Moody's
ANALYTICS

Solving the Data Challenges of Solvency II

Contents

Abbreviations

Throughout this publication in the interest of brevity, we have used the abbreviated form for industry terms and names. The following list provides a reference to the full definition.

BAU	Business As Usual
CRM	Customer Relationship Management
ECaR	Economic Capital-at-Risk
EIOPA	European Insurance and Occupational Pensions Authority
ETL	Extract, Transform, Load
FLAOR	Forward Looking Assessment of Own Risk
FSA	Financial Services Authority (now Prudential Regulatory Authority or PRA)
IFRS	International Financial Reporting Standard
GAAP	Generally Accepted Accounting Practice
MCEV	Market-Consistent Embedded Value
NCA	National Competent Authority
OLAP	Online Analytical Programming
ORSA	Own Risk Solvency Assessment
PRA	Prudential Regulatory Authority
QRT	Quantitative Reporting Template
RaEVA	Risk-Adjusted Economic Value Added
RAROC	Risk-Adjusted Return on Capital
ROE	Return on Equity
RDR	Retail Distribution Review
RORAC	Return on Risk-Adjusted Capital
RSR	Report to Supervisors
SCR	Solvency Capital Requirement
SFCR	Solvency and Financial Condition Report
SII	Solvency II
XBRL	Extensible Business Reporting Language

Introduction

There is little doubt that data is one of the most important and difficult aspects of complying with Solvency II and other regulatory regimes such as International Financial Reporting Standards (IFRS). Without accurate and complete data any capital or solvency numbers generated will, in effect, be meaningless.

At the heart of Solvency II and IFRS, we have analytical data, including actuarial, finance, risk, investment and data provided by a third party or external data (i.e. credit ratings, instrument and issuer information, asset prices, income related data, etc.), together with multi-faceted management and business reporting. Obtaining this data, improving its quality, aggregating, reconciling, and consolidating it in a manner consistent with EIOPA standards for data governance and compliance can be a major challenge. The Own Risk and Solvency Assessment (ORSA) requires that insurers do so.

Implementing a full Solvency II program by January 2016 will be a major undertaking for many insurers, particularly the large composite and multinational firms.

While full Solvency II compliance for 2016 is challenging in its own right, it is made even more challenging because EIOPA is requiring local regulators, or National Competent Authorities (NCAs), to deliver interim measures in 2014 and 2015 as well. We await to see if all NCAs can deliver within the timescales.

So while analytical data is crucial for regulatory reporting, it is equally vital to the business decision-making process. Decisions require information, which requires data. Insurers look to drive business benefits from their Solvency II and other regulatory programs. Such benefits can only be derived from better informed decision making on product portfolio, capital allocation, hedging strategy or acquisitions.

In response to these data challenges, many insurers are seeking new technology solutions such as analytical and reporting tools, and centralized analytical repositories. Automating data processes continues to be increasingly important as reporting cycles become shorter and shorter.

This publication addresses the full spectrum of data challenges: data governance, data quality, tactical and strategic reporting, and data needed for informed decision making. While certain aspects of data and the associated technologies can be complex, the scope and structure of this publication has been designed with non-IT and business professionals in mind, exploring the problems and solutions in a simple, practical manner.

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Chapter 1

Data Governance Best Practice: Smoothing the Way to Solvency II Compliance

In this chapter we look at the obstacles that insurers have to clear in order to get their data management and governance house in order. In particular, we address the following:

- *Regulatory requirements*
- *EIOPA and data management requirements*
- *Determining where the real challenges lie*
- *Looking beyond Solvency II and IFRS*

With successive waves of new financial regulation such as Solvency II, Sarbanes Oxley, Dodd-Frank and International Financial Reporting Standards (IFRS), insurers can be forgiven for feeling overwhelmed by the attendant costly and complex compliance measures they have to establish. But with EIOPA recently re-energizing the Solvency II initiative insurers now have to refocus efforts on their own data governance and management processes. The imperative for good practice, from both a decision-making standpoint as well as the wider regulatory compliance perspective is more important than ever.

With the delay last year in enacting Solvency II, many insurers postponed some aspects of their regulatory programs particularly those relating to data and reporting. However, perhaps a better strategy might have been to take a more holistic approach, tackling all of the regulation driven data management and reporting (including Solvency II) requirements earlier rather than deferring them: a sensible approach when one considers that insurers need to make extensive use of data, both for regulatory and business decision-making purposes now.

Insurers would be wise to start improving the quality of their data, aggregating their data, and ensuring its accuracy and consistency across lines of business now, rather than waiting for full Solvency II implementation in 2016. Indeed there is little choice but to begin the process as in November 2013 when the European Insurance and Occupational Pensions Authority (EIOPA) issued a series of measures designed to reinvigorate the Solvency II initiative. In essence EIOPA has introduced the concept of interim measures driving a phased implementation approach to Solvency II based on the proportionality principle, with larger insurers having to meet some requirements in 2014 (such as the "FLAOR"), more extensive requirements by 2015, and full compliance in 2016.

In this chapter we look at Solvency II as the prime example for scoping the requirements for good data management and governance, but the principles apply to all the analytical and external data an insurer requires. It is also worth mentioning that Solvency II type regimes are being implemented outside Europe—Japan, South Africa, China and Mexico are examples, and the North American Insurance Council (NAIC) in the US recently introduced own risk solvency assessment (ORSA) type legislation.

While many insurers are relatively comfortable with the quantitative aspects of Pillar I for Solvency II, the prospect of implementing Pillars II and III presents far greater challenges. A central requirement of all three pillars is the large amount of analytical and external data needed for calculation and reporting purposes. Insurers have traditionally focused on operational and transactional data (policy, CRM and claims data) and they now need to focus on more analytical data defined as actuarial, finance, asset and risk data. Moreover, insurers have to make sure that the external data required to compute and report the solvency capital requirements (i.e. credit ratings from rating agencies and other data sourced from data distributors) is held to the same standards as their internal data. EIOPA has set out additional base requirements detailing what a Data Quality Management Framework and Policy should look like within a system of governance. The Omnibus 2 Directive to be finalized in late 2014 will undoubtedly build on this.

1 CP 43 and 46

The FSA (now the Prudential Regulatory Authority (PRA)) recently stated that "Most firms underestimated the time required to embed data governance processes into business as usual (BAU). Dependence on complex IT implementations to support data governance also caused delays at some firms. Typically firms have had to recruit additional resources to manage BAU data governance activities".[1]

These multiple challenges in meeting the data requirements are compounded by the fact that analytical data typically resides in a vast array of systems. Those systems typically have no common data model or standards, and so extracting and transforming the data to be consistent across all lines of business can be challenging. Equally the issue of poor data quality is inherent in many core systems. Some systems, particularly in the actuarial arena, are desktop-based and are supported by a sea of unwieldy spread sheets.

Collating, aggregating and storing the data and making it accessible in a understandable format for regulatory reporting (such as the QRT templates) further add to the task at hand. So too does the requirement for the quantitative data needed for the Solvency Financial Condition Report (SFCR), Regular Supervisory Report (RSR) and ORSA, to be integrated with the narrative text and graphics

Solving the analytical data problems are key to successful Solvency II and Integrated Risk and Finance programs but also to achieving a better understanding of risk and capital within the business, which ultimately will lead to improved profitability.

Regulatory Requirements

We have already highlighted the fact that the insurance market has been subject to a whole range of regulatory initiatives with Solvency II and IFRS having the greatest impact. Solvency II, in particular not only introduces a new risk-based capital culture but also a comprehensive regulatory reporting regime backed by demonstrable risk management practices. Consequently many insurers are looking for synergies between their Solvency II and IFRS programs and for ways that the two projects can integrate together. Indeed some insurers are already embarking on integrated risk and finance programs.

The quantitative requirements of Pillar I, while challenging, are well known and within the capabilities of most insurers, and because insurers excel in producing numbers, calculating the actuarial, financial and capital metrics required for Solvency II and IFRS, this won't be a major concern for them. Pillars II and III of Solvency II will however present a much greater challenge. In particular, the data management and reporting provisions are extensive. These involve not only new data sets and reports, but data management standards and controls which must be transparent and fully auditable.

Indeed EIOPA requires a Data Quality Management Framework and Policy to be in place as part of the IMAP process and this is also relevant to the ORSA. Insurance companies are also expected to establish licenses for sourcing the external data required in their Solvency II calculations and reporting, including credit ratings from rating agencies or additional market, instrument and issuer information from data distributors.

EIOPA Data Management Requirements

Good data governance and practice should already be in place for most insurers as part of their compliance program. However EIOPA also requires insurers to implement a dedicated Data Quality Management Framework and Policy. The purpose of which is to ensure that all data utilized for Solvency II purposes is accurate, complete and appropriate and sets down standards for data quality. A practical problem is that users often are not always able to define 'accurate', 'complete' or 'appropriate'. The PRA noted that this was a particular issue with catastrophe exposure data, where underwriting teams did not always have adequate understanding of the quality criteria or the point at which a data error could be considered material. The table below gives EIOPA's interpretation:

EIOPA Data Quality Requirements

Accurate	» Free from material mistakes, errors and omissions » Recording is accurate timely and consistent » High levels of confidence » Credibility demonstrated though usage in decision-making process
Complete	» Allows recognition of the main homogeneous risk groups » Sufficient granularity to identify trends and the full understanding of the underlying risks » Sufficient level of historical detail is available
Appropriate	» Fit for purpose » No bias » Relevant to the portfolio of risks of the insurer

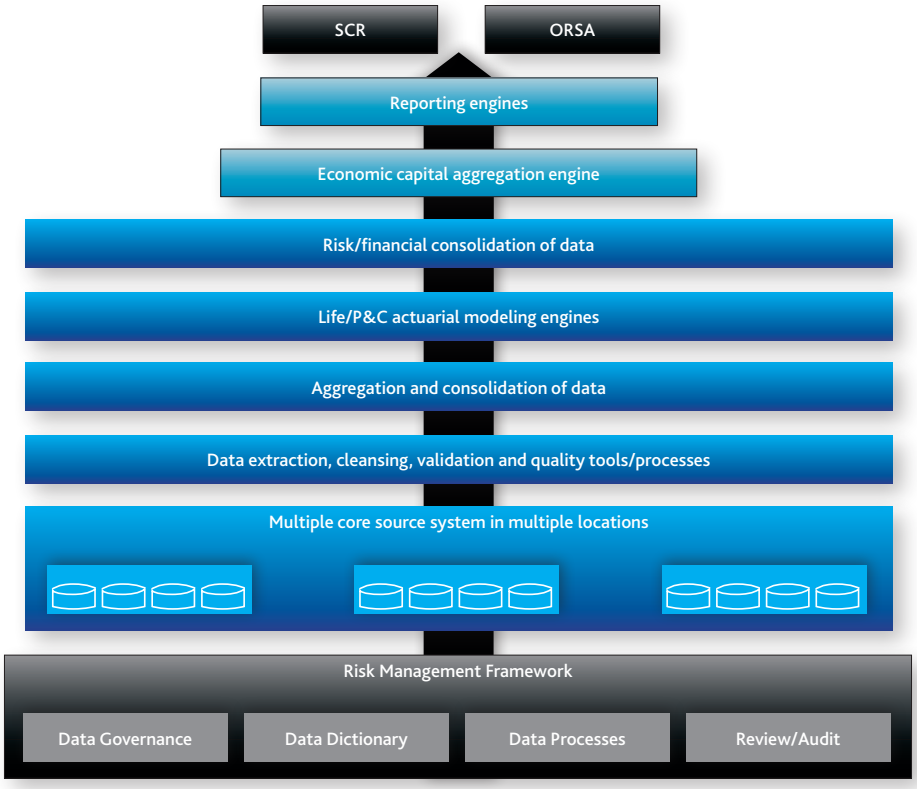
EIOPA will finalize the data management requirements in the Omnibus 2 Text (expected to be published in late 2014) but sufficient principles are known for insurers to commence their data management projects in confidence today.

So what might a Data Quality Management Framework and Policy look like in practice? The following table illustrates a practical example:

Data Quality Framework

1. Policy	Establish a data management policy which details the approach to managing data quality and define realistic and practical metrics to measure the completeness, accuracy and appropriateness of data. Educating users will be important in this respect. Due to the movement and transformation of data from one system to another, it is important to assign data ownership to individuals as part of the framework.
2. Data Quality Management	Embed a system of data quality management across the enterprise and undertake periodic data quality assessments. This should include a process for identifying and resolving data errors and deficiencies. Cases where data quality has been compromised, including the implications and mitigating actions should be fully documented.
3. Data Dictionary	Formulate a "data dictionary" containing all the data entities (and their attributes) used in the internal model/ Solvency II processes, defining each attribute's source, owner, characteristics and usage.
4. Monitor Processes	Define and monitor processes for identification, extraction , transformation, processing, and storage of data and how it can be accessed.
5. Lineage	Ensure that data processing and lineage from the underlying source systems all the way though the various layers up to the models and reporting is transparent, auditable and demonstrable.
6. Auditor's role	Agree and document the role that the internal and external auditors play in assessing data quality.
7. Audit Trails	Provide audit trails and rationale for data updates particularly when applying expert judgment in lieu of reliable internal or external data.
8. Change Management	Manage changes or data updates which materially impact model outputs.
9. Communication	An often overlooked aspect in data quality is communication across the enterprise. Everybody involved in the processes needs to understand their role and the importance of data quality

One of the most complex areas is auditability and lineage. In principle there should be a look-through capability starting from the individual policies in the administration systems through to the various process layers and ultimately through to the standard model/ internal model/ORSA calculations. In practice this can be quite convoluted particularly in terms of data trail in relation to actuarial engines (e.g. model points and policy aggregation where the link to individual policies is lost). The diagram below highlights the possible data tree from source systems through to the SCR calculation and ORSA:



For all but the smallest of insurers the data management process will be heavily dependent on technology and in particular extract, transform and load tools (ETL), underlying database technologies and reporting engines.

