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Letter from the Managing Editor

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The articles in this issue of *Harvard Deusto Business Research* present studies and research on loss index trigger modeling for cat bonds; the competence profile and the performance evaluation of care assistants in a nursing home; the current situation of cloud computing, from the perspective of the European Union and SMEs; and training in values as an incubator of sustainable attitudes.

In the first article, Professor María José Pérez-Fructuoso presents a continuous random model that makes it possible to calculate the loss index trigger for cat bonds, based on the rate of claim statements, calculated as the difference between the variables of the total amount of the catastrophe and the incurred-but-not-yet-reported loss amount. The fundamental hypothesis behind the modeling considers a decrease over time of this amount that is proportional to a function, which is referred to as the "mixed rate of claim statements".

Next, the work by Juan M. Fernández Millán, Marina Fernández Navas, Raimundo Aguayo Estremera and Alejandro González Cánovas explains the research conducted to develop the competence-based professional profile and subsequent performance evaluation, based on behaviors that reflect the selected competences for the position of care assistant in a nursing home.

In the following article, Professor Pedro R. Palos Sánchez discusses a technology that is relatively unfamiliar to many organization and users: cloud computing. He believes that the cost savings and the simplification of the technology infrastructure are two decisive factors for its expansion, while the lack of standardization, the need for new professionals and misgivings about the security of the data constitute barriers to its adoption. He also reviews the strategic positioning of the European Commission with regard to the consequences of adopting the cloud paradigm.

In the final article closing this issue, Juan Manuel Pineda-Albaladejo, Francisco José Moya-Faz and Jorge López Puga present a critical review of the Schwartz model, dealing with the cognitive representations of the human needs contained in the Theory of Values, given their importance for the comprehension and behavior associated with entrepreneurial initiative, presenting the academic curriculum addressing the ethical and moral profile as a promoter of sustainable attitudes.

Finally, as always, I would like to thank the authors for their effort and the inestimable collaboration and professionalism of the members of the editorial committee and the reviewers, as well as the warm reception by the readers of *Harvard Deusto Business Research*. Thank you very much to everyone.

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Modeling Loss Index Triggers for Catastrophe (Cat) Bonds: An Alternative Continuous Approach

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Title

Modeling Loss Index Triggers for Catastrophe (Cat) Bonds: An Alternative Continuous Approach.

Abstract

This paper proposes a method for continuous-time random modeling of loss index-triggered catastrophe bonds (cat bonds) that simplifies both rating and pricing throughout their maturity period. This index is based on the amount of declared losses calculated as the difference between the total amount of the catastrophe and that of incurred-but-not-yet-reported losses, which is modeled by means of a geometric Wiener process. The fundamental assumption of this model lies in considering that this amount decreases proportionally to a function, hereby called the mixed-rate of claims statement, which represents the pace of claim statements as growing linearly up to a certain moment, after which it becomes constant until the bond reaches maturity.

Key words

Catastrophe bonds (cat bonds); reported loss amount; incurred-but-not-yet-reported loss amount; mixed claim reporting rate; geometric Brownian motion; catastrophic loss ratio.

The incurred-but-not-yet-reported loss amount is the fundamental variable of the model

1. Introduction

Cat bonds are financial assets that condition their coverage on the occurrence of a certain trigger that is established at the time of issue. This trigger is selected based on the risks covered and the way in which the indemnity process is structured, in an attempt to, from the perspective of the investor, maximize its transparency and, from the perspective of the sponsor, minimize the basis risk or that of insufficient coverage. For this reason, over time, the triggers used in the processes of securitization of insured risk have varied from the initial indemnity and parametric indexes triggers to the current trend of sector loss indexes (or loss indexes from the insurance industry). This is basically due to the fact that compared to the accounting book-supported structure for the indemnity trigger, the loss index triggers are easier to understand for the investor and reduce the moral hazard. Furthermore, from the perspective of the insurer, they prevent a lot of the information subject to confidentiality from being made public. However, the main drawback to this system of structuring cat bonds is related to the use of poorly developed indexes that do not accurately represent the industry losses and generate basis risk.

A relevant aspect in both the theoretical and practical analysis of these financial-actuarial instruments with loss index triggers is their pricing over a set time horizon, based on the definition of a model that makes it possible to calculate the dynamics of the total amount of the losses, and therefore, the claims ratio underlying this type of contracts.

Different authors have considered this matter. Cummins and Geman (1995) and Geman and Yor (1997) have developed models for assessing options and futures for catastrophic risks based on two hypotheses: they use, on the one hand, Wiener's geometric processes to describe the instantaneous claim reporting and, on the other, Poisson processes, which incorporate the possibility of the occurrence of large catastrophes in the model. Aase (1999; 2001) models the dynamics of the loss index through a Poisson process consisting of random jumps to assess futures and future options for catastrophes (*cat futures* and cat *options*), as a specific case of the model developed by Embrechts and Meister (1995), which represents the behavior of the underlying value by means of a combination of compound Poisson processes and a random claim frequency. Loubergé, Kellezi and Gilli (1999) apply the option valuation model for catastrophes developed by Cummins and Geman (1995) to calculate the price of a catastrophe bond whose trigger is a loss index from the insurance industry. Lee and Yu (2002) incorporate the credit risk in the valuation of cat bonds through a Brownian geometric movement, as well as practical factors associated with moral hazard and base risk. Cox and Pedersen (2000) propose a method for calculating the price of a cat bond in incomplete markets based on the definition of a certain term structure for the interest rates and structure of probabilities of the catastrophic risk occurring. Muermann (2003) uses the loss index modeling developed by Aase (1999) to make a valuation, consisting in actuarial terms of derivative assets, options and futures negotiated on the Chicago Board of Trade (hereafter, CBOT). Nowak and Romaniuk (2013) apply term structure of interest rates models (risk-free spot interest rates) under the hypothesis that the occurrence of the catastrophe is independent of the behavior of the financial markets. Finally, Zong-Gang and Chao-Qun (2013) consider a stochastic interest rate environment to describe catastrophic losses through a compound non-homogeneous Poisson process.

This review of the financial-actuarial literature reveals the frequent use of the Brownian geometric movement to model the behavior of the loss index triggering the derivatives associated with insurance in general, and more specifically within this type of assets, cat bonds. Working under this hypothesis leads us to assume exponential growth, on average, of the instantaneous claim reporting, which contrary to what the empirical evidence reveals,

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The incurred-but-not-yet-reported loss amount decreases according to a Brownian geometric movement

tends to be uniform over time. To resolve these inconsistencies, Alegre, Pérez-Fructuoso and Devolder (2003) developed a random model over discrete time that models the behavior of the loss index underlying the futures and options for catastrophic risks negotiated on the CBOT, based on the definition of the total amount of a catastrophe as the sum of two random variables: the reported loss amount and the incurred-but-not-yet-reported loss amount, limiting the possibility of the occurrence of catastrophes to one per period. Later, Pérez-Fructuoso (2008; 2009) expanded the previous discrete random model to the continuous field, assuming that the dynamics of the amount of incurred-but-not-yet-reported loss amount follows a Brownian geometric movement representative of a time decrease of this variable according to a real function of the real variable, referred to as the "rate of claim statements".

For the case of a constant rate of claim statements (instantaneous rate of claim statements), the reported loss amount, the fundamental variable for the calculation of the loss index in the case of the occurrence of a catastrophe, is thus easily obtained as the difference between the total amount of the catastrophe and the incurred-but-not-yet-reported loss amount. However, disrupting the rate of claim statements with white noise amplified by volatility can result in negative values for said rate, which would cause an increase in the time of the incurred-but-not-yet-reported loss amount, due to the inverse variation defined for said variable. This can happen when, after the claim statements have been made, the appraisal by the insurance adjusters results in loss valuations that are less than those initially estimated. For this reason, the incorporation of randomness through a Wiener process would only be valid for volatility values that would give rise to a practically negligible probability that the incurred-but-not-yet-reported loss amount would increase.

In order to solve this problem, this article proposes a continuous model based on the same hypotheses as the original model by Pérez-Fructuoso (2008; 2009); i.e., the incurred-but-not-yet-reported loss amount decreases according to a function called the "rate of claim statements," which is disrupted by means of a Wiener process that reflects the irregularity of the claim statements over time. The essential difference from the preceding model is based on the mixed definition of the rate of claim statements, i.e., as a defined function in two segments: the first of which grows linearly until a point in time when the pace of claim statements changes and becomes constant at a certain level.

The article is structured as follows: after an exhaustive review of the cat bond pricing models developed to date, section 2 presents the definition of the risk coverage instruments analyzed and includes an example of how they work. Section 3 presents the hypotheses on the occurrence of catastrophes and loss reporting upon which the loss index will be formulated subjacent to the bond and based on which their valuation will be carried out by means of traditional methods to assess the options used in the capital markets. Next, the process is carried out to calculate the variable corresponding to the incurred-but-not-yet-reported loss amount, first in a deterministic context and then randomly, assuming that it decreases according to a function called the "rate of claim statements," which is disrupted using a Wiener process that reflects the irregularity of the claim statements over time. The reported loss amount, the value of which will be equal to the loss index in the event the catastrophe occurs, is obtained by the difference between the total amount of the catastrophe and the incurred-but-not-yet-reported loss amount. These magnitudes are calculated for any functional definition of the rate of claim statements and considering that the pace of claim statements, represented by the rate of claim statements, is a function defined in segments, which increases until a certain point and then becomes constant until the bond reaches maturity. Section 4 focuses on the calculation of the loss index. Finally, section 5 summarizes the most important conclusions reached in this work.

2. Contextualization of cat bonds

2.1. Definition of a cat bond and current market situation

Cat bonds were created in the early 1990s to give the insurance industry access to a new source of risk coverage through the capital markets. Even though their structure is similar to that of traditional bonds, the results of catastrophe bonds are conditioned by the occurrence of a certain triggering event, the parameters of which are established at the time of issue (Pérez-Fructuoso, 2005).

For the most part, these instruments are sponsored by insurance companies, reinsurers and private companies that transfer to a special purpose vehicle (SPV) all or part of their catastrophic subscription risk. The SPV, in return, takes out a conventional re-insurance policy with the sponsor and seeks out financing (issuing bonds) in the capital market, which in turn acts as the counterparty in the established reinsurance agreement. The cash flows obtained with the bond issue and the premium paid by the cedent by way of the reinsurance price are invested by the SPV in short-term assets with high profitability that are deposited in a collateral account, insuring the transaction and generating sufficient resources to cover the risks undertaken in the reinsurance contract and the coupon payment promised to investors in the amount loaned through the purchase of the bonds. The real benefits generated in this account are exchanged at the LIBOR, with a swap counterparty that is highly rated by the rating agencies. Through this swap mechanism, the bonds become floating rate notes, so that the interest rate risk is eliminated for the most part. During the life of the bond, the periodic interests paid by the SPV to investors are obtained from the combination of two components: the premiums paid by the sponsor by way of reinsurance coverage and the LIBOR profitability generated by the principal of the bond, which is guaranteed by the counterparty of the swap. Then, at the end of the life of the bond, if the claim covered by the contract does not occur, the principal is returned to the investors, just like with any other fixed income investment. However, if the triggering claim event of the bond occurs, depending on its structure and the reinsurance contract, the investors will lose the interest and the principal of the investment or part of them.

Currently, the main investors in cat bonds are, in order of importance, large multinational companies (40%), life insurance companies (20%), hedge funds (15%), investment funds (10%), reinsurers (10%) and banks (5%). By region, the United States invests the most in this type of instruments (59%), followed by Europe (25%), Bermuda (11%), Japan (3%), Canada (1%) and Australia (1%).

In 2015, $5.917 billion of cat bonds were issued in a total of 25 transactions, a figure that is lower than the record $7.9 billion reached in 2014. During the first nine months of 2016, activity in the cat bond market reached $3.7 billion.

Table 1
Capital risk issued in cat bonds between 1998 and 2015 (in millions of dollars)

1998	1999	2000	2001	2002	2003	2004	2005	2006
874.2	1,052.5	1,142	966.9	989.5	1,988.2	1,142.8	1,499	4,614.7
2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
7,187	3,009.9	3,396	4,599.9	4,107.1	5,855.3	7,083	7,926.7	5,917.2

Source: author's own work, based on Artemis (2016).

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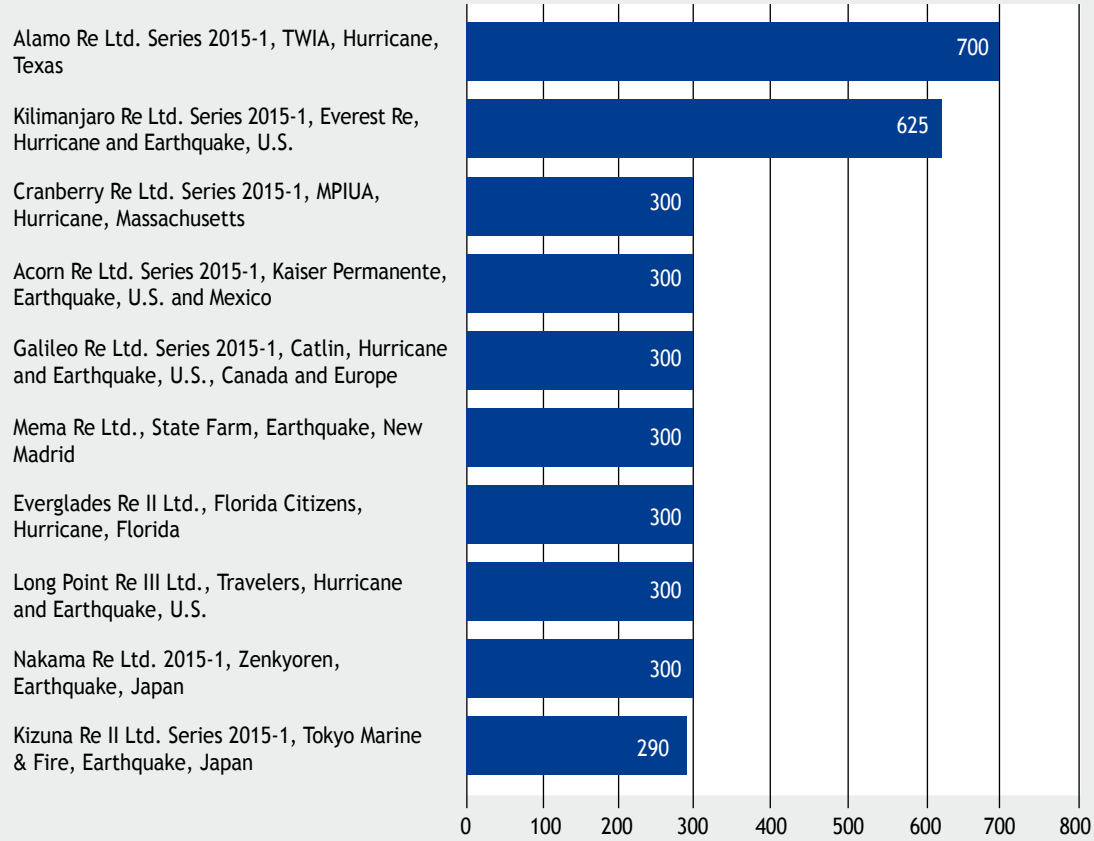
As can be seen in Table 1, since 1998, when the cat bond market began to be more active, the issued capital risk figure has shown an increasing trend, with a drop in 2008 coinciding with the start of the worst financial crisis in history. Since 2009, however, the issue of cat bonds has quickly increased, reaching $7.083 billion in 2013, with 31 transactions, and the record figure of $7.9 billion in 2014, above the figure of $7.2 billion issued in 2007. The most important transactions made with cat bonds in 2015 are shown in Table 2.

Table 2
Main transactions with cat bonds in 2015 (in millions of dollars)



Source: Insurance Information Institute.

In terms of the trigger type of cat bonds, until 2007, the initial issues based on indemnity triggers gave way to a growing preference for contracts with insurance industry loss index triggers that included the occurrence of catastrophic damage associated with a certain catastrophe. In 2007, however, the use of indemnity triggers resurfaced, evidencing the increasing sophistication of investors and the growing leverage of the sponsors. This trend has been maintained until present. Table 3 shows the evolution of cat bond issues since 2007 according to the type of trigger.

The rate of claim statements is defined as a mixed function

Table 3
Cat bonds issued by type of trigger (percentage)

	Indemnity	Loss index	Parametric	Modeled losses	Multiple trigger
2007	35.1	27.3	20.2	6	5
2008	51.7	20.4	24.4	0	0
2009	25.7	38.9	19.9	8.7	6.8
2010	34.7	37.3	4.4	2.7	12.6
2011	30.1	48.8	4.1	4.8	0
2012	49	23.4	9.8	5.9	3.2
2013	58	21.9	7.8	0	5.5
2014	67.7	22.1	0.7	2.8	1.1
2015	57.8	16.3	12.6	0	2.6
2016	68.7	26.5	0.6	0	0

Source: author's own work, based on Artemis (2016).

2.2. Example of how a cat bond works: cat bond issued by the United Services Automobile Association (USAA)

The United Services Automobile Association (USAA) is a non-life insurance company with headquarters in San Antonio that offers personal financial management products to military service members (on active duty or retired) belonging to the U.S. Army and their dependents (Cox, Fairchild & Pedersen, 2000; Pérez-Fructuoso, 2005).

