IBM Insurance Information Warehouse and the European Union Solvency II Insurance Directive

Whitepaper

About this paper

The purpose of this paper is to outline the components of the IBM Insurance Information Warehouse (IIW) and how they assist insurance companies to address the data management and data integration issues relating to the European Union 'Solvency II' Directive.

This paper is divided into the following chapters:

Chapter 1 "**Data integration for strategic enterprise risk management and the IBM Insurance Information Warehouse**" summarizes the benefits of IIW as a central data repository for an insurance company.

Chapter 2 "**IBM Insurance Information Warehouse components**" offers a brief description for each of the IIW components.

Chapter 3 "**IIW support for compliance with the Solvency II Directive**" summarizes how the IIW components address the Solvency II compliance requirements.

Chapter 4 "**IIW components and the Solvency II solution architecture**" describes briefly an overall functional and data architecture for Solvency II solution.

Chapter 5 "**IIW support for Solvency II pillars**" discusses Solvency II Pillar 1 and Pillar 3 requirements and how IIW can address these.

Contents

Who Should Read This Whitepaper

- Solvency II programme and workstream managers / project managers
- Members of the steering committees of Solvency II programmes
- Functional business managers and business analysts involved in Solvency II programmes
- IT architects, data analysts and business analysts assigned to Solvency II programmes

Introduction

From the end of 2012 insurance companies operating in Europe will have to comply with a new EU directive that introduces a new risk-oriented regime for calculating, managing and reporting their solvency position.

The Solvency II regulation updates the approach an insurance undertaking must take in order to determine the capital it should hold against unforeseen events.
It is based on an enterprise risk model where perils are measured on consistent principles and capital requirements are aligned with the underlying risks that the company is assuming, while its assets and liabilities are to be measured on an economic valuation basis.

Solvency II requires coherence between insurance undertakings' strategy, enterprise risk management, financial management and operational implementation.

The supervisory process mandated by the Solvency II directive is aiming to ensure that the risk-based calculation and allocation of solvency capital is a top concern for the management of the business on a day-to-day basis. Companies will have to implement an internal 'Own Risk and Solvency Assessment' process, which requires them to assess their risk profile versus the risk appetite embedded in their business strategy and operations, with the objective being to correctly align the strategy and its implementation with the risks that the company is assuming and the capital needs that follow from those risk exposures.

Solvency II poses an unprecedented enterprise-wide data challenge for the insurance industry, due to the volume of data required, the variety of sources that will need to be integrated and the direct impact of any integrity, quality or timeliness issues on the calculation of solvency capital charges.

The assessment of their risk profile and the calculation of solvency capital charges requires that insurance undertakings have an "accurate, appropriate and complete" set of data at all times in order to properly derive their solvency capital and also to pass the "use test" imposed by regulators in respect of embedding solvency-driven decisions in the management of the business.
It is therefore imperative that the insurance companies must ensure that their IT systems and the data they provide satisfy the regulatory demands at all times.

Data quality and integration is crucial for Solvency II compliance.

Chapter 1: Data integration for strategic enterprise risk management and the IBM Insurance Information Warehouse

The long-term viability and reputation of an insurance undertaking under the upcoming Solvency II regime is highly dependent on satisfying its regulators that the company is able to properly monitor and assess all the risks it assumes and is exposed to.

Insurers will have to prove that the data they use for underwriting and pricing, asset/liability management, capital allocation and strategic decisions is accurate, complete and appropriate. They will also have to prove that they do have in place processes to ensure the integrity of their data and that it is actually use in the day-to-day running of the business.

Data for Solvency II compliance processes and reporting must be accurate, appropriate and complete.

Therefore the many types of data that insurance companies have accumulated in various systems should be aligned according to a common, shared enterprise-wide understanding of key business risk and drivers and made available and visible for decisions at all levels.