Data Licensing Agreements

The extensive and diverse external data required to compute the solvency capital requirements and to meet the quantitative reporting requirements of Solvency II entail that insurers need to establish licensing agreements with third party data providers such as Bloomberg, Reuters and credit rating agencies such as Moody's.

Solvency II requires that the credit assessments of an external credit rating agency used by insurers in their SCR calculations have to be linked to credit quality steps pre-defined by EIOPA. Furthermore, in cases where several ratings are available for a given credit exposure, the second-best rating should be applied. As a result, insurers may require multiple credit ratings for their Solvency II reporting.

The Real Data Challenges

Practical data management challenges can be split into a number of key areas:

Understanding what data is actually required

Solvency II and IFRS reporting requires a vast array of analytical and external data to be generated together with a high degree of granularity. While some of the data will not be new, particularly from the finance perspective, much of it will be, for instance, credit ratings, asset transaction data, and look-through requirements for the Asset QRT templates. In practice the required data will come from a myriad of systems (as well as some external feeds e.g. from investment managers). Some of the data will even have to be "downloaded" from the minds of experts within the organization and manually input. Thus it must be accepted that there will always be an element of manual data input and expert judgment which must be catered for.

The situation is further complicated by the fact that certain data from multiple solo entities and business units has to be consolidated up to group level. Each entity will typically have its own unique systems and technologies. There will typically be an absence of a common data (or metadata) model, with each entity having their own data, technologies and governance processes. Group and solos will have different data and reporting requirements.

The problems above are well illustrated by the QRT templates—these require, literally thousands of data items, a high degree of granularity (e.g. the technical provisions and asset templates) and both solo and group perspectives that have to be aggregated.

One of the key requirements of Solvency II in relation to models is the ability to re-run a model at a future date and produce the same results. This means that the model itself must be stored together with all the assumptions and datasets pertaining to that model, even down to the seed number in a random number generator. Additionally the actual technology that runs a particular model will change over time and may, by the time it comes to execute a re-run have been replaced or upgraded.

Having defined the requisite data the insurer must proceed down the route of developing the data directory[2] which describes the attributes, ownership and usage. This may sound simple but the sheer volume of data required, the number of business entities and plethora of systems involved can make this a very complex exercise for large insurers.

By way of an example of the volume of QRTs that need to be produced, a simple group with two solos will have to generate in excess of 300 QRT templates each year.

The next step is to understand where the data actually comes from. A key problem here is that in many instances an insurer may have a significant number (often hundreds) of systems that contribute data. Many of these systems can be quite old (so called 'legacy systems') which are typically poorly documented with few people who understand them. Thus extracting the data can be problematic in its own right and even then there is the issue of addressing the poor data quality often inherent in legacy systems.

A further problem presents itself in the actuarial arena where models are often effectively hand coded using desktop systems. Consequently each model may be different in format, structure and results output. In theory this should not be a major problem, but in reality an insurer may have tens or even hundreds of actuarial models to extract and collate data from (e.g. for the Technical Provisions QRT templates).

Control, lineage and auditability of datasets and assumption sets that are used by actuarial models must also be considered. These often take the form of spreadsheets which present another control issue. At a minimum insurers will need an inventory of critical spreadsheets classified by use, by the impact on the internal model, and by complexity.

Some insurers automate their spreadsheet process and this reduces the risk of manual error, but it can also introduce different problems such as reduced oversight and inadequate transparency about the extent of linking and proliferation of nested linked spreadsheets. Linked spreadsheets typically pass only single numerical values, without an indication of the date of last update, creating the risk of relying on out-of-date data.

Data Transformation Challenges

The next step in the process is to transform the extracted raw data—this effectively transforms the data into a common format. The process requires knowledge of the underlying systems or sources of the data, the end system to which that the data is being loaded to and the purpose for which it is being used. This is effectively a mapping exercise which is generally undertaken using one of the extract, transform and load (ETL) tools - such as PowerCenter from Informatica or Oracle's ODI—or tools built into the underlying database technology. This process can be automated once the initial mappings have been done, and it will become increasingly important to do so as reporting deadlines become progressively shorter in the coming years.

Data Quality Challenges

Unfortunately data extraction and transformation is but the first of many stages: data then has to be run though a series of data quality checks to ensure that it is fit for purpose. Data quality checks can either be undertaken in the underlying source systems, in the ETL process or within the data repository itself. Going back to all the source systems and correcting all the data is, for most insurers, impractical due to the sheer scale, complexity and age of the systems.

Perhaps the most effective way of executing data checks for analytical data is to execute them within the data repository itself. Executing checks after the data loading allows business users to have direct access to the data quality checks (even if they are not

2 In the context of Solvency II a data directory is a list containing a description of all data items together with their attributes and owners that are used for Solvency II and Internal models. The data directory is meant to be a documented repository where different users can go to understand which data is being used in the model, the source it comes from, how it is used, and its specific characteristics.

directly responsible for the data quality). This means that they, in their ordinary activity of reviewing, modeling and testing, can have a view of the data quality assessment and validate each single data check. Furthermore, embedding quality checks inside the database enables the maintenance of full traceability.

An important aspect of Solvency II is that it requires a reconciliation against, for example, accounting data. Executing data quality checks after data loading facilitates easier general ledger reconciliation such as IFRS and local GAAP against Solvency II balance sheet.

A final step in the process is for the data to be approved or signed-off by the relevant qualified person and the approval process tracked and logged for audit purposes. This is particularly important as analytical data is a key constituent of an internal model and SCR calculations. Once approved, the final version of the data needs to be locked down in the repository.

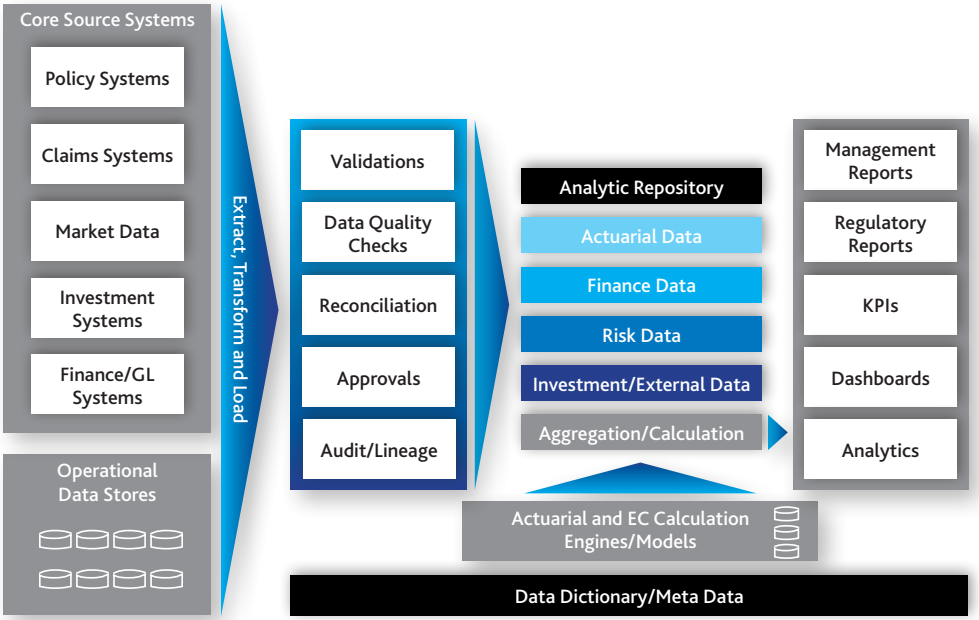
The data quality checks are designed to protect the integrity of the repository. As the process checks the data quality, it attempts to correct the problems. In practice the process has to cleanse the data, remove duplicate fields and finally run a series of contextual "rules" that check the format and content of the data against business logic. An important aspect that is often forgotten is that it isn't sufficient merely to have data quality checks in place—you must be able to demonstrate the effective operation of data quality checks to both auditors and the regulator. Thus, evidence of controls and the reporting of issues identified as a result of conducting the check is essential.

Sourcing of third-party data can also be problematic in that sometimes insurers may rely on controls by third parties (for example, investment managers, market data feeds such as Bloomberg and Reuters) without any mechanism to obtain assurance over the control environment and without independently validating the quality of external data received.

Specialist data profiling tools are available and these can also be used to improve data quality and are used in the analysis of data sets for accuracy, completeness and appropriateness using known properties of that data (e.g. outliers, unusual trends and patterns, statistical distribution, consistency with historical data, etc).

Challenges of Storing Analytical Data

Storage of analytical data can pose a problem as its characteristics differ from operational data which insurers traditionally store in their warehouses. While current storage arrangements can be adapted, many insurers are looking for a dedicated solution designed not only to store analytical data but also to undertake additional functions within the database itself. These additional functions might include data being shocked, stressed and aggregated within the database. Further, there might be capacity to store cash flows and loss triangles produced by actuarial modeling engines with a sufficiently high degree of granularity for analysis—this is very different from storing client and CRM data. Except for very small insurers, the solution is to build out a dedicated *analytical data store* as the central source of the truth to drive both regulatory and management reporting. The diagram below illustrates the role of an analytical data store and its integration with existing systems.



Reporting Challenges

The whole purpose of storing analytical data is to use it to provide information to the business and regulatory reporting processes. Clear regulatory reporting is a major driver. Insurers now need to:

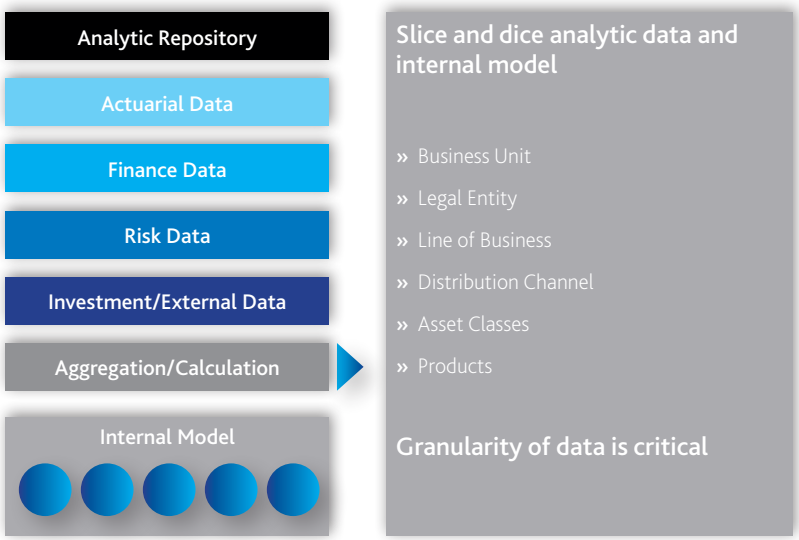
» Have in place by the submission deadlines a series of annual and quarterly regulatory reports including the new QRTs, SFCR, RSR and Variance Analysis.

» Produce an ORSA document that basically sets out an insurer's risk appetite, their risk management practices and framework, stress test approach and a projection of the balance sheet over the a 3-5 year planning horizon.

» Establish licenses for supplying the external data, including credit ratings, to support Pillars I, II and III of Solvency II.

These reports are defined by EIOPA but local regulators may also specify additional requirements and templates. In parallel with the solvency requirements an insurer will also have to integrate Solvency II reporting with their IFRS and annual reporting regimes.

While it is important for the quantitative data to be stored with a sufficient level of granularity it must also be possible to slice and dice it to accommodate various reporting formats. The diagram below illustrates the levels of granularity that may be required.



Beyond Solvency II and IFRS

Perhaps the greatest challenge of both Solvency II and IFRS is to actually drive tangible business benefits from the respective programs. In practice this boils down to better business decision making in relation to key aspects of the business. Ultimately this means having a better understanding of risk. Insurers are also increasingly looking to risk adjusted measures for performance analysis. Thus the calculation and storage of risk and capital data is strategically critical.

The following table is not an exhaustive list but is indicative of the areas where enhanced capital and risk data can support critical business decision making.

Business Benefits

Business Planning	Capital Allocation based on Risk Diversification
Product and Pricing Strategy	Business Transformation and Expansion
Investment Strategy	Profitable Capital Allocation linked high ROE
Optimal use of Reinsurance	Capital alignment to Risk
Risk Optimization	Mergers and Acquisitions
Alternative Risk Transfer Mechanisms	Maintaining adequate Rating Agency status
Dividend Strategy	Hedging Strategies

Key Takeaways

There is little doubt that data and the associated data management technologies play a major role in regulatory compliance and reporting. Furthermore, they can also add value in the form of supporting the internal business decision-making process. Insurers are compelled to invest in data management to meet the Solvency II requirements and it therefore seems logical to maximize the benefit of the investment being made by extending the project to cover both IFRS and inform wider business decision making.

The underlying theme here centers on better understanding of the risks within a business and adopting capital allocation strategies that optimize return on capital in line with a firm's stated risk appetite. Defining this data and implementing tools that manage it certainly requires extra effort and resources but in the long run this is essential for gaining profitability and competitive advantage.

At the heart of a successful data management project will be the implementation of an analytical data repository that not only holds all the risk and capital data required but also provides the lineage and auditability required and tools that extract and improve the inherent quality of the data.

Ultimately, insurers who step beyond the minimum regulatory requirements will be successful—they are the ones who are investing in data today.