To cover the overexposure to the risk of hurricanes in its automobile and real estate portfolios, for the first time in 1997 it issued annual term bonds through a reinsurance captive from the Cayman Islands, Residential Re, with a face value of $477 million and variable coupon payment and principal return, depending on the losses recorded by the real estate properties belonging to their insured parties, caused by hurricanes in the Gulf of Mexico and on the East Coast of the United States. The risk covered in the issue is defined precisely as "damage to USAA clients on the East Coast and the Gulf of Mexico of the United States as the result of the occurrence of a hurricane during the period between June 1997 and June 1998, classified as a category 3, 4 or 5 storm on the Saffir-Simpson scale, in the states covered by the contract and the losses of which exceed $1 billion." The bonds were issued in two series. In the first series, only the coupons had any risk associated with them; the principal was guaranteed. For the second series, both the coupons and the principal were conditioned by the risk of hurricanes. In this manner, in the second series, the coupons and the principal of the bond are not paid to investors if the losses derived from the risk defined in the contract exceed $1 billion. For the first series, on the other hand, after losses above $1 billion, the coupon begins to decrease and after $1.5 billion, the coupon disappears entirely.

For the series with only the risk coupon, the profitability offered by the bond is the LIBOR plus a differential of 2.73% (273 basis points). The series with the risk coupon and principal offers a yield of the LIBOR plus 5.76% (576 basis points).

How was the transaction carried out? Residential Re reached a reinsurance agreement with USAA to cover 80% of the level of $500 million in excess of the first $1 billion of losses by USAA. USAA retained the remaining 20% of the $500 million, i.e., $100 million. Residential

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Table 4
Specifications of the cat bond issued by the USAA

Issuer	Residential Re Ltd. (Cayman Islands): SPV company from the Cayman Islands that provides reinsurance to the USAA.
Reinsured	USAA
Investors	Investment funds, life insurance companies, reinsurers, etc.
Issued bond coupon	• Class A-I bonds: LIBOR + 273 points. • Class A-II bonds: LIBOR + 576 points.
Reinsurance agreement	Residential agrees with USAA to cover 80% of $500 million of risk in excess of the first $1 billion of losses. USAA retains the remaining 20% of the $500 million tier ($100 million).
Covered risk/Triggering event of the contract	Hurricane occurring between June 1997 and June 1998, classified as category 3, 4 or 5 on the Saffir-Simpson scale in the states covered by the contract and in which losses exceed $1 billion.
Type of coverage	Single occurrence: the contract offered by Residential is limited to a single hurricane that causes losses in an amount greater than $1 billion. If another hurricane occurs that produces similar losses, USAA is not covered.
Covered states	Alabama, North Carolina, South Carolina, Connecticut, Delaware, District of Columbia, Florida, Georgia, Louisiana, Maine, Maryland, Massachusetts, Mississippi, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont and Virginia.
Period of coverage	June 16, 1997 to June 14, 1998.
Bonds	Two types of bonds are issued: • Class A-I: $164 million ($77 million of principal protected; the rest variable). • Class A-II: $313 million (principal is 100% variable).
Credit rating	• Class A-I: AAAr/Aaa/AAA/AAA by S&P, Moody's, Fitch and D&P, respectively. • Class A-II: BB/BA/BB/BB by S&P, Moody's, Fitch and D&P, respectively.
Risk assessment and modeling	Applied Insurance Research, Inc. (AIR): company that has applied its hurricane simulation model to assess the bond risk.

Re issued two types of bonds, Class A-I and Class A-II, with variable interest coupons, for a total of $476.98 million. Approximately $400 million (80% of the coverage of $500 million) were made available to USAA in the case that the covered claim were to occur. The remaining 77 million were placed in a type of investment account called a defeasance account. The functioning of the Class A-I series is shown in Table 5.

Class A-I bonds were rated higher by the rating agencies because the principal was protected and therefore its return was assured. 53% of the capital obtained with the issue of this series, $87 million, was invested by Bankers Trust Co as a secured debt. The rest, approximately $77 million, was deposited in an account that was also invested in secured debt, but in this case, it was administered by Chase Manhattan. To guarantee the profitability obtained in these two accounts, a swap was conducted with Merrill Lynch Capital Service, as it was in the case of the Class A-II bond, thus eliminating the interest rate risk.

Since the reinsured event did not occur, at bond maturity, the principal was returned to the investors. If the claim trigger would have occurred that is described in the contract, the collateral account funds would have been used to purchase U.S. Treasury bonds with a ten-year maturity in the amount of $163.8 million (the principal of the Class A-I bonds). This purchase was guaranteed by the irrevocable agreement with Goldman Sachs Mitsui Marine Derivate Products, L.P. in the form of a forward option agreement that insured the purchase

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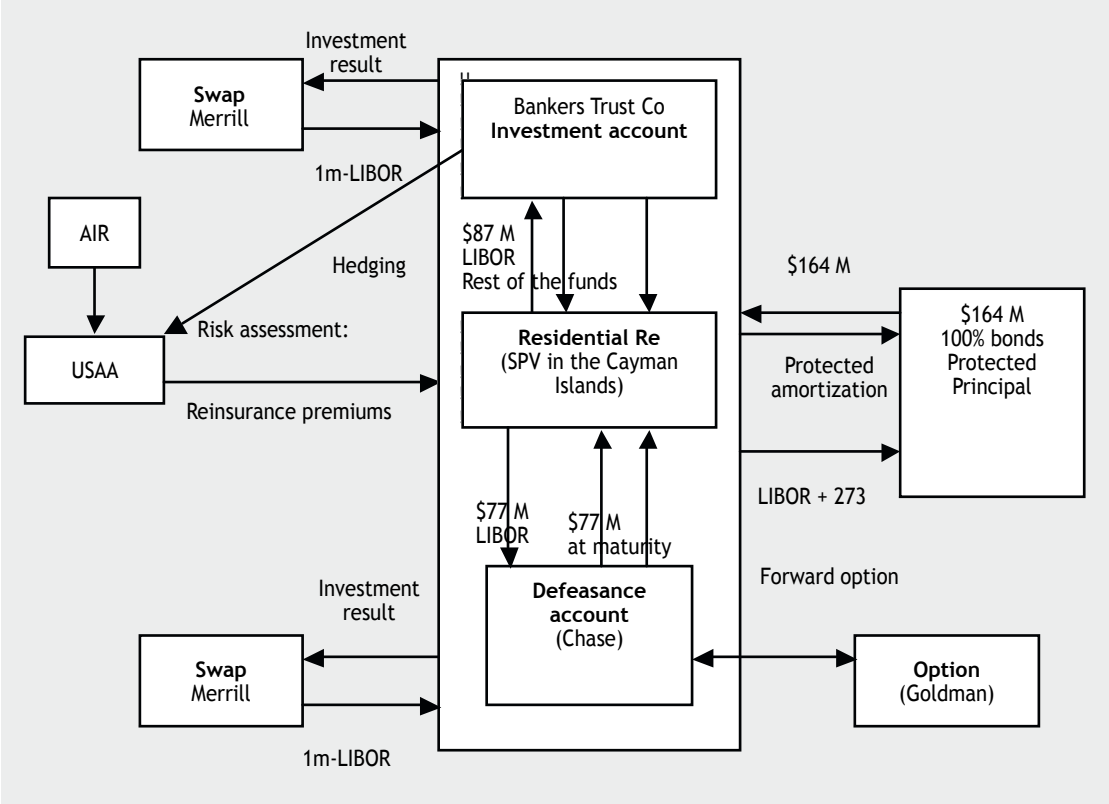
The rate of claim statements increases linearly until s_m^i and then remains constant

Table 5
Structure of the series A-I cat bond issue by USAA



Source: Pérez-Fructuoso (2005).

of the bonds that permitted the return of the principal at a specified price (a contingent defeasance securities agreement, or an operation to establish a risk-free bond portfolio, normally consisting of state debt, that will be used for the payment of the *cash-flow* promised to a group of creditors). In this case, the maturity period would have changed to December 15, 2008 instead of June 15, 1998.

For series Class A-II, the functioning scheme is shown in Table 6.

The $313 million obtained with the issue of Class A-II bonds was invested by Bankers Trust Co in secured debt. The interest (or coupons) for the bond purchasers was obtained from the monthly reinsurance premiums paid by USAA, from the earnings from the investment account and a swap agreement signed with Merrill Lynch Capital Service. This agreement was established as the result of the current legal restrictions, and as a result of it, the earnings from the secured debt from Bankers Trust Co were exchanged with monthly LIBOR interest to insure the payment of the variable interest promised to the bond investors (LIBOR + 576 points). Since the reinsured event did not occur, at bond maturity on June 15, 1998, the principal was returned. If the trigger event would have occurred, the interest and principal would have been canceled out proportionally to the claim paid.

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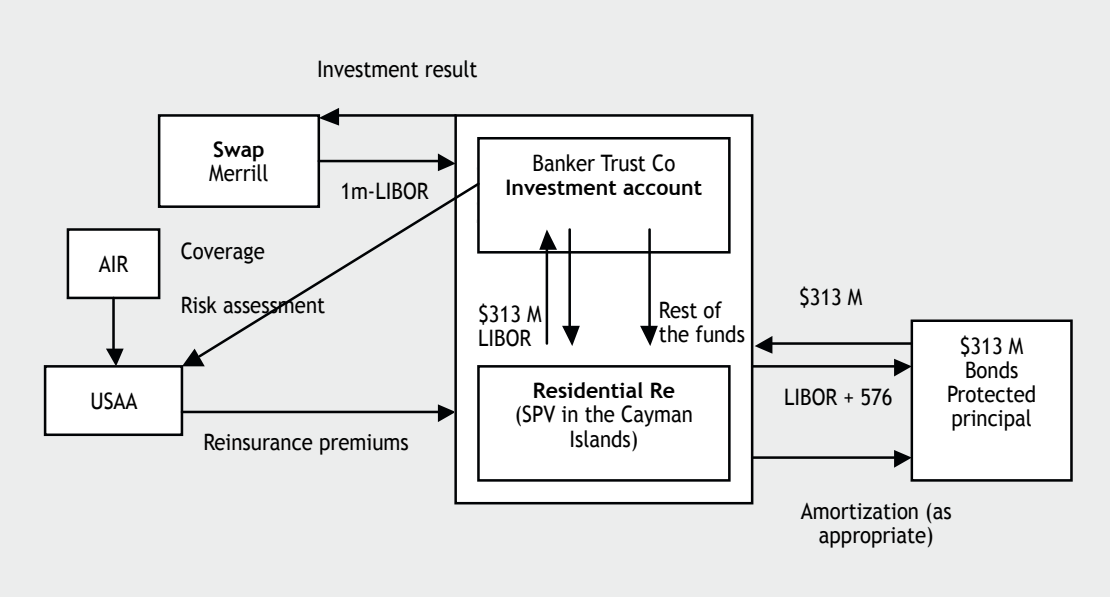
Table 6
Structure of the series A-II cat bond issue by USAA



Source: Pérez-Fructuoso (2005).

Taking this operation into account, USAA, using the capital market, has had access to more than $6 billion since 1997, through 25 different catastrophe bond offers. The last issue sponsored by USAA occurred in December 2015 in the amount of $125 million to cover multiple risks through a cat bond designed with an indemnity trigger.

3. Model for calculating the loss index

3.1. Catastrophe occurrence hypothesis

According to Pérez-Fructuoso (2008), we establish $[0, T] \subset [0, T']$ as the risk period of the catastrophe bond, in such a way that $T' \geq T$ is the maturity date or date of contract amortization and $\tau \in [0, T]$ is the moment when the disaster occurs that is covered by the bond issue. We define K_τ^i as the random variable that represents the total amount of the disaster with intensity i occurring at moment τ with $i = 1, 2, 3$, in such a way that $i = 1$ if the disaster that occurs is small in amount, $i = 2$ if it is of an average amount and $i = 3$ if it is large in amount (Alegre, Pérez-Fructuoso & Devolder, 2003).

Finally, we consider a variable indicator, δ_τ^i, which has a value of 0 if the catastrophe does not occur that is covered by bond at time $\tau \in [0, T]$; otherwise it is 1.

3.2. Claim reporting hypothesis

We assume that the claim reporting process associated with the occurrence of a catastrophe begins the very moment that it occurs and lasts until the moment of bond maturity, T'. Therefore, for a valuation point $t \in (\tau , T'] \subset [0, T']$, we define the total amount of the catastrophe occurred at time point τ, K_τ^i as the sum of two random variables —see formula 1, in which $S_\tau^i(t)$ is the reported loss amount and $R_\tau^i(t)$ is the incurred-but-not-yet-reported loss amount, both referring to valuation point t–.

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The loss index is the reported loss amount, multiplied by a variable indicator

$$K_\tau^i = S_\tau^i(t) + R_\tau^i(t) \quad (1)$$

The variables $R_\tau^i(t)$ and $S_\tau^i(t)$ are subject to the following boundary conditions:

a) Initial boundary condition, $t = \tau$: if the moment of bond valuation coincides with the moment the disaster occurs, $R_\tau^i(t) = K_\tau^i$ and $S_\tau^i = 0$

the incurred-but-not-yet-reported loss amount matches the total volume of the catastrophe and, consequently, the reported loss amount is zero.

b) Final boundary condition, $t \to \infty$: if the valuation of the bond occurs at a time distant enough from the occurrence of the catastrophe (tends to infinity), $\lim_{t\to\infty} R_\tau^i(t) = 0$ and $\lim_{t\to\infty} S_\tau^i(t) = K_\tau^i$

the losses associated with the catastrophe have already been fully reported and therefore there are no incurred-but-not-yet-reported losses.

3.3. General calculation of the variables $R_\tau^i(t)$ and $S_\tau^i(t)$ in the true model

Based on the analysis of the empirical evidence, a fundamental hypothesis of the model is considered to be that the intensity in the claim statements is very high immediately after the occurrence of the disaster and diminishes over time until disappearing when there are no longer any claims to declare. As a result of this, during an early construction phase of the model, the instantaneous claim rate is represented by a true differential equation (see equation 2) that describes an increase in the amount of claim statements proportional to the incurred-but-not-yet-reported loss amount and in which $\alpha_\tau^i(t-\tau)$ is a real function of the real variable referred to as the rate of claim statements, the explicit form of which is obtained through an analysis of the empirical data on catastrophe claim statements and according to the hypothesis that the claims associated with the average amount disasters will be reported sooner than the claims resulting from large disasters, in other words $\alpha_\tau^2(t-\tau) > \alpha_\tau^3(t-\tau)$. In terms of small catastrophes, $i = 1$, it is considered that they are reported instantly at the moment when they occur, and form part of the loss index directly. Therefore $\alpha_\tau^1(t-\tau) \to \infty$, $S_\tau^1(t) = K_\tau^1$ and $R_\tau^1(t) = 0$.

$$dS_\tau^i(t) = \alpha_\tau^i(t-\tau)R_\tau^i(t)dt \quad (2)$$

Differentiating equation 2, we get expression 3.

$$dS_\tau^i(t) = -dR_\tau^i(t)dt \quad (3)$$

In equation 2, by replacing $dS_\tau^i(t)$ with the result obtained in expression 3, we obtain the true differential equation that describes the evolution of the incurred-but-not-yet-reported loss amount, $R_\tau^i(t)$, a fundamental variable in our modeling, as is shown in equation 4.

$$dR_\tau^i(t) = -\alpha_\tau^i(t-\tau)\,R_\tau^i(t)\,dt \tag{4}$$

Solving ordinary differential equation 4 with the boundary conditions a) and b) that were previously defined, we obtain equation 5.

$$R_\tau^i(t) = K_\tau^i e^{-\int_0^{t-\tau}\alpha_\tau^i(s)\,ds} \tag{5}$$

By replacing 5 in equation 1, which establishes the relationship between the variables $R_\tau^i(t)$ and $S_\tau^i(t)$, we easily obtain the reported loss amount up to t, $S_\tau^i(t)$ as the difference between the total amount of the catastrophe and the incurred-but-not-yet-reported loss amount, as shown in equation 6.

$$S_\tau^i(t) = K_\tau^i - R_\tau^i(t) = K_\tau^i\left[1 - e^{-\int_0^{t-\tau}\alpha_\tau^i(s)\,ds}\right] \tag{6}$$

3.4. Calculation of the variables $R_\tau^i(t)$ and $S_\tau^i(t)$ in the true model for a mixed rate of claim statements

The model presented in the previous section is developed in the work by Pérez-Fructuoso (2008), following the work of other authors, such as Cummins and Geman (1995), for the random case and assuming a constant value for the rate of claim statements function. This hypothesis implies the assumption that the pace of claim statements is the same for the entire period analyzed. However, experience shows that the pace of claim statements is faster in the first few days following a disaster, which causes a greater reduction in the incurred-but-not-yet-reported loss amount at that time, and thus a greater growth in the amount of claim statements.

