based on national risk assessments and be commensurate with the scale of the risk.

Countries and their health systems are vulnerable to loss and disruption as a result of pandemic influenza , nuclear contamination or chemical spills. Therefore, the ERMH objectives are, as indicated, to strengthen the capacity of countries to manage the risks of death and ensure that the health sector has a comprehensive risk management program in place.

The ERMH is based on the principles of **Comprehensive risk management**, all-hazards approach, **multisectoral** approach, including government, the business sector and civil society, and **ethical** principles.

In this latter respect, ethics in the management of a pandemic entails making decisions that need to balance potentially incompatible individual and community interests. For

example, critical services could suffer an overload that makes it necessary to focus on priority cases. It can also lead to taking decisions on quarantine, social distancing and forced isolation.

It is important to underscore how the WHO itself establishes that the measures that affect and limit individual rights and civil liberties must be necessary, reasonable, proportional, equitable, non-discriminatory and compatible with national and international laws

As a result of this 2020 pandemic, ethical dilemmas are evident. For example, faced with the shortage of mechanical ventilators, doctors need to take difficult decisions such as which of two patients suffering from COVID-19 should be given a ventilator: the elderly patient with a good medical history or the younger one with a poor medical history due to a respiratory disease? Which decision should be taken by the doctor who is responsible for these two patients? Should it be based on his own ethics or principles? Should the doctor count on pre-established ethical criteria?

For this very reason, the actual management of the crisis must be supported by ethical criteria and principles that are already in place. This will make it possible to use these criteria to take decisions such as in the example above, as to which of the two patients ought to be given the mechanical respirator. In this way medical staff will be aware of the "ethical rules or standards" that must prevail when faced with an ethical dilemma of this nature.

Furthermore, the ethical grounds are also important in other social circumstances such as social distancing and lockdown. Is this the same thing? What are the differences between them? These dilemmas will be addressed later on. But let's look at other ethical and moral problems that are arising in this health crisis.

For example, faced with the death of a loved on, either due to coronavirus or another disease, the government has decided, through regulations approved to this effect, to forbid attendance at the mortuary and funeral. It is therefore not possible to say farewell to a loved one, either with or without a religious service. Is it fair and morally acceptable that the nearest and dearest are not permitted to say farewell to a loved one?

But, there's more, let's take an example of a real case. My friend Joaquín (I will not mention his surname out of respect for his family) spent the six months prior to the declaration of pandemic, at a public hospital, caring night and day for his sister. I remember phoning him and, on a few occasions, visiting him at the hospital, in the hope that his sister would be able to receive a liver transplant, due to a severe degenerative disease that was affecting this vital organ. After having the usual coffee in the cafeteria opposite A&E, Joaquín would tell me about how his sister was slowly getting worse. But there was always the possible hope that a compatible liver would be found. What's more, my friend, who is a devout Catholic and who prays to his Virgin every night, tearfully told me that his sister had had a hard life ever since she was born. Well, in that six-month period of suffering, the pandemic arrived and his sister passed away during the period of mandatory lockdown. And much to his surprise, after a lot of argument, the mortuary allowed him to be present, together with his wife, ten minutes before the incineration in order to say farewell to his sister. A few minutes after entering the chapel, an employee from the mortuary told him that his sister's body had been lost. What? It's been lost? Well yes, it appears that the body wasn't at the mortuary He phoned me and I went to the mortuary, as his friend and lawyer. When I arrived, the person in charge informed us

that, finally, they hadn't lost the body (which he was unable to prove), but it was out of the city and had been incinerated in another mortuary in another province.

Out of respect for the family and in honor of her memory, I am omitting some unpleasant and sad moments in the hours and days following this dramatic episode which was "like something out of a film". Let this paragraph serve in remembrance and tribute to that wonderful woman, a fighter, from her beloved town of Aracena, of the cured ham we ate, and may God receive her in heaven for eternity.

What I would like to emphasize about this true case, is the ethical dilemma it raises: Like many other similar cases, it makes us ask ourselves many things, as a society: what are the measures and actions to be taken in the face of this pandemic crisis? Do we need to consider these dilemmas before they happen? Or, on the contrary, do they have to be managed as and when they occur?

On the other hand, to go beyond ethical dilemmas, the key components to be managed in a crisis are as follows, as established by the WHO:

- Policies and resource management: legislation, capacities, financing and human resources.
- Planning and coordination: ERMH units in the Ministry of Health, prevention and response plans
- Information and Knowledge Management: risk assessments, early warning, surveillance, information and knowledge management
- Infrastructure: logistics, supplies and safer, better prepared healthcare facilities
- Related services: healthcare services
- ERMH area capacities .

Effective governance of ERMH is based on the prior existence of appropriate policies, plans, strategies and legislation for a pandemic. In other words, before taking crisis measures, these must be planned and approved. What happens if this has not been done? Well, the crisis will be marked by improvisation.

Let's look at other examples of what's happening at a global level with regard to improvisation and, I would venture to say, the indoctrination of society by its governments and by the mass media delivering this message. Most governments have published and claimed that the pandemic was an unforeseeable event and that the healthcare system is unable to cope, given that it was prepared for other more common diseases. The television and social media have also shown how a large majority of citizens have, on their own initiative, started to make protective clothing and masks, to share messages from alleged doctors who tell of their bad experiences in A&E and warn of the seriousness of what is awaiting us, a long list of situations in which citizens become heroes and make praiseworthy attempts to do their bit.

The questions that might arise in this regard, are of the type: in a war, can you imagine citizens starting to make, on their own initiative, protective clothing for the soldiers? Along these lines, can you image a factory starting to make arms, with no government authorization? For my part, I would have serious misgivings about these measures in situations of war, both with regard to the government and the effectiveness of the citizens' measures. But something similar is being observed in the management of this crisis. But of course, everything is justified by the need to protect many human lives, an asset worthy of protection. But if this were a war, would lives be lost? How many losses would society in general be prepared to tolerate?

To return to the crisis management components, particular mention should be made of the approval of explicit laws that contemplates the prevention, mitigation, preparedness, responsiveness and recovery in a pandemic or other health emergency situation. Likewise, there must be laws to specify in detail the functions of the different organizations during a health emergency, which should be based on an ethical framework that guides policy development and implementation. Finally, this essential component must have a human resources plan that contemplates the staffing requirements for the management of health emergencies and defines the competencies required. Capacity development is essential to ensure that health personnel are correctly prepared for ERMH.

Prevention and mitigation actions for any risk should be determined following a detailed risk assessment at a national level. The initial risk assessment should include the preparation of short and long-term action plans, resource assignment and the urgent provision of community care and support. Recovery should be part of the response plans and should be done in parallel to other risk management measures and well in advance of any emergency.

Information and knowledge management should also include technical guidance on risk management, communications, and early warning and surveillance measures. During the ERMH, effective and efficient communication between the health sector and the public is critical. Communications by doctors and healthcare staff through their social media to inform the public of the severity of the pandemic, are not meaningful. The information must be precise and timely.

The correct management of emergencies requires access to, and the correct management of, a suitable infrastructure and logistics. The most important measures are transport, stockpiling and the supply of temporary healthcare facilities. Field hospitals that are away from sources of infection and city centers are a good example.

Regardless of the nature of the emergency, other healthcare services must continue to be provided, to save lives and deliver healthcare to patients with acute medical conditions, other than influenza Given that, if everything is focused on the emergency, then this can lead to an increase in the mortality rate for seasonal diseases that are prior to the pandemic phase.

This is another essential factor. It includes healthcare staff and also trained volunteers, personnel from other sectors such as education, water supply and other key sectors. The pandemic puts to the test the resilience of countries, enterprises and communities, based on their responsiveness. The risk management of an influenza pandemic requires an integrated approach.

The three broad social groups that must manage a pandemic are the government, the commercial sector and civil society.

5

RISK THEORY

The risk theory is explained below, a theory that underpins the assessment and management of a crisis such as the current pandemic. If you are already familiar with risk theory, or if you are not familiar with some mathematical concepts, then you can either skip this chapter or leave if for later.

Future events

The term event has its origin in the Latin word *eventus* and is particularly used when the occurrence or incident triggered has certain far-reaching significance. Such as a pandemic, a natural disaster or radioactive contamination.

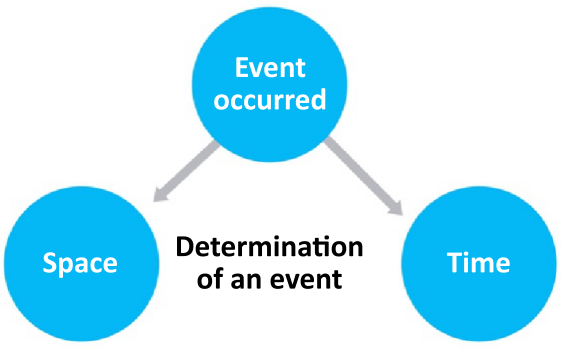
The significance is a serious or very important result or consequence that is far removed from everyday life. In the sphere of life, events are also marked by significance. An irrelevant event that has no impact on the physical or virtual world, from a practical point of view, has no significance.

A relevant event, however, is one that has substantial consequences in the physical world, in the virtual world perceived by our senses, or in the world of cyberspace, depending on the type of event.

A **material** event is one that can be classified as material if it solely occurs in the physical world, while it may have consequences in both the physical and virtual worlds. On the other hand, an immaterial event is one that can be classified as immaterial if it solely occurs in the virtual world although, exceptionally, immaterial events can occur in the physical world, such as a person's thoughts. Regardless of the material/immaterial classification, there are two key factors to define an event.

Space is one of these determining factors when evaluating an event. An event occurs in a specific space and at a specific time. It cannot occur in two different spaces at the same time. Space will determine, from a legal point of view, the classification of an event. An event occurring in the legislative framework of a country in the Middle East is not the same as one occurring in the legislative framework of a European capital city.

Time is the second determining factor when evaluating an event. An event either occurs at a unique specific time or over a specific period of time. An event cannot occur in the same way at more than one moment in time. Time is unique and events occur once only, decisively altering their legal assessment. An event occurring in the legislative framework of a country during the Middle Ages, is not the same as one occurring at the start of the 21st century.



Material event, space and time

A material event is one that solely occurs in the physical world, while it may have consequences both in this environment and also in the virtual or immaterial world. Material is defined as the matter out of which a thing is or can be made, that is, the opposite of spiritual or virtual. In other words, it is tangible and measurable from the point of view of physics. For this reason, a material event can also be termed an action or act.

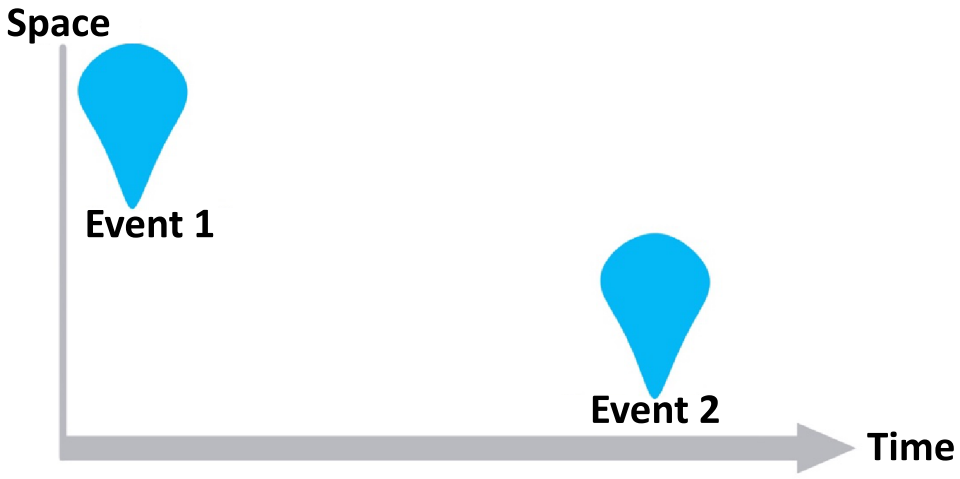
A material event is determined by space and by time. Space is one of the determining factors when making a legal assessment of the events occurring. This is because the place where the event occurs will determine the validity/invalidity, correctness/incorrectness or relevance/irrelevance of this event

Based on the characteristics listed above, a material event performed by an individual will occur in a specific space at a specific time. It cannot occur in two different spaces at the same time.

With regard to time, the second determining factor when assessing an event, will also determine the validity/invalidity, correctness/incorrectness or relevance/irrelevance of this event, to the same extent as space. Time is generally defined as the duration of things subject to a change, that is determined by eras, periods, hours, days, weeks, centuries, etc. This word comes from the Latin *tempus*.

The concepts set out here can be interpreted with the notation of the Theory of General Relativity, formulated by Einstein in 1905, in the sense that space and time are united. As a point of interest, by adding a fourth dimension (time) to the spatial coordinates, Minkowski introduced the concept of "event" in order to extend the concept of three-dimensional "point".

To continue with this relationship with the Theory of Relativity, it is not possible to have a material event in a specific moment in time without the existence of a specific space. Even from a legal point of view, all events must always show these two characteristics in order to be classified as a real event.



Immaterial event, space and time

In contrast to a material event, an immaterial event is one that occurs both in the physical world and in the virtual world or in the world of thought, and may have consequences in both environments. For the physical world, the term immaterial would mean the absence of matter or a physical entity. For this reason, an immaterial event should not be termed an action or act, and must be delimited to the concept of thought or purpose.

However, this definition is meaningless when speaking about the virtual world, in which virtual acts and actions are performed. All the events occurring in cyberspace, by definition, are immaterial. However, they are not mere thoughts or purposes, but constitute real cyber-actions that lead to cyber-consequences. For example, as a result of a pandemic, most citizens go to the social media, TV series or work from home.

In other words, in the virtual world, although all the events occurring are immaterial events they can be classified as actions or acts (or, in this case, cyber-actions or cyber-acts), in equivalence to what would happen in the physical world, given that they take the shape of virtual actions or acts that affect other organizations or individuals through the Network.

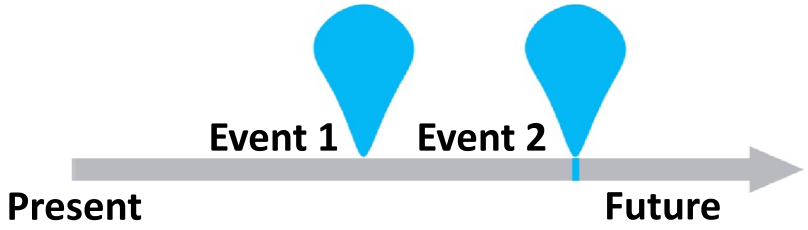
Although a material event is determined by space and by time, an immaterial event, however, may a priori appear to be lacking this spatial characteristic and solely be determined by time. If it is determined that an event has no space to take place, then it cannot be classified as a real event and, therefore, it cannot exist. However, it is possible to find a different concept relating to this immaterial event-space relationship that argues that the virtual world is a different space to the physical space. And this is the concept followed in this work.

Cyberspace, the Internet or the Network is a site or "Place" that can be classified as space, as is understood by the physical space defined herein. Therefore, immaterial events that are termed actions, could take place in cyberspace as real events.

In a similar vein, it could be said that these actions are real because human beings perceive them through some of their senses and they are finally interpreted by the brain. For example, those actions known as fake news.

As far as time is concerned, the same classification used for material events applies. The event will always be determined in this environment by the time in which it occurs and, regardless of the space variable, it will be the most determining factor when classifying an event.

In other words, the occurrence of an immaterial event is only possible in a specific time and space, in this case a virtual space. In this respect, these immaterial events can also be related to Einstein's theory of relativity.



The principle of interpretation and justice

The principle of judicial interpretation stems from the idea of the hierarchical structure of the legal order. The relationship between the upper-level and lower-level norms in a legal order, and that existing between the constitution and the law, or between the law and the administrative act, is a hierarchical, deterministic or binding relationship. The upper-level norm governs or conditions the act by which the lower-level norm is created (or, where appropriate, executed).

This being so, the declaration of a state of alert cannot contradict the higher-level norm, in this case the Constitution of each country or nation.

Therefore, the interpretation can be defined, from a positive understanding of law, as the intellectual process made by human beings in the progressive shift from the upper-level norm to a lower-level norm provided for by the former.

This is what happens in the most usual case, namely the interpretation of the law, whereby based on the general legal norms, the corresponding individual norm that is applicable to the event is obtained, which is the administrative act or the legal sentence. It also happens, in the interpretation of the Constitution, understood to be the original norm at the top of the hierarchy, in the sense that the creation of the following norms, by the appropriate legislative process, entails lower-level norms.

However, this determinism is neither absolute nor complete. This is because the upper-level norm is unable to foresee and describe all the future material or immaterial events. There is always a margin of discretion, as is the case for the declaration of the state of alert in each country as a result of the pandemic.

From the above it can be deduced that any judicial event is to a certain extent indeterminate, and therefore determinism is not an absolute value. This indetermination refers both to the fact (described in the norm) and to the legal consequence (described in the same or another norm). This indetermination may be an unintentional consequence of the actual nature of the norm. This may occur due to the different meanings of words, so that they can be interpreted in various possible ways. Thus, for example, a court ruling means the creation of an individual norm related to the upper-level norm, however it does not means that it is a single individual norm, but an individual norm of the potential norms coming within the general framework described by the upper-level norm.