Chapter 2

Analytical Data: How Insurers Can Improve Quality

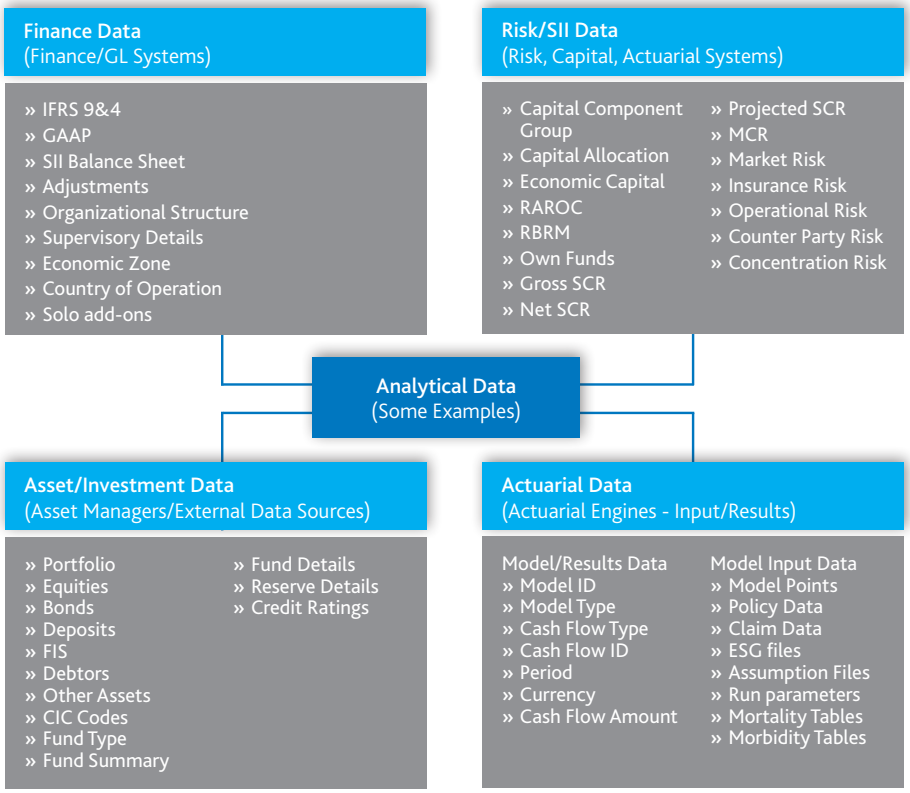
In this chapter, we look at the types of analytical data required for Solvency II, capital and risk decision making. We also set out to demystify how IT techniques can be used to improve data quality. Coverage includes:

- *Broad definition of what constitutes analytical data*
- *Quality process improvements that can be made*
- *Data profiling tools*
- *Data quality rules*
- *The role of spreadsheets*

In the Chapter 1 we examined the overall data requirements for key regulatory initiatives such as Solvency II, the new International Financial Reporting Standards (IFRS) and for capital and risk decision making in the business. In this Chapter we will delve more deeply into the topic of ***analytical data***: what it is and how various tools, techniques and approaches can be employed to improve the quality of that data. The subject of spread sheets is also examined because these are, and will continue to be, an important source of analytical data. Regulators, such as the Prudential Regulation Authority in the UK, have acknowledged that such sources of analytical data will not go away.

What is Analytical Data?

Analytical data can be defined as the actuarial, finance, risk, investment and other external data required for Solvency II or IFRS and multi-faceted management and business reporting. The following table illustrates with some examples the types of and provenance of data that can be classified as analytical.



Analytical Data is Different

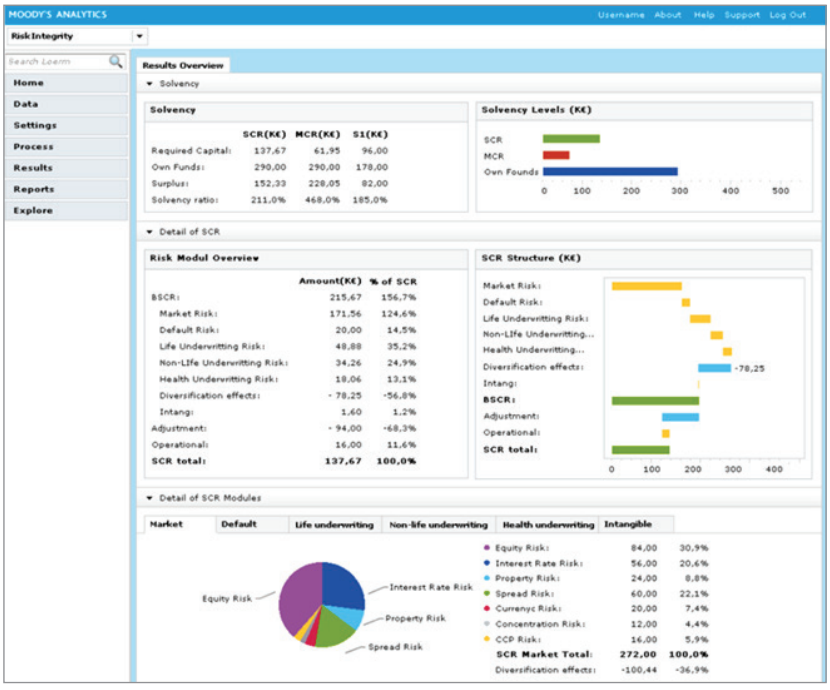
Analytical data by its very nature is different from the transactional or operational data that insurers are traditionally used to handling and storing. The key differences are summarized below:

- Analytical data comes from a range of different sources—primarily finance and actuarial systems, but also from, for example, external fund management systems. Some of these sources are desktop based systems and spreadsheets, and because these are not linked into the main IT infrastructure, problems with extraction and standardization often occur.
- Analytical data typically requires a much higher level of granularity in the data than is required for regulatory and compliance reporting purposes. For example, the asset and technical provisions Quantitative Reporting Templates(QRTs) require very granular data, and the Asset D1 template can potentially require millions of lines of asset transaction details.
- Analytical data may well have to undergo complex aggregations and transformations (e.g. the generation of model points). Equally, the data has to be carefully reconciled into a single source of truth. This is because the same data may come from different sources. For example, premium data may come from both administration systems and general ledgers and must be reconciled.

Solvency II is acting as a catalyst driving insurers to consider how they are going to handle analytical data: are they going to adapt their existing transactional data repository, or build a new one? Practice varies but we are seeing a trend towards insurers building an Integrated Risk and Finance Data Repository.

Business Intelligence and Reporting

The whole purpose of extracting and storing analytical data is to be able to use it to good effect. For insurers that primarily means relying on it for regulatory and management reporting and capital/risk decision making. Ease of analysis and interpretation can be best achieved when information is presented in a graphical format – a dashboard interface is therefore to be regarded as the ideal – as illustrated on below.



For such a dashboard to have real value users must be able to drill down to the underlying data. In order to achieve this, the underlying data has to be carefully structured and stored in what is termed a star schema* or snowflake schema in a relational data warehouse or in a special-purpose data management system.

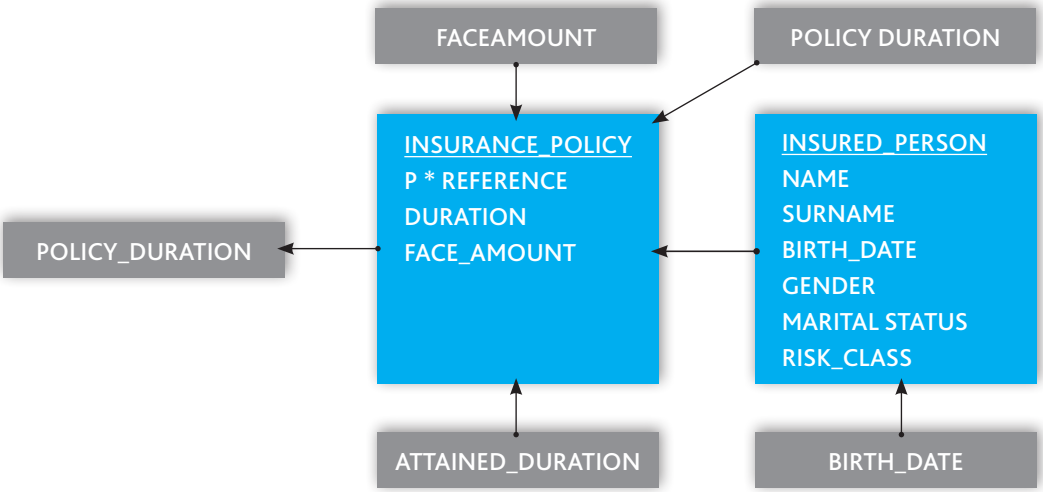
However, in order to actually generate the dashboards, On-Line Analytical Programming (OLAP) Cubes are required to structure and present the data in a logical, understandable format.

* A star schema is a database structure comprising a number of primary (or master) data tables referencing any number of other dimensional tables. The star schema is an important special case of the snowflake schema, and is more effective for handling simpler queries. A snowflake schema is simply a logical arrangement of tables in a multidimensional database such that the relationship diagram of the tables resembles a snowflake in shape.

*An **OLAP cube** is required in order to present the data in a user friendly, graphical manner as this will facilitate ease of assessment and interpretation. An OLAP cube is an array of data within which the cells comprising the cube hold a number that represents some measure which represents an element of the business such as premium, claim, capital, expenses, budget or forecast. The OLAP cube effectively provides the drill down capability and granularity required. While business users need to carefully define the data required and the level of granularity it is often an IT function to construct the OLAP cubes.*

The diagram below illustrates how data is stored in a relational database. This is a logical format that shows how data elements stored in tables relate to each other.

Database Structure Extract



The following table gives some examples of Regulatory and Management reports that extensively utilize analytical data. Clearly these vary considerably by the type of insurer and environment in which they operate, but the volume of reports can be quite staggering: typically hundreds of reports have to be produced at both local entity and group level.

Regulatory Reports	Business Reports
» SII QRT Templates	» Balanced Scorecards
» Solvency II Risk Margin	» Key Performance Indicators
» SFCR	» Market Risk Dashboard
» RSR	» Profitability
» ORSA	» Costing
» Use Test	» Budgeting
» Regulatory Returns - PRA (UK) Forms and equivalent across Europe - BAFIN, DNV	» Variation Reporting
» Tax Reports	» Exception Reporting
» VAR Reports	» Analysis and Trending
» EV/EEV/MC EV	» Forecasting
» Analysis of Change in EV/EEV/MC EV	» What if/scenario planning
» IFRS 4 Phase II returns	» Reconciliation process
» IFRS plus sensitivities and stresses	» Sensitivity Analysis
» ICA (UK)	» Experience Analysis
	» Group Capital Adequacy
	» Capital Allocation
	» Risk Adjusted Return Measures
	» Valuation
	» Analysis of Profits/losses
	» Historical Asset Shares
	» Exposures

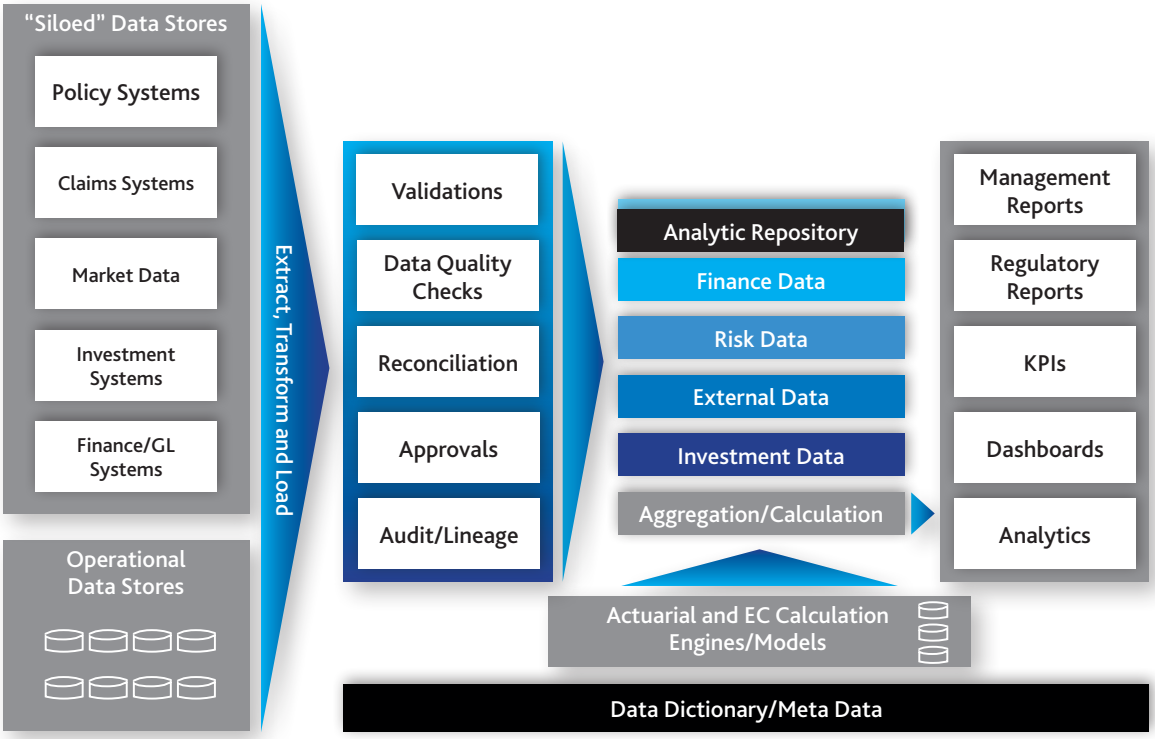
Data Quality Process Improvements

Data Silos

The numerous sources of raw analytical data within an organization give rise to questions regarding its quality, consistency and reliability, and this is particularly the case as the volume of data increases. To compound the problem both analytical and operational data is often organized into separate silos. This sometimes means that there is duplication of data and inconsistent values. Analytical data often comes disaggregated from multiple silos according to different dimensions, such as legal entity, line of business, risk category, etc. The silo approach produces a general tendency towards low quality data, mainly due to the proliferation of data duplication and multiple data quality approaches from one silo to the next.

An example of data quality issues can be found in the multiple policy administration systems maintained by insurers – each of which may store a policy holder's age and birth date in different formats. Similarly, Premium data may come from both a policy administration system and the general ledger, and they rarely match.

One answer to the problem of data quality is to establish a central analytical repository and use associated technologies to improve the quality of data and reconcile it. This approach provides ***a single source of truth*** to provide consistency in reporting and decision making. The diagram below illustrates how data can be drawn from multiple silos/source systems and effectively improved and centralized.



