معهد تمويل التنمية للمغرب العربي

End of Studies Project

Topic :

Risk Management in Insurance:

Operational Risk Mapping of the Automobile Business Line

Case study: CAAR Insurance

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Dedication

To my loving parents,

To my brothers and sisters,

To all my sweethearts Hana, Selma, Lamis, Nouha, Insaf

To my dear friend Rania…

And to my BFF Mina

Hajer

Summary

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The abbreviations list

(AAA): the American Accounting Association

(ABI ORIC): Association of British Insurers, the Operational Risk Insurance Consortium

(AICPA): the American Institute of Certified Public Accountants

(BNA): the National Bank of Algeria

(BSCR): Basic Solvency Capital Requirement

(CAAR): the Algerian Company of Insurance and Reinsurance

(CEIOPS): the Committee of European Insurance and Occupational Pension Supervisors

(COSO): the Committee of Sponsoring Organizations of the Tread way

(CPA): Popular Credit of Algeria

(CSFI): the Centre for the Study of Financial Innovation

(EIOPA): European Insurance and Occupational Pensions Authority

(ERM): Enterprise Risk Management

(FEI): Financial Executives International

(FERMA): the Federation of European Risk Management Associations

(IAIS): The International Association of Insurance Supervisors

(IFACI): Institut français des auditeurs et contrôleurs internes

(IIA): the Institute of Internal Auditors

(IMA): the Institute of Management Accountants

(ISO): the International Organization for Standardization

(MCR): Minimum Capital Requirement

(ORSA): Own Risk and Solvency Assessment

(PwC): PricewaterhouseCoopers

(QIS): Quantitative Impact Studies

(RIMS): the Risk and Insurance Management Society

(SCR)Solvency Capital Requirement

Abstract

Operational risks arise from inadequate internal processes, people and systems, or from external events. The new european standard Solvency II imposed to insurance companies a new framework, more adapted to their risks. One of the biggest novelties is that companies have the obligation to set aside a part of their stockholders' equity to absorb unforeseen operational risks.

Indeed, in its second pillar, the standard Solvency II, encourages companies to adopt the ERM (Enterprise Risk Management) approach, so that they are able to identify, assess and treat their risks through the application of the device "Own Risk and Solvency Assessment (ORSA).

The objective of this thesis is to present a methodological example of operational risk required capital and risk mapping of the automobile insurance business line in the Algerian Company of Insurance and Reinsurance (CAAR).

Key words: operational risk, risk mapping, Solvency Capital Requirements, CAAR, automobile insurance business line.

Résumé

Les risques opérationnels découlent de l'inadéquation des processus internes, du personnel et des systèmes, ou des événements externes. La nouvelle norme européenne Solvabilité II a imposé aux compagnies d'assurance un nouveau cadre règlementaire, plus adapté à leurs risques. L'une de ses nouveautés est l'obligation des compagnies de mobiliser une partie de leur capital pour faire face aux risques opérationnels imprévus.

En effet, dans son deuxième pilier, la norme Solvabilité II, encourage les entreprises à adopter l'approche ERM (Enterprise Risk Management), afin qu'elles puissent identifier, évaluer et traiter leurs risques grâce à l'application du dispositif "Own Risk and Solvency Assessment (ORSA).

L'objectif de ce mémoire est de présenter un exemple méthodologique de cartographie des risques opérationnels, du capital requis et des risques de la branche d'assurance automobile de la Compagnie Algérienne d'Assurance et de Réassurance (CAAR).

Mots clés: risque opérationnel, cartographie des risques, Capital de Solvabilité Requis, CAAR, branche automobile.

General Introduction

General introduction

In a world increasingly complex and unpredictable, where competition is becoming tougher day by day, the chief executives of different companies understand well the necessity of seeking efficiency in every aspect of their operations. A primary factor of competitiveness and efficiency is the knowledge and management of business risks.

Effective risk management allows the understanding of the potential positive and negative aspects that can influence the company's activity, thus, increases the chances of business success by reducing uncertainty about the achievement of the set goals.

As for Insurance companies, their core competences and main contribution to society is to accept the risks underwritten by businesses and individuals. In order to protect policyholders, insurers must protect their assets and revenues and manage effectively their risks by complying to regulations and corporate governance requirements and best practicies to ensure a minimum financial solvency and the continuity of its operations.

Typically, some companies may focus on the more traditional insurance and financial risks such as: under-reserving, under-pricing, under-supervised delegating of underwriting authority or abuse of reinsurance; rather than how to run their business more efficiently even though, larger losses are often the cumulative effect of a number of smaller operational losses.

Operational risk losses are high profile, uncertain, and headline-grabbing. Despite the best endeavours of companies, material operational risk losses keep occurring. In the insurance sector, operational risk losses tend to be less dramatic than in banking, measured in the hundreds of millions. Nevertheless, one of the worst possible scenarios for an insurance company; an entity that is ultimately responsible of managing the financial future of others; is finding itself the target of lawsuits, or the subject of high-profile news stories linked to mis-selling, breach of fiduciary trust, breach of contract, or an inability to meet its obligations.

The introduction of the new European standard Solvency II imposed to insurance companies a new stringent regulatory framework, it increases inexorably the need of an effective management of operational risks and the development and implementation of structured methodologies for its analysis and assessment.

General introduction

In its second pillar, the Solvency II guidelines, encourages companies to adopt the Enterprise Risk Management (ERM) approach, to enable companies to estimate and measure their risks, in particular through the application of the device "Own Risk and Solvency Assessment (ORSA). This latter sets up a host of processes and procedures that help identify, assess, monitor, manage, and report the short and long term risks an insurance company faces or may face.

The objective of this thesis is to present a risk mapping work in the context of operational risk management in the automobile business line of the Algerian Company of Insurance and Reinsurance (CAAR) that has always been a very important operator on the Algerian market since its creation. In 2017, it was ranked third among property and casualty algerian insurers in terms of turnover[1].

The choice of the automobile business line is based on its importance, which is obvious on the company's balance sheet: it represents the second largest share of the company's portfolio and contributes with -approximately- the third of the company's turnover every year. Therefore, the executives decided to enhance the efficiency of the processes by creating a risk management structure, and we intend to enrich their knowledge capital through this project by tackling operational risks.

Through this thesis, we will build a risk map that could help enhance the processes efficiency and cut costs related to different operational risks including errors, fraud and inadequate procedures. To that end, we are using the Solvency II taxonomy related to operational risks and its approach of risks identification and assessment since it is considered as a reliable guideline throughout Europe.

Given these incentives, we will attempt to answer the following problematic:

What are the operational risks inherent to the automobile insurance business line?

This problematic leads us to ask the following questions:

- What is the approach to follow to build an operational risk map of an insurance company?
- What is the impact and the level of control of these risks?
- How much is the required capital to mitigate operational risks according to solvency II?

1General Directorate of the Treasury of Algeria, Directorate of Insurance, *Insurance activity in Algeria, annual report*, 2017.

General introduction

- What controls to implement in order to mitigate these risks?

In order to carry out our study properly, we have chosen to structure our work as follows:

The first chapter will focus on the importance of risk management in insurance companies in accordance with the new regulations brought by the Solvency II reform.

The second chapter gives an overview of different operational risks and risk mapping tools and approaches.

In the third chapter, we will present the Algerian Company of Insurance and Reinsurance (CAAR) in the first section. The second and the third sections will be dedicated to our case study, where we will attempt to measure the required capital to absorb unforeseen operational losses according to Solvency II, then, we will build a risk map of the major operational risks. The expected objective is to have a global view of risks to which the Automobile insurance line is exposed and to propose control actions that aim to mitigate the identified risks

Chapter I:
Risk Management in Insurance Company

Chapter I: Risk management in insurance company

Chapter introduction

Risk management has been practiced informally by everyone, with or without conscious of it, since the dawn of time. It increases the probability of success, and reduces both the probability of failure and the uncertainty of achieving the organization's overall objectives by addressing methodically all the risks surrounding the organization's activities past, present and in particular, future.

Insurance is one of the most important areas in every country's economics; therefore, it requires sophisticated and sensitive risk analysis in order to ensure stability and solvency of insurance companies and their ability to protect the policyholders and manage effectively the risks to which it is exposed. Thus, she must avoid catastrophic scenarios that could jeopardize her financial situation and make it vulnerable to threats.

To start this thesis, the first chapter will focus on risk management in insurance companies in accordance with the changes of regulations brought by the Solvency II reform. The key objectives of this latter were to increase the level of harmonization of solvency regulation across Europe, to introduce more sensitive capital requirements (than the previous minimum Solvency I requirements) to the levels of risk being undertaken, and to provide appropriate incentives for good risk management.

As such, this chapter is divided into two sections:

Section 1: The necessity of risk management in insurance companies;

Section 2: Risk management under Solvency II.

Section 1: The necessity of risk management in insurance companies

1- Definition of risk

Risk; a word that evokes elements of, uncertainty, danger, threat, chance and hazard. These connotations usually include the possibility of loss, injury, or some other negative event.

The Cambridge dictionary defines risk as 'the possibility of something bad happening'.

Chapter I: Risk Management In Insurance Company

The International Organization for Standardization defines risk in a brief way; according to ISO 31000, risk is the "effect of uncertainty on objectives"[2] whether that effect is positive or negative compared to what was expected.

Another definition is given by the Committee of Sponsoring Organizations of the Tread way (COSO), as follows: 'risk is the possibility that an event may occur that adversely affects the achievement of enterprise objectives.'[3]

In a business context, risk has an upside as well as a downside. Without risk there would be no opportunity for return. A proper definition of risk, then, should recognize both its cause (a variable or uncertain factor) and its effects (positive and negative deviation from an expected outcome). Thus, risk could be defined as:

'A variable that can cause deviation from an expected outcome, and as such may affect the achievement of business objectives and the performance of the overall organization.'[4]

2- Risk management

Understanding risk is just a preliminary step toward managing it. In the following, we ought to define the concept of risk management.

2-1- Definition of Risk Management:

ISO 31000 defines Risk Management as "Coordinated activities to direct and control an organization with regard to risk".[5]

Risk management could be defined as 'a scientific approach to dealing with risks by anticipating possible losses and designing and implementing procedures that minimize the occurrence of loss or the financial impact of the losses that do occur.'[6]

This definition states the two techniques that are widely used in risk management:

- Risk control that focuses on minimizing the risk of loss and includes the techniques of avoidance, prevention and reduction.

[2] ISO, *International standard ISO 31000, Risk management Guidelines*, 2018.

[3] Robert R. MOELLER, *Executive's Guide to COSO Internal Controls: Understanding and Implementing the New Framework*, edition Wiley, 2013, p42.

[4] James LAM, *Implementing Enterprise Risk Management*, edition Wiley, 2017, p 36.

[5] ISO, *International standard ISO 31000, Risk management Guidelines*,2018.

[6] Emmett J. VAUGHAN & Therese M. VAUGHAN, *Fundamentals of Risk and Insurance*, Edition by Wiley, 2013, p 22.

- Risk financing that includes the tools of retention (by creating special funds to cover any losses) and transfer (insurance contracts), it concentrates on arranging the availability of funds to meet losses arising from the risks that remain after the application of risk control techniques.

Though, some large corporations choose to deal with their risks by acquiring an insurance company to cover part or all of their risks. These companies are commonly known as captive insurers. But generally, companies use a combination of methods to manage risks effectively, since these methods are not mutually exclusive, but complementary.

2-2- Objectives of Risk management

Mehr and Hedges (2016), in their classic 'risk management in the business enterprise', suggest the following classification of risk management objectives[7]:

2-2-1- Pre-Loss objectives

Important objectives before a loss occurs include:

- Economy by preparing for potential losses in the most economical way like safety programs and insurance premiums paid for instance;
- Reduction of anxiety since loss exposures can cause huge fear for the risk managers;
- Meeting legal obligations such as government regulations.

2-2-2- Post-Loss objectives

Which includes:

- Survival of the firm and its capacity to presume at least partially its activities;
- Stability of earnings, that could happen only if the firm continues to operate even if this could incur additional expenses;
- Continued growth;
- Social responsibility; by minimizing the effects that a loss will have on others such as employees, suppliers, customers, investors, creditors, and the community in general.

2-3- Limitations with traditional approaches to risk management:

In every business unit, functional experts are responsible for managing risks related to their unit, but if we take a closer look, we'll find several limitations to this traditional approach such as:

[7] Michael McNAMARA; George E. REJDA, *Principles of Risk Management and Insurance*, Edition Pearson, 2016, p 52.

1- Some risks might be on the horizon without capturing the attention of any of the silo leaders causing that risk to go unnoticed until it triggers a catastrophic event;
2- Some risks affect multiple business units in different ways. For some it could be obvious and innocuous while it may have a significant cumulative effect on other units of the organization who may fail to foresee it;
3- Individual responses to a particular risk might affect other aspects of a business by triggering a significant risk somewhere else in the business;
4- The focus of traditional risk management is related to internal operations with minimal interest on external risks.

3- Enterprise risk management (ERM)

Risk management evolved to include an organization-wide concept known as enterprise risk management (ERM) which is the latest name for a comprehensive risk management approach.

3-1- Definition of ERM:

According to The Federation of European Risk Management Associations (FERMA), ERM is defined as "a process designed to identify potential events that may affect the entity, manage risk to be within its risk appetite and provide reasonable assurance regarding the achievement of entity objectives."[8]

The Risk and Insurance Management Society (RIMS) defines ERM as "a strategic business discipline that supports the achievement of an organization's objectives by addressing the full spectrum of its risks and managing the combined impact of those risks as an interrelated risk portfolio."[9]

COSO's 2017 Framework defines ERM as: "the culture, capabilities, and practices, integrated with strategy-setting and performance that organizations rely on to manage risk in creating, preserving, and realizing value."[10]

A proper definition of ERM should describe what it is, its main objective and how it works. Thus, ERM may be defined as follows:

"ERM is an integrated and continuous process for managing enterprise-wide risks including financial, strategic, compliance, operational, and reputational risks in order to

[8] FERMA, *a risk management standard*
[9] https://www.rims.org/
[10] Robert R. MOELLER, *Executive's Guide to COSO Internal Controls: Understanding and Implementing the New Framework,* edition Wiley,2013, p 64.

minimize unexpected performance variance and maximize intrinsic firm value. This process empowers the board and management to make more informed risk/return decisions by addressing fundamental requirements with respect to governance and policy (including risk appetite), risk analytics, risk management, and monitoring and reporting."[11]

3-2- ERM frameworks

Frameworks are used for transmitting easily understandable ideas in other regions of the business world. It is a useful communication tool for something as complex as ERM especially since it remains until now poorly understood outside the practice of risk management itself. Therefore, a simple standardized framework helps managing complexity since the number of risks faced by organizations is constantly growing: strategic, operational, financial, reputational, legal- and compliance-related, and more recently, cyber security. Hence, a broadly accepted standardized model is a valuable goal.

Today two such models are in use internationally: the COSO ERM framework, and ISO 31000. These two frameworks take very different approaches to risk management and are suited to different kinds of organizations.

3-2-1- ISO 31000

ISO 31000 gained a very wide acceptance broadly and among large corporations as it is practical, it focuses on seeing both the positive opportunities and negative consequences associated with risk, thus, decision making is more effective that way, it is a guideline that helps organizations enhance the likelihood of achieving their objectives and increasing the protection of their assets and enables them as well to compare their activities with a benchmark standardized by ISO.

In a changing climate of business, in order to remain relevant, a revised version of ISO 31000 was published in 2018 to take into account the new challenges of the market since it was first released in 2009, this second edition cancels and replaces the first one.

3-2-1-1- the four main updates to ISO 31000

Compared to ISO 31000: 2009, the new version released in 2018:

- Provides more strategic guidance and recommends more involvement of risk management in the organization's structure, processes, objectives, strategy and activities;

[11] James LAM, *Implementing Enterprise Risk Management*, edition Wiley, 2017, p 67.

- Places a greater emphasis on the iterative nature of risk management, we can say it revolves around revising every process element, action and control at each stage of the process;
- Arranges the content by providing an open systems model that regularly exchanges feedback with its external environment so that it fits multiple contexts and needs.

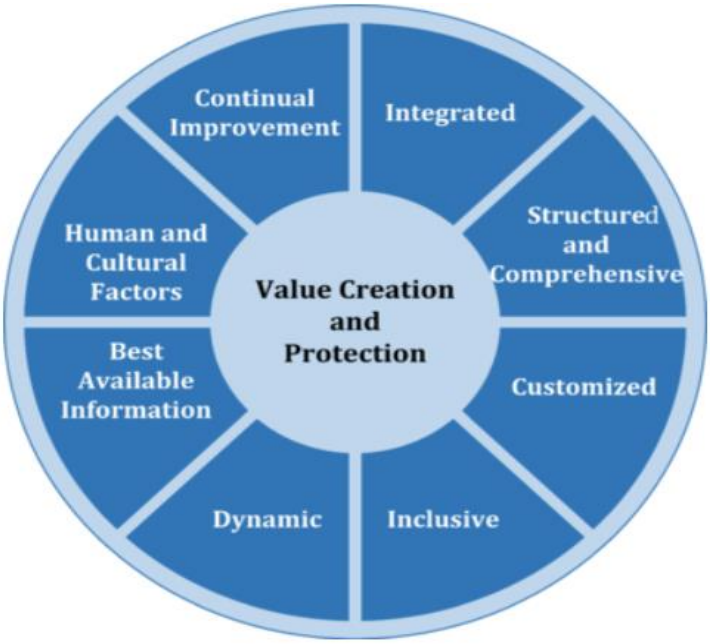
3-2-1-2- The three components of ISO 31000

It starts by providing risk professionals with a list of key risk management terms that have been carefully defined then it explains its three main components: principles of managing risks, framework of managing risk and process of managing risks.

a- ISO 31000 risk management principles

The principles are outlined in the following figure:

Figure 2: **ISO 31000 risk management principles**



Source: ISO 31000:2018, Risk management guidelines

The main purpose of risk management is the creation and protection of value, in order to reach that objective, there is a list of principles that should be considered when establishing the organization's risk management processes, and it should be:

- **integrated** in all organizational activities
- **Structured and comprehensive**

- **Customized** by taking in account the organization's external and internal context
- **Inclusive**: by timely involvement of stakeholders which improves awareness and informed risk management.
- **Dynamic**: in a changing context, risks can emerge, change or disappear therefore; risk management should anticipate, detect and respond to those changes in an effective and timely manner.
- **Best available information:** based on historical and current information, as well as all future expectations. It should be timely, clear and available to relevant stakeholders.
- **Human and cultural factors:** since human behavior influences different aspects of risk management at each level.
- **Continual improvement**: Risk management is continually improved through learning and experience.

b- ISO 31000 risk management framework

The purpose of this framework is to help the organization in integrating risk management into its processes, activities and functions.