This means that data regarding operational insurance transactions, including insureds' details, pricing, reserving, benefit payments, other expenses, non-insurance exposures, investments, economic developments and other areas must be:

- classified according to a shared, rigorous business terminology
- inter-related according to the relevant underlying business relationships
- properly tagged according to its sources, timing and lifecycle properties
- stored in an uniform manner in an enterprise-class repository, from where it can be easily retrieved, re-purposed, aggregated and disseminated

Various data sources required for all Solvency II aspects must be cleanly integrated across lines of business, processes and technical systems.

In other words, all data streams must be conceptually integrated using an enterprise-level model of the business and physically stored in such a fashion that it is easy and transparent for use.

The IBM Insurance Information Warehouse (IIW) provides a design for such an enterprise data integration environment.

The role that IIW plays as the central data component of an overall Solvency II solution architecture is presented below.

Solvency II Solution Architecture
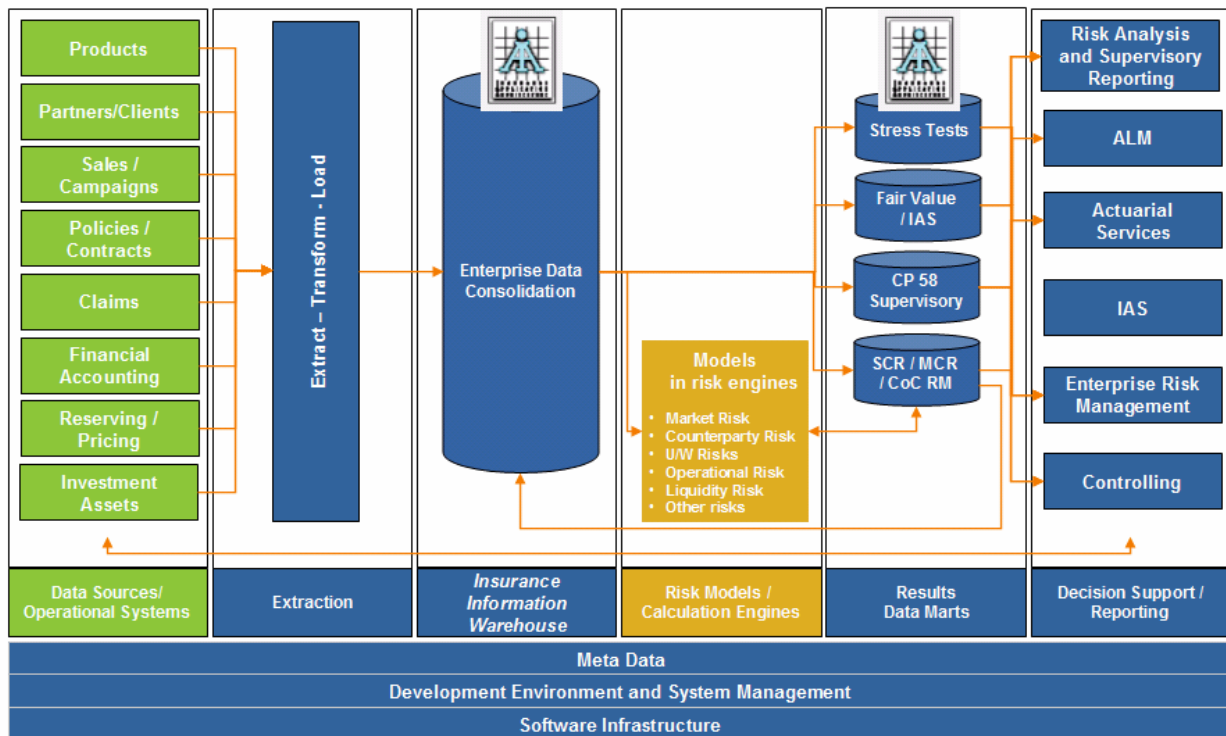
The benefits of using IIW as *the* insurer's data integration hub with a single consolidated view of data include:

- Jump-start in implementing a deep enterprise data repository and one or more Solvency II external and internal reporting datamarts, which are interconnected by way of business definitions and data flow mappings

