

## Paper 142-27

## The Benefits of Data Warehousing for an Insurance Company

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### ABSTRACT

German property and casualty (P&C) insurance companies have faced dramatic new challenges: intensified competition (such as price reduction and high-risk underwriting) has caused losses, especially in car insurance. Volatile stock markets have intensified the problems. To react to the situation, Mannheimer had to find an improved basis for decision-making. We had to make key facts and figures available, anytime and anyplace. However, like most financial services companies, Mannheimer has a variety of transactional systems with large stores of data that cannot readily be analyzed without great effort.

Our approach was to establish a group wide database which integrated all data of our business lines. The biggest challenge was consolidating the data; therefore, it was vital to have a powerful data management solution with SAS/Warehouse Administrator®.

The objectives of this paper are: to give you an insight into the implementation of our SAS Data Warehouse and the challenges we met concerning the integrity of data sources, project schedule and technical environment; to highlight the results so far; to describe how the warehouse can support our strategic management; and to describe our next steps.

This presentation is aimed at an audience of managers and decision-makers and requires neither previous SAS experience nor in-depth insurance knowledge.

### INTRODUCTION

Mannheimer's business strategy is based on flexibility, innovation and short time to market. It is focused on the German market with an emphasis on growing its life and health insurance business. Mannheimer markets tailor-made, modular premium products through independent agents and brokers to selected market segments. The underwriting is selective and strictly profit-oriented. As a result we usually show combined ratios (losses plus expenses in relationship to premiums) substantially below 100%. Mannheimer is also maximizing its use of Internet technologies to support sales, to optimize its business processes, and to acquire online business. In 2001 Mannheimer wrote \$ 0.9 billion in gross premiums and had \$ 4.0 billion assets under management.

Like most financial services companies, Mannheimer has a variety of historically grown online transaction processing (OLTP) systems with large stores of data that could not readily be analyzed without a lot of effort. Different areas use differing systems. As a consequence, 22 different contract administration systems are in use. Additionally, we have OLTP-systems for collecting, commissions, claims and proceeds of policy administration, reinsurance, and accounting. Furthermore, we have systems for rating and actuarial reporting. These systems are only connected by interfaces. In addition, there is no comprehensive and homogeneous data model. Every system has its own fields and entities. This leads to a tremendously complex situation concerning information delivery.

Previous analysis was merely generated in the form of paper lists by regular batch processes. Every customization of these batch processes required a new IT-project taking time and effort. Every department created its own database by downloading files from the host or direct access via ODBC.

This individual data processing only met the specific information needs, but could not be used for more comprehensive interpretation - a far from ideal situation, as we were launching a series of new brand products combining various lines of insurance (e.g. P&C with life, life with asset management, and P&C with health and life) in the midst of a changing competitive environment.

We had a lot of data but we could not get to the information needed to meet the new requirements for planning and controlling. So we urgently needed to find an improved basis for decision making in order to sustain our competitive advantage.

### VISION

Our vision is to establish the group wide database derived from our various data sources and to integrate all data from our business lines. Group wide and specific applications for business segments and business cases are set up on the database. At top level we will focus on the key figures. An important factor is the continuous integrity of data (see figure 1). Consequently, we had

- ◆ to create a uniform group wide data model for information delivery,
- ◆ to select and organize data relevant for decision-making, and
- ◆ to make business and financial key figures available anytime and anyplace.

According to a survey made by the German institute 'Psychodynamics' [1], our approach is fairly unique. As to the enormous problems that have to be solved, no other German insurance company has achieved this degree of integration and only a few have even started.

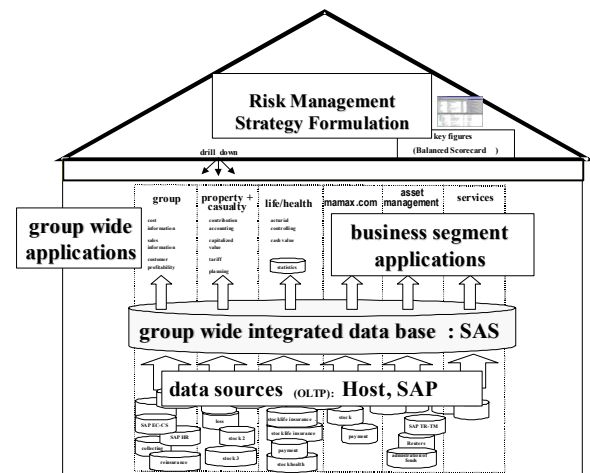


Figure 1: Conceptual framework of information delivery

### BUSINESS CASES AND INFORMATION REQUESTS

We defined specific business cases according to our strategic targets. We analyzed all information requests according to our strategic objectives.