Data Quality/Accuracy

Data can be considered of high quality if it is fit for purpose in terms of its intended use (e.g. statutory reports, business planning and decision making, etc). What makes up data quality? Here are the major factors, again bearing in mind the purpose:

- *Accuracy*
- *Completeness*
- *Appropriateness*
- *Relevance*
- *Consistency*
- *Reliability*

The quality of data in most insurance organizations is often quite poor so improvement is essential. Improving the quality of data, is however a multi-faceted process that takes raw data and subjects it to a set of algorithms, business rules and as a last resort common sense. This, coupled with expert judgment, enables the data to be validated or corrected. The data quality tools used to do this have inbuilt data "logic" in terms of patterns, trends and rules built up over a number of years. Data is tested against this logic. Simple errors can thus be automatically corrected and flags raised for data that requires expert judgment. The end result may not always produce perfect data (no process can do that) but the data should at least be fit for purpose.

The following table looks at a typical process that raw data may go through to improve the quality. The steps may not necessarily follow this order.

Checklist for Data Improvement

Process	Description
Data Extraction – the "ETL" process	» Extract data from the various source systems – policy and claims systems, general ledgers, actuarial systems, investment system, etc. » Store in a staging area of the repository. » There are specific Extract, Transform and Load (ETL) tools to control this process. Alternatively, data may be captured in Spreadsheets, CSV files or even input manually.
Data Profiling	Utilize data profiling techniques to make an initial assessment of the data to understand its overall quality challenges and anomalies. This primarily utilizes patterns, trends and algorithms (both general and specific to the insurance industry) to produce a picture of the overall data quality – typically expressed as a percentage of the data that appears accurate.
Data Accuracy	Execute a series of data quality checks/rules against the data. There are a number of data quality tools that include many thousands of pre-built data quality rules (both general and industry specific) and these are then supplemented with a number of user-defined rules. Best practice is to execute the data quality rules within the repository. Alternatively this can be undertaken in the extraction (ETL process)
Generalized "cleansing and deduping"	This is a dual process: **Data cleansing** » Identify and modify corrupt or inaccurate data from the repository. » Remove or modify incomplete, incorrect, inaccurate, irrelevant data. This process may involve removing typographical errors or validating and correcting values against a known list of entities. The validation may be strict (such as rejecting any address that does not have a valid postal code) or fuzzy (such as correcting records that partially match existing, known records). After cleansing, a data set will be consistent with other similar data sets in the repository. **Data de-duplication** » Reduce storage needs by eliminating redundant data. » Retain only one unique instance of the data within the repository. Redundant data is replaced with a pointer to the unique data instance.
Quality Monitoring	Keep track of data quality over time. Use software to auto-correct the variations based on pre-defined business rules. The process should only be repeated on values that have changed; this means that a cleansing lineage would need to be kept, which would require efficient data collection and management techniques. These processes can be in real time or batch oriented.
Enrichment	Enhance the value of data held in the repository by appending related attributes from external sources (for example, consumer demographic attributes or geographic data). This may be valuable for the underwriting and pricing of household policies (e.g. flood risk data) or marketing certain types of products to certain customers who have certain socio-economic attributes, e.g. high disposable income.
Load	Store validated data in the results area of the data repository.

Making Use of Data Profiling Tools

We can examine the data available in a data repository and make an assessment of its quality and consistency, uniqueness and logic using data profiling techniques. This is one of the most effective ways of improving data accuracy in an analytical repository. A number of proprietary data profiling tools are available from leading vendors.

Data profiling utilizes different kinds of descriptive techniques and statistics such as minimum, maximum, mean, mode, percentile, standard deviation, frequency, and variation as well as other aggregates such as count and sum to analyze data according to known patterns. Using these it is possible for an expert to find values that are unexpected and therefore potentially incorrect. Profiling can help insurers identify missing values which can then be replaced by more logical values generated by data augmentation algorithms.

The key benefits of data profiling are summarized below:

Data profiling will help you to:	
1	Understand any inherent anomalies in the raw data
2	Determine whether the data can be used for multiple purposes and assess the impact of usage in new/other applications The insight gained by data profiling can be used to determine how difficult it will be to use existing data for other purposes.
3	Generate initial metrics on data quality
4	Improve search capabilities by tagging or using key words
5	Assess whether the metadata accurately describes the actual values in the source database

Introducing Data Quality Rules

In order to further improve data accuracy, insurers should execute a number of data quality rules against their data. Various vendors offer data quality tools which can include thousands of rules. These comprise a number of generic rules together with some specific to the insurance industry. Additionally, such tools also enable insurers to define supplementary rules specific to their own lines of business or functions. Some examples of types of data quality rules are set out below:

Type of Rule	Description	Insurance Example
Basic Business Rules	Basic business logic rules	» The date of a claim cannot be earlier than the date of inception of the policy.
Data-Type Constraints	Values in a particular column must be of a particular data type, e.g. Boolean, numeric (integer or real), date, code, etc.	» CIC/ISO Code in asset data » Premium frequency – monthly, quarterly, annually
Regulatory Constraints	Data validations or rules laid down by regulators such as EIOPA/PRA.	» The Validation rules contained in the QRT templates specified by EIOPA.
Range Constraints	Typically, numbers or dates should fall within a certain range. That is, they have minimum and/or maximum allowable values.	» Eligible ages for insurance contracts - eligible age must be between say 18-65 » Minimum premium amounts in GBP » Reinsurance limits
Mandatory Constraints	Certain columns cannot be empty, e.g. not null.	
Unique Constraints	A field, or a combination of fields, must be unique across a dataset.	No two policyholders can have the same national insurance number.
Set-Membership constraints	The values for a column come from a set of discrete values or codes.	A person's gender may be Female, Male or Unknown (not recorded).
Foreign-key constraints	This is the more general case of set membership. The set of values in a column is defined in a column of another table that contains unique values. terminology.	In a "town" column it must be aligned to a county from a "County Table".
Regular expression patterns	Occasionally, text fields will have to be validated this way.	Phone numbers may be required to have the pattern (0044) 1234-5678 or DD/MM/YYYY format.

While it is the role of the IT department to execute data quality rules it is up to the practitioners in the business to provide the "logic" in conjunction with rules that are very specific to a particular set of data. When discussing this logic with IT, consider carefully the ultimate usage of the data. For example, for policy data the input required for actuarial modeling is primarily around the type of contract, benefits/coverage, premiums, term, etc. These have to be correct as they impact on the accuracy of the cash flows generated. Other policy related data such as post code, phone number, etc. are not relevant for these purposes and if incorrect have no impact on accuracy.

Where to Execute the Rules?

Executing the data quality rules during the transformation phase of the ETL process is a logical choice when it is required to transfer data directly from one IT system to another. However, when applied to an analytical data repository approach this has a number of problems:

1. ETL tools are complex and not readily accessible or comprehended by the business people who play an important part in the process.
2. Managing a large number of data quality rules in the ETL process can be complex and may result in duplication of some rules and inconsistencies.
3. Under Solvency II the users, actuaries, risk mangers etc, must be confident that the data is accurate—to do this they need to view the data, and this is best done via the repository rather than the ETL process.
4. Finally there must be reconciliation of data from multiple sources particularly accounting data and again this is best executed in the repository.

Our suggested approach is to execute the data quality rules in the repository after the data loading stage as this allows the business users to have direct access to the data quality checks (even if they are not directly responsible for the data quality). This means that the business users, in their business as usual activities such as modeling and auditing, can have a view of the data quality and address each single data check.

Furthermore, embedding the quality checks inside the repository enables the full traceability and auditability of the data and shows the regulator whether or not low quality data has been accepted too early in the process. Finally, as we have mentioned above, Solvency II requires reconciliation against accounting data. Executing data quality rules after data loading makes the reconciliation process both easier and more traceable.

What is Metadata?

IT departments often use the term "Metadata". In simple terms Metadata is just data about data – basically descriptive information about a particular data element. It describes what a particular data element is, how and when and by whom a particular set of data was collected, how the data is formatted and how it is used.

Metadata is essential for understanding information stored in a data repository as it describes the structural components of underlying tables and their elements. For example, metadata about an element could include data types, name of data, size and many more characteristics such as length of fields, number of columns, where the tables are located and other relevant information.

One of the main uses for metadata is to provide a link between the people who created the data and the people who are actually going to use the data. Metadata allows the users to speed up the search for individual data by allowing users to set parameters for searches, allowing the filtering of unwanted information.

There is often confusion between meta data, a data directory (specifically required for Solvency II) and a data dictionary:

» **Metadata** – high level descriptive information about data as described above.

» **Solvency II Data Dictionary** – non-technical description about data that ordinary business users can understand. The data dictionary (or data glossary if you prefer) is meant to be a documented repository which different users can use to understand which data is being used, where it comes from (source systems, how it's being used and what its specific dependencies and characteristics are. This is a requirement of the Solvency II Data Governance Framework. The traceability of data through the various layers is best represented diagrammatically to help understand where the data comes from.

» **Data Directory** – is more of a technical descriptor that typically lists all the tables, fields, primary keys, foreign keys, etc that are available in the repository, the number of records in each table, and the information about the fields

The Role of Spreadsheets

No review of analytical data quality would be complete without considering the role of spreadsheets. Spreadsheets are now commonly considered as part of the wider group of technology assets called end-user computing (EUC)—that is any technology asset which may be created, updated or deleted outside the purview of the IT department or standard software development lifecycle management processes. Other assets in this class include MS Access databases, CSV files, MatLab scripts etc. However, spreadsheets tend to be the most prolific and problematic of all EUCs because of their flexibility and familiarity to most users.

The ability of a spreadsheet to act as a data source (e.g. data connections/links, expert judgment), a data manipulator (e.g. policy data, assumption tables, run parameters) and as an application (e.g. formulas, macros) create a variety of data quality issues. When combined with the additional uncertainty of ownership and access rights over specific spreadsheets, it is not surprising that spreadsheet control issues have received specific mention in data thematic reviews conducted by the FSA (now PRA).

Spreadsheets pervade many financial and actuarial processes in insurance but the regulatory focus of Solvency II has been drawn particularly to spreadsheets that hold and manipulate data prior to its utilization in calculations and the internal model. It is very common to find extensive 'webs' of thousands of spreadsheets connected by spreadsheets 'links' that may have an impact on data quality. In practice many of these are dormant, but their presence and the possibility of erroneous updates creates uncertainty and risk in the modeling process.

Resolution of the problem can be seen in terms of three steps: ***discovery, triage and control***.

Discovery is the process by which businesses can evaluate their current dependence on spreadsheets. Such a 'health check' will consider the scope and complexity of spreadsheet usage. It can be done manually but may be accelerated using technology.

Once the spreadsheet landscape is mapped and analyzed, the future of identified spreadsheets and spreadsheet-supported processes can be '**triaged**' for different forms of improvement. This may simply be a matter of training users to further exploit existing solutions, or require the adoption of new software capability through integration or third-party vendor solutions. Triage perspectives include ranking spreadsheets by:

» Financial materiality – Sarbanes Oxley, Solvency II.

» Operational inefficiency – by costs and hours of rekeying.

» Operational losses due to errors, missed deadlines, revenue leakage, fraud, compliance fines. Also consider exposures created by MS Access and PC based databases, the three dimensional equivalents to spreadsheets.

It is likely that the spreadsheet triage process will produce a road map for process improvement that will take some years to complete, so that business-critical spreadsheets will continue to exist in the business for a lengthy period. Furthermore, constant business innovation will undoubtedly continue to create more spreadsheets. Both these factors mean that spreadsheet elimination should be seen as a continuous process, rather than a planned destination. Businesses are therefore increasingly turning to technology to provide on-going spreadsheet **control** in the form of enterprise spreadsheet management software. This provides the opportunity to detect and report user activity which is outside pre-determined tolerance levels across the key risk areas of data, functionality and security. However this does not mean that some spreadsheets cannot be eliminated by:

» Expanding the functionality of existing systems or by building new dedicated systems.

» Uploading unique data in the spreadsheet into user defined tables within the repository with enhanced reporting generated from the repository.

» Reporting from the spreadsheet can be migrated to a business intelligence system or OLAP dashboards.

» Some or most of the spreadsheet model and data is removed in several steps, reducing risk along the way until the spreadsheet is finally eliminated.

Key Takeaways

There is little doubt that analytical data is a foundation not only for Solvency II and IFRS programs but also better informed capital/risk decision making. Insurers need to master data management and can do so by leveraging the following ten principles:

1. Analytical data (actuarial, finance, risk, investment and other external data) is very different in character from the transactional data insurers are used to using and storing.
2. When considering analytical data, the business needs look to the ultimate usage of the data, typically reports and dashboards—and level of granularity and drill through required.
3. IT can utilize OLAP techniques to provide sophisticated multi-dimensional views of data but only if the required outputs are well defined.
4. Ensuring the quality of analytical data is absolutely critical—without this, the accuracy of all generated finance capital and actuarial numbers can be called into question, and insurers may fail to meet the EIOPA data quality requirements.
5. Data accuracy requirements are not the same for all purposes. It is important to articulate why accuracy is needed, otherwise valuable effort can be wasted on improving data quality that has little materiality.
6. There are tools which can help improve the quality of data which are combination of techniques and expert judgment. These should be utilized wherever possible.
7. Business rules are an important part of the data quality process and while there are many pre-built generic rules it will be critical to supplement these with user defined rules that reflect unique business considerations.
8. Improving data quality is an ongoing process—not just when the data is initially loaded. Data is constantly changing. An analytical repository is an essential element in improving data quality.
9. Spreadsheets remain an important element of analytical data and must be carefully managed and controlled. Specific tools such as Cluster 7 are designed for this.
10. Most data related projects don't fail because of the technology; they fail because practitioners cannot define precisely what data they want, what purpose they are going to use it for and the quality criteria necessary.

Chapter 3

Pillar III Reporting: Avoiding the Pitfalls

For insurers there may be more than one approach to meeting the considerable challenges of complying with Solvency II's Pillar III. In this chapter, we assess both tactical and strategic approaches for addressing the Pillar III requirements, and propose a hybrid approach that both satisfies immediate needs and can grow into a strategic solution over time.