The components of a framework are illustrated in the following figure:

Figure 3: ISO 31000 risk management framework

Source: ISO 31000:2018, Risk management guidelines

The organization should evaluate its existing risk management practices and evaluate any gaps and include those gaps within the framework:

- **Leadership and commitment**

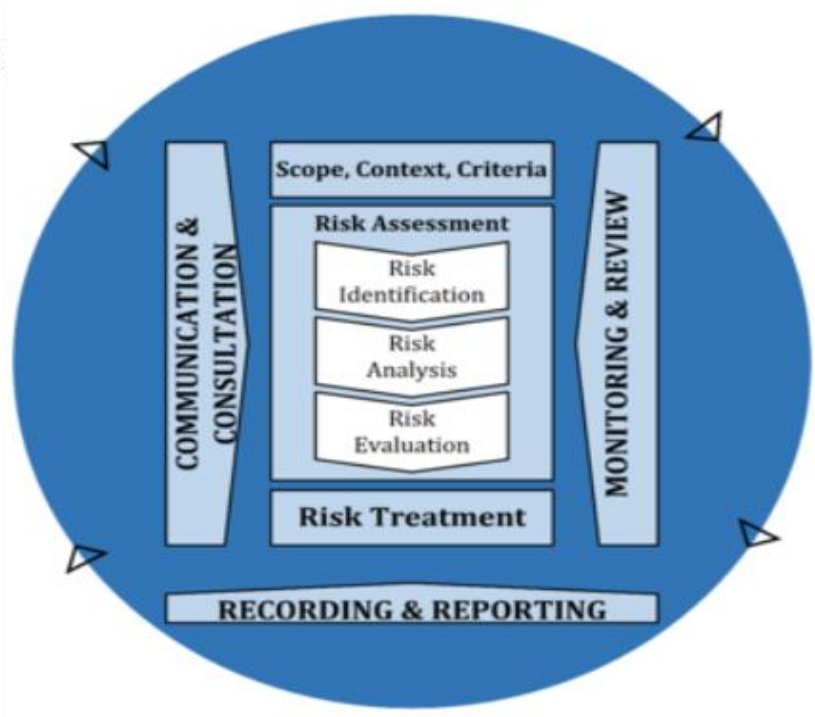
Top management is responsible of the full integration of an appropriate risk management framework into all organizational activities;

- **Integration;**
- **Design** by a perfect understanding of organizational structures and context;
- **Implementation:** this framework should be implemented by the development of an appropriate plan including time and resources;
- **Evaluation** an effective evaluation measures periodically the risk management framework performance against its purpose;
- **Improvement:** provides continuous suitability, adequacy and effectiveness of the risk management framework.

c- Process

The process is outlined below:

Figure 4: ISO 31000 risk management process



Source: ISO 31000:2018, Risk management guidelines

- **Communication and consultation:** help relevant stakeholders to better understand the risk the basis on which decisions are made;

- **Scope, context and criteria:** we need to outline the considered scope, the external and internal context and the used risk criteria (the type of risk that might be taken and the evaluation criteria);
- **Risk assessment:** includes the overall process from risk identification to risk analysis and risk evaluation;
- **Risk treatment:** among all risk treatment options we ought to select the most appropriate regarding a balance between the potential gains and costs, effort or disadvantages of implementation. Which involves risk avoidance, risk acceptance in attempt to seize an opportunity; risk transfer through buying insurance or risk prevention by removing the risk source and changing the likelihood of its occurrence;
- **Monitoring and review:** in order to assure the effectiveness of process design, implementation and the quality of outcomes;
- **Recording and reporting:** for communication purposes, appropriate mechanisms should be used to document and report the process and its outcomes.

3-2-2- COSO1, COSO 2 and COSO 3

COSO is a joint initiative of five major U.S. accounting industry organizations, including the Institute of Management Accountants (IMA), the American Accounting Association (AAA), the American Institute of Certified Public Accountants (AICPA), the Institute of Internal Auditors (IIA), and Financial Executives International (FEI).[12]

COSO first published a framework for internal control in 1992, which was adapted in 2004 as an integrated ERM framework, this framework was meant to assist management teams as they identify, assess, and manage risk. It is distinguished from others thorough its inclusion of all possible risk levels and responses. However, to some this almost full inclusion made it seem complicated and hard to use.

In June of 2017, the COSO new guidance on ERM entitled “Enterprise Risk Management - Integrating with Strategy and Performance (the “Framework”)” was released replacing the previous ERM guidance of 2004.

3-2-2-1- The structure of COSO 1

This framework had 3 main objectives in relation with:

[12] James LAM, *Implementing Enterprise Risk Management*, edition Wiley, 2017, p 22.

- **Operations:** the effectiveness of the running operations and the expected performance;
- **Reporting:** periodically and in an iterative way;
- **Compliance:** with the applied laws and regulations in a particular business.

It has 5 components as well:

- **Control environment**: shaping company culture, its ethical values and risk appetite;
- **Risk assessment:** an evaluation of risk based on its impact and probability of occurrence;
- **Information and communication:** since information are the basis of decisions;
- **Monitoring activities;**
- **Control activities:** establishing procedures of control to ensure appropriate response when needed.

3-2-2-2- The Structure of COSO 2

In 2004, the London-based Tread way Commission's Committee of Sponsoring Organizations released “Enterprise Risk Management-Integrated Framework”, which provided a host of "best practice" standards for companies to use in implementing ERM programs.

This updated framework named COSO 2 is a set of four basic entity objectives, the three old ones regarding operations, reporting and compliance plus a new strategic objective of high level related to mission-oriented goals.

The eight components of COSO 2 include aside from the five components of COSO 1, three additional ones regarding:

- **Objective setting:** fixing goals within the four objectives;
- **Event identification:** outlining internal and external risks and opportunities;
- **Risk response:** deciding whether to avoid, accept, reduce, or share risk.

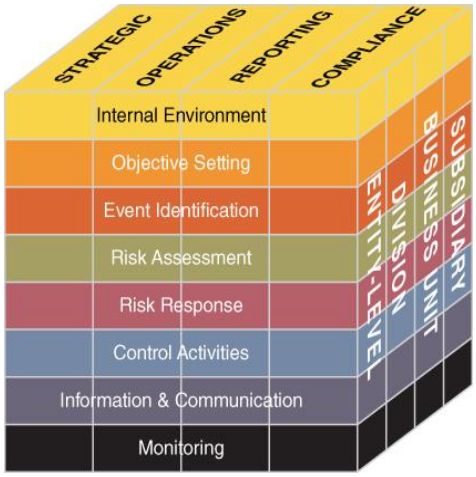
In both versions, the framework is a cube-shaped matrix, one dimension of the framework provides the categories of entity objectives and the second dimension shows a list of components.

COSO avoids such a sequential view of these elements, it chooses instead to emphasize their interconnected nature as illustrated in the following two figures:

Figure 5: **COSO 01 cube**

Source: COSO, a framework for internal control, 1992

Figure 6: **COSO 02 cube**



Source: COSO, an integrated ERM framework, 2004

3-2-2-3- The structure of COSO 3:

Since the publication of the 2004 ERM guidance, concepts and practices of risk management have been evolving continuously; this dynamic nature of risk justifies the need for an updated framework. Therefore, a new version was released in 2017, although, little is new in that one compared to the version published in 2004, it focuses on the integration of ERM with strategy and emphasizes the role of governance and culture providing a comprehensive framework and helps integrating these aspects.

The Framework itself is a set of principles organized into five interrelated components:

- **Governance and culture:** governance sets the oversight responsibilities while culture pertains to desired behaviors;
- **Strategy and objective-setting**: enterprise risk management, strategy, and objective-setting are interrelated in the planning process. A risk appetite is aligned with strategy; business objectives are necessary to put strategy into practice;

- **Performance**: risks need to be identified, assessed and prioritized by severity in the context of risk appetite. Afterwards, the organization then selects risk responses and takes a portfolio view of the amount of risk it has assumed;
- **Review and revision**: by considering the quality of performance of the functioning components and deciding what revisions are needed;
- **Information, communication, and reporting**: enterprise risk management requires a continual sharing of information, from both external and internal sources, which flows down, up, and across the organization.

Those five components in the updated Framework are supported by a set of principles illustrated below. They're adaptable with any corporation size, type, or sector, and they prescribe practices that can be applied in different ways. Following these principles can provide top management with a reasonable expectation and helps to manage the risks related to its strategy and business objectives.

Figure 7: Enterprise Risk Management Integrating with Strategy and Performance, components and principles.

Source: COSO, Enterprise Risk Management Integrating with Strategy and Performance, executive summary

Section 2: Risk Management under Solvency II

In fact, it is not possible to talk about international standards to regulate insurance companies world-wide. In the United States, the regulation of insurance companies is handled at the state level with some input from the Federal Insurance Office and the National Association of Insurance Commissioners. However, in Europe, insurance companies are regulated by the European Union. In 2016, the long-standing regulatory framework in Europe, known as Solvency I was replaced by Solvency II. Nevertheless, Quantitative Impact Studies are still carried out.

1- Solvency II guidelines

According to the official website of the European Union, the Solvency II regime introduces for the first time a harmonized, sound and robust prudential framework for insurance and reinsurance firms in the EU. It is based on the risk profile of each individual insurance company in order to promote comparability, transparency and competitiveness.[13]

Solvency II, as its name implies, is the second version of the European Insurance Regulatory framework. It replaces a patchwork of 14 rules commonly known as 'Solvency I'.

1.1.Solvency I shortcomings:

The 'Solvency I' has existed for 40 years, all along these years, it presented several weaknesses that consisted basically of a lack of risk sensitivity; we could count a number of key risks, including market, credit and operational risks that were either not captured in capital requirements or were not properly taken into account in the one-model-fits-all approach. The consequences of this lack of risk sensitivity are:

- The extreme simplicity of the model does not lead to a quite accurate risk assessment of each insurer;
- It does not ensure accurate and timely intervention by supervisors;
- It does not entail an optimal allocation of capital.

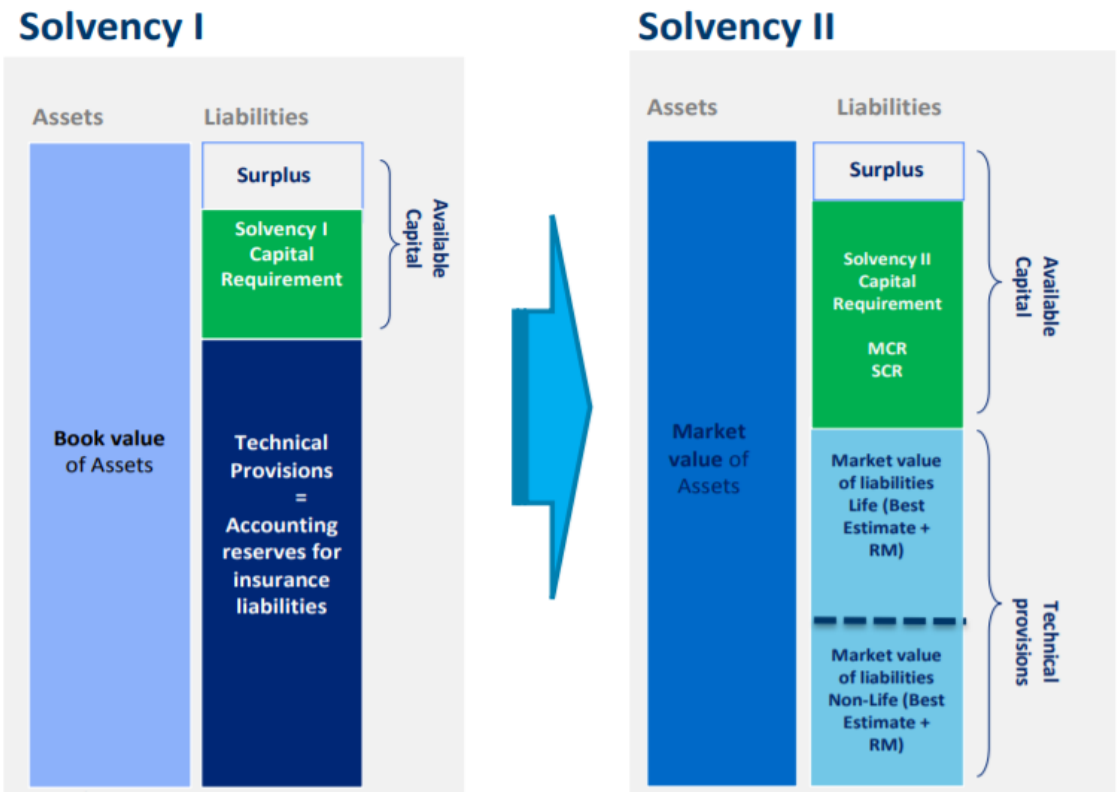
Therefore, the Solvency II guidelines proposes to remedy these shortcomings by introducing prudential requirements customized to the specific risks which each single insurer

[13] https://ec.europa.eu/info/business-economy-euro/banking-and-finance/insurance-and-pensions/risk-management-and-supervision-insurance-companies-solvency-2

faces. Moreover, it considers investment risks and operational risks while calculating the required capital whereas Solvency I take only underwriting risks into account.

The following illustration highlights the main differences between the two versions of this solvency directive.

Figure 8: fundamental differences between solvency I and solvency II



Source: KBC Group, solvency II external communication, 2016

1.2.The Solvency II framework

The main purposes of this directive are to increase the protection of policyholders, create a level playing field for the insurance industry in the European market and ensure substantially uniform supervisory practices throughout Europe.

This framework sets out regulatory requirements covering financial resources, governance, risk assessment and management, supervision and reporting, it is based on 3 pillars and consists of:

- A directive;
- Implementing rules;
- Technical standards.

a- Pillar 1 (quantitative requirements):

Pillar 1 is a risk-based calculation of capital requirements and the types of capital that are eligible; it determines a Minimum Capital Requirement (MCR) as well as a Solvency Capital Requirement (SCR).

Its capital should not fall below the SCR level but in case it did, the insurance company is meant to, at minimum, deliver a plan to restore the capital to above the SCR level. Particular corrective measures might be required by the supervisor. The MCR is considered as an absolute minimum level of capital (typically between 25% and 45% of the SCR[14]). If capital drops below the MCR level, supervisors may prevent the insurance company from taking new business or might force the company into liquidation.

To calculate the SCR; we can use the standardized approach or the internal models' approach. The internal models approach involves a (VaR) calculation with a one-year time horizon and a 99.5% confidence limit.

The SCR involves a capital charge for investment risk, underwriting risk, and operational risk.[15] Investment risk includes market risk and credit risk, underwriting risk encompasses risks arising from life insurance, non-life insurance, and health insurance. Besides those risks, this capital should be adequate to deal with some large adverse events and some specified catastrophic risk scenarios.

The internal models must satisfy three tests:

- A statistical quality test which examines the soundness of the used data and methodology in calculating var;
- A calibration test, tests the accordance of the used risk assessment method with a common SCR target criterion;
- A use test, which shows whether the model is genuinely relevant to be used by risk managers.

b- Pillar 2 (qualitative requirements)

The European Solvency II Directive establishes the ground rules for good governance, as well as the details of the supervisory process

[14] John C. HULL, *Risk Management and Financial Institutions, Edition Wiley*, 2018, p 89.
[15] Ibid, p 92.

The main articles fall into the following four major categories:

- **New supervision process (from article 27 to 39)**[16]

This process should be based on permanent dialogue with the regulator who can sanction any quantitative or qualitative divergence from expected standards through 'capital add-ons'.

- **Risk governance (from article 41 to 49)**[17]

Those articles set out general governance requirements as well as the key functions and the scope in risk management and explain the principle of proportionality of the risk system in relation to the complexity of the risk profile.

- **Internal model (from article 120 to 126)**[18]

Those requirements ensure that the internal model is used effectively in monitoring (operational risk management, capital allocation)

- **Own Risk And Solvency Assessment (ORSA) (article 45)**[19]

A host of processes and procedures used to identify, assess, monitor, control and report internal and external short-term and long-term risks that an insurer faces or could face. These risks are used to determine the company's capital requirement to ensure its solvency at all times.

c- Pillar 3 (transparency and disclosure)

The reporting requirements are set out in Pillar 3 of the Solvency II framework and contain a mixture of quantitative elements that include the technical provisions, own funds and other data on the business and qualitative ones divided into three reports:

- The solvency and financial condition report (SFCR), which is publicly available;
- The regular supervisory return (RSR), which is sent privately to supervisors;
- The ORSA report.

[16] Directive 2009/138/Ec Of The European Parliament And Of The Council Of 25 November 2009.
[17] Ibid
[18] Ibid
[19] Ibid

2- Focus on the quantitative impact studies (QIS)

QIS5 is the latest in a series of quantitative studies initiated by the European Commission in order to ensure the most accurate formulation of the Solvency II framework. QIS1 to QIS4 took place between 2005 and 2008; QIS 5 was released in 2010. The results of these studies provided the empirical basis for the preparation by the Commission of the Solvency II Directive (2009/138/EC). The Solvency II Directive was accompanied by a number of detailed technical rules laid down in implementing measures.[20]

2-1- The solvency capital requirement (SCR)

The Solvency Capital Requirement (SCR) is the risk-based capital requirement for undertakings under Solvency II. It is calibrated to a 99.5% (VaR) confidence level over one year.

In structure, the SCR is composed of a number of 'modules' which in turns are composed of 'sub-modules'. The capital requirements arising from these sub-modules and modules are aggregated using a correlation matrix.[21]

The SCR is divided into the following risk modules:

• Non-life underwriting risk;

• Life underwriting risk;

• Health underwriting risk;

• Market risk;

• Counterparty default risk;

• Operational risk;

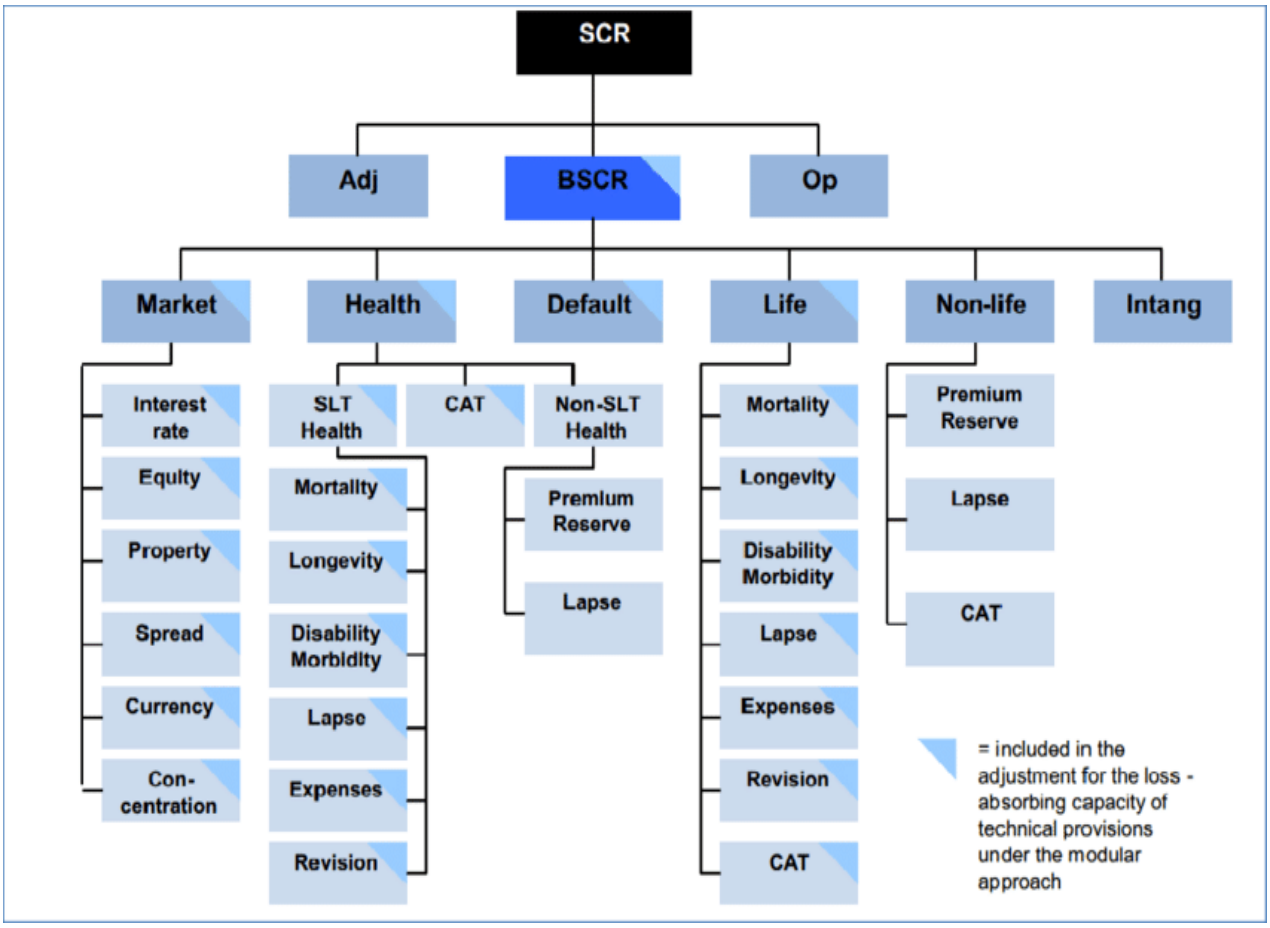
• Intangible assets risk.

