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DISCUSSION
PAPER

RISK MAPPING FOR SOCIAL SECURITY PENSION SYSTEMS

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ABBREVIATIONS

ISO31000	International Organization for Standardization Enterprise Risk Management Standard
COSO	Committee of Sponsoring Organizations of the Treadway Commission
ERM	Enterprise Risk Management
RM	Risk Management
ISSA	International Social Security Association
ILO	International Labour Organization
IAA	International Actuarial Association
AAE	Actuarial Association of Europe
IORP	Institutions for Occupational Retirement Provision
ORSA	Own Risk and Solvency Assessment report (insurance)
ORA	Own Risk Assessment report (pensions)
BIS	Bank for International Settlements
EIOPA	European Insurance and Occupational Pensions Authority
DB	Defined Benefit
DC	Defined Contribution
PAYG	pay-as-you-go
RR, TRR	Replacement Rate, Theoretical Replacement Rate
FR	Funding Ratio
CR	Contribution Ratio
AROP	At Risk of Poverty

INTRODUCTION

In our present-day context, risk management has become an integral aspect of organizational governance and operations. This is particularly crucial for entities tasked with ensuring the financial stability and long-term sustainability of their sectors. While Enterprise Risk Management (ERM) principles are widely adopted as standard practice, certain institutions have unique characteristics that necessitate specialized risk management frameworks. Moving closer to our focus, within the financial sector, banks adhere to the Basel Accords, while insurers operate under the principles of the Solvency regime. These regulations, predating international ERM standards, effectively manage risks specific to their operations. However, they also integrate ERM into their risk management strategies as organizations. These risk management systems share common elements and may contribute to establishing a social security risk management framework. In this paper, considering the similarities with other financial institutions, we will highlight the differences between them and pension funds. Private pension funds, entrusted with safeguarding the financial security of many individuals in their retirement years, are often perceived to be similar to insurance products or savings plans, despite their intricacies and crucial societal role. Furthermore, mandatory social security pension schemes, designed to provide a safety net for the working population, add an additional layer of complexity to risk management practices. While the importance of risk management in the pension sector is widely acknowledged, a universally applicable, comprehensive risk management framework tailored specifically for social security pension systems remains an underdeveloped area of study.

The objective of this paper is, accordingly, to address the critical gap in social security risk management, aiming to assist actuaries working in this field in establishing their risk management (RM) system.

Specifically, we endeavor to formulate a generalized risk management framework tailored for social security systems. In doing so, we interpret the overarching principles of Enterprise Risk Management (ERM) as applicable to pensions and delineate the intrinsic features of social security pension schemes that set them apart from other financial institutions. Our aim is to furnish social security actuaries with a cohesive and adaptable method to effectively manage the inherent risks of pension systems. In pursuing this objective, we aspire to equip social security actuaries and professionals with a robust toolset for identifying, measuring, and monitoring risks. Additionally, we aim to spark further discussions on this pertinent topic.

1 SETTING CONTEXT

The European Commission's triennial Pension Adequacy Reports and the Ageing Reports offer the most comprehensive mapping of the European pension systems. These reports regularly analyze European pension systems using projections of future states of the systems and apply a wide range of metrics to assess them against expected outcomes. Then the conclusions are used to advise national governments to avoid adverse scenarios. Formulating the process like this makes it similar to the risk management cycle. Indeed, contingent future events pose risks to pension provision and regular monitoring, assessment, and advice provide risk controls. In this paper, we will adopt a more formal approach to devise a risk management framework for pension institutions.

Enterprise risk management or ERM has developed widely used methods which can be used for general purposes, and so to pensions, too. Enterprise risk management is dealing with organizations and institutions which have explicitly defined objectives. In our case, the objective is providing pensions. A common understanding is that the effect of the risks in the likelihood x impact coordinates is generally measured in financial terms, again easily applicable to our case. In the general case, the business objectives of an enterprise are by definition expressed in monetary terms. In our case, we interpret pension as a financial transaction for this purpose. This approach is consistent with all definitions of pension, as insurance, deferred income, or consumption smoothing, and classifying pension funds as financial institutions. We follow this interpretation but later on we will define the distinctive features of social security pension funds financed and administered by the state.

Financial institutions' enterprise risk management best practice relies on the ISO31000 and COSO standards. These standards define the risks relative to the objectives of the organization. This approach positions RM together with strategic and business planning. The risk management framework also has strategic and operational-level feedback cycles. The first one aligns the RM to the objectives and monitors and revises the RM framework. The second cycle implements and gives feedback to the RM framework. This one is built around risk assessment and risk treatment processes. The main point of reference is the risk appetite of the organization. The risk appetite is defined in relation to the performance objectives of the organization and based on the assessment of all relevant risks (the risk universe). Enterprise risk management has another applicable concept. As we just pointed out, ERM focuses on business objectives and business planning that can be expressed in financial terms. The business of financial institutions is trading in risks and money. The ERM of financial institutions confirms that the main categories of risks are governance and organizational relations, own specific business, and operational. All three have financial risks. For financial institutions, the best example of own business finances is investment. For the other categories, the financial transactions are expenses and costs.

The main difference between financial institutions can be identified according to their objectives and their specific own business. According to our definition, social security pensions are deferred income earned during an active career. From this perspective, a pension is a financial transaction dealing with the risks of old age and retirement. The objective of pensions is providing old age benefits. In social security, the objective is to provide adequate, sustainable, affordable, and robust pensions.

The risk events occur during active life and retirement at individual and economy levels. The events form a multi-state model of active, inactive/unemployed, disabled, retired, deceased states. Risk indicators can be identified in the cross-section of the risk events and the decomposition of the main risks. The completeness of the event space and the systematic decomposition of the objective may secure that all relevant risks are included in the risk universe and help establish a complete set of risk indicators. Other risk management tasks of a proper RM cycle include risk evaluation, prioritization, treatment as well as monitoring and review are also applicable to the pensions case. In our examples based on the multi-state pension model, we identify which variables change in a transition to one state from another during the career and retirement and identify the indicators which these variables are used in. Not surprisingly we arrived at the well-known risks of sustainability, adequacy, and intergenerational equity, and the indicators of the Ageing Report and the Pension Adequacy Report, like the replacement rate or the dependency ratio. Identifying other risks would need more research. The most straightforward risk treatments change the rules of the pension system according to the prioritized objective components. However, changing regulations of pension systems means changing Laws. In this process, the role of actuaries can only be expert advisors', but an RM framework can be used for devising provident risk mitigation tools, like Automatic Adjustment/Balancing Mechanisms. Other risk mitigation tools support monitoring, analysis, and the work of the public pension administrator.

As part of establishing the context we are giving an overview of articles about our topic in the following.

OVERVIEW OF INSURANCE AND PENSION RM ARTICLES

ERM is a general framework for managing risks. Actuaries manage a special set of quantifiable risks, so actuarial methods and skills are readily applicable to RM. From a different perspective, actuarial tasks arise in the context of an organization, which is an enterprise. So there is a two-way road between the topics of interest of the two areas.

The IAA has produced several papers exploring ERM from actuarial perspectives. Two of them deal with the development of an ERM system for insurers. The first one is a general guideline from 2009 establishing ERM for insurers, and the other is more focused on actuarial methods but still embedded in the ERM context (2016). Another IAA paper is added to the 2009 IAA Note on ERM to establish the relation between the insurers' case and pensions. An AAE paper discusses operational risk management of insurers and occupational pension schemes (IORPs according to the EU Directive) with a certain outlook on the general case and the own risk assessment reports (ORSA and ORA, respectively). Here the main purpose is to establish the role of actuaries in risk management. The two IAA papers dedicate specific sections to definitions and explaining the basics of ERM. The AAE paper clarifies the difference between operations in general and the operations which are common to every organization. It points out that in the financial sector operations related to credit and investment and risks are different from running the organization. For this narrow-sense operational risk concept, they rely on the BIS and the EIOPA definitions.

The IAA papers follow a top-down approach to the description of the system, starting from risk governance to the risk culture of the organization and the description of the risk management processes. At this stage, they distinguish the governance, management, and daily operations levels. However, they discuss strategic level risk appetite/tolerance issues among the processes rather than as a governance topic. It is interesting that the 2009 IAA Note and AAE paper identify upside risk as an integral part of the financial sector business. The Note Addendum on pensions points out that operating an occupational pension scheme is a downside risk for the employer.

Discussion of the ERM processes begins with a broad list of risks and the usual disclaimer about the examples and interpretations. All lists are similar but still different. Only the IAA Actuarial Aspects paper proposes a layered approach to market risk. The IAA Note Addendum on Pensions discusses the difference between insurers and pension funds but fails to elaborate on a set of risks for pension schemes. It also claims that the case of DB pension schemes can be extended to public pension schemes where the employer's covenant falls on the taxpayers.

