

## BUSINESS INTELLIGENCE FOR INSURANCE COMPANIES

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**Abstract:** The article presents current status of IT implementation in Polish insurance companies. Afterwards the main issues connected with information management and proposal of dealing with these issues, due to the implementation of Business Intelligence system, is presented. Definition, structure and scope of application as well as the Business Intelligence system implementation methodology, with a particular consideration for the insurance market character, are presented. Article is summed up with examples of effective Business Intelligence systems implementations in selected insurance companies.

**Key words:** Business Intelligence, insurance company, analytical data processing, data mining, OLAP, data warehouse.

### 1. Introduction

Currently there are no insurance companies without implemented IT systems and many of them work with specialized applications with a narrow scope of implementation and without the possibility for quick and easy data exchange. Even though, data gathered at the transactional level is broad and concern most aspects of enterprise's activities, number of used IT solutions causes difficulties in the use of gathered resources. Even in case of an integrated system the data is usually dispersed in many modules and difficult to access in order to gain cross-sectional managerial reviews.

New needs emerge in the field of data migration, integration of existing solutions and a free access to integrated and processed information, which influences the quality and effectiveness of corporate management.

In such case, *Business Intelligence* application tools, which enable the construction of integrated managerial information systems and allow the access to complete, updated and real information, support managerial processes in the enterprise, become essential. The article presents the definition, structure, scope of application and implementation methodology for the *Business Intelligence* systems, which assure effective use of IT resources – gathered and processed by the insurance company.

### 2. Polish BI market and insurance IT systems

Insurance companies provide insurance products to the market, which take the equitable transfer of the risk of a loss, from one entity to another. Business process-

es in insurance companies, their unique character and attributes, influence the character of implemented IT solutions. Poland is a relatively large and not entirely occupied market for insurance companies in comparison with highly industrialized countries. During 1999-2004 from 50-70 million of different insurance policies were sold in Poland [7]. The number of active insurance companies has been growing in Poland since 1991. According to the data from the third quarter of 2004 the number was equal to 72 insurance companies and dropped to 69 in the end of 2004. More consolidations took place in 2005 [7]. One of the conditions for further development of the insurance market in Poland is the awareness of the fact that IT solutions grant a better competitive position in the market.

According to the estimations of the DiS analytical company [7] the value of insurance IT market in 2004 was equal to 690 million PLN. Let's take a closer look at the expenses structure in this sector. Approximately 120 software products used in insurance sector were analyzed in the DiS report on insurance IT [7]:

- one third of those programs is used in insurance services,
- integrated insurance systems are 25% of applications presented in the report,
- 11% of presented applications are the Business Intelligence tools,
- ERP packages are the 10% of presented titles,
- remaining products are the self-reliant software titles, which deal with asset management, CRM and e-learning.

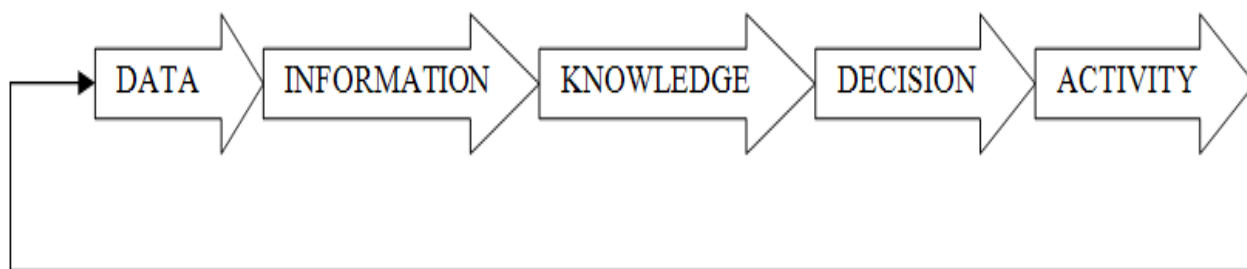


Figure 1. Idea of Business Intelligence System functioning (*source: self study*)

In case of BI and CRM solutions, apart from representation in the form of individual systems, they are a part of inbuilt element of both integrated insurance systems as well as systems supporting insurance agencies. Still the level of BI and CRM solutions usage in Polish insurance companies is relatively low.

The biggest limitation in the usage of the possibilities offered by BI is the lack of automation in the areas of data processing and analysis. Using the improvements provided by BI is lower if the company is using manual data processing.