Coverage includes:

- *Implications of deferring Pillar III projects*
- *Pros and cons of a purely tactical approach.*
- *Advantages of a strategic approach*

At the heart of Solvency II is the requirement for insurers to provide regulators with detailed reports that demonstrate capital adequacy, risk appetite and risk management practices. A key component of Solvency II's Pillar III reporting is the quantitative reporting templates (QRTs). These comprise a series of over 70 prescriptive templates, relating to both solo and group reporting which capture details such as the insurer's capital position, balance sheets, assets, liabilities, revenue/expenses, business analysis, claims experience and reinsurance. The number of reporting templates has been increasing with each EIOPA and local regulator update, and together they require literally thousands of data items and a high degree of granularity (e.g. the technical provisions and asset templates).

Whilst some of the data required for the QRTs will already exist, particularly data from existing finance systems, much of it will be new, such as the asset transaction data and look-through requirements for the Asset QRT templates. In order to produce the necessary reports, insurers will need to aggregate and consolidate data from myriad internal systems as well as some external sources. Some of the required data may even have to be input manually because it only exists inside people's minds.

The situation is further complicated by the fact that certain data from solo and business unit operations must be consolidated up to group level. Each solo will typically have their own unique systems, technologies and governance processes. There won't be a common data (or metadata) model. Furthermore, the data requirements of group and solo will differ.

In practice the extraction, management and aggregation of large amounts of analytical data act as the foundation of QRT reporting. It should also be noted that the Own Risk Solvency Assessment (ORSA) process requires different data and capital calculations but should be considered an integral part of the reporting process and technology solution selected. The benefits that insurers derive from their Solvency II programs will depend largely on how good these processes are for generating granular risk and capital information and metrics.

Deferral of Pillar III Projects

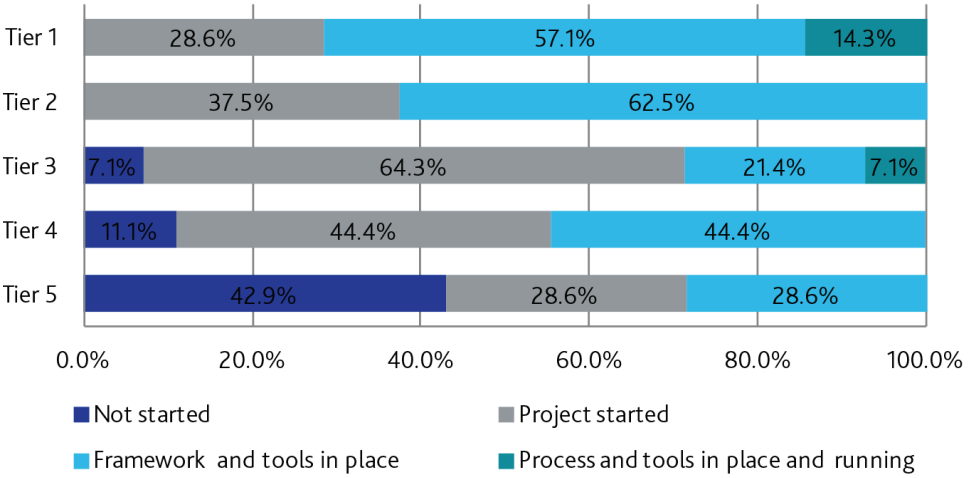
According to a survey conducted by Moody's Analytics[1], EIOPA's decision in late 2012 to defer the full Solvency II implementation date to January 2016 had an impact on the preparation efforts across firms of all sizes and countries. In particular, preparations regarding Pillar III were affected, with 29% of respondents indicating a slower pace of Solvency II implementation since the deferral announcement. Moreover, many insurers in our survey sample indicated that they faced progress constraints because Solvency II-related budgets have been frozen due to uncertainty about the final regulation and timetable. Of course this has now been resolved with EIOPA firmly committing to the 2016 timetable and introducing an "Interim Measures" for 2014 and 2015.

We also found that many insurers had focused their attention and efforts on the quantitative measurement of capital under Pillar I and the risk management requirements of Pillar II. Consequently they had deferred the implementation of Pillar III reporting. Indeed, 56% of firms in our survey sample at that time had not fully addressed the disclosure and transparency requirements under Pillar III.

1 *Solvency II: A Field of Missed Opportunities?* Moody's Analytics 2013 SII Practitioner Survey

The following table illustrates the progress on Pillar III across a range of insurers with Tier 1 being the largest insurers and Tier 5 being the smallest.

Pillar III Progress by Tier



Solvency II: A Field or Missed Opportunities? Moody's Analytics 2013 SII Survey

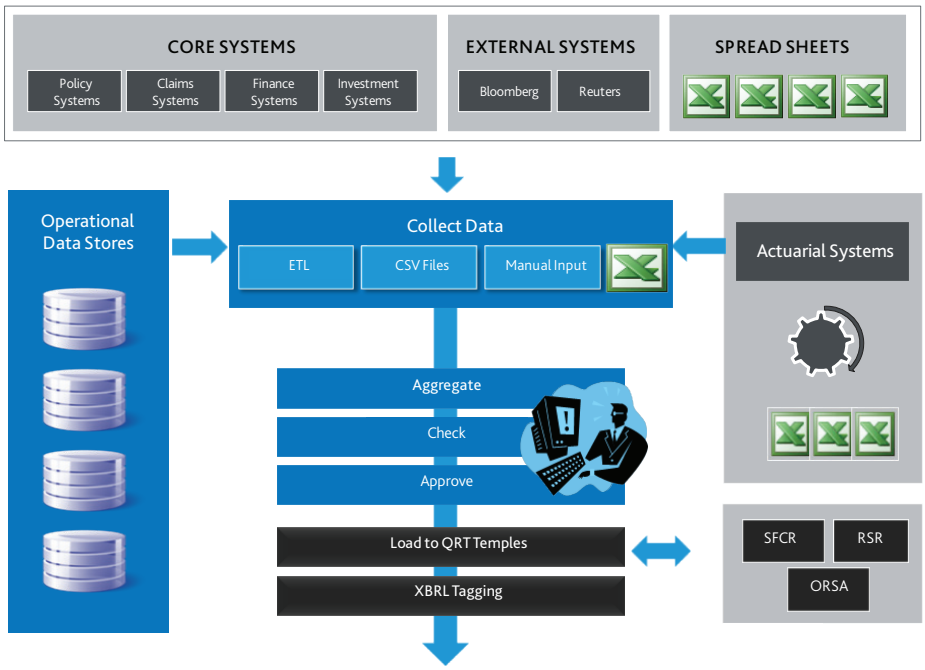
Interestingly our survey indicated that insurers were adopting one of two basic approaches to tackling Pillar III: one is tactical and the other strategic. Even after the confirmation of the interim measures, these approaches are still relevant. We examine each of these approaches in detail below and conclude with a third approach that we believe many insurers will find attractive, particularly bearing in mind the fact that the first annual QRTS are scheduled for 22 weeks into 2015.

Rather than adopting a more strategic approach that encompasses the planning and implementation of all the three Pillars simultaneously, it appeared that many insurers were only considering implementing Pillar II requirements towards the end of the planned project. This is surprising, because, in our view, the work required to satisfy the quantitative and qualitative aspects of Pillar III are considerable. In particular, we think that the short time frames and comprehensive level of data that insurers must disclose pose significant operational challenges.

Approach 1 – Tactical

The tactical approach treats the collation of the data required for Solvency II as essentially a one-off event which then needs to be repeated on a regular basis. For this approach to work a huge amount of resources will be required to manage spreadsheets, CSV files and manual processes to collect the data, aggregate, consolidate and check it, load to QRT templates and ultimately generate the XBRL files for the regulator. These same costly resources involving people, laborious processes and systems have to be deployed again and again at each and every reporting cycle thereafter.

The diagram below highlights a typical tactical process:



The key points to note here are first, collecting all the data is a fairly piecemeal process which employs a variety of extraction methods. Second, the process is manually intensive from collecting the data through to aggregating, checking and loading it into QRT Templates. Integrating with the Solvency Financial Condition Report (SFCR) and the Regular Supervisory Report (RSR) and ORSA processes (which are largely narrative based) can be problematic.

There are some vendor solutions on the market that enable insurers to load aggregated and quality-checked data into pre-built QRT templates that in turn generate the XBRL files for the regulator. While these can be useful in terms of the QRT structures and XBRL tagging, they do not typically address all the underlying data quality issues, or the consolidations required, nor do they help to automate the collation process. These can be regarded as quick-fix solutions which produce needed reports, but do not produce all the data collation and consolidation required by the overall process and the full audit trails.

The adoption of such a tactical solution has a number of significant drawbacks, and although it can certainly be a way forward for very small insurers whose legal entity structures and product range are quite simple, larger insurers might only find this option viable in the short term.

The following table illustrates the main pros and cons of the tactical approach.

Tactical Approach - Pros and Cons

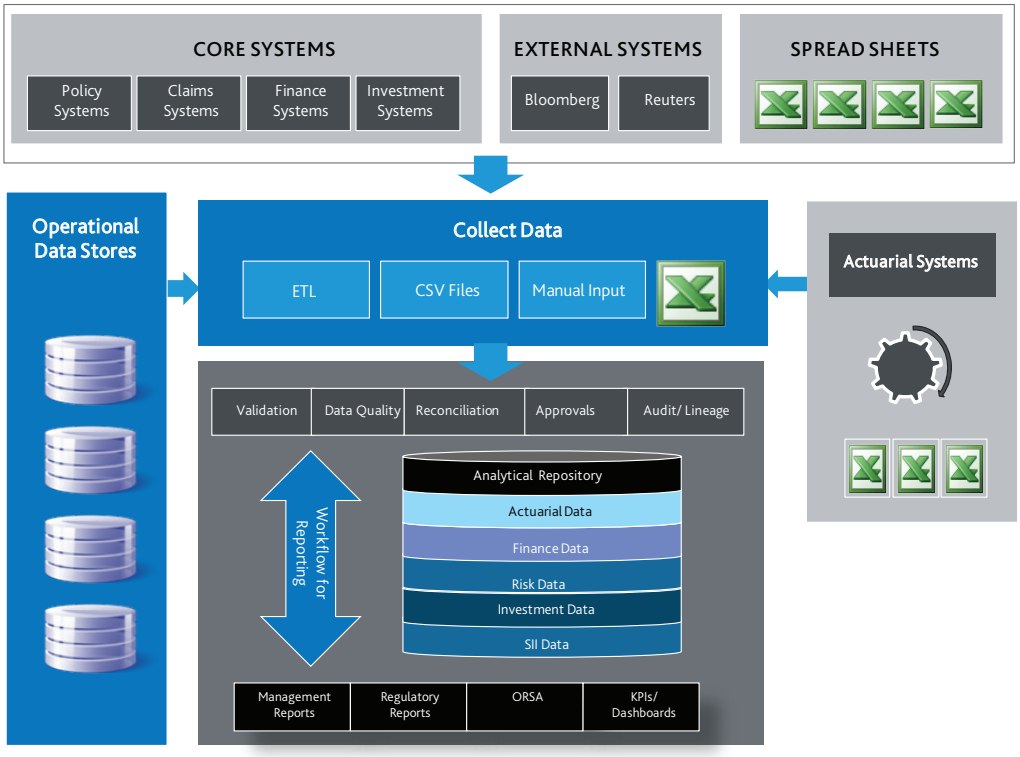
Category	Pros	Cons
Approach	» Primarily a manual based approach which is typically used for dry runs or as a quick fix. » Only viable as a long-term solution for the smallest insurers.	» Adequate for the short-term needs, but may lead to a complete Pillar III rebuild if the tactical solution is not flexible or scalable enough.
Implementation Process (1)	» Quick to implement due the manual orientation and compromises made.	» Essentially a "throw-away" approach as the collated data is just used once and then only stored in the QRT templates. » The data is not available for wider usage and analysis – (e.g. International Financial Reporting Standards (IFRS) integration, Pillar I calculations) leading to potential inconsistencies across the different pillars. » No historic comparisons are possible e.g. for different versions of the QRTs and to support the Variance Analysis templates. » Automation is needed to meet ever smaller decreasing reporting cycles.
Implementation Process (2)	» Given the continual delays implementing Solvency II some insurers may see this as a viable interim step until the regulations are finalized. This of course has now changed with the introduction of the Interim Measures by EIOPA	» The whole approach is essentially based on manual processing with limited technological support – fine for small insurers. For medium/large insurers (particularly those with group/solo structures) this should be seen as an interim step as ultimately they will need to automate the processes, quality checks, consolidations and approvals.
Implementation Costs	» Implementation costs are low in the short term as very little investment in new systems, data ETL and automated processes is required.	» Extracting and transforming the data is piecemeal and there may be auditing/lineage issues in tracing back to source. » Data quality and validation remain key issues. » No central repository to store analytical data.
Data & Process (1)	» Facilitates a dry-run type approach that allows insurers to understand the data and process requirements before committing to a more strategic solution.	» The insurer may have to devote dedicated resources to keeping the QRT templates updated in line with changing regulation and the XBRL tagging – some vendor strategic solutions provide this automatically.
Data & Process (2)	» Manual data processing and quality checks mean that no investment in data quality, audit and security tools are necessary.	» There are little or no automated data quality processes and there is an over reliance on manual implemented checks – this may cause issues with regulators in relation to data quality standards Additionally the high level of manual work may impact on the timing of the close cycle potentially delaying submission and regulatory expectation. » Reconciling data from multiple source system (e.g. finance and policy administration systems) presents challenges. » There are typically audit, security and control issues, with intensive manual processes both from a regulatory and internal auditor perspective. These may prove to be problematic to meet and importantly to demonstrate to the regulator that they are in place.
Reporting	» Driven by manual processes so very flexible.	» Physically collating , validating and reconciling all the data required should not be underestimated.