In relation to the risk management process, these papers introduce the concept of the risk management cycle of risk identification, analysis, evaluation, and treatment, followed by monitoring and reporting. Risk metrics and/or KRIs are discussed under different headings in multiple sections. The IAA papers explicitly consider risks on an inherent – residual basis. The Economic Capital Models and ORSA are also examined in detail. The IAA Note Addendum on pensions proposes to have a kind of ORSA for pension schemes, and of course, the AAE paper covers the ORA of the EU IORP Directive as well.

ISSA ILO Actuarial Guidelines on Risk Management

The closest source to our topic is the ISSA ILO Actuarial Guidelines, which includes a chapter on actuarial contribution to risk management. However, without having another dedicated ISSA Guideline on RM, this guideline discusses risk management and actuarial contribution side-by-side as if the RM framework had already been defined. First, they set out the objective of risk management in social security systems, then discuss an RM framework and process, and the requirement for a dedicated RM function. After discussing the elements of a basic RM cycle, the guidelines provide for a risk inventory and establishment of the risk appetite (as risk budget) and a risk management plan. The guideline describes the risk management process as the project of the risk function unit. The risks are delineated under the categories of Scheme risks and Operational Risks. Without going into details here, the ISSA Guidelines risks are:

- **Scheme risks**
 - Benefit expenditure risk
 - Financing risk
 - Investment risk
 - Interest rate risk
 - Currency risk
 - Third-party provider risk
 - Scheme objectives risk

- **Operational risks**
 - Human resources risk
 - Governance risk
 - Regulatory risk
 - Reputational risk
 - Operational risk

While it is mentioned that some risks may overlap, other grouping could be applied. For the sake of our discussion in the following sections, we draw the attention to Governance and organisational risks (responsibilities and reporting lines) as strategic issues which could be separate from operations, and can be a risk category on its own right. Scheme objectives risk can also belong there, as a strategic one. Third party risk is also a strategic decision, while the operational consequences may appear under the function which has been outsourced. Investment risks might also be positioned and discussed differently.

The primary definition in the Guideline sets out the objective well: Risk management enables the social security institutions to increase the likelihood of achieving its objectives, in responding to life-cycle risks of the population. For our purposes all the life-cycle risks and benefits – including monetary and in kind – are too broad topics, and indeed, in some cases leading too general or irrelevant guidance for us, for example in risk mitigation.

The risk management framework seems to follow other standards than the COSO or ISO. The focus is on the processes of the risk function unit, and could be best described as a project management guide than risk management. However, the ways and modalities of actuarial contribution are well elaborated.

Definition of the inventory of elementary risks and mitigations is a critical element of the process. It should be derived from the objectives. In this sense, while all branches of social security can be best described by multi-state models, their risk events and financing models are significantly different. So it would worth to define the objectives and the corresponding risk inventories of the branches of the social security branches one-by-one. In most cases the governance and administration (institution and organisation) of these institutions are separated anyway.

NEXT CHAPTERS

Following the original course of thought, setting the context, in the next chapters we discuss ERM in general to establish common terminology – RM experts may skip this two-pager – and a new concept of common risk categories for all entities. Then we focus on risk management of financial institutions as the broader context for pensions and the articles which have already dealt with risk management topics for insurers, with some outlook to pensions. Next, we point out the distinctive features of pensions before and, at the end, we focus on social security pension provision by public sector financial institutions.

This step-by-step approach could help us in adopting the already established methodologies and still take into account the differences between the pension sector and other financial institutions before focusing on social security pensions. The main section of the paper is devising the pension risk universe, ending with an example of using a risk heatmap for assessing social security pensions sustainability as an illustration of the above considerations.

Further examples and general information on risk management for reference are quoted in the Annex.

2 ERM RISK AND RISK ASSESSMENT

RISK CONCEPTS

The most widely used standards in this area are developed by COSO and ISO for business enterprises in support of business planning and achieving business objectives.¹ However, the concepts and methodology are formulated in a way that makes it possible to adapt for all kinds of organizations with defined objectives.

An organization may fail to achieve the objectives or may gain from assuming risks for several reasons. The ever-changing risk universe can be derived from the objectives and operational environment of the organizations. They give the general risk categories. In this approach risk is the possibility that an event will occur and (*adversely*) affect the achievement of objectives.² The objectives must be set consistently with the appetite and tolerances of the organization as measured against performance, providing the risk profile of the organization. It requires the assessment of all risks of the organization's risk universe. In a risk management system, the risk universe is systematically described by a risk register or inventory, which is using similar concepts and methods as the business performance measurement. The links with objectives and performance establish the relationship with strategic and business planning. The risk register identifies the risk with several descriptors, among others, Key Risk Indicators.³

1 Name or title of risk	<ul style="list-style-type: none"> • Unique identifier or risk index
2 Scope of risk	<ul style="list-style-type: none"> • Scope of risk and details of possible events, including description of the events, their size, type and number
3 Nature of risk	<ul style="list-style-type: none"> • Classification of risk, timescale of potential impact and description as hazard, opportunity or uncertainty
4 Stakeholders	<ul style="list-style-type: none"> • Stakeholders, both internal and external, and their expectations
5 Risk evaluation	<ul style="list-style-type: none"> • Likelihood and magnitude of event and possible impact or consequences should the risk materialize at current level
6 Loss experience Indicators and Monitoring	<ul style="list-style-type: none"> • Previous incidents and prior loss experience of events related to the risk
7 Risk tolerance, appetite	<ul style="list-style-type: none"> • Loss potential and anticipated financial impact of the risk or attitude • Target for control of risk and desired level of performance • Risk attitude, appetite, tolerance or limits for the risk
8 Risk response, treatment and controls	<ul style="list-style-type: none"> • Existing control mechanisms and activities; Level of confidence in existing controls • Procedures for monitoring and review of risk performance

1 Those who are familiar with the topic may skip the chapter.

2 Still the methodology includes upside risk, the risk responses are 'reduce, accept, transfer or avoid'.

3 See Appendix B.

Establishing and reviewing a risk register is supposed to include all relevant risks once and only once with minimal overlap between them to achieve the best coverage. Similarly, finding the best set of risk indicators might also present a challenge. For that purpose, we start by breaking down the objective into components and mapping all events that will occur during the course of achieving the objective. Risks can be identified at the cross-section of the components of the objective and the events. Having the components of the objective and the risk events defined, the potential impact of the events on performance and losses can help define risks and risk indicators.

Most risk management frameworks analyze risks considering impact and likelihood and distinguish between inherent and residual risk after applying risk controls or mitigants. In the COSO approach, the underlying concept is Value at Risk or Capital at Risk, and the Cost of Risk = Expected Loss + Cost of Capital (and the cost of other risk controls). In practice, risks are assessed on the Likelihood x Impact coordinates. The methodology is capable of comprising both quantitative and qualitative indicators and addressing both downside and upside risks.

RISK ASSESSMENT PROCESS

Risk assessment involves processing all relevant risks in relation to the objective. Not by coincidence, both the risk management framework and the process are usually defined as feedback cycles. The first one sets the strategic context for the second, implementing the strategy and providing information to the first one.⁴ Setting objectives and decisions on risk appetite and risk profile are regarded as framework at the governance and strategy level, while risk-by-risk assessment is the focus of the operational level risk management implementation process.⁵ Again, the risk management cycles are aligned with strategic and business planning.

The COSO risk management implementation process consists of:

- Identifying risk
- Risk assessment, performing: Developing assessment criteria and Assessing risks and risk interactions by qualitative and quantitative risk metrics, indicators
- Prioritizing and Responding to risks and establishing Residual risk assessment
- Monitoring Performance in portfolio view. Regular own risk reporting is part of the monitoring process.

The process is preceded by objective setting in relation to the risk appetite (given profile, tolerance, and performance) and supported by control activities, information, and communication.⁶

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4 Both ISO and COSO defines principles, framework and process. See Appendix B.

5 The terms of framework and risk management are sometimes also used to refer to the methodology or one element of the process, depending on the standard in question.

6 In the ISO standard Risk assessment includes risk (i) identification, (ii) analysis, and (iii) evaluation in a narrow sense. Risk assessment preceded by defining the scope, context and criteria and followed by Risk treatment and Monitoring and review. The process is completed by recording and reporting, communications. Here the term of Risk assessment describes different elements of the process. Analysis and evaluation might better specify elements assessment, but interactions, prioritization and portfolio view better highlighted in the COSO methodology.

3 ENTERPRISE RISK CATEGORIES

Enterprises and institutions share common characteristics. They all have a mission and must have governance and organizational structures. Their staff performs operations both to achieve their specific goals in production, servicing, trading, or other business or activities they might pursue, and to administer the organization's HR, bookkeeping, IT systems, maintenance of immobile assets, etc., in general.

What makes them distinct is their individual mission and how they decide to fulfill it. In ERM terms, their own specific objective and business define their uniqueness. Their area of business operations and performance differentiate them from others, even if they may use the same or similar governance and organizational structures, processes, IT systems during their daily operations.