Together with the development of technology the number of data types and sources increased – today we can speak of not only structured data but also data without a formal structure: text, graphics or multimedia.

Gathered data is usually stored in a way that limits the data usage possibilities when one is using application other than the mother one. On the other hand the data users usually are not aware of the data significance and do not know how it can be used in a useful and purposeful way.

There are cases when different departments do not want to share the data or avoid determining a clear rules and responsibility for data management.

As a result analysts from different departments are preparing reports on the same subjects based on seemingly same data, reaching different results, which, apart from the waste of time, undermines the reliability of such reports.

The article presents practical approach towards system implementation, which enables effective information management and optimal usage of owned data resources, with special attention to the environment of the insurance company.

IT systems supporting managerial processes are currently present in every insurance company. Considerable amount of data is gathered, from every area that the insurance company is interested in, so called transactional data. However the large number of IT solutions is disturbing the data gathering process – even in case of integrated systems the data is dispersed in many modules and not easy to access if one needs to gather data for the sectional managerial report. Therefore implementation of Business Intelligence solution, IT system that transforms transactional data into managerial information understandable, useful and reliable for analysts and managers, becomes justified.

Analytical and forecast preparation aiding applications as well as data mining are the elements of such solution. Business Intelligence becomes an essential tool in insurance company management, which allows diagnosing current and predicting future states.

According to Gartner Group (Gartner Group report, September 1996): „BI solution can be defined as a system that provides technology and set of products allowing access to information necessary to perform business activities and undertake strategic business decisions.”

Alexander Miler from Oracle states that [4]: „Business Intelligence is a collection of technology for gathering, storing, sharing and analyzing of information about the enterprise.”

According to Andrzej Kicingier from SAS Institute Polska [4]: „Business Intelligence is an integrated corporate informational architecture with interfaces dedicated to different user groups, which allows quick and easy access to credible information in the decision making process”.

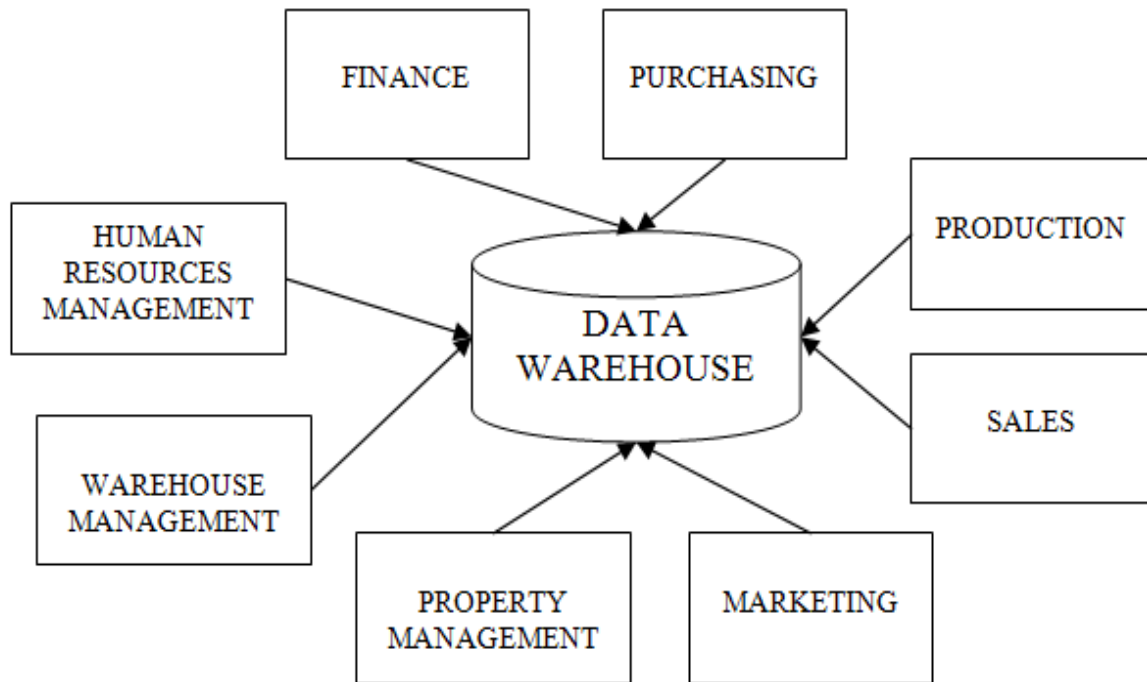


Figure 2. Data sources for Business Intelligence System (*self study*)

### 3. Definition of Business Intelligence System

Business Intelligence solutions are usually understood as dedicated analytic and reporting software with a graphical user interface, which processes and visualizes information required for managerial decision making processes.