This article presents an alternative definition for this rate, which we call the "mixed rate of claim statements," the expression of which is shown in equation 7 and represents a linear increase in the claim statements up to point s_m^i that then remains constant from this point until at level α_τ^i.

$$\alpha_\tau^i(s) = \begin{cases} \left(\dfrac{\alpha_\tau^i}{s_m^i}\right)s & 0 \le s \le s_m^i \\ \alpha_\tau^i & s > s_m^i \end{cases} \tag{7}$$

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When the rate of claim statements is defined in this manner, it is possible to distinguish between two cases, depending on where the valuation point is:

1. If the valuation point, *t*, is before the point when the pace of claim statements changes, $\tau + s_m^i$, i.e., $\tau \leq t \leq \tau + s_m^i$, the solution for the integral in equation 5 is that which appears in equation 8.

$$\int_0^{t-\tau} \alpha_\tau^i(s)\,ds = \int_0^{t-\tau} \frac{\alpha_\tau^i}{s_m^i} s\,ds = \frac{\alpha_\tau^i}{s_m^i}\frac{s^2}{2}\Big]_0^{t-\tau} = \frac{\alpha_\tau^i (t-\tau)^2}{2s_m^i} \tag{8}$$

In this case, the incurred-but-not-yet-reported loss amount in *t* and the reported loss amount up to moment *t* are those appearing in equations 9 and 10.

$$R_\tau^i(t) = K_\tau^i e^{-\alpha_\tau^i (t-\tau)\frac{(t-\tau)}{2s_m^i}} \quad \text{con } i = 2,3 \tag{9}$$

$$S_\tau^i(t) = K_\tau^i \left[1 - e^{-\alpha_\tau^i (t-\tau)\frac{(t-\tau)}{2s_m^i}}\right] \quad \text{con } i = 2,3 \tag{10}$$

2. If the valuation point, *t*, is after the point when the pace of claim statements changes, $\tau + s_m^i$, i.e., $t > \tau + s_m^i$, the solution for the integral in equation 5 is that which appears in equation 11.

$$\int_0^{t-\tau} \alpha_\tau^i(s)\,ds = \int_0^{s_m^i} \frac{\alpha_\tau^i}{s_m^i} s\,ds + \int_{s_m^i}^{t-\tau} \alpha_t^i\,ds = \frac{\alpha_\tau^i}{s_m^i}\frac{s^2}{2}\Big]_0^{s_m^i} + \alpha_\tau^i s\Big]_{s_m^i}^{t-\tau} = \alpha_\tau^i (t-\tau) - \frac{\alpha_\tau^i s_m^i}{2} \tag{11}$$

In this case, the incurred-but-not-yet-reported loss amount in *t* and the reported loss amount up to moment *t* are those appearing in equations 12 and 13.

$$R_\tau^i(t) = K_\tau^i e^{-\alpha_\tau^i (t-\tau)} e^{\frac{\alpha_\tau^i s_m^i}{2}} \quad \text{con } i = 2,3 \tag{12}$$

$$S_\tau^i(t) = K_\tau^i \left[1 - e^{-\alpha_\tau^i (t-\tau)} e^{\frac{\alpha_\tau^i s_m^i}{2}}\right] \quad \text{con } i = 2,3 \tag{13}$$

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The claim statements are the total amount, minus the incurred-but-not-yet-reported loss amount

3.5. General calculation of the variables $R^i_\tau(t)$ and $S^i_\tau(t)$ in the random model

To capture the irregular behavior of the catastrophe claim statements over time, we introduced a Wiener process in equation 4, which led to equation 14, a stochastic differential equation (Pérez-Fructuoso, 2008; 2009) in which $\alpha^i_\tau(t-\tau)$ represents the trend of the process, α^i_τ is a constant indicating the volatility of the process and $w^i_\tau(t-\tau)$ is a standard Wiener process associated with the catastrophe of type i occurring at moment τ.

$$dR^i_\tau(t) = -\alpha^i_\tau(t-\tau)\,R^i_\tau(t)\,dt + \sigma^i_\tau R^i_\tau(t)\,dw^i_\tau(t-\tau) \quad \forall t \in [\tau, T] \tag{14}$$

The Wiener process represents the differences in the claim reporting intensity, as it is considered that each disaster has its own characteristics that are not expressed in the model. This is reflected in the model by introducing different disturbances through independent Wiener processes.

Differential equation 14 is solved by applying Itô's lemma to the transformation $y = \ln R^i_\tau(t)$ (Arnold, 1974); from this, considering boundary conditions a) and b), we obtain equation 15:

$$R^i_\tau(t) = K^i_\tau e^{-\int_0^{t-\tau} \alpha^i_\tau(s)\,ds - \frac{(\sigma^i_\tau)^2}{2}(t-\tau) + \sigma^i_\tau w^i_\tau(t-\tau)} \tag{15}$$

By replacing 15 in equation 1, which establishes the relationship between the variables $R^i_\tau(t)$ and $S^i_\tau(t)$, we easily obtain the reported loss amount until t, $S^i_\tau(t)$, as the difference between the total amount of the catastrophe and the incurred-but-not-yet-reported loss amount (see equation 16), without the need to define a stochastic differential equation to describe its dynamics.

$$S^i_\tau(t) = K^i_\tau - R^i_\tau(t) = K^i_\tau \left[1 - e^{-\int_0^{t-\tau} \alpha^i_\tau(s)\,ds - \frac{(\sigma^i_\tau)^2}{2}(t-\tau) + \sigma^i_\tau w^i_\tau(t-\tau)}\right] \tag{16}$$

3.6. Calculation of the variables $R^i_\tau(t)$ and $S^i_\tau(t)$ in the random model for a mixed rate of claim statements

In this case, the incurred-but-not-yet-reported loss amount, $R^i_\tau(t)$, and the reported loss amount, $S^i_\tau(t)$, are obtained by replacing in equations 15 and 16 the results obtained in 8 and 11, and performing the operations, so that:

- If the valuation point is before the point when the pace of claim statements changes, $\tau + s^i_m$, i.e., $\tau \leq t \leq \tau + s^i_m$, equations 17 and 18 apply.

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$$R_\tau^i(t) = K_\tau^i e^{-\left(\frac{\alpha_\tau^i}{2s_m^i}(t-\tau)+\frac{\left(\sigma_\tau^i\right)^2}{2}\right)(t-\tau)+\sigma_\tau^i w_\tau^i(t-\tau)} \quad \text{con } i = 2,3 \tag{17}$$

$$S_\tau^i(t) = K_\tau^i\left[1 - e^{-\left(\frac{\alpha_\tau^i}{2s_m^i}(t-\tau)+\frac{\left(\sigma_\tau^i\right)^2}{2}\right)(t-\tau)+\sigma_\tau^i w_\tau^i(t-\tau)}\right] \quad \text{con } i = 2,3 \tag{18}$$

- If the valuation point is after the point when the pace of claim statements changes, $\tau + s_m^i$, i.e., $\tau > \tau + s_m^i$, equations 19 and 20 apply.

$$R_\tau^i(t) = K_\tau^i e^{-\left(\alpha_\tau^i+\frac{\left(\sigma_\tau^i\right)^2}{2}\right)(t-\tau)+\sigma_\tau^i w_\tau^i(t-\tau)} e^{\frac{\alpha_\tau^i s_m^i}{2}} \quad \text{con } i = 2,3 \tag{19}$$

$$S_\tau^i(t) = K_\tau^i\left[1 - e^{-\left(\alpha_\tau^i+\frac{\left(\sigma_\tau^i\right)^2}{2}\right)(t-\tau)+\sigma_\tau^i w_\tau^i(t-\tau)} e^{\frac{\alpha_\tau^i s_m^i}{2}}\right] \quad \text{con } i = 2,3 \tag{20}$$

4. Determination of the catastrophe loss index

A catastrophe loss index can be defined as the ratio between the total amount of losses associated with one or more catastrophes occurring throughout a specified period of time and a constant value whose definition depends on the type of index used (for example, this might be the volume of premiums accrued during the risk period to cover the related catastrophic losses or a constant value to refer to the losses recorded at market trading points).

Cat bonds that use loss indexes as triggers for indemnities only consider for the development of said indexes the occurrence of a catastrophe, and when making payments, they are based on the value that the index used reaches at the time of contract termination, *T'*. We thus have equation 21, in which *LI*(*T'*) is the value of the loss index at maturity.

$$LI(T') = \delta_\tau^i \times \frac{S_\tau^i(T')}{cte} = \begin{cases} 0 & \text{si } \delta_\tau^i = 0 \\ \dfrac{S_\tau^i(T')}{cte} & \text{si } \delta_\tau^i = 1 \end{cases} \quad (21)$$

In equation 21, by replacing $S_\tau^i(t)$ for $t = T'$ with its generic expression given in equations 18 and 20, the value of said index at maturity, depending on the time when the change occurs in the pace of claim statements, is calculated as follows:

$$LI(T') = \delta_\tau^i \times \frac{S_\tau^i(T')}{cte} = \delta_\tau^i \times \frac{1}{cte} \times K_\tau^i \times \left[1 - e^{-\left(\frac{\alpha_\tau^i}{2s_m^i}(T'-\tau) + \frac{(\sigma_\tau^i)^2}{2}\right)(T'-\tau) + \sigma_\tau^i w_\tau^i (T'-\tau)}\right] \quad (22)$$

- If $T' \leqslant \tau + s_m^i$, we have equation 23.

$$LI(T') = \delta_\tau^i \times \frac{S_\tau^i(T')}{cte} = \delta_\tau^i \times \frac{1}{cte} \times K_\tau^i \times \left[1 - e^{-\left(\alpha_\tau^i + \frac{(\sigma_\tau^i)^2}{2}\right)(T'-\tau) + \sigma_\tau^i w_\tau^i (T'-\tau)} e^{\frac{\alpha_\tau^i s_m^i}{2}}\right] \quad (23)$$

$LI(T')$ Is random because $S_\tau^i(T')$ is a random variable: *a priori,* when the bond is issued, it is not known whether the catastrophe covered by it will occur or not, and therefore its amount and the time of its occurrence are also unknown.

The value of this loss index at maturity has been determined at the time of issuance of the coverage contract. Next, we will analyze how its probability distribution changes when, over time, instant $t \in [\tau, T']$ is reached and the available information on the claim statements reported so far is incorporated. To this end, $LI^*(T') = LI^*(T')/F_t$ is defined as a random conditioned variable that represents the total amount of losses reported as of T', with F_t being a filter that represents the possible history of interval $[\tau, t]$.

$LI^*(T') = LI^*(T')/F_t$ is obtained by calculating, first of all, the total amount of the losses reported at any time $t \in [\tau, T']$, $LI(t)$, which conditions $LI(T')$ (i.e., $LI(t) \cong F_t$).

It is not necessary to define a differential equation to obtain the reported loss amount

Therefore, taking into account whether the valuation period t is before or after the point when the pace of claim statements changes, we obtain the following:

- If $t \leqslant \tau + s_m^i$, we have equation 24.

$$LI(t) = \delta_\tau^i \times \frac{S_\tau^i(t)}{cte} = \delta_\tau^i \times \frac{1}{cte} \times K_\tau^i \times \left[1 - e^{-\left(\frac{\alpha_\tau^i}{2s_m^i}(t-\tau) + \frac{(\sigma_\tau^i)^2}{2}\right)(t-\tau) + \sigma_\tau^i w_\tau^i (t-\tau)}\right] \quad (24)$$

- If $t > \tau + s_m^i$, we have equation 25.

$$LI(t) = \delta_\tau^i \times \frac{S_\tau^i(t)}{cte} = \delta_\tau^i \times \frac{1}{cte} \times K_\tau^i \times \left[1 - e^{-\left(\alpha_\tau^i + \frac{(\sigma_\tau^i)^2}{2}\right)(t-\tau) + \sigma_\tau^i w_\tau^i (t-\tau)} e^{\frac{\alpha_\tau^i s_m^i}{2}}\right] \quad (25)$$

Once $LI(t)$ has been determined, it is incorporated in the variable $LI(T')$, which produces the following value for the conditioned loss index:

- If $t \leqslant \tau + s_m^i$, we have equation 26.

$$LI^*(T') = (\delta_\tau^i / F_t) \times \frac{1}{cte} \times \left[\begin{array}{l} L(t) + \\ + (K_\tau^i / F_t) \times \left[1 - e^{-\alpha_\tau^i (T'-\tau) + \frac{(\sigma_\tau^i)^2}{2}(T'-t) + \sigma_\tau^i \times w_\tau^i (T'-t) + \frac{\alpha_\tau^i s_m^i}{2} + \frac{\alpha_\tau^i (t-\tau)^2}{2s_m^i}}\right] \times \\ \times e^{-\left(\frac{\alpha_\tau^i (t-\tau)}{2s_m^i} + \frac{(\sigma_\tau^i)^2}{2}\right)(t-\tau) + \sigma_\tau^i \times w_\tau^i (t-\tau)} \end{array}\right] \quad (26)$$

- If $t > \tau + s_m^i$, we have equation 27.

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$$LI^{*}(T') = (\delta_{\tau}^{i}/F_{t}) \times \frac{1}{cte} \times \left[\begin{array}{l} L(t) + \\ +(K_{\tau}^{i}/F_{t}) \times \left[1 - e^{-\left(\alpha_{\tau}^{i} + \frac{(\sigma_{\tau}^{i})^{2}}{2}\right)(t-\tau) + \sigma_{\tau}^{i} \times w_{\tau}^{i}(t-\tau) + \frac{\alpha_{\tau}^{i} s_{m}^{i}}{2}} \right] \times \\ \times e^{-\left(\alpha_{\tau}^{i} + \frac{(\sigma_{\tau}^{i})^{2}}{2}\right)(T'-t) + \sigma_{\tau}^{i} \times w_{\tau}^{i}(T'-t)} \end{array} \right] \quad (27)$$

Calculated in this manner, the loss index makes it possible to easily calculate the catastrophe bond price at a time t of its negotiation period, applying the general theory of option valuation (see for example Loubergé, Kellezi & Gilli, 1999, or Pérez-Fructuoso, 2008).

5. Conclusions

The continuous model proposed in this work makes it possible to simply calculate the loss index trigger of the cat bond, providing its valuation at a particular point in time. Unlike many of the preceding models (see, for example, Cummins & Geman, 1995 or Geman & Yor, 1997) that assume growth over time of the reported loss amount and represent said evolution through a Brownian geometric movement, the main hypothesis of the model presented here is the definition of the dynamics of the claim statements based on a growth that is proportional to the incurred-but-not-yet-reported loss amount. This amount is the fundamental variable in the process of formalizing the model, the decreasing time evolution of which we modeled through a Wiener geometric process. Once this variable has been determined, the total of the claim statements is obtained as the difference between the total amount of the catastrophe and the incurred-but-not-yet-reported loss amount, thus eliminating the need to define a stochastic differential equation to describe its dynamics. The catastrophic loss index is the result of multiplying the reported loss amount by a random dichotomous variable that indicates whether or not the catastrophe has occurred.

These variables have been obtained in a generic manner, for any functional definition of the rate of claim statements, and then a mixed form has been attributed to said rate, which increases linearly until a certain point and then remains constant until the bond reaches maturity. The aim of considering this definition for the claim reporting rate as an alternative to the constant definition proposed in the preceding models is to attempt to better represent the real evolution of the claim statements over time and to eliminate the incongruence that emerged in the initial model when said rate was disrupted by the incorporation of the Wiener process.

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Development of a Competence Profile and Performance Assessment for Care Assistants from a Labor Pool at a Nursing Home

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Title

Development of a Competence Profile and Performance Assessment for Care Assistants from a Labor Pool at a Nursing Home.

Abstract

This article presents the development of a competence-based professional profile and the subsequent performance assessment, which were built on behaviors that represent the competences in a sample of care assistants working in a nursing home. Nine employees who knew the tasks performed by care assistants were asked to select and rank the competences in order of significance, considering their importance for performing the job efficiently. Based on the weights obtained, the selected competences are transformed into behaviors and, finally, into a five-point Likert scale used to assess the sample of care assistants (a total de 16 employees) and classify them using overall and specific scores on each of the competences.

Keywords

Assessment, performance, competences, assistant performance.

1. Introduction

Social sciences such as labor psychology and human resources have taken on greater importance in businesses in recent decades. The increase in the number of young people with a higher education (university degrees, master's degrees, doctorates, etc.), the mastery of languages and, in general, the highly qualified nature of the new generations of employees have made it necessary to create new systems of selection, evaluation and promotion for staff members, among others. These systems are intended to give the company the human capital that would enable it to reach the levels of efficacy and efficiency necessary in a labor market that is more competitive than ever and in a situation such as the present economic crisis (Fernández Millán & Fernández Navas, 2013).

With all of this in mind, this study is presented with the aim of showing current practices in the business sector in the area of competence profile development and performance assessment, specifically for care assistant positions in a nursing home.

1.1. Theoretical framework

As occurs with other terms in the social sciences, the concept of *competence* (professional or labor) has received numerous definitions, in particular, since McClelland (1973) expanded the focus based on competences, depending in part on the field in which it is used (Fernández-Salinero, 2006). Along these lines, Boyatzis (1982), based on the studies by Flanagan (1954), defined competences "as a set of observable behaviors that are causally related to the good or excellent performance in a specific job and a specific organization." Later, other authors have defined the term; one example of this is by Woodruffe (1993), who defines competences as "sets of behavioral patterns that the person must bring to a position in order to perform his or her tasks and functions efficiently."

Moreover, performance has also been defined by different authors, starting with Murphy who defined it as "the set of behaviors that are relevant for the goals of the organization or organizational unit in which the person works" (Murphy, 1990, p. 162). Starting from this base, other authors created the foundation for the concept as "any cognitive, psychomotor, motor or interpersonal behavior under the individual's control that is scalable in terms of ability and relevant to the organizational goals" (Campbell, Gasser & Oswald, 1996; McCloy, Campbell & Cudeck, 1994). The concept of performance assessment is currently understood as the system through which the necessary information is obtained on how a worker behaves in a specific organization and position; its objective is to determine whether these behaviors are optimal.