Making a distinction between own business and organizational operations, we need to clarify some overlapping terms in our use. Operations may refer to both business and organizational activities, but here we specifically mean the latter. In most languages, 'investment' is the only term for financing core business and all other organizational infrastructure. However, this duality could be seen in finances: financing the core business is mostly capital investment and held in specific asset classes, while the closest term to financing organizational processes and their infrastructure is general and administrative expenses. This is like comparing apples to pears (and oranges), but the accounting terms of capital investment and non-capital investment are not made according to the purpose of use of the assets, as we intend to do. In this paper, we focus on financing the core business, that is investment in the narrow sense. This distinction is important to avoid all uncertainties in the case of financial institutions, where investment will mean investing assets for funding liabilities to investors/policyholders/fund members and statutory capital (if required).

Our starting point is the objective of the organization, and the risks will be defined as the effect of uncertainty on objectives (ISO 31000). The funding documents and mission statement define the distinctive objective of the institution. The business strategy and plans specify the business objectives taking into account the risk appetite.

In the following, we define the general risk categories in a way that makes it possible to distinguish the risks according to the own objectives and the common features of the organizations.

Using these distinctions, we may define the main risk categories at the highest level as:

1. Governance and organizational structures
2. Own business
3. Operations of the organization

1. Governance and organisation risks

- a. Governance and Strategy risks, Reputational risk, Compliance risk
Decisions on Risk appetite/tolerance belongs here
- b. Organisational, responsibilities, reporting, and structures, HR and organisational culture and processes

2. Business or enterprise risks: specific to own business/enterprise activities

- a. Risks of achieving the mission and objectives of the organisation
- b. Including Financial risks of financing own business: financing development projects, investment, financial asset risks like: Market risks (market: to which the business is exposed to), Credit risk (lender or borrower), Solvency/Liquidity risks

Here we understand the term of business or enterprise in general meaning, denoting the organisation's own specific activities.

3. Operational risks: operating as an organisation (the 'infrastructure' of the organisation and the business)

BIS definition: the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events

E.g. IT/cyber risks are here, financing risks of the operations and organisation (expenses, costs)

In this approach financial institutions differ from others in their business risks. Their own business is transforming risks and durations of financial transactions, so financing own business, investment is in itself their core activity. Therefore, for example their risk appetite/tolerance is special in financial risk taking.

4 FINANCIAL SECTOR CONTEXT

Banking and even more insurance are examples for pensions, and their advanced methods can be applied in pensions, taking into account the differences. Historically the Basel Accords in banking and the solvency criteria for insurers preceded the general purpose ERM standards. The business of banks and insurers is trading in money and risks. These financial sector regulations start from business risks and look at operational and other risks from the perspective of reasons endangering their specific business objectives. The regulations prescribe regulatory/solvency capital requirements, proportional to risks, as mandatory risk control tool. The most recent versions of the Basel and Solvency regulations also require comprehensive risk management systems, so as to take into account risk other mitigations.

The COSO and ISO ERM standards also have predecessors. Both organisations first developed compliance and internal control standards. Their guidelines are more principle based and procedural without taking into account specific business areas and assigning specific mitigant tools like capital requirements on business portfolio risks assessment. Banks and insurers are enterprises using ERM in their operations. In a survey of central banks 91% rely on ISO31000 and 75% takes into consideration COSO in their organisational ERM framework.⁷ For that reason the general ERM approach will be helpful as the common starting point in finding the similarities and the differences between pensions and other financial institutions. Their processes and methods are similar, but the objectives are different. Banks, insurers and some pension funds are private financial sector service providers. Finally, social security pension is public service, therefore their liabilities and the funding of liabilities are also prescribed by law, but it is part public finances management. In this case we have to be careful considering the similarities and the differences.

7 ISO 31000 remains top framework for risk managers - Central Banking.

5 PENSIONS AS FINANCIAL SYSTEM

Looking at pensions as a financial instrument, we may regard it as transfer of income to retirement (consumption smoothing) and as insurance against old age poverty. Pension funds are financial institutions, trading in risk and money, collecting contributions and paying out pension annuities and other benefits. In this section we describe social security pension institutions highlighting their special features as part of a multi-pillar pension system.

Pension systems are defined by long-term social contracts covering the widest group of people because of the mandatory nature of social security. For most of them, this is the largest financial transaction of their lives, in which the price for the benefits is paid in advance before the service is provided.⁸

Different pension arrangements share risks differently among the participants.⁹
In ascending order of risk sharing:

- In a defined contribution (DC) scheme, risk of varying returns during the pension accumulation phase falls entirely on the individual. In extreme cases, an individual may use securities accounts as a funding vehicle, although this is typically only observed in financially literate savers. If the annuitization of the savings is not solved collectively, the risk of old age poverty remains unsolved.
- In a funded defined benefit (DB) scheme, financial risks, e.g. the risk of varying returns falls on the guarantor, that is the plan sponsor. However, in an occupational or industry pension scheme the management has the means to transfer the risk of costs of the scheme to their shareholders and customers.
- In a public unfunded pay-as-you-go (PAYG) scheme, the risk of rising pension costs falls primarily on current insured workers, who are paying the pension contributions and on the taxpayers as a last resort.
- In a tax-financed minimum pension scheme, risk falls on taxpayers and hence, via government borrowing, can be shared with past and future taxpayers.

8 In the normal cycle the consumer chooses and pays after a product is manufactured. In pensions the insured first pays until retirement and then gets a benefit which they are not in a position to change.

9 Source: prof. Nicholas Barr.

Social security systems are also pension funds, but with significantly different policy objectives and governance, funding, administration and statutory regulations than private pensions.¹⁰

Social security pension is the first pillar of the pension system. Multi-pillar pension systems have evolved either historically or developed by structural reforms, but nowadays exist in all EU Member States. The pillars are usually defined by their adequacy objectives and risk appetite of the targeted socio-economic group. Therefore, a multi-pillar system can be regarded as an old-age risk management tool. Including affordability in the definition we arrive to the core concept of the COSO risk appetite/tolerance and performance/target space.

The pillars of a pension system define the governance, organisation and finances as

- Public or private
- Financing: pay-as-you-go (PAYG)¹¹ or fully funded
- Benefit definition: Defined Benefit (DB) or Defined Contribution (DC)¹²
- Mandatory or voluntary
- Intergenerational arrangement (or not)

In the 1st pillar there are significant differences between social security systems in different countries in Europe, with relevance to their risk appetite and tolerance. In particular their risk sources – rules and regulations, demographics, funding and financing – are different.

The Word Bank¹³ defines the objective of pension systems to provide

- Protection against the risk of poverty in old age,
- Consumption smoothing from work to retirement,

10 Richard Hinz: Supervision of Pension Funds: Theory and Practice in Supervising Private Pensions: Institutions and Methods, OECD 2005.

11 Financial system where annual disbursements of social security benefits are approximately in balance with annual receipts. <https://metadata.ilo.org/thesaurus/>.

12 DB: Pension scheme paying benefits expressed as a prescribed percentage of previous insurable earnings.
DC: Pension scheme where benefits are based on amounts accrued on a participant's account.
Source: <https://metadata.ilo.org/thesaurus.html>.

13 Robert Holzmann, Richard Paul Hinz and Mark Dorfman: Pension Systems and Reform Conceptual Framework, SP Discussion Paper No. 0824, The World Bank 2008.

and the evaluation criteria of achieving the objective are:

- Adequate and equitable,
- Sustainable,
- Affordable, and
- Robust and predictable retirement income.

Adequacy and sustainability are discussed in the European Commission's Ageing and Adequacy reports. Affordability considers the financing capacity of both the individual and the economy. An equitable system may provide for income redistribution from the lifetime rich to the lifetime poor consistently with agreed social preferences, but otherwise provides the same benefit for the same contribution. Predictability assumes unforeseen changes in the rules and the value of the benefits. Robustness is the capacity to withstand major shocks, including those coming from economic, demographic and political volatility. Equitable, robust, and predictable pensions may protect against the risks of intergenerational fairness. This paper focuses on improving the risks of Adequacy and Sustainability as the main issues.

There are significant differences in financing, benefits, mandating and organisations between social security systems. For the purposes of discussion, in this paper we take the example of a generalized 1st pillar mandatory PAYG social security pension system. Under this arrangement pension contributions are deducted from present income (pensionable salary), the rights to future pension benefits accrue by contribution payments during the active working career phase and until retirement (establishing the service period), and finally the pension annuity is calculated based on career average salary which is proportional to the service period. The government is guarantor of the benefits and administrator of a public sector pension institution. Note that some European countries may have different basic pension or 1st pillar model and the risk management systems have to be different for all pension systems.¹⁴

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14 In some European countries the main public scheme is a tax financed basic and/or minimum pension arrangement, and main source of old age income comes from a funded occupational scheme. For them only the basic concepts described here are applicable. Other papers discuss funded pensions with more emphases on investment issues.

In the following we summarise main features of the social security pension system according to the ERM risk categories.