The diagram below illustrates furthermore the structure of the SCR under the standard formula (modules and sub-modules):

[20] https://ec.europa.eu/commission/presscorner/detail/en/IP_11_316

[21] EIOPA Report, *the fifth Quantitative Impact Study (QIS5) for Solvency II*, 2011, p 63.

Figure 9: the structure of SCR under the standard formula of solvency II



Source: eiopa.europa.eu

2-1-1- SCR calculation

The SCR is determined as follows[22]:

$$SCR = BSCR + SCROp + Adj$$

SCR = The overall standard formula capital requirement

BSCR = Basic Solvency Capital Requirement

SCRop = The capital requirement for operational risk.

[22] EIOPA, *draft of technical specifications QIS 5*, 2012, p73.

Adj = Adjustment for the loss absorbing effect of technical provisions, security mechanisms and deferred taxes in market risk, pension liability risk and counterparty default risk sub module.

2-1-2- The Minimum Capital Requirement (MCR)

The MCR is a lower, minimum level of security below which the amount of insurers' financial resources should not fall, otherwise supervisory authorities may withdraw authorization.

According to the fifth quantitative impact studies of solvency II (QIS5), the MCR is calibrated to 85% Value at Risk confidence level over one year and is subject to a corridor of between 25% and 45% of SCR.[23]

3- Focus On The Own Risk And Solvency Assessment Process (ORSA)

The Committee of European Insurance and Occupational Pension Supervisors (CEIOPS) defines ORSA as 'the entirety of the processes and procedures employed to identify, assess, monitor, manage, and report the short and long term risks a (re)insurance undertaking faces or may face and to determine the own funds necessary to ensure that the undertaking's overall solvency needs are met at all times'.[24]

Thus, we can conclude that the underlying objective of the ORSA is a tool to improve the risk management of EU insurers and reinsurers by promoting a better understanding of the company's overall solvency needs disclosing sufficient and clear information on a company's risk profile enhancing the board responsibility not to take on more risks than the capital base is allowing.

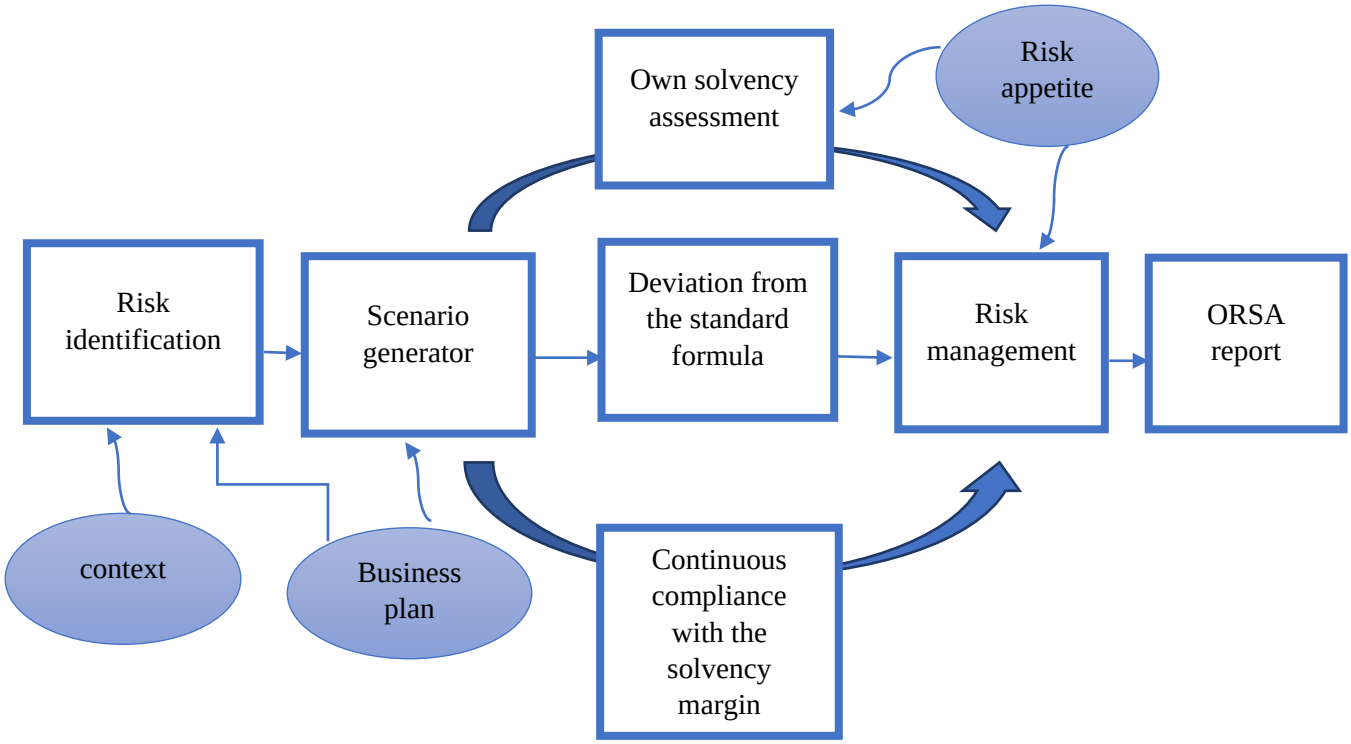
ORSA implementation follows a five steps process that essentially covers three major points:

- As applied, ORSA shows whether or not the risk management processes developed by the organization are appropriate;
- It is integrated into business strategy and is taken into account in the organization's strategic decisions. Its analyses and reports are taken into account by decision makers;
- The assessment can be performed following any significant change in the risk profile of the organization.

[23] EIOPA Report, *on the fifth Quantitative Impact Study (QIS5) for Solvency II,* 14 March 2011, p117
[24] EIOPS, *ORSA Issues Paper*, May 2008

The process is summarized in the following diagram:

Figure 10: The ORSA process



Source: la gestion des risques, Axelle BRAULT- FONTERS & al

The (ORSA) aims to make sure that the undertaking engages in the process of assessing all the risks inherent to its business and determines the corresponding capital needs. To achieve this, the insurance company needs to conduct the process[25] illustrated above:

- **The context analysis**

This analysis should be carried out according to at least two dimensions:

- **The financial context**: which includes the analysis of the evolution of the stock market, interest rates, the real estate markets…etc. in order to gain an insight of the economy and be able to foresee the market development over the horizon of the business plan.

[25] Axelle BRAULT- FONTERS & al, *la gestion des risques*, edition l'argus de l'assurance, 2016, p 159.

- **The technical context**: to analyze the technical context we need to examine the evolution of the competitors' performance and elements of the economic environment, which are likely to influence the company's losses, such as: the tax environment, the commercial development and profitability of underwriting activities.
- **Business plan**

The business plan is based on the analysis of the technical and financial context in addition to the risk appetite of the insurance organization. It formalizes the strategy as well as the actions to be implemented in order to achieve the objectives. Besides that, it is necessary to identify the impact of the strategy on the technical and financial balances of the company year by year on the horizon of the business plan.

- **Risk identification**

Insurers need to analyze all reasonably foreseeable and relevant material risks (i.e., underwriting, credit, market, operational, liquidity risks… etc.) that could have an impact on an insurer's ability to meet its policyholder obligations.

- **Scenario generator**

Scenario generator must make it possible to measure the financial situation of the company in different economic and financial environments by projecting the balance sheet and the income statements over the horizon of the business plan. These scenarios can be determined using a random generator, external data, a risk distribution scenario or expert judgment.

- **Own solvency assessment**

It is a question of evaluating the risks of the company most of the time at a 99.5% level of confidence over one year.

- **Deviation from the standard formula**

This part involves justifying the differences between the results of the SCR calculation using the standard formula and the capital requirements observed at the end of the internal solvency assessment.

The ORSA process should evaluate whether the capital available is sufficient to protect the company from future insolvency over the business plan horizon, within the context of its risk profile and strategy.

- **Continuous compliance with the solvency margin:**

The assessment of the compliance on a continuous basis with the regulatory capital and technical provisions requirements, the recognition and evaluation bases have to be in line with the relevant principles provided by Solvency II.[26]

If it is observed that the SCR is a prudent assessment of the solvency requirement in all circumstances of the company, we can be satisfied with the projection of the SCR only. Another approach consists of starting from an amount of loss equal to the SCR, to imagine the scenarios that could lead to this loss.

- **Risk management**

The undertaking should take into account the results of the (ORSA) and the insights gained during the process of this assessment in at least:

a) Its capital management;

b) Its business planning;

This step makes sure of the consistency of risk appetite, risk tolerance and risk limits with regard to the results of the ORSA, if the result is outside the scope of the risk appetite limit adopted by the organization, the risk management actions to be implemented should be specified. Its actions may result in the reduction of risk exposure or by the implementation of risk reduction strategies such as the use of reinsurance for technical risks or the use of hedges for risks financial.

- **The (ORSA) report:**

The undertaking should communicate to all relevant staff at least the results and conclusions of the ORSA.

[26] https://register.eiopa.europa.eu/Publications/Consultations/EIOPA-BoS-14-259_Final%20report_ORSA

4- Risks classification under solvency II

Risk terminology differs from an organization to another, and actuaries working in different organizations may use different terms to refer to the same risk, or use the same nomenclature for completely different risks. Therefore, a standard classification was introduced by the guidelines of solvency II; it outlines three major risk categories:

- Underwriting risks;
- Operational risks;
- Economic risks.

Each of these categories is further subcategorized.

Chapter conclusion

This chapter intended to describe the fact that any insurance company is exposed to a host of risks that can affect its activity and have serious consequences especially on its solvency. Therefore, knowledge and management of business risks are an integral part of every successful business strategy and are increasingly becoming a primary factor of competitiveness.

We have shed lights on the risk management system, which comprises a set of consecutive steps that begin with the company's definition of its risk appetite and objectives. Subsequently, it is necessary to identify risks, assess them, define and implement a strategy for risk mitigation and finally ensure the control of the device to ensure its effectiveness.

Managing risks efficiently requires the use of tools allowing the proper functioning of the risk management system including risk mapping, which appears to be one of the tools deemed the most relevant which will be the subject of our next chapter.

Chapter II:
Operational Risk Management under Solvency II

Chapter II: Operational Risk Management under Solvency II

Chapter introduction

Operational risk potentially exists in all business activities during the course of conducting day-to-day business operations; it encompasses a wide range of events and actions or inactions, such as fraud, human error, accounting errors, legal actions and system failures.

Insurance companies are complex entities that are ultimately responsible of managing the financial future of others. One of the worst possible scenarios for an insurance company is finding itself the target of lawsuits, or the subject of high-profile news stories linked to mis-selling, breach of fiduciary trust, breach of contract, or an inability to meet its obligations.

Therefore, a better understanding of this risk is necessary to manage it properly, a risk mapping process is deemed effective to identify measure, prioritize and mitigate eventually different operational risks.

This chapter gives an overview of different operational risks and risk mapping tools and approaches. As such, it is divided into two main sections:

Section I: The operational risks concept
Section II: Operational risk assessment

Section I: The operational risks concept

1- Overview of the risks related to the insurance sector

The international study "Insurance Banana Skins 2019"[27] was conducted by the Centre for the Study of Financial Innovation (CSFI), in association with PricewaterhouseCoopers (PwC). It surveys a sample of 927 insurance practitioners from 53 countries, based on their responses, it identifies the current risks (the banana skins) faced by the insurance industry and their main concerns about the sector over the next 2-3 years.

Respondents were asked to score each of the 22 topical risks in this survey from 1 to 5, where 5 is the most severe.

[27] The CSFI, Insurance Banana Skins, *survey of the risks facing insurers*, December 2019

The following table shows the major four categorizes

Table n°01: Major four categories of insurance risks

	2019	2017	variation
Operating risks	3.46	3.39	+ 8%
Economic environment	3.30	3.57	- 2.7%
Governance	3.12	3.18	- 6%
Public environment	3.20	3.14	+ 6%

Source: Insurance Banana Skins 2019 report

The obvious rise in operating risks and public environment is a huge source of anxiety to insurers world-wide, the threat of cybercrime and technology modernization challenge the industry's traditional structures as well as the introduction of IFRS 17 and other regulatory changes which could impose constraints on the industry, thus, insurers have concerns that the industry may fail to attract sufficiently qualified people to address change successfully.

1-1- The necessity of studying operational risk

Typically, operational risk is a neglected area in the insurance industry because companies tend to focus on the more traditional insurance and financial risks rather than how to run their business more efficiently even though, larger losses is often the cumulative effect of a number of smaller operational losses.

A firm can lose business opportunities while computer systems are down. When receiving a penalty notice for the late filing of documents or in case customer records are gone missing because of a data breach. These are the day to-day hazards of running a business beyond its money-making activities which could lead to heavy losses.

Recently, operational risk is gaining increasing importance in the management and corporate governance of insurance companies as it became recognized as a major distinct risk category following a number of large-scale insolvencies mainly in the banking industry. In these cases, significant losses were incurred due to operational failures, thus, the magnitude of these loss events strongly demonstrates the need for an adequate measurement and management of operational risks.

Chapter II: Operational Risk Management under Solvency II

1- A historical overview of operational loss events

One of the most mentioned events in this context is the bankruptcy of Barings Bank in 1995, the use of the term operational risk started after the Barings event in 1995, when a rogue trader caused the collapse of a venerable institution by placing bets in the Asian markets and keeping these contracts out of sight of management.[28]

In these early days, operational risk had a negative definition as "every risk that is not market and credit", which was not very helpful to assess and manage this risk, it took quite some time until this definition was abandoned and a more proper one was established.

Similar examples in the insurance sector include:

2-1- The AIG accounting scandal in 2005

In October 2000, AIG announced a decrease in their loss reserves by $59 million, which was followed by a drop of 6% of their stock in New York Stock Exchange. The top executives of AIG sought help from General Reinsurance Corporation who agreed to pay $500 million premium and shift $500 million worth of claims with little or no risk to AIG, $250 each in 2000 and 2001. Since there is no actual risk transferred, the transaction is not an insurance deal according to Insurance Accounting 101, which means the $500 million should not be categorized as income on its income statement. However, AIG accounted for the transaction as a normal reinsurance deal and recorded $500 million in their premium revenue, which increased the loss reserves to pay claims.

In 2005, AIG was caught in scandal for fraudulent accounting, sham reinsurance transactions with GenRe, cooking books and other wrongdoings. It has agreed to pay 1.64$ billion to federal authorities in the commission's settlement while General Re had to pay 92.2$ million.[29]

2-2- Premera Blue Cross data breach in 2015

According to ALGO FIRST database of IBM analytics, Premera Blue Cross, a Washington state-based health insurance provider disclosed on March 17, 2015, that confidential data of up to 11 million current and former customers had been compromised[30]. The stolen information included names, birthdays, e-mails and physical addresses, telephone numbers, Social Security numbers, and bank accounts.

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[28] https://content.naic.org/cipr_topics/topic_operational_risk.htm

[29] https://www.sec.gov/news/press/2006-19.htm

[30] IBM Algo FIRST, q*ualitative and quantitative database of external risk loss events*, 2016.

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According to the official website for the Premera Settlement: Premera will establish a $32 million settlement fund, which will be used to provide various benefits for Class Members affected by the data breach, it has agreed also to spend $42 million[31] over the next three years on enhanced security measures.

2-3- BUPA insurance data breach in 2017

Recently, most of the rising operational risks are related to information security and data breaches. In 2017, BUPA, a British international healthcare provisioning and multi-insurance group suffered a data breach affecting 500,000 customers when an employee fraudulently copied and removed information including names, dates of birth and some contact information and then posted them for sale on the dark web.

In 2018, the U.K's regulator has fined Bupa Insurance Services $228,000 after stolen data surfaces on dark web. [32]

2- Operational risk definition

Operational risk was a complicated topic to define, until the late 80s, it was a residual category for risks that are not identified as financial or market risks that were difficult to quantify and manage in traditional ways.

The Directive 2009/138/EC has outlined that operational risk means the risk of loss arising from inadequate or failed internal processes, personnel or systems, or from external events[33]. This definition is based on the underlying causes of such risks and seeks to identify why an operational risk loss happened, It also indicates the four dimensions of this risk: internal processes, people or systems, or from external events that could lead to reverse events, which cause losses.

According to the technical specifications of solvency II: operational risk should include legal risks, and exclude risks arising from strategic decisions, as well as reputation risks. The operational risk module is designed to encompass all risks that have not been explicitly covered in other risk modules.

[31] https://www.premerasettlement.com/
[32] https://ico.org.uk/about-the-ico/news-and-events/news-and-blogs/2018/09/bupa-fined-175-000-for-systemic-data-protection-failures/
[33] Directive 2009/138/EC of the European Parliament and of the Council of 25 November 2009 on the taking-up and pursuit of the business of Insurance and Reinsurance (Solvency II)

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The Bank of Algeria defines operational risk as follow:

Operational risk shall mean the risk of loss resulting from deficiencies or failures inherent to procedures, staff, internal systems or external events of banks and financial institutions. This definition excludes strategic and reputational risks but includes legal risk.[34]

3- Operational Risk Categorization (taxonomy)

Basel and Solvency use seven major categories, secondary categories, and sub categories of operational risk.