The development of these terms and their applications in the labor field has led to management by competences gradually replacing other human resource models (Pereda, Berrocal & Sanz, 2003), and numerous applications created for the development of competence profiles, such as those by Bozu and Canto Herrera (2009) for university faculty and professional teaching competences, in which they attempted to determine which professional competences university instructors must have in order to meet the needs that the knowledge society demands of today's universities, and for performance assessment, where we can highlight the work by Díaz Cabrera, Hernández Fernaud, Isla Díaz, Delgado Rodríguez, Díaz Vilela and Rosales Sánchez (2014) on the development of mixed standard scales as a tool to measure employee performance or research to improve the accuracy and success of their application (López Martínez, Montaño Moreno & Ballester Brage, 2014).

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The first nine competences explain a high percentage of performance (95.26%)

For some authors, such as Cubeiro and Fernández (1998), the use of competence development and management programs increases the results in some positions by between 30% and 72%.

The very people affected by the job position being studied are the ones who participate in the development of the professional profile, indicating on a previously provided competence questionnaire the competences that any person who holds the job position needs to have to perform his or her functions in an optimal manner. Only once the professional profile is obtained upon the analysis of the previously delivered questionnaires can the chosen performance assessment method be developed (mixed standard scales, Likert scales, etc.), since it is based on the competence profile that has been obtained.

However, not all the changes that occurred in personnel management were a product of the creation of new management systems. The variables that modify the creation of job positions, their number and the competences required for them are usually based on society's needs at a particular time. In the case of care assistants, the demographic changes arising over the last century have been what has determined their increasing demand. The population pyramid in Spain has evolved towards an inverted trend (Carabaña, 2003), which means that it has gone from being supported by a large number of young people (the product of high natality and mortality rates) to a large increase in the adult-elderly population (resulting from a reduction of both mortality and natality).

As a result of everything set out above, the present work describes the process followed to create the job competence profile and the subsequent assessment of the performance among the workers in the labor pool at a nursing home, as well as the results obtained. The intent is to offer a practical and objective tool for application in any area of human resource organization and management. The actions are also presented that have been taken to involve the interested parties, and to ensure impartial selection. In this case, the care assistants, who are the staff members whose function is to assist the nursing home users in the performance of daily activities that they cannot do for themselves and to perform those tasks aimed at the personal care of the able-bodied or assisted residents and their surroundings (personal hygiene of the user, cleaning and maintenance of the resident's room and utensils, making beds, picking up clothes and taking them to the laundry, collaboration in room maintenance, help feeding those users who cannot feed themselves, changes in posture, communicating incidents that occur in the health of users, cleaning and preparation of furniture, materials and first aid devices, and accompanying the user on outings, walks, errands, excursions, games and during their free time in general).

2. Methodology

2.1. Participants

Participating in different ways and at different times during the process were the company director, the human resources manager, the trade union representatives (4), the company psychologist, the housekeeper (in charge of supervising the daily work of the assistants), the doctor, the registered nurses (2), the permanent care assistants (20), members of the personnel and hiring department (2) and the evaluated assistants (16).

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To determine the score for each candidate on the behavior questionnaire, each was randomly assigned 3 evaluators

2.2. Procedure

The evaluation was carried out at the request of the organization's management and with the consent and collaboration of the human resources department.

The steps that were established by recommendation of the technician (psychologist) were the following:

1. Meeting with the trade union leaders and the company's human resources managers to explain the procedure, obtain their acceptance and involve all parties in the selection of the evaluators.
2. Development of the professional profile based on competences and the respective behaviors that define them.
3. Development of the evaluation questionnaire.
4. Determining the extent to which each evaluee exhibits the defining competences (evaluation of the level of each competence presented by each assistant).
5. Informative session for the evaluated employees.

Meeting with trade union leaders and the company's human resources managers

The process began by calling a meeting with the trade union leaders and the company's human resources managers to explain the procedure to follow, obtain their acceptance and involve all parties in the selection of the evaluators.

Development of the professional profile based on competences and the respective behaviors that define them

Since there was no previous professional profile of the competences for the evaluated position, the first step was to develop said profile. To do this, it was agreed which professionals would choose the competences that would best describe the nursing assistant job position. The questionnaire on competences (list of competences with their definitions previously created *ad hoc* at the company for other occasions) was distributed among the evaluators (3 care assistants with a permanent contract, 2 registered nurses, the housekeeper and the doctor) and they were asked to choose 5 competences and rank them in order of importance (see Appendix 1). Following the method for selecting the competences according to relevance (percent of evaluators who choose the competence out of the total number of participating evaluators) and importance (sum of all the scores for each competence over the total of the evaluators) by Pereda, Berrocal and Sanz (2003), the weights and the order of each competence were obtained (see Table 1). The weight of each competence consists of calculating the product between the relevance and the importance of each competences and dividing it by the sum of these products for the set of all the competences as a whole $(R \times I) / \Sigma c_{1\text{-}26} (R \times I)$.

At this point, it is the job of the technician to decide the number of competences chosen to evaluate the employee. In terms of their cumulative weight, the competences must explain at least 90%, but for practical reasons, they must be as few as possible to prevent a large number of items (behaviors) from being required for evaluation. The first 9 competences explain a high percentage of performance (95.26%). In spite of being a large number of competences, the decision was made to include all 9, reducing the number of behaviors they reflected to 2 (which resulted in a total of 18 behaviors for the profile).

Development of the evaluation questionnaire

Once the competences were determined that make up the professional profile of the job position being studied, Human Resources (the psychologist) selected and adapted the

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Table 1
Competences organized in order of weight after the statistical processing of the questionnaires

Competences	Relevance	Importance	RxI	Order	Weight	Cumulative weight
14. Team work	85.71	16	1,371.4	1	26.74	26.74
21. Empathy	71.43	19	200.0	2	26.46	53.20
4. Communication	57.14	15	857.1	3	16.71	69.92
20. Responsibility	42.86	9	385.71	4	7.52	77.44
11. Planning/organization	28.57	7	200.0	5	3.90	81.34
12. Collaboration	28.57	7	200.0	5	3.90	85.24
22. Energy	28.57	7	200.0	5	3.90	89.14
6. Stress resistance	28.57	6	171.43	6	3.34	92.48
9. Technical knowledge	28.57	5	142.86	7	2.79	95.26
2. Flexibility	28.57	3	85.71	8	1.67	96.94
1. Learning	14.29	4	57.14	9	1.11	98.05
18. Loyalty	14.29	4	57.14	9	1.11	99.16
5. Excellence	14.29	1	14.29	10	0.28	99.44
15. Continuous improvement	14.29	1	14.29	10	0.28	99.72
25. Commitment	14.29	1	14.29	10	0.28	100.00
3. Decision-making	0	0	0.00		0.00	100.00
7. Negotiation	0	0	0.00		0.00	100.00
8. Personnel development	0	0	0.00		0.00	100.00
10. Leadership	0	0	0.00		0.00	100.00
13. Problem solving	0	0	0.00		0.00	100.00
16. Creativity and innovation	0	0	0.00		0.00	100.00
17. Vision of the future	0	0	0.00		0.00	100.00
19. Customer service orientation	0	0	0.00		0.00	100.00
23. Influence	0	0	0.00		0.00	100.00
24. Information gathering	0	0	0.00		0.00	100.00

behaviors that would reflect these competences (based on interviews with the registered nurses, whom we asked to describe behaviors that would depict the competences in their daily work) and would conform the items for the Likert scale that would be presented to evaluate the competences (see Appendix 2). As can be seen, the response scale used to evaluate each behavior consisted of 5 points, where "Never" was worth 0 and "Always" was equal to 4 (Never = 0; Sometimes = 1; Often = 2; Almost always = 3; Always = 4).

Although there are other systems to develop questionnaires that make them more accurate and credible, such as mixed standard scales (Díaz Cabrera et al., 2014), we opted for a more traditional Likert scale system, since it is simpler to respond to and requires less time.

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Decisions were made based on the statistical criteria established by Chebychev's rules

Determining how closely each evaluee exhibits the defining competences (evaluation of the level of each competence presented by each assistant)

To determine the score for each candidate on the behavior questionnaire, each evaluee was randomly assigned 3 evaluators. The evaluators were selected at random from among the housekeeper, nurses (2), permanent care assistants (20) and the doctor. It is important to remember that the persons being evaluated are employees who are performing the work associated with the position at the time of evaluation and that all the potential evaluators have direct, ongoing contact with these employees and observe their performance on a daily basis.

The scores obtained were used to create a list with different statistical measures (total average score and the standard deviation for each candidate, overall mean and standard deviation, and statistics to determine Chebychev's rule) that were used as an evaluation criterion.

Once the scores were obtained that the evaluators (3 per evaluee) gave on the 18 items for each evaluee (in this case, 16 of them), the totals were calculated, along with the averages for each evaluee and the standard deviation (see Table 2).

Table 2
Direct scores on the competences, mean and standard deviation of the evaluated care assistants

	EVALUEES															
COMPETENCES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Stress resistance	22	22	17	22	22	23	24	5	18	22	14	23	22	22	20	24
Technical knowledge	21	23	20	24	24	23	23	8	19	21	19	22	23	22	17	22
Planning/organization	23	22	21	21	24	23	21	6	15	20	19	21	22	22	14	22
Collaboration	22	24	23	23	23	24	20	6	18	20	20	23	23	24	14	22
Team work	24	23	20	22	24	24	20	10	16	20	22	23	23	24	15	22
Energy	23	23	23	20	23	24	20	3	13	20	19	23	19	23	15	22
Communication	24	24	24	24	24	24	23	7	23	23	20	23	22	24	20	22
Responsibility	24	23	23	24	24	24	24	9	19	23	22	24	19	24	18	22
Empathy	21	21	19	23	23	24	22	7	23	22	23	20	20	20	19	22
Mean of totals	68.0	68.3	63.3	67.7	70.3	71.0	65.7	20.3	54.7	63.7	59.3	67.3	64.3	68.3	50.7	66.7
Standard deviation of totals	2.0	4.7	2.9	3.8	1.5	1.0	7.1	8.1	11.7	3.5	8.1	5.7	7.1	4.7	19.6	9.2

The overall mean and total standard deviation were obtained from all the total scores (see Table 3).

Table 3
Statistics obtained from the total scores

Mean	Stand. Dev.	X – 2SD	X + 2SD
61.85	13.69	34.48	75.54

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The first decision-making criterion that was adopted is intended to rule out candidates that have large differences in the evaluations

In addition to the random assignment of evaluators, two other measures were agreed to ensure impartiality: the candidates never knew who was going to evaluate them and the statistical processing was done by students in the 3rd year of the Labor Relations and Human Resources degree program at the College of Social Sciences on the Melilla Campus (supervised by their professor), who did not know the name of the evaluee, which had been replaced by the label "Candidate No. ...," with the correspondence of the identities remaining inside a sealed envelope.

Informative session for the evaluated employees

Finally, once the decisions were made about the evaluated staff and made known to the trade union representatives, the evaluees were gathered and informed about the criteria (evaluated behaviors) used and the results. Besides sharing the results with those affected, this served to give the rest of the staff information about what competences were expected of them in order to effectively develop them.

Those candidates who earned the highest scores were also congratulated in writing.

3. Results

The scores on which the decision-making was based in this evaluation were the total mean score of each candidate (X_i) and his or her standard deviation (SD_i). The overall mean score was obtained from the total score of all three evaluators (the same method was used to obtain the standard deviations). The decision-making was based on the statistical criteria established by Chebychev's rules (see Table 4) and agreed on with management and the company's trade union representatives.

Table 4
Scores-criteria obtained according to Chebychev's rules

Mean	Stand. Dev.	$2SD_t$	$X_t - 2\ SD_t$	$X_t + 2SD_t$
61.85	13.69	27.38	34.48	89.23

The first decision-making criterion that was adopted is intended to rule out candidates who have large differences in the evaluations, indicating "disagreement" among the evaluators, since this would indicate that they did not minimally coincide about their performance.

Statistically speaking, there are procedures and formulas to determine the reliability or agreement among judges. Along these lines, the intraclass correlation coefficient (ICC), Pi or Kappa coefficient (for reliability) or the concordance correlation coefficient can be used to determine the equivalence of the values.

However, the processes are complex and, for the purpose of these studies, basing the agreement or homogeneity among the judges' responses on a cut-off point based on an index (the standard deviation) that is objective, but "agreed upon" in a subjective manner (two times the value of the SD), seemed more suitable when reaching agreements with the social forces in the business environment.

To do this, the cut-off point was set as those standard deviations (SD_i) that were above 2 times the total standard deviation (SD_t; standard deviation of all the total scores), since according to

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The second criterion is intended to indicate those candidates who, as indicated by their low scores, would not reach certain minimum levels in terms of their competences in order to perform efficient work

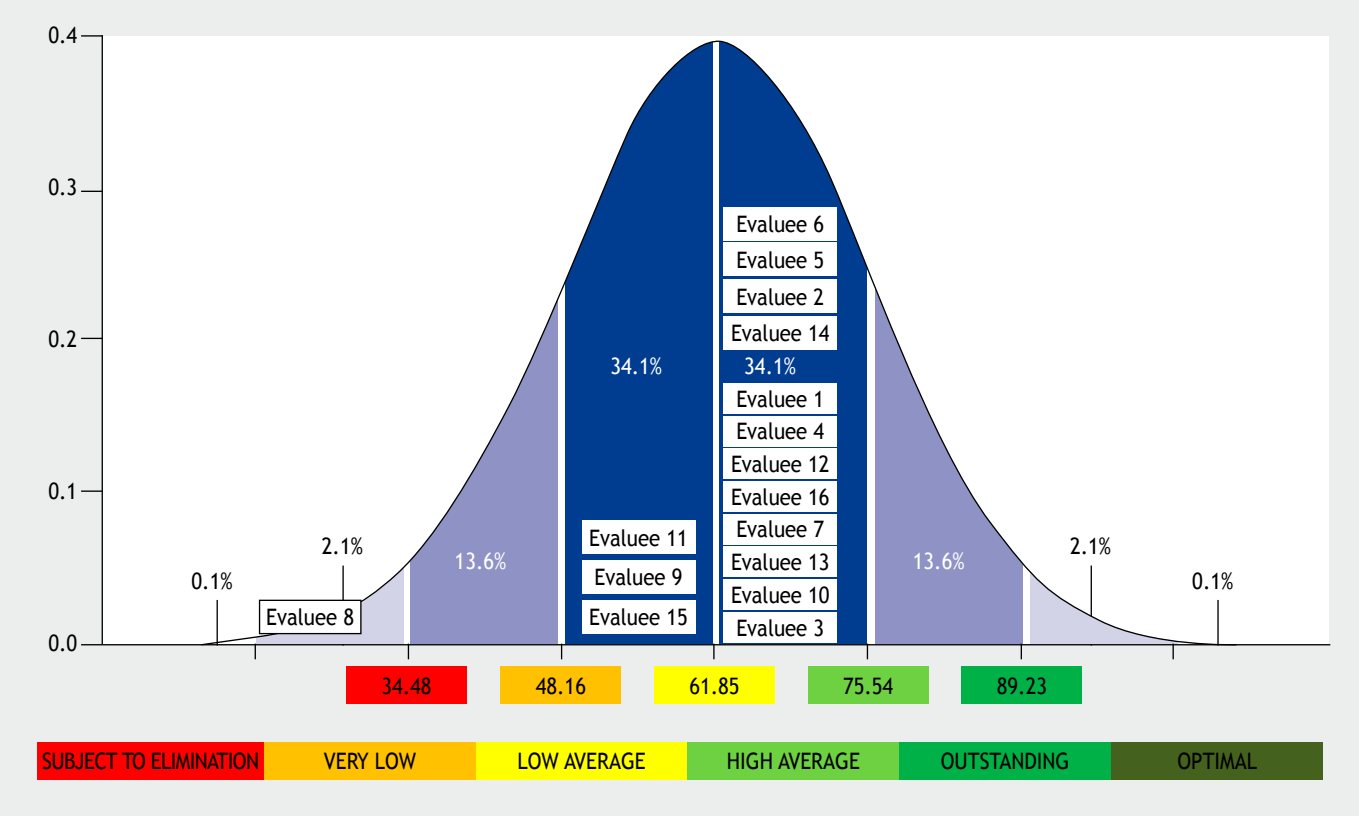
Chebychev's rule, 75% of the data of any series have a value that is less than two times the standard deviation (SD_t) from the mean (X_t). In this case, the cut-off point was a SD_i greater than 27.38, and no candidate presented a SD greater than this value; for this reason none was eliminated (see Table 4).

The second criterion is intended to indicate those candidates who, as indicated by their low scores, would not reach certain minimum levels in terms of their competences in order to perform efficient work. Chebychev's rule was used once again to obtain the cut-off point. In this case, it was established that those candidates who had obtained a score (X_i) of less than $X_t - 2\ SD_t$ (= 34.48) met this criterion. Table 2 shows that candidate 8 had a X_i (20.33) lower than the aforementioned cut-off point.

Finally, the third criterion seeks to establish the closest match between the competence profile and the position being evaluated. Consulting the means and the standard deviations obtained for each candidate, it is observed that none of them exceeds Chebychev's rule for this criterion ($X > X_t + 2\ SD_t$ (89.23); therefore, we are limited to ranking the candidates according to their scores and selecting those with the best average.

With all the statistical data obtained, a normal curve is calculated on which the different candidates are "positioned" (see Table 5), which will be used as easy-to-understand teaching material for later explanations given to the social forces and company representatives, as well as the employees themselves.