Objective

- Provide pension benefits in old age.

We decompose the pension objective as providing adequate and equitable, sustainable, affordable, and robust and predictable retirement income.

Governance and organisational relations

- the social security institution: public pensions;
- with the involvement of ministers and politicians, formal interface with Ministry of Finance and Labour/Social Ministry;
- with public accountability; and
- rules defined by Laws.

Business and Finances

PAYG DB: contribution payment and benefit delivery of overlapping generations:

- business risk driven by demographic factors, including fertility, longevity, dependency ratio;
- economic situation;
- impact of changing earnings structures and working patterns;
- exogenous factors such as pandemics; and
- evolving attitudes to ill-health and disability.

Operations (of the organisation)

- Public sector administrator;
- government department or independent agency;
- challenges of running such a large agency efficiently and economically; and
- database and information challenges: life-long employment, family status and benefit records.¹⁵

Social security institutions should have dedicated risk management units, reporting to the governing body, closely working together with budgeting and planning. They have similar methods and procedures. Where there is a difference, their approach complements each other: budgeting focus on sustainable funding, and considering risks in relation to scheme financing. Actuaries can and should be involved because of the same reasons.

In social security pension systems, the risk management framework may contribute to more adequate, sustainable, affordable and robust pension systems by risk-based monitoring and risk assessment by adopting new risk controls. They can improve monitoring methods, help systematically devise control mechanisms, or prioritise and schedule other risk controls. For example, automatic balancing mechanisms, as described in the AR¹⁶ fit into this framework. They use risk indicators as triggers to parametric changes.

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15 Socio-economic status.

16 See also the SSSC discussion paper on this topic.

6 DEVisING THE PENSIONS RiSk UNIVERSE

In case of social security pensions, the objective is to provide pensions in old age. More specifically, the objective is to have adequate and sustainable pension benefits after a full working career. Career events that may affect pension benefits could be a change in employment, change of employer and/or the pension system itself. Adequacy is an individual level concept, while sustainability is a macroeconomic issue. But for example, in the case of an economic crisis, an employer may have to make workers redundant to reduce its contribution costs and so pension benefits of the employees concerned are affected. This is influencing both adequacy and sustainability, even if lagging in time. The usual method of analysing pension systems is aggregating pension rights of the covered population. It is readily applicable for sustainability issues and average adequacy measures. The Ageing Report is further breaking down the pension expenditure indicator (PE/GDP) into demographic, labour and adequacy components of dependency, coverage, labour market and benefit levels. For adequacy, more granular measures can be found analysing the socio-economic groups. Having the components of the objective of a pension system and the risk events defined, the potential impact of the events to costs (sustainability) and benefit levels (adequacy) can help in defining risks and risk indicators.¹⁷

We have defined the objective and the main risk categories of a pension system in the previous chapter. Here, we focus on the potential impact of risks on financing cost (sustainability) and benefit levels (adequacy) to help in defining risk indicators. Here we catalogue the events of an individual life with effect on pensions as the risk event space.

The objective of all pension systems can be measured by the benefits and by the variables defining the benefits and benefit financing at the individual level and system-wide level. The events influencing the pension benefit occur at individual level during the active career of the individual. Society or system level changes may influence the working careers of people according to their socio-economic groups.¹⁸ Different events influence the careers of different socio-economic groups differently. Usually, we analyse the demographics of the system by adding the age dimension (demographic cohort) and calendar year (as cross section) to the event space. The events influence the outcome in relation to the objectives, in that the risks that materialise may have an effect on adequacy and sustainability. A pension system has an explicit or implicit retirement benefit objective relative to an assumed career.

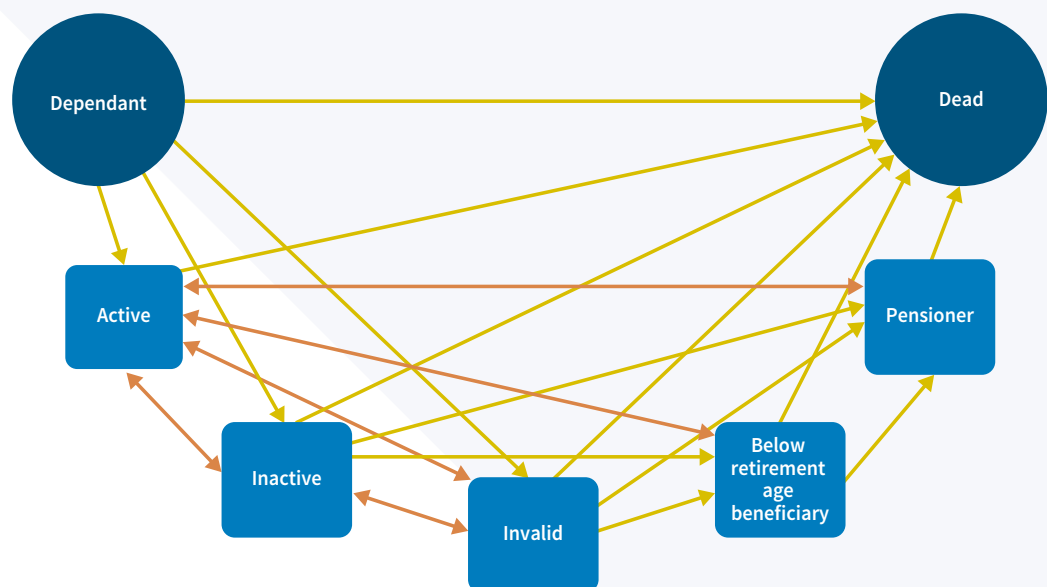
17 We focus only on risks endangering benefits and do not deal with governance, organisational and operational risks.

18 Socio-economic status and socio-economic groups might be defined on employment, income and education scores. In our discussion gender, career (active, disabled, retired) status and family (married, widowed, dependent) status also relevant.

There are events at society and economy level which may, in the end, influence the individual pensions. The rules of the pension scheme and/or the employment regulation may change, and economic and demographic changes may also influence the pension outcome. These occurrences obviously influence individual life paths. We only make this distinction because some events are easier to formulate at individual level, while others will be better done on aggregate. The impact at economy/society level depends on demography and actuarial neutrality or the level of the benefits. For example, split career patterns, gig economy, minimum wage declaration, ageing society and increased longevity, systemic generosity, distortive redistribution, ad hoc systemic changes might be easily assigned to the main event categories. Events and indicators can be further detailed and fine-tuned to establish the monitoring and risk assessment of a specific pension scheme.

Pension systems can be best described by a multi-state model.¹⁹ Transitions are between the Dependant, Active, Inactive, Invalid, Below retirement age beneficiary (i.e., early retirement), Pensioner, Dead states as represented by the arrows. Events change status and affect the benefits and so may pose risks if there are deviations from the expected. Indicators measure risks based on their impact. Transitions occur at individual level and can be aggregated to society level for a period, like for example the population of an age cohort in a calendar year. The key risk indicators measure the effect of the events on the outcomes throughout monitoring of the system.

FIGURE 1: MULTI-STATE MODEL OF PENSION SYSTEMS



Source: Author

19 For simplicity we deal with transitions between Active, Inactive/Unemployed, Pensioner, Dead.

On the risk response spectrum of *accept - avoid - reduce - share - pursue* social insurance systems accept pension, death and disability risks while making some preventive measures to mitigate the downside of consequences. Risks of unemployment or disability are managed separately. Here we focus only on the impact on pension benefits, as unemployment and disability cause shorter service/contribution period and earlier access to benefits. This approach assumes that the benefit formula is not actuarially neutral, but generous. Another assumption is that the finances of the scheme are in balance or at least sustainable by the time of the assessment.

The next step is defining risks according to the events in relation to the main component categories of the pension objective. A systematic review table can be used to define the descriptions, the changing variables of the risk indicators, and in the end the items of a risk register/inventory. The first step is to examine the impact of the event space transitions to the variables describing the objectives.

EVENTS	IMPACT	INDICATORS
<p><i>What can change pensions? To whom? When?</i></p> <p>Events influencing pensions in multi-state events space occur</p> <ul style="list-style-type: none"> • at individual level and at system level • with different effects on socio-economic groups <p>Also taking into account demographic cohorts: age 18, ..., 100 in year 2016, ..., 2070</p>	<p><i>Events may change outcomes in relation to the objectives</i></p> <p>Risks with effect on</p> <ul style="list-style-type: none"> • Adequacy • Sustainability • Affordability and • Robustness (vs volatility) of the retirement income 	<p><i>Key Risk Indicators</i></p> <p>Examples</p> <ul style="list-style-type: none"> • PAR: Adequacy indicators: Replacement rates • AR: Pension expenditure measures: PE/GDP and its component factors • Affordability: Required contribution rate • Contribution density • Robustness: Benefit 'volatility'

A more detailed table of variables and indicators can be found in Appendix C.