**Process-redesign of information delivery**

We needed to reorganize the existing process of information delivery and isolated individual data processing. We had to establish one single, unified and integrated data warehouse.

**Improved management decision systems**

The host-based application of our contributing accounting system was to be replaced by a modern one fulfilling our new requirements. The sales information system should be released in the next step.

**Customer focus**

In terms of customer relationship management (CRM), we will establish applications to predict the propensity of customers to buy other Mannheimer products and the probability that they will cancel, enabling the formulation of effective cross-selling and retention strategies. We will also implement applications to identify individuals' revenue potential and lifetime value, enabling us to focus resources on the acquisition of more profitable customers.

In addition to the traditional insurance business, we set up click-stream analysis of web log files to deliver improved service to customers of mamax.com. Mamax is our internet-based life insurance company with main focus on permanent disability insurance, unit-linked policy assurance and pension insurance according to the law drafted by German federal employment minister Riestler.

**Underwriting and actuarial controlling**

We will define applications to reduce our underwriting expenditures by utilizing statistical predictions for claims and fraud probability.

**Rating and Risk Management**

We have to be able to identify risks due to the calculation of tariffs and concerning the adequacy of our reserves for outstanding claims. Therefore, we plan to build up applications to review our tariff structure in order to improve it. We also plan solutions like a Balanced Scorecard and an early warning system.

Additionally, we must be able to assess the local and temporal accumulation of our insured risks in order to be conscious of the value concentration in case of loss. September 11, 2001 shows that *one* loss event can easily lead to an enormous accumulation of claims. None of the insurance companies and not even one of the reinsurance companies ever expected to be faced simultaneously with claims of buildings insurance in New York, business interruption insurance for airports and third party claims of airlines. Further possible combined effects with policies in the health and life insurance have not been examined so far.

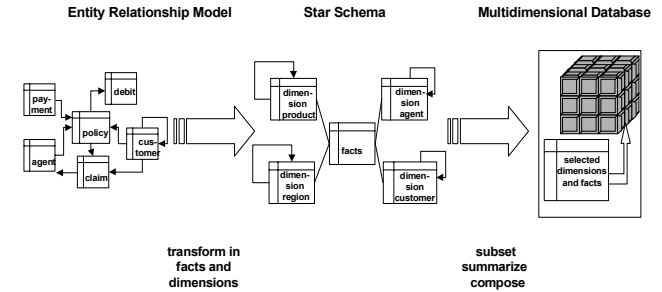
**MODELLING OF DATA**

We used different design methods (see figure 2) according to specific purposes (e.g. extraction, preparation and presentation of data).

We started working conceptually, defining the business contents. In this early stage we did not consider any technical restrictions (e.g. platform). We defined our logical data model for all our heterogeneous systems. To identify the necessary key- and value-fields we examined the existing and required reports and consulted our controllers and specialists as to their information needs.

We structured our complex data in a simple logical data model. To do so we selected and standardized the required fields. Furthermore, we had to examine the relevant objects and the existing relations while not considering the time aspect. These relations were reproduced in the entity-relationship-model (ERM). In figure 3 the entities are pictured as boxes and the relations

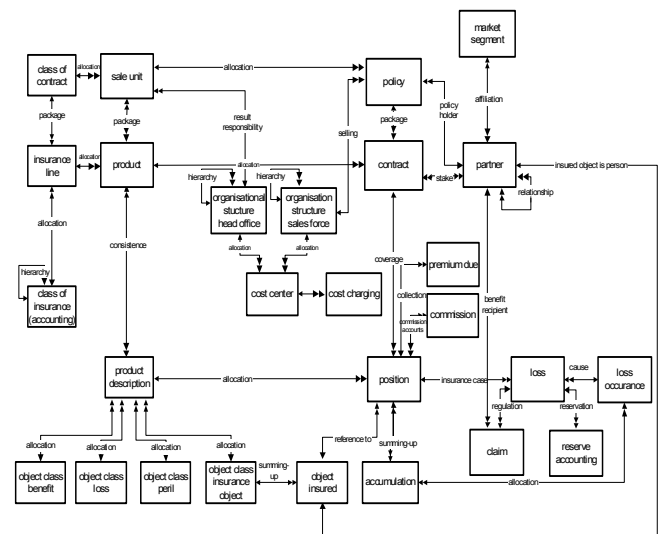
with their cardinality (1:1; 1:n; n:m) as arrows.