The following categories were identified based on ABI ORIC definitions[35]; however, this list is by no means exhaustive; the further one drills down into sub-categories, the greater the potential for overlap with other categories and for confused classification:

Table n°02: Operational risk 3 levels classification under solvency 2

Categories (level1)	Categories (level2)	Examples (level 3)
Internal Fraud	• Theft and Fraud • unauthorized activity	• circumventing regulations; • False insurance claims with internal complicity; • Pocketing premiums; • Fake documents when Agent (insurer) issues fake policies.
External Fraud	• Theft and Fraud • Systems Security	• Fraudulent claims by an external party (arson-for-profit) ; • Exaggerated claims (Overstating the amount of loss); • “Phishing”, hacking damage.

[34] Regulation 14-01 Of February 16th, 2014 Relating to Solvency Ratios Applicable To Banks And Financial Institutions, The Governor of the Bank of Algeria, article 20

[35] Association of British Insurers, the consortium database ORIC for insurers, 2012.

Employment Practices and Workplace Safety	• Employee relations; • Safe environment; • Diversity and discrimination.	• Strikes • All discrimination types (racial, sexual, religions, etc.); • Red lining; • Violations of employee health, safety and well-being rules.
Clients, Products & Business Practices	• Suitability; • Improper business or Market practices; • Product flaws; • Advisory activities • Selection and exposure	• Unintentional failure or negligence in meeting professional obligations to clients (the suitability of advice) • breach of faith • failure to examine well client status; • unfair, unclear or illegal terms of a contract • bribery; money-laundering
Damage to Physical Assets	• Disasters and other events	• Losses from damage to property from natural catastrophes (hurricanes, floods) or man-made events (vandalism)
Business disruption and system failures	• Systems security	• Losses due to hardware or software failure (computer crashes)

Delivery & Process Management	• Customer intake and documentation • Transaction capture, execution & maintenance • Customer / client account management • Monitoring and reporting • Trade counterparties • Vendors & suppliers	• errors in setting up contracts • Data entry, maintenance, or loading error • Legal documents missing/incomplete • asset managers; reinsurers outsourcers • Inaccurate external report (adjustor's report)

Source: The consortium database ORIC for insurers (Association of British Insurers, 2012)

4- The capital requirement challenge of operational risk

The key challenge for the regulator is to assess the operational risk capital charge at such a level that it encourages firms to assess operational risk more rigorously. Since the SCR should deliver a level of capital that enables an insurance undertaking to absorb significant unforeseen losses over a specified time horizon and gives reasonable assurance to policyholders that payments will be made as they fall due without penalizing those smaller firms that might not have the resources to undertake a more sophisticated assessment.

In this regard, the standard formula does not appear to work. However, the challenges of developing and internal model should not be underestimated as well; thus, the choice in approach is not obvious.

5-1- The different approaches to calculate the SCR

Under Solvency II, insurers have a choice of which methods they use to assess risk and capital, they could use the standard formula or an internal model (full or partial).

While some insurers will opt for the Standard Formula as the basis for an economic view of their business, others would choose an internal model that reflects better the company's risk profile, therefore, they should be aware of their advantages and limitations.

Chapter II: Operational Risk Management under Solvency II

5-1-1- The standard formula

In order to measure an operational risk (SCR_{OP}), the following inputs are necessary:

- $\mathbf{pEarn_{non-life}}$ = Earned premium during the 12 months prior to the previous 12 months for non-life insurance obligations, without deducting premium ceded to reinsurance
- $\mathbf{pEarn_{life}}$ = Earned premium during the 12 months prior to the previous 12 months for life insurance obligations, without deducting premium ceded to reinsurance
- $\mathbf{pEarn_{life-ul}}$ = Earned premium during the 12 months prior to the previous 12 months for life insurance obligations where the investment risk is born by the policyholders, without deducting premium ceded to reinsurance
- $\mathbf{Earn_{life}}$ = Earned premium during the previous 12 months for life insurance obligations, without deducting premium ceded to reinsurance
- $\mathbf{Earn_{life-ul}}$ = Earned premium during the previous 12 months for life insurance obligations where the investment risk is borne by the policyholders without deducting premium ceded to reinsurance
- $\mathbf{Earn_{non-life}}$ = Earned premium during the previous 12 months for non-life insurance obligations, without deducting premiums ceded to reinsurance
- $\mathbf{TP_{life}}$ = Life insurance obligations. For the purpose of this calculation, technical provisions should not include the risk margin, should be without deduction of recoverable from reinsurance contracts and special purpose vehicles
- $\mathbf{TP_{life-ul}}$ = Life insurance obligations for life insurance obligations where the investment risk is borne by the policyholders. For the purpose of this calculation, technical provisions should not include the risk margin, should be without deduction of recoverable from reinsurance contracts and special purpose vehicles
- $\mathbf{TP_{non-life}}$ = Total non-life insurance obligations excluding obligations under non-life contracts which are similar to life obligations, including annuities. For the purpose of this calculation, technical provisions should not include the risk margin and should be without deduction of recoverable from reinsurance contracts and special purpose vehicles
- $\mathbf{EXP_{ul}}$ = Amount of annual expenses incurred during the previous 12 months in respect life insurance where the investment risk is borne by the policyholders.

This module delivers the $\mathbf{SCR_{OP}}$, which stands for the capital requirement for operational risk, it is determined as follows[36] :

[36] EIOPA, technical specifications, QIS 5, 2012.

$$SCR_{OP} = \min(30\%.BSCR ; Op) + 25\%.EXP_{ul}$$

Where:

Op = Basic operational risk charge for all business other than life insurance where the investment risk is born by the policyholders is determined as follows[37] :

$$Op = \max(Op_{premiums}; Op_{provisions})$$

Where:

$$Op_{premiums} = 4\% \cdot (Earn_{life} - Earn_{life-ul}) + 3\% Earn_{non-life})$$

$$+ \max(0 ; 4\%(Earn_{life} - 1.1 \cdot pEarn_{life} - (Earn_{life-ul} - 1.1 \cdot pEarn_{life-ul})))$$

$$+ \max(0 ; 3\% \cdot Earn_{non-life} - 1.1 \cdot pEarn_{non-life})$$

$$Op_{provisions} = 0.45\% \max(0 ; TP_{life} - TP_{life-ul}) + 3\% \max(0 ; TP_{non-life})$$

The Basic Solvency Capital Requirement (BSCR) is the solvency capital requirement before any adjustments, combining capital requirements for the following six major risk categories:

- Market risk
- Counterparty default risk
- Life underwriting risk
- Non-life underwriting risk
- Health underwriting risk
- Intangible assets risk

The BSCR is determined as follows:

$$BSCR = \sqrt{\sum_{i,j} Corr_{i,j} * SCR_i * SCR_j} + SCR_{intangible}$$

Where the factors $Corr_{i,j}$ are the entries of the correlation matrix, and SCR_i , SCR_j are the capital requirements for the individual SCR risks according to the rows and columns of the correlation matrix.

[37] EIOPA, technical specifications, QIS 5, 2012.

Table n°03: The SCR standard formula correlation matrix

i j	Market	Default	Life	Health	Non-Life
Market	1				
Default	0.25	1			
Life	0.25	0.25	1		
Health	0.25	0.25	0.25	1	
Non-life	0.25	0.5	0	0	1

Source: QIS 5 technical specifications

The capital requirement for intangible asset risk $\mathbf{SCR_{intangible}}$ is calculated as follow:

$$\mathbf{SCR_{intangible} = 0{,}8 \cdot IA}$$

Where IA is the value of the intangible assets and its coefficient is fixed at 0,8.

5-1-2- The standard formula challenges

In this standard formula, the company's risks are measured based on certain pre-determined parameters. The advantage of a standard formula is that the capital requirements are relatively easy to calculate. The drawback obviously is that the risk landscape assumed to derive the parameters is only an approximation of the entity-specific risk landscape. The required capital can be over- or underestimated

One major limitation of the standard formula is the fact that it doesn't take into account certain risk mitigation effects and penalizes all companies equally with high capital charges despite the efforts that some are making to develop good practices to manage operational risks, which may encourage more companies to use partial or full internal models.

5-2- The internal models

The framework Directive of Solvency II (2009) does not define an internal model. The International Association of Insurance Supervisors (IAIS), however, has provided guidance and standards for internal models and defines this latter as:

A risk measurement system developed by an insurer to analyze its overall risk position, to quantify risks and to determine the economic capital required to meet those risks. [38]

[38] https://www.actuaries.org.uk/

Chapter II: Operational Risk Management under Solvency II

5-2-1- The expected benefits of internal models

- Improved risk sensitivity of SCR related to the insurer's specific profile;
- leading to higher competitiveness through better risk management and hence lower costs of capital;
- Cost efficiencies through re-use of risk modeling infrastructure for discussion with supervisors, rating agencies, analysts and shareholders;
- Enabling insurers to capture potential risks related to new technology and products, as these risks are not likely to be captured by historical loss data.

5-2-2- Internal models challenges

The main challenges that internal models face are:

- **Quality and Availability of data**

The information reported to management is often inaccurate, incomplete, untimely and not relevant. There are also gaps in information, which prevent management from monitoring their risk profile across all parts of the business and all risk types;

- **Biases in the Firm's Risk Profile**

Most high-profile losses in recent years were due to circumstances that firms did not foresee or misjudged. Management's view of their own firm's risk profile can be biased;

- **The obligation of meeting the tests and standards for internal model approval.**

5-2-3- Solutions

- Management needs good information to have visibility on their business and make sound business decisions. Achieving data quality requires regular review and validation of the data by the business. Where internal data is not abundant or sufficient, it is often useful to supplement it with external data such as external public and consortium information;
- A robust scenario process, which draws on the knowledge and experience of business experts, is also a very useful tool to help management achieve a better understanding of their firm's risk profile, in particular for the types of risks that might give rise to severe losses. If designed well, a good scenario process should primarily support

management decisions and will be used to drive the strategy and the business planning process.

Section II: Operational risk assessment

The article 44 of the Directive Solvency II stipulates that:

"Insurance and reinsurance undertakings shall have in place an effective risk-management system comprising strategies, processes and reporting procedures necessary to identify, measure, monitor, manage and report, on a continuous basis the risks, at an individual and at an aggregated level, to which they are or could be exposed, and their interdependencies."[39]

This article highlights the permanent nature of an effective risk management system, as it should be updated continuously. It outlines the concept of interdependencies that is sometimes perceived intuitively but hard to quantify. In addition, it sets a complete self-risk assessment process that guaranties if respected an effective risk management.

1- Own risk self-assessment (ORSA) process under Solvency II

The article 45 of the Solvency II Directive requires that:

"As part of its risk-management system every insurance and reinsurance undertaking shall conduct its own risk and solvency assessment."[40]

(EIOPA) defines the (ORSA) as "the entirety of the processes and procedures employed to identify, assess, monitor, manage, and report the short and long term risks a (re)insurance undertaking faces or may face and to determine the own funds necessary to ensure that the undertaking's overall solvency needs are met at all times."[41]

The ORSA is regarded as the heart of the Solvency II framework, and the first step in this process is identifying and assessing the risks inherent to the activity. To that end, some risk identification tools could be of use.

[39] https://www.eiopa.europa.eu/
[40] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32009L0138&from=EN
[41] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32009L0138&from=EN

Chapter II: Operational Risk Management under Solvency II

1-1- Risk identification

The risk identification process should encompass all reasonably foreseeable and relevant material risks. It is one of the most important steps in the entire process. Without a good identification, it is not possible to measure, prioritize or manage the risks.

1-1-1- Overview of some risk identification tools

The aim is to identify key organizational risks, the major business threats that could jeopardize its objectives.

Therefore, we could use:

a- internal data sources such as:

- **Brainstorming**

Initial brainstorming can be done individually, in small groups to gather ideas on hazards, threats, and vulnerabilities that can have an adverse impact on the business. They then position those risks according to how likely they believe they will occur and how serious they believe the impact would be.

- **Incident database**

An incident is a realized risk; it should be captured and registered. Incident reporting is considered an important source of risk management data for identifying and addressing the causes of errors that occur in organizations.

The creation of the database will help monitoring risks and the effectiveness of controls in place as well as feeding the internal model for the calculation of economic capital.

b- Or **external data sources such as:**

- **External databases**

Aside with the internal sources of data, it could be helpful to incorporate information from external business environment to be aware of emerging risks, regulatory developments and the emerging best practices of managing the risk.

Some key information sources are public loss data such as the one from IBM and SAS and the loss data consortium like ORX, GOLD and ORIC.

Only by combining internal and external sources, the risk identification will reflect the true understanding of the risk and enable an organization to select an appropriate risk response strategy.

1-1-2- Overview of risk identification approaches

It is possible to distinguish among the many possible methods two main approaches. The first, is to use the process to identify the various risks of the insurance company, the second is based on a census of risks by the executive committee. These two possibilities are not opposed but complementary:

1-1-2-1- Top-down approach

Top-down risk identification typically relies on sessions that include senior risk owners, members of the executive committee and heads of business lines. Sessions are best organized as brainstorming workshops with supporting techniques and tools. It provides a visibility on the main risks to which the Company is exposed.

1-1-2-2- Bottom-up approach

The starting point in this approach is the operational level, it is performed by a questionnaire, interviews or it could take place in an open space meeting, allowing greater freedom in the expression of the vision process for the low levels of the hierarchy.

One of the drawbacks of this technique is the fact that we might fail to see a beach because we are too busy observing the grains of sand, we may miss the big picture when it comes to risks and their interactions because identification takes place at a level that is too low in the organization.

1-2- Risk assessment

To assess a risk properly, it is advisable to make the difference between raw risk and residual risk:

- **Raw risk**, which measure the risk without any control, (lack of procedures, lack of internal controls, lack of computer system… etc.), it's the risk taken into account assuming the passive business.

For a good risk assessment, it is necessary to know how to appreciate the risk: by frequency levels (likely, likely, unlikely or unlikely) and according to a financial assessment of the impacts (what is the estimated cost of the occurrence of risk). The evaluation of a risk consists to provide defendable information on the frequency and impacts of risk.

Indeed, the raw risk can be summarized by the following equation[42]:

Raw risk = Predictable impact x Frequency of occurrence

1-2-1- The frequency of occurrence

It is recommended to use a scale of frequency from 1 to 4, from the least frequent to the most frequent since it is better to hold that: the more the risk is big, the greater the number should be.

The following table illustrates the scale of frequency proposed by the (IFACI) institute:

Table n°04 : Example of a frequency measuring scale

Rating	Frequency	Measuring details
1	Rare	Occurs once or twice in 3 years
2	Moderate	Occurs once a years
3	Occasional	Occurs a few times a year
4	frequent	Occurs daily or weekly

Source: IFACI, cahier de recherché

1-2-2- The impact

To measure the impact we need to answer the following question: what are the expected consequences of the occurrence of a risk?

We can break down the consequences to 3 main categories:

- Financial loss (a loss of income or an increase of costs) ;
- Legal (civil and / or penal liability ; professional penalties);
- Reputational damage.

We could opt for a more holistic view by analyzing the risks' impact on the capacity of achieving strategic objectives and executing all business operations as illustrates the following table.

[42] IFACI, la cartographie des risques, Cahier de la recherche, 2e édition, 2013.

Table n°05: Example of an impact measuring scale

Rating	Impact	Measuring details
1	Insignificant	Low impact on strategic objectives but no impact on business operations
2	Minor	Noticeable impact on strategic objectives and minimal impact on business operations
3	Moderate	Noticeable impact on strategic objectives and business operations
4	Significant	Serious impact on strategic objectives and business operations
5	Catastrophic	Catastrophic impact on the achievement of the entity's objectives

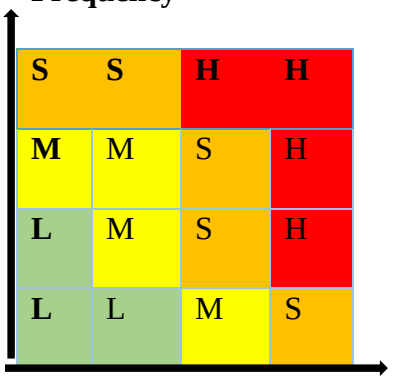
Source: IFACI, cahier de recherche

1-2-3- The raw risk heat map

Mapping is probably the most common risk identification and assessment visualization tool. A risk heat map is a two-dimensional representation of data in which values are typically represented by colors (often red, green, and yellow). In the risk assessment process, visualization of risks using a heat map presents a concise, big-picture view of the full risk landscape to discuss while making decisions about the likelihood and impact of risks within the company.[43]

After assessing the predictable impact as well as the frequency of occurrence, we can illustrate the raw risk in a heat map as follows:

Figure 11: Raw risk heat map



L	**Low risk**
M	Moderate risk
S	Significant risk
H	High risk

Source: IFACI, cahier de recherche

[43] https://www.iia.nl/actualiteit/nieuws/eight-steps-to-ceating-a-risk-heat-map

The raw risk is rarely supported by the company, because it would require a completely passive attitude of the latter. It is indeed its impact before intervention of the elements of protection, which lead to mitigate totally or partially the risk to contain it in acceptable areas in terms of consequences. These control elements thus transform the raw risk into a residual risk. It is also in this sense, that we can understand the value of an internal control system, which will contribute to the reduction of the likelihood of the risk occurring.

- **Residual risk** (or net risk): which measures the risk after implementation of the elements of control and risk mitigation (internal control, financial coverage, risk transfer… etc.).

the residual risk can be evaluated by the following equation[44]

Residual risk = Predictable impact x Frequency of occurrence – mitigation actions

To assess the residual risk, we should primarily identify the risk tolerance or level of willingness to accept risk and evaluate the state of mitigating controls that are designed to diminish effects of the inherent risk.

- **Risk tolerance** is the stated amount of risk a company is willing and able to take on in executing its business strategy. It represents the risk appetite variation on the different risk factors relevant to the insurer.[45]

Mitigation controls establish what should and should not be done, they either prevent errors from occurring (preventative) or find undesirable events and errors after they have occurred and mitigate their impacts (corrective) or even provide evidence as to whether the preventative controls are effective (detective).

The mitigation controls and measures could be evaluated as outlined in the next table:

[44] IFACI, la cartographie des risques, Cahier de la recherche, 2e édition, 2013.
[45] https://ermgovernance.com/

Table n°06: A scale of mitigation controls evaluation

rating		The mitigation controls
4	Effective	Measures able to reduce the frequency or impact of the risk and bring it to a satisfying level: written and detailed rules, formalized and applied controls.
3	Sufficient	Measures significantly reduce the frequency or impact of the risk: written rules but to be completed, existing and relevant control elements, formalized but to complete.
2	Average	Mitigating controls significantly reduce notably the frequency or the impact of the risk: oral rules, elements of control partially existing but not formalized.
1	Insufficient	Lack of mitigation control device: little or no rules, trusting the staff experience, little or no staff awareness of risks.