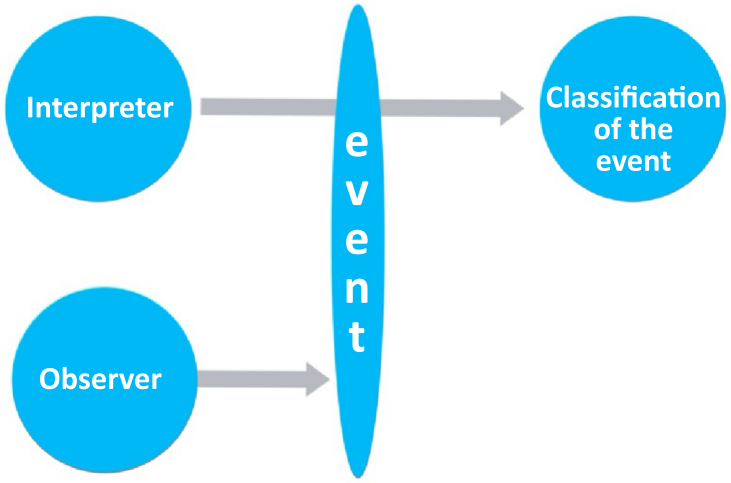
In fact, case law is considered in different jurisdictions to be a secondary source of law, but not an original source. This case law, as a secondary source, clarifies the concepts of the upper-level norm (generally a law) but is linked to a greater or lesser extent to the original source (the law).

Observer vs. Interpreter

The observer is the person present at the occurrence of an event. The observer is the witness to this event and, from a strict point of view, has no greater relationship to the event (beyond that explained in the sections above in relation to space and time).

However, when the work of this observer is to evaluate the event and classify it according to the legal order or set of norms, in a specific time and place, then that observer becomes a judicial interpreter. For example, the interpretation made by a government of the severity of the pandemic, to then classify this event and interpret it as a de facto assumption that could come within an exceptional state of general alert.

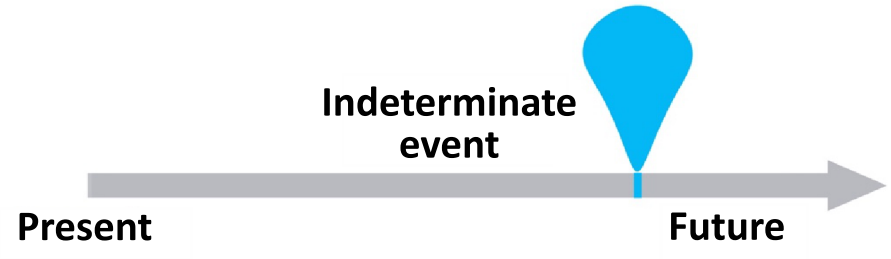
This interpreter, either in the capacity of president, judge, or in the capacity of lawyer or victim, will make a classification of the events in relation to their space and their time which, depending on the entrusted task, may or may not be decisive for an organization. For example, the interpretation of an event by an organization's employee will not have the same value or the same consequences as the interpretation of this same event made by the president of a government.



Uncertainty

In the area of event prediction within an organization or country, uncertainty is the main obstacle to be overcome. As humans are unable to calculate the extent of uncertainty, this at times leads to an unfounded fear to protect oneself against potentially harmful events.

The aim of event prediction is to determine the greatest number of factors that have an influence on an event, should it occur, and to achieve this with calculations of the highest level of accuracy.

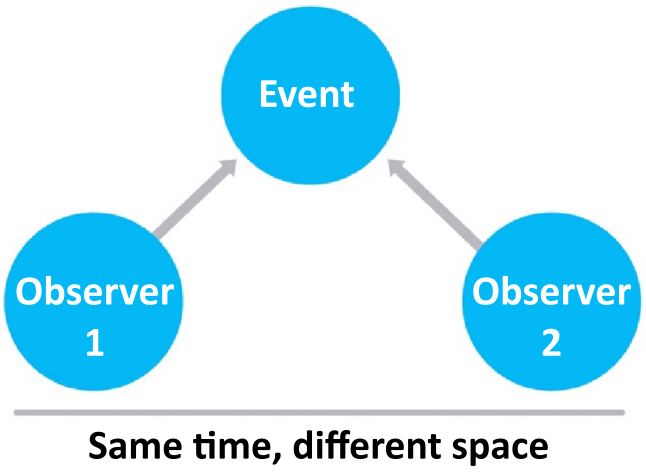


Model-dependent and observer-dependent reality

After having explained the space-time combination in the section on the definition of events, we will now go on to establish the concept of reality. An event occurs in a reality which, as explained above, can either be physical or virtual, and is observed by an observer.

Just like events, the observer, who can be anyone, is delimited by space and by time. For this reason, the legal evaluation of an event by an observer will be different each time, given that space-time will have changed. This leads to the conclusion that the observer's reality cannot be expressed in absolute terms, but must be envisaged as a reality that is relative to the space and time in which the observer is placed.

The theory of relativity enunciated by the scientist Albert Einstein shows precisely that any interpretation depends on the conditions of the observer, which is determined by a specific space and time. Although it is true that this theory is applied in the field of physics, in the field of social sciences, Kant, the German teacher and philosopher, delimited the concepts of space and time to explain the sense that is has as a "sense of reality" for an observer.



This being so, the pandemic event is interpreted differently by each observer. The government considers the event to be extremely serious, however as a result of its lack of medical knowledge, it does not know how to measure this seriousness in terms of human health. For this reason, it is advised by a team of medical experts. What a responsibility for the team! I wouldn't want to be in their position.

Likewise, this medical team will interpret the event and its impact on the population through an intellective process that may take account of general objective data or subjective data that is morally biased, such as saving lives even despite the possible medical consequences on healthy individuals or on other patients not suffering from the virus.

The relativity of justice and its international law

Law, as a legal system or order, is a hierarchical system of legal norms created and invented by man. Or, to put it another way, the legal order and its norms are not acts of nature. A number of legal norms forms a unit, an order, a system. The contents of a legal norm are valid if created according to a specific form, rule or method. For the purpose of this work, law is valid in the sense of positive law, understood to be imposed law.

Law is valid in the positive sense that it is imposed, regardless of the moral significance of the said norm. In a legal order, the fundamental norm generally comprises the Constitution. This fundamental norm grants power to the action of the leading legislator and, consequently, to the rest of the lower-level norms.

The hierarchical relationship of the norms within a legal order may appear to imply that any conduct or human act is valid if it is real. But this is misleading, given that the existence of law does not lie in the natural reality. This is how it is possible to interpret how one country decrees a state of emergency while another country does not do so.

It is true that law must take account of the natural reality of events (material or immaterial) by delimiting the validity of law, but law and reality should not resemble each other.

As Hans Kelsen states:

> *"If we replace the concept of reality (as effectiveness of the legal order) by the concept of power, then the problem of the relation between validity and effectiveness of the legal order coincides with the more familiar problem of the relationship between Law and Power or right and might. And then, the solution attempted here is merely the scientifically exact formulation of the old truism that right cannot exist without might and yet is not identical with might. Right (the law), according to the theory here developed, is a certain order (or organization) of might."*

Therefore, the legitimate government has the power to decree the state of alert or emergency, following the procedures and observing the upper-level norms, but this does not mean that the government's power is in accordance with the law. Which, in my understanding, could be the case of the pandemic.

Now that it has been established that the observer's reality cannot be expressed in absolute terms, but must be envisaged as a reality that is relative to the space and time in which the observer is placed, it is now necessary to question the validity of Justice and Law as a universal concept.

A group of observers, constituting a society, are ordered and governed by a set of norms N that constitute its Law and, by extension, the assessment of justice that they will make of the legal events. A group of different observers may determine a set of norms N that is different from those of the first group, constituting a different Law and, therefore, they will have a different assessment of Justice.

The absolutist interpretation of Justice (such as iusnaturalism) and the Law determine that these are unalterable and indifferent, regardless of the society in question. This interpretation will establish that an event is just, or is in accordance with the Law in all the societies in which it occurs.

However, events, as has already been stated, occur in different societies in different spaces and times. Each society classifies the events according to its norms (general norms - laws and individual norms - rulings) and its customs, and the interpretative evaluation of these events changes. For this reason, the absolute classification of an event is not the approach that best suits its nature, being governed by these external elements.

§

Given that events occurring in different societies are classified in different ways, Justice and Law cannot be classified as absolute but must be treated as relative.

§

Security: threat, vulnerability and risks

As mentioned above, the term security comes from the Latin *securitas,* which is defined as the quality of being safe, that is, risk-free. Security is a value of great stability and basic importance, because it implies the certainty of knowing what to expect.

Likewise, the legal security of a country is, in principle, part of Law, something which is universally recognized. The basis of this principle lies in what is known as "legal certainty", the security of having knowledge, or that it is possible to gain such knowledge. This means that legal security, in the subjective sense of the term, is a human need that the world, the society in which a person lives, be governed by a Law that

provides certainty, confidence and stability. But can legal security be said to exist in a state that has declared a state of emergency or alert?

Concept	Natural disasters
Threat	Earthquake
Vulnerability	Inability to prevent the earthquake from causing damage

Legal security seeks to build a "climate" of trust in the legal order, basing this trust on a certain regularity and predictability, both with regard to the norms and to the actions geared towards these norms. It therefore involves:

- knowledge of the norms in force
- a certain stability of these norms
- knowledge of the actions of the judicial power and the consequences of compliance or non-compliance with the norms.

Likewise, in an objective sense of the term, Legal Security can be defined as that situation of an entity or natural person that gives a measure of its "resistance" to suffering an incident or negative situation in this area. As far as this present work on risks is concerned, and in the objective and mathematical sense of the term, security can be measured and calculated, as discussed above.

A high level of legal security would indicate a "strength" or, what is the same, a minimal or residual risk of suffering a negative consequence. A low level of security would imply a high probability of suffering consequences of this nature. It is a matter of assessing the vulnerability of individuals and countries with regard to their life expectancy and survival. Subsequently, once this vulnerability has been assessed, the aim would be to reduce such vulnerability by acting preventively against potential threats.

A few concepts related to this idea are presented below.

Threat and vulnerability

In general, a threat is defined as the probability of occurrence of an event with potentially negative or disastrous consequences during a period of time in a certain place - in the widest sense of the term. For example, the COVID-19 virus or pathogen would be the threat, for natural and legal persons and countries alike.

The term vulnerability comes from Latin vulnerabilis and comprises three clearly distinct parts: the root word "vulnus", which can be translated as "wound", the affix "abilis" which is equivalent to "possibility" and finally the suffix "itas" which is indicative of "condition or quality".

Hence, vulnerability can be defined as "the quality that one has to be possibly injured". Vulnerability is the quality of being vulnerable, that is one who can be physically or morally harmed. The concept can be applied to a person or an entity, based on their capacity to prevent, resist and overcome an impact. Vulnerable persons or entities are those that are in a risk situation.

Vulnerability is defined as the inability to resist against a threat, or the inability to recover after such a threat has occurred. In the current context of the pandemic, the event associated with the threat, from the point of view of a country or person, would be the COVID-19 virus or pathogen.

The possibility of this virus threat materializing in the future is associated with a measure of probability that can be set in a specific period of time and space. Based on this evaluation, the greater the probability associated with the occurrence of a threat, the greater the vulnerability of a country or person.

In order to better understand the concepts of threat and vulnerability, these are concepts are compared when they arise in the field of natural disasters, epidemics or an earthquake, for example:

To continue with the example, of two areas threatened by an earthquake, Tokio and Haiti, the latter will be more vulnerable as it shows a greater inability to avoid the damages caused by the earthquake. In the case of the pandemic, two companies will be threatened to the same degree, yet the most vulnerable company will be the one that - due to its internal management or its characteristics - is more exposed to the possibility of suffering a greater impact.

As has been seen above, the processes associated with future events are affected by uncertainty, given that they depend on a series of uncontrolled factors that are difficult to specify. Therefore, the said variability must be considered to be random and this uncertainty must be correctly addressed. An example of this situation in another area would be the insurance of a car, in which the premium to be paid depends on a series of external factors (condition of the roads, number of claims, etc.) and other internal factors (age of driver, how long the driver has held a license, etc.)

Automated or Machine Learning techniques are appropriate in this context. Within the problems of automated learning, this study is focusing on the Problem of classification, detailing the classification trees as this is the most suitable technique for the prediction models associated with the business world and the risks of pandemic. Although, logically, other predictive models can be used.

Automated learning technique and data mining

Certain problems are not governed by a universal law, such as the law of universal gravitation, but are strongly dependent on each specific situation. For this reason, the said law or mathematical model needs to be determined on a case by case basis, "learning" from the data that identify the said situation.

"Learning" in this context means the identification of complex patterns in the data, which may be extremely voluminous. For this reason, it is necessary to propose an algorithm (or machine) which,

based on the original data, is able to predict future values for the said data. In this way the term Machine Learning is justified, also known as Automated Learning.

Machine Learning is therefore introduced as the scientific discipline directed at getting systems to learn automatically. Machine Learning comes under Artificial Intelligence, which came into being in 1956 with J. McCarthy, M. Minsky, N. Rochester and C. E. Shannon. The basic objective of artificial intelligence is to construct an algorithm that performs in such a way that, if a human being were to do the same, then that person would be called intelligent.

In this context, in which the data take on particular importance, as they determine the model or law that characterizes them, a new concept has been introduced, namely Data Mining. This brings together the set of techniques - basically statistical and computing - that try to infer the laws giving rise to the data The Machine Learning procedures used in Data Mining include neural networks, decision trees, support-vector machines, Bayesian networks, etc.

Both Machine Learning and Data Mining are closely related to Statistics, by trying to infer patterns or behavior of the data and, in general, to mathematics, given that they propose mathematical models.

Statistics includes descriptive methods and inferential or predictive methods alike. Descriptive statistics collect, present and characterize a data set (for example, population age, lethality or mortality rate, by epidemic, temperature in the summer months, etc.) in order to appropriately describe the diverse characteristics of this data set, collected by the different mathematical variables. The use of descriptive statistics makes it possible to simplify and summarize the (complex) information of a data set in a group of indices that can be easily viewed as a graph or table.

Inferential Statistics, or simply Statistics, are based on a data subset (sample) of the data total (population) in order to infer the behavior or underlying law in the population, based on the information collected in the sample. The final aim is to deduce or predict the future performance of certain variables of interest. To do so, a mathematical model is constructed that can either be a function (as in the case of regression) or it may not have an explicit mathematical representation (as in the case of decision trees).

In any case, the data extracted are processed and transformed, selecting the "useful" information in order to subsequently build a "mathematical" model through statistical and computational techniques, that will make it possible to obtain analytical conclusions and predictions.

Different data mining techniques are available. The selection of the most suitable technique(s) and which will determine the predictive mathematical model, will depend on the nature of the study data and also on the nature of the problem itself. Different techniques can be used for some studies, to later compare the models obtained.

The following table shows some of the key data mining techniques:

Technique	Supervised yes/no	Linear	High dimensionality
Analysis of the Principal Components	NO		YES
Clustering	NO		YES
Discriminant analysis	YES	YES	NO
Logistic Regression	YES	NO	NO
Linear Regression	YES	YES	NO
Principal Component Regression - PLS	YES	YES	YES
Penalized Regression	YES	YES	YES
k-NN	YES	NO	NO
Neural Networks	YES	NO	NO
Support Vector Machines	YES	NO	YES
CART	YES	NO	YES
Bagging / Random Forest	YES	NO	YES
Boosting	YES	NO	YES

Data and variables

Therefore, the methodology followed to construct the business equations, should include procedures used in data science. Data science is a discipline consisting in extracting knowledge from data and which combines procedures and processes from different data analysis fields such as statistics, data mining and predictive analysis. The new data-driven approach is therefore followed, instead of the traditional theory-driven approach.

The first step in this methodology is to detect and combine the data sources, by extracting from the sources the information required for the analysis and guaranteeing data consistency and integrity. As mentioned earlier, in this step it is important to have expert knowledge in the specific business area in order to be in a position to extract only the relevant information.

Once the data have been obtained and stored for processing, the next step is to identify the mathematical models underlying the data and that will make it possible to construct the legal equations that can be used to predict future decisions and behaviors. In the case of an organization, the different data sources need to be identified in order to extract the information required for analysis, while guaranteeing data consistency and integrity.

All these data can be studied and analyzed for the purpose of making predictions, however two basic points need to be taken into account:

1. What information is to be predicted and what response variables are of interest?

2. What information is relevant in order to predict the said response variables?: predictor variables.

The meaningful data for the data analysis need to be selected from all the accessible data. To do so, a pre-selection should be made of all relevant information.

In the present environment, in this step, a person with expert knowledge of the business area should select the meaningful data. Based on the experience and facts known by the expert, "variables" or information unrelated to the desired prediction can be rejected, in order to decide on the variables to be used in the model.

Based on the mathematical model, once the data analysis techniques have been applied, the significant variables should be selected from the variables used in the analysis. That is, those variables that affect the response variable or variable to be predicted.