**Figure 2: Design methods**

The logical data model of figure 3 illustrates the most important entities and types of relations of our insurance business [2]. The main views relate to product, contract, customer and organizational structure.

We evaluated different software solutions and choose the SAS software. Therefore, as our next step we developed a decision-oriented database on the underlying facts of the ERM. We used the star-scheme to structure the decision-oriented data.



**Figure 3: Entity Relationship Model**

The Star Schema [3] divides the data items in facts (values) and dimensions (grouping and classification keys with the corresponding hierarchies). The facts and all keys on the lowest level of each dimension are combined in one table. Other tables consist of these keys and the additional data items of each dimension. Based on well-defined keys this kind of data modeling allows to combine facts and dimensions by joining these tables in a convenient and flexible way.

We subdivided the dimension- and fact tables in a multistage model. The technical term is 'snowflake schema' (see figure 4). This was necessary to fully meet our requirements with regard to our huge data volume and our technical performance expectations.

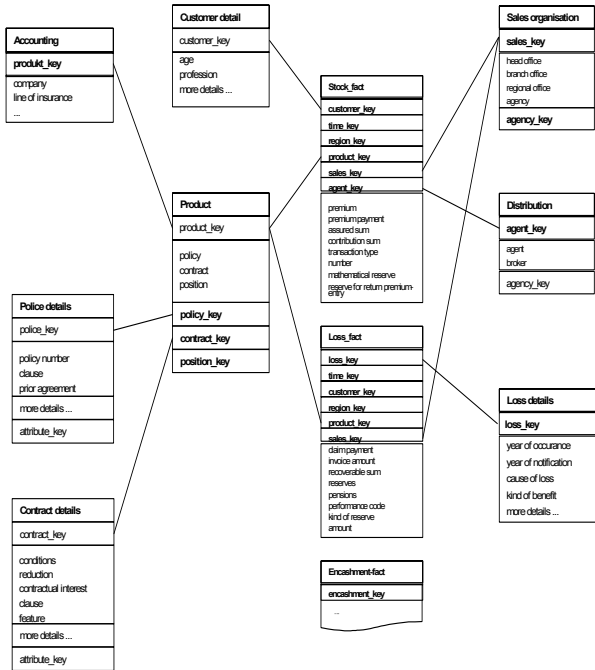


Figure 4: Simplified description of our Snowflake Schema

### IMPLEMENTING THE DATA WAREHOUSE

In 1999 we drafted the framework for the *entire* warehouse after 2 years of conceptual work [4]. We regularly explained and discussed the solution with users and management. Since 2000 we have been supported by SAS Professional Services.

### STRUCTURING THE DATA WAREHOUSE

Our data warehouse is clearly structured into 3 different levels (see figure 5):

- ◆ Operational Data Definition (ODD)
- ◆ Central Warehouse
- ◆ Data Marts

All data is stored as SAS data sets.

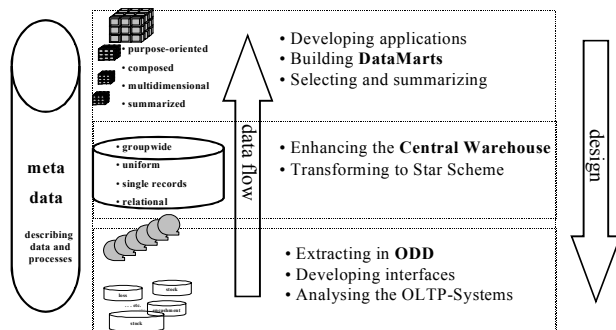


Figure 5: Levels of the Data Warehouse

In general, the files on the ODD-level are structured exactly like the files in the data sources. This was a quick and simple method

of implementation. It also ensures easy maintenance.

In the Central Warehouse, the required fields are adjusted and unified. This concerns formal rules (e.g. nomenclature, formats) as well as contents like unification of different business lines, and the handling of missing values or relations. To make sure that new information needs can be solved, there are still single records in the Central Warehouse, even in the data history from the last 10 years.