7 RISK MODELLING CONSIDERATIONS

At individual level the career events (unemployment, disability) change the level of pensionable earnings and the length of the service period during active life. The timing of the retirement determines the level of pension benefits and the length of period during which the annuity is being paid. At system level, the aggregate number of contributors and their contribution capacity provide the source of funding the pension benefits of the retired population.²⁰ The variables affected by the events include the number of contributors and pensioners, the level of pensionable income, service period, level of benefit and length of retirement. This description might be adequate for the analysis of the macro sustainability a PAYG system. However, to obtain more detailed assessment, the transitions should be observed at, and take into account, the socio-economic group of the individual.

In the simplest cases, relevant risk indicators for individuals are those in relation to adequacy risks, while aggregate indicators at the economy or society level are those relevant to sustainability. Indeed, risk events such as decreasing pensionable earnings and/or service period impact negatively both on adequacy and PAYG financing. We are aiming at more sophisticated results than what is immediately apparent in order to find better risk mitigation tools. We reference adequacy indicators from the Pension Adequacy Report and other papers analysing the adequacy.²¹ The Ageing Report provides pension sustainability measures, e.g. the projected expenditure. ILO and the World Bank reports use required contribution rate and contribution density as usual measure pointing to affordability, or rather ‘unaffordability’. Benefit volatility maybe a measure of robustness at economy and society level.

Most pension modelling exercises face the uncertainty of long-term modelling. For the purposes of risk modelling the starting point is that all pension schemes/systems are operational and are paying the benefits by the time of the assessment. The risks must be formulated supposing a possible scenario different from the expected, and by assigning likelihood to that scenario.

Measuring risks in terms of benefits helped to define the impact. The other axis of risk measurement is probability. In case of pension modelling, it will need careful consideration.²² The best way is to look at it as rough qualitative scaling and using comparing past modelling and statistics as a starting point.

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 20 Turnover effect: On the pensioners’ side of the pay-as-you-go equation the number and level of new benefits may significantly be different from that of the deceasing pensioners.

21 See SSSC discussion papers on adequacy.

22 In fact, it is the case in other professions, too. It is difficult to explain the necessity of involving risk management into financial planning to a successful businessman.

Going beyond the general considerations, similar scenarios might take place with different impact and probability in different pension systems, depending on their specific scheme rules and micro- and macro-operational environment and demographic situation. We may consider the different definitions of the multi-pillar systems and observe that benefits can differ between countries. Consequently, even starting with the same key risk category, the definition of the component risks must be specific to the scheme. Therefore, *to start with a rough model, it might be advisable to examine and compare the results of past models and statistics only to establish a simple qualitative scaling of each risk.*

8 NEXT STEPS OF THE RM CYCLE

Without going into too much detail, a proper risk management cycle also includes the Risk evaluation, treatment, and the monitoring and review stages. Following the results of this assessment, the risk response could be to avoid, accept, reduce, share, or transfer risks, taking into account the total risk portfolio and the risk appetite/tolerance and performance coordinates.

In case of competing or even contradicting objectives, prioritisation may assist to provide direction. In pensions, adequacy and sustainability objectives can be easily interpreted as contradicting. Furthermore, decomposing objectives, and considering other risk criteria (coverage, timing, etc.) may further help to explain the significance of a risk. Other concerns may arise at the economy/society level and within the operations of the pension administrator organization. Social security RM should be holistic, because many factors and groups have to be considered. The COSO answer is to apply a portfolio view approach and prioritise.

Risk treatment/mitigation means selecting the most appropriate risk treatment option(s); and designing risk treatment plans specifying how the treatment options will be implemented. At system level, risk management requires changing regulations and policies, based on expert analysis and actuarial advice. For the pension administrator, risk mitigations are the usual administrative and operational policies, control activities and procedures, which are implemented and carried out regularly to help ensure the appropriate risk responses.

However, the basis of all this should be data collection and monitoring. Monitoring and review – again, this is something that actuaries are already applying, even if this is done for other purposes. Most elements of the actuarial valuation can be applied to risk management purposes and can be included in the risk management cycle.

Pension systems accept risks basically according to service period, pensionable earnings, contribution payments, retirement age and benefit rules. The simplest risk treatments change these rules according to the objectives that have been prioritised. Changing regulations of pension systems means changing Laws, and one of the roles that actuaries can play is that of expert advisors. Monitoring can be used for devising risk mitigation tools, like Automatic Adjustment/Balancing Mechanisms.

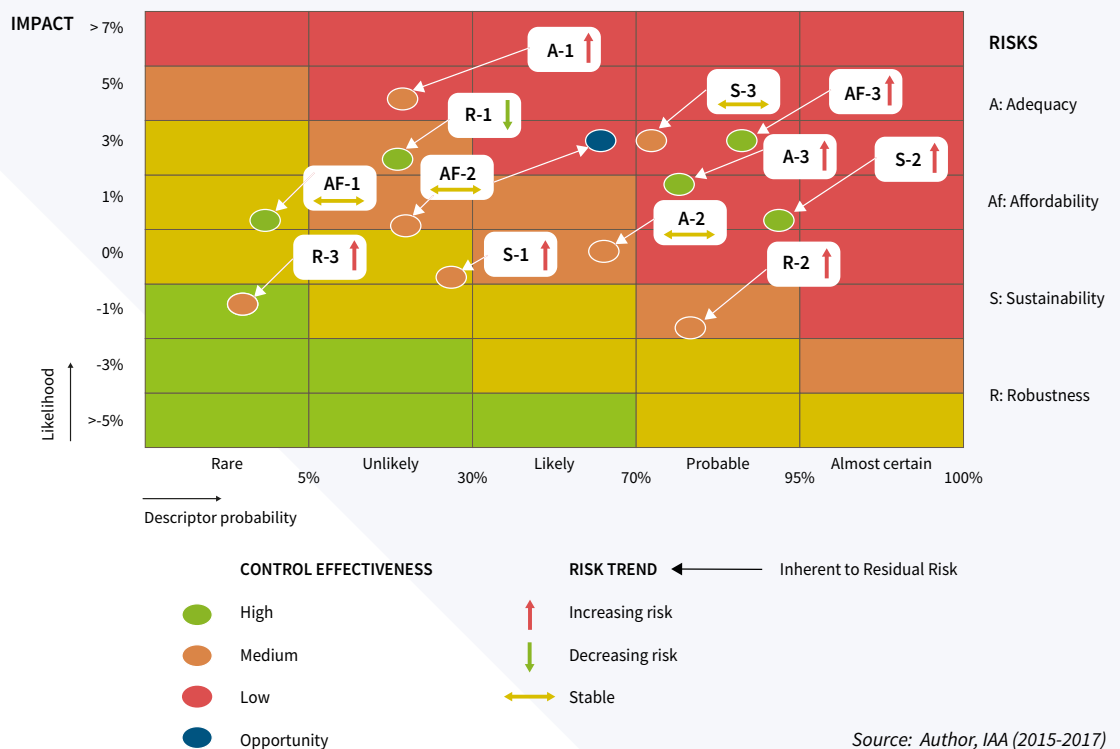
9 EXAMPLE: SOCIAL SECURITY RISK MAPPING OF ONE COUNTRY

Example Social Security risk mapping

Risk maps serve as standard tools in risk management dashboards. They interpret an Impact-Probability domain of all relevant risks of the risk universe. The scales of the axes can be both quantitative and qualitative. When showing multiple risks or entities on the same map the values must be congruent for comparability. The impact on the y-axis can be loss, expressed in monetary terms or in percentages, for comparisons like pension expenditure/GDP of the EU Member States. The probability on the x-axis in qualitative terms can be (Very) Low, medium, (Very) High. Heatmaps can show inherent and residual risks and trends as well, depending on the purpose of the discussion, for example prioritisation.

Take the example of a pension system, where the risk universe identified twelve risks, three in the main categories of Adequacy, Sustainability, Affordability and Robustness. The aim of the own risk assessment was to examine the effectiveness of the risk controls in place. The result can be summarised in a heatmap.

FIGURE 2: PENSION SYSTEM HEATMAP



Source: Author, IAA (2015-2017)

In the Appendix we illustrate the above heatmap on the Pension Expenditure/GDP indicator of Ageing Report. The indicator can be used for country contributions to assess the EU, and the breakdown to Replacement Rate, Dependency Ratio, Coverage Ratio, and Labour Market effect is applied to the assessment of one country.

10 CONCLUSIONS

Although there are differences between the Ageing Report and the Pension Adequacy Report with respect to pension systems of EU Member States, both agree that the main risks are sustainability, adequacy, and intergenerational fairness. A risk management system should ‘provide reasonable assurance regarding the achievement of the objectives’.

Risk management in pensions can be implemented by considering the ISO/COSO ERM framework, similarly to other financial institutions. The objectives and the categories of governance and organisation, the specific characteristics of the business, and the operations of the scheme, establish the basis for the comparison. Social security pensions have specific features because of public sector objectives and determinations. The pension objective of social security is decomposed as providing adequate and equitable, sustainable, affordable, robust and predictable old age benefits.