The said "significant" variables, which serve to predict, will be the "Predictors" or "Factors". There is no fixed rule on number and they will be selected by considering:

- The nature of the problem to be addressed
- The type of predictor variables
- The number of values that each variable can take.

The types of variables, both the response variables and the factors, identify and classify the nature of the data involved in the prediction. The variables appearing in the data analysis are statistical variables and, therefore, can be of two types:

1- Quantitative variables.

Their value is a number, so that their higher or lower value is a measure of the relevance of the variable itself. In turn, two types can be distinguished:

- Discrete. The values of the variable will be within whole numbers, that is positive natural numbers, zero, and negative numbers. And, in some cases, they may be limited within an interval, that is, only a series of values are taken. An example would be a person's age, which could be defined in years from o to 150 (estimating that life expectancy will not be more than 150 years).
- Continuous. The variable can assume any numerical value within real numbers. We can therefore have positive values, negative values, with or without decimal places. An example would be the amount of a fine, that could take any value from 0 euros upwards. For their representation, decimal numbers with various decimal places can be used. These variables can also be limited within an interval of values.

For quantitative variables, an upper (lower) limit is defined as the maximum (minimum) value that can be taken, and the range is the interval of valid values identified by these two limits.

2- Qualitative variables.

Those that express an attribute or category, they simply indicate different situations. In turn, they are divided into:

- Ordinals. The variable represents a category that has an order, and the values taken are within an ordered range. For example, if we classify the companies that could be fined by turnover, we would not take the annual invoicing figure as a variable, but we could define a category for turnover with values of: (very low, low, medium, high, very high).
- Nominal. They represent a category that has no order. The values are "labels" of the different categories, that could be numbers, but its numerical value has no sense as such.

With regard to the Risk assessment, which is dependent on the Result of the process and the Impact Quantity, the methodological approach followed will consist in considering the two variables mentioned as random variables, for which the values are known in a given time interval in a subset. The aim is to infer the future behavior of the said variables by relating it - if this is possible and relevant - with other variables in order to predict the risk.

6

THE INVISIBLE ENEMY

§

"IF YOU KNOW THE ENEMY AND KNOW YOURSELF, YOU NEED NOT FEAR THE RESULT OF A HUNDRED BATTLES".

SUN TZU

§

In this respect, it is important to indicate that, at present, the world constitutes a decisive geopolitical scenario in which Governments, Public Authorities, private sector entities, big investment funds and individuals themselves, are waging real "battles" over the new social order and the sustainability of a global, capitalist environment.

Who has not questioned whether the COVID-19 was created by nature or, on the contrary, whether it was developed by scientists in a high biotechnology laboratory. What does seem to be clearer is that a "battle" or "war" is being fought against an unknown enemy.

In this respect, in order to correctly wage the "battle" of the pandemic, it is essential "to know ourselves and to know our enemy", in other worlds it is crucial to diagnose our situation and identify the threats that we are exposed to and the key health safety strategies, and even political and economic strategies, that we could implement in order to counteract such impacts and/or, where applicable, mitigate any potential future risks.

Firstly, we need to consider the various social, political and technological phenomena that have come to remodel the structures of the new world, at a local, national and global level. By way of example, the dependence on, and easy access to the international market, mean that the interferences in this area are becoming progressively more common and more troubling. To a large extent, the pandemic permits the materialization of new risks and threats. Likewise, other threats are progressively more sophisticated and represent major dangers that threaten the security and stability of governments and/or private sector entities.

In the midst of the scenario described, as the military strategist Sun Tzu would say in the 4th century B.C. "You cannot fight against something that is unknown to you". It is therefore necessary to be aware that the pandemic is a "battle" that is waged in a changing scenario with the existence of threats that could have far more complex and harmful effects than those resulting from traditional threats such as terrorism.

In addition, the pandemic and all its consequences and impacts on the new order entail the appearance of new permanent "enemies" on this new "battlefield". Despite the fact that they regularly appear, on occasions these actors are not even noticed or managed adequately.

The lack of identification and management of such threats, such as fake news, appears to be intrinsically related to the lack of awareness of the security risks associated with the global opening and the interconnection between the traditional environments, and the inadequate assessment of the threats, which are generally seen as uncertain or improbable. And the pandemic is one of these. You only have to look at how all the political leaders have publicly declared that the COVID-19 was unforeseeable.

In order to face up to our "enemy" in the global "arena", the risks detected must be objectively measured and managed in a way that is reproducible. For this purpose, it is essential to ensure that a security strategy is in place, underpinned by tools and methodologies that permit a detailed analysis of each and every risk, through catalogues of assets, threats and vulnerabilities, capable of adapting methodologies to the specific characteristics of the global, interdependent world. England is an example of a country that foresaw the pandemic as a national safety threat and considered it to be among the three threats with the highest probability of occurring.

Likewise, national safety strategies must involve a continuous improvement process. For this purpose, it would be advisable to implement monitoring tools that make it possible to measure security through indicators that are in line with the goals of a nation: suitable incident detection and management systems, in order to examine the exposed vulnerabilities, as well as a procedure to handle the response.

As already mentioned, in the "Battlefield" it is essential to "know oneself". This involves: (i) identifying each of the circumstances (normative, economic, social, technological, etc.) affecting the performance of our activity in the world; (ii) detecting, analyzing and managing the risks and vulnerabilities, in order to anticipate the probability

that a threat may take advantage of a vulnerability, impacting on our way of life. This aspect can be represented by the following formula:

RISK = IMPACT X PROBABILITY

In this respect, the new risk professionals represent an ally who will efficiently collaborate in the identification, based on objective criteria, of the probability that a risk will affect our environment and become an impact.

This objective shall be achieved through a threat assessment, the mapping of elements under threat, vulnerability assessment and an estimate of costs and / or benefits that could be derived from the implementation of a comprehensive security strategy. The United States is also an example of a nation that has studied and shared the costs and benefits with its citizens, in the form of estimated loss of lives and economic losses.

In this way, the subjects affected in the world environment can wage the "battles" against the "**security enemies"** through management models that make it possible to progress from simple prevention to the detection and planned response to potential threats, in a context that permits resilience, threat reduction, the development of a healthcare, economic and social defense policy, and the establishment of an integrated and coherent security strategy.

The invisible enemy. A Biological War?

Some more or less well-known and respected voices have put forward the idea that the pandemic was developed by a high-tech country in an endeavor to impose a new world order. Although the proof of this theory needs to be checked by the intelligence services of each nation or group of nations, we can still do an exercise in analytical thinking and consider the said possibility, purely from an intellectual point of view.

A biological war can be defined as the fight or conflict between two or more nations or between different bands within a nation, where the national health of its citizens is the battlefield. This is the place where the USA and China could be waging a great war to control the new global political and economic order. And this is the battlefield on which a new war could be waged, one that is not only commercial or diplomatic, where there are no clear borders or sovereign states, and neither is there a pre-established and clear legal order.

The acts characteristic of a biological war between two states (or more, who knows) would be directed at eliminating their enemy in his own territory. A biological war would include acts in which attacks on persons using infectious pathogens would be combined with other support capacities (for example cyber attacks). Political, intelligence, trade, pharmaceutical means would be combined to identify and analyze the malicious activity, while at the same time executing response actions to eliminate hostile attacks on the interests of each nation.

Health has become a strategic, privileged vector for the cultural, social and economic development of all States and, for this reason, new conflicts will increasingly take place in this setting. However, it should be said that everything

that has been stated above needs to be demonstrated with facts and reliable data. All the same, it still serves as a good intellectual exercise, by way of reflection, allowing the reader to investigate and consider whether such a possibility could arise in the near future.

7

CYBERSECURITY

Following the pandemic-related news publications on the internet, as well as the personal stories posted on the social media about events in hospitals and emergency wards, whether or not these are true, in this section I would like to put forward some considerations about security in a virtual environment that is connected to the territorial environment. This is all the more so if we consider that, as a result of the restriction of movement or lockdown, people are getting their news about their environment through this new cyber world.

We're talking about the so-called cyber-hoaxes, fake news or real news such as messages circulating through the social media in which alleged doctors talk about the serious consequences of the pandemic disease and how this can affect young and healthy individuals, as well as how COVID-19 is causing many problems for the healthcare staff, presenting them to society as real heroes. Or how hospitals are experiencing cyber-attacks directed at bringing them to a standstill, without knowing who is behind these serious security incidents.

To what extent does Internet offer us new opportunities to progress? Are we sufficiently protected against fake news? Is it possible to be properly protected on the Internet? Is the Internet a new scenario in which fundamental rights are violated? These are just some of the question considered in this document.

Internet has represented a real revolution. Today, thousand of millions of people, enterprises and even machines co-exist on the Internet, and there is no denying that it is a reality that is here to stay. A reality that we will call cybersociety. Cyberspace has been established as a new virtual world, devoid of matter and territory, created by humans, revolutionizing the relationships and communications of individuals, organizations, corporations and States.

Over the last few years, security on the Internet, termed cybersecurity, has focused on protecting information, based on three basic pillars: Availability, Integrity and Confidentiality (AIC). This is a protectionist vision of an asset, namely the information and the machines processing this information. However, this asset has not been expressly recognized as a legal asset worthy of protection. This form of addressing cybersecurity does not take account of another asset of vital and perhaps even greater importance, namely human rights and freedoms of individuals, enterprises and the State itself, who receive, send, process and interpret this information that, on many occasions, as is happening in this health crisis, may be fake.

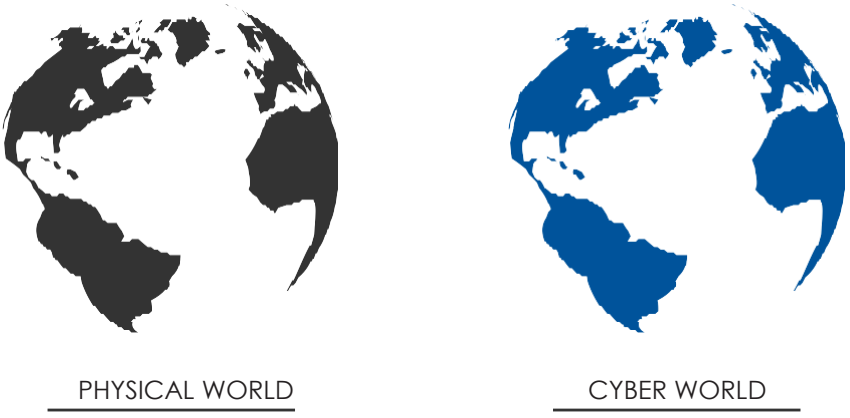
Internet was created by communications specialists for a purpose (the sending of information between computers) with guarantees of sending and securing the information sent (AIC). However, at present, this information exchanged between machines not only affects computers but also natural and legal persons and the public and state institutions. Given that these are the people who send-receive this information, being interpreted by a person's most complex organ, the brain. And the health crisis and the information circulated through the Internet is a clear example of the power of lies, given that it is difficult for machines and people to distinguish between true and fake information.

The brain is the biological organ that connects the two worlds, the geographical world and the virtual one. This means that the information interpreted by an individual can be either malicious or beneficial. It could be said that, at present, malicious information is that which affects the rights and freedoms of citizens and enterprises, both in their biological life and in their virtual life or cyber-life.

Immaterial events such as cyber-attacks, fake news, cyber-blackmail, cyber-harassment, identity theft, content piracy, DDoS, ransomware, cyber child pornography, terrorist recruitment, cyber-hoaxes, sexting and a large number of cyber-events, are not technical but problems of a social nature which, due to the complex communications network, escape the control of the traditional legal, executive and legislative powers. And this means that the States and citizens can merely stand by and watch how the malicious code incidents grow year after year, at an alarming rate. This creates a climate of distrust and insecurity.

All this is combined with a feeling of insecurity and fear, that is affecting the large majority of people around the world. And in this cybernetic world there are security problems and the cyber-risk theory is similar to that contemplated in the territorial world.

Cyberspace, a new lawless world



Cyberspace is a reality that is here to stay. In it, billions of machines, internauts, enterprises and organizations of all types coexist. Who is missing? The States, their governments and, why not say it, the legislative and judicial powers. You only have to read the news to see how the political leaders are constantly "reporting" fake news and hoaxes which, according to them, affect peaceful coexistence in a democratic state. Likewise, these leaders are requesting the assistance of the justice and its judicial bodies, even in the knowledge that there is little possibility of success.

It goes without saying that Cyberspace has become a new digital or virtual world, with no physical borders. A new world or cyber-society that must no be outside the law and the various legal orders that structure are civilized, modern world. But of course, a world in which physical space does not exist - although time does -, it is not clear who holds the legislative and judicial powers. We are therefore facing a world of regulatory lawlessness where, paradoxically, all types of communities coexist.

Faced with this new situation, some States have set out to conquer the Internet: some to censor it (which is what China appears to be doing), and others, in the name of national

security, to protect their citizens. China, Russia, Israel and the USA are good examples of states that are seeking to colonize cyberspace.

Moreover, it should be added that most states have neither declared nor recognized cyberspace as public property or property in the public domain, with the exception of certain countries which, in their recent legislation, have sought to make declarations of cyber sovereignty.

Cybersecurity....from what?

As has been pointed out, the aim of cybersecurity today is to protect information and the systems and communications networks that process this information. This technified vision of cyberspace, provided by the IETF (Internet Engineering Task), focuses on threats and vulnerabilities of a technical nature. It is thus understood that the threats are of the type such as DDOS, phishing, hacking, keylogger, malware, and security vulnerabilities such as Exploits, which takes advantage of a certain vulnerability or breach at a device firmware level.

This technified vision of Internet considers that cybersecurity depends on a number of pillars that underpin security. These pillars are the availability, integrity and confidentiality of the INFORMATION exchanged between machines identified with an IP number. In this way, internal security protects the information exchanged and processed solely by computers.

This way of understanding the cyberspace security problems has led legislators to pass laws with an exclusively technological content in a regulatory framework that is applicable at a territorial level. This way of legislating on security keeps the focus on the securing of information. Information is an asset of great value for enterprises, citizens and the State itself.

Enterprises are of the understanding that they should be responsible for protection and, accordingly, have proceeded to create teams of computer experts within their organizational structure with a view to protecting their assets and properties. The regulator is also of the same understanding, imposing legal obligations with a primarily technological content. This whole view has led to the growth of a private industry for cybersecurity products and services, in which a great deal of money is exchanged.

However, this private view of the cybersecurity industry is facing an ever-increasing volume of threats, vulnerabilities and, in short, damages. The result is that the shareholders of corporations, the bank being among the most important ones, do not see a reduction in the cyber impacts even when they increase their expenditure on defense. The lack of order in matters of public security (police and judges) is moreover creating a feeling of distrust, not only in the business sector, but also in the general public.

This technified and private view of cybersecurity is creating an increasing helplessness in the average citizen, who does not understand or has no private means (products and services) of defense against cyber threats. On top of all this, we must add the new threats that, together with the old ones, are directed at citizens coexisting in a specific State. For example, the fake news on COVID-19 that is causing so much confusion among citizens, who are unable to differentiate between real and fake information.

These threats are not of a technological nature, neither can they be defended by hackers, computer experts or the public CIRTs, nor by the private solutions or products directed at protecting the AIC of information systems. Moreover, the current vulnerabilities are not of the Exploit type, but are vulnerabilities of a personal nature. These vulnerabilities are those affecting moral integrity, honor, privacy, self-esteem, ownership of immaterial assets, freedom and social peace.

In short, the threats and vulnerabilities are affecting another asset of considerable value, namely HUMAN RIGHTS. And, in the pandemic phase, with restrictions on the rights of movement, freedom of enterprise and others, we must add these serious cybersecurity incidents, in which the information systems of hospitals and businesses alike are being subjected to ongoing cyber attacks. All this has created a feeling of distrust and insecurity that is affecting citizens, organizations, the domestic market and the State itself.

In this respect, the recent National Cybersecurity Strategies are seeking to promote secure cyberspace, by covering social aspects that go beyond the purely technical ones. For this purpose, these strategies define a new approach to cybersecurity, in the face of the threats and vulnerability of cyberspace, to move into the political, economical and social spheres.

In this way, the National Cybersecurity Strategies of many countries have started to establish the general objective of guaranteeing the secure and reliable use of cyberspace, protecting the rights and freedoms of their citizens.

Something is not working

As mentioned above, over the last few year the public and private vision of cybersecurity focused on protecting the information systems and the communication networks that process the information from hardware devices. This technological approach understood Internet as a technified world, forgetting the more social and humanistic side of cyberspace.

Cybersecurity focused on identifying, analyzing, managing, mitigating and solving risks (threats and vulnerabilities) of a technical nature. In other words, those risks affecting machines. No account was taken of the fact that the information exchanged between machines was also affecting and being interpreted by humans.

This way of addressing cybersecurity failed to consider risk as a factor or probability of violating human rights. With the exception of the fundamental right to the protection of personal data in the form of a European Regulation, other human rights appeared to be excluded from the scope of cybersecurity protection.