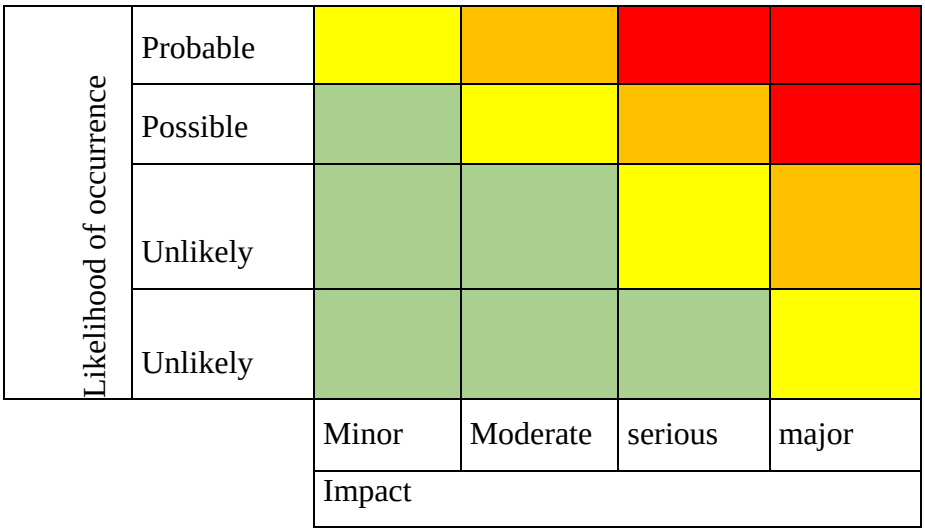
Source: IFACI, cahier de recherche

1-2-4- The residual risk map

A risk heat map is a tool used to present the results of a risk assessment process visually and in a meaningful and concise way.

Figure 12: A residual risk scale and heat map

L	**Low risk**	**Risk under control**
M	Moderate risk	Monitoring actions required but not urgent (caution)
S	Significant risk	Immediate measures needed (alert)
H	High risk	The most urgent attention is required



Source: https://www.dur.ac.uk/

1-3- The mitigation plan

In this step, we ought to identify a range of solutions to prevent, reduce and control the risks deemed to be a priority and agree on the best choice using available resources. The amount of resources allocated to each action should be in proportion to the expected results. There should be a balance between the costs of preventing the risk versus the cost of recovering in case it occurs.

Four main strategies are used to deal with different risks:

- **Risk Acceptance**:

Risk acceptance does not reduce any effects; however, it is still considered a strategy. It is a common choice when the cost of other risk management options, such as avoidance or limitation, may outweigh the cost of the risk itself.

- **Risk Avoidance**:

Risk avoidance is the opposite of risk acceptance. It is the action that avoids any exposure to the risk whatsoever.

- **Risk Limitation**:

Risk limitation is the most common risk management strategy used by businesses. This strategy limits a company's exposure by taking some action. It is a strategy employing a bit of risk acceptance along with a bit of risk avoidance or a combination of both.

- **Risk Transfer**:

Risk transference involves handing risk off to a willing third party such as outsourcing. It helps a company to focus more on its core competencies

1-4- Risk map update

Risk areas can change in intensity and new risk areas can occur. Hence, it is key to keep the risk map up-to-date and to monitor the implementation of the action plan. Because risks are not static, the process of identifying, understanding, evaluating and prioritizing risks must be repeated regularly in order to ensure that the key risks are being appropriately managed.

Senior management must periodically review what has happened in the recent past and assess whether risk management efforts produced the expected results. A risk mapping exercise should be carried out regularly so that progress can be registered and new threats taken into account.

Chapter conclusion

This second chapter starts by introducing the concept of operational risk, its taxonomy and quantification approaches under Solvency II. Then, attempts to highlight the importance of assessing and managing different operational risks through a risk mapping process.

Even if the managers of insurance companies have a vision and a global approach of the inherent risks to their activities, build a risks mapping can only bring them new elements of observation intended to master better and to direct their objectives. This is the reason why leaders must be convinced of a value of risk mapping, encourage and participate actively in its implementation.

Chapter III:
Operational Risk Mapping of the Automobile Line

Chapter III: Operational Risk Mapping of the Automobile Line

Chapter introduction

The previous two chapters were presenting a literature review that aimed essentially to discuss the importance of risk management and risk mapping in improving business performance.

In this chapter we will present the Algerian Company of Insurance and Reinsurance (CAAR) that has always been a very important operator on the Algerian market since its creation. This presentation will include a brief overview of its history, organization, and key figures.

The second part of this chapter will be dedicated to our case study, which is building a risk map of the major operational risks. We will follow the methodology previously explained in the theoretical part. The expected objective is to have a global view of risks to which the automobile insurance line is exposed and to propose control actions that aim to mitigate the identified risks.

Thus, this chapter will be divided into three sections:

Section 1: The presentation of CAAR insurance

Section 2: Operational risk capital requirements

Section 3: Building an operational risk map

Section I: presentation of the Algerian Insurance and Reinsurance Company (CAAR)

1- Presentation of (CAAR) insurance

1-1- History

The Algerian Insurance and Reinsurance Company (CAAR) is one of the first financial institutions of independent Algeria, under the supervision of the Ministry of Finance.

With roots that trace back to 1963, it was created by Law n° 63-197, in the form of a public establishment of a commercial nature. It was in charge of controlling and supervising foreign companies as well as it handled the management of insurance operations with a deduction of 10% of the premium collected.

Chapter III: Operational Risk Mapping of the Automobile Line

Authorized by the ministerial decree of February 26th, 1964 to deal with direct insurance operations, its scope of operation extends to all branches within the framework of a monopoly to the benefit of the State by ordinance 66- 127 of May 27th, 1966.

Today, the Algerian Insurance and Reinsurance Company (CAAR) is a Joint-stock company that has total assets of 17 billion dinars.[46]

In 2011 the (CAAR) created a new subsidiary specialized in personal insurance (CAARAMA)

1-2- The organizational structure

1-2-1- The headquarters

It is the central body responsible for designing the strategy and policy of the company and ensuring their implementation. (Appendix n°01).

1-2-2- The Regional Directorates (branches)

They are attached directly to the headquarters and ensure the coordination, animation, control and management of direct and indirect agencies. The distribution network of the (CAAR) products is currently made up of five regional offices:

- Algiers (BOUZERIAA)
- Algiers (CHERAGA)
- Annaba
- Constantine
- Oran

Each is made up of four departments, namely:

- Production department.
- Commercial department
- Claims department
- Administration and finance department

1-2-3- The agencies

The agency is defined as the nucleus of insurance activities. It represents a specific insurance company at a local level to solicits, negotiates, or instigates insurance contracts on behalf of an insurer within the limits of its delegated authority.

[46] https://caar.dz/chiffres/

1-3- The distribution network

The (CAAR) uses two main distribution channels:

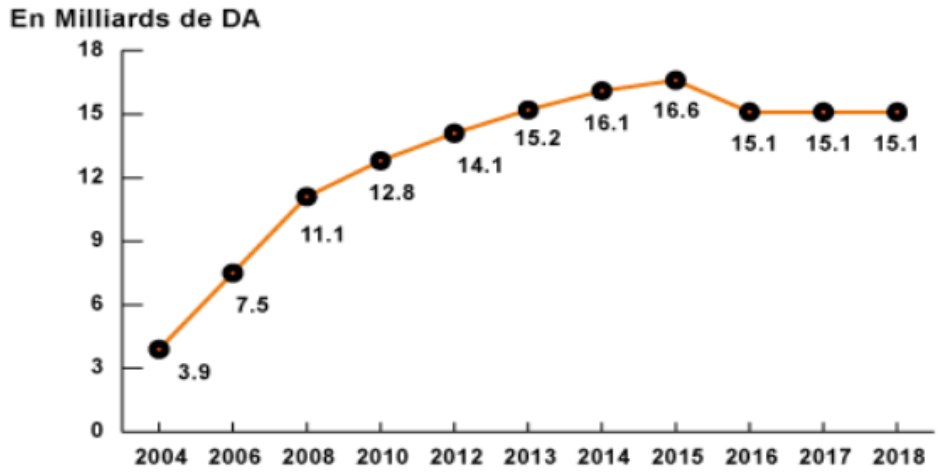
(90) Direct agencies located across the national territory

- **Captive or Exclusive Agent (direct writers): t**hey represent only one insurance company. They get paid by salary or commission or both. Insurance companies that use such Captive Agents are called Direct Writers. The (CAAR) has a network of 49 captive agents.
- **Independent agents (broker):** they are self-employed. They represent several insurance companies and are paid on commission only. Their mission is to solicit, write and bind policies through many different insurance companies. The (CAAR) works with 30 brokers.
- **Banccassurance**: An arrangement between an insurance company and a bank where the insurance company allows the bank to sell its products to this latter's clients. This partnership arrangement can be profitable for both companies. As for the (CAAR), it is in partnership with two public banks: the Popular Credit of Algeria (CPA) and the National Bank of Algeria (BNA).

2- The (CAAR) key figures

Figure n° : The evolution of the (CAAR) insurance turnover (in billions of DZD)

Figure 13: CAAR Insurance portfolio structure



Source: https://caar.dz/chiffres/

Table n°07: (CAAR) portfolio structure between 2017 and 2018

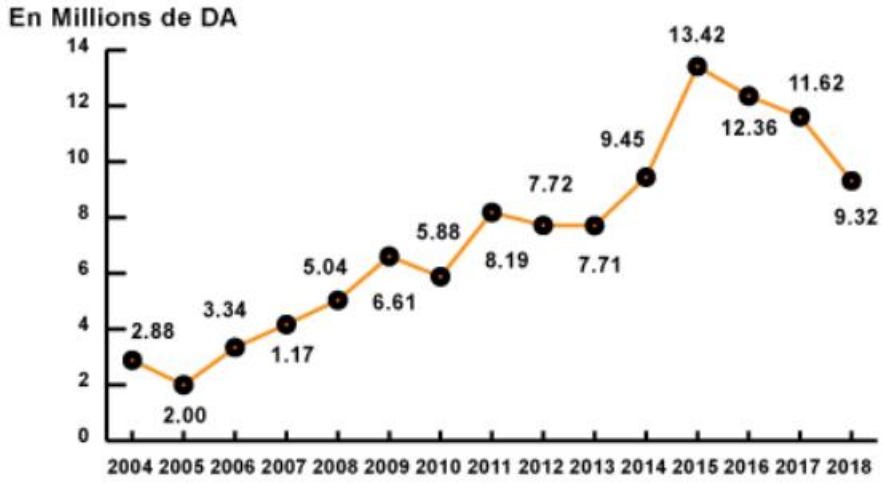
Branches	CA 2017	Structure du Portefeuille 2017	CA 2018	Structure du Portefeuille 2018	Evolution 2017/2018
Incendie	4 601 289	30%	4 035 336	27%	-12%
Engineering	1 344 858	9%	1 128 189	7%	-16%
RC	717 311	5%	808 827	5%	13%
RD/RS	400 689	3%	347 734	2%	-13%
Cat-Nat	463 374	3%	885 624	6%	91%
Total IARD	**7 527 521**	**50%**	**7 205 709**	**47%**	**-4%**
Transport	2 022 071	13%	1 753 394	12%	-13%
Automobile	5 568 506	37%	6 170 569	41%	11%
ADP	-	-	-	-	-
Crédit	35 929	0,2%	65 396	0,43%	82%
TOTAL	**15 154 026**	**100%**	**15 195 069**	**100%**	**0,3%**

Source: Annual report 2018 of the CAAR (in thousands of DZD)

Since 2004, the turnover curve had a positive slope until 2015 where we can clearly notice a slight decrease to remain steady afterwards till the end of 2018 where the company achieves a turnover of about 15.2 billion dinars. An increase of 0.3% compared to 2017, generated by the performance of the automobile line, with +11%, civil liability with +13%, and natural disasters with +91%.

Since 2015, as a result of non-compliance of pricing practices with the professional technical standards, the other casualty lines such as simple risks have decreased. Same for the engineering and cargo lines, whose performance has regressed as a result of the economic situation (slowdown in the economy in the launch of public investment projects and reduction of importation).

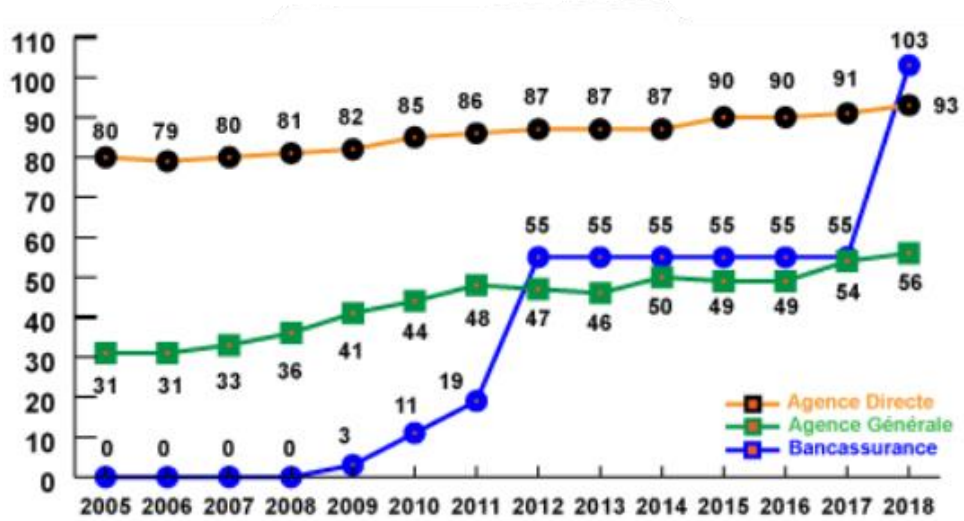
Figure 14: The evolution of compensations paid by (CAAR) insurance



Source: https://caar.dz/chiffres/

The figure above shows a steady increase in the amount of compensations during ten flourishing years (2004-2015) which reflects its ability to guarantee commitments to customers as well as a strong local presence. As from 2015, a decrease in compensations amount is witnessed and continues to illustrate the overall ebb in the underwriting activity as part of a stagnating economy.

Figure 15: Evolution of the (CAAR) network



Source: https://caar.dz/chiffres/

The figure above illustrates the company's network's obvious expansion in a dozen of years through banc assurance; the (CAAR) made arrangements with two bank-partners networks: the Popular Credit of Algeria (CPA) and the National Bank of Algeria (BNA). This distribution channel grants insurers access to banks networks, thus a much wider reach with less investment. It helps them cut operational costs as bank employees are closing the deals and taking responsibility, a similar reach through traditional channels would need them to hire several hundred agents in different parts of the country.

Since our case study is mainly carried out in the automobile insurance line in addition to the risk management directorate, we will briefly present them in the following pages.

3- Automobile insurance line

Some key figures of this line are outlined in the following table:

Table n°08: key figures of the (CAAR) automobile insurance line

				In Thousands of DZD
Automobile business line				
Earnings	**Portfolio Structure % 2017**	**Earnings**	**Portfolio Structure % 2018**	**Evolution 2017/2018**
5 568 506	37%	6 170 569	41%	11%
Compensations	**%**	**Compensations**	**%**	**Evolution 2017/2018**
5 114 707	44%	4 883 967	52%	-5%
Earnings 2018	**Ceded Premiums**	**Cession Rate**	**Received commissions**	**Commission Rate**
6 170 569	2 797	0,05%	140	5%

Source: Annual report 2018 of the CAAR

The automobile line, which has been showing signs of running out of steam in recent years as a result of restrictions on new vehicles importation, is recovering and is showing a strong rate of growth (11%) due to the underwritings of fleets, the adjustment of the civil liability tariff and the growing share of income generated by the product breakdown cover. However, compensations decreased of 5% in 2018 compared to 2017.

Finally, we ought to mention that in this specific line, the company uses its own resources to handle almost all claims without reaching out to reinsurance.

4- CAAR insurance products:

Automobile insurance coverage provided by CAAR is the following:

- **Auto liability coverage**

Auto liability coverage is mandatory in Algeria. Drivers are legally required to purchase at least the minimum amount of coverage, it has two components:

- **Bodily injury liability** may help pay for costs related to another person's injuries if you cause an accident.
- **Property damage liability** may help pay for damage you cause to another person's property while driving.

- **Comprehensive coverage**
- **Collision coverage:**
- **Breakdown coverage**
- **Theft and fire coverage**
- **Auto glass breakage coverage**
- **Defense, appeal and legal actions**
- **Insurance for transported persons**

Besides these products, CAAR offers a set of additional coverage options of excluded risks that can be redeemed by paying an additional premium such as: riot, earthquakes, Sabotage and terrorism insurance coverage.

5- Risk management directorate

The (CAAR) undertaking is fully aware of the fact that risks has intensified and diversified over the years to such an extent that risk management is now a main key success factor of business, and that a winning business is a business that is able to handle all situations. In other words, the creation and implementation of a Risk Management Department at the CAAR insurance is a response to the evolution of risks and the social, economic and financial environment of the overall insurance activity in Algeria.

By equipping itself with this new structure, the company has in fact equipped itself with an additional operational management tool and a valuable aid to strategic decision-making.

It was created by decision N ° 013 / CEO of 02/15/2012 [47]as part of the implementation of many changes of the organizational chart of the (CAAR).

The Risk Management Directorate includes two sub directorates:

A- Operational Risks (OR) sub directorate: a structure in charge of dealing with the various operational risks specific to the CAAR insurance;

B- Risk Control and Customer Assistance (RCCA): This provides advice for policyholders of the (CAAR) regarding their risk management.

Section II: The operational risk capital requirements

The solvency capital requirement (SCR) should deliver a level of capital that enables an insurance undertaking to absorb significant unforeseen losses over a specified time horizon and gives reasonable assurance to policyholders.

Under Solvency II, we have a choice of which methods to use to assess risk and capital, an internal model is more risk sensitive and more reliable since it reflects the real risk profile of the company. In the absence of an internal model in (CAAR), we use the standard formula of Solvency II.

In this part of the thesis, we are attempting to measure the required capital of operational risk (SCR_{OP}) of the company CAAR, determined as follows:

$$\mathbf{SCR_{OP} = \min(30\%.BSCR ; Op) + 25\%.EXP_{ul}}$$

Nevertheless, the unavailability of the basic solvency capital (BSCR) which requires a reassessed balance sheet to be determined within the company because of all the differences in accounting standards between Europe and Algeria made the calculation of the (SCR_{OP}) hard especially with the handing out deadlines and time pressure. Therefore, we are going to compare only the component **(Op)** of the Algerian insurance sector, the CAAR company and its Automobile insurance line. It is an estimation of the cost of operational risks and its capital

[47] CAAR, *quarterly review of the n°67*, January, February, March 2019.

charge under Solvency II as per quantitative impact studies QIS5 technical specifications already mentioned in the first part of this study.