Table 5
Position of the evaluees on the normal curve



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In addition to the performance evaluation and based on the data obtained in a general manner for each competence (mean of the scores in a range of 0 to 8, four maximum points per item), the level of acquisition of the different competences by the labor pool employees was studied. Table 6 shows an example of how the total scores were obtained to determine the level of acquisition of each competence in the group of evaluees, which will aid us in determining what training contents the company must focus on.

Table 6
Example of the calculation of the level (over 8) of acquisition of the competences in the group of evaluees

	Scores obtained on the items and the sum of the scores in order to obtain the scores on the competences							Mean of the competence scores
Item 13. When starting his or her shift, speaks with coworkers to receive information and instructions or consults the incident book and upon leaving his or her shift, waits for coworkers to give them information and instructions and records anything he or she deems important in the incident book.	4	4	4	4	4	4	...	
Item 14. Speaks respectfully to residents and speaks properly to family members of residents to receive and/or provide information.	4	4	4	4	4	4	...	
Communication	8	8	8	8	8	8	...	7.31
Item 15. Does not need the housekeeper to constantly indicate what needs to be done.	4	2	4	4	3	4	...	
Item 16. Does not leave work until finishing the task he or she has started.	4	4	4	4	4	4	...	
Energy	8	6	8	8	7	8	...	7.21
Item 17. Handles the elderly residents according to their mood that day.	4	1	4	4	1	4	...	
Item 18. Listens attentively to the elderly residents when they address him or her.	4	4	4	4	4	4	...	
Empathy	8	5	8	8	5	8	...	6.85

The data obtained (see Table 7) show that "Communication" is one of the most commonly shared competences among the employees, which translates into a good exchange of information at shift change. Even so, it should be noted that over these months, the notes in the incident report book were sporadically reviewed and a style was observed that is not very specific, and in some cases that is rather offensive and exaggerated. "Responsibility" is another competence that is fairly well developed among the assistants.

On the negative end (even through the means are not low) is the level attained in terms of "Energy" (the level and the intensity of work do not remain constant) and "Planning" (the work day is not structured). This latter deficit may be due to the management and organization of the work (its unpredictability and supervision can have an influence, making planning difficult).

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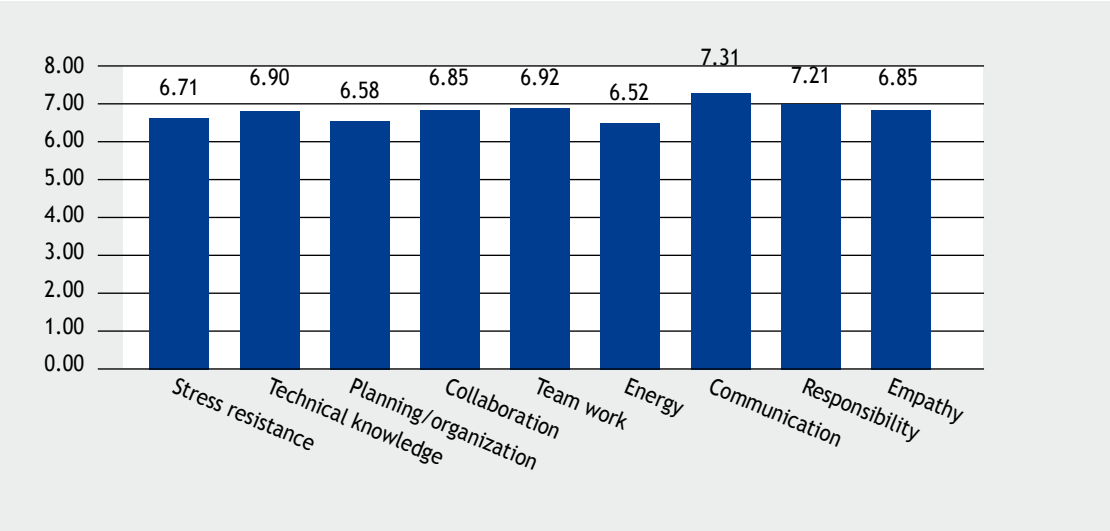
Finally, the third criterion seeks to establish the closest match between the competence profile and the position being evaluated

Table 7
Mean score (over 8) for each competence, obtained from the mean of all the evaluees



Between these two extremes (even though there is not a large difference between the means) are, in decreasing order of average scores, "Team work," implying that the candidate performs the assigned task within the work group; "Technical knowledge," which translates into knowing the risks and occupational hazard prevention measures that are appropriate for his or her job; "Empathy," which involves understanding and attending to the feelings of the elderly; "Collaboration," or providing information and assistance to one's colleagues; and "Resistance to stress," meaning that the candidate keeps calm and maintains a logical order in urgent or problematic situations.

4. Conclusions

The intent of the present study has been to offer the application of a human resource management tool based on the competence model. The application of the professional profiles and competence evaluations enables us to have greater objectivity and impartiality in personnel management, which favors the perception of fairness on the part of the company (Martínez-Tur, Moliner, Ramos, Luque & Gracia, 2014) by the employees, since they can see objective criteria on which decisions are based.

One obstacle that must be overcome before implementing this type of actions is the perception that exists even today regarding performance assessments, which are seen by employees and trade union representatives as something negative and harmful, jeopardizing the security of the job position. It is necessary to obtain the support of the staff within the company, since otherwise, even if the most efficient technique is applied, its effectiveness and feasibility will be limited (Farr & Jacobs, 2006; Keeping & Levy, 2000). Furthermore, the development of these techniques permits important positive repercussions in employee motivation, thanks to the feedback provided to them by performance evaluations. For all of these reasons, management by competences should be a tool implemented by the various organizations, due to all the positive effects that come from its application. Of course this also entails economic benefits that the organization obtains with its use, such as in the case of an

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Management by competences should be a tool to be implemented by the various organizations, due to all the positive effects that come from its application

employee who does not comply with the functions and demands of his or her job position, with the savings that this would bring about.

The development of this professional profile and subsequent evaluation was the first system and criterion used for the company for personnel management based on competences. Until then, criteria such as seniority or training had been used to grant promotions. The proposed evaluation system (in which the employees' coworkers and supervisors participate, and which is based on observable behaviors) improves the attitude towards evaluation and decision-making, and as mentioned earlier, provides a perception of fairness in the workplace in terms of the process by using objective criteria.

With regard to the use of a statistical indicator (Chebychev's rule) as a criterion for decision-making in personnel management, on the one hand, it enables us to increase the objectivity of these decisions, and on the other hand, to vary the cut-off points (considering one or two standard deviations) in order to adapt it to our goals, as long as this is agreed upon with the company and the trade unions.

Even through the evaluation was conducted with the goal of selecting the care assistant from the labor pool with the best developed competences in order to sign a permanent contract with him or her (promotions policy and staff motivation), the appearance of an employee whose score fell below $X_t - 2\ SD_t$, i.e., in the 2.1% of the residual population with the lowest scores on the normal curve, prompted that this evaluation was also used as decision-making criterion not to rehire the employee in question.

At the end of the process, we considered that the relevance of the scores for the competences on the evaluation should reflect the weight they had in the profile, since each competence has a different level of importance in terms of effective job performance. Therefore, for example, the score on the "Team work" competence (with a weight of 26.74) for a subject who would have earned 16 points, after being weighted, would become 427.84 (16 × 26.74), while this same score, after being weighted, would only represent 62.4 (16 × 3.90). Consequently, in subsequent evaluations conducted, the total score earned in each competence was weighted, multiplying it by the weight of that competence; this seems to be a wise approach and an improvement over the process described in this work.

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Appendix 1

Choose 5 competences of the 26 proposed that people must have who work as _____. Once you have selected them, assign them a number in order of importance (the smaller the number from 1 to 5, the greater the importance).

ORDER	COMPETENCES
	1. Learning. Learns quickly and applies new work methods.
	2. Flexibility. Is capable of modifying the work method if the situation changes and of doing the work just as well in different settings, with different tasks, responsibilities and people.
	3. Decision-making. Makes decisions quickly, even though they may be difficult or not very popular (others do not like them, but he or she thinks that they are good for work).
	4. Communication. Explains things in such a way that others understand, regardless of their level of knowledge, culture or mental condition. Expresses information clearly, in both oral and written form.
	5. Excellence. Performs tasks, striving in his or her activities to provide the highest level of quality and ways to improve previous actions.
	6. Stress resistance. Remains emotionally stable and his or her level of effectiveness and efficiency remains constant in situations of pressure, opposition, disagreement and difficulties or failures, releasing stress in a way that is acceptable to others. Does not "get nervous."
	7. Negotiation. When he or she does not agree with something, he or she discusses it in an appropriate manner, arriving at good solutions for both parties.
	8. Personnel development. Is interested in training and periodically participating in courses.
	9. Technical knowledge. Has ample and detailed knowledge of products and the best way to do his or her work. Knows how to do his or her job.
	10. Leadership. Guides the group in the performance of a task, structuring it, directing it and delegating responsibilities to accomplish it.
	11. Planning/organization. Organizes work in such a way that tasks are performed with enough time and materials.
	12. Collaboration. Works well with people who occupy different levels and perform different functions. Provides assistance if asked.
	13. Problem solving. When a problem arises, seeks out and chooses the best solutions in a set period of time.
	14. Team work. Works openly, is friendly and cooperative with other people, facilitating team work.
	15. Continuous improvement. Seeks out other ways of doing work in order to do it better. Applies what he or she has learned to improve the work.
	16. Creativity and innovation. Seeks out new ideas that usually produce original solutions. Invents new ways of performing tasks.
	17. Vision of the future. Capacity to visualize trends around him or her with a positive, optimistic attitude and orient his or her behavior to achieving goals.
	18. Loyalty. Does what he or she promises, even though he or she may not totally agree with it.
	19. Customer service orientation. Adapts the way he or she works to satisfy customers.
	20. Responsibility. Commitment, strong sense of duty, fulfillment of obligations. Does not leave work without fulfilling his or her obligations.
	21. Empathy. Knows how to understand others. Puts him or herself in the place of coworkers and clients.
	22. Energy. Does his or her work at a good pace and without having to be told continuously what to do.
	23. Influence. Capacity to persuade others and get them to voluntarily change their behavior.
	24. Information gathering. Obtains the information he or she needs to do his or her job, asking others or consulting manuals.
	25. Commitment. Is aware of and accepts his or her responsibilities and contribution to the results of the organization.
	26. Other. Specify: _____ _____ _____

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Appendix 2

Evaluee: _____

---------- CUT ----------

Evaluee No. _____

Mark with an X the level that most closely represents the behavior of the employee being evaluated.

1. Keeps calm in urgent or stressful situations, such as when receiving criticism from a resident or a family member.	Never	Sometimes	Often	Almost always	Always
2. Maintains a logical, controlled focus in problematic or conflictive situations that require quick, precise action, such as the critical worsening of a resident's health.	Never	Sometimes	Often	Almost always	Always
3. Has experience in the use of the most appropriate techniques in his or her work.	Never	Sometimes	Often	Almost always	Always
4. Knows the risks and the appropriate measures to prevent occupational hazards in his or her work.	Never	Sometimes	Often	Almost always	Always
5. When starting his or her shift, structures tasks so that there is enough time.	Never	Sometimes	Often	Almost always	Always
6. Identifies and develops appropriate methods to achieve the goals of the team or department and those of the company.	Never	Sometimes	Often	Almost always	Always
7. Provides information, instructions, etc. to other coworkers.	Never	Sometimes	Often	Almost always	Always
8. Provides assistance to other coworkers when requested.	Never	Sometimes	Often	Almost always	Always
9. Accepts and performs the task assigned to him or her within the group working on his or her shift.	Never	Sometimes	Often	Almost always	Always
10. Makes appropriate use of humor to reduce tension at work.	Never	Sometimes	Often	Almost always	Always
11. Maintains a constant level of performance and is willing to work hard, regardless of the high demands placed on him or her by situations, goals or particular projects.	Never	Sometimes	Often	Almost always	Always
12. Works intensely, even in changing or alternative situations that involve different participants and tight deadlines.	Never	Sometimes	Often	Almost always	Always
13. When starting his or her shift, speaks with coworkers to receive information and instructions or consults the incident book and upon leaving his or her shift, waits for coworkers to give them information and instructions and records anything he or she deems important in the incident book.	Never	Sometimes	Often	Almost always	Always
14. Speaks respectfully to residents and speaks properly to family members of residents to receive and/or provide information.	Never	Sometimes	Often	Almost always	Always
15. Does not need the housekeeper to constantly indicate what needs to be done.	Never	Sometimes	Often	Almost always	Always
16. Does not leave work until finishing the task he or she has started.	Never	Sometimes	Often	Almost always	Always
17. Handles the elderly residents according to their mood that day.	Never	Sometimes	Often	Almost always	Always
18. Listens attentively to the elderly residents when they address him or her.	Never	Sometimes	Often	Almost always	Always

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Drivers and Barriers of the Cloud Computing in SMEs: the Position of the European Union

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Title

Drivers and Barriers of the Cloud Computing in SMEs: the Position of the European Union.

Abstract

Cloud computing is one of the technologies that organizations, and especially users, know the least about. It is a new Internet-based technology used to store information on servers, and is provided as an on-demand service to clients. Cost savings and simplification of the technological infrastructure are two of the most decisive factors in its increasing use. However, the lack of standardization, the need for new professionals and the emergence of distrust are some of the barriers to its adoption. The purpose of this paper is, firstly, to present the current situation of this technology from the perspective of businesses by reviewing the existing literature. Secondly, we analyze the situation of this technology from a two-part viewpoint: the European Union, and in particular, the situation in SMEs. Finally, the strategic positions of the European Commission will be reviewed with respect to the consequences of the adoption of the cloud paradigm.

Keywords

Cloud computing, Economic model, Europe, Governance.

This change in paradigm enables the software to be used without having to install licenses

1. Introduction

Cloud computing represents a change in the business paradigm, since it is no longer necessary to have servers, hardware and software in the company's offices, as processes are carried out over the Internet. All of this is on demand, and occurs in a dynamic and scalable manner, to the extent that the needs for resources can increase or decrease according to business needs.

The features offered by cloud computing would not be possible without virtualization technology. Through it, clients share a combination of servers, hard drives, communication devices, data devices and memory devices (Cervone, 2010). According to Hwang (2008), "cloud computing has brought about new possibilities in building and deploying computational infrastructures and complex services, thanks to virtualization."

These services are maintained and controlled, but users only pay for what they use of these aforementioned computing resources, and not in terms of the amount or duration of use. The cloud appears as a single access point for the needs of all users, where the only requirement is access to the Internet.

These two ideas are partnered with the cloud concept and have led to a very interesting field of research for information systems in organizations, as they represent an opportunity for small and medium-sized businesses to grow without investing excessive amounts of resources in IT resources and for new business ideas to emerge, based on services using this technology. The question to investigate is whether the change this has meant in the computer resource usage model is having a parallel repercussion in the European Union, and in particular, in Spain. The intent is therefore to establish the conceptual bases of cloud computing from a business perspective or business model, reviewing its primary technical characteristics. From there, the objective is to find out the European Union's position with regard to this paradigm, the most recent studies and, in particular, those decisions that are most closely related to Spain and SMEs.

The first section of this article establishes the theoretical framework for cloud computing. This includes a review of different definitions, its scope and vision in Europe. Later, in a separate subsection, it does this for Spain and finishes by establishing the barriers and drivers of the cloud, based on a bibliographic review. The methodology is then discussed in a separate section, followed by another that analyzes the main cloud initiatives in the European Union and their application in Spain. Finally, it ends with a conclusions section and another part with interesting recommendations that are the product of the previous sections.

2. Theoretical framework

2.1. Concept of cloud computing

Cloud computing is defined as computing services from anywhere, using any mobile device with an Internet connection, provided through a type of parallel distributed system on virtual computers that are interconnected and can be dynamically procured, and it is presented as one or more computing resources unified on the basis of service level agreements or SLAs that are established between the service provider and the user (Misra & Mondal, 2011).

One unanimous definition of cloud computing is provided by the U.S. National Institute of Standards and Technology (NIST). The cloud is a model that permits ubiquitous access in a convenient and configurable manner, at the request of the network. Computer resources (for example, networks, servers, storage, applications and services) can be quickly procured at the

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The cloud permits ubiquitous access in a configurable manner, at the request of the network

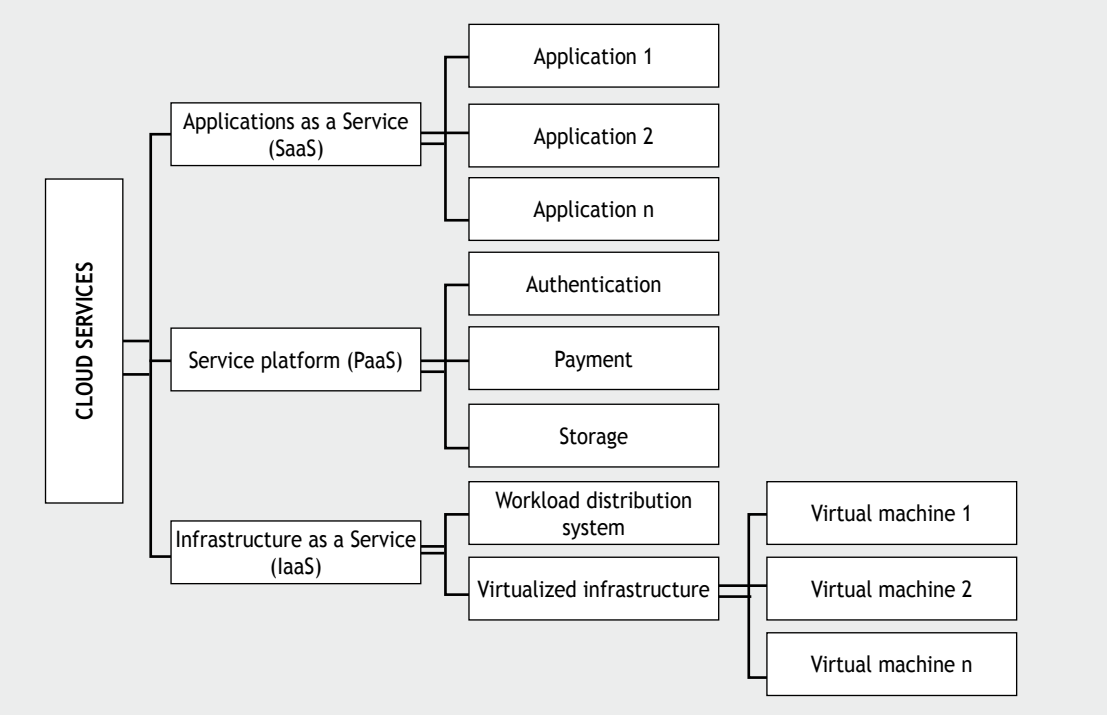
client's request, and with minimal effort in terms of management or service in contact with the supplier (Mell & Grance, 2011; Sabi, Uzoka, Langmia & Njeh, 2016).