In reality the functioning of managerial information system is based on a structured transformation sequence of data gathered by the enterprise (Fig. 1).

Data provided to the BI system consists of operational data from many different sources, such as: internal resources and customers, resources gathered or purchased from external companies or Internet. This data can be structured or non-structured, stored in many different formats and originate from various applications and transactional systems. Business Intelligence solutions, as an integration element, allow the access to different dispersed data from sources of different structure and format (Fig. 2).

Moreover, BI systems allow the data analysis based on classification, forecasting and simulation methods, what allows gathering new and useful business information. BI systems are especially useful in the following types of analysis:

- financial – researching the income and expenses cost, income statement, profit and loss account with classification of expenses by function, balance and break-even analysis, financial markets analysis and extended controlling system,
- marketing – sales income analysis, sales and margin profitability, sales plan realization, lead time, competition activities analysis, stock prices,
- customers – customer maintaining period, customer profitability, customer relation and activity modelling, customer satisfaction analysis,
- production management – identification of production bottle-necks, order delays, production dynamics study, comparison of production results between departments, plants etc.,
- logistics – quick identification of value chain creation partners,
- salary financial data – specification of salaries according to function, from the company structure perspective, salary specification according to the type of employment, salary surcharges, average salary analysis,
- personal data – employment fluctuation study, employment possibilities according to the division proposed by the Central Statistical Office, employee personal data access.