(Op) stands for the basic operational risk charge for all business other than life insurance where the investment risk is born by the policyholders is determined as follows[48] :

$$\mathbf{Op = max\ (Op_{premiums};\ Op_{provisions})}$$

Where:

$$\mathrm{Op}_{\mathbf{premiums}} = \mathbf{4\% \cdot\ (Earn_{life}\ - Earn_{life-ul}\ ) + 3\%\ Earn_{non-life}\ )}$$

$$\mathbf{+\ max(0\ ;\ 4\%(Earn_{life}\ - 1.1 \cdot pEarn_{life}\ - (Earn_{life-ul}\ - 1.1 \cdot pEarn_{life-ul}\ )))}$$

$$\mathbf{+\ max(0\ ;\ 3\% \cdot Earn_{non-life}\ - 1.1 \cdot pEarn_{non-life}\ )}$$

We use the premiums of the last 12 months and possibly the previous 12 months in case of an increase of 20% in premiums).

$$\mathrm{Op}_{\mathbf{provisions}} = \mathbf{0.45\%\ max(0\ ;\ TP_{life}\ - TP_{life-ul}\ ) + 3\%\ max\ (0\ ;\ TP_{non-life}\ )}$$

1- The (Op) charge of the CAAR Company:

In order to measure an operational risk (Op), the following inputs are necessary:

- $\mathbf{pEarn_{non-life(2017)}}$ = earned premium during 2017, for non-life insurance obligations, without deducting premium ceded to reinsurance.
- $\mathbf{Earn_{non-life(2018)}}$ = earned premium during 2018 for non-life insurance obligations, without deducting premiums ceded to reinsurance.
- $\mathbf{TP_{non-life(2018)}}$ = total non-life insurance obligations excluding obligations under non-life contracts.

because of the market specialization and the separation between property and casualty insurances and personal insurances instituted by the Law N°06-04 in Algeria since July 2011 and the fact that CAAR is a P&C insurer, other inputs related to life insurance are not needed.

[48] EIOPA, *technical specifications, Quantitative Impact Studies (QIS* 5), 2012.

Chapter III: Operational Risk Mapping of the Automobile Line

1- The difference between earned premiums in 2018 and 2017:

Table n°09: CAAR total earned premiums

	2017	2018	evolution
CAAR earned premiums	15 154 026,00	15 529 621,00	0.27%

Unit : thousand DZD

Source: developed by the author

Since the increase in earned premiums between 2017 and 2018 is less than 20%, $Op_{premiums}$ is determined as follows:

$$Op_{premiums} = 3\% \; Earn_{non-life(2018)}$$

Thus, Op is detemined as follows : $\mathbf{Op = max\ (Op_{premiums(2018)};\ Op_{provisions(2018)})}$ given that: $Op_{provisions} = 3\%\ max\ (0\ ;\ TP_{non-life(2018)})$

Table n° 10: the CAAR Op charge

	2018
CAAR earned premiums	15 529 621,00
$\mathbf{Op_{premiums}}$	465888,07
CAAR $\mathbf{TP_{non-life(2018)}}$	11 259 948,00
$\mathbf{Op_{provisions}}$	337798,44
CAAR (Op)	**465888,07**
technical result	989 360
CAAR (Op) / technical result	**46.07%**
Net income	628 433
CAAR (Op)/ Net income	**72.53%**

Unit : thousand DZD

Source: developed by the author

As per key figures of year 2018, if CAAR insurance decides to follow the Solvency II guidelines, it has to allocate a capital of **465 888 070 DZD**, to absorb unforeseen operational losses if Op is greater than 30% of its BSCR. Which represents **3%** of the earned premiums.

This charge consumes **46.07%** of the company's technical result and **72.53%** of the net income of the year 2018.

2- The (Op) charge of the CAAR Automobile business line:

Same inputs of the previous part but only relating to the Automobile line.

2-1- The difference between earned premiums in 2018 and 2017:

Table n° 11: the CAAR Automobile line earned premiums

Unit : thousand DZD

	2017	2018	evolution
CAAR Automobile line earned premiums	5 568 306,00	6 170 369,00	10.81%

Source: developed by the author

Automobile insurance premiums increased by 10%, since it's less than 20% we are only using earned premiums of 2018.

Table n° 12: the CAAR Automobile line Op charge

	2018
CAAR Automobile line earned premiums	6 170 369
$Op_{premiums}$	185111.07
Automobile $TP_{non-life(2018)}$	4327430
$Op_{provisions}$	129822.9
Automobile (Op)	**185111.07**

Unit : thousand DZD

Source: developed by the author

To absorb operational risks related to the Automobile business line, the CAAR company needs to allocate a capital of **185 111 070 DZD,** which represents **3%** as well of the earned premiums of the year 2018, and **1.21%** of the total earned premiums of the company. There is no discrepancy between the capital Op of the company and the Automobile line. The Op charge of the Automobile line represents 40% of the Op charge of the company, this is due to the importance of this business line within CAAR.

3- Comparison with the (Op) charge of the Algerian insurance sector

In order to be fair, we are comparing CAAR figures of 2018 to the rest of the property and casualty Algerian insurance sector.

3-1- The difference between earned premiums in 2018 and 2017*:*

Table n°13: P&C insurance sector earned premiums

	2017	2018	evolution
P&C insurance sector earned premiums	113 268 402	117 746 352	3.9%

Unit : thousand DZD

Source: developed by the author

The earned premiums of the property and casualty algerian insurance sector increased slightly by 3.9%, which is less than 20%. Therefore, we are using 2018 earned premiums only.

Table n° 14: the P&C insurance sector Op charge

	2018
P&C sector earned premiums	117 746 352
$\mathbf{Op_{premiums}}$	3 532 390,56
$\mathbf{TP_{non-life(2018)}}$	78 679 675
$\mathbf{Op_{provisions}}$	2 360 390,25
P&C sector Op	**3 532 390,56**
Sector technical result	41 475 000
P&C sector Op/ Sector technical result	**0,085169152**

Unit : thousand DZD

Source: developed by the author

The operational risk capital to be set aside so as the entire property and casualty Algerian sector could handle any operational loss is 3% of its earned premiums, the equivalent of 8.5% of its technical result. The conclusion we can make so far is that this charge could impact companies in different ways since it could absorb 46% of the CAAR technical result while it costs the entire sector 8.5%.

4- Comparison with the (Op) charge of the Algerian Automobile insurance sector

4-1- The difference between earned premiums in 2018 and 2017:

Table n° 15: Automobile sector total earned premiums

	2017	2018	evolution
Automobile sector earned premiums	61144180	64446400	5%

Unit : thousand DZD

Source: developed by the author

Automobile insurance premiums increased by nearly 5%, since it's less than 20% we are only using earned premiums of 2018.

Table n° 16: the automobile insurance sector Op charge

	2018
Automobile sector earned premiums	64446400
$\mathbf{Op_{premiums}}$	1933392
$\mathbf{TP_{non-life(2018)}}$	34019000
$\mathbf{Op_{provisions}}$	1020570
Automobile sector Op	**1933392**

Unit : thousand DZD

Source: developed by the author

As for the Automobile business line, the Op charge of the Algerian sector is 1 933 392 000 DZD, which represents 54.7% of the Op charge of the P&C sector in Algeria. As for CAAR insurance, the Op related to the Automobile line is 40% of its total Op charge.

Section III: Building an operational risk map

This section is dedicated to design and build a risk map of different operational risks in the automobile insurance line, in this part we will follow the combined approach previously presented.

The first phase involves identifying the foreseeable risks and the existing mitigation controls. We will then proceed to the assessment and analysis of these risks as well as their

prioritization by zone according to their degree of criticality; finally, we will propose an action plan, which is the ultimate purpose of every risk-mapping project.

1- The risk mapping process

1-1- The choice of risk map

Since comprehensive mapping is a long process that requires a lot of time and resources to identify the entirety of risks related to all activities of the insurance company, we opted for the creation of a thematic assurance map with a limited scope that only focuses a specific business line which is the automobile insurance line.

1-2- The choice of approach

The "Top-down" approach relies on sessions that include senior risk owners, members of the executive committee and heads of business lines. It allows us to obtain a first-time visibility into key risks facing the company. However, the starting point of the "Bottom up" approach is the operational level. Since we intend to encompass all different aspects of operational risks we opted for the combined approach to leverage advantages of the two styles, gain a better insight and cope with the shortcomings of each approach.

1-3- Data collection tools

1-3-1- Documentation review

The standard practice to identify risks is reviewing relevant documents such as internal guides and formalized organizational processes in order to obtain a description of the practices used and knowledge of the flow of information circulating between automobile insurance actors within the company.

Our analysis is based on the exploitation of following internal documents of (CAAR):

- Guide of procedures relative to automobile insurance;
- The (CAAR) annual report 2018;
- Guide of automobile insurance products.

1-3-2- Interviews

During our internship, we conducted semi-directive interviews with managers of three directorates at the head office: the automobile insurance directorate, the human resources directorate and the information system directorate, as well as some operational staff at a few agencies. The aim being to better understand the structure of the automobile insurance line as well as the role of different sub-departments, consequently, we were able to define the

different processes and identify the risks they face as well as the deployed mitigation actions to handle those risks.

1-3-3- Questionnaire

The questionnaire is an essential tool since we are mapping the operational risks, therefore, we needed to understand the practices used at a low level. Therefore, it was sent to some automobile insurance operational staff at the agencies, in order to enable us to identify the risks they face and assess them based on the staff responses, which are based on their experience and judgment regarding the gravity of the risks, their frequency and the effectiveness of the control measures.

1-2- Process identification

The first step in our approach is to identify the different processes based on a narrative description given by managers as well as a documents analysis.

The processes we analyzed are presented in the table below:

Table n°17: the identified processes in the automobile business line of CAAR

	Process	Tasks	
Process n°1	Risk analysis and assessment	Reception of a request for insurance / the specifications sheet	
		Visiting and taking pictures of the vehicle	
		Launch the underwriting process under ORASS	
		Automatic risk pricing	
		Establishment of a quote	
Process n°2	Establishment of the policy	Reception of the needed documents	
		Cashing the premium	
		Policy issuance	
		Transmission of premium receipts as an evidence of payment.	
Process n°3	Claims handling process	Reception of the accident statement form	Case of casualty claims
		Opening of the claim file under ORASS	
		Warranty check	
		Evaluation of the amount of the provision	
		Appointment of an adjuster	

		Reception of the loss adjuster's report	
		Settlement of the claim	
		Reception of the accident statement form and the police report	Case of bodily injury claims
		Opening of the claim file under ORASS	
		Warranty check	
		Procedure for settling material claims	
		Reception and analysis of documents and calculation of compensation for the bodily injury claim	
		Settlement of the claim	
Process n°4	Recourse management process	Settlement of claims according to the adjuster's report	
		Transfer of the claim file to the Recourse Platform	
		Send an indictment to the opposing party (Responsible)	
		Fault assessment	
		Update information / Recourse under ORASS	
		Cashing of recourse amount	
		Closing the file / insured payment	

Source: developed by the author

1-3- Risk identification

After defining the different processes, we proceeded to identify the risks. In order to do so, we drew up a list of risks inherent to the Automobile insurance line, based on the interviews we conducted and the questionnaire replies we received. Then, we classified these risks into risk groups of level three as presented in the IFACI nomenclature[49]. This step enabled us to focus on a reduced number of risks and to determine the necessary control measures afterwards.

In this risk identification phase, we were able to identify 16 level 3 risks presented in the table below:

[49] IFACI, *La cartographie des risques, Cahier de la recherche*, 2e édition, 2013, p75.

Table n°18: the identified risks of the automobile line of CAAR

Level 2	Level 2 risks	Level 3	Level 3 risks
R301	Clients, products and business practices	R30116	Business practices / threshold crossing
		R30124	Failure to examine the client's status
R302	Execution, delivery, and process management	R30201	Data entry, execution and monitoring of transactions - errors
		R30202	Data entry, execution and monitoring of transactions - compliance with procedures
		R30211	Data entry, execution and monitoring of transactions - deadlines and obligations to clients
		R30222	Suppliers - poor performance of services
R303	Business disruption and systems failures	R30301	Systems - irretrievable loss or alteration of data
		R30302	Systems development
		R30312	It continuity planning risks
R304	Employment practices and workplace safety	R30409	Human resources management - salary policy
		R30406	Inadequate recruitment
		R30415	Human management resources - other
r305	Damage to physical assets	R30506	Pandemic
R 306	Internal fraud	R30603	Power abuse
		R30604	Unauthorized activity - false claims

R307	External fraud	R30701	Deliberate false claims

Source: developed by the author

PS: *The details of each risk as well as the mitigation controls are presented in appendix N°03 so as not to clutter up the content with tables.*

1-4- Risks assessment

Risk assessment can be done according to a qualitative or quantitative approach, this latter is considered more relevant and interesting since it is based on historical data processing, the frequency of risks that have occurred and the measurement of their impact in terms of financial loss according to statistics. Nevertheless, because of the unavailability of this data at (CAAR) insurance, we have adopted a qualitative approach to risk assessment. Despite its subjectivity, this approach makes it possible to assess risks and risk mitigation devices based on the information collected during interviews and using the questionnaire (appendix n°02).

We have tried to analyze the raw risk according to the following main criteria:

- **Causes:** What are the underlying causes of this risk?
- **Consequences:** What can be the consequences of the occurrence of this risk?

These elements are presented in Appendix n°04 for each risk.

1-4-1- Raw risk:

Since the identified risks must be assessed. This evaluation is based on two dimensions, namely: frequency and impact.

This evaluation is carried out according to scales that facilitate the prioritization of risks and, eventually, the mitigation actions to be taken. Four-level even scales are to be favored in order to "take sides" and categorize the risk. It helps avoid the « average » risks, not allowing a meaningful analysis.

1-4-1-1- frequency

In our study case we are going to use the scale of frequency proposed by the (IFACI) institute:

Table n°19: The frequency measuring scale

Rating	Frequency	Measuring details
1	Rare	Occurs once or twice in 3 years
2	Moderate	Occurs a few times a years
3	Occasional	Occurs many times a year
4	frequent	Occurs monthly or weekly

Source: IFACI, cahier de recherche

1-4-1-2- Impact:

We are going to use the following scale of impact:

Table n°20: The impact measuring scale

Rating	Impact	Measuring details
1	low	Low financial impact
2	significant	Average financial impact and damage to the brand's image
3	major	Significant financial impact and damage to the brand's image
4	critical	Serious impact that affects the company's survival

Source: IFACI, cahier de recherche

The raw risk can be evaluated by the following equation[50]:

Raw risk = Predictable impact x Frequency of occurrence

After assessing the predictable impact as well as the frequency of occurrence, we can illustrate the raw risk materialized by the score in the in a heat map as follows, the following possibilities emerge:

[50] IFACI, *La cartographie des risques, Cahier de la recherche*, 2e édition, 2013.

Figure 16: the raw risk heat map (possible scores)

		Frequency			
		1	2	3	4
Impact	1	1	2	3	4
	2	2	4	6	8
	3	3	6	9	12
	4	4	8	12	16

In order to simplify the codification of the raw risk and the measurement of the net risk, we have modified the raw risk scale as follows:

	score	rating
Low risk	[1,2]	1
Average risk	[3,4]	2
High risk	[6,9]	3
Critical risk	[12,16]	4

Source: developed by the author

1-4-2- The risk mitigation device:

For each identified risk, we define the existing risk mitigation devices and actions and evaluate them using a scale from 1 to 4, as outlined in the table below:

Table n°21: the scale of mitigation controls evaluation

rating	RMD	
4	Effective	Measures able to reduce the frequency or impact of the risk and bring it to a satisfying level: written and detailed rules formalized and applied controls.
3	Sufficient	Mitigating controls significantly reduce the frequency or impact of the risk: written rules but to be completed, existing and relevant control elements, formalized but to complete.
2	Average	Mitigating controls reduce moderately the frequency or the impact of the risk: oral rules, elements of control partially existing but not formalized.
1	Insufficient	Lack of mitigation control device: little or no rules, trusting the staff experience.

Source: IFACI, cahier de recherché

1-4-3- The residual risk

Using the assessment of the raw risk and the mitigation devices, the net risk or the residual risk that persists afterwards can be evaluated by the following scale:

Figure 17: the evaluation scale of the residual risk.

Raw risk \ RMD	4	3	2	1
1	1	1	1	1
2	1	1	2	2
3	1	2	3	3
4	2	3	4	4

Low	Zone 1
Average	Zone 2
High	Zone 3
Critical	Zone 4

Source: developed by the author

Based on the questionnaire (appendix n°02) and the interviews conducted with the managers of (CAAR) insurance, specifically at the automobile line, the information system directorate and the human resources directorate, we obtained the following results:

Table n°22: the assessment of the net risks

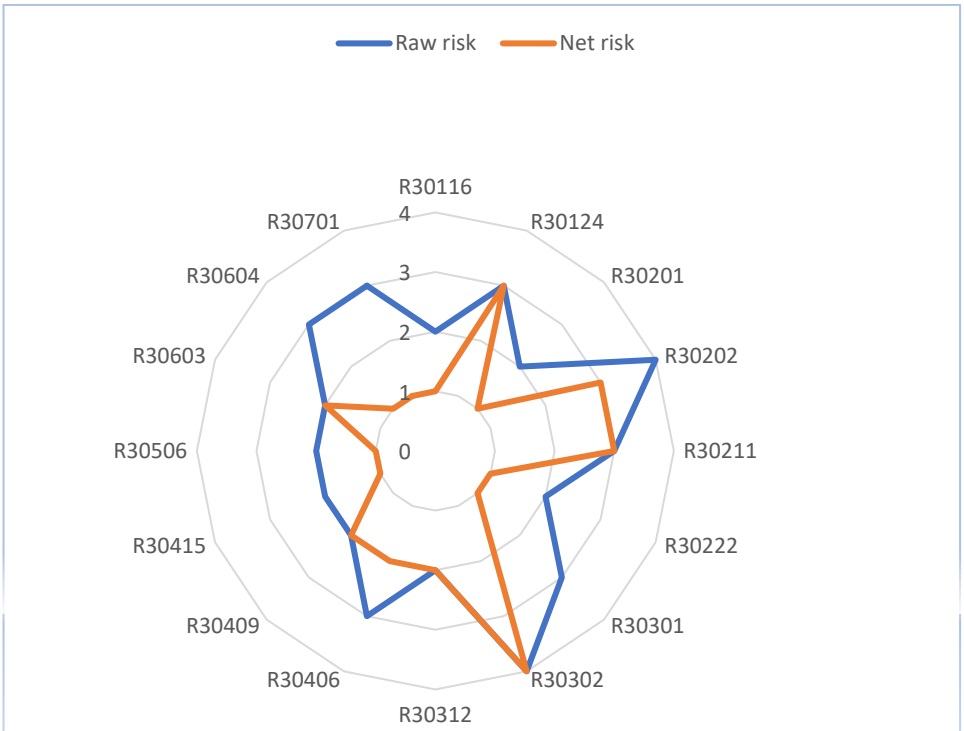
Level 3	Level 3 risks	Raw risk	RMD	Net risk
R30116	Business practices/ threshold crossing	Average	Sufficient	Low
R30124	Failure to examine the client status	High	Insufficient	High
R30201	Data entry, execution and monitoring of transactions - errors	Average	Average	Low
R30202	**Data entry, execution and monitoring of transactions - Compliance with procedures**	Critical	Average	High
R30211	Data entry, execution and monitoring of transactions - deadlines and obligations to clients	High	Insufficient	High
R30222	Suppliers - poor performance of services	Average	Average	Low
R30301	Systems - irretrievable loss or alteration of data	High	Effective	Low
R30302	**Systems development**	Critical	Insufficient	Critical
R30312	It continuity planning risks	Average	Insufficient	Average
R30409	Human resources management - salary policy	Average	Insufficient	Average
R30406	Inadequate recruitment	High	Average	Average

R30415	Human management ressources – other (work overload)	Average	Average	Low
R30506	Pandemic	Average	Average	Low
R30603	Power abuse	Average	Insufficient	Average
R30604	Unauthorised activity - false claims	High	Sufficient	Low
R30701	Deliberate false claims	High	Sufficient	Low

Source: developed by the author

1-5- Automobile insurance line risk mapping

Figure 18: (CAAR) Automobile insurance line risk map radar



Source: developed by the author

For a better visibility, we have created radar of raw and net risks; we can obviously see that raw risks reduced as a result of the application of control measures, which proves the

effectiveness of the control measures implemented by the CAAR. This illustration also gives us the ability to distinguish high profile risks from low ones.