At the third level of the warehouse, Data Marts are generated, summarizing and combining the data as well as creating additional key figures. Data Marts are built as multidimensional databases (MDDB) for online analytical processing applications (OLAP) or as summary tables or views for analysis in our departments.

Data Marts represent a partition of the data and simplify the analysis while optimizing the performance. In some cases we used multidimensional databases and relational data-tables in combination to provide a performant reach-through on the single records.

Temporary tables required during the transformation processes are located in a separate transformation level. However, only the level of the Central Warehouse and the Data Marts are accessible for users. All data definitions (views, tables, fields, formats, labels, etc.), mappings and other transformation processes (user-exits) are separately stored as metadata with SAS/Warehouse Administrator (figure 6).

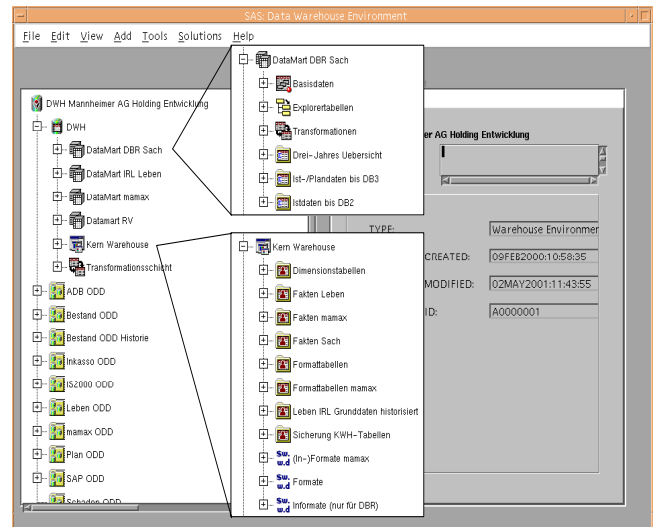


Figure 6: Partition of the data structure built with SAS/Warehouse Administrator

Mannheimer has over one million contracts, most of which undergo several changes during their lifetimes. Obviously, the combination with different dimensions leads to a huge amount of data. Table 1 shows the dimension of the Data Warehouse.

### EXTERNAL LOADING PROCESS

The interfaces to the various OLTP-systems had to be programmed and the transformation rules had to be designed. As a first step we had to load the historical data of the last 10 years. Necessary data from the OLTP systems are copied into flat files. To bring our warehouse up-to-date, flat files from each data-source are loaded monthly. Depending on the volume of the data-sources, some flat files contain only the alterations of the last month. For the eCRM-application of mamax.com data is even delivered daily.

The flat files are transformed into SAS files on a UNIX server as

ODDs. Outgoing from the ODDs data is transformed on a single record basis into our Central Data Warehouse store.

**Table1: Dimension of the Data Warehouse**

**ODD**

Source	Tables	Columns	Records	GB
Contracts	134	11,949	Replace: 58,168,784 Append: 46,074,795	36.2 1.1
Collections	1	230	Append: 1,496,104	7.5
Claims	27	441	Replace: 11,498,027	3.0
Customers	4	129	Replace: 17,326,581	3.7
Others	12	134	Replace: 189,448 Append: 9,650	0.1
mamax.com	25	249	Append: 181,620	0.1

**Central Warehouse**

Type	Tables	Columns	Records	GB
Facts	72	2,830	226,600,000	86.1
Dimensions	45	195	13,197,900	1.3

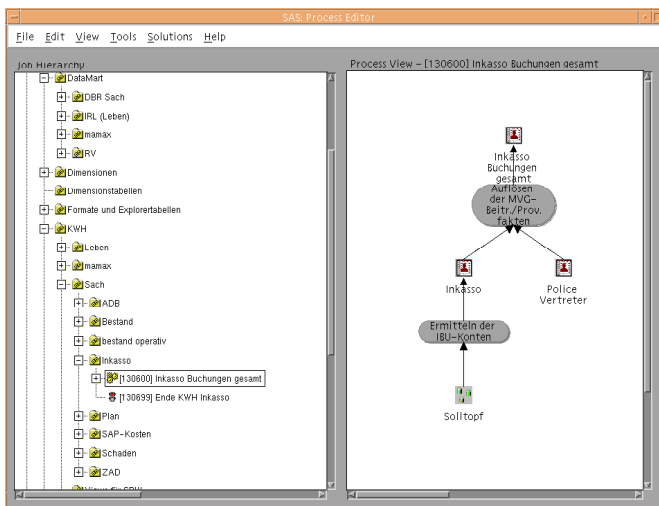
**Data Marts**

Type	Tables	Columns	Records	GB
p/c	78	4,390	241,872,503	85.9
Life	37	2,096	70,181,656	30.4
mamax.com			mddb: 8; var.: 168	0.1