In this sense, there was and still is no clear vision and provision for a public order and a set of laws on cybersecurity and the risk of the potential impact of Internet on human rights. Few countries, including European ones, have understood that trust in Internet must go beyond the field of technology and into the public and social spheres, to protect against the violation of the rights of individuals and entities. Given that the

political, judicial and legislative powers are eminently powers of a territorial nature, they are unable to understand or effectively act on a cyber or virtual scenario.

Recently, the de facto powers have fallen to new entities, that set up on virtual sites or places and that regulate their services (web, rrss, ftp, telnet, mail...) with social rules and legal norms with no force of law, that have not been previously agreed between all parties, nor approved in a democratic parliament. That is why Facebook has the power to unilaterally remove any COVID-19 related contents considered to be malicious to society.

These virtual sites boast political, legislative and legal powers. That is why, for example, the American government and even the European Government are negotiating the new rules or norms of coexistence with the big technological corporations. Look at the case of Facebook and the publication of news coming from Russia.

To this, there is a need to add that, in the Deep and Dark Net, the sites operate with no rules or pre-established order. And, logically, they have no desire to do so. They are interested in a world of anarchy, where the strongest reap the benefits, showing no concern for the violation of human rights and freedoms.

Moreover, something still isn't working, given that the cyber events and threats are taking place in virtual sites, and repeatedly over time. Look at a bot, a search algorithm or AI. For example, Siri neither insults nor displays erotic images. In the case of Facebook and Twitter, these are a clear example that both companies have the power to remove what they consider to be "fake" user accounts or contents that go against the rules that they themselves have approved. In other words, they are legislators and judges at the same time with regard to the norms of coexistence in their "virtual State". This power to decide what is right and what is wrong and to resolve any dispute to which they themselves are party, raises ethical and public security dilemmas, given that citizens have doubts about whether this is right or wrong. All the same, if one thing is certain it is that they are not going to want to voluntarily give up the power that they have legitimately gained.

However, there is now a possibility of leading a new channel for scientific and social research and development, given that cybersecurity must cover personal and virtual vulnerabilities. Human rights are the target of threats directed at causing the greatest damage and impact, and some countries are aware of this, including Russia and China.

Legal security: Impact of Internet on rights

Therefore, the problems of digital sovereignty and how to address its challenges with new solutions are outlined below:

New threats

The old and new threats affecting human rights are:

- Fake news,
- Cyber-hoaxes,
- Cyber child pornography
- Coercion and threats

- Theft of immaterial property: intellectual and industrial property,
- Cyber harassment,
- Theft of virtual money,
- Identity theft,
- The new AI virtual personal assistants: good or malicious,
- Any that may be created in the future.

"New"Vulnerabilities

The new vulnerabilities are:

- those affecting individuals and their rights,
- organizations and their rights
- the Social and Democratic State of Law

Human rights and freedoms affected

The rights affected and subject to impact or violation, are:

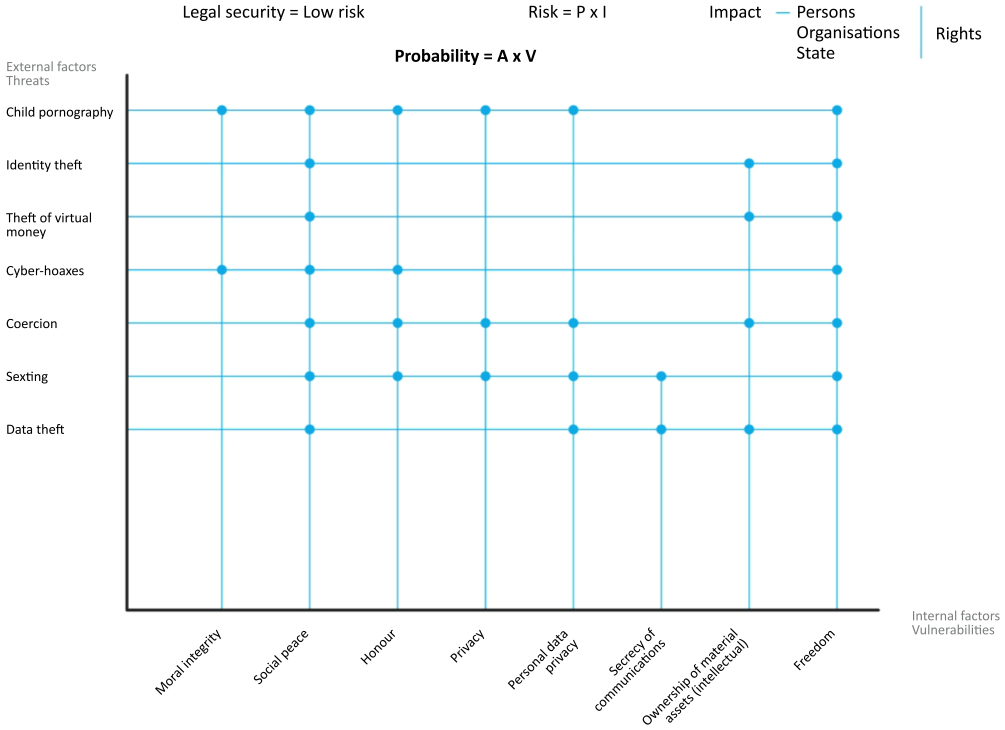
- Moral integrity:
- Dignity and social peace:
- Liberty and security: art. 3 UDHR.
- Protection of the law against attacks upon honor and reputation: art. 12 UDHR.
- Personal and family privacy: art. 12 UDHR.
- Honor and reputation: art. 12 UDHR.
- Personal data protection: EU Regulations.
- Secrecy of communications: art. 12 UDHR.
- To the private ownership of intangible assets: money, intellectual and industrial property: art. 27.2 UDHR.
- Freedom of thought, conscience and religion (with limitation of public and legal order): art.
  18 UDHR.

Problems and vulnerabilities of the State

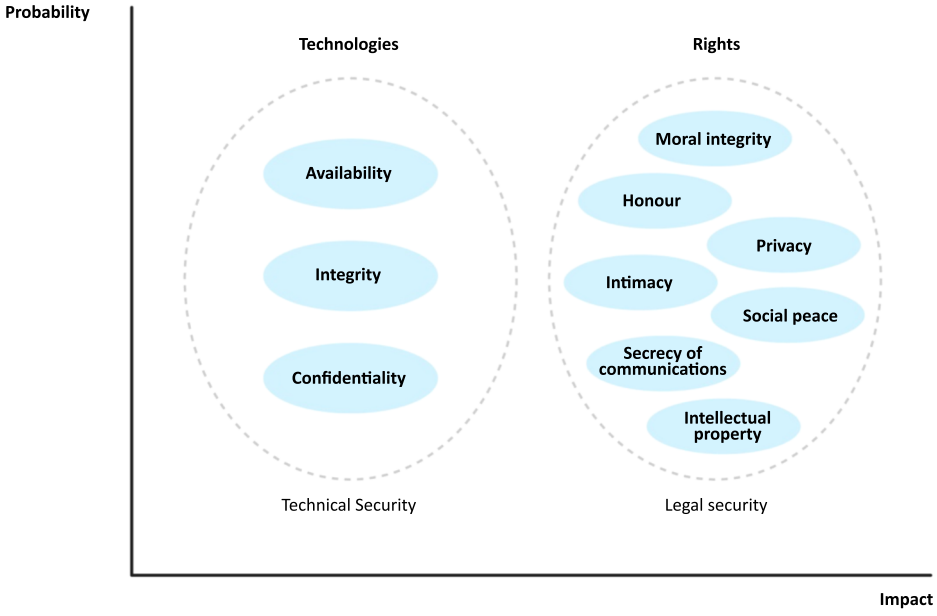
The problems of States are:

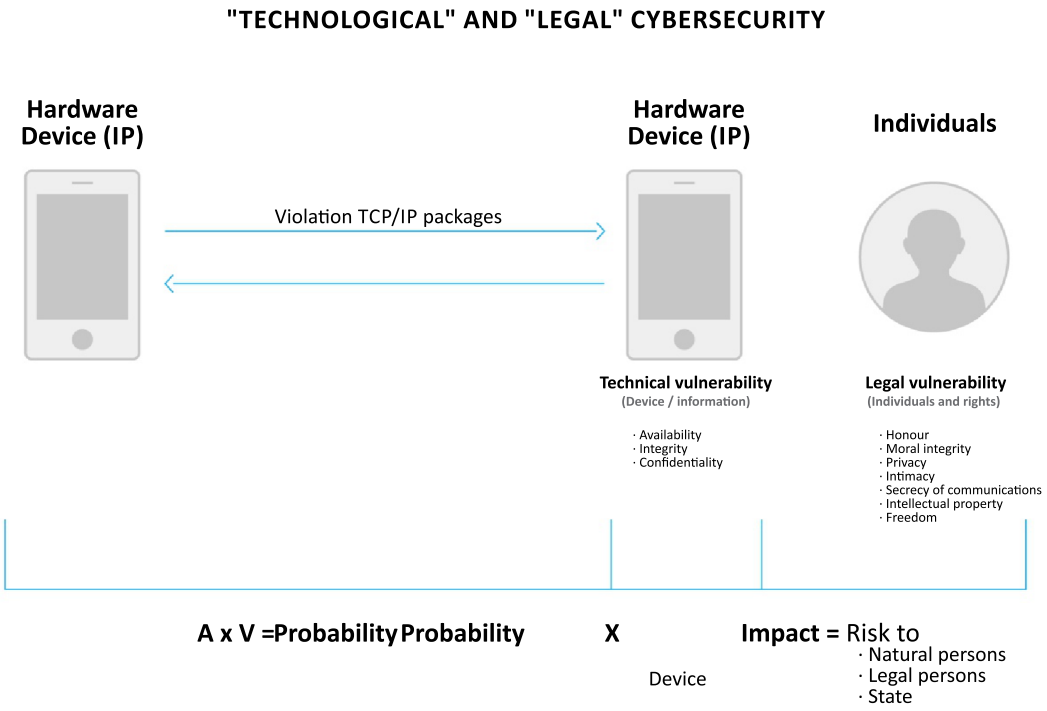
- Guarantee the security and liberty of natural and legal persons
- National sovereignty
- Public, constitutional and democratic order
- Social peace
- Constitutional State

GRAPH SHOWING THE NEW RISKS AND DAMAGE TO INDIVIDUAL RIGHTS



LEGAL RISK AND TECHNOLOGICAL RISK





Lines of action, protection and defense of human rights on the Internet

Once the pandemic crisis is over, the lines of action taken by governments should be directed at establishing a climate of trust and reducing the security risks with regard to the impact on, and violation of human rights in the cyber environment.

In order to achieve this difficult goal, it would be interesting for governments to make a Declaration of applicability of their fundamental rights in the Internet environment. For this purpose, they need to define the scope of each human right that is affected or vulnerable, as mentioned herein. Likewise, they should develop an effective legal defense, through the appropriate jurisdictional bodies, for each right concerned. To do so, they would be obliged to involve the internet service providers as guarantors of the protection of human rights against cyber risks.

On the other hand, governments must make a scientific study and investigation, from a social, political, ethical and technological perspective, of the creation of the Digital Personality, also known as Digital Person or Cyber person. Just like there is a legal personality for enterprises and organizations, there is a need to consider a third type of legal personality, what I call a "digital personality".

In the same context, the search for a political and legal consensus with regard to the legislative recognition and approval that declares and incorporates the Digital Person or Cyber person in the legal and constitutional system of each country. And, finally, there is a need to put the political focus on the training and education in Cyber law of politicians, jurists and members of civil society such as public and private defense agents, in the exercise of the citizens' rights in cyberspace.

8

LEGAL OPINION

After defining the necessary requirements for making the necessary initial risk analysis and assessment, and having subsequently defined the appropriate measures to be taken in a health crisis, it is important to point out some legal considerations that I submit to any other opinion that is better founded in law.

I will now go on to precisely analyze the extent to which the events and what is known so far, fit into the applicable regulatory requirements in the face of a pandemic situation. In my opinion, the measures that a number of governments have legally implemented, have not generally been complied with by the majority of countries while other measures of dubious effectiveness are being improvised.

In the inter-pandemic phase, the majority of countries who are members of the WHO ought to have conducted an assessment of their health risks. However, this has been shown not to be the case. This assessment must be performed prior to the pandemic phase and ought to have taken into account three basic indicators: transmissibility, seriousness of disease and impact. Neither does this appear to have been done.

In the pandemic phase, the risk management announced in a number of resolutions of the World Health Assembly ought to have been implemented, the most noteworthy of which being Resolution WHA58.5 and WHA 64.10, which ought to have been prepared and approved by the member states.

According to the International Health Regulation, the measures taken must be limited to health risks, avoiding as far as possible unnecessary interference with international traffic and trade. National trade and international traffic have been affected almost completely. And it is questionable whether it was necessary to stop all trade to avoid the collapse of hospitals or a higher death rate, primarily because other countries opted for alternative measures that have proved to be more effective and efficient.

According to the WHO, the measures that limit rights and liberties must only be those that are absolutely necessary, reasonable, proportional, equitable, non-discriminatory and in full compliance the law. The state of alert and emergency, as the sole solution to the crisis, does not appear to observe some of these principles of proportionality. The state of alert was even declared in some countries when the measures taken by the local governments were more in line with the so-called state of siege. In my opinion, it rather seems that the declarations of state of emergency were taken to "gain time" and avoid the inevitable collapse of the hospitals given the lack of foresight and responsiveness of the public health systems to infectious diseases.

The essential factors to deal with this health crisis were planning, coordination and supply management. Neither do these conditions appear to have been met. No planning has been made in most countries while their governments never cease to declare that no nation could be prepared for an unforeseen event of such severity. What is known as a "black swan" event. But they are forgetting to mention that, according to the resolutions of the World Heath Assembly and the IHR, they were required to do quite the opposite.

Proportionality and the balancing of the dilemma of individual rights, the freedoms of many as opposed to the risk of death of a few, as well as the balance of individual rights in relation to collective rights, from a legal and ethical point of view, may have led to perverse, poorly calculated effects, such as the death of others due to failure to provide sufficient medical attention. The weighting of these opposing rights has not been analyzed in detail,

and neither has it been interpreted by the judicial authority, and nor has any clear information been given to society. For example, the governmental authorities have not provided any details for deaths from other diseases resulting from failure to provide sufficient medical attention or the selection of previously agreed ethical priorities. Likewise, the calculation of the lethality rate is incorrect given that there are no reliable and robust data available.

In my opinion, improvisation and not taking the civil and commercial sectors into account, were ineffective and erroneous measures. In time and although subsequent to the event, a comparison with measures that did not restrict rights or constitutional freedoms, as adopted by other countries that did plan for, and foresee the crisis, will delimit the responsibilities of national governments and the authorities of the WHO, who have either failed to anticipate, manage and respond to the problem or are unable to demonstrate this. The extraordinary measures under its responsibility are part of the problem. One of the most salient errors was to alarm society with the infection indicator in the actual pandemic phase, while failing to provide many other measures and information of vital importance which, although unpopular, were ethical and legal, in the management of this crisis.

Neither does it help that communication in the actual pandemic phase is based primarily on highlighting the problem, in the form of number of infected and seriousness, and that the media is focusing on alarming or indoctrinating society with a single thought "save lives at any cost" , which appears to be the motto, given that the alert phase has ended and citizens and countries are now in the actual pandemic and crisis response management phase. The solution to the problem cannot be obtained by analyzing the actual problem itself to a greater or lesser extent, but by responding to and implementing the crisis measures indicated in the applicable regulations, something that each country ought to have planned and approved in advance.

Thus, based on the reasons founded in law and on the interpretation of the implementing regulations, I conclude that the measures approved by some national governments, such as the declaration of state of alert or emergency, were inefficient and of questionable international legality, due to their failure to comply with the requirements demanded in the applicable regulatory framework. In my understanding, the approval of these measures was poorly planned, unnecessary, as there were many other options available, and they have affected millions of people who have not been infected as they are not vulnerable. However the social and economic consequences in the near future have not been well calculated. And these poorly calculated problems could create future health problems with a greater impact than the virus itself.

Likewise, the states of alert and emergency and the limitation of rights and fundamental freedoms, have entailed pre-assessed collateral health impacts such as suicide, failure to provide sufficient medical attention in relation to chronic diseases and corresponding death; or severe economic impacts on citizens, such as unemployment, which in turn will be transferred to the health sector in the form of slight health impairments, requiring psychiatric care and possible subsequent disorders.

I therefore exercise my right to freedom of speech, to dissent and to state my opinion based on the knowledge and information available to me. I would request the judicial powers, primarily the international tribunals, to urgently intervene and to clarify the legality and fairness of the measures, based on the constitutional order of each country and on the international legal order, and I would urge states to draw up health security policies in the short term in order to ensure that the same mistakes are not repeated.

9

ALTERNATIVE SOLUTIONS

By way of a summary, the alternative solutions that should have been adopted for a pandemic crisis are as follows, in this order:

1. Make a risk assessment of the pandemic prior to the pandemic phase, and have it approved at a national level by each member country of the WHO.

The indicators and parameters to be taken into account in the assessment, should have been:

Threat. This can be measured as high, due to the high spread rate.

Vulnerability. This can be measured as low, given that the potential host that could become infected with either a serious or moderate medical condition is the population aged over 65 years approx. with an underlying disease (HIV, COPD ,asthma, pregnant women, heart disease and lung problems), which ranges between 8% to 14% of the global population.