- Lineage is defined between Solvency II summary results and the elementary data items that contribute to their calculations (for the SCR/MCR standard model; may be customized for internal models)

- Single data source for both external compliance reporting, internal risk management and strategic capital allocation

- Ability to analyze and summarise data in a similar manner across lines of business, using uniform data classifications and relationships that are compliant with Solvency II LoB definitions

- Ability to analyze risk exposure correlations across lines of business and counterparties

- Increased consistency in data usage

- Increased flexibility to address, and faster response to, new requirements

- IT cost savings due to a reuse of population, storage and reporting components

The IBM Insurance Information Warehouse is an enterprise-wide data architecture for a consolidated view of business data

Chapter 2: IBM Insurance Information Warehouse components

The IBM Insurance Information Warehouse is a set of models aimed at enabling insurance organizations to build and deliver a business-oriented, enterprise-class data warehouse.
Its constituent models also aligned with the IBM Insurance Application Architecture process and service models.

The components of IIW are:
- A comprehensive glossary of **Business Terms**
- A large set of analytical **Business Solution Templates**
- A conceptual **Business Data Model**
- An **Enterprise Warehouse** data model
- A set of sample **data mart** models
- A set of **project views** scoping the IIW content across models according to the needs of specific business areas

The Business Terms glossary

This is a comprehensive list of insurance, financial services and general business terms, complete with
- definitions written in plain business language
- detailed data elements that together specify what each particular business term means for the insurance undertaking from the data perspective

Terms may be related to one another through relationships such as 'more generic / more specific' or as synonyms / aliases.

The IIW glossary of business terms is included in the IIW Requirements Model. It allows non-technical business experts to describe and define in their own words the concepts they use every day.
At the same time, the capturing of these terms at a detailed level in respect of data items allows analysts to make a solid start towards defining complete and unambiguous data requirements for an enterprise data warehouse.

The Business Solution Templates

The IBM Insurance Information Warehouse contains over 200 Business Solution Templates (BSTs), reflecting the most common sets of queries and analysis for business performance measurement and reporting. The IIW also supports other analytical functions such as ad hoc reporting, data mining and decision support.

The BSTs have three main components:

- 2000+ reusable business measures
- 30+ reusable dimensions of analysis
- 200+ assemblies of measures and dimensions into reporting templates that can be easily customized for local requirements

The BST measures represent the key performance indicators (KPIs) for an insurance company. Each measure is fully defined and can be used either in its own right, or as a component contributing to another key performance indicator, which itself may contribute to other business performance measures. This reuse ensures conformity of business measure use across the organization and is a key aid in the business metadata activities of a business intelligence environment within an organization.
Measures are used to drive value based behavior in an insurance company (e.g., operating income and operating expenses by function).

During the analysis of each insurer's reporting requirements, the BSTs can be used to accelerate discussions with business users to rapidly provide prototypes of specific sample reports

The BST dimensions provide the headings under which measures can be broken down and compared and under which the organizations behavior is monitored and tracked. Some 30 industry standard dimensions are supplied, with all members fully defined.
Dimensions are reused in several reporting and analysis templates, thereby enforcing conformity of dimensions used in different analysis areas. This enables uniformity of reporting and the ability to cross reference measures from different areas of analysis (e.g., comparing profitability to risk measures across the same geographical and temporal breakdowns).

The BSTs provide the grouping of a specific set of measures and dimensions taken from the existing pools, which together capture and describe an analytical need in a given business area.
The supplied set of templates can be fully customized and/or new templates created in order to exactly reflect the needs of a particular insurer. New measures and dimensions can also be added to their respective pools and incorporated into templates.

A set of reusable, industry best practice key performance indicators grouped by types of analysis specifically designed for insurers

Specifically the regulatory compliance BSTs cover reporting requirements for : IFRS / IAS standards (e.g. IFRS 4, IAS 18, IAS 32, IAS 37, IAS 39, and IAS 40), SOX (such as compliance sections 302, 404, 409, 802, 906 and 1001) and Solvency II.