Cloud computing lets companies opt among deployment models for software solutions, platforms or computer infrastructure in the cloud. These three deployment models are outsourced as network services by the cloud provider (Mell & Grance, 2011) (see Table 1). The first is known as IaaS (Infrastructure as a Service). IaaS consists of the outsourcing of IT resource infrastructures for the computing, storage and management of data. This model offers resources in the form of products that are offered as the remote delivery of an IT infrastructure that is accessible via the Internet (Sultan, 2011).

The cloud can be deployed as PaaS (Platform as a Service), where they are provided according to the traditional model. The services offered in this modality are usually network equipment, databases and management systems, specialized in keeping everything running, such as operating systems, databases, middleware, web servers and other software resources.

The latest deployment modality is SaaS (Software as a Service), in which the applications are executed with web browsers and from servers over the Internet and are used by accessing the Internet. There is no need for an installation or software maintenance. This service frees clients from the complexities of software and hardware (Sultan, 2011). These services are subscription-based or pay per use and are helping reduce implementation times, even for large systems, and expand ICT (information and communication technologies) capacities for companies in a flexible manner (King & Ganti, 2010).

Table 1
Cloud computing architecture



Source: author's own work.

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In 2019, the most commonly found and adopted service model will be SaaS

The forecasts indicate that by 2019 the most commonly used and adopted service model for cloud workloads in public and private environments will be SaaS (59%), up from a current level of 45% (2014); 30% of all cloud workloads will be IaaS, down from 42% in 2014; and 11% of all cloud workloads will be PaaS, declining from the 13% they represented in 2014.

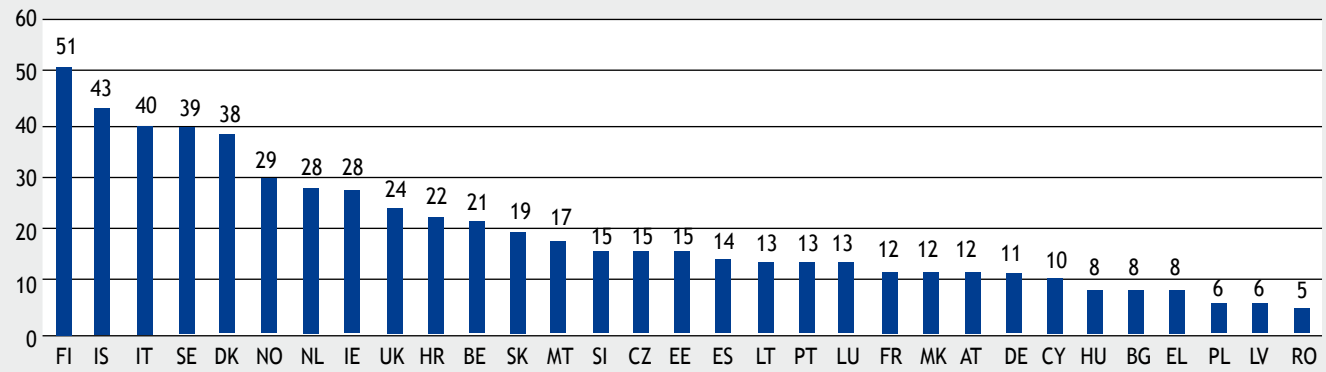
It is estimated that in 2019 the cloud traffic figures by region (Cisco, 2015) will be led by North America, which will have the greatest cloud traffic volume (3.6 ZB[1] per year), followed by the Asia-Pacific region (2.3 ZB annually) and Western Europe (1.5 ZB per year). North America will also generate most of the data center traffic in 2019 (4.5 ZB annually), followed by the Asia-Pacific region (2.3 ZB per year) and Western Europe (1.8 ZB per year).

2.2. The cloud in the European Union

In 2014, the European Union conducted a survey, the results of which showed that 19% of the companies in the European Union use cloud computing, particularly for email systems and file storage in an electronic format. 46% of these companies use advanced cloud services conditioned by the use of financial and accounting software applications (ERP), customer relationship management (CRM) applications or energy savings reasons.

In spite of the fact that the proportion of companies with Internet access is very nearly 100% in most of the member States, only one in five (19%) use cloud computing services. Significant differences are observed in all countries (see Table 2).

Table 2
Use of cloud services in 2014 (percentage of companies)



Source: Eurostat.

In Finland, Iceland, Italy, Sweden and Denmark, more than 30% of companies use cloud computing. On the other hand, less than 10% do so in Hungary, Bulgaria, Greece, Poland, Latvia and Romania. With regard to the use of the cloud, around 66% use a cloud-based solution for their email. Instead of creating a server infrastructure for their email system, which would increase investment and maintenance costs, companies have opted for a cloud

[1] A zettabyte is a unit of information storage that is the equivalent of 10^{21} bytes; it is abbreviated as ZB. The prefix, adopted in 1991, comes from the Latin word *septem*, which means seven (like *hepta-*), since it equals 1000^7 (Wikipedia, 2017).

19% of companies in the European Union used it for e-mail and storage

solution based on per user operating costs. Like these cloud services, many others can meet a wide range of ICT needs in companies. More than half (53%) use the cloud to store files in an electronic format (see Table 3).

Table 3
Use of cloud services in companies (2014)

	Cloud use	Email	File storage	Database hosting	Office software	Financial and accounting software	CRM application software	Computing power for the software
	Percent of companies	Percent of companies that use cloud computing						
EU-28	19	66	53	39	34	31	21	17
BE	21	52	62	45	31	33	26	23
BG	8	74	50	53	58	50	24	16
CZ	15	79	41	34	38	35	18	20
DK	38	63	70	55	42	49	34	34
DE	11	46	56	33	21	25	18	20
EE	15	58	41	18	41	47	17	7
EI	28	57	74	37	36	25	23	17
EL	8	67	50	36	31	32	25	26
ES	14	61	69	54	28	21	24	25
FR	12	62	61	49	32	26	23	14
HR	22	85	49	46	52	50	13	26
IT	40	86	32	28	41	33	14	8
CY	10	68	70	26	39	23	29	16
LV	6	58	58	55	42	47	19	26
LT	13	70	50	47	34	45	33	38
LU	13	46	61	41	32	19	18	14
HU	8	64	46	33	43	35	25	20
MT	17	60	57	44	31	17	19	19
NL	28	55	63	64	40	52	37	18
AT	12	51	54	31	33	23	23	16
PL	6	69	54	41	31	27	22	19
PT	13	78	49	31	36	31	18	30
RO	5	76	36	37	37	33	0	19
IS	15	67	44	39	35	33	20	29
SK	19	84	34	31	46	54	13	22
FI	51	66	54	38	39	39	29	13
SE	39	55	65	43	32	37	26	25
UK	24	51	71	44	29	25	24	22
IS	43	69	74	73	45	62	25	26
NO	29	63	66	54	41	41	33	31
MK	12	74	48	47	57	63	27	31

Source: Eurostat.

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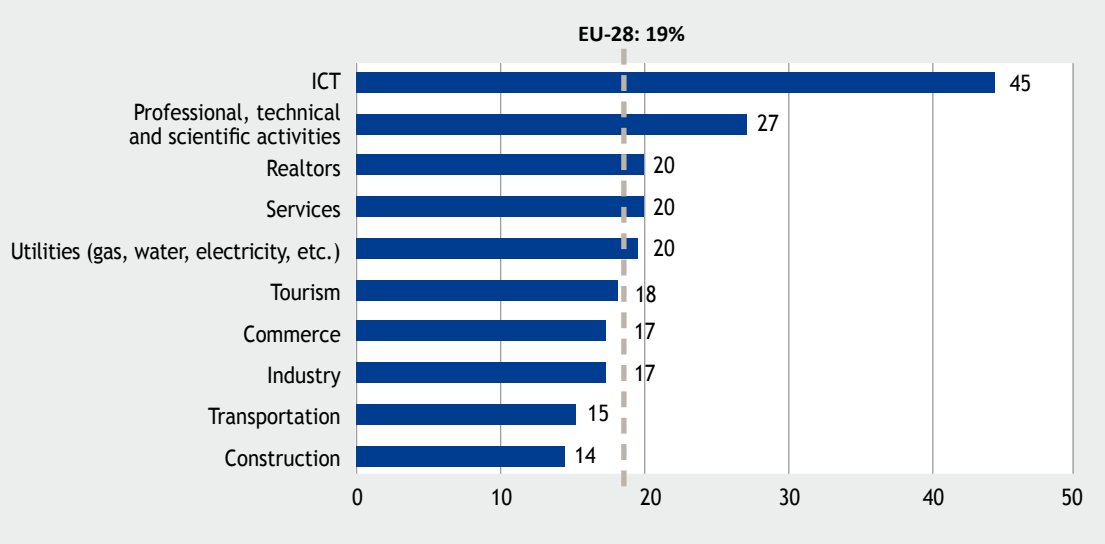
Most companies that use the cloud (45%) belong to the ICT sector

Nearly 39% use it to house their database, while 34% use office software from the cloud (for example, word processors, spread sheets, etc.). The most important thing is that companies access the most advanced management software in client mode; for example, ERP 31% and CRM 21%.

In addition, as can be seen in Table 3, 17% use the cloud computing platforms due to their high performance and computing power in order to run their own business software applications.

As shown in Table 4, the majority of companies that use cloud computing services (45%) belong to the ICT sector, while in almost all the remaining economic sectors, the percentage varied from 14% to 20% (Giannakouris & Smihily, 2014).

Table 4
Cloud use by activity sector in the EU-28 in 2014 (percent of companies)



Source: Eurostat.

2.3. Cloud computing in Spain: the cloud

In the case of Spain, the data provided by the National Institute of Statistics report on the percent of companies that purchased some cloud computing service over the Internet (see Table 5). It should be noted that file storage, email services and database services are the most commonly used services, exceeding 54% in all cases. Trailing the list and with a very small incidence are customer management software (CRM), financial software or computing capacities for running the company's own software.

Previous studies have confirmed that SMEs are unaware of the advantages of adopting cloud solutions (ONTSI, 2012), which means that only 9.8% of SMEs have implemented cloud solutions. These alarming data can be justified by the recent innovation that cloud technology represents, but they highlight the need for training and awareness campaigns regarding their adoption in the business world, in other words, stimulating the demand for services.

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The cloud concept is in its earliest adoption phase

Table 5
Spanish companies that have contracted cloud services

Company total	Percentage
22. Cloud computing: percent of companies that purchased a cloud computing service used over the Internet (3)	15.0
22.1. Cloud computing: percent of companies that purchased one of the following cloud computing services used over the Internet (6): email	61.4
22.2. Cloud computing: percent of companies that purchased one of the following cloud computing services used over the Internet (6): office software	27.7
22.3. Cloud computing: percent of companies that purchased one of the following cloud computing services used over the Internet (6): company database server	54.7
22.4. Cloud computing: percent of companies that purchased one of the following cloud computing services used over the Internet (6): file storage	69.0
22.5. Cloud computing: percent of companies that purchased one of the following cloud computing services used over the Internet (6): financial or accounting software applications	20.7
22.6. Cloud computing: percent of companies that purchased one of the following cloud computing services used over the Internet (6): software applications to process customer information	23.1
22.7. Cloud computing: percent of companies that purchased one of the following cloud computing services used over the Internet (6): computing capacity to run the company's own software	25.1

Source: INE, 2014.

However, this process cannot be carried out without the required stimulus from the ICT sector, which must bring itself up-to-date and offer solutions accessible to the SMEs. We are therefore faced with another need: to stimulate the offer.

2.4. Factors facilitating and inhibiting the adoption of cloud computing in SMEs

This change in paradigm means being able to use the new software services and ICT infrastructure on the go, without having to pay for the use of software licenses or purchase hardware that must be installed in the offices. This drastically reduces the cost of implementing applications (Durkee, 2010) and provides a set of advantages for companies: outsourcing, cost savings, improved quality and access to a specialized support (Leimeister, Böhm, Riedl & Krcmar, 2010).

It may seem to many traditional software providers who until now have been selling packs (for example, ERP, CRM, office software, productivity software, etc.) that they would be on the losing end, as they are no longer selling licenses or packages, but they have discovered how to evolve and nowadays they apply rates for using these same applications that use cloud computing, offering new complementary services, such as cloud-based back-up copies or storage, all with a high degree of adaptation in terms of the offer.

Among the drivers most often found in the literature on cloud computing is the market-oriented architecture, which unlike the resource management architecture centralized in the traditional system, is regulated by the offer and demand for cloud resources, and is therefore based on the market balance and on its flexibility (Buyya, Yeo, Venugopal, Broberg & Brandic, 2009), which simplifies the technology infrastructure. Another of the drivers of cloud computing that is most often cited is the scalability of the cloud model (Benlian, Koufaris &

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Three out of ten SMEs that use the cloud are held back by the risk of a security breach

Hess, 2011; Saya, Pee & Kankanhalli, 2010), which offers the option of increasing or decreasing ICT resources on demand through the use of virtualization.

The ubiquitous access to cloud-based services is also highly valued (Benlian, Hess & Buxmann, 2009; Saya et al., 2010). The high degree of availability of the cloud services is an important advantage (Benlian et al., 2011), along with the high quality of service and performance (Steinfield, Markus & Wigand, 2011). Finally, payment per use and its pricing model is another driver (Armbrust, Fox, Griffith, Joseph, Katz, Konwinski, Lee, Patterson, Rabkin, Stoica & Zaharia, 2010; Saya et al., 2010) that permits important cost savings.

This model offers great possibilities for organizations in terms of investment, scale economies, offshoring, access to information from any location, etc. (Palos & Correia, 2016).

The cloud business model also has disadvantages that could prevent users from adopting cloud services. The strongest barrier to this technological innovation is data security, which refers to their protection against unauthorized access, dissemination, modification or destruction while being stored, processed or transfered within a cloud computing system as the result of loss or theft of the data (Benlian et al., 2011; Hay, Nance & Bishop, 2011; Saya et al., 2010). The lack of reliability (Koehler, Anandasivam, Dan & Weinhardt, 2010; Marston, Li, Bandyopadhyay, Zhang & Ghalsasi, 2011) and a deficit of standardization (Clemons & Chen, 2011; Padilla & Pinzón, 2016) are other notable barriers. These barriers highlight the need for new professionals who are specialized in the use of cloud technology, since IT knowledge and the skills of professionals in the ICT sector constitute a crucial factor to bear in mind and as a result, their ongoing training represents an important challenge (Khajeh-Hosseini, Greenwood, Smith & Sommerville, 2012; Hutchinson, Ward & Castilon, 2009).

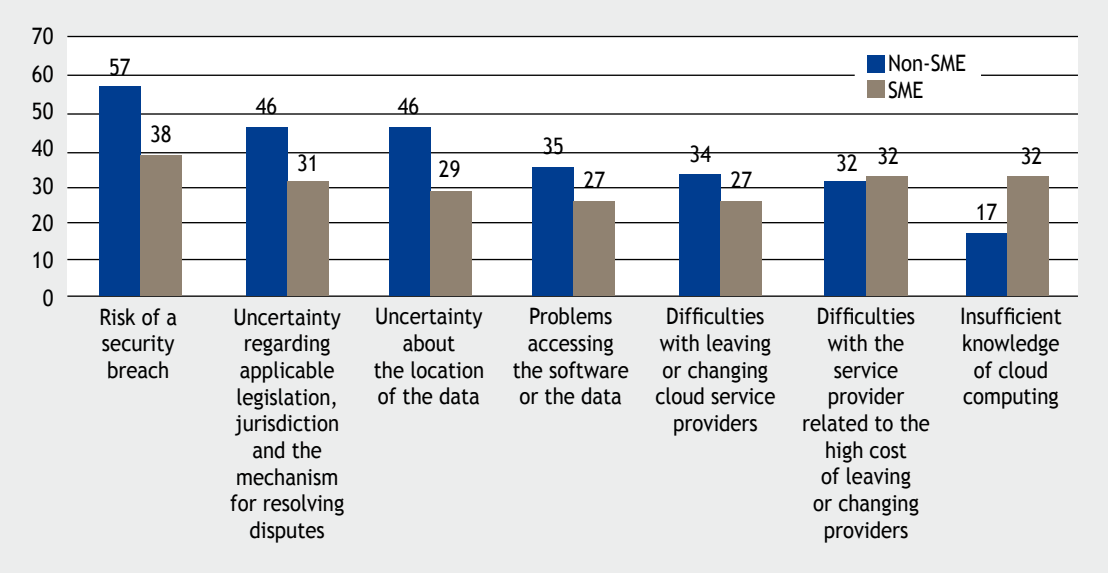
The cloud as a technology or new business model represents progress, but it must be adopted according to a modular scheme that offers great facility for reconfiguration, in which resources or services can be accumulated in a flexible manner, in order to meet changing market demands. However, particularly in Spain and in a general sense in the rest of the world the concept is still in its earliest adoption stage, affecting in disparate ways the two key sectors of the business world: big business and SMEs.