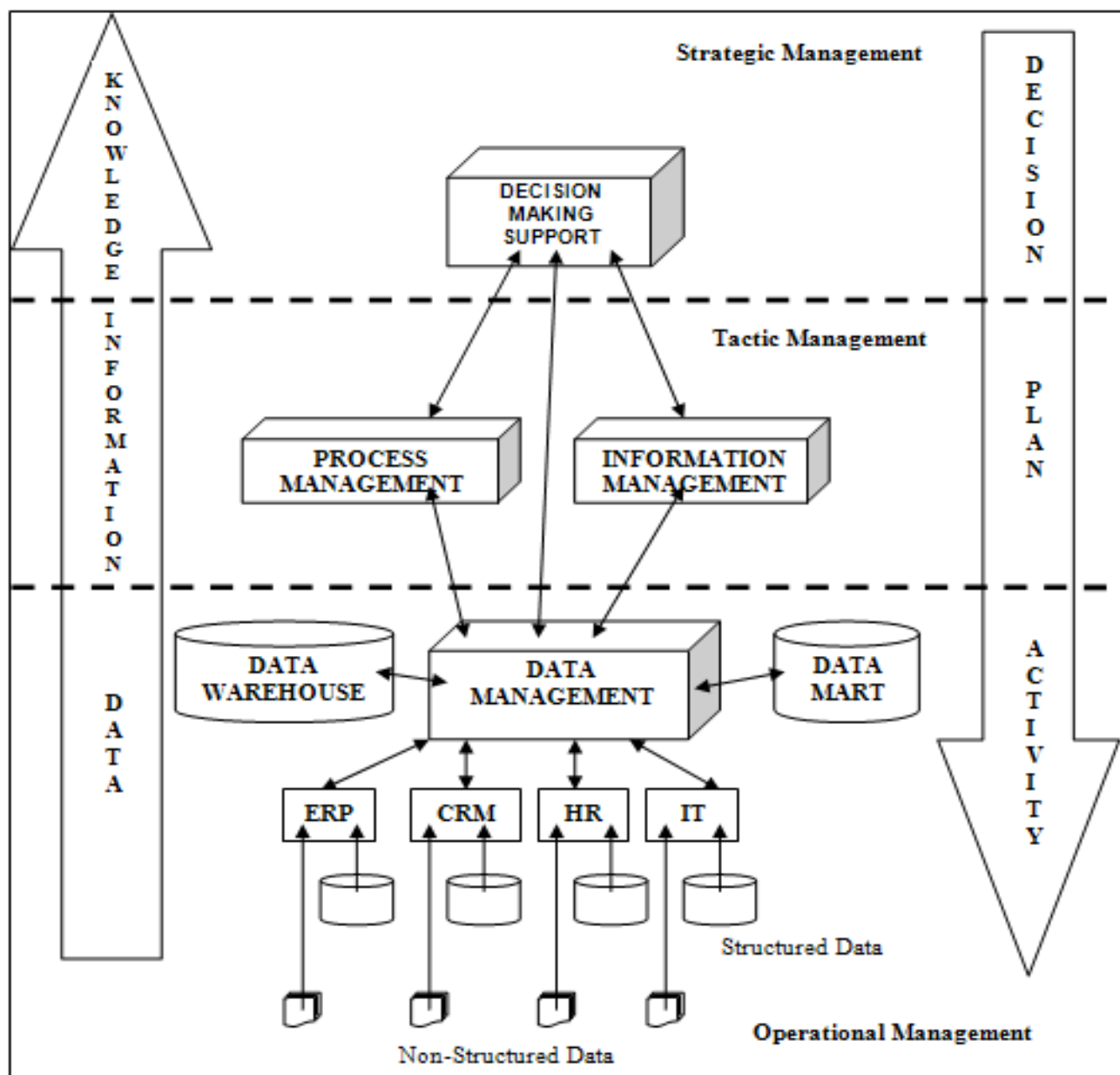


Figure 3. Role of Business Intelligence System in the process of management (source: [1], pp. 13)

Analysis results are shared with a variety of tools such as: reporting and analytical systems, informational portals and IT knowledge bases.

Knowledge is the basis for specific managerial decisions. Implementation of taken decisions into business practice assures effective enterprise management and the possibility of gaining competitive advantage in the market.

BI systems are used for gathering, storing and sharing of data as well as information management with the use of various analytical tools. BI systems aim at improvement of information management processes in the stra-

tegic, tactical and operational areas (Fig. 3, [10]):

- strategic level – allow precise target setting and tracking of the realization; allow to elaborate different comparison specifications e.g. historical data, profitability of offers, effectiveness of distribution channels etc. as well as performing of development simulations, prediction of future results with set assumptions,
- tactical level – bring basis for decision making in the scope of marketing, sales, finance and capital management; allow to optimize future activities and properly modify organizational, financial and technological aspects of enterprises functioning,

to allow more efficient realization of set strategic targets,

- operational level – used for ad hoc analysis, tend to answer questions connected with current operations of departments, current financial situation, sales, supplier, wholesaler, customer cooperation etc.

Summing up, enterprises use BI systems to aid corporate management, customer relationship optimization, business activities supervision, reporting, planning and decision making aiding. Main strengths of Business Intelligence solutions are:

- shortening of analysis and decision making time,
- simplifying of temporary, collective and other report elaboration with detailed and aggregated data,
- complex reporting systems,
- short response time for user inquiry,
- consolidation, allocation and drilling of data,
- moving the point of balance from data introduction to analysis, exploration of tacit data and detailed interpretation,
- relatively easy localization of significant states in the company e.g. according to cost, delivery on time, customer service etc.,
- providing actual and forecasted data,
- quick and easy system exploration,
- possibility to develop the model and the continuous influence of the user on the system modelling process,
- diversification of data sources.

Problems that can limit BI system implementation are as follows:

- high user training cost,
- requirement of considerable knowledge about analysis techniques (systems generate large amounts of data, therefore the user can have problems with proper interpretation of the data),
- relatively costly and time-consuming implementation,
- high software and hardware requirements,
- vulnerability of the system to poor quality and inconsistency of data, high cost of system administration and development.

Many of these problems can be solved with the proper preparation of BI system implementation – through support of proper implementation methodology and the creation of system, which is essential for and properly used by the company. The following chapter presents the most important areas of the application of managerial information system in insurance companies.

#### 4. BI applications for insurance business

Maintenance of the market position requires from the insurance companies a constant analysis of needs and requirements of the customers as well as adjustment of all business processes in a value chain (Fig. 4) in a way to assure its effective fulfillment.