Impact. This should take account of the impact on society and, specifically, on the mortality rate compared to the previous year (in 2019 around 500,000 deaths according to the figures provided by the WHO), which should be considerably higher than for prior mean rates for seasonal flu. This social impact can be calculated on the basis of prior statistical parameters (avian influenza) or figures from the Chinese population with a very low mortality rate (4,000 persons approx. in 3 months out of a population of 1,500 million). This can also be calculated with more sophisticated mathematical models.

Impact. This must take account of the impact on the health sector and the avalanche and impossibility of adequately caring for all patients. This health impact must be measured before declaring the state of alert. This is because, once declared, this could lead to the collapse of the health system, which is precisely what is to be avoided. Even so, this indicator should have been calculated, which would have show a moderate to high impact parameter. It should be pointed out that, if this impact is calculated beforehand and a high score is obtained, then there is still time and opportunity to manage it effectively and to take the appropriate measures, including military field hospitals and the procurement of material from any international manufacturers who are not in an emergency situation and are able to supply.

In conclusion, the risk assessment, taking into account these mandatory indicators, would have given a low to moderate risk, from a risk approach without taking into account other moral or ethical issues.

2. The management of the crisis in the pandemic phase itself.

Once the world is in the actual crisis phase, measures that could be implemented, other than the state of alert are:

- Governance, led by the national government of each country. In this measure, there is no dissidence whatsoever.

- Coordination, led by a committee of interdisciplinary experts: healthcare professional, scholars in philosophy and ethics, risk analysts, representatives of civil society and representatives of the commercial sector, and economists.

- Ethical bases: although ethics appears to be a subject that is not applicable in a crisis situation, it is in fact essential, given the need to foresee different situations without leaving anything to improvisation. Specifically, it is necessary to ethically assess the conflict of interests between individual and collective rights, and also to discuss and decide which patient has priority over another in the face of a shortage of medical supplies. Here the criteria to be followed must be approved beforehand, such as priority to younger patients or to older patients who are in better medical condition and have a greater life expectancy, etc. Each activity in the crisis must be based on ethical principles.

- A risk-based approach: all decision-making should be based on risks, while political and medical decisions should be set aside due to potential conflicts of interest. Both parties, medical professionals and politicians, are part of the solution and their biases and egos must be put aside. They are not responsible for the disease or virus, nor do they have the antidote, they are not heroes but are accountable for their work and the duties they perform in society.

- Decision-making at a national level, in coordination with the WHO but with each nation maintaining its independence. The development of a pandemic varies from country to country for a variety of reasons, these include the analysis of non-robust data, climate changes and a population with a greater number of patients susceptible to virus infection. Therefore, independent decision-making is necessary. Account should also be taken of the fact that the WHO already erred in the declaration and management of the Asian influenza pandemic. Moreover, the WHO has lost part of its public-private independence due to the fact that, in the face of a shortage of funds (many member states stopped paying the amount agreed in previous years) it is currently financed by private investors (Gates Foundation, Gavi Foundation and a number of pharmaceutical companies) who have undeclared interests with regard to the World Health Organization.

- Social distancing measures. According to the healthcare experts, here lies part of the problem and solution. These social distancing measures cannot fall solely on healthcare workers because isolation at home is not, strictly speaking, medical treatment and, moreover, it is a social measure from the 19th century. In itself, it is not a cure for any disease, neither has it become a recognized treatment in medical disciplines. It is rather a social or ethical treatment, but not strictly medical. Furthermore, this social distancing can be performed in many different ways, although the measures must always be proportional, equitable, non-discriminatory and reasonable. In my understanding, the lockdown of the entire society is not the solution to the problem, primarily because, if you isolate the whole population, then the second wave of infection will be more virulent. This is because most of the population will not have immunity, another reason is because it is also possible to decide to isolate only the population that is vulnerable or with a potential host susceptibility to the disease, as most countries have done. What is more, each citizen cannot be made responsible for preventive social treatment just because the health systems are unprepared to respond to an infectious disease or epidemic which, by its very nature, causes high hospital admission rates in short periods of time.

- Social distancing vs lockdown. In my understanding, the probability of a death risk is calculated by taking into account two essential factors, namely the threat and

vulnerability. COVID-19 is the threat and its potential for infection is high. And the vulnerability is represented by the host individual who, due to that person's age or immune system, may be severely affected and die. Therefore, as few social measures are available, the focus should be on proactive monitoring, giving priority to field hospitals and to isolating the vulnerable population and distancing it from others, who could represent a threat of infection. And those persons who represent a threat, which is the majority of the population, should be allowed freedom of movement, so that quarantine is solely for the vulnerable population, which is far less in number. Mass testing for infection should be performed on the population with freedom of movement, putting those with a positive result in quarantine in facilities other than their homes (State-subsidized hotels). I believe these measures to be proportional from a social point of view and, in terms of risk, they are more appropriate given that it is a question of separating the threat from the vulnerability and directing the security controls to protecting the vulnerable. These two concepts should not be combined in order to direct the measures at the entire population, as such measures are neither effective nor efficient (those countries doing so have the highest mortality rate) due to a lack of means and resources.

- The consideration and public declarations making each person responsible for being a potential threat to another are, on the one hand, discriminatory and, on the other hand, from an ethical perspective they are also incorrect given that the person who is a potential carrier does not even know this and is still less able to control it. No one on his own, and without his knowledge, is a threat to another. Among other reasons, in terms of security, the same person cannot be a threat and defense at the same time. Threat and defense, in terms of security and "war" cannot fall on the same person, this is a physical and intellectual inconsistency. In my understanding, it appears to be more reasonable to perform detection tests on the wider population and request isolation as a defensive measure for vulnerable persons, in addition to isolating those with positive tests, on similar lines to South Korea.

- Information management: Currently, only the dangers are being reported in order to justify the complete isolation of the population. Above all, much more information should be communicated and made available to society. And, above all, avoid lies in the interest of truth. The current management leaves much to be desired, primarily because society is treated without the objective information that it requires, which should be made available even if it is unpopular and has an impact on fear and death.

- Healthcare infrastructure: If a prior assessment had been made, then it would have been possible to foresee the purchase of the material required and make it rapidly available. Improvisation has led to the uncontrolled, unplanned procurement of material. In order to publicly correct the problem, there is no sense in announcing that the material will be purchased from local businesses, when the current market is global. When facing a crisis, material and human means are limited, for this reason it is more effective and efficient to direct such means to the vulnerable part of the population, which is far fewer in number compared to the threatened part (number of persons who could become infected).

- Healthcare and related services: If there is no advanced planning, then it is difficult to determine the level of requirements during the crisis phase. It is therefore necessary to count on related healthcare services that can be

made available when the demand is far higher than the averages of previous years. These measures include counting on military healthcare personnel.

- Field hospitals: these military medical centers are perhaps one of the most important and effective measures to control the disease and deal with the strain on the overwhelmed healthcare system and its high impact. It is advisable to implement these centers sooner than later. The government and its armed forces are in a position to do so and in fact they did try. I consider this to be the best measure of all. Primarily because it separates the source from the disease and avoids infecting the medical staff concentrated in the hospitals.

- Vaccination: this will be the cure for the entire problem. However, here the reasonable and ethical doubt arises as to whether shorter timeframes can be achieved. There is also the question as to which company would benefit from this mass purchase and whether such companies are financing the WHO.

- For reasons of transparency, governments should declare and publish which companies are financing their election campaigns in order to prevent financial donors from being "creditors" for a "financial debt or a pay back favor", which may be transacted in the future in the form of a law or administrative order. The money and healthcare costs are also part of the taxes paid by each citizen, without bypassing the tax regulations, as this would lead to considerable fines. This is a basic factor in order to ensure that, in future health crises, correct information is made available to the entire democratic society on the allocation of health expenditure and can then vote in full awareness and with the greatest amount of information possible.

- A good measure is to process and prepare a database of vulnerable persons with their prior underlying diseases. This database of vulnerable persons could be based on information already available at public and private hospitals, and should include the cell phone number. Logically, this exceptional measure should observe the fundamental right to personal data protection.

- With the approved emergency measures, the phone numbers of vulnerable persons could be used to request telephone operators to check that these individuals do not move further than 30 meters from their position during the quarantine period. This control measure and the geolocation of future sources of infected persons, permits the real-time monitoring of possible cases in order to anticipate any serious consequences.

- Finally, the whole group of vulnerable persons must be given assistance at a public healthcare centre, specially created to manage the preventive and healthcare actions required in the pandemic phase by those persons with the greatest exposure to the risk of death.

Some of these alternative measures are highlighted in the table below.

IRL
Instituto de Riesgos Legales

State of Alarm
Is it legal and does it comply with International Law?

Obligations of IHR 2005 + WHO guidelines

Respect for dignity, human rights and fundamental freedoms

Mitigate public health risks and avoid interferences with international trade

According to the WHO guidelines, the measures that limit rights and liberties must be:

Reasonable
For commerce? Lockdown for the uninfected and infected population alike?

Equitable
Every person is a threat to another and, in turn, that same person is his/her best defence?

Proportional
Lockdown all society?

Non-discriminatory
Discriminate against individuals for walking in the street?

Legal
The Constitutional Tribunal must review its adequacy

Has Spain met these requirements?

NO for the following reasons:

Non-compliance
Spain has been obliged to conduct healthcare risks assessments since 2017

Improvisation
It has not assessed collateral consequences such as:
- Limitations of rights
- Fundamental liberties
- Impact on other chronic diseases, negligence for serious diseases

The legality of the state of alarm is questionable and the Constitutional Tribunal should be the one to determine whether or not it is in line with the Constitution

HOW SHOULD SPAIN HAVE ACTED?

1. **By including risk experts on the crisis committee: commercial, bioethics and military-strategic sectors**
2. **By taking risk-based decisions + avoiding political + medical bias and based on scientific and ethical criteria**

ADOPTING MEASURES

Healthcare measures to save lives

- Mass procurement of medical supplies to avoid infectionsRecruit more healthcare professionalsHome visiting
- Mandatory tests on the street
- Distribution of patients

Measures to address economic risks

- Do not restrict all commercial activities
- Do not restrict all international travel activities
- Promote teleworking

Measures to address legal risks

Adoption of measures to mitigate violation and damage to fundamental rights:

- Social distancing of at-risk and vulnerable populations: +65 years, HIV, asthma, pregnant women, etc.
- Lockdown of persons with positive COVID-19 test
- Database of vulnerable persons
- Monitoring by phone and home visiting
- Permit those under 59 years to go to work, avoiding contact with at-risk persons
- Quarantine for positive cases and their relatives
- Closure of schools
- Ban on public gatherings
- TV campaigns on hygiene and protection measures
- Online appointments for emergencies
- Diagnosis and treatment in field hospitals

10

REFLECTIONS

When in 1801 the Italian astronomer Giuseppe Piazzi discovered the dwarf planet Ceres, he was able to follow its trajectory for 40 days until he could no longer do so due to its orbit around Neptune.

In the course of that year, many scientists tried to calculate its movement in order to predict the place where it could be located once more, based on the observations made public by Piazzi.

Although the majority of the estimates were unsuccessful, there was one that did in fact correctly predict its future location. We are referring to the one made by Carl Friedrich Gauss. By using his work on the least squares method to calculate the trajectory, he is considered to be the first person to predict a future event using mathematics, applied in this case to astronomy.

Shortly afterwards, and much to the appreciation of the group of astronomers, they located the dwarf planet at the position estimated by the calculations of Gauss.

What can we learn from this example?

That predictions help to prepare for any future event, with a high degree of certainty. And that mathematics and social science studies form the scientific base for the predictions.

Furthermore, the predictions show the direction to take in order to resolve problems in other disciplines by applying mathematics and legal knowledge as tools to give certainty in the results. In other words, to convert uncertainty into certainty.

Gauss, who has gone down in history as "the greatest mathematician of ancient times", demonstrated with his Gauss-Markov theorem that mathematical prediction can be applied to many other aspects, by providing accurate calculations in a host of contexts and making it easier to objectively propose more probable results.

When it comes to risks, if you can't measure it, you can't manage it. How is it possible to know that the total lockdown of the population was the right measure to take, if there are no data to compare it with? Politicians will explain that the mortality rate was rising due to the spread of the virus and that it started to drop thanks to the measures adopted by them. But it is also possible to state quite the opposite and this opinion would be equally valid. Imagine hearing that, due to the lockdown measures approved by the government, many more people died than if lighter, social distancing measures had been adopted, as has happened in other countries. What I would like to show with this example is that, if the actions taken are not compared with a pre-agreed measure, then quite the opposite could be equally argued, and both would be valid. However in science, all correct actions are measured against a parameter set by a particular rule or method that has been studied and approved beforehand, based on a method underpinned by social and natural scientific studies.

The current context

All persons and organizations are greatly concerned about the relentless growth of internal and external risks to which they are exposed. The pandemic is one such risk, and others are likely to occur in the future. Most leaders powerlessly watch how the volume of events relentlessly grows, in all layers of the different processes of daily life. What does this lead to? To have to detect and manage a host of: economic, environmental, reputational laws, regulations, norms, standards, as well as corporate codes of conduct.

We need to add to this regulatory reality the great change caused by the never-ending technological innovations and the Law of accelerating returns enunciated by Ray Kurzweil in 2001. According to the author, the pattern of technological advancement can be described exponentially, that is, each technological generation progresses exponentially, not linearly, producing considerable quantitative and qualitative advances with regard to computational possibilities and their applications.

This claim can be easily understood by analyzing a few milestones which, although they appear to be long-standing, are in fact extremely recent. Internet came into being in 1990. From then onwards, we have witnessed the exponential growth of the number of users connected to the network, with an estimated volume of more than 3,700 million internauts in 2017. Moreover, we have seen the creation and expansion of great domains (technological organization) also in astonishing time frames: Wikipedia (2001), Gmail (2004), YouTube (2005), Facebook (2006), Twitter (2006), Instagram (2010) and WhatsApp (2010).

It is surprising to reflect on the most valuable brand in the world, which started out just over 20 years' ago: Google. It was founded in 1998 by Larry Page and Sergey Brin, as a result of their university thesis. Or just think that Apple launched its first terminal device in 2007, shaking up a number of industries. Although it seem to be a long time ago, Steve Jobs presented the iPhone just a few years back.

And, finally, the impact of the global pandemic on the lives of so many people, workers, organizations and the global economy. All these examples, which show the exponential development of technologies and social changes, as well as that of the industries and services developing around them, have one thing in common: regulation and method.

Each innovation and change is accompanied by how it should be ordered, the framework that defines how it should perform and its rules of operation. And this happens at all levels and affects states, organizations and private individuals. In other words, the regulation has become embedded in each and every layer. This means that the countries, enterprises, their processes, their employees, their services, their products, the data, the protocol, the software, the communication and, soon, even artificial intelligence, everything, absolutely everything is or will be regulated in some way.

Therefore, what is the next challenge in which professionals, civil servants and directors will be immersed?

Risk Approach

There is a unique opportunity here. And only those who are able to understand it and adapt their structures to this new reality will be in a position to reinvent their services and avoid disappearing in the face of these exponential changes.

All this leads to one conclusion, the need to be aware of the urgent need to think in terms of risks, and in the tremendous opportunity that the immediate future is offering us, to participate in resolving and helping countries and private individuals to manage this regulatory acceleration with this new approach.

The growing regulatory approval poses the challenge to manage these regulatory frameworks from two approaches:

- Risk by design
- Law by algorithm

Risk By Design

The risk by design approach can be a useful tool to plan and implement the processes and activities of a society. The implementation of a risk methodology, as we have seen throughout this manual, will help to identify, manage, mitigate and recover from any risks that may occur.

And the existence of these risks must be known and developed in each process or activity of an organization, right from its design, in order to avoid as far as possible the negative consequences of an impact in the form of a health, economic or reputational risk.

Law by Algorithm

In the same way as the pandemic is already reaching everyone, the regulation will reach all activities. What is more, each thing will be programmed with a code in order to comply with the regulation. The vehicles transporting us in the very near future will not only self-check that they are complying with the highway code, but also they will be programmed with performance algorithms in order to manage any risks that may arise while driving. However, the most important point is that they will constantly and automatically record everything that is happening from a number of sensors. In the event of an accident, the vehicles themselves will be party and judge, and they will have created all the necessary forensic information to be used by the system. Not only to determine which party is in the wrong, but also to provide information on the risks managed in order to identify new risks that could be included in the system and, finally, to provide the data for the algorithms and thereby optimize the predictions for other vehicles and future situations.

To consider the Internet platforms , or any other social network, anti-social conducts are regulated by the platforms themselves, identifying which actions are well received and which are not permitted, banning or eliminating any accounts and data that do not comply with their own cyber rules. This leads us to two reflections.

The first is that things, and I refer to things because they affect all activities, will have their coded artificial intelligence, so that they will participate in the management of risks for non-compliance with the applicable rules, being the ones to manage their control and to generate evidence of compliance.

The second point is that traceability will be taken to each sensor and device that may be incorporated by a private person or worker, as a permanent record of compliance that generates proof automatically.