The events space of a pension system can be described by a multi-state model of the active career and retirement. The events have impact on the components, and this is how the risks, and their indicators can be systematically mapped for the pension systems. *This way a Risk Management Framework can be systematically built up for SSPSs. Social security risk management should be holistic, because so many factors and groups have to be considered. This report outlined the first steps and provided examples of the methods and some illustrations. The details are still waiting for discovery.*

Because of the systemic approach and *more consistent and **comprehensive** analysis and, by definition forward-looking risk mitigation methods, risk management can prioritise a wide range of objectives on a comparative basis, under the umbrella of an integrated framework.*

The most straightforward risk treatment is to change the rules of the pension system. Changing regulations of pension systems means changing Laws, and the role of actuaries can be that of expert advisors. Actuarial contribution – just as to SSPS administration – is certainly applicable to building up and operating an SSPS Risk Management framework. As pointed out in other pensions papers, *establishing a Risk Management Function, and carrying out regular Own Risk Assessment reporting, is firmly advisable for SSAs. These are challenging areas in pensions, where further research is necessary.*

Actuaries certainly play a role in this area, because *the regular actuarial reviews of the financing of a social security scheme, and other standard actuarial methods, are key risk mitigation measures and may lead to specific risk mitigating design features like the Automatic Balancing Mechanisms.*

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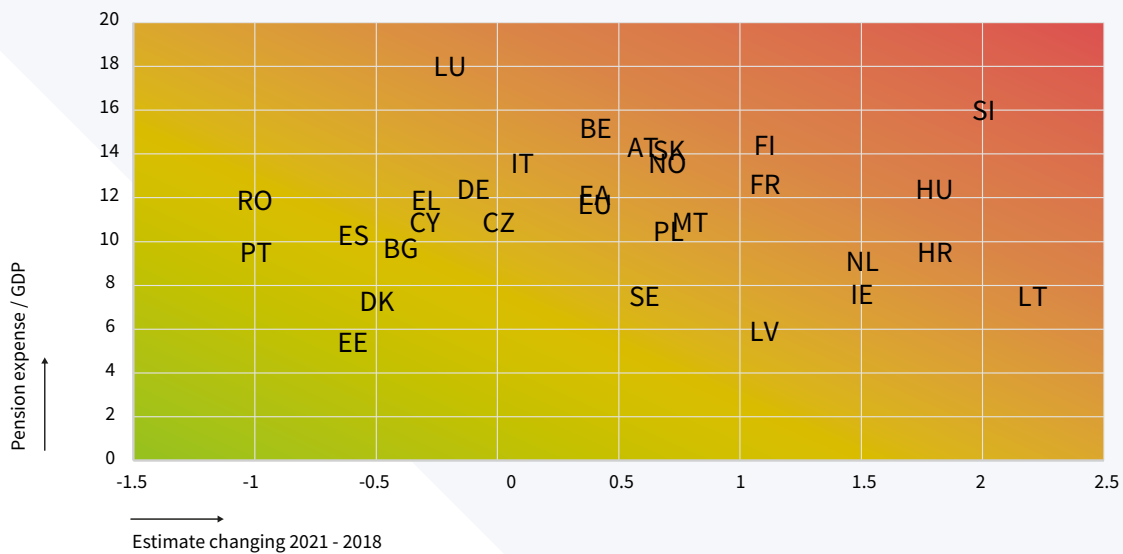
Guidelines on Actuarial Work for Social Security, ISSA-ILO 2022

APPENDIX A: EXAMPLE: RISK MAPPING - SUSTAINABILITY IN THE AGEING REPORT

For the illustration of risk assessment and interpretation on a heatmap we use data from the 2021 Ageing Report. The central metrics of Ageing Report is expenditure/GDP, that is a sustainability measure. This is used in cross-country comparisons. The breakdown of this measure applies benefit ratio, coverage ratio, dependency ratio and the employment or labour ratio as component factors. The decomposition may be used for conclusions also at individual country level.²³

The first graph intends to show the risk of the Member States contribution to the Pension expenditure/GDP risk at EU level. The higher the percentage the higher the impact is. A proxy of the probability is derived from the measure (pp) and direction (up or down) of the change since the last assessment in 2018.

FIGURE 3: CHANGENG PENSION EXPENDITURE IN AGEING REPORT 2021

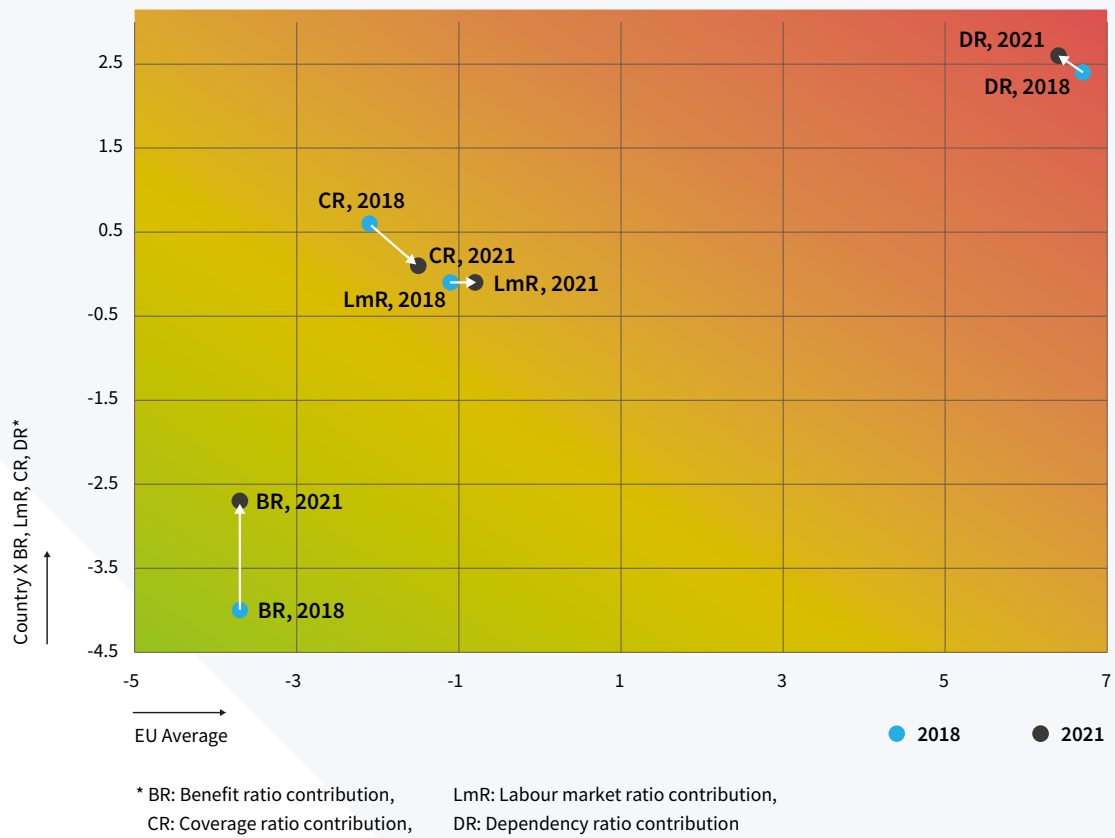


Source: Author

23 The Ageing Report was prepared by Commission and the Member States with immeasurable thorough work and analysis.

The second graph describes the changes of the decomposition of the PE/GDP risk index of a selected country in the two assessment periods. The idea is to expect that the policy advice in the Reports and the following European Semester exercise is a risk control mechanism and contributes to changing the risks. So, had we drawn the picture ex ante, it would have illustrated an inherent – residual risk graph. The y-axis shows the contribution of the risk components to the total risk, and the x-axis is a proxy scaling of probability by deviation from the EU average.²⁴

FIGURE 4: DECOMPOSITION OF PENSION EXPENSE RISK, COUNTRY X



Source: Author

24 As for an average measure in the EU practice see the inflation and interest rates definitions in the conditions of the introduction of the euro currency.

APPENDIX B: RISK MANAGEMENT STANDARDS

International standards apply a three-step top-down approach to defining ERM. First, they state the definition and objective of risk management in line with the objectives of the organisation. The second level embed ERM into the governance and organisation and defines the strategic risk governance actions. The last layer is the daily operations of risk management.

In the following we show this in the cases of the ISO and the COSO Standards. In our interpretation we are highlighting the similarities to establish a general approach.

COMPONENTS OF ISO 31000:2018

The ISO model differentiates the strategic or governance and executive/operational level elements of the framework, even if sometimes it risks becoming redundant.

1. Principles

The purpose of risk management is the creation and protection of value. It improves performance, encourages innovation and supports the achievement of objectives. Principles include the requirement for the risk management initiative to be (1) customised; (2) inclusive; (3) structured and comprehensive; (4) integrated; and (5) dynamic.