As can be seen in Table 6, more than three out of every ten SMEs that use the cloud (38%) find that the risk of a security breach is the main factor limiting the use of these cloud services. A similar proportion of SMEs (32%) do not use the cloud due to a lack of knowledge and point to this as the main barrier in adopting cloud technologies. Other relevant factors are related to good service by the providers (27%) or problems associated with access to the data (27%).

The cloud is important for companies because they outsource the service to specialized providers in the cloud who are able to offer scale economies (Leimeister et al., 2010) and who take over the maintenance and updating, saving customers time and resources in infrastructure management (Benlian et al., 2011). This cost reduction, along with the scalability of the cloud, permits a very efficient use of resources (Steinfeld et al., 2011). Organizations that adopt this technology improve their processes, since they have better access to ICTs. However, as seen in Table 4, the statistics on use show that less than half of European companies use the cloud. This limited use is directly related, in quite a pronounced manner in the case of SMEs, to the second barrier found: the insufficient knowledge of cloud computing.

The Cloud is an external service from specialized providers who are able to offer scale economies

Table 6
Barriers encountered by companies that use cloud services, classified by size, in the EU-28 in 2014 (percent of companies that use the cloud)



Source: Eurostat.

For the European Commission and the rest of its institutions, the industrial power is made up by SMEs. They form significant segments of the industry in the European Union and are responsible for most of the employment actions in this territory (Etro, 2009). They therefore require specific political attention. While their strength lies in the flexibility with which they can adjust to changes in market conditions, their small size makes them less able to bear the high initial costs of investments in ICT. For this reason, as we will see below, stimulus programs designed for SMEs have been launched and funded.

As we can see below, the importance of cloud technologies in SMEs is crucial to the European economy. The adoption of cloud technology by organizations can mean substantial improvements in the efficiency throughout the economy, and especially in SMEs. The cloud could be especially important for SMEs in the economies with the greatest difficulties or in remote or rural regions, as it would make it possible to take advantage of those markets in the more thriving regions (European Commission, 2012).

There are studies indicating that cloud technology is developed easier in developing countries or emerging nations (Kshetri, 2010) and specifically, in European countries such as Romania or Greece, where cloud technology is a very important tool in the advancement of their SMEs (Marešová & Hálek, 2014).

Some studies conducted prior to the final deployment of the cloud estimated that in Europe one of the consequences of the adoption of the cloud would be the creation of around a few hundred thousand new SMEs throughout the European Union. The effect of the cloud will be that the creation of SMEs will be sustained over time, almost as a permanent effect, with a more profound effect in the countries in which the spread of SMEs is particularly strong or in

The importance of the cloud for SMEs is crucial for the European economy

which the adoption of ICTs has been generally quick. In absolute terms, it is estimated that Italy has experienced the greatest impact in terms of new businesses (81,000), followed by Spain (55,000), France (48,000), Germany (39,000), the United Kingdom (35,000) and Poland (32,000).

Part of the positive effects of cloud computing are going to be related to the speed with which the new technology is adopted. Research suggests that authorities must promote as much as possible a quick adoption of cloud computing with tax incentives or subsidies in the most dynamic sectors of the economy. Likewise, foreign companies can be attracted through the introduction of favorable regulations in terms of data processing that promote the movement of data between their country and Europe. On the other hand, in a context like the European, the smallest countries would be able to obtain the greatest benefits from these policies, at least in the initial phase, because they would easily attract foreign investments from the largest countries (Etro, 2009).

3. Methodology

This research project was conducted according to a methodology based on the review of the existing literature on the adoption of cloud computing in SMEs. It relied on the use of secondary data sources of an external nature (technical reports, research articles and books), web sources from the European Commission and the Spanish government's Ministry of Industry and SCOPUS databases, the Web of Science and Science Direct to consult articles and scientific books.

This research thus uses an exploratory methodology, since the objective of the study is to examine a research problem that has received little or no study and about which questions remain. Such research is also exploratory when the literature review reveals that the ideas have been vaguely related or when we want to investigate a topic from a new perspective or expand the existing ones (Hernández, Fernández & Baptista, 2007).

4. Analysis of cloud initiatives in the European Union

It was in the Granada Declaration (2010) that the European Union recognized cloud computing as a strategic sector with great market potential. In 2010, as the result of this declaration, the European Digital Agenda was approved, in which cloud technologies were highlighted as one of the strategic pillars of the future (Joyanes, 2012).

In 2011, different consultations were begun with experts. These consultations made it possible to involve the main users, to coordinate a standard that provided support for the interoperability and portability of data, but above all they permitted gathering information to develop a European strategy on cloud computing.

In 2012, the European Institution stated that this technology represented an important opportunity for the Public Administration and that a guide needed to be followed for the oversight of cloud contracts in a homogeneous manner throughout the European Union. This guide made it possible to inform the different Administrations about the security criteria when contracting services.

Within the European Commission's Digital Agenda, a set of initiatives was enacted to increase the use of ICTs by SMEs. Specifically, the strategy was based on the initiative "Unleashing the potential of cloud computing in Europe," which defines the cloud as an opportunity to

In 2012, the European Union stated that this technology represented an opportunity for the Administration

improve business competitiveness through the adoption of its different technological solutions.

4.1. The European Union's cloud computing strategies

The initiative "Unleashing the potential of cloud computing in Europe," discussed for 18 months with different experts, intends to accelerate and increase the use of cloud computing throughout the economy, promoting European companies and the productivity of the Public Administration.

The acceleration of the adoption of cloud services experienced in Europe in 2012-2013, particularly in services such as web-based email and the social networks, is still limited in terms of the evolution forecast by the European Union. This is due to the fact that, unlike the Internet, cloud computing is in an early stage of development. This permits its legal framework to be developed and to ensure that companies and users are capable of benefiting from the supply and demand of cloud services.

There are three cornerstones of the strategy:

- **Strategy 1. Promotion of interoperability and building consumer confidence in cloud services.** The intent is to generate the essential rules for seamless communication and data portability, that help prevent customers from having problems in changing providers when they wish, and promote competition. The Commission is working with the European Union Agency for Network and Information Security (ENISA) and other corresponding entities to aid in the development of voluntary certification systems throughout the European Union for the cloud (including data protection).

  Their application began with the creation of a group of experts on certification in the framework of the Cloud Selective Industry Group (C-SIG), which gathers representatives of various cloud providers and other industry participants. Its conclusions are presented to the governing board of the European Cloud Partnership (ECP). ENISA has already drafted a report on the certification and auditing of the cloud from a security perspective. It has also contributed to the creation of a directory of cloud computing security standards, in collaboration with the European Telecommunications Standards Institute (ETSI).

- **Strategy 2. Generating a set of secure terms and fair contracting conditions.** The intent is to promote fair and transparent practices in the provision of cloud contracts. This is necessary not only for consumers and small companies, but also for Service Level Agreements (SLAs) between large companies and the public authorities. A series of standard agreement templates have been drafted based on eleven attributes. Work has also been done on a code of conduct for cloud computing providers that will support the uniform application of data protection standards. The Commission will also review the contract clauses applicable to the transfer of personal data to third countries and has already interacted with the national data protection authorities to approve the binding corporate standards for cloud providers.

- **Strategy 3. The establishment of a European Cloud Partnership to promote innovation and growth in the public sector.** The initiative brings together industry experts and public sector users to work on the common requirements for contracting cloud services. The intent is to establish a common ground for contracting requirements that can represent greater efficiency and reduced costs for national budgets, intensifying at the same time interoperability. A high level administrative board that represents countries in the

Authorities must promote quick adoption of the cloud technology through incentives

European Union and cloud service providers advises the European Commission in order to, among other purposes, minimize the risk of a loss of confidence in the cloud by companies and users. This loss of confidence would fragment the cloud market in separate national market segments, which would represent a step backwards for the common market, with the subsequent detriment of not obtaining the critical mass of customers needed for the development of the cloud in Europe, and therefore its own European industry.

This strategy has culminated in a list of recommended certifications, called CCSL, the compliance with which is voluntary. As an extension of the CCSL, Certification System Metaframework (CCSM) has been created to facilitate the use of the existing certification systems during the procurement of cloud services.

As a whole, the initiative proposes measures to gain 2.5 million new job positions in Europe, as well as an annual increase in the GDP in the European Union equal to €160 million (around 1%) between 2014 and 2020.

The resolution on the unleashing of the potential of cloud computing (European Parliament, 2013) recognizes the economic potential of cloud computing to increase the global competitiveness of Europe and it can become a powerful instrument for growth and employment.

Clearly, cloud computing is based on the expectation that it will become an element of development that transforms all sectors of the economy. In addition, it is indicated that it is important for the European Union to develop its enabling technologies and the underlying infrastructures and competences, in particular in benefit of SMEs, as one of the key factors in order to be able to take advantage of the opportunities afforded by cloud computing and compete on a worldwide level in the data economy (European Commission, 2013).

The importance given to this matter makes room for it in the European Digital Agenda of the Horizon 2020 Project, where its repercussion on the European economy is stressed. A specific program has been created for this purpose, for the development of cloud computing ("European Cloud Computing Strategy," 2012). The program objective covers a time frame of up to 2020. It is articulated in a set of actions that make it possible to generate 2.5 million new European jobs and contribute an annual growth figure of €160 million (1%) to the GDP by 2020. While the figures do not match those included in the document "Unleashing the potential of the cloud, 2012," it does indicate the importance given to it by the Commission.

The SMART 2013/0043 study on the adoption of cloud technology in Europe provides some quantitative estimates of the impact of cloud computing on the economy of the European Union for 2020. The study focuses on the potential economic impact that the adoption of cloud computing solutions by the public and private sector could have on the economy of the European Union as a whole. The study found that between 2015 and 2020, cloud computing may contribute a cumulative total of €449 billion to the joint GDP of the 28 member countries, including their public sectors, of which €103 billion would be the net growth in 2020, which represents a 0.71% share of the European Union's total GDP, or more than three times the amount it represented in 2013.

Between 2015 and 2020, approximately 303,000 new companies will be created, particularly SMEs, thanks to the availability and adoption of cloud computing. Furthermore, of the 1.6 million job positions expected to be created between 2008 and 2020, almost 1 million jobs will be created during the 2015-2020 period. The total market value of the cloud in the

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Assistance in the development of voluntary certification systems throughout the European Union for cloud technologies

European Union in 2013 was estimated to be €9.5 billion, less than 3% of the total ICT budget for the public and private sectors in the European Union. This value is expected to increase to €17.2 billion in 2015 and €44.8 billion in 2020, i.e., accounting for almost five times the size of the market in 2013 and more than 10% of the ICT budget anticipated for 2020.

The study found that the cloud replaces ICT service and system-related expenses. For example, the adoption of SaaS (Software as a service) eliminates the need to purchase software and servers. As a matter of fact, every €1 spent on SaaS replaces €2.30 of expenses that an organization would spend to achieve the same result through a traditional solution. The results of this study back the Commission's strategy to create a single digital market, as announced in May 2015.

Measures are currently still being implemented from the "Unleashing the potential of cloud computing" initiative, following the recommendations of the Eurostat Report (2014) and the European Union Conference on Cloud Security (ENISA, 2015).

4.2. Spanish strategy on cloud computing

The Spanish Digital Agenda is aligned with the strategy of the European Union and establishes the objectives, lines of work and measures to promote the development of the Information Society. The Ministry of Industry formed a Group of High Level Experts for the Digital Agenda, the first meeting of which was held in 2012, with the aim of proposing and guiding measures to develop the government's strategy in Telecommunications and the Information Society (Joyanes, 2012).

Some of these measures benefit from financing with funds from the FEDER operational programs, which are intended to give a major boost to the availability and use of telecommunications and information technologies, implementing services and deploying infrastructures for networks and broadband Internet access in the areas of greatest need for citizens and SMEs. It would also create digital contents, supporting projects in SMEs aimed at incorporating technological solutions and the adoption of ICT services and applications that can serve as a level for greater electronic business development and for the ultimate integration of Spanish companies in the Information Society. This would contribute to increased productivity in their economic activity and their competitiveness (Red.es, 2015).

In this sense, the Intelligent Growth Operational Program 2014-2020 (hereafter, IntGOP) specifies the strategy and objectives for intervention by the central state administration (CSA), co-financed with the FEDER fund, to contribute to the improvement and the recovery of the competitiveness of the Spanish economy, by promoting a more intelligent growth model based on research, innovation and ICTs, with special attention to the needs and potential of SMEs.

For this reason, the IntGOP concentrates its actions on three thematic objectives of the eleven set out in Article 9 of Regulation (EU) No. 1303/2013. The Spanish Digital Agenda is essentially framed within thematic objective 2, enhancing access to, and the use and quality of ICT.

Within this thematic objective and the scope of the digital economy are actions supporting the implementation of R&D projects in the ICT sector, which will contribute to developing an effective industrial policy in the ICT sector in Spain, promoting both the economy and the digital society. This line will address the finance needs of the ICT sector, especially for innovative projects that are closer to the market for the development of ICT products and services, having identified cloud computing, big data, smart city, cyber security and the Internet of the future as the main ICT industries of the future (Red.es, 2015).

A program to promote the offer of cloud solutions in underprivileged areas

For this reason, within the IntGOP framework, a series of initiatives were programmed to promote the development of the ICT offer, through support for companies as they develop products and services in technologies and industries of the future, and in particular in the areas of smart cities, smart destinations, the Internet of things, big data and cloud computing.

The priority lines of action for the Digital Agenda are an aid program to town councils and associations aimed at promoting the existence of smart cities, an e-commerce mentoring program for SMEs (2011-15), the program promoting the offer of cloud solutions in the Castille-La Mancha, Extremadura and Andalusia regions (2015) and the current program of assistance in the program promoting the demand for cloud computing solutions for SMEs.

The latter two programs have provided the biggest push for the Spanish strategy promoting the adoption of cloud technologies. On the one hand, the program supporting the offer of cloud computing solutions for small and medium-sized businesses offered SMEs and freelance workers who worked in the ICT sector assistance for migration or the development of new solutions in SaaS mode. This financial assistance provided an amount of between €12,500 and €60,000 per beneficiary, corresponding to a percentage of between 50% and 80% of the subsidizable budget requested. The program was endowed with €25 million.

The second program, which took effect in May 2016, offers SMEs in any sector assistance for the adoption of cloud solutions, which can be selected from a catalog divided into categories, made available to them through Red.es, a public business organization attached to the Ministry of Industry, Energy and Tourism (MINETUR), which offers an extensive set of programs so that Spanish society reaps the full benefits of the possibilities offered by ICTs.

The program is endowed with a total budget of €40 million and co-finances between 50% and 80% of the adoption cost of the assistance during a period of approximately nine months. The aid will cover an amount of between €625 and €15,000 per beneficiary. Red.es defines beneficiaries as SMEs or freelance workers with fewer than 250 employees, a business volume of less than €50 million and tax residence in Spain, which have begun activity prior to the publication of the subsidy rules.

The catalog classifying the offer is divided into the following ten categories: user stations, economic management, business management, customer relations, point of sale management, presence on the Internet, e-commerce, infrastructure as service, development platform as a service and virtual switchboard.

The company providers whose cloud solutions make up the catalog were selected through a public approval process and a general call to tender. This program therefore boosts demand, but at the same time selects and promotes specialization in the offer by providers and constitutes an important leverage point to consolidate the adoption of cloud solutions in Spain.

5. Conclusions

The sectors with the greatest knowledge about cloud computing technology are the ICT sector and industry, with 62.7% and 57.5% (ONTSI, 2012), and with 37.7% of the SMEs in the ICT sector being aware of the technology and making use of it, as well as the professional activities and services sector (legal, accounting, technical, scientific, etc.), with 31.8%, among those who are the quickest to adopt cloud technology in Spain. These figures do not agree with other European studies, which after the ICT sector also mention professional activities, but

Europe must exploit its great strength in the area of legal security, protection and transparency

immediately speaking, it is the tourism sector that has the greatest levels of dependence, which is in agreement with other studies on cloud computing in the hospitality sector (Palos & Aguayo, 2016). It may thus be of concern that the Spanish tourism sector is not in line with the competitiveness that this innovation produces.

Companies, in particular SMEs, have low levels of knowledge and training in the functionalities and advantages of the cloud. Moreover, in some cases, they use these technologies and are formally unaware that they are doing so. Therefore, communication and training are revealed to be two aspects that may provide to be key, especially in SMEs, and efforts towards dissemination and education are needed by providers and institutions in Europe.