An alternative approach

The majority of countries and people need time to understand the challenges that these social changes are posing, as well as the difficulty to detect and manage risks and uncertainty. They need assistance to understand the reality and the (in)security that it brings. And, as risk professionals, we have the obligation to be experts, hyper-specialists in risk management as a pillar to underpin our services and advice, directed at helping to achieve the greatest possible security.

To study and learn from wise men such as Kelsen, Einstein and Gauss is part of the culture of knowledge. Furthermore, with a relativist vision, understanding the events and risks as something that depends on the model, and which are in constant movement. And, in particular, with a risk methodology that applies mathematical algorithms to make it possible to scientifically predict and quantify future risks.

As the popular quote goes, for a film that was ahead of its time:

§

"welcome to the real world"

§

ANNEXES

Risk theory: classification problems Decision trees

The formal exposition of the classification problem is as follows: Given a dataset{(xj,yj), j=1,2,..,n}, identifying each one of the n data xj=(xj1, x j2, x j3,..., x jp) a set of p characteristics, that can either be numerical (a length, for example), ordinal (high, low, etc.) or categorical (red, green, etc.) and identifying each one of the values yj the category to which datum j-th belongs; the classification problem tries to identify the influence of the values of variable x in order to assign a class to variable y. Starting with the information contained in dataset n, the aim is to identify with a specific criterion the best procedure that is consistent with the said data. The prediction problem is posed when trying to assign the category to a new datum with known characteristics p.

In short, the aim is to identify an application

$$\mathbf{f}: \mathbf{X^1} \times \mathbf{X^1} \times \cdots \times \mathbf{X^p} = \{\mathbf{1}, \mathbf{2}, \ldots, \mathbf{K}\}$$

That assigns to each set of p characteristics (the independent variable x) one of the K classes of y (the dependent variable), so that f(x) ∈ {(1, 2, ... ,K}.

Example:

In a case studied by Fisher in 1936 (Fischer, 1936) to classify three types of flowers. The dataset contains 50 samples from each of three species of Iris (Iris setosa, Iris virginica and Iris versicolor) and **for** each one of the 150 flowers, four measurements were taken: length and width (in cm.) of a sepal and a petal. Based on the combination of these four features, Fisher developed a linear discriminant model to distinguish one species from another.

With the notation above, n=150, p=4 y K=3.

A subsample of the dataset is detailed below:

Order No.	**Length of sepal (X1)**	**Width of sepal (X2)**	**Length of petal (X3)**	**Width of petal (X4)**	**Class (Y)**
1	5.1	3.5	1.4	0.2	I.setosa (1)
2	4.9	3.0	1.4	0.2	I.setosa (1)
....	....	....	....	....	....
51	7.0	3.2	4.7	1.4	I.versic. (2)
52	6.4	3.2	4.5	1.5	I.versic. (2)
....	....	....	....	....	....
101	6.3	3.3	6.0	2.5	I.virgin. (3)

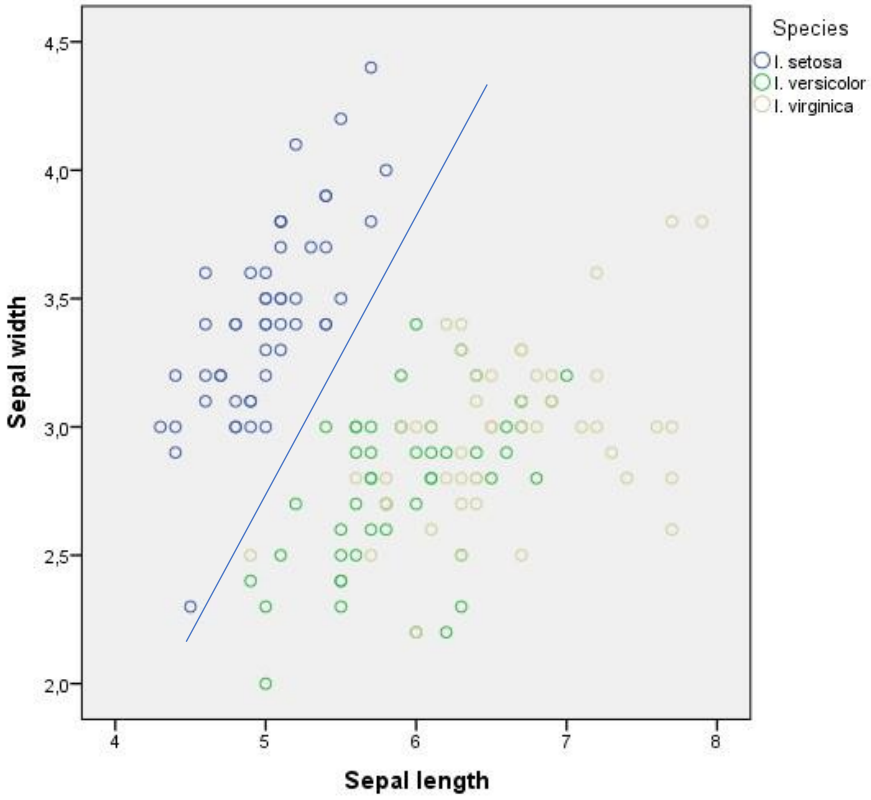
102	5.8	2.7	5.1	1.9	I.virgin. (3)
….	….	….	….	….	….

In this example, all the independent variables (the four flower measurements) are numerical and the aim would be to identify which variables permit the correct classification of the three types of flower, how to identify the flowers based on the said selected variables, what criterion was followed and what is the classification error.

The objective would be as follows: given a flower, taking the length and width of a petal and a sepal, to be able to predict the class to which the flower belongs, from the three classes indicated above.

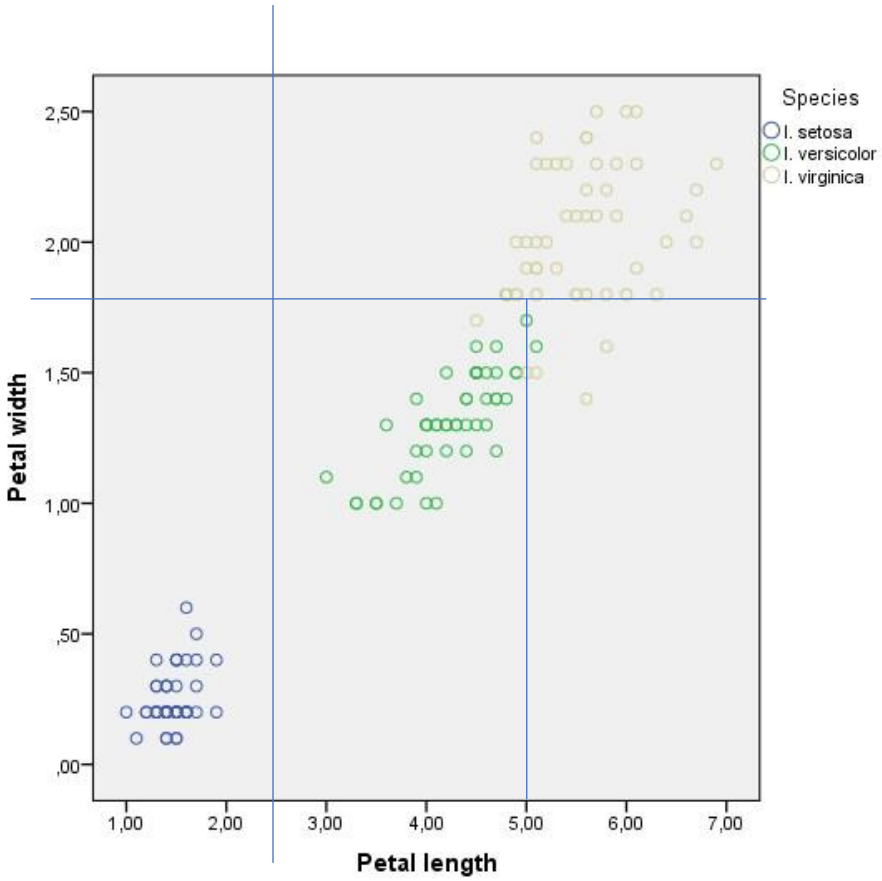
Detailed below is the classification tree procedure, which makes it possible to incorporate ordinal and qualitative variables among the independent variables, which would be our case. In any statistical study, it is advisable to start with a descriptive or graphical analysis of the data which, as well as refining the data, makes it possible to illustrate potential relationships of interest between the variables.

To continue with the example of the flowers, a graphical representation of the three types of flowers with different colors in the two-dimensional space with the length and width of the petals, is as follows:



The only relationship indicated on the graph is that the I.setosa class is linearly separated from the other two, but these latter two are mixed together, making an a priori classification difficult.

However, if the graphical representation is based on the length and width of the petals, then this representation is as follows:



This graph shows, however, a division of the three classes with some specific characteristics: the lines are parallel to the coordinate axes, therefore the classification function would be given by the following scheme:

- Petal length (X3) ≤ 2.4 à I.Setosa
- Petal length (X3) > 2.4
  - Petal width (X4) ≤ 1.8
    - P.l. (X3) ≤ 5.0 à I.Versicolor
    - P.l. (X3) > 5.0 à I. Virginica
  - Petal width (X4) > 1.8 à Class I. Virginica

The supervised classification problem would thus have been resolved through a classification tree, such that, and this would be the prediction problem, if we were given the measurements of a new flower, for example x=(6.1, 3.1, 3.9, 1.2), we would only use the last two components: as X3 = 3.9 > 2.4 in the first decision we would go to the second option; as X4 = 1.2 ≤ 1.8 in the second decision we would go to the first option and, finally as X3 = 3.9 ≤ 5.0 we would take the first option for the final decision and we would conclude that the class assigned to the flower under study would be Iris Versicolor.

As shown above, the result is strongly conditioned by the variables selected (measurements of petals or sepals). We will now go on to introduce the decision criterion that makes it possible to select the right variable and, moreover, determine the order of the variables and the critical values or thresholds to be applied to the variables in order to build the decision tree. We will also show when splitting should be made and when to consider the tree complete.

We have yet to discuss the criterion used to select the variables and the order, as well as the partition associated with the variable selected, the number of partitions or branches of the decision tree defined in this way and the classification error in order to evaluate the accuracy of predictions.

These points are detailed below for the binary classification algorithm, known as CRT, which stands for Classification and Regression Tree.

CRT algorithm Independent variable to be split

In the Fisher flower example, the petal length variable was selected as the first variable. In order to study the influence of the variable selected, the calculations above will be performed with the sepal length. We will first introduce a series of concepts that are key to understanding classification trees.

Each tree is identified by a series of nodes, starting with the root node which identifies the number of cases associated with each of the K values of the dependent variable; this K value vector can be interpreted as a probability distribution for the classes. By splitting the root node into two new nodes, based on the values taken by one of the independent variables, both vectors are identified with K values with the corresponding probability distributions associated with each one; and so on. The ideal situation would be to end in nodes with a degenerate distribution, in the sense that all the cases would belong to the same class, with a "1" appearing in the corresponding box of the associated distribution and K-1 “0’s” in the remaining boxes; the decision problem would end by identifying each terminal node with a class.

The problem is that it will not always be possible to achieve terminal nodes with a degenerate distribution, implying that there will be an associated error when the said terminal nodes are associated with the class with the greatest probability. For example, in the root node of the Fisher case, the number of cases for each of the three classes of flowers is (50, 50, 50) and the associated distribution is (1/3, 1/3, 1/3). In this case, it is possible to a priori assign any of the classes and the error probability would be equal to 2/3.

The above can be defined by introducing the following notation: If a node is identified by index m, Nm is the number of cases that belong to the region associated with node Rm, pmk is defined, the relative frequency of the cases whose dependent variable (y) takes

value $\in \{1,2,\ldots,K\}$:

$$p_{mk} = \frac{1}{N_m} \sum_{x_i \in R_m} I\{y_i = k\}$$

In the root node, m=0, N_0=n y $R_0 \stackrel{1}{=} \left\{\left(x_j, x_j^2, .., x_j^p\right), j = 1, .., N_0\right\}$.

Each node m will be associated with the most frequent class C(m) as:

$$p_{mC(m)} = \max_k\{p_{mk}\}$$

With this assignment, and with any other, a misclassification may be made and this shall be evaluated with what is known as an impurity index; the most basic index is the one that identifies the probability of misclassification; in the case of assigning a node to the most frequent class, it is calculated as:

$$E_m = 1 - p_{mC(m)}$$

However, another impurity index is generally used, the Gini index, which is defined for each node m as follows:

$$G_m = 1 - \sum_{k=1}^{K} p_{mk}^2$$

Illustrated below are each of these values for the first three nodes (0,1,2) of the tree in the example, using, at nodes 1 and 2, the partition obtained respectively when selecting the cases with X3 ≤ 2.4 and X3 > 2.4; nodes 3 and 4 are associated with the partition using the sepal length variable and the cases are selected according to whether they are X1 ≤ 5.4 and X1 > 5.4:

m	Description	N_m	Distribution			C(m)	E_m	G_m
0	Origin	150	50/150	50/150	50/150	SET	0.66	0.66
1	*$X_3 \leq 2.4$*	50	50/50	0/50	0/50	SET	0	0
2	*$X_3 > 2.4$*	100	0/100	50/100	50/100	VERS	0.50	0.50
3	*$X_1 \leq 5.4$*	52	45/52	6/52	1/52	SET	0.13	0.24
4	*$X_1 > 5.4$*	98	5/98	44/98	49/98	VIRG	0.47	0.54

As mentioned above, node 1 perfectly identifies class Iris Setosa (C(1)=SET) and the classification error is 0, which is reflected in the two impurity indices presented above. On the other hand, the worst impurity index is associated with the root node; in this case, the distribution is uniform, which is the least informative and with maximum entropy, which would be another index that could be used to build the tree and whose formula is:

$$-\sum_{k=1}^{K} p_{mk} \log(p_{mk})$$

Of the three impurity indices presented, the Gini one will be used, as it has a clearer statistical interpretation. The fact is that, by minimizing this index, this minimizes the variance of the random variable that assigns 1 to the most frequent class and 0 to the remaining classes. This intuitively seeks the partition of nodes that identify the appropriate class as accurately as possible.

To continue with the example, in view of the table, the following question arises: which variable is of interest for the partition, X1 or X3? The first would give partition (3,4) while the second would give (1, 2).

According to the Gini index, node 1 provides value G1=0, which is the minimum value, but it is accompanied with index G2=0.50. The option taken is to weight these two values, based on the cumulative proportion of cases of each one, in order to obtain:

$$G_{1,2} = \frac{50}{150}G_1 + \frac{100}{150}G_2 = 0.333$$

If the operation is repeated with the partition (3,4), the following is obtained:

$$G_{3,4} = \frac{52}{150}G_3 + \frac{98}{150}G_4 = 0.436$$

In this respect, the first partition is preferable, associated with variable X3, given that the improvement of this partition (Gini index for the root node less the weighted Gini index for both nodes) is greater than for the other partition:

$$\Delta(1,2) = G_0 - G_{1,2} = 0.666 - 0.333 = 0.333$$

$$\Delta(3,4) = G_0 - G_{3,4} = 0.666 - 0.436 = 0.231$$

CRT algorithm Partitioning associated with the split variable

Once the criterion has been determined to select the variable to be split determined at node m, let's call this variable Xj, the next step is to determine the associated critical value, which will determine the two sets of the split.