Approach 2 – Strategic

Perhaps the only positive aspect of the delay in implementing Solvency II is that it has given insurers extra time to think through their processes more thoroughly and implement a more durable solution to their Pillar III reporting needs. The key to a more strategic approach is to automate the reporting process as much as possible while at the same time automating the analytical data collection and quality processes. In order to do this, three important pieces of technology are required:

1. Data extract, transform and load (ETL) tools that automate the data extraction and collection process.
2. A centralized data repository to store in a standard format all the analytical data required, making it available to the enterprise for multiple purposes.
3. A reporting and Extensible Business Reporting Language (XBRL) generation and workflow capability for regulatory and management reporting.

The diagram below highlights how these elements combine to support a typical strategic Solvency II reporting process:



The key points to note with this approach are:

1. The role of the centralized repository is to be the *single source of truth*, provide reporting and analytical capabilities, and store, audit, reconcile and track data back to source systems with full lineage.
2. By storing all the data in a relational repository it is possible to provide various historic snapshots of the data for comparison and reporting purposes, e.g., variance analysis.
3. ETL tools automate a significant percentage of the data extraction and loading into the repository. However it should be noted that there will always be an element of data that has to be input manually (such as operational risk data, capital tiering information etc.) or by spreadsheet or CSV files which is typically the case with output from actuarial engines.
4. Workflow technologies are either embedded in the central repository or provided by a dedicated workflow engine that can identify errors, and automate, control and monitor the reporting/close process and provide email alerts and warnings if the process is running late.
5. Critical data quality checks can be undertaken in both the ETL process and the repository. For analytical data the best practice typically sees the data quality checks executed in the repository.

The following table illustrates some pros and cons related to the strategic approach.

Strategic Approach - Pros and Cons

Category	Pros	Cons
Approach	» A *strategic* approach is based on a centralized repository which acts as a *single source of truth* for all analytical data the business needs. » Can be easily extended to additional analytical reporting beyond the confines of Solvency II reporting and other reporting regimes – e.g. IFRS. » Provides richer Business Intelligence supported by more granular data.	» There are significant costs and resources required to build an effective analytical data repository, however these can be partially mitigated if a phased implementation approach is taken.
Implementation Timeline & Costs	» Typically an enterprise deployment project connecting all entities and participants to a centralized repository and automated processes.	» Significant costs and resources required over a longer timeline to create an effective analytical data repository, but this can be offset to a degree by the business benefits generated.
Data & Process (1)	» Data can be re-used for multiple purposes: management and regulatory reporting, KPIs, dashboards, Pillar I calculations, exposure monitoring etc.* » Both data extraction and reporting process can be highly automated.	» Time and effort has to be spent building the ETL routines and defining the reporting processes for the workflow. » There will always be an element of manual processing required. » Spreadsheets have to be catered for.
Data & Process (2)	» Data can be automatically tracked and audited for both regulatory and internal audit purpose. » Historic snapshots of data can be generated for comparative purposes and variance analysis.	» None. This is very difficult to achieve and demonstrate in a manual environment.
Data Quality	» Built-in data quality checks can improve the quality of the raw data to meet both business and SII requirements. » Ongoing data quality processes can also be automated to a degree.	» Expertise may be required to validate and interpret the execution of some data quality checks and techniques.
Reporting	» Reporting engines can be readily interfaced to the repository via online analytical programming (OLAP) cubes to generate regulatory and management reports with drill-through capabilities.	» Time and effort must be expended on developing the OLAP cubes, but once done, reporting can be highly automated with multiple levels of drill through.

** For example, input data for actuarial models can be leveraged in the repository and reused for SCR calculations and if data is stored in sufficient level of granularity it can be utilized for investment and exposure limits monitoring.*

Is There a Way to Combine Both Approaches?

The polarized tactical and strategic approaches to producing Solvency II Pillar III reports can be effectively bridged by a third possible approach, which we term the Hybrid Approach. This approach initially implements the tactical requirements but is based on a longer-term strategic solution. This might seem paradoxical at first glance, but it can work, and it can yield real benefits. For example, insurers can achieve their immediate tactical requirements such as QRT dry runs, process dry runs, and testing data quality, but within the framework of a strategic solution. This can be gradually expanded over time to support other reporting elements such as ORSA. Thus insurers can gradually build up the solution as regulations and processes become better defined and focus on automation to reduce close times. Crucially, this approach also helps to reduce initial costs and the impact on scarce resources.

The hybrid approach involves using components of the technology in the strategic approach to satisfy the immediate business requirements. This may suit some insurers particularly given the uncertainty around Solvency II and the emerging business requirements.

An example of this approach might be to utilize the technology to support a QRT dry run, and then, as budget and resources become available, to implement the full strategic solution. For a first deliverable such as this, rapid implementation should be possible in around 60 days. The full solution would ultimately provide greater automation, audit and security controls, data quality checks and validations, and greater reporting functionality. It also enables work undertaken to be reused and helps to familiarize personnel with the processes prior to full implementation.

Adopting this approach might mean a number of initial compromises, which we describe below, but these can be resolved as the project progresses.

1. All the data sources and inputs may initially not be fully identified and automated. This means there will be a significant number of manual inputs and file downloads. Eventually, however, the data sources and processes will become better understood and gradually automated.

2. While the underlying repository may only initially hold the minimum data required for Solvency II reporting, over time it can be extended to much wider usage, ultimately into a fully integrated risk and finance repository moving beyond Solvency II.

3. Limited data quality may be acceptable in the short term, enabling the reporting process to be tested and embedded in the business. Over time the reporting processes can become better defined and automated and data quality can be gradually improved.

4. While lineage and auditability are crucial in the longer term, particularly as part of the organization's risk management practices, compromises and manual perspectives may be adequate at the initial stages. Again as the project progresses, greater lineage with full audit trails can be added.

In essence this Hybrid Approach advocates a phasing in of modular, interoperable technology and functionality over an extended time. This, we believe, will be preferred by many insurers as it will enable them to undertake dry runs, test their processes and obtain clarity on the regulations before committing to a full strategic build. This may be the ideal solution for those insurers who wish to spread implementation costs and resources, and gradually build out the solution as their needs grow.

Key Takeaways

To conclude we summarize below the key points of the three approaches:

Approach	Points
The **Tactical Approach** advocates a piecemeal methodology to collating data that is predominantly manually oriented and essentially throwaway. It is generally quick and cheap to implement but lacks essential controls and the possibility of re-use. Probably only suited to insurers adopting a minimal compliance approach or as a quick fix.	» Quick-fix » Cheap to implement » Manually intensive » Not reusable » May cause compliance issues » Difficult to audit and track » Does not address data quality issues » Good for dry-runs of QRT process » Low initial costs
The **Strategic Approach** is at the opposite end of the spectrum and advocates a robust solution based on a centralized repository and associated data quality and workflow tools. This strategic approach provides a long-term platform for analytical data and reporting and a significant commitment to implement.	» Robust, scalable solution » Automated processes » Central repository for analytical data » Improves data quality » Extend beyond Solvency II reporting » Major implementation project » Meets audit and security requirements
The **Third Way** effectively utilizes a modular technology approach in a tactical, phased manner to meet immediate needs ***but*** within the context of a strategic framework. It allows insurers to start with basic functionality and add capabilities over time to meet both internal and regulatory requirements. This means scarce resources and costs can be carefully balanced against changing requirements	» Hybrid approach – tactical implementation on a strategic platform » Phased implementation and costs » Quick to initially install (60 days in some cases for first deliverable) » Grow as requirements emerge » Gradually improve data quality

Today insurers are taking either a tactical or strategic approach to their Pillar III and ORSA reporting projects. We believe that insurers adopting the tactical approach should consider adopting the hybrid approach, discussed above, now. For insurers who are already going down the strategic road we encourage them to continue on that path as this is the best way to support risk and capital management within the business in the long term.

Chapter 4

Making the Most of Analytical Data in Decision Making

In this chapter we discuss the many ways in which insurers can use analytical data to support their strategic risk and capital decision-making processes and how this can be integrated with the Own Risk Solvency Assessment (ORSA) and Use Test processes.

Coverage includes:

- *The IT infrastructure*
- *Benefits for insurers of using artificial intelligence networks*
- *Investment information*
- *Legal entity structure and diversification*
- *The type of information relied on by decision makers in the insurance industry*

Introduction

The insurance marketplace is more competitive today than ever given the pressure to reduce operating costs, the impetus to provide better returns to shareholders, the emergence of new distribution channels, and the climate of low investment returns. Consequently, making the right business decisions is absolutely crucial — decisions that are directly linked to high-quality data.

Equally, insurers have to contend with an ever-increasing regulatory burden, including Solvency II, International Financial Reporting Standards (IFRSs), the Dodd-Frank Act, and the Retail Distribution Review (RDR). Compliance with this legislation is challenging, considering the operating environment. While most of the legislation is primarily concerned with governance, much of the practical management is driven by data — particularly Solvency II and IFRS.

THE CONNECTION BETWEEN DECISION MAKING AND REGULATORY COMPLIANCE DATA

Data is the common theme between decision making and regulatory compliance. A significant amount of analytical data is required for Solvency II and IFRS, but much of this data is also relevant for making business decisions. While additional data may be required for decision making, the key to success is developing a common approach and standards to data management and storage that can meet both regulatory and business needs. A further crossover is that informed business decisions are at the heart of the Own Risk and Solvency Assessment (ORSA) and Use Test processes.

RISK DATA IS KEY

As the fundamental business of an insurer is to underwrite and pool risk, strategic business decisions are often based on risk data (or analytical data). Granular data on all these risk factors is required to support the decision-making process and regulatory reporting. Much of this data is analytical in nature, but some operational data is needed, such as policy and claims data for input into an insurer's actuarial modeling engines.

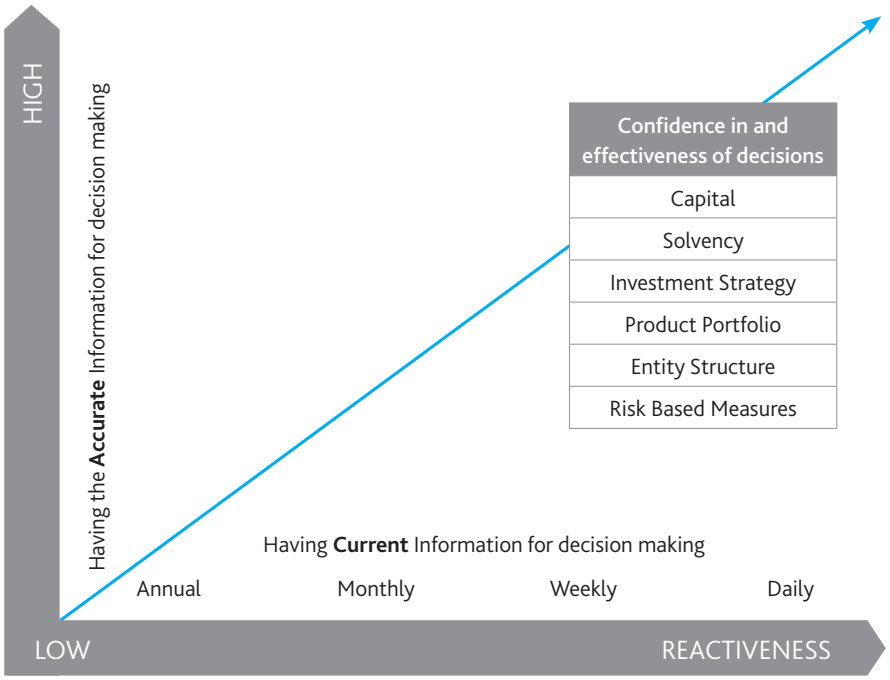
While much of the regulatory risk data is defined and can effectively be reused for decision-making purposes, new data may be required, particularly for generating risk-adjusted metrics (e.g., risk-adjusted return on capital, or RAROC, return on risk-adjusted capital, or RORAC) and for forward-looking planning (e.g., multi-year projection of economic balance sheets). This latter aspect is the most problematic and, as well as base data, it may require new actuarial models, methodologies, and scenarios to project into the future.

INFORMATION NEEDED

In terms of strategic decision-making, a significant amount of information may be required to meet key questions, such as:

- How much risk capital will be needed to survive the next five years?
- What is the most effective and profitable use of the firm's capital?
- How can the business grow profitably?
- What should the firm's product portfolio look like?
- What are the scenarios that might put the firm out of business?
- How would an acquisition impact the firm's capital requirements?

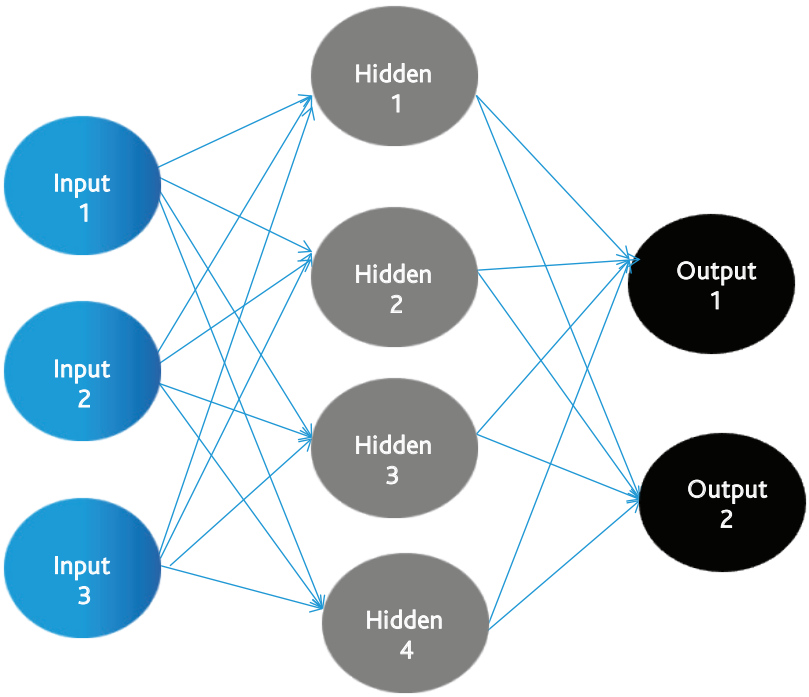
In order for insurers to remain competitive, they must be able to react quickly to change, which involves instant access to accurate and relevant information. This information is often provided via interactive dashboards that are produced at a set time or when certain events occur.