2. Risk management architecture/Framework²⁵

The purpose of the risk management framework is to assist with integrating risk management into all activities and functions. The effectiveness of risk management will depend on integration into governance and all other activities of the organisation, including decision-making.

Leadership and commitment, including: Risk management strategy

- aligning risk management with the strategy, objectives and culture of the organisation;
- risk management philosophy issuing a statement or policy that establishes a RM approach;
- making necessary resources available for managing risk; and
- Risk appetite and attitude to risk: establishing the amount and type of risk that may or may not be taken.²⁶

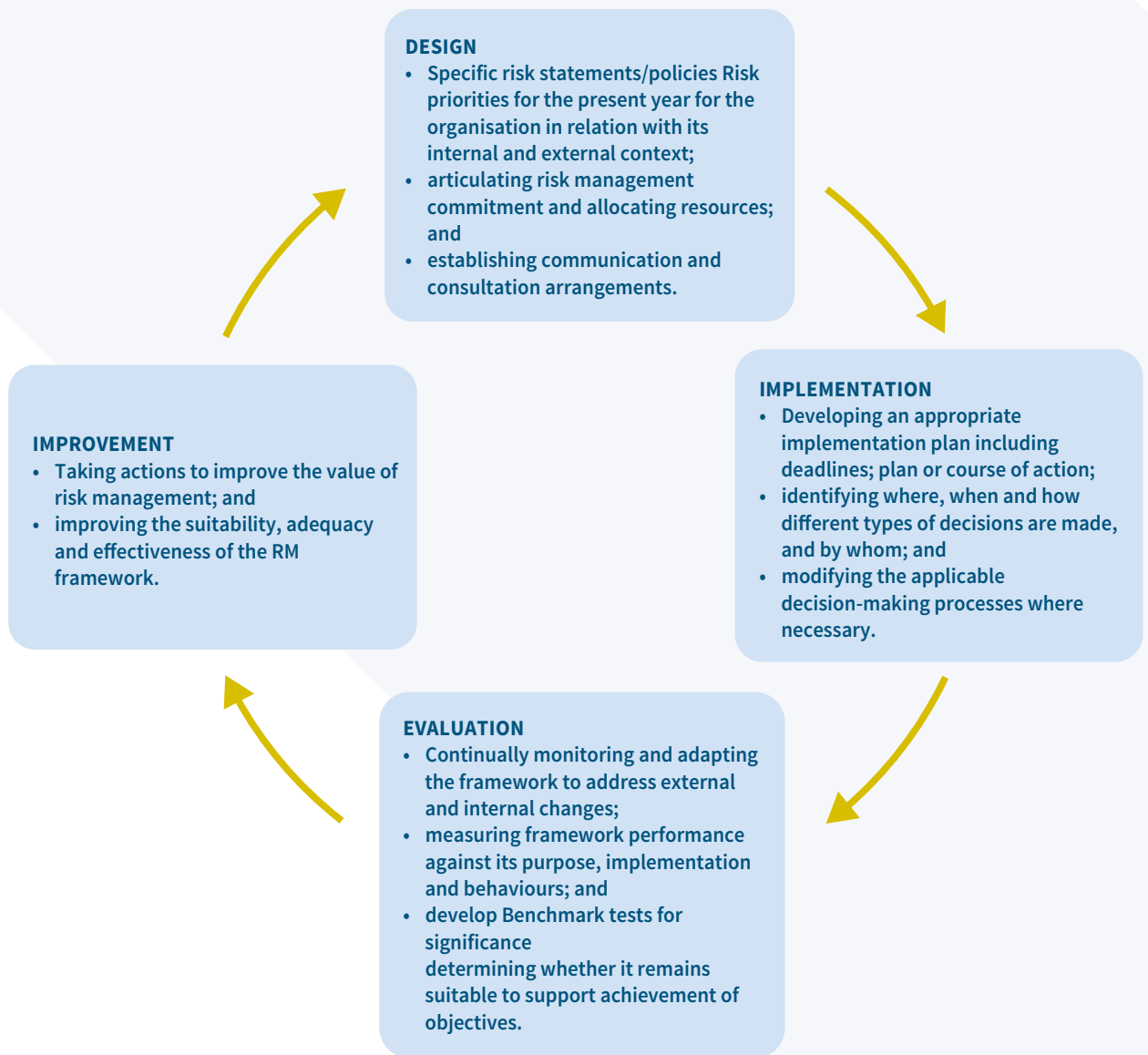
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25 Note that in some terminology Framework refers to the whole RM system.

26 When establishing risk appetite, we mean the whole process from defining risk universe, then appetite, tolerance, etc. vs performance

Arrangements for embedding risk management: Integration

- determining management accountability and oversight roles and responsibilities;
- ensuring risk management is part of, and not separate from, all aspects of the organisation;
- roles and responsibilities, structures and terms of reference; and
- internal reporting requirements and external reporting controls.

FIGURE 5: ISO STRATEGIC RISK MANAGEMENT CYCLE



Source: A Risk Practitioners Guide to ISO 31000 (2018)

3. Risk management Process

The risk management process involves the systematic application of policies using procedures and practices [or protocols²⁷ in general] to the activities of communicating and consulting, establishing the context and assessing, treating, monitoring, reviewing, recording and reporting risk.



27 Risk management protocols include • RM Tools and techniques • Risk classification system • Risk assessment procedures • Risk control rules and procedures • Responding to incidents, issues and events • Documentation and record keeping • Training and communications • Audit procedures and protocols • Reporting/disclosures/certification.

COSO DEFINITION OF ENTERPRISE RISK MANAGEMENT

1. Principles



Governance & Culture

1. Exercises Board Risk Oversight
2. Establishes Operating Structures
3. Defines Desired Culture
4. Demonstrates Commitment to Core Values
5. Attracts, Develops, and Retains Capable Individuals



Strategy & Objective-Setting

6. Analyzes Business Context
7. Defines Risk Appetite
8. Evaluates Alternative Strategies
9. Formulates Business Objectives



Performance

10. Identifies Risk
11. Assesses Severity of Risk
12. Prioritizes Risks
13. Implements Risk Responses
14. Develops Portfolio View



Review & Revision

15. Assesses Substantial Change
16. Reviews Risk and Performance
17. Pursues Improvement in Enterprise Risk Management



Information, Communication, & Reporting

18. Leverages Information and Technology
19. Communicates Risk Information
20. Reports on Risk, Culture, and Performance

The COSO ERM Standard focuses on a concise ordered list of RM activities which has to be adapted and implemented consistently at all functional and hierarchy levels of the organisation.

Definitions and objective: Enterprise risk management is dealing with risks and opportunities affecting value creation or preservation of the entity, and is

- ongoing and flowing **process** through an entity;
- able to provide **reasonable assurance** regarding the achievement of entity **objectives**;
- effected by an entity's board of directors [**governing body**], management and other personnel: i.e. **by people at every level of an organisation**;
- applied to **strategy** setting;
- applied across the enterprise: at every level and unit;
- ERM includes taking **an entity-level portfolio view of risks** (all of them separately and in interrelations); and
- designed to identify **potential events** that may affect the entity and to manage risk within its **risk appetite**.

FIGURE 6: COSO VALUE CREATION CONCEPT



Source: COSO Enterprise Risk Management Integrating with Strategy and Performance (2017)

2. Risk management architecture/Framework

The COSO RM framework is integrated into the organisation's business planning and implementation model. This way better supporting value creation but only implicitly following the Performance, Design, Implementation, Evaluation, Improvement risk governance feedback cycle. In COSO terms it looks like:

FIGURE 7: COSO ERM FRAMEWORK



Source: COSO Enterprise Risk Management Integrating with Strategy and Performance (2017)

3. The COSO implementation model is a three-dimensional cube

We define the RM governance dimensions by decomposing the objectives according to functional and organisational hierarchy: The value creation is defined as an outcome of the implementation of the objectives set by the strategic management (governing body). The objectives are converted to the following levels:

- Strategic – high-level goals, aligned with and supporting its mission
- Operations – effective and efficient use of its resources
- Reporting – reliability of reporting
- Compliance – compliance with applicable laws and regulations

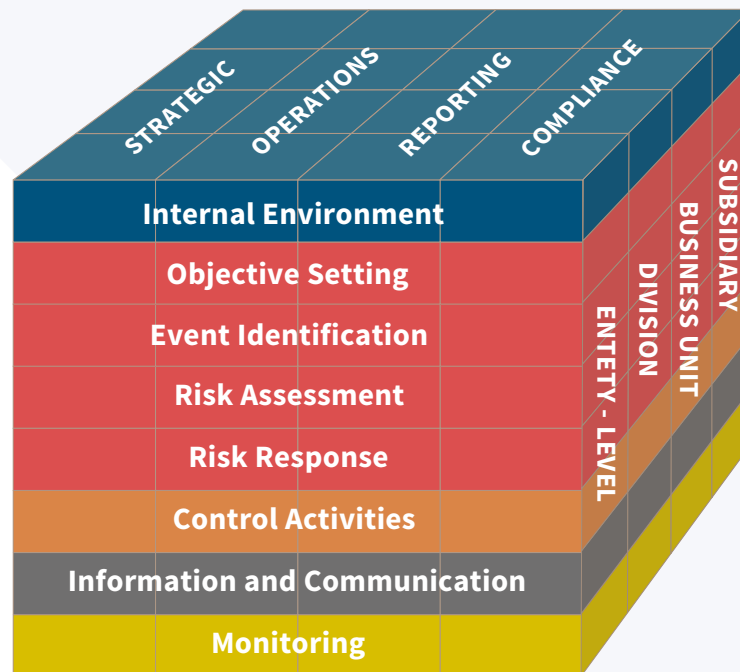
On another axis, according to the organisational hierarchy:

- Entity, Division, ..., Unit

At the process level the COSO Enterprise risk management consists of eight interrelated components integrated in the management processes:

- Setting Internal Environment – Organisational culture to risk culture, including risk management philosophy and risk appetite²⁸
- Objective Setting – Consistent with its risk appetite and risk tolerance
- Event Identification – Risk profile: risks and opportunities
- Risk Assessment – likelihood and impact, inherent-and-residual basis
- Risk Response – on portfolio and priority basis execute actions to: avoid, accept, reduce, or share, transfer risks
- Control Activities – Policies and procedures are established and implemented to help ensure the risk responses are effectively carried out
- Information and Communication
- Monitoring and Review

FIGURE 8: COSO ERM IMPLEMENTATION



Source: COSO Enterprise Risk Management Integrating with Strategy and Performance (2017)

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 28 Again, when establishing risk appetite, we mean the whole process from defining risk universe, then appetite, tolerance, etc. vs performance.

APPENDIX C: DEVISING RISK INDICATORS

APPENDIX C-1: ADEQUACY AND SUSTAINABILITY RISK INDICATORS: EVENTS' IMPACT ON OBJECTIVES

EVENT, TRANSITION (STATUS)	ADEQUACY Individual level	INDICATORS Society/Economy level
Baseline: Working (Active)	<i>Increase in pension rights according the scheme rules</i> Still, Employer risks: Contribution payment and/or reporting issues	<i>Contributes to the finances of the scheme</i> Still, Systemic risks: Changing career patterns, gig economy, risks of the state pension administrator
Active Becomes Unemployed (Inactive)	<ul style="list-style-type: none"> • Lower pensionable earnings, assessment base • Lower pension • RR down 	Working population, Contributions: <ul style="list-style-type: none"> • Decrease in contribution base • DepRatio, LM_Int • CR up, FR up
Active Deceases (Dead) Covered risk	<ul style="list-style-type: none"> • Spouses benefit usually limited • Risk of poverty • AROP 	<ul style="list-style-type: none"> • Demographic stability, actuarial neutrality • Working population, Contributions: • Decrease contribution base • DepRatio, LM_Int • CR up, FR up
Active Retires (Pensioner) early	<ul style="list-style-type: none"> • Lower Pension • Risk of poverty • AROP • RR down 	<ul style="list-style-type: none"> • Contributions, Working population, Pensions Pensioners • More pensioner, for longer period • DepRatio, LM_Int worsen • CR up FR up
Active Retires (Pensioner) after NRA Contributions, Working population, Pensions, Pensioners	<ul style="list-style-type: none"> • Higher pension • RR depends 	<ul style="list-style-type: none"> • Contributions, Working population, Pensions, Pensioners • Higher pensions for shorter period • DepRatio, LM_Int Improve • CR imp? FR?
Unemployed Retires (Pensioner) early	<ul style="list-style-type: none"> • Much lower Pension • Risk of poverty • AROP • RR down 	<ul style="list-style-type: none"> • Contributions, Working population, Pensions Pensioners • More pensioner, for longer period • DepRatio, LM_Int worsen • CR up FR up
Unemployed Retires (Pensioner) at NRA Covered risk	<ul style="list-style-type: none"> • Lower pension • AROP • RR down 	<ul style="list-style-type: none"> • Pensions, Pensioners • DepRatio, LM_Int worsen • CR up FR up

EVENT, TRANSITION (STATUS)	ADEQUACY Individual level	INDICATORS Society/Economy level
Unemployed Deceases (Dead) Covered risk	<ul style="list-style-type: none"> • Spouses benefit limited • Risk of poverty • AROP 	<ul style="list-style-type: none"> • Demographic stability, actuarial neutrality • Contributions, Working population • Demographic stability, actuarial neutrality • DepRatio, LM_Int worsen • CR up FR up
Retired Deceases (Dead) ‘early’	<ul style="list-style-type: none"> • Pensions • TRR 	<ul style="list-style-type: none"> • Pensioners, Pensions • Demographic stability, actuarial neutrality • DepRatio impr • CR imp FR
Retired Deceases (Dead) ‘late’ Pensioners, Pensions	<ul style="list-style-type: none"> • Pensions • TRR 	<ul style="list-style-type: none"> • Pensioners, Pensions • Demographic stability, actuarial neutrality • DepRatio worse • CR up FR

**APPENDIX C-2: AFFORDABILITY AND ROBUSTNESS RISK INDICATORS:
EVENTS' IMPACT ON OBJECTIVES**

	AFFORDABILITY		ROBUSTNESS	
EVENT, TRANSITION (STATUS)	Individual level	Society-Economy level	Individual level	Society-Economy level
Working (Active)	<ul style="list-style-type: none"> • Chance for higher income 	<ul style="list-style-type: none"> • More contribution to economic development (added value/ GDP) 	<ul style="list-style-type: none"> • Better predictability 	<ul style="list-style-type: none"> • Less exposure of economic or political volatility
Active Becomes Unemployed (Inactive)	<ul style="list-style-type: none"> • Limited, indirect effect 	<ul style="list-style-type: none"> • Narrows contribution base 	<ul style="list-style-type: none"> • Lower than expected pension 	<ul style="list-style-type: none"> • May lead to crisis, increase volatility
Active Retires (Pensioner) early	<ul style="list-style-type: none"> • Risks of poverty 	<ul style="list-style-type: none"> • More pensioner, but higher poverty 	<ul style="list-style-type: none"> • Lower than expected pension 	<ul style="list-style-type: none"> • More pensioner, but higher poverty
Active Retires (Pensioner) after NRA	<ul style="list-style-type: none"> • Higher pension • If one cannot afford retiring at NRA 	<ul style="list-style-type: none"> • Higher pensions for shorter period 	<ul style="list-style-type: none"> • Higher pensions 	<ul style="list-style-type: none"> • Higher pensions for shorter period
Unemployed Retires (Pensioner) early	<ul style="list-style-type: none"> • Risks of poverty 	<ul style="list-style-type: none"> • More pension for longer period 	<ul style="list-style-type: none"> • Increasing unpredictability 	<ul style="list-style-type: none"> • Increasing volatility
Unemployed Retires (Pensioner) at NRA	<ul style="list-style-type: none"> • Covered Risk but still lower pension 	<ul style="list-style-type: none"> • Covered Risk 	<ul style="list-style-type: none"> • Covered Risk, but lower than expected pension 	<ul style="list-style-type: none"> • Covered Risk with political risk
Active Deceases (Dead)	N/A	<ul style="list-style-type: none"> • Depends on Souses' benefits generosity 	N/A	<ul style="list-style-type: none"> • Demographic stability
Unemployed Deceases (Dead)	N/A	<ul style="list-style-type: none"> • Depends on Souses' benefits generosity 	N/A	<ul style="list-style-type: none"> • Demographic stability, actuarial neutrality
Retired Deceases (Dead) 'early'	N/A	<ul style="list-style-type: none"> • Souses' benefits generosity 	N/A	<ul style="list-style-type: none"> • Demographic stability, actuarial neutrality
Retired Deceases (Dead) 'late'	N/A	<ul style="list-style-type: none"> • Souses' benefits generosity 	N/A	<ul style="list-style-type: none"> • Demographic stability, actuarial neutrality

THE ACTUARIAL ASSOCIATION OF EUROPE

The Actuarial Association of Europe (AAE), founded in 1978 under the name of Groupe Consultatif Actuariel Européen, is the Brussels-based umbrella organisation, which brings together the 38 professional associations of actuaries in 37 countries of the EU, together with the countries of the European Economic Area and Switzerland and some EU candidate countries.

The AAE has established and keeps up-to-date a core syllabus of education requirements, a code of conduct and discipline scheme requirements, for all its full member associations. It is also developing model actuarial standards of practice for its members to use and it oversees a mutual recognition agreement, which facilitates actuaries being able to exercise their profession in any of the countries concerned.

The AAE also serves the public interest by providing advice and opinions, independent of industry interests, to the various institutions of the European Union - the Commission, The Council of Ministers, the European Parliament, ECB, EIOPA and their various committees - on actuarial issues in European legislation and regulation.



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