If the independent variables are continuous, as in the Fisher flower case, then the critical value for the variable will be value hj so that, if the two nodes of the split are m1(hj) (associated with Xj ≤ hj) and m2(hj) (associated with Xj > hj), the weighted Gini index is minimized for both nodes:

$$G_{m^1(h_j),m^2(h_j)} = \min_h G_{m^1(h),m^2(h)}$$

In order to illustrate how the weighted Gini index varies with the selection of the critical value, a table is given below with the partitions associated with nodes (1,2) with the critical value (optimal) for X3 = 2.4 and partitions (5,6) and (7,8) with critical values 1.5 and 4.5 respectively. It should be observed how these latter two weighted Gini indices (last column) are greater.

m	Description	N_m	Distribution	C(m)	E_m	G_m	G.
0	Origin	150	50/150 50/150 50/150	SET	0.66	0.66	
1	$X_3 \leq 2.4$	50	50/50 0/50 0/50	SET	0	0	
2	$X_3 > 2.4$	100	0/100 50/100 50/100	VERS	0.50	0.50	0.33
5	$X_3 \leq 1.5$	37	37/37 0/37 0/37	SET	0	0	
6	$X_3 > 1.5$	113	13/113 50/113 50/113	VERS	0.56	0.59	0.44
7	$X_3 \leq 4.5$	87	50/87 36/87 1/87	SET	0.42	0.50	
8	$X_3 > 4.5$	63	0/63 14/63 49/63	VIRG	0.22	0.34	0.43

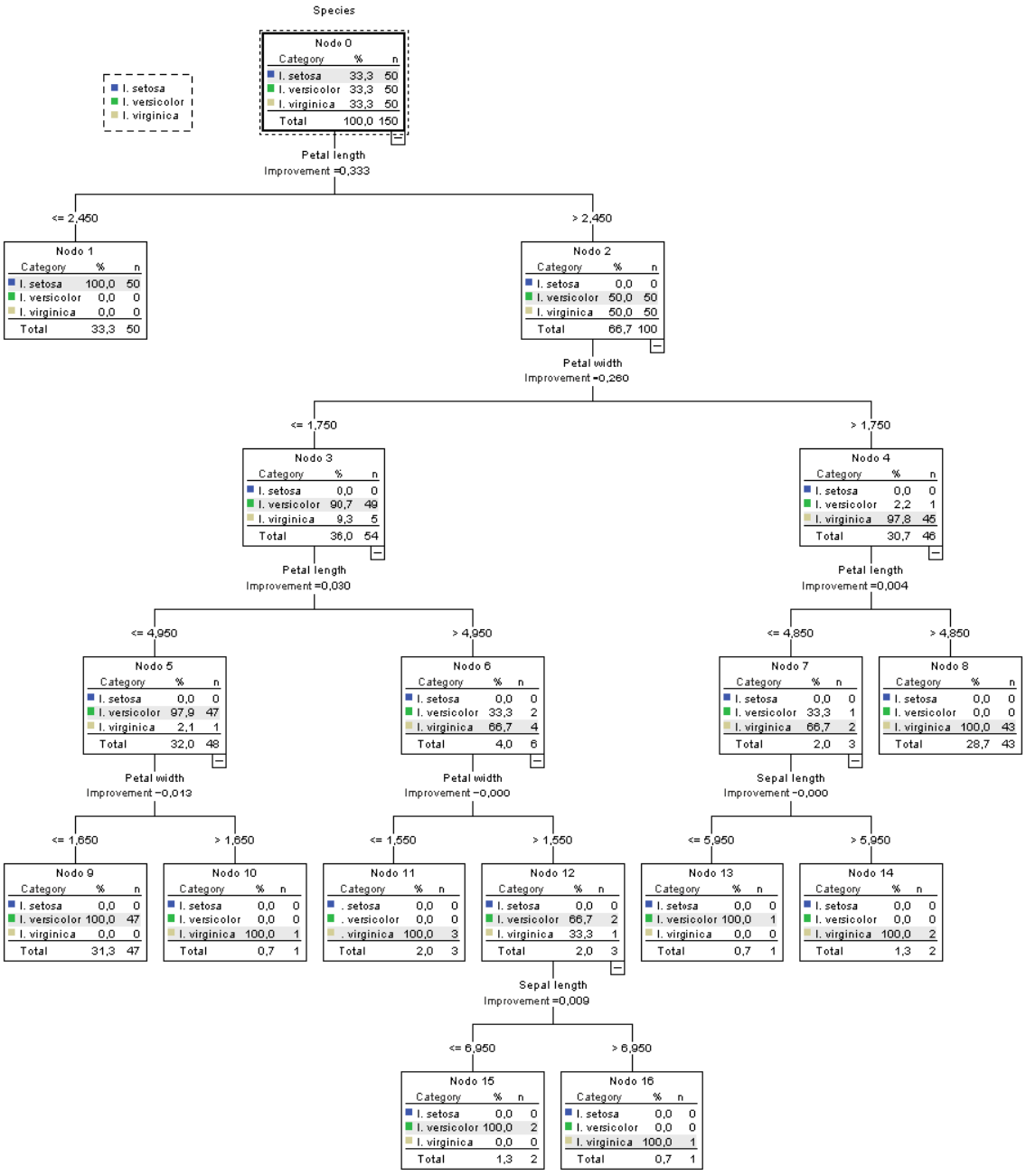
If the independent variables are ordinals, in other words they permit the ordering of the type, for example "high>medium>low", then the critical value can be determined in the same way as for the continuous variables.

For qualitative variables, for example, article 8.1 of the LOPD (Constitutional Law on Personal Data Protection), article 6.3 of the LOPD, etc. , there are no critical values, instead one needs to go directly to the partition created in the Rm dataset associated with node m: let $R_m = A_m \cup A_m^c$ a partition of this set, if m1 (AM9 and m2(Amc) are the nodes associated with this partition, the optimal will be determined by the minimum of the weight Gini index:

$$G_{m^1(A_m),m^2(A_m^c)} = \min_{A \cup A^c = R_m} G_{m^1(A),m^2(A^c)}$$

Size of the classification tree

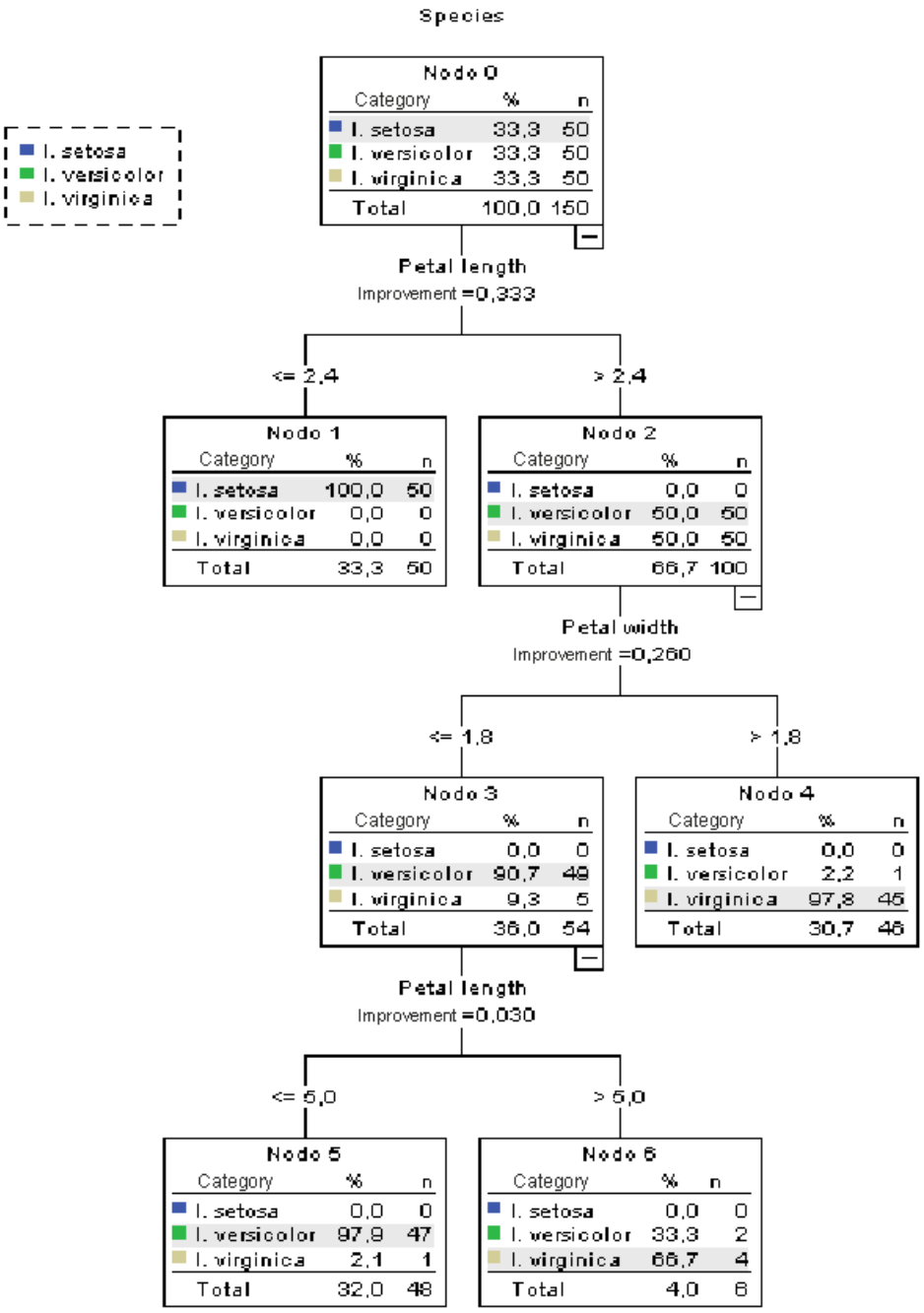
Another relevant question is the determination of the tree size, which can be defined by its depth or maximum number of branches to reach a terminal node. As discussed above, the ideal situation would be for all the terminal nodes to have a degenerate distribution (Gini index equal to 0); in the Fisher example, this is achieved with a depth equal to 5. The associated tree is as follows:



However, a tree of these characteristics is not the best for predictive purposes given that it perfectly fits the training data, yet any other datum that is not the same as the initial data may be misclassified. This problem is known as over-fitting. Moreover, it should be noted that the improvement of each partition is progressively reduced as one goes down the tree until improvements of the order of a thousandth are reached.

There are several ways to avoid this "over-fitting": one is to limit the depth of the tree, although this would not prevent some terminal nodes from having few nodes or an insignificant improvement; another alternative would be to prune the tree to avoid insignificant branches. Another way would be to required that any node resulting from a partition must have a minimum number of cases or, in order to split a node it must have a minimum number of cases.

In the Fisher example, if a minimum of 5 cases is required for any node resulting from a partition and the number of cases for a node to be partitioned or split is limited to 10, then the following tree is obtained:



Prediction accuracy

Once the tree has been built, an initial measure of the quality of the tree is provided by the number of cases that have been correctly assigned. Based on the tree above, it can be seen that, of the 150 cases, 4 are misclassified in nodes 4 and 5 (one in each case) and in node 6 (two cases). This situation is shown in the following table:

Classification with the CRT Algorithm. Fisher example

Observed	Predicted			
	I. setosa	I. versicolor	I. virginica	Percentage correct
I. setosa	50	0	0	100.0%
I. versicolor	0	47	3	94.0%
I. virginica	0	1	49	98.0%
Overall percentage	33.3%	32.0%	34.7%	97.3%

In any case, there are two more accurate ways of assessing the classification tree accuracy:

1. Split the set of cases available into two samples: a training set to build the tree with the criteria presented above and a validation dataset, to measure the data classification errors using the tree built in the training phase. A tree is well designed if the classification errors in the training and validation phases are similar.

2. Use cross-validation which automatically and randomly divides the set of cases into a number of sub-samples or folds (they can be 5, 10, etc.) and select all except one as a training sample and the remaining one for validation, repeating the operation and exhausting all situations and determining the mean of the corresponding errors as the training and validation errors. The proposed final tree uses the set of cases as a whole.

In Fisher's example, the cross-validation procedure was used with 10 folds and narrowing down to 10 the number of cases for splitting a node and provided that any of the nodes resulting from the split have at least 5 cases. Details of the training and validation errors are provided in the following table:

Training and validation error (CRT).

Fisher example

Method	Estimation	Standard error
Resubstitution	.027	.013
Cross validation	.047	.017

The table indicates that the training error is 0.027, that is 2.7%, or what is the same, 4 of the 150 cases, therefore with an accuracy of 97.3%; the validation error was 0.047, under 5% of the cases.

Some of the advantages of classification trees compared to other procedures are:

- They can process a voluminous dataset, with many cases and many predictive variables; the algorithm takes care of selecting the influential variables. No data preparation required, for example, there is no need for data standardization, use of fictitious variables, etc.

- They can combine predictive, numerical, ordinal, categorical variables and process them together.

- The Resulting predictive model is easy to interpret and use for non-expert users, as it is based on simple, transparent rules that do not require complicated calculations.

However, trees do have a few limitations; for example, from the point of view of computational complexity, the problem of the decision to determine the "optimal" classification tree is an NP-complete problem, and therefore it is impossible in practice to calculate it when the size of the problem is medium or large. In fact, the algorithm described above is a heuristic greedy one, which seeks in each branch the variable that best splits the set of cases, but this approach does not guarantee an optimal classification tree.

In fact, the actual algorithm described above can become extraordinarily slow as soon as the dataset is sufficiently large, which has been achieved with the data under analysis in this Project. For these cases, a different algorithm may be used, as described below.

QUEST algorithm

This algorithm is more efficient from a computational point of view, compared to the CRT described above. The name stands for "Quick, Unbiased, Efficient, Statistical Tree".

It is a fast method that avoids the bias shown by other methods in favour of predictors with many categories. Unlike the CRT which used the Gini index, QUEST uses a chi-square test for categorical independent variables and a variance analysis based on the F distribution for continuous independent variables.

The variance analysis to justify the partition of the tree when the independent variables are continuous is developed below:

Any one of the tree nodes is identified by index m, Rm is the sample subset pertaining to this node, and N_m is the cardinal of the said subset. Initially, $m=0$,

$N_0=n$ y $\mathrm{R}_0 = \left\{\left(\mathrm{x}_\mathrm{j}^1, \mathrm{x}_\mathrm{j}^2, \ldots, \mathrm{x}_\mathrm{j}^\mathrm{p}\right), \mathrm{j} = 1, \ldots, \mathrm{N}_0\right\}$.

The pmk vector identifies the relative frequency of the cases whose dependent variable (y) takes value $\mathrm{k} \in \{1,2, \ldots, \mathrm{K}\}$:

$$p_{mk} = \frac{1}{N_m} \sum_{x_j \in R_m} I\{y_j = k\}$$

In this algorithm, the same as for the CRT, each node m will be associated with the most frequent class C(m) as:

$$p_{mC(m)} = \max_k \{p_{mk}\}$$

The variance analysis statistically evaluates whether the mean of each independent variable (continuous) xi is the same in all the groups identified by class yj = k. This analysis is made on each node m and for all the variables in order to identify which independent variable has the highest F-statistic, as detailed below for each node m:

1. $\bar{x^i} = \frac{1}{N_m} \sum_{x_j \in R_m} x_j^i \quad \forall i \in \{1,2,..,p\}$
2. $N_{m,k} = \sum_{x_j \in R_m} I\{y_j = k\} \; \forall k \in \{1,2,..,K\}$

   (verify that $N_m = \sum_{k=1}^{K} N_{m,k}$)
3. $\bar{x^i}(k) = \frac{1}{N_{m,k}} \sum_{x_j \in R_m} x_j^i \cdot I\{y_j = k\} \quad \forall i \in \{1,2,..,p\} \; \forall k \in \{1,2,..,K\}$
4. $\bar{x^i} = \frac{1}{N_m} \sum_{x_j \in R_m} x_j^i \quad \forall i \in \{1,2,..,p\}$
5. $F_m^i = \frac{\sum_{k=1}^{K} N_{m,k} (\bar{x^i}(k) - \bar{x^i})^2 / (K-1)}{\sum_{x_j \in R_m} (\bar{x_j^i} - \bar{x^i})^2 / (N_m - K)} \quad \forall i \in \{1,2,..,p\}$
6. Select variable x^{i*} that verifies $F_m^{i*} = \max_{1 \le i \le p} \{F_m^i\}$ to split node m.

7. The selection of the critical value of variable x^{i*} is governed by this criterion of the F-statistic, this time in order to minimize the weighted sum of the nodes resulting from the partition; if 1 and 2 are the said nodes and *m=0* is the root node, then this weighted index is defined as:

$$F_{1,2} = \frac{N_1}{N_1 + N_2} F_1 + \frac{N_2}{N_1 + N_2} F_2$$

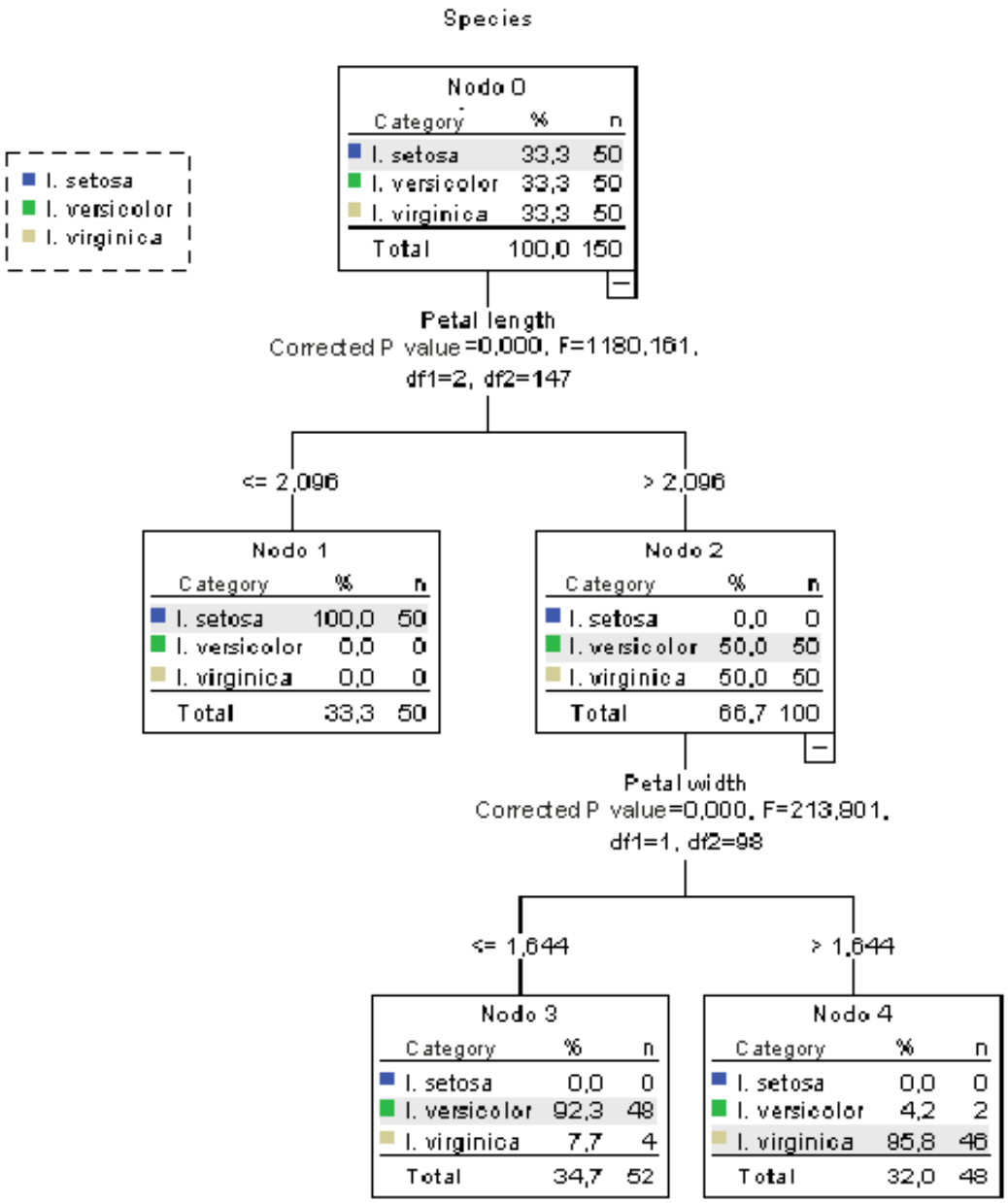
To illustrate these concept, a variance analysis was applied to the Fisher example (as shown in the following tables) for the four variables and considering the groups defined by the three types of flowers. The higher the value of the F-Statistic (column F), the greater the difference of the means between the different groups and the significance level (column Sig), or p-value will be lower. The table shows that all the significance levels are very small (less than α=0.05) which would indicate that all the groups (types of flowers) have different means for the four variables. With regard to the F value, it should be noted that the maximum (1180.00) is achieved by the Petal length variable, which would be the one selected for the classification tree.