Increasing Use of Artificial Intelligence and Neural Networks

Insurers are increasingly using artificial intelligence and neural network techniques on their vast data repositories because advances in areas such as machine learning and natural language comprehension enable them to better mine and exploit data to identify trends and patterns. Fraud detection in claims, for instance, is just one of the areas where insurers are using statistical and artificial intelligence techniques to spot anomalies in client behavior to help them detect the characteristics of fraud at an early stage. They are also making use of neural networks. These non-linear statistical data modeling or decision-making tools attempt to emulate the immense parallel computing power of the human brain. Such networks can be used to model complex relationships between data inputs and outputs or to find complex, hidden patterns in data. Neural networks effectively learn from their experience and adapt their logic and predictive models accordingly.

Typical Neural Network Configuration



Typically a neural network comprises hundreds of single units, artificial neurons, or processing elements connected with coefficients. These are organized into layers where each processing element has weighted inputs, transfer functions and outputs. The diagram above illustrates the architectural framework of the commonly used artificial neural network consisting of layers of input units connected to a layer of hidden units which are connected to a layer of outputs.

Customer retention is a practical application of neural networks. Here, insurers are interested in identifying any characteristics displayed by policyholders that might indicate a propensity to surrender policies or to allow them to lapse. Having identified such characteristics, insurers can then decide whether to exclude them at the underwriting stage or take remedial action mid-term. Also of interest to them is the ability to assess whether the percentage of surrender requests increases in relation to a particular sub-set of policyholders.

...economic capital metrics need to be included into incentive plans for senior executives to ensure risk-based decision making is pursued as standard practice.

Additionally, some insurers are using artificial intelligence/neural networks to:

- Develop insolvency prediction models.
- Predict car insurance losses using the information available to the underwriters when a policy is accepted.
- Underwrite policies where the insurer wants to identify what the propensity to claim is, or the likely level of a claim. This can be used as a model for the basis of accepting or rejecting a proposal.
- Balance pricing to match claims in a manner that retains good clients and attracts new clients.

Embedded Value versus Economic Capital

As a metric of performance, some insurers, particularly property and casualty (P&C) insurers, are turning away from embedded value reporting[1]. Partially driven by Solvency II, many insurers are now adopting Economic Capital as the most critical measure. The reasons for this are clear:

1. Economic capital enables an insurer to develop a range of consistent risk metrics across the entire business.
2. It provides a transparent view of risks across the business and allows for correlation between and across risks.
3. It enables the effective testing of business initiatives from a risk management perspective.

In order to be successful however, economic capital metrics need to be included into incentive plans for senior executives to ensure risk-based decision making is pursued as standard practice.

Economic capital, however, is not the only measure being used by insurers. In particular Risk-Adjusted Return on Capital (RAROC) is also viewed by many insurers as a key metric. This is because it enables insurers to connect financial performance to capital attribution in relation to risks assumed and value created.

RAROC consistently measures the performance of different business activities and can be utilized, for example in:

- Allocating capital to business units
- Scorecards which measure shareholder value
- Compensation plans for executives based on performance
- Evaluating potential acquisitions and sell-offs
- Accurate product pricing

The use of RAROC increases focus on risks versus return in the decision-making process. Consequently it stimulates the use of scarce capital in the most efficient way. Risk-adjusted pricing tools are also used as a basis for the pricing of certain transactions and as an important determinant in credit-approval procedures.

1. Market consistent embedded value (MCEV) is still widely used in the life sector.

Insurers may also adopt other capital metrics and we summarize some of these below:

Capital Measures

RORAC (Return on Risk Adjusted Capital)	RORAC is a measure based on rate of return whereby riskier projects and investments are evaluated on the capital at risk. In theory, RORAC calculations make it easier to compare and contrast projects with different risk profiles. RORAC = net income / allocated economic capital, where allocated economic capital = **the firm's capital, adjusted for a maximum potential loss based on the probability of future returns or volatility of earnings**. RORAC is similar to risk-adjusted return on capital (RAROC), however, with RORAC, the capital is adjusted for risk, not the rate of return. RORAC is often used when the risk varies depending on the capital asset being analyzed and this can be considered a useful step towards RAROC.
RAROC (Risk-Adjusted Return on Capital)	RAROC is a risk-based profitability measure for analyzing risk-adjusted financial performance and providing a consistent view of profitability across businesses. RAROC is essentially a trade-off between risk and return. RAROC = expected return / economic capital RAROC is typically employed to evaluate the relative performance of business units exhibiting different levels of risk. It is common to compare RAROC performance to an insurer's cost of capital or to its ROE target, depending on whether the capital attributed to business segments is the insurer's "economic capital" or the insurer's available capital measured under GAAP accounting rules. Evaluating financial performance under RAROC calls for comparison to a benchmark return; when the benchmark return is risk-adjusted, the result is similar to risk-adjusted return on risk-adjusted capital (RARORAC), though the term RAROC is still applied.
ROE (Return on Equity)	ROE is a profitably measure based on the amount of net income returned as a percentage of shareholders equity. ROE measures an insurer's profitability by revealing how much profit he will generate compared with the capital which shareholders have invested. ROE = net Income / equity The weakness of ROE is that it is limited in terms of risk adjustment to the extent of the risks covered in the general ledger. As a result, RAROC and RORAC are considered a "step-up" from ROE.
RaEVA (Risk-Adjusted Economic Value Added)	Risk-adjusted economic value added (RaEVA) is a performance measure that attempts to account more properly for the cost of capital. It is based on the economic capital (EC) of each division within the business. RaEVA is the sum of operating capital (OC) and risk capital. It can also be utilized as a management control system which measures capital based independent business units and staffing levels.
MCEV (Market- Consistent Embedded Value)	Embedded Value (EV) is the present value of future profits plus adjusted net asset value. It is a financial measurement applied primarily to long-term (life) insurance business. MCEV provides a means of measuring the value of such business at any point in time and of assessing the financial performance of the business over time. EV is a measurement of the value that shareholders own in an insurance company, comprised of capital, surplus, and the present value of earnings to be generated from the existing business. As its name implies, MCEV is EV calculated using market-consistent assumptions.
ECaR (Economic Capital-at-Risk)	Economic capital is the amount of risk capital, assessed on a realistic basis, which a firm requires to cover the risks it is running or collecting as a going concern. Examples include market, credit, and operational risks. It is the amount of money which is needed to secure survival in a worst case scenario. Firms should then aim to hold risk capital of an amount at least equal to economic capital.

Insurers can adopt any of the above methods, but common to all of them is the requirement to have all relevant data available at both the line of business and policy level. This is driving insurers to build dedicated analytical data repositories, as discussed at page 11.

Making Use of Other Information

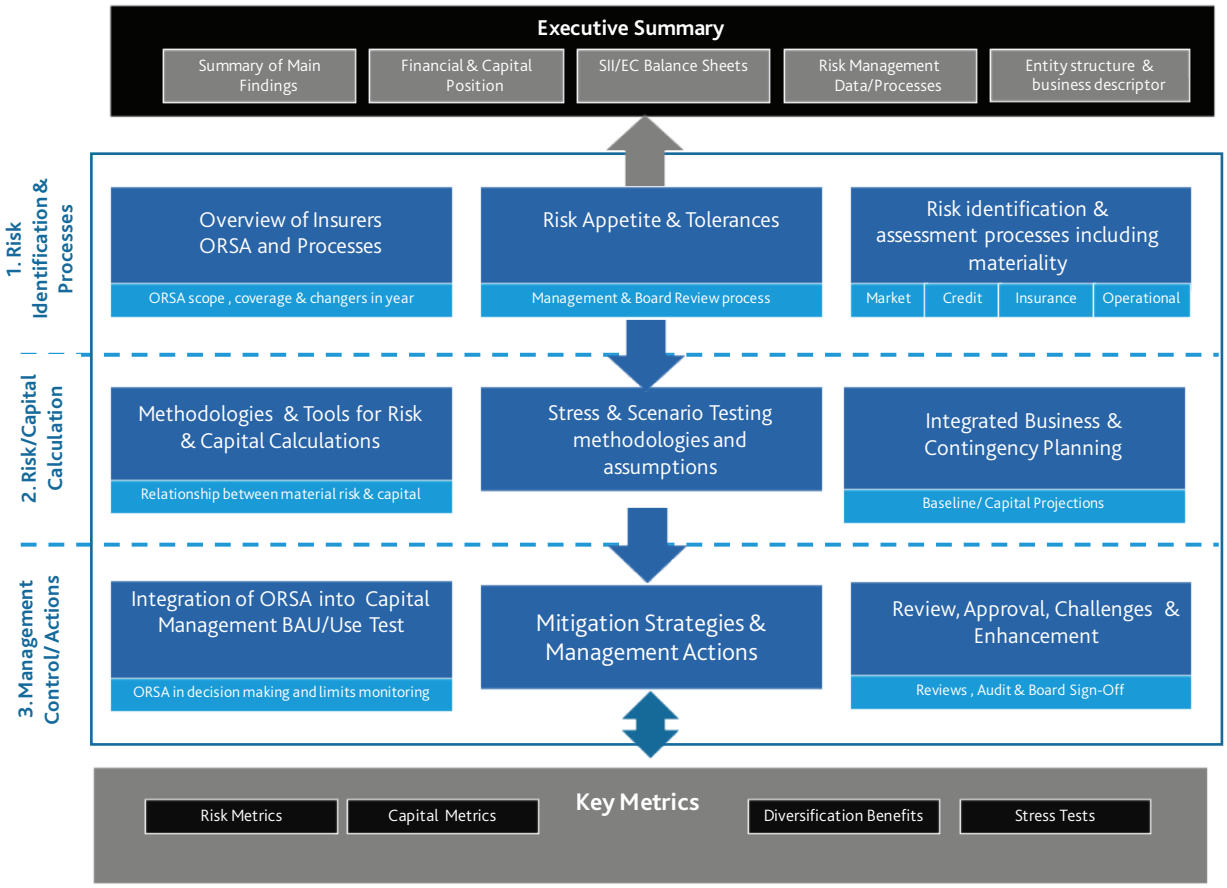
We have examined some of the key performance measures an insurer might use, but what other information should be considered in the decision-making process?

The ORSA and Use Test put risk and capital-based decision making at the heart of the strategic planning process. Insurers can adopt a minimal compliance approach to the ORSA or fully embrace it and adopt a proactive risk and capital culture throughout the business. We believe that embracing the ORSA and embedding it within the overall strategic planning and decision-making process is the most advantageous approach.

The diagram below highlights the ORSA comprising, at the centre, the three key process layers of:

1. Risk Identification and Processes
2. Risk and Capital Calculations
3. Management Controls and Action

For the purposes of the ORSA document an executive summary is required, and to complete the process, the ORSA should generate a series of capital and performance metrics which are central to the running of the business.



Investment Information

Volatility in the financial markets and historically low yields, mean that making the right investment decisions is of paramount importance, but what type of investment information should decision makers and senior management look for? The following provides some areas that might be considered:

- Market risk dashboard – shows capital adequacy across a range of measures based on current market prices, typically produced daily or weekly.
- Optimal asset portfolio – provides information showing the comparison between yield and capital allocated to assets. It indicates the best yields, capital and risk ratios.
- Credit/concentration risk – as insurers seek better yields they increasingly look to invest in alternative credit assets such as Infrastructure and corporate loans, and credit default swaps (CDS). These provide a better yield than bonds and match the insurer's long-term liabilities, but greater granular credit risk information is required to fully understand the risks and returns.

It can be a challenge for insurers to obtain granular asset information from investment managers and internal investment systems for evaluating returns and assessing how differing investment portfolios impact on the level of capital required. Such information, however, is essential to support the decision-making and the regulatory reporting processes, e.g. the D1-D6 QRTs.

Product Portfolios

Low yields on bonds and the capital requirements of Solvency II have encouraged insurers to switch from insurance products with inherent guarantees such as with-profit life contracts, towards unit-linked contracts, where all investment risk is effectively transferred to the policyholder. As a consequence, insurers are re-assessing their product portfolios with the aim of reducing capital held in relation to products. However, to support this, insurers need at their disposal a whole raft of actuarial modeling and capital data.

Legal Entity Structure and Diversification

Solvency II is also driving insurers to closely examine their legal entity structures and the impact that their structure has on capital. For instance, some multi-national insurers have re-structured their legal entities to different groupings or converted subsidiary companies into branches, whereas to obtain regulatory and capital advantages, others have sought to relocate the group geographically. Clearly tax and fungibility rules come into play, but there is a definite trend towards legal entity simplification, and for this to happen, analysis, granular finance, actuarial, asset and risk data at entity levels are required.

The advantages of seeking diversification benefit are widely endorsed, and this has led many insurers to carefully consider what businesses and books of business to acquire or divest. The traditional approach of just valuing books of business on an embedded value basis is now influenced by its impact on diversified capital

What-if Analysis

The interaction of investment portfolio, product portfolio, legal entity structure and the potential effect of diversification benefits is heightening interest in conducting what-if analysis. The scope of any what-if analysis might include:

- Economic capital/ solvency capital requirement projections under multiple scenarios
- Hedging strategy analysis
- Changes in product portfolio
- Strategic asset allocation
- Acquisitions and sales
- Changes in dividend strategy
- Changes in entity structures
- Interim balance sheet valuation

Each of the above analyses and the performance measures previously discussed require a high volume of analytical data. And, whilst the data is critical, many insurers will also have to review their actuarial models and develop new ones – e.g. for International Financial Reporting Standard (IFRS) figures. They will also need to look for new tools and techniques such as economic capital calculators and proxy modeling, particularly for large complex liability portfolios, where full stochastic modeling is required for internal model solvency capital calculations.