The IIW BSTs that support Solvency II reporting and analysis requirements are described in the next chapter.

The Business Data Model

This is a conceptual data model meant to represent, at a high level and from a technical perspective, the totality of the data requirements that an insurance organisation has.

The Business Data Model is a

- Conceptual - "what", not "how" ;
- Normalised (to 3NF) ;
- Flexible ;
- Corporate-level, standard across all functions and departments ;
- Cleansed, reconciled, non-redundant

business view of the atomic, elementary data concepts and elements needed by the enterprise in its operational functions.

The view that the Business Data Model embodies is classified as a *business* view because it does not include technical implementation considerations, such as details related to any specific database.

It is also not concerned with optimizations for reporting and analysis, such as aggregations, derivations or denormalisation.

The Business Data Model utilizes a very regular, hence easy to understand, set of patterns in order to represent the standardized conceptual data entities of the organization.

The entities are placed in a hierarchy based on 'generic / specific' classifications and are related through top-level relationships that link the major groupings in the hierarchy at the top level. The more specific relationships between data concepts are placed themselves in a complementary hierarchy, as specialized kinds of the generic relationships.

An important quality of the IIW Business Data Model is that it is inter-linked with the Insurance Application Architecture's Business Object Model, by representing *exactly the same* data concepts using the E/R formalism while the BOM represents them using the UML formalism.

The Enterprise Warehouse Model

The IIW Enterprise Data Warehouse model is a customizable data model that provides the historical and atomic data needed for a data warehouse and business intelligence infrastructure supporting multiple lines of business and analytical functions within medium to large insurers.

The aim of this shared infrastructure is to provide a reusable platform and data structure environment that will reduce the development and operational costs in providing business intelligence functionality to the myriad of front and back office organization units. This is made possible by creating a data integration environment and leveraging this information for business intelligence, risk management and regulatory reporting. In this way organizations can then focus on realistically managing the implementation of consistency of definition, transformation, and distribution of the data used for business intelligence across the lines of business.

Technically, the IIW Enterprise Model is a <u>design</u> model, complete with technical elements that support full historic versioning and reconciliation of the atomic transactional data that is being loaded into the enterprise warehouse from various source systems. It also includes summarised information, in the form of denormalised fact entities arranged in dimensional 'star schema' pattern.
The atomic elements of the IIW Enterprise Warehouse Model are mapped to the conceptual model elements included in the Business Data Model, while the analytical, summarised elements are mapped to BSTs and their measures and dimensions.

The Enterprise Warehouse model does include a default physical database design, generated from the logical entity/relationship data model. It is very likely, though, that this default model would need to be customized further by a data warehouse design team of experts comprised of senior warehouse architects and database administrators, so as to ensure optimal configuration for the financial institution's data distribution and performance characteristics.

The IIW Enterprise Data Warehouse model does contain data structures needed by an insurance company to support the IFRS / IAS, SOX and Solvency II reporting requirements.

An IIW Project View provide a filtered view across the data warehouse structures for specific regulatory compliance reporting requirements.

The Project Views

The IIW Project Views are a series of business subject area views which span across all IIW models and components. They give users a very clear understanding of the data coverage required for a specific business requirement – such as Solvency II SCR – and assist in focusing on only those items in the IIW models that contribute to solving the immediate business issue. They make use of the traceability cross-model mappings that connect model elements across all IIW components.

Each project view is anchored on a particular reporting solution template, and only selects from that solution template the subset of measures and dimensions specifically needed to address the particular reporting requirement. The scope of each IIW project view can then be extended to include the relevant pre-defined mappings that exist between the BSTs and the IIW Enterprise Data Warehouse Model.

IIW does include project views specific to Solvency II with each of its components, from Business Terms through BSTs and the Business Data Model down to the Enterprise Warehouse model. The corresponding elements in each project view are linked through cross-model mappings.

Chapter 3: IIW components and the Solvency II solution architecture

The Solvency II solution architecture that IBM proposes for the data layer is presented in the figure below.