Statistics for the sample of the Illustrative Example

Species		Sepal width	Sepal length	Petal length	Petal width
I. setosa	Mean	3.4280	5.0060	1.4620	.2460
	N	50	50	50	50
	Std. Dev.	.37906	.35249	.17366	.10539
	Variance	.144	.124	.030	.011
I. versicolor	Mean	2.7700	5.9360	4.2600	1.3260
	N	50	50	50	50
	Std. Dev.	.31380	.51617	.46991	.19775
	Variance	.098	.266	.221	.039
I. virginica	Mean	2.9740	6.5880	5.5520	2.0260
	N	50	50	50	50
	Std. Dev.	.32250	.63588	.55189	.27465
	Variance	.104	.404	.305	.075
Total	Mean	3.0573	5.8433	3.7580	1.1993
	N	150	150	150	150
	Std. Dev.	.43587	.82807	1.76530	.76224
	Variance	.190	.686	3.116	.581

ANOVA table for the Illustrative Example

		Sum of squares	gl	Quadratic mean	F	Sig.
Sepal width * Species	Inter-group	11.345	2	5.672	49.160	.000
	Intra-group	16.962	147	.115		
	Total	28.307	149			
Sepal length * Species	Inter-group	63.212	2	31.606	119.265	.000
	Intra-group	38.956	147	.265		
	Total	102.168	149			
Petal length * Species	Inter-group	437.103	2	218.551	1180.161	.000
	Intra-group	27.223	147	.185		
	Total	464.325	149			
Petal width * Species	Inter-group	80.413	2	40.207	960.007	.000
	Intra-group	6.157	147	.042		
	Total	86.570	149			



Training and validation error (QUEST). Fisher example

Method	Estimation	Standard error
Resubstitution	.040	.016
Cross validation	.040	.016

Classification with the QUEST Algorithm. Fisher example

Observed	Predicted			
	I. setosa	I. versicolor	I. virginica	Percentage correct
I. setosa	50	0	0	100.0%
I. versicolor	0	48	2	96.0%
I. virginica	0	4	46	92.0%
Overall percentage	33.3%	34.7%	32.0%	96.0%

SIXTY-FOURTH WORLD HEALTH ASSEMBLY **WHA64.10**

Agenda item 13.4 **24 May 2011**

Strengthening national health emergency and disaster management capacities and resilience of health systems

The Sixty-fourth World Health Assembly,

Recalling resolutions WHA58.1 on health action in relation to crises and disasters, and WHA59.22 on emergency preparedness and response, resolution WHA61.19 on climate change and health, and other World Health Assembly and Regional Committee resolutions and action plans, inter alia, on health security and the International Health Regulations (2005), as well as on pandemic preparedness, safe hospitals and other matters related to emergencies and disasters at local, subnational and national levels;

Recalling United Nations' General Assembly resolution 60/195, which endorsed the Hyogo Declaration and the Hyogo Framework for Action 2005–2015: Building the Resilience of Nations and Communities to Disasters, as well as resolutions 61/198, 62/192, 63/216, 64/200 and 64/251, which, inter alia, called upon Member States to increase efforts to implement the Hyogo Framework, to strengthen risk-reduction and emergency preparedness measures at all levels, and to encourage the international community and relevant United Nations' entities to support national efforts aimed at strengthening capacity to prepare for and respond to disasters;

Reaffirming that countries should ensure the protection of the health, safety and welfare of their people and should ensure the resilience and self-reliance of the health system, which is critical for minimizing health hazards and vulnerabilities and delivering effective response and recovery in emergencies and disasters;

Regretting the tragic and enormous loss of life, injuries, disease and disabilities resulting from emergencies, disasters and crises of all descriptions;

Mindful that emergencies and disasters also result in damage and destruction of hospitals and other health infrastructure, weakened ability of health systems to deliver health services; and setbacks for health development and the achievement of the Millennium Development Goals;

Expressing deep concern that continuing poverty, increasing urbanization and climate change are expected to increase the health risks and impacts of emergencies and disasters on many countries and communities;

Acknowledging that most actions to manage the risks to health from natural, biological, technological and societal hazards, including the immediate emergency response, are provided by local- and country-level actors across all health disciplines, including mass casualty management, mental health and noncommunicable diseases, communicable diseases, environmental health, maternal and newborn health, reproductive health, and nutrition and other cross-cutting health issues;

Recognizing the contribution of other sectors and disciplines to the health and well-being of people at risk from emergencies and disasters, including local government, planners, architects, engineers, emergency services and civil protection, and academia;

Concerned that country and community capacities to manage major emergencies and disasters are often overwhelmed, and that coordination, communications and logistics are often revealed as the weakest aspects of health emergency management;

Appreciating that some countries, including those with low-income or emerging country development status, have reduced mortality and morbidity in disaster situations through their investment in emergency and disaster risk-reduction measures, with the support of local, regional and global partners;

Recognizing that WHO plays an important role as a member of the International Strategy for Disaster Reduction system and as the health cluster lead in the framework of humanitarian reform, and works closely with other members of the international community, such as the United Nations Secretariat of the International Strategy for Disaster Reduction, UNDP, UNICEF, the United Nations Office for the Coordination of Humanitarian Affairs, the International Red Cross and Red Crescent Movement, and other nongovernmental organizations, on supporting country capacity development and developing institutional capacities for multisectoral emergency and disaster risk-management, which includes disaster risk-reduction;

Building on the International Strategy for Disaster Reduction, the 2008–2009 World Disaster Reduction Campaign on Hospitals Safe from Disasters, the 2010–2011 Campaign on Disaster Resilient Cities, World Health Day 2008 on Climate Change and Health, World Health Day 2009 on Hospitals Safe in Emergencies, and World Health Day 2010 on Urban Health Matters, which have resulted in local, subnational, national and global actions on reducing risks to health from emergencies and disasters;

Recognizing that improved health outcomes from emergencies and disasters require urgent additional action at country, regional and global levels to ensure that the local, subnational and national health risk-reduction and overall response in emergencies and disasters are timely and effective and that health services remain operational when they are most needed, in this respect bearing in mind that emergencies and disasters affect men and women differently,

1. URGES Member States: 1

1) to strengthen all-hazards health emergency and disaster risk-management programs (including disaster risk-reduction, emergency preparedness and response). 2 as part of national and subnational health systems, supported by, and with effective enforcement of, legislation, regulations and other measures, to improve health outcomes, reduce mortality and morbidity, protect health infrastructure and strengthen the resilience of the health system and society at large, and mainstream a gender perspective into all phases of these programs;

2) to integrate all-hazards health emergency and disaster risk-management programs (including disaster risk-reduction) into national or subnational health plans and institutionalize capacities for coordinated health and multisectoral action to assess risks, proactively reduce risks, and prepare for, respond to, and recover from, emergencies, disasters and other crises;

3) to facilitate access by concerned government and other related agencies to information on types and quantities of hazardous materials stored, used or transported, in order to support effective health emergency and disaster risk-management;

4) to develop programs on safe and prepared hospitals that ensure: that new hospitals and health facilities are located and built safely so as to withstand local hazards; that the safety of existing facilities is assessed and remedial action is taken; and that all health facilities are prepared to respond to internal and external emergencies;

5) to establish, promote and foster regional and subregional collaboration, as well as interregional cooperation within WHO, including sharing of experience and expertise for capacity development, in risk-reduction, response and recovery;

6) to strengthen the role of the local health workforce in the health emergency management system, to provide local leadership and health services, through enhanced planning, training for all health-care workers and access to other resources;

2. CALLS UPON Member States, donors and development cooperation partners to allocate sufficient resources for health emergency and disaster risk-management programs and partners through international cooperation for development, humanitarian appeals, and support for WHO's role in health emergency and disaster risk-management matters;

---

[1] And, where applicable, regional economic integration organizations.

2. Health emergency and disaster risk-management includes all measures to assess risks, proactively reduce risks, prepare for, respond to, and recover from, emergencies, disasters and other crises.

3. REQUESTS the Director-General:

1) to ensure that WHO at all levels has enhanced capacity and resources, and optimizes its expertise across all disciplines in the Organization, in order to provide the necessary technical guidance and support to Member States and partners for developing health emergency and disaster risk-management programs at national, subnational and local levels;

2) to strengthen collaboration with and ensure coherence and complementarity of actions with those of relevant entities, including those in the public, private, nongovernmental and academic sectors, in order to support country and community health emergency and disaster risk-management, which includes disaster risk-reduction, as well as ongoing efforts by Member States to implement the International Health Regulations (2005);

3) to strengthen the evidence base for health emergency and disaster risk-management including operational research and economic assessments;

4) to support national and subnational assessments of risks and capacities for health emergency and disaster risk-management, as a basis for catalyzing action and strengthening national and subnational health emergency and disaster risk-management capacities, including disaster risk-reduction;

5) to report to the Sixty-sixth World Health Assembly through the Executive Board at its 132nd session, on progress made in implementing this resolution;

6) to consider, as appropriate, providing support to regional and subregional networks, as well as interregional cooperation with WHO, in order to strengthen their collaboration on health emergency and disaster risk management.

Tenth plenary meeting, 24 May 2011
A64/VR/10

= = =

WHA58/2005/REC/1

WORLD HEALTH ORGANIZATION

FIFTY-EIGHTH WORLD HEALTH ASSEMBLY

GENEVA, 16-25 MAY 2005

RESOLUTIONS AND DECISIONS
ANNEX.

GENEVA
2005

4) to ensure early implementation of the outstanding audit recommendations, and to propose to the Executive Board at its 117th session a tracking program for external and internal audit recommendations which include timeframes for implementation;

5) to carry through his strong commitment to further strengthen the performance of the Organization, in particular at regional and country levels;

6) to provide guidance on WHO's relative priorities when requesting voluntary contributions;

7) to report to the Sixtieth World Health Assembly, through the Executive Board, on progress made in implementation of this resolution

(Eighth plenary meeting, 23 May 2005 -
Committee A, fourth report)

WHA58.5 Strengthening pandemic-influenza preparedness and response

The Fifty-eighth World Health Assembly,

Having considered the report on influenza pandemic preparedness and response;[1] Recalling resolutions WHA22.47, Diseases under surveillance: louse-borne typhus, louse-borne relapsing fever, viral influenza, paralytic poliomyelitis; WHA48.13, Communicable diseases prevention and control: new, emerging, and re-emerging infectious diseases; WHA56.19, Prevention and control of influenza pandemics and annual epidemics; and WHA56.28, Revision of the International Health Regulations; and the global agenda for influenza surveillance and control;

Acknowledging with growing concern that the evolving, unprecedented outbreak of H5N1 avian influenza in Asia represents a serious threat to human health;

Stressing the need for all countries, especially those affected by highly pathogenic avian influenza, to collaborate with WHO and the international community in an open and transparent manner in order to lessen the risk that the H5N1 influenza virus causes a pandemic among humans;

Mindful of the need to address the limited progress being made in development of influenza vaccines and transit to the production stage;

Emphasizing the importance of strengthening surveillance of human and zoonotic influenzas in all countries in order to provide an early warning of, and a timely response to, an influenza pandemic;

Noting the gaps in knowledge and the need for additional research on various aspects of the spread of influenza and for influenza preparedness and response;

[1] Document A58/13.

Noting the importance of strengthening linkages and cooperation with the mass media;

Acknowledging that communication with the public must be improved in order to increase awareness of the seriousness of the threat that an influenza pandemic represents, and of the steps in basic hygiene that citizens can and should take in order to lessen their risk of contracting and transmitting influenza;

Emphasizing the need to strengthen collaboration on human and zoonotic influenzas with organizations responsible for animal and human health at local, national and international levels;

Aware of the need to expand the availability of influenza vaccine so that protection in a pandemic can be extended to populations in more countries, with particular attention to requirements in developing countries;

Recognizing the need to prepare for international cooperation during the initial stages of a pandemic, particularly in the event of inadequate stockpiles of vaccine and antiviral medications;

Recognizing further that influenza antiviral medications will be an important component of a containment strategy, but that additional studies are required to establish their appropriate use in containment;

Recognizing also that a global stockpile of these agents is lacking and few countries have established national stockpiles,

1. URGES Member States:

1) to develop and implement national plans for pandemic-influenza preparedness and response that focus on limiting health impact and economic and social disruption;

2) to develop and strengthen national surveillance and laboratory capacity for human and zoonotic influenzas;

3) to achieve the target set by resolution WHA56.19, Prevention and control of influenza pandemics and annual epidemics, to increase vaccination coverage of all people at high risk, which will lead to availability of greater global vaccine-production capacity during an influenza pandemic;

4) seriously to consider developing domestic influenza-vaccine production capacity, based on annual vaccine needs, or to work with neighboring States in establishing regional vaccine production strategies;

5) to ensure prompt and transparent reporting of outbreaks of human and zoonotic influenzas to WHO’s regional offices, FAO, Office International des Epizooties, and neighboring countries, particularly when novel influenza strains are involved, and to facilitate the rapid sharing of clinical specimens and viruses through the WHO Global Influenza Surveillance Network

6) to communicate clearly to health-care workers and the general public the potential threat of an influenza pandemic and to make effective use of media and other appropriate communication channels to educate the public about effective hygienic practices and other public health interventions that may protect them from influenza-virus infection;

7) to strengthen linkages and cooperation among national health, agriculture and other pertinent authorities in order to prepare for, including by mobilizing resources, and respond jointly to, outbreaks of highly pathogenic avian influenza;

8) to support an international research agenda to reduce the spread and impact of pandemic influenza viruses, to develop more effective vaccines and antiviral medications, and to advance, among various population groups, especially people with immunodeficiencies such as HIV-infected and AIDS patients, vaccination policies and strategies, in close consultation with the communities concerned;

9) to contribute, as feasible, their expertise and resources to strengthen WHO programs, bilateral country activities and other international efforts to prepare for pandemic influenza;

10) to take all necessary measures during a global pandemic, to provide timely and adequate supplies of vaccines and antiviral drugs, using to the full the flexibilities contained in the Agreement on Trade-Related Aspects of Intellectual Property Rights;

2. REQUESTS the Director-General:

1) to continue to strengthen global influenza surveillance, including the WHO Global Influenza Surveillance Network, as a crucial component of preparedness for seasonal epidemics and pandemics of influenza;

2) to seek solutions with other international and national partners, including the private sector, to reduce the present global shortage of influenza vaccines and antiviral medications for both epidemics and pandemics, including vaccination strategies that economize on the use of antigens, and development and licensing of antigen-sparing vaccine formulations;

3) to provide Member States with technical support and training in order to develop health promotion strategies in anticipation of, and during, influenza pandemics;

4) to draw up and coordinate, in collaboration with public and private partners, an international research agenda on pandemic influenza;

5) to assess the feasibility of using antiviral-medication stockpiles to contain an initial outbreak of influenza and to slow or prevent its international spread, and, as appropriate, to develop an operational framework for their deployment;

6) to evaluate the potential benefit of personal protection measures, including the wearing of surgical masks, to limit transmission in different settings, especially health-care settings;


IRL
Instituto de Riesgos Legales