The economic expectations that the European Commission had placed on the cloud industry do not match the published data. One of the reasons is because the Administrations themselves are not adopting this technology. We therefore coincide with previous studies that indicate that the Public Administrations are possibly not aware of the real importance of cloud computing and even though efforts are acknowledged to convince companies to adopt ICTs, there is still a great deal of work to be done in the development of infrastructures and the dissemination and support for the incorporation of these technologies (Maqueira-Marín & Bruque-Cámara, 2012).

The lack of standardization of application program and technology platform interfaces means that interoperability among platforms is poor. Companies are not capable of easily transferring data from one cloud provider to another. In this sense, the European strategy is creating an important regulatory body of certifications, whose translation into the reality of each Member State will play an important role.

It is thus important to prevent consumers from encountering lock-in data providers, i.e., the difficulty or impossibility to change providers. This perception of lack of control could discourage companies from starting to adopt cloud computing (Armbrust et al., 2010).

The uncertainty of the service availability and its reliability, especially the concern about the time during which the system would be inactive in light of an unexpected interruption could dissuade companies from adopting cloud computing, since it increases project costs and business risks. All these data herald large public and private investments in these technologies and at the same time also make a strong reconversion of the ICT sector necessary, which is used to developing applications or providing services according to models that are now absolutely obsolete in their deployment or business model.

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Training in Values as an Incubator for Sustainability Attitudes

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Title

Training in Values as an Incubator for Sustainability Attitudes.

Abstract

Following the proposals arising from the Schwartz model on the cognitive representations of human needs expressed in his Theory of Values, instrumental values and terminal values, which are vital for understanding and entrepreneurship behavior, we have engaged in a critical review of this model and the types of values. We go on to examine the academic curriculum of ethical and moral profiles as promoters of sustainable attitude values in order to contribute an integrated and updated option to the academic world.

Key words

Values, attitudes, entrepreneurship, entrepreneur, sustainability, sustainable entrepreneur.

Values from a "Christ-centric" profile follow already existing theories

1. Introduction

Values are considered to be cognitive representations, the motivational purposes of basic human needs, on both an individual level as biological organisms, the fruit of social interaction, and owing to the very survival and/or well-being of the collective or group. As a motivational construct, they are dedicated to desirability and achievement. They are abstract goals that guide the selection and evaluation of actions as standards or criteria, organized according to a hierarchical system that is unique to each subject, that transcends specific actions, and that is more reminiscent of norms and attitudes. An example of this is the immense research arising from the Theory of Needs (Maslow, 1998) and even more, Schwartz's Theory of Values (1996), which defines values as desirable goals that are trans-situational, vary in importance and serve as a guide for the life principles of people. This author provides a thorough discussion of the evidence and the consideration that processes, such as accessibility, produce greater activation towards the behavior and motivate and influence attention to relevant aspects, perception and interpretation of situations and even the planning of the subject's actions and, therefore, lead to an activation of said values and their priorities, as has been proposed by other authors. The specific objective of this study is therefore to delimit the typology described and to consider the transcendence of value training in support of the intended sustainable attitudes.

2. Theories of Needs and Values

It is obvious that the personal and contextual circumstances of the subject and his or her needs anticipate to a great extent the quest, the cost or the expansion of the different human values without it constituting the entirety in said dynamic relationship, as the subjective evaluative experience is also predetermining as the expression prior to the objective current reality. This is what we could call the "ecological economy of value." We are therefore talking about overcoming the subjectivism-objectivism antithesis, a dynamic relationship between subject and object in qualitative terms, where the value as a reactive structural quality vis-à-vis the properties of the object is reciprocally mediated by principles, as propositions or theoretical formulations aimed at reason, that express a certain way of proceeding that is physical, spiritual or moral, and that acquire value when the subject makes them his or her own and they drive him or her to action and through the conviction as a fruit of the spirit, this is to say, that dimension that is beyond the sensitivity and reason, that is inspiration and creation, and that from which we live and for which we are willing to risk our life. This is an undeniable entrepreneurial factor. The evident proposal of the fundamental values in a "Christ-centric profile" that contemplates constructs such as love in opposition to selfishness and indifference, justice as opposed to exclusion, peace instead of violent behaviors, honesty in the face of prevailing corruption, solidarity in the presence of individualism and fierce competition, austerity as the antithesis of consumerism, in addition to reflective contemplation and gratitude, are examples that bring us closer to the Theories of Needs and Values already present in science.

The Theory of Needs presents, in five groups or categories, from its humanistic perspective that primary, secondary, individual, societal, economic or non-economic and aesthetic needs, as well as the needs for knowledge or understanding of the human being, are prioritized and oriented from survival towards those aimed at development through goods (complementary, substitutes and independent, capital or consumer, perishable or non-perishable) or services (private or public). As one meets the needs in increasing pyramidal order, the individual passes through physiological, safety, social or belonging

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Values training is transcendental for sustainability

and esteem needs to the ideal construct that all beings aspire to, related to general satisfaction, which the author calls "self-realization." As can be seen, this humanistic model leaves aside the existentialist achievement of the deep sense of life, so part of the science has ordered the axiom that the subject is master of his own destiny, being aware in his or her individuality where successes and failures are wrought from and declaring himself or herself, obviously, responsible for his or her own actions. This is how we have reached the boundaries of an exacerbated anthropocentrism, halfway between the ontological truth and pure praxeology.

If the needs are in themselves a source of motivation, as a contribution to this field, the Theory of Values provides a relational framework for the analysis, prediction and explanation of behavior from the orientation of ten values or motivational purposes, as a cognitive representation of the aforementioned human needs and unifying theory for the field of human motivation. That is to say, it is a way of organizing the different needs, motivations and objectives proposed by the scientific literature, through moral, philosophical-political and ideological dimensions, or simply a social perspective in which the subject can situate himself or herself. Schwartz described the offshoots of the ten basic values according to their motivational purposes, from a circular structure, organizing them into two dimensions: the individualistic, consisting of self-direction, stimulation, hedonism, achievement and power; and the collectivist dimension of benevolence, tradition and conformity. Security and universalism could be placed together in a mixed dimension, since they can operate in both the individual and the collective dimensions. This theory of circular structure and its relationships according to the principles of compatibility and logical contradiction of values goes against the unidimensional proposal presented by Triandis, Bontempo, Villarreal, Asai and Lucca (1988), where the subject is polarized towards independence (idiocentric, individualistic) in his or her priority towards values that give him or her independence or towards group dependence (allocentric, collectivist).

It is interesting to reflect on the results obtained in the descriptive study by Moriano, Trejo and Palací (2001), comparing the different types of values and the specific values among a group of subjects who are entrepreneurs and another group whose members are not, indicating that the entrepreneurs are more individualistic (positive correlation with power, achievement, self-management and stimulation) as opposed to the collectivists (who identify with benevolence, tradition and conformity), a matter which in some ways ratifies the "group think" phenomenon as the result of globalism in all its facets, whether it be on the basic formative level or in the economistic philosophy of the markets.

All considered, there is that large group of entrepreneurs with balanced individual and collective values, with a sustainable mentality and initiative, that not only provide a work space for society, they also use their businesses to promote initiatives that minimize the environmental impact, resorting to the most human needs in a potential vision of a better future (Gagnon & Michael, 2012; Gagnon, 2012), as is understood by the sustainable business spirit, focused on preserving the natural environment, supporting life and community, seeking to transcend towards innovation and improvement through products, processes and services in which profiting is global: for the individual himself or herself, society and the ecosystem and its natural resources (Shepherd & Patzelt, 2011). Because of all this, this is more than enough reason to consider the scope of the training in values that the most traditional and universal subjects present in their academic syllabus, in order to achieve the homeostasis of attitudes that bring us to predictive theories of the subject's behavior in specific and general situations, in a stable manner over time.

The Theory of Values provides an analytic, predictive and explanatory framework for behavior

3. The transcendence of value training

Quintero (2012) states that values are the foundations of all human training, seen from any perspective. Value training implies the harmonious development of all dimensions of the individual. For Max Scheler, mentor in the development of phenomenology, ethics and philosophical anthropology and religion with its individualistic view of man, values are phenomenological events that can be distinguished from natural and scientific events, in which love is the true driving force, since emotional life is irreducible to sentient and intellectual life (López, 2013). This objectivist conception that considers values as independent and immutable qualities is what that enables us to talk about a "material ethics of values," already proclaimed by this author in the early part of this century, with the premise of inducing this moral state of mind in future sustainable entrepreneurs. Teaching objectives, therefore, must be oriented towards the insertion of bioethics, inspiring the progressive development of professional competence through cognitive psychological (habits and skills), motivational (professional interest, values, ideals, self-assessment) and affective (emotions, sentiments) training, harmonizing the values of specialized technical-scientific knowledge with those of the global and humanistic knowledge of the person, thus favoring the symbiosis among the objectives and the way in which means and resources are orchestrated to implement them (Franco & Duque, 2015).

The UNESCO report from 1997, entitled *Learning: the treasure within,* contemplated the fundamental pillars in education, such as learning how to learn, to do, to coexist, to live with others and, what is considered essential, "learning to be," thus improving one's own personality, acquiring autonomy, judgment and a sense of responsibility, building memory and reasoning, aesthetic sense, physical capacities and communications skills. Could it be possible to integrate the values of "being" and "know-how" into the learning that promotes attitudes, with sustainable values as a bio-psycho-social-spiritual subject? From the dialectic axiom of composition and synthesis, joining conceptual and methodological aspects, values, attitudes and skills in each case or discipline, it is possible to achieve their integration. This process of the communion of theoretical elements and paradigms favors the knowledge of the subjects of study, strengthening competences and personal skills and coping with a changing society, with a methodical ordering of contents between the subject matters of the different disciplines and sharing the decisions regarding the epistemological structuring of each of them, without losing the specific singularity. It means "learning how to engage in entrepreneurship" in a sustainable manner. Therefore, curricular integration proves transcendental as a flexible process and structure, relating and methodically ordering, where thanks to the institutional mechanisms that favor new curricula, which are coordinated both vertically and horizontally, they become a crucial objective in research, including that on values.

4. Values and subjects in the curriculum

From research currently underway on the transcendence of the inclusion of ethical-moral subjects in the curricula, we are faced with the challenge of exploring the correlation between sustainable attitudes and the constructs of both psychological and spiritual wellbeing, as well as the social-moral human values that are derived from the subjects implemented in the academic curriculum of many universities, such as Humanities, Ethics, Theology, Social Doctrine of the Church and Bioethics. These examples promoting applied human and social values lead us to a hypothetical construct of an "intelligent university training," generating dynamic expertises in thought and action, beyond the basic contents of environmental education taught in the levels prior to the university period, even considering financial,

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In sustainable entrepreneurship, earnings are global

technological and political factors, recognized nowadays as more important, apart from education (Albano, 2014).

It is paradoxical to recognize the need to implement said subjects in the area of higher education and yet observe a rejection of their teaching by the educational community, when it should be facilitating and guiding values education. Perilla and Guerrero (2009) outline certain causes related to pedagogical knowledge, education and teaching conditions, since their contents must lead to structures of universal moral judgment and reasoning, overcoming the purely descriptive and demanding that we go beyond good intentions or sophist exercises. Values such as discipline, responsibility, autonomy, effort, interest in knowledge, respect, honesty and identity still constitute academic values, extolling attitudinal and intentional synergies that derive in sustainable behaviors. Therefore we must start by avoiding an exclusively intellectual and mechanistic model by developing suppositions of personal competence and ethical values that represent a level of personal wellbeing, satisfaction, promotion, progress and sustainable growth.

In Spain, we have the example of the Catholic University of Murcia (UCAM) and its teaching guides for the 2015-2016 academic year, with their specific and common contents in most of the degree programs it offers:

- Basic ethics. It focuses on reasoning and the synthesis of contents from the field of knowledge of ethics, reflectively analyzing information of an ethical nature and the essential elements on which the moral classification of human acts depends, identifying the characteristics of the person from a comprehensive anthropology. Its fundamental objectives are to identify the structural elements of the human action, to individualize and distinguish among the different values linked to the action and to relate the moral structure of the actions to professional practice.

- Theology I and II. Its main objective is "to promote a comprehensive education that enables the full development of the person and excellence in his or her professional future, considering fundamental aspects of European and western culture as the basic elements: theology, ethics and the humanities." All of this means expanding the vision of man and the world from categories and values that have shaped our culture, facilitating greater personal maturity and the comprehension of the social and cultural context in which the student will conduct his or her future profession. It aims to analyze the profound questions of human beings (life, death, happiness, pain, God) and the answers that have been given in the history of thought, contrasting the anthropology held by the Christian revelation with the ideologies of modernity and post-modernity. From the reasoned basis underlying knowledge of God, a coherent discourse is articulated on human dignity, recognizing the Revelation as a response to the world's questions and their transcendence.

- Social Doctrine of the Church. It intends to interpret and provide guidance according to faith about complex human relationships and the problems that are derived from them, from the family setting to international relations, collaborating with social transformation through the training of true professionals who demonstrate the ethical commitment acquired with habits that exhibit conscious, free and responsible responses to transform reality and thus build civilization from a perspective of justice and love, as a showing of sensitivity to the world's inequalities and injustices from the Christian perspective.

- Applied Ethics and Bioethics. Directly related to the objective of this university, it undertakes the promotion of a comprehensive education that permits the full development

With bioethics, technical-scientific values are harmonized with those of global and humanistic knowledge

of the individual and excellence in his or her professional future. It considers the basis of European and western culture, "theology, ethics and the humanities," as basic elements, developing the reflective and critical capacity of students with regard to social matters, stimulating professional responsibility as a path of self-fulfillment and giving them the skills they need to adequate reflect on important modern bioethical questions through the acquisition of rational, scientific and ethical criteria. It means acquiring the capacity to gather and interpret relevant data for the issuance of judgments of a social, scientific or ethical nature, relating the moral structure of actions with the future professional practice, identifying the characteristics of human beings from a comprehensive anthropology and substantiating human dignity, analyzing and discussing bioethical questions with regard to human sexuality and the beginning and end of human life from an ontological individualistic perspective.

- Humanities. Men and women as spiritual beings, their thought and lives through the centuries, are the subject of its study. It intends to promote a cultivated creative intelligence and a more complete human training, distinguishing the essential foundations of our civilization from its accidental cultural characteristics, basic historical landmarks of circumstantial events and those elements that constitute its cause-effect structure, focusing on the structural limitations of human knowledge and identifying the relationship that exists between pain, suffering or death and the finite nature of the human being. Among its objectives is an attempt to individualize the basis of the social nature of human beings and the structure of society, with the distinction between the different models of the ideal society and the political and social processes that characterize our contemporary society.

The reading of its specific contents and its objectives inevitably leads us to the reflection that all respond to the aforementioned human needs (individual, social and survival-related, and the collective wellbeing), as well as its cognitive representation, translated into motivational purposes called quintessential human values, and even further, into mixed dimensional criteria in a balanced manner, from reflection on them until the ability to interpret them practically and professionally (Small, 2013; Reyes, Díaz, Dueñas & Bernal, 2016). In brief, we find ourselves in the presence of an "intellectual and human matrix," where there also underlies an affinity with Scheler's axiology, in which spiritual values determine beauty (an aesthetic quality), justice (a legal quality) and truth (an intellectual quality) of objects, which inevitably represents the analysis and qualification of one's own acts by the subject, maturing one's own knowledge and the social-cultural context in which one operates, facilitating the necessary synergies for social updating and transformation in terms of sustainable, just, rational, egalitarian, inclusive, scientific and biothethical development and through the cultivation of a creative intelligence and ontological and anthropological human training, making the comprehensive development of the individual possible, and thus certain implicit sustainable attitudes (Melé, 2015; Sánchez, 2015; Booth, Simón, Sandoval, Echeita & Muñoz, 2015).

The refining and vocation to which these subjects and their intercultural verification lead make sense of the hypothesis proposed in terms of their mediation in the values suggested by Schwartz in his studies (Schwartz, 2005, 2006). Without sacrificing their individualistic dimension, power, achievement, hedonism, stimulation and independence of action and thought as self-management in turn come to serve the community in favor of benevolence and tradition, acting according to expectations and social norms, from the shared values of personal safety and interpersonal relationship, as well as comprehension, appreciation, tolerance and the protection of nature and social wellbeing as universal values. It is the phenomenon of childhood "protofusion" (Gaviria, Ferreira, Martínez & Whitehouse, 2015) or adult "group fusion," in which the union between personal and social identity is proposed,

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Personal values and those of the world that have shaped our culture are the primary objectives

with functional implication between them, and that leads the individual to a high level of commitment, no only to oneself and one's identity, but also to the group (Galindo, 2015; Gómez & Vázquez, 2015).

5. Conclusions

Values as the expression of the changing needs of human beings and as the phenomenological significance of development and existential progress find their sense in their conduct with others and the environment. Succeeding in forming a conscience that reflects and establishes the ethical qualities of reality poses a challenge in light of the amorality that might arise from an entrepreneurial spirit of a purely individualistic nature and without any sensitivity towards the collective and the natural context they share. The investment in psychological capital and its value system seems promising, as well as that made in its learning through the strengthening of universal values that directly affect the attitudes, intentions and conducts promoting sustainability, beyond theories or entelechies that are difficult to apply. It is a matter of "learning how to engage in entrepreneurship" in a sustainable manner, as an axiom that leads to transformational leadership, whether from a lay or religious focus that acts by earning respect, that expresses its confidence in the achievement of its objectives, that overcomes problems from different points of view, helping develop the very capacity in its individualized consideration, with the capacity to transcend one's own interest in benefit of the group, altering the hierarchy of needs and achieving a change in values, attitudes and beliefs, with an exceptional increase in one's own performance.

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