The components of this architecture that the IIW models primarily provide - marked in the figure with the IIW logo - are:

- the Enterprise Data Warehouse, used for consolidating and standardizing data from across business lines, systems and functions
- the reporting and analysis data marts, used for internal management analysis and reporting and for external, supervisory and public disclosure and reporting
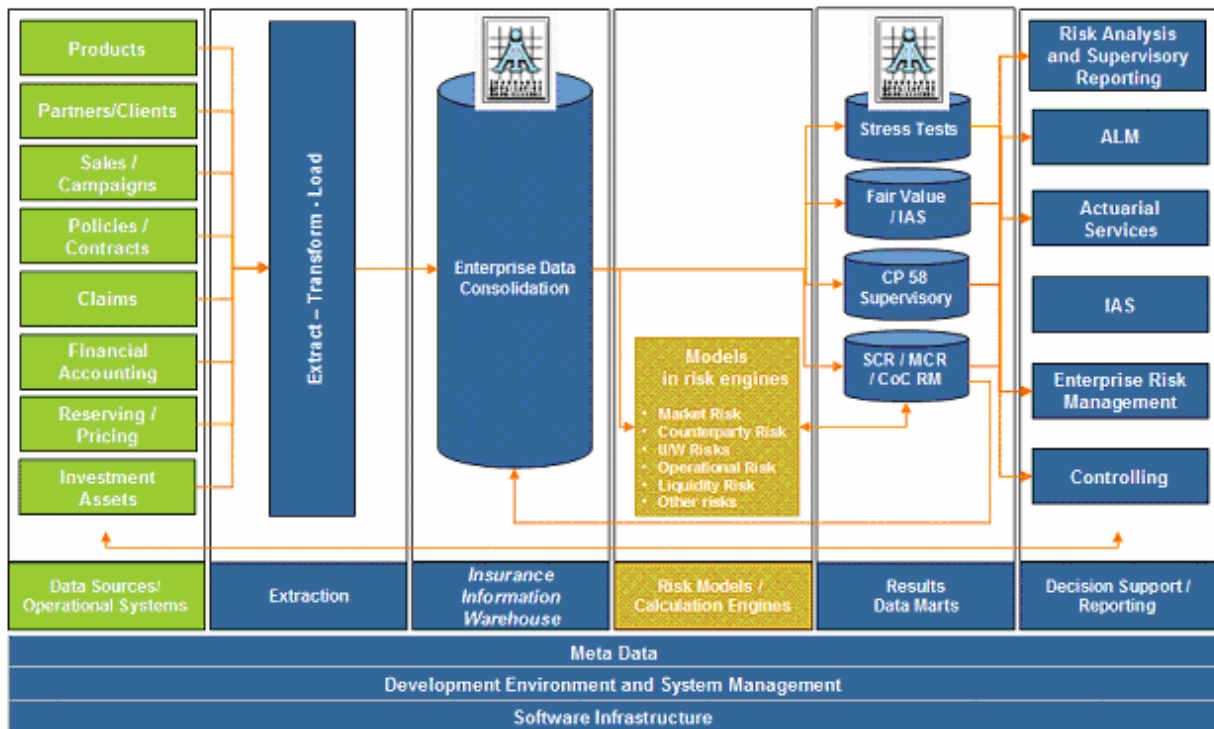
Specifically, the "Enterprise Data Consolidation" layer of the Solvency II architecture is provided by:

- the IIW Enterprise Data Warehouse model, through its *atomic* data design layer
- the IIW Business Data Model, which contains conceptual definitions of detail, transactional data requirements for Solvency II calculations and reporting
- the IIW Business Terms, which offer the user-friendly definitions of the business concepts and their data elements involved with Solvency II requirements

The "Results Data Marts" layer of the Solvency II architecture is provided by:

- the IIW Enterprise Data Warehouse model, through its *analytical* data layer
- the IIW Business Solution Templates, which contain the definitions of Solvency II intermediary and final measures required for Pillar 1 calculations and Pillar 3 reporting
- the IIW Business Data Model, which contains conceptual definitions of dimensional axes of analysis required for reporting
- the IIW Business Terms, which offer the user-friendly definitions of the business concepts used as headings and axes of analysis for Solvency II reporting (e.g. the concept of 'Line of Business')

Supplementary, the IIW structures in the Enterprise Data Warehouse model may be used to define the data interfaces between the "Enterprise Data Consolidation" layer of the architecture and the "Risk Models / Engines" component that provides all the financial, actuarial and risk calculations behind the Solvency II reporting measures.