What Information is Required by Decision Makers?

The nature of information demanded will vary by the roles within the business, and whilst there will always be a requirement for complex reports, there is a growing trend for information to be presented in the format of interactive dashboards. Dashboards have the advantage of presenting complex data in a simple format and, if supported by granular data, viewers can drill down into much higher levels of detail. A sample dashboard follows:

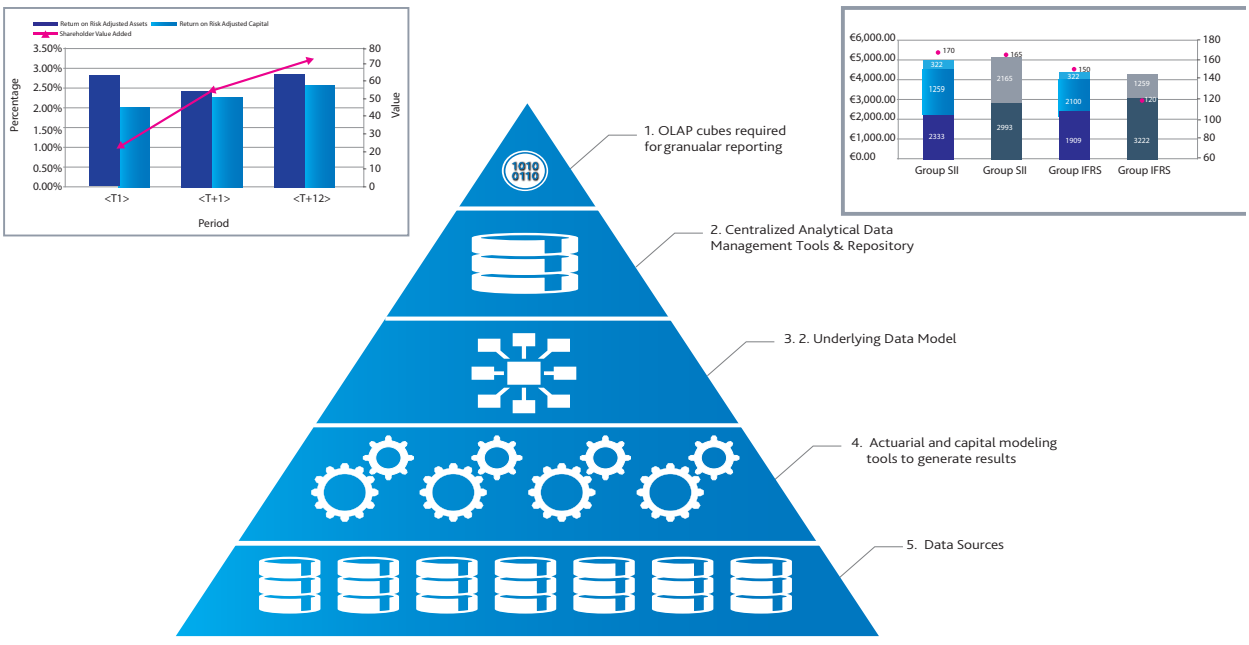
In the table below, we set out the types of information that might be required by the chief risk, finance and executive officers, and also the board.

Chief Risk Officer	Chief Executive Officer
» Economic Capital » Regulatory Capital » Risk Profile/Appetite/Tolerances/Concentrations » SCR/MCR levels » SCR Projection » SCR/Risk Breakdowns » Economic Balance Sheet Projection » Operational Risk » Scenario Analysis	» Group Economic Capital » Group Regulatory Capital » Diversification Benefits » Market Risk Dashboard
Chief Finance Officer	**Board**
» Balance Sheet » IFRS Profit » Economic Capital & Economic Capital at Risk (ECaR) » Return on Equity » Expense and Fraud ratios » Product Profitability » Risk Adjusted Return Measures (RAROC/RORAC etc) » Solvency II/IFRS/GAAP reconciliation	» KPIs » Capital Allocation » Strategic Planning » Investment Yields » Risk Profile » Scenarios » What-if Analysis

Data Framework is Crucial

Regardless of the measures, metrics and information available, it is essential that insurers are able to calculate and analyze information in a high level of granularity—by line of business, product category, or geography, for example. Typically the data to support the calculations and analyses required will be scattered in non-integrated silos or within disparate data architectures, applications and methodologies, and this can inhibit the complete and accurate calculation of the measure. To circumvent this problem, many insurers have built and centralized analytical repositories to store finance, actuarial, risk and investment data.

Reporting Engine



Organizing and storing this analytical data at the lowest level of granularity greatly increases the flexibility for multi-dimensional analysis of results. In turn this facilitates interactive dashboards and reports. Furthermore, if multi-dimensional analysis is generated from a common repository it will help ensure data reconciliation and validation. However the disadvantage of granularity is that the repository may have to handle potentially huge volumes of data. Equally, performance measures and methodologies grow in complexity and can become ever more data hungry.

A centralized analytical repository means that risk and capital data and metrics are available to the whole enterprise to access and analyze. This approach also avoids duplicated and unnecessary movement of data.

A risk and capital literate development team is essential for providing insight into how successful the repository is in supporting risk-based decision making. Nonetheless building the repository can be a complex task. This is because it involves numerous detailed steps:

- Business owners and the users must define the reports and data they require and the drill-down (granularity) capability needed.
- IT can then build a flexible data model and the structure of the repository accordingly.
- IT will have to build the data integration and transformation processes required to load the data into the repository.
- Finally IT will have to construct the online analytical processing (OLAP) cubes necessary to support the generation of reports and dashboards specified by the business.

The Importance of Management Actions

Generating correct and meaningful reports and dashboards is undoubtedly an important part of the decision-making process, but so too is the willingness of management to take action on the basis of the information provided. In some situations management actions can be pre-built into certain scenarios, so that in the event of the scenario materializing, a series of pre-planned actions are triggered. In other circumstances actions will have to be much more reactive.

One example of where pre-determined actions might be triggered is where the stress testing shows that there are scenarios where the solvency ratio falls below desired levels. To cover such an eventuality, plausible management actions such as hedging risk to reduce market risk exposure, transferring risk via reinsurance, reviewing product mix and potentially exiting specific products or lines of business, or of raising new capital in extreme cases, could be developed. Any such plans would need to be documented and regularly reviewed and approved by the board.

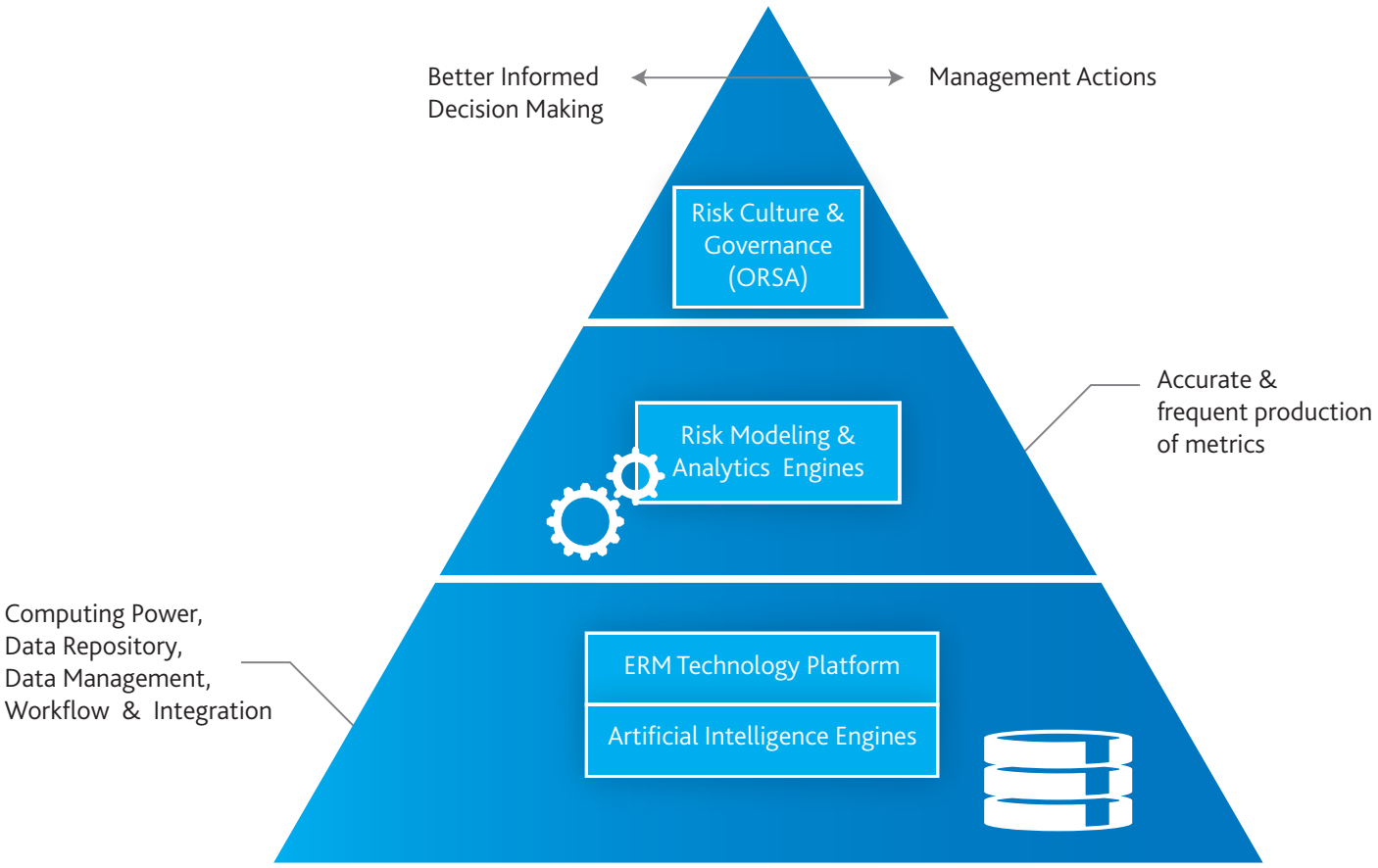
Whilst there will always be a focus on strategic management actions, insurers should also consider more tactical information. For example, if there is an increase in the number of quotes for surrender values, the insurer should set in motion actions to try to avoid a series of actual surrenders. This can only happen if the insurer is storing all the relevant data and conducting the relevant pattern and trends analyses.

Key Takeaways

The quest by insurers for better informed decision-making processes and resources is increasing for both strategic and tactical reasons. In order to achieve this goal, there must be a good risk culture and system of governance in place which supports the ORSA, decision making and action taking. The board must have a holistic view of risk and capital within the business and this means that they have to be provided with a stream of precise and accessible information.

Actuarial and capital modeling engines are a prerequisite for producing the capital and risk metrics and measures. Supporting complex what-if analysis may require new techniques such as proxy functions due to limitations of current technologies. Finally there has to be an ERM technology platform to provide the analytic data, workflow and data management, quality and validation tools that underpin the whole process.

The key to achieving informed decision making is having data and associated technologies in place to support the process. This is illustrated in the diagram below.


Better Informed
Decision Making
Management Actions
Risk Culture &
Governance
(ORSA)
Risk Modeling &
Analytics Engines
Accurate &
frequent production
of metrics
Computing Power,
Data Repository,
Data Management,
Workflow & Integration
ERM Technology Platform
Artificial Intelligence Engines

Chapter 5

In Conclusion

There can be little doubt of the importance of data to insurers not only for regulatory reporting but also to achieve a better understanding of the mechanics of the business in order to make superior business decisions. Data will also play an increasing part in better targeting and selling to clients, identifying fraud, patterns and trends in behaviour.

Whilst it can be argued that data is the most valuable asset an insurer can have, transforming that data, which is stored in a plethora of sources and systems, into information that is valuable to the business is a major challenge. Millions of policies, legacy administration systems, desktop based systems, multiple finance systems, spreadsheet and external sources all contribute to this problem. Furthermore, the quality of this data can often be quite poor.

In a highly competitive industry, insurers will seek competitive advantage wherever they can find it and one way of doing this is to transform data into meaningful interpretative information. Hopefully this booklet has explained some of the issues and challenges that insurers face and given readers some practical insights to possible solutions.

We end this document with a few observations regarding successful data management programs:

- The business must be clear about what information it needs for regulatory and business purposes—then the process can begin to determine what data is required to generate that information and identify any gaps in current data.
- Technology is critical—there are a range of database, ETL and data profiling technologies available and selecting the right components is essential. But it must be remembered that these tools must be aligned to deliver the information the business needs and improve the quality of the data—avoid buying technology for the sake of it.
- Making the information available to the business in a readily accessible format is also critical. Different people need different information in differing levels of granularity. Increasingly business people need information displayed in graphical formats such as interactive dashboards as well as traditional reports.
- Agility is also vital. Whilst the business might be prepared to wait for some information to become available, other information must be available daily or on-demand. Thus users must be able to define when they need information and what format they need it in. Wherever possible users should be able to define their own reports and schedule when they are run.
- Automation—as the demand for information grows the processes and model runs to supply that information must be automated as much as possible. Continually getting IT to set-up new runs manually, develop new reports, etc must be avoided.

Most data related projects don't fail because of the technology , they fail because practitioners cannot define precisely what data they want, what purpose they are going to use it for and the quality criteria necessary.

Moody's Analytics offers solutions to manage all aspects of Solvency II compliance, including data management and reporting. Moody's Analytics also assists insurers deploy the rapid and bespoke implementation approaches referred to in this paper.

For more information on the range of solutions, visit **www.moodysanalytics.com/solvency2**.

About Moody's Analytics

Moody's Analytics, a unit of Moody's Corporation, helps capital markets and credit risk management professionals worldwide respond to an evolving marketplace with confidence. The company offers unique tools and best practices for measuring and managing risk through expertise and experience in credit analysis, economic research and financial risk management. By offering leading-edge software and advisory services, as well as the proprietary credit research produced by Moody's Investors Service, Moody's Analytics integrates and customizes its offerings to address specific business challenges.

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