The risk of **system development (R30302)** is a critical one. This is expected in insurance companies since their core activity requires the availability of a high performance information system to accomplish nearly every task from underwriting policies to compensations payment, it is indeed a major risk for the entirety of the insurance industry and is always among top risks in exposure surveys.

This risk arises from insufficiency if not obsolescence of the information system used in CAAR insurance, which lacks much functionality that are judged necessary for the insurance business today; yet, they were not considered while designing the system. In a world where cyber criminality and fraud are experiencing an exponential growth, CAAR insurance can't cope with that using a simple IS that doesn't detect fraud nor include any blacklists. It doesn't provide any kind of statistics to help build an internal database or even allow effective internal control by granting the top management access to the data on its network in real time since it is entirely decentralized.

The mapping reveals the existence of certain high risks such as:

The risk of **Data entry, execution and monitoring of transactions - compliance with procedures risk (R30202)**, a critical risk because of three main risk elements namely:

a- The non-compliance with the (IRSAM) convention related to recourse actions between insurers that has an important financial impact and thus a shortfall in case recourse actions are not proceeded in time, the nature of automobile insurance that covers liabilities and receives daily claims is a factor that intensifies the impact of that risk; which is difficult to handle since it involves many other companies.

b- Wrongful rejection or settlement of claims: it is often the rejection that takes place because of the insurer's doubts and suspicions; sometimes it is due to inattention of the staff at the agencies.

   This risk can have a financial impact if the insurer settles a claim that he should not and damage to the brand's image if he rejects a claim that is due, it could be harmful to the company's reputation if a large number of cases are brought to court and its service quality will be questioned.

c- delay/non-collection of unpaid premiums (case of fleets): the financial difficulties of some clients and the nature of the payment procedures followed by local authorities

that require the approval of the financial control, which is very time consuming, is the main reason of this risk. The result is a shortfall due to the delay in collection of large debts and the additional expenses if legal action is taken.

Nevertheless, this critical raw risk was reduced thanks to hierarchical controls, briefing notes, trainings, monitoring of unpaid premiums and the platform that ensures that recourse actions are processed.

Another high profile risk is the **failure to examine the client status (R30124):** two elements make this risk high:

a- The absence of risk visit of fleets: a cumbersome procedure that requires time and human resources, thus it is rarely carried out, which leads to a poor risk assessment that impacts the company's income.
Fortunately, the CAAR obliges its network to pay a risk visit and take photos if the client is a car rental agency.

b- No checking of the clients' bonus malus class nor his loss ratio: the non-existence of a central of risks office to enable insurers to check the bonus-malus class of new clients and non-compliance with procedures when renewing contracts are the main reasons of this failure to examine the client's status, which has an important financial impact; if an additional premium is not charged (in the case of substandard risks) when it is due, the good policyholders are penalized (which may harm the brand image).

The Data entry, execution and monitoring of transactions - deadlines and obligations to clients (R30211) is high due to lack of monitoring of compensation deadlines by agency, branch or even headquarters and lack of regulations regarding deadlines payment, this latter is considered a performance criterion and excessive delays have a significant impact on the company's image

In terms of obligations to clients: the failure to settle claims due to insufficient knowledge of the methods of calculation of compensation reflects the lack of competence of staff, especially at the agencies, their inattention and the insufficiency of management control. It could have financial impact if we pay more than we should and damage to the image if we pay less than necessary.

As for the risks related to internal or external fraud, their criticality is high; nevertheless, the mitigation device implemented by CAAR is significantly reducing the impact of

deliberate false claims. It consists of management controls and the ALFA institution that examines deeply every suspicious claim, which works as a corrective measure since it doesn't prevent fraud but reduces the undetected files.

The pandemic risk (a rare risk that is not likely to happen) also was significantly mitigated (analysis of the covid-19 crisis) by the special committee that was set up since the very beginning of the outbreak to predict any unforeseen events and manage the crisis. This pandemic was a test of the capacity of all companies to survive such rare adverse event and the (CAAR) seems to succeed as far as we know until this date, it has proven its financial consistency and management effectiveness.

The risks related to employment and workplace safety would have been low if it wasn't for the inadequate recruitment. As an insurance undertaking, it is needed to have a high number of operational staff and the mismatch between new recruits and the wanted profiles provides the company with employees who can't fulfill their tasks correctly and tend to commit more errors since they don't meet the requirements.

1-6- Risks prioritization

After assessing the risk exposure we can prioritize these risks as well as the required action plans according to the following areas:

Zone 1: this zone represents risks of low frequency and impact that do not require special further treatment.

Zone 2: these are risks that represent a very high criticality but remain under control (effective control system), or risks with a medium criticality but an insufficient control system. In these two cases, the impact on processes is not very significant. The implementation of corrective actions is possible, it is not a priority but its implementation depends on a benefit/cost ratio.

Zone 3: these risks represent a high criticality and can have a significant impact on processes.

Zone 4: these are risks with an extremely high criticality and a deficient control system, the occurrence of which has an impact on the company's financial situation and operations as well as its brand image. It is a priority action zone.

1-7- Automobile insurance line heat map

We opted for a heat map, as a common concise visualization tool to gives a big-picture view of the operational risks landscape of the automobile insurance line.

Figure 19: (CAAR) Automobile insurance line heat map

Raw risk					
	Critical			• **R30202**	• **R30302**
	High	• **R30301**	• **R30604** • **R30701**	• **R30406**	• **R30124** • **R30211**
	Average		• **R30116**	• **R30201** • **R30222** • **R30415** • **R30506**	• **R30603** • **R30312** • **R30409**
	Low				
		Effective	**Sufficient**	**Average**	**Insufficient**
		RMD			

Source: developed by the author

This matrix shows the ranking of risks by zone, which allows us to identify net risks by combining the raw risk and the relevant mitigation device implemented by the company. Our matrix shows a clear concentration of average risks and a few high ones, besides two extremely critical risks that require an immediate action.

The four risk-zones identification is not a purpose by itself but a first step towards designing an action plan to handle the entirety of these risks according to their priority.

1-8- The treatment plan

After identifying and prioritizing risks, we are going to establish a treatment plan in accordance with the International Risk Management Standard ISO 31000[51] rules , that will describe the actions to be taken, the responsible in charge, a timetable for accomplishment, for the risks in zones 2, 3 and 4 which are evaluated as "average", "high" and "critical".

When we selected these actions, we considered the organization objectives, and the new risks that risk treatment options might introduce. We will describe the benefits to be achieved and the impact on raw risks.

[51] https://www.iso.org/iso-31000-risk-management

As for low risks, we believe that these are risks are sufficiently controlled by the company and that incurring costs to address these risks may be disadvantageous. However, this hypothesis can only be verified after estimating the respective costs of the risks and the actions to be taken, which requires further studies.

Table n°23: the proposed treatment plan

Risk code	Level 3 risk	Actions to take	Department in charge of action	Time period	Starting date	Argument
R30302	Systems development	Start creating an incident base	Information System Directorate, Auto line, CEO,	3 years	Immediately	• This techniques could reduce raw risks by reducing its frequency as a preventive tool by detecting a potential fraud before issuing the policy through blacklists, loss ratios and ALFA files, if including lists in the system is too expensive, it is advisable to have blacklists and ALFA lists shared on the company's internal network, or even on a word separate document shared with all the agencies. • Bonus malus coefficients do not make a huge difference in terms of premiums in each policy but since we are dealing with the automobile line, the huge number of policyholders emphasizes the loss, adding search
		Include a national blacklist in the system		3 years	Immediately	
		Include a blacklist of clients with high loss ratio and grant access to operational staff at the agencies to this list, which should be continuously updated		3 years	Immediately	
		Include ALFA files especially those revealed fraudulent		3 years	Immediately	
		Add some search filters in the ORASS to check the client's history, his loss ratio and his bonus malus class if he asks for a contract renewal		2 years		
		Add other functionalities that can detect any human error while running ORASS		2 years	Immediately	
		Add other functionalities to ORASS in order to avoid staff using other manual methods to edit and deliver any official document		2 years	Immediately	

						filters could be expensive but it could cut the repetitive losses that could cost the company even more, which could help reduce the impact of this risk, • These measures can not eliminate this critical risk but it could at least make it rather high
R30202	Data entry, execution and monitoring of transactions - compliance with procedures	In case of a new client, ask for his claims record, it's an old practice that is no longer used but we could establish it back in the absence of a national central of risks	Communica-tion department, Auto line, CEO, Human Resources Directorate	/	Immediately	• Putting pressure on clients to avoid delays costs nothing but it could fasten claims settlements, which helps brighten the brand's image. Reminders and briefing notes do not seem to reduce the risk of compliance with procedures, which causes enormous shortfalls. Therefore, two projects are to be defended at the UAR and finance ministry are recommended since we are dealing
		Put pressure on the policyholder to avoid slow reactivity to complete missing documents		/	Immediately	
		• Take recourse actions with no delay and try to apply the procedure set by IRSAM convention and monitor closely its application		3 year	Immediately	

		• Require an arrangement with local authorities to resolve the problem of delayed premiums payment, which causes a considerable shortfall for the company since it regards important fleets insurance contracts		3 years	Immediately	with exogenous parts to monitor closely the application of the IRSAM convention and to reach an arrangement with local authorities regarding their delay in paying premiums, in order to reduce this risk's impact to an acceptable level,
R30124,	Failure to examine the client status	Make risk visits mandatory in all cases of fleets and provide the necessary resources to do so (human, necessary tools and time allocated to fulfil this task), or even outsource this task to some external service provider	Auto line, Human Resources Directorate, Information System Directorate, Administrati-on and General Means Directorate.	1 year	Immediately	• the risk visits allow a right appreciation of risks, thus a right pricing is made, and a guarantee of payment is acquired (thanks to solvency requirements), which preserves the company's solvency and helps reduce this risk's impact to an acceptable level through the allocation of resources or outsourcing, it could as well reduce its frequency to nearly zero if this procedures are always respected thanks to good management control.
		Require solvency information in specifications		/	Immediately	
		Add some search filters in the ORASS to check the client's history, his loss ratio and his bonus malus class if he asks for a contract renewal		2 years	Immediately	
		Put the know your client process on point		/	Immediately	

R30211	Data entry, execution and monitoring of transactions - deadlines and obligations to clients	Continuous training of the staff to ensure not only mastering insurance concepts, but also build a risk sensing mind-set to help them detect fraud or any suspicious client at the first moment of underwriting	Human Resources Directorate, Risk Management Directorate, Auto Line	2 days a month/ 12 months	Immediately	• Human errors, delays in claims settlement cost the company money and damage its image, continuous training may seem a waste of money to a non expert but managers with insight are aware of its tangible and intangible benefits, continuous trainings helps prevent fraud and errors
		Monitoring of compensation deadlines by agency, branch and headquarters (a dashboard is advisable)		/	Immediately	
		Update the procedures manual, disseminate procedures to all staff and provide continuous reminders of internal and external procedures to be followed.		3 months	Immediately	
		Raise staff awareness of the importance of vigilance when carrying out their work.		/	Immediately	
R30406	Inadequate recruitment	Hire the right people for the right positions, have clear job requirements, formalized description of the profiles needed	Human Resources Directorate, Auto Line	6 months	Immediately	• if we are in need to hire we should hire the right person since the beginning as a preventive measure to avoid future errors and losses and reduce the frequency and the impact
		Double interview (with the HRM and the manager of the automobile line)		/	Immediately	

		Have a test period than an evaluation with clear criteria, especially for workers at the agencies		3 months	After every hiring procedure	of this risk at once,
R30604,	Unauthorized activity - false claims	Establish a culture among the claims staff that emphasizes the importance of recognizing, identifying and investigating suspicious claims	Auto line, Human Resources Directorate	/	Immediately	• false claims are expensive, and internal complicity makes it worse, the best way to handle it is prevention by establishing a culture against complicity and fraud, as well as ethical values, which could help reduce the frequency of fraud, and eventually turn this medium risk's criticality into a low one, as a corrective measure, we need to know our employees, to be able to detect those who have done or willing to do any unauthorized activity and put them under supervision secretly
		Create clear ethical standards and have a zero-tolerance policy against fraud		/	Immediately	
		Diligence in the hiring process to detect any warning signs that applicants may have a motive to commit fraud.		/	Immediately	
		A know your employee practice: whether he has a criminal record or any financial issues which could be a motive to commit fraud		1 year	Immediately and after every hiring process	
		Implement anonymous reporting to encourage employees call out any signs of fraud and complicity		/	Immediately	

R30701	Deliberate false claims	Check a list of "Suspicious Loss Indicators" such as the one developed by The American National Insurance Crime Bureau (NICB), use behavioral analysis techniques	Auto line, Human Resources Directorate, Information System Directorate,	1 year	Immediately	• to fight deliberate false claims, we should start immediately with the available resources by imparting each employee's experience, this measure only requires workshops inside the walls of the company, afterwards we should consider the acquisition of more sophisticated ways to detect and mitigate fraud, such as a claims database that could take a long time but the benefits in terms of reducing the frequency of undetected false claims will diminish considerably,
		Build a paid claims data base and include checks serial numbers to be able to Perform Cross-Checks to detect fraudulent claims where policyholders with a deductible fragment one big claim into a few small ones to guaranty their coverage each time		2 years	Immediately	
		Experienced claims staff can detect patterns that reveal fraud, formalizing this knowledge and imparting it throughout the company so that other staff charged of the same task could improve their skills of fraud detection		1 year	Immediately	
		Social media screening to find proof of fraud on suspicious claims especially cases of faked injuries		/	Immediately after receiving	

					every claim report	
R30603	Power abuse	Sharing tasks can reduce practices like pocketing premiums since many employees are involved to issue one policy, which gives a feeling of enhanced supervision	Human Resources Directorate, Auto line,	1 month	Immediately	• efficiency is closely related to daily practices, tasks organization and ergonomics cost nothing but have a significant impact on this raw risk, it helps reduce its frequency and impact at once with the high level of supervision it provides
		More access to data on the system means more chances of adverse manipulations, a system control that gives restricted access is more reliable and an effective hierarchical control can make sure of the adequacy of issued policies, data saved on the system and the cash register		/	Immediately	
R30312	IT continuity planning risks	A formalized fallback is required in order to be able to react immediately in the event of any kind of crisis relative to company's information system and network	Information System Directorate,	3 year	Immediately	• since insurance daily activity depends on the information system, a crisis of any kind could destroy the company, therefore, the least is to have a formalized fallback to be able to get the company back on track as soon as

						possible as a corrective action to reduce the impact of such a risk
R30409	Human resources management - salary policy	Explaining the compensation system to the operational staff in the agencies, this misunderstanding creates a feeling of injustice	auto line, Human Resources Directorate, Risk Management Directorate	2 weeks	Immediately	• the least to do with an unsatisfied employee with his salary is to explain the inputs and the calculation principles, afterwards, adjusting the salary to the workload is a great way to increase work satisfaction which leads to less errors and more attention and dedication, it reduces as well somehow the risk of unauthorized activities aiming to enrich one's self
		Set up a statistical analysis regarding the workload in the automobile insurance line and adjust the salaries this way		18 months	Immediately	
R30201	Data entry, execution and monitoring of transactions - errors	Raise staff awareness of the importance of vigilance when carrying out their work.	Human Resources Directorate and Auto line	/	Immediately	• having hierarchical and system controls are great tools to correct errors in case they occur (corrective action), but investing in actions that could raise self-awareness could avoid the risk (preventive action)

R30222	Suppliers - poor performance of services	Adapt the adjuster's fees to the quality of the service provided by creating a monitoring system (dashboard).	Automobile line	1 year	Immediately	• the objective of operational risk management is to run a business effectively and cut unnecessary costs like paying a higher fee than we should
R30415,	Human management ressources - other	Adjust the workload to make it fair for every worker	Human Resources Directorate, Automobile line	6 months	In 18 months	• after Setting up a statistical analysis regarding the workload, the company will have a better understanding of the flaws of the present organization, which could be improved through simple changes of working ergonomics
		Allow a degree of mobility to give the front office employees a break from receiving clients		2 months	Immediately	
		Have working ergonomics and spaces arrangements to make work easier especially in the agencies		6 months	Immediately	
R30506	Pandemic	• Development of a business continuity plan	Information System Directorate,	3 year	Immediately	• the covid-19 pandemic is still showing flaws in the company's organization, the need of investing in digital and automation is becoming a necessity, however it is a long term project that requires important

		• Invest in automation, digital and remote-working	CEO, Automobile line, risk management directorate	3 years	Immediately	investments and a deep study. Even though the CAAR's activity did not stop completely, a shortfall persists since agencies were closed for quite a long while and people's mobility in general was reduced. if this company was already selling products online, this shortfall could've been of a less importance, from the same perspective, if workers were familiar with digitalization, remote working could've been much more efficient. the direct link is obvious between pandemics and losses even though this latter is hard to quantify, pandemics as a rare event are unpredictable and of a huge impact, we can not control their occurrence frequency but we can be prepared for any kind of outbreaks to mitigate its impact.

Chapter conclusion

In this chapter, we first introduced CAAR Insurance, the Automobile Line Directorate and the Risk Management Directorate.

The second and third sections of this chapter deal with our study case. We have applied the methodology explained in the theoretical part, which has enabled us to calculate a component of the required capital to absorb operational risk in the automobile line in CAAR and compare it to the rest of the insurance operators, and to develop a risk map of the automobile line.

The 16 risks identified were analyzed and assessed in order to prioritize them in the risk matrix. The most significant risks in the automobile line are related to the information system and compliance with procedures.

Since the challenge of risk mapping is to be able to treat risks, we have proposed a treatment plan that could help reduce risks or even avoid it at the lowest possible cost. Indeed, we have tried to associate each risk with action plans and an approximate timetable for achievement.

We ought to mention that the proposed action plans must be the subject of an analytical study in order to study the feasibility and the budget allocated to each risk, this requires the consideration of several criteria, such as :

- The availability of means;

- The human factor and the skills required;

- The required budget;

- The company's risk management strategy.

General conclusion

General conclusion

General conclusion

Insurance is one of the most important areas in every country's economics; therefore, it requires sophisticated risk analysis in order to ensure stability and solvency of insurance companies, to protect the policyholders and to manage effectively the risks to which it is exposed. Thus, it must avoid catastrophic scenarios that could jeopardize her financial situation and make it vulnerable to threats.

Even if the managers of insurance companies have a vision and a global approach of the inherent risks to their activities, build a risks mapping can only bring them new elements of observation intended to master better and to direct their objectives. It is an essential tool for managers to raise their awareness of the threats and vulnerabilities of the company. Risk management is a relatively recent discipline, at least for algerian companies, but it is rapidly developing in recent years.