Finally, it is important to mention that the "Enterprise Data Consolidation" layer of the Solvency II solution architecture is able to provide standardised, reusable data, both at detail and at summary level, for management analysis and compliance reporting for financial purposes, such as compliance with IFRS standards that overlap with Solvency II requirements.

Chapter 4: IIW support for Solvency II pillars

Based on many years of IBM's and its customers' experience in building enterprise-class data warehouse repositories, IIW is now offering specific support for the data requirements arising out of the Solvency II regulatory demands.

At the time of this writing, IIW release 8.3 includes business-level requirements specifications and technical designs for:

IIW 8.3 currently supports existing Solvency II draft specifications for :
- *Pillar 1 quantitative requirements (QIS4):*
  - *SCR*
  - *MCR*
  - *Risk Margin*
  - *Balance sheet*
- *Pillar 3 supervisory reporting (CP58):*
  - *SCR*
  - *MCR*

- A Solvency II external reporting datamart, based on CEIOPS Consultation Paper no. 58 and on the Quantitative Impact Studies technical documents describing calculations and aggregations for:
  - Solvency Capital Requirement
  - Minimum Capital Requirement
  - Cost-of-Capital Risk Margin
  - Balance Sheet
  - Own Funds

- A scoped Solvency II repository of transactional, elementary data elements supporting the external reporting and capital measure calculations mentioned above

- An underlying enterprise-class data warehouse that supports integration and sharing of data required for Solvency II with all other streams of business intelligence and management information that an insurance undertaking needs, such as financial accounting, underwriting performance, product profitability analysis, claims management and analysis etc.

Other data areas of interest for Solvency II compliance are being actively considered for further IIW development.

IIW support for Solvency II Pillar 1 quantitative calculations

IIW release 8.3 (April 2010) covers a number of key subject areas within the requirements of the Solvency II Pillar 1 for quantitative calculations.

This coverage is provided through:
- Business Solution Templates (grouped by Focus Area)
- Analytical fact entities and related dimensions in the IIW Enterprise Data Warehouse model

The Pillar 1 subject areas covered are as follows:

➢ **Solvency II Solvency Capital Requirement - Standard Formula (SCR)**, for 'solo' entities – through the following BSTs and corresponding fact tables:
- Standard Formula
- Operational Risk
- Market Risk
- Market Risk Concentration analysis by counterparty
- Market Risk Spread analysis by exposure
- Counterparty Default Risk
- Counterparty Default Risk analysis by counterparty
- Counterparty Default Risk analysis by reinsurance contract
- Counterparty Default Risk analysis by derivative contract
- Counterparty Default Risk analysis by intermediary
- Counterparty Default Risk analysis by other credit exposure
- Life Underwriting Risk
- Life Underwriting Lapse sub-risk analysis by insurance policy
- Non-Life Underwriting Risk
- Non-Life Underwriting Risk analysis by LOB
- Non-Life Underwriting Risk analysis by LOB and historic year
- Non-Life Underwriting Risk analysis by LOB and geographical area
- Non-Life Underwriting Risk analysis by LOB geographical area and historic year
- Non-Life Underwriting CAT Sub-Risk analysis by catastrophic risk
- Health Underwriting Risk

➢ **Solvency II Minimum Capital Requirement - Standard Formula (MCR)**, for 'solo' entities – through the following BSTs and corresponding fact tables:
- Overall MCR calculation
- Life MCRlife
- Supplementary Non-Life underwritten in addition to Life – MCRxlife
- Non-Life MCRnl
- Non-Life business similar to Life business – MCRxnl