**MANAGING COMPLEXITY WITH THE SAS/WAREHOUSE ADMINISTRATOR**

Overall, we have to deal with low data quality in nearly all OLTP systems, i.e. data that is incomplete, inconsistent, and/or difficult to access. The biggest challenge was to consolidate the data. So it was vital to have a powerful data management solution with SAS/Warehouse Administrator.

The SAS/Warehouse Administrator is the control panel for administrating all definitions and processes for extraction, transformation and delivery of data. The SAS/Warehouse Administrator automatically generates the programming code, although individual customizing is also possible. Administration tasks can be dispatched by point-and-click without typing code. Thus, we have achieved great organizational advantages in development and maintenance of the warehouse. Figure 7 shows such an implementation process for our collection data where the data items are mapped and enriched.



**Figure 7: Exemplary process in SAS/Warehouse Administrator**

After configuring our UNIX server (AIX 64 bit) and organizing the file system we set up the environment in the SAS/Warehouse Administrator by defining the structure of the different data-elements. The loading-process for nearly all of our data sources were implemented; the rules for the transformation into the central warehouse designed according to our unified data model.

We had to straighten out several inconsistencies with our data. We had to adjust historical contracts and to develop workarounds in case of missing or overlapping time periods.

The accounting information system as our first application started on time; but further on, we have been confronted with many problems with the complexity of the various different contract-administration systems of property and casualty insurance. The fields in the different systems sometimes have the same meaning but different names or have the same names with differing contents or formats. Therefore, we did not transform the contract systems all at once. In order to reduce complexity, we decided to start with a single contract-administration system. In 2002, we will set up a pilot-project for both contract analysis and tariff review by creating a special Data Mart 'rating' for the insurance line private property.

**RESULTS SO FAR**

We wanted to get the first application working as quickly as possible. We continued to broaden the warehouse-scope according to the defined framework. Thus, in general, we will avoid redesign and we can easily include additional data.

**ACCESS TO DATA**

Currently, the ODD-level is almost completed. The stock-portfolio data for life and property and casualty insurance, all accounting entries (e.g. premiums, benefits, commissions, expenses) and the data concerning our sales organization and customers are regularly infilled.

The data from life insurance is completely transformed from the ODD-level to the Central Warehouse. As mentioned above, so far there is a lack of the stock-portfolio data for the non-life insurance in the Central Warehouse.

In addition, 3 Data Marts were installed. One of them consists of all information for internal accounting and actuarial controlling for the life insurance. The second contains all data for the contributing accounting system, and the third is for eCRM of mamax.com.

In principle, analysis is possible on all 3 levels of the data warehouse. However, the data in the ODD-level is not adjusted and standardized. Therefore, detailed knowledge of the data-structure is necessary. Access to this level is only possible with SAS base® programming language.

Our Data Warehouse is geared to different user groups with varying information needs and levels of technical knowledge. We distinguish between 3 groups:

- ◆ 'Standard-users' use our web-based application
- ◆ 'Specialists' work directly on the Data Mart tables with Enterprise Guide® or Enterprise Reporter®
- ◆ 'Power-users' apply SAS base® (SQL, data steps, SAS procedures etc.) on all warehouse levels.

**HISTORY AND UPDATE OF DATA**

Single records are available in the Central Warehouse in the data history from the last 10 years. In the Data Mart for our contribution accounting we have a data history from the last 3 years on a single record basis and for all our key figures. In the Data Mart related to eCRM we will hold up a data history of 1 year, in the accounting Data Mart for life insurance of 3 years.

To bring our warehouse up-to-date, flat files from each data-source are loaded monthly. The Data Marts are refreshed monthly but we will come to a weekly cycle. For the eCRM-application we have installed a daily external loading process.