In this thesis, we addressed the notion of risk management, and we presented an overview of references, namely: ISO31000, COSO I, COSO II and COSO III, as well as the operational risk capital requirements of Solvency II guidelines. Then we outlined the theoretical framework of risk mapping, more specifically the approach to be followed and the tools used in its implementation. Finally, we presented the company and the automobile directorate to better highlight the context in which our work will be carried out.

We attempted to assess the solvency capital requirement of the operational risk module (SCR_{OP}) but given the unavailability of a reassessed balance sheet, required for calculating the (BSCR), we had to do with the first component of the SCR op only. We compared the (Op), which is one main component of the required capital of the automobile line of business, to the required capital of the company CAAR, this capital turned out to represent 3% of the earned premiums of the automobile line and 40% of the Op charge of the company, this is due to the importance of this line within CAAR. As for the Op charge of the total Algerian automobile business line, it represents 54.7% of the Op charge of the P&C sector in Algeria. The discrepancy between CAAR automobile line Op charge and the Op charge of the total Algerian automobile insurance sector is considered relatively low.

Finally, we moved on to building a risk mapping, we began the process within the automobile line by identifying the processes of the technical activity, namely: underwriting, claims management and recourse management. Than we outlined the tasks performed in each. The second step consisted in identifying the risks and control elements through a combined

approach (top-down and bottum up). Afterwards, we proceeded to assess these risks based on the data we were able to collect through interviews and a survey. Finally, we prioritized the risks according to their level of criticality. This process enabled us to highlight the different risk areas and to draw up a risk matrix.

Based on the results of our study, we believe that the most critical risks are those related to the:

- **system development** since the core activity of insurance companies requires the availability of a high performance information system to accomplish nearly every task. This risk arises from insufficiency of the information system used in CAAR insurance, which lacks many functionalities that are judged necessary for the insurance business.
- **Data entry, execution and monitoring of transactions - compliance with procedures risk**; the main element that made that risk critical is the non-compliance with the (IRSAM) convention related to recourse actions between insurers that has an important financial impact and thus a shortfall in case recourse actions are not proceeded in time, the nature of automobile insurance that covers liabilities and receives daily claims is a factor that intensifies the impact of that risk; which is difficult to handle since it involves many other companies.

These two large scale risks that can not be overlooked, their existence and criticality is undeniable and represents a priority area that requires immediate intervention.

Other high risks have been spotted such as:

- The **failure to examine the client status** because of the absence of risk visits of fleets and not checking the clients' bonus malus class nor his loss ratio.
- **Data entry, execution and monitoring of transactions - deadlines and obligations to clients** due to lack of monitoring of compensation deadlines by agency, branch or even headquarters and delay in claims settlement, which has a significant impact on the company's image.

To address these risks, we have tried to propose certain treatment plans for each risk in the priority action area, the area to be monitored and the area to improve. The action plans must be implemented by CAAR in order to improve the risk mitigation device, with corrective and preventive measures.

General conclusion

However, we ought to mention that the action plans appropriate to each risk must be the subject of a technical and financial study to estimate the costs and necessary resources as well as the feasibility of each action. If the costs incurred to handle a risk are greater than the impact of the risk itself, it is in the company's best interest to study the possibility of accepting it.

CAAR insurance has always shown an interest in risk management and has already set up a risk management department. It would be interesting to build a global operational risk mapping within CAAR, involving the various departments of all business lines to cover as many risks as possible to ensure the efficiency of the entirety of its processes and cut related costs.

The implementation of an incident database that will list events that could disrupt the normal course of business processes and generate financial losses or damage to the company's image would be a great tool to prevent risks from happening and detect it rapidly using crosses and patterns thanks to this internal database.

Indeed, it is always useful for any insurance company to inculcate the culture of risk management to operational staff and managers, and to provide trainings in order to raise awareness of the importance of this function within the company.

Finally, we would like to emphasize that we had heavy time pressure, this work is limited by data collection limitations and availability, this data is described as subjective as it is based on the judgment and appreciation of managers. We ought to mention that it is key to keep the risk map up-to-date and to monitor the implementation of the action plan since risks are not static, they change and emerge with the company's environment. Thus, the process of identifying, understanding, evaluating and prioritizing risks must be repeated regularly in order to ensure that the key risks are being appropriately managed. In the context of the own risk and solvency assessment (ORSA), it is useful to complete this risk identification first step with a quantitative scenario analysis of the most critical and high risks to predict any adverse events, estimate their frequency and impact in order to be prepared in case they occur.

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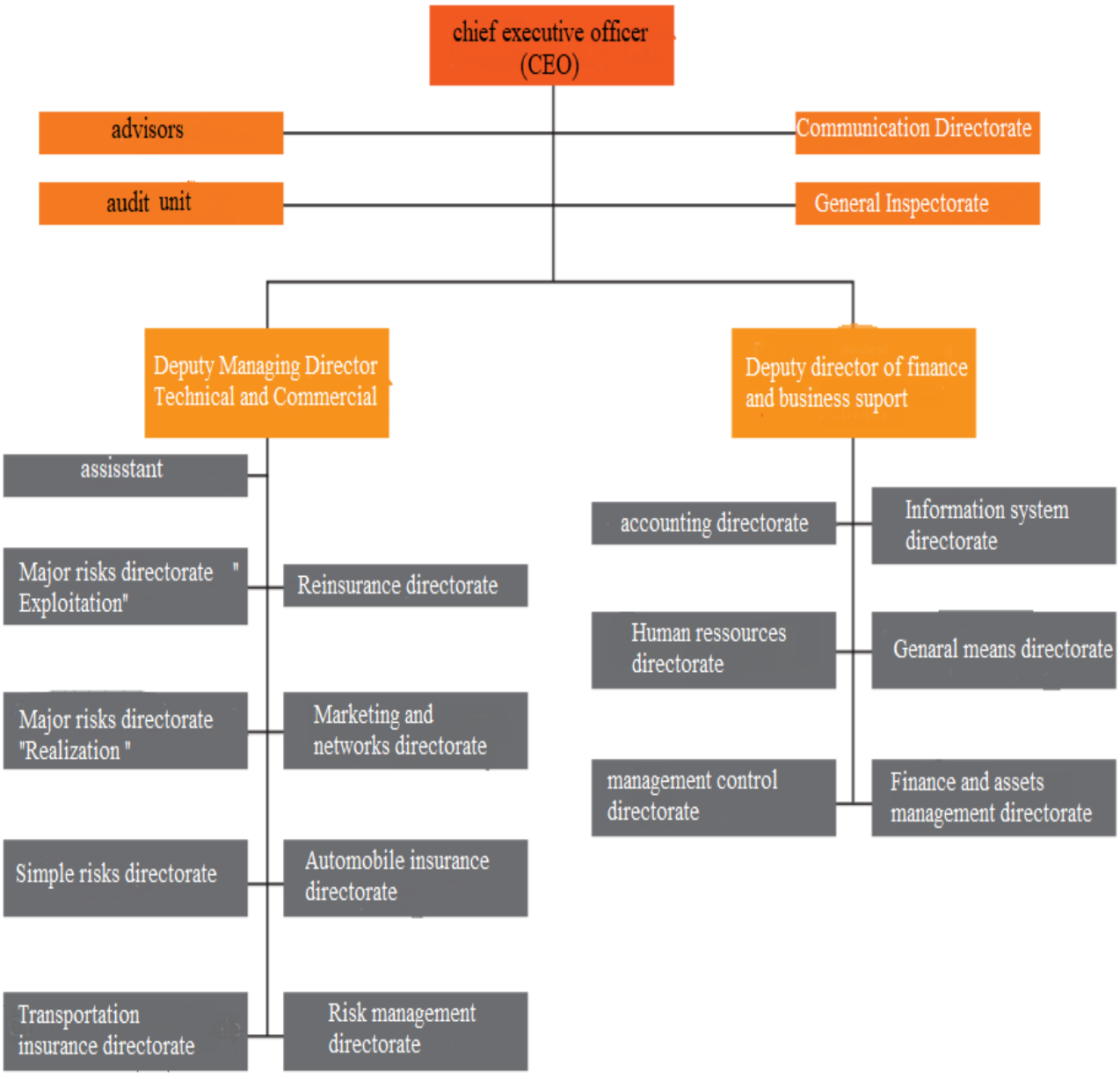
Appendix

Appendix n°1: the (CAAR) company organizational chart



Appendix n° 2: The questionnaire

- What are the risks inherent to this process?

For each risk:

- What are the underlying causes of this risk?

- What are the consequences of this risk?

- How would you rate the frequency of occurrence of this risk? (on a scale from 1 to 4)

Rating	Frequency	Measuring details
1	Rare	Occurs once or twice in 3 years
2	Moderate	Occurs once a years
3	Occasional	Occurs a few times a year
4	Frequent	Occurs monthly or weekly

- How would you judge the impact of this risk in case it occurs? (on a scale from 1 to 4)

Rating	Impact	Measuring details
1	low	Low financial impact

2	significant	average financial impact and damage to the brand's image
3	major	significant financial impact and damage to the brand's image
4	critical	Serious impact that affects the company’s survival

- Are there any mitigation measures to get this risk under control?

  - Yes
  - No

- If so, what are they?

- On a scale from 1 to 4, how would you rate the efficiency of the implemented mitigation actions related to this risk?

rating		
4	Effective	Measures able to reduce the frequency or impact of the risk and bring it to a satisfying level: written and detailed rules, formalized and applied controls.
3	Sufficient	Mitigating controls significantly reduce the frequency or impact of the risk: written rules but to be completed, existing and relevant control elements, formalized but to complete.
2	Average	Mitigating controls reduce moderately the frequency or the impact of the risk: oral rules, elements of control partially existing but not formalized.
1	Insufficient	Lack of mitigation control device: little or no rules, trusting the staff experience.

- What do you propose to address this risk?

Appendix n°3: Risks identification

Affected process	**Risk elements**	**Mitigation risk device (MRD)**
R30116 business practices / threshold crossing		
Claims handling process	Non-compliance with settlement thresholds in agencies and branches	Multi-level inspection and monitoring
R30124 failure to examine the client status		
Risk analysis and assessment,	Absence risk visit of fleets	The CAAR obliges its network to pay a risk visit if the client is a car rental agency, the hierarchical control in other cases
Establishment of the policy	No verification of the clients' bonus malus class and his loss ratio	This risk is known but there is no measure of control, in fact if it is a new policyholder we can ask for his claims record but this procedure is not respected
R30201 data entry, execution and monitoring of transactions - errors		
All processes	Data entry errors	Is control - hierarchical control
R30202 data entry, execution and monitoring of transactions - compliance with procedures		
Establishment of the policy	An incomplete or inconsistent claim report	
Claims handling process	Delay in handling the reported claims	Monitoring and hierarchical control
Recourse management process	Delay/non-collection of debts (case of fleets)	Control and monitoring of unpaid premiums
	Delay/non-collection of debts (case of individuals insurance	Disciplinary measures, hierarchical control,

	Wrongful rejection or settlement of claims	Briefing notes - trainings - hierarchical control - seeking mutual agreement between the insurer and the policyholder
	(non-compliance with the IRSAM convention)	Hierarchical control, a platform that ensures that recourse actions are processed.
R30211 data entry, execution and monitoring of transactions - deadlines and obligations to clients		
Claims handling process	Lack of monitoring of compensation deadlines by agency, branch and headquarters.	Management control
Recourse management process	Failure to settle claims due to insufficient knowledge of the methods of calculation of compensation.	Different trainings - management control
R30222 suppliers - poor performance of services		
Claims handling process Recourse management process	Delay / inaccuracy of the loss adjuster's report - incorrect assessment of the claim by the adjuster: significant discrepancy between the real cost of the claim and the assessment	Putting pressure on the expert to transmit the report on time
R30301 systems - irretrievable loss or alteration of data		
risk analysis and assessment, Establishment of the policy Claims handling process	irretrievable loss or alteration of data (unintentional)	Backup hard drives, servers, different data recovery technics,

R30302 systems development		
Risk analysis and assessment, Establishment of the policy	Development error	Periodic system updates
R30312 it continuity planning risks		
Risk analysis and assessment, Establishment of the policy	Non- continuity of operations because of the lack of a back-up plan in the event of serious difficulties in running the information system	Consultation with the provider of the information system, informal tips that the team can try out
R30409 human resources management - salary policy		
All processes	Insufficient remuneration	
R30406 inadequate recruitment		
risk analysis and assessment, Establishment of the policy Claims handling process	Discrepancy between job requirements and the profiles of new recruits	Explanatory notes for guidance
R30415 human management resources - other		
risk analysis and assessment,	Work overload	Work ergonomic and a higher number of staff in the automobile line

Establishment of the policy Claims handling process		
R30506 pandemic		
All processes	The prominent example is covid-19 or any other pandemic	A special committee was set up at the start of the pandemic to anticipate any unforeseen events and manage the crisis encouraging teams working during the pandemic
R30603 power abuse		
Risk analysis and assessment, Establishment of the policy	Information system manipulation to change parameters of some insurance policy	Procedures of reacting after detection of fraud
R30604 unauthorized activity - false claims		
Claims handling process	Fraudulent/exaggerated insurance claims with internal complicity	Management control - examination of files by ALFA.
R30701 deliberate false claims		
Claims handling process	Fraudulent/exaggerated insurance claims	Management control - examination of files by ALFA.

Appendix n°4: Risks analysis

Risks analysis					
Level 2 risk	**Level 3**	**Level 3 risk**	**Risk elements**	**Risk analysis**	
				Cause	**Consequence**
R301 Clients, products and business practices	R30116	Business practices/ threshold crossing	Non-compliance with settlement thresholds in agencies and branches	Non-compliance with procedures - lack of control and sanctions	Possibility of error and therefore a financial impact
	R30124	Failure to examine the client status	Absence of risk visit of fleets	A cumbersome procedure that requires time and human resources	Poor risk assessment, which impacts the company's income
			No verification of the clients' bonus malus class and his loss ratio	The non-existence of a central risk office to enable insurers to check the bonus-malus class of new clients and non-compliance with procedures when renewing contracts	Poor assessment of risks leads to a financial impact; if an additional premium is not charged (in the case of substandard risks) when it is due, the good policyholders are penalized (which may harm the brand image), yet the coefficients of the scale used are relatively low, so the impact is moderate

R302 execution, delivery, and process management	R30201	Data entry, execution and monitoring of transactions - errors	Data entry errors	Lack of attention - insufficient control	
	R30202	data entry, execution and monitoring of transactions - compliance with procedures	An incomplete or inconsistent claim report	Unclear accident statement form	Difficulty to determine the fault and thus possibility of loss of the right to recourse
			Delay in handling the reported claims	Delays in collecting the amount of recourse from other insurers since some policyholders have to wait for it to receive the whole claim settlement - slow reactivity of the client to complete missing documents, especially in the case of bodily injury claims	Delay in handling a claim may cause financial loss to the insured and damage the company's image.
			Delay/non-collection of debts (case of fleets)	The financial difficulties of some clients and the nature of the payment procedures followed by the local authorities that require the approval of the financial control, which is very time consuming	A shortfall due to late collection of large debts, additional expenses if legal action is taken

			Delay/non-collection of debts (case of individuals insurance	Failure to comply with procedures regarding premiums cashing before validation of the policy	A financial impact in terms of non-collection of unpaid premiums, which may adversely affect the insurer's image
			Wrongful rejection or settlement of claims	It is often the rejection that takes place because of the insurer's doubts and suspicions, sometimes it's the incompetence of staff at the agencies	Financial impact if you settle a claim that you shouldn't and damage to your image if you reject a claim that is due, it could be harmful to the company's reputation if a large number of cases are brought to court
			(non-compliance with the IRSAM convention)	Difficult to apply since it involves many external players	Financial impact and shortfall when recourse actions are not proceeded in time and damage to the company's image because of delay in handling claims
	R30211	Data entry, execution and monitoring of transactions - deadlines and obligations to clients	Lack of monitoring of compensation deadlines by agency, branch and headquarters.	Insufficient management control - lack of regulations regarding deadlines	Payment deadlines are considered a performance criterion and excessive delays have a significant impact on the company's image
			Failure to settle claims due to insufficient knowledge of the methods of calculation	Lack of competence of staff, especially at the agencies - omission - insufficient management control - lack of system control	Financial impact if we pay more than we should and damage to the image if we pay less than necessary

			of compensation.		
	R30222	Suppliers - poor performance of services	Delay / inaccuracy of the loss adjuster's report - incorrect assessment of the claim by the adjuster: significant discrepancy between the real cost of the claim and the assessment	Lack of cooperation	Delay in claim settlement, dissatisfied customers, damage to the brand's image
R303 business disruption and systems failures	R30301	Systems - irretrievable loss or alteration of data	irretrievable loss or alteration of data (unintentional)	Human errors	Loss of clients' data, which requires a lot of time to recover, affecting the financial side of the company as well as its brand image
	R30302	Systems development	Development error	Lack of updates, not considering certain functionalities that are necessary for the insurance business when designing the system.	Insufficient control of the is, which does not detect certain human errors that could have an impact on the financial situation and harm to the brand's image, lack of necessary functionalities to detect fraud and provide statistics (setting up a database), its decentralisation does not allow the top management to access to

					the data on its network in real time.
	R30312	IT continuity planning risks	Non- continuity of operations because of the lack of a back-up plan in the event of serious difficulties in running the information system	Serious difficulties of external or internal origin in the absence of a formalized fallback	Cessation of the underwriting activity but continuity of compensation as this latter is done independently from ORASS
R304 employment practices and workplace safety	R30409	Human resources management - salary policy	Insufficient remuneration	relatively low salaries at the agency level compared to the workload in the automobile business line specifically, employees' misunderstanding of the compensation system at branch level	Unsatisfied employees are unmotivated workers who tend to make more errors than others
	R30406	Inadequate recruitment	Discrepancy between job requirements and the profiles of new recruits	Unclear job requirements, non-formalized description of the profiles needed	Mismatch between new recruits and the wanted profiles hence, employees who don't meet the requirements tend to commit more errors and can't fulfill their tasks correctly, which leads to shortfalls

	R30415	Human management resources - other	Work overload	The nature of the automobile business line in terms of poor working ergonomics	Source of operational errors that may have a negative impact on the company's image and financial situation
R305 damage to physical assets	R30506	Pandemic	The prominent example is COVID-19 or any other pandemic	An external event that affects several companies simultaneously including the CAAR.	-The unfavorable economic conditions of the country cause a diminish in the demand for coverage in general, yet in spite of this decline, the CAAR has always a stable resource thanks to the compulsory liability insurance . -A loss of income due to the increase in debts, -A reduced workforce and therefore a greater workload for the present employees
R 306 internal fraud	R30603	Power abuse	Information system manipulation to change parameters of some insurance policy	Low wages of employees at the agency level . Insufficient is security .insufficient management control	-Pocketing premiums, impact on the financial situation

	R30604	Unauthorized activity - false claims	Fraudulent/exaggerated insurance claims with internal complicity	Lack of control of the is, if there is no sufficient management control, there is no way to detect this type of fraud	Financial impact plus damage to the brand's image
R307 extemal fraud	R30701	Deliberate false claims	Fraudulent/exaggerated insurance claims	Attempt to enrich oneself	Financial impact plus damage to the brand's image

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