➢ **Solvency II Cost of Capital Risk Margin** – through the following BSTs and corresponding fact tables:
- Summary CoC Risk Margin calculations
- Life SCR CoC at t0 by LOB
- Non-Life SCR CoC at t0 by LOB
- Present value of capital charges for projected Life SCR CoC by LOB and run-off year

- Present value of capital charges for projected Non-Life SCR CoC by LOB and run-off year

➢ **Solvency II Balance Sheet Solo Entity** – through the following BSTs and corresponding fact tables:
- Balance Sheet Solo
- Assets and Liabilities Valuation Analysis
- Participation Investment Assets
- Own Funds
- Undated subordinated liabilities and hybrid capital
- Dated subordinated liabilities and hybrid capital

All of the above have been derived from the technical specifications of the CEIOPS Quantitative Impact Study number 4 (**QIS4**), as of June 2009.

IIW support for Solvency II Pillar 3 supervisory disclosure and reporting

IIW release 8.3 (April 2010) provides coverage for some areas in the requirements of the Solvency II Pillar 3 for supervisory disclosure and reporting as specified in the CEIOPS **Consultation Paper no. 58 'Supervisory Reporting and Disclosure'**, as of July 2009.

The Pillar 3 CP58 subject areas covered are as follows:

➢ **CP58 basic and supplementary SCR details** – through the following BSTs and corresponding fact tables:
- B2A - Basic SCR charges for firms on standard formula or partial internal models
- B3A - Basic SCR charges for market risks
- B3B - Basic SCR charges for counterparty default risks
- B3C - Basic SCR charges for life underwriting risks
- B3D - Basic SCR charges for health underwriting risks
- B3E - Basic SCR charges for non life underwriting risks

➢ **CP58 basic MCR details** – through the following BSTs and corresponding fact tables:
- B4A and B4Q - Final MCR calculation
- B4A and B4Q - Life MCR calculation
- B4A and B4Q - Life MCRx calculation
- B4A and B4Q - Non Life MCR calculation
- B4A and B4Q - Non Life MCRx calculation

IIW support for detail data required for Solvency II Pillar 1 and Pillar 3 aggregate calculations and reporting

For a seamless and auditable solution, the Solvency II Pillar 1 and Pillar 3 intermediary and final aggregate calculation results and reporting items must be supported by clean, standardised and reconciled detailed, transactional data.

IIW provides support for this requirement through the design constructs of its Enterprise Data Warehouse model.

Full support for historical versioning of any atomic data item is provided 'out of the box' in the IIW Enterprise Model design, hence auditing is facilitated to a high degree of precision.

IIW models provide support for the detail data required in Solvency II calculations and reporting and allow mappings between calculation results and the underlying atomic data.

The transactional atomic data is represented through a solid set of optimized data entities, which together cover, in a generic fashion, the key components of atomic data sets required for Solvency II compliance. The Business Data Model provides the underlying conceptual description of these data items.

For example, IIW supports monetary accounts and account entries for anything that insurance companies need to extract from their financial systems and reuse in Solvency II calculations.

For calculated data items that are future estimations obtained through risk or financial models IIW provides the concept of 'Financial valuation', which can – and should be – further customized to faithfully represent how each insurance company structures its models and their outputs and inputs.

Finally, any other amounts that may not be posted to the organisation's accounts but are nevertheless required in solvency calculations may be represented in the IIW Enteprise Data Warehouse model through the 'Money provision' entity and its specialized subtypes.

These data elements in the IIW Enteprise Warehouse Model are linked to the Solvency II measures whose calculations they are contributors to via mappings included in the IIW models. It is expected that each insurance organisation implementing a Solvency II solution with IIW would review and customise these mappings to represent correctly the internal data flow that the organisation wished to implement.

These customised mappings and specialisations of the more generic IIW constructs would then provide the basis for detailed specifications of the technical development for data extraction, population, integration, calculations and aggregations that must be included in a Solvency II solution.