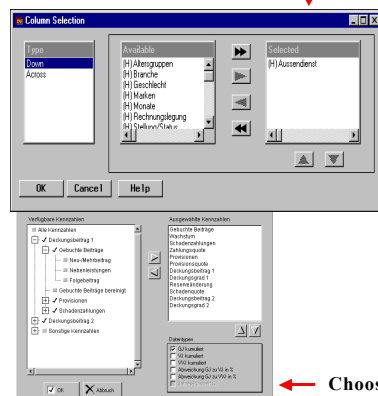
**WEB-APPLICATION**

The application of our contributing accounting system is serving the information needs of managers and specialists (see figure 8). The outstanding advantages of the new application are better knowledge of customers, claims and contracts leading to better results by:

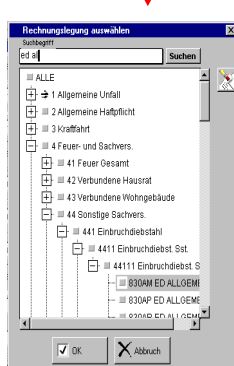
- ◆ addition of our brand products
- ◆ focus on customer-groups
- ◆ drill down to *single* claims and premium payments to contracts
- ◆ easy to handle application
  - self-explaining web-application using point-and-click functionality,
  - flexible way of defining individual reports,
  - various dimensions and search-functionality,
  - navigation in and between dimensions (e.g. explorer tables),
  - printing and exporting functions.

In the fact tables all information can be analyzed relating to the dimensions distribution (structure, channels, i.e. agencies and brokers), products (lines, accounting lines, liability sectors) and customer (e.g. occupation groups, age classes, status, sex).

**Change dimensions (customer, product, sales organisation)**



**Hierarchy in the product line**



Choose key figures

**Figure 8: Contributing Accounting Application**

We used the new web-features of SAS V.8 to construct our web-application (intranet-based thin-client). We generated java server pages with AppDevStudio® communicating with the SAS software and our data on the UNIX server. The application accesses to MDDBs and data-tables of the Data Mart on the third level of our Data Warehouse.

The thin-client solution simplifies the distribution of the application to approximately 150 standard-users in the head-office and the local sales offices. The standard-users only need a web-browser (e.g. Netscape). It is not necessary to install SAS software.

**INDIVIDUAL ANALYSIS**

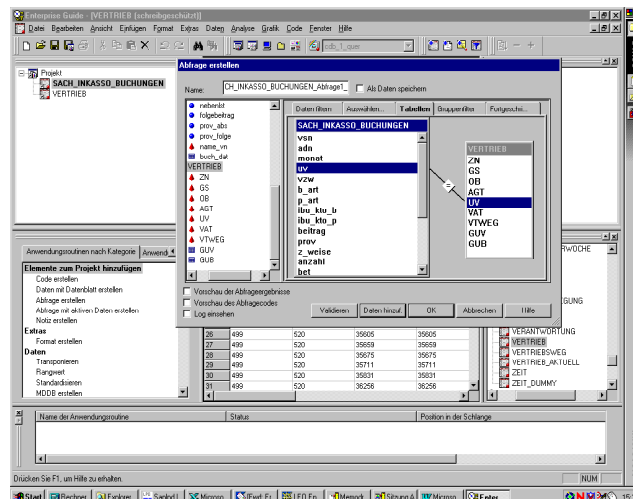
Mannheimer 'specialists' and 'power users' use SAS/Enterprise Guide, SAS/Enterprise Reporter or SAS base procedures to create individual queries, reports and statistical evaluations.

Specific individual analysis for the life insurance is necessary for the year-end closing. Access to the Data Mart allows us a quick analysis of the following data partly as condensed data or on the level of single records:

- ◆ Segmentation of premiums
- ◆ Evaluation of the mathematical reserve (net liability)

- ◆ Allocation of surplus to policy holders
- ◆ Stock-portfolio transactions and structure
- ◆ Data of loans

Figure 9 illustrates an exemplary query with SAS/Enterprise Guide. Tables from different libraries are selected, joined, grouped and filtered. This query joins the fact table ('SACH\_INKASSO\_BUCHUNGEN'=accounting recognitions for collecting) on the left with a dimension table ('Vertrieb'=distribution) on the right (connection between the fields 'uv' and 'UV'). By joining the fact tables and the dimension tables you can analyze the key financials at every hierarchy-level without redundant keys and data in the fact table. In case of structural changes in the sales organization we only have to adjust one dimension table.



**Figure 9: Query with joined tables in SAS/Enterprise Guide**

In summary, with SAS we have manageable interfaces to host-systems, scalability, and web functionality. SAS software offers powerful analyzing capabilities and universal support of the warehousing process from loading and transforming up to analyzing and presenting data. Our next task is to enlarge the scope of our warehouse to meet all defined business cases. In 2002, we will especially make progress with tariff review and risk management.

**BOTTOM-LINE BENEFITS**

Already in 2001 we realized considerable business benefits: We were able to identify those commercial customers who already had one of our single standard covers and who had a good loss ratio. We offered these valued customers a new branded multi-risk coverage, giving them better service while we earned higher premiums. In 2001, we achieved higher written premiums of about \$ 1.0 million and an improvement in our underwriting result of \$ 0.3 million due to these actions: but of course the long-term benefits of better customer relations and higher customer lifetime value will be greater.

We made a significant reduction in the loss ratio in the automobile insurance. Our Data Warehouse facilitated the identification of contracts with a high loss ratio and low overall customer value, and we could take appropriate actions following negotiations with customers, such as premium adjustment, loss prevention measures and in some cases contract cancellations. Mainly on account of this, in 2001, we reduced our gross claim expenditures by \$ 3.0 million and the loss ratio by six percentage points to 89%, resulting in an improvement of our net underwriting result to the order of \$ 1.0 million.

## DATAWAREHOUSING AND STRATEGIC MANAGEMENT

Our SAS Data Warehouse also provides us a unique informational basis for Strategic Management.

In general, Strategic Management can be differentiated into 5 main areas [5]:

- ◆ Strategic Enterprise Management
- ◆ Strategic Capability Management
- ◆ Strategic Surprise Management
- ◆ Strategic Issue Management
- ◆ Strategic Evolution Management

with a different focus on

- ◆ the company's level (e.g. entire company vs. elements or functions)
- ◆ the emphasis on fundamental aspects (such as reduction of complexity vs. concentration on potentials)
- ◆ the way to deal with the future (contingency planning vs. creation of the relevant conditions)

At the Strategic Enterprise level the aim is to reduce the complexity of managing the company as a whole, using a Balanced Scorecard for strategy formulation and supporting strategic decision making through a contribution accounting information system and a sales information system. Strategic Capability Management is also applied company-wide, but concentrates on the major business potentials such as CRM, eCRM and internal process redesign.

Strategic Surprise and Issue Management focus on 'managing the future' in specific functional areas. Surprise Management addresses contingencies by providing early warning alerts on impending risks, and enables daily risk management e.g. through the Value at Risk (VaR) model. Issue Management creates the conditions for growth, for example through tariff review, loss prevention, reduction of loss ratio, and claims probability analysis.

Strategic Evolution Management is concerned with creating the conditions for the long-term health and vitality of the entire company through the identification of organizational learning needs.

<b>Strategic Enterprise Management</b> > Entire company > Reduction of complexity	> Strategy Formulation > Balanced Scorecard > Contribution accounting information system > Sales information system	sas®
<b>Strategic Capability Management</b> > Entire company > Concentration on potentials	> Cross selling > Acquisition of new, valuable customers > e-CRM > Customer lifetime value > Actuarial controlling for life insurance > Process redesign of information delivery	sas® sas® sas®
<b>Strategic Surprise Management</b> > Elements/Functions of the company > Contingency	> Early warning system > Value at Risk	
<b>Strategic Issue Management</b> > Elements/Functions of the company > Creating the relevant conditions	> Tariff review > Loss prevention > Reduction of loss ratio > Retention plans > Claims probability	sas®
<b>Strategic Evolution Management</b> > Entire Company > Generating variety > Creating the relevant conditions	> Organizational learning	

sas® : completed in 2001

**Figure 10: Data Warehousing and Strategic Management**

Our defined business cases match these five areas of Strategic Management (see figure 10). Subsequently our business solutions support our Strategic Management. The business cases we completed in 2001 have been marked. This shows that we have put theory into practice.

## CONCLUSION

Although we knew we would not get tangible benefits for some time, we had to start with the 'basics', i.e. data modeling and meta data repository.

Competitive advantage and measurable ROI could only be achieved with our clear strategic management focus. Now we see significant benefits in a variety of business areas; but we still have a long way to go to accomplish our feat.

In today's business environment, strategic management and decision making without a Data Warehouse is like navigating without a compass.

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