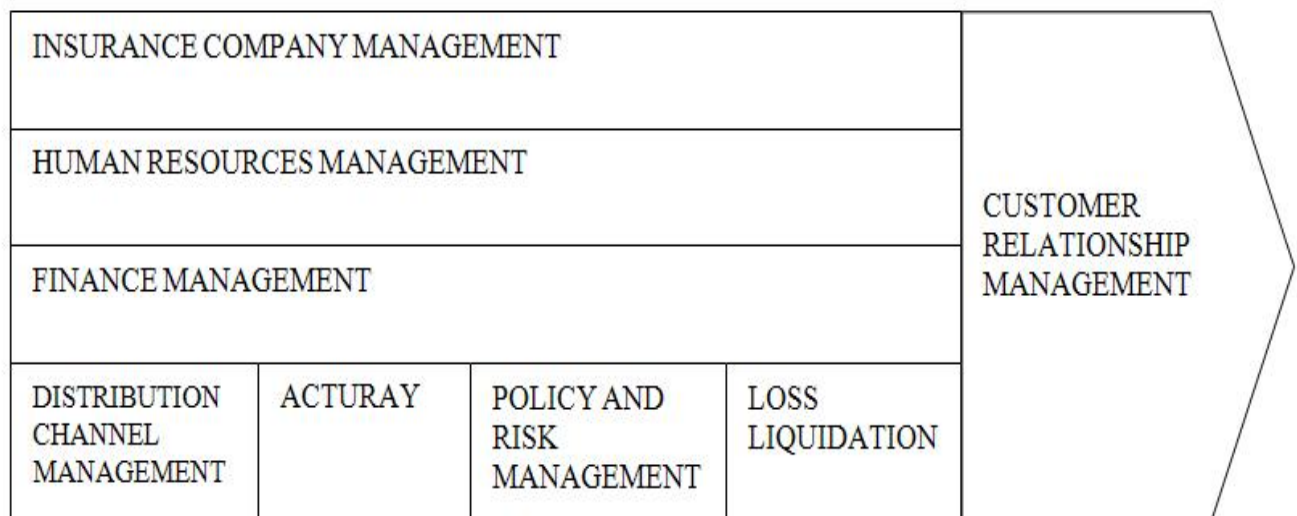


Figure 4. Value chain in an insurance company (source: [14], pp. 19)

In order to fulfill these assumptions, insurance companies need to be able to process considerable amount of data (about customers, agents, compensations and policies) into useful business information, which allows proper decision making processes. Business Intelligence tools can greatly improve the goal achievement in different parts of the value chain.

#### 4.1 BI for Customer Relationship Management

Three steps can be distinguished in the insurance company CRM process [13]:

- identification of the most profitable current customers and the ones that will be profitable in the future,
- identification and understanding of customers selected in the previous step and the analysis of their needs,
- cooperation with identified customers in order to fulfil their expectations.

Business Intelligence in particular stages of CRM process is presented in the Fig. 5. It starts with the identification of the most profitable customers in order to improve the quality of cooperation with them. Customer identification includes the determination of customer's profitability and his lifetime value (Fig. 5).

Profitability analysis should provide answer for the following question: why some customers are profitable and other are not? Customer profitability analysis helps to develop new products and adjust the products to the current customer needs and to proper customer segments. Customer lifetime value is an extremely useful measure. For example, data mining tools are used to model customer lifetime value, registering all the factors connected with customer value in the process of all his contacts with the insurance company.

Understanding of the needs of customers selected in the previous stage is based on a multidimensional analysis that includes: segmentation, switching cost and similarity analysis. Segmentation is used to determine customer segments with common characteristics. Such established segments can be treated as separate units and the future cooperation can be adjusted directly to their needs.

Customer segmentation allows preparing offers dedicated to certain groups of customers, what decreases marketing cost and considerably increases its effectiveness. Customers are grouped according to the set of characteristics: personal, demographic, psychological, service cost and profitability of the cooperation. Usually the purchase of an insurance product is a decision with a long time horizon for the customer and if he decides to change the insurance provider, it is highly unlikely that he will come back to the old provider. Therefore maintaining of customers should be the top priority.

Customer resignation causes analysis is the first step to reach the high maintenance of the customers. It requires the analysis of data gathered during the customer contact in different stages of the cooperation.

Customer contact data is connected with other data sources in order to complete the customer resignation analysis.

Created data collections are linked with particular customers and they allow identifying and understanding the causes of their made decisions.

Analysis results can be also helpful in the improvement of particular customer contact stages. Similarities analysis, also known as market-basket analysis, is based on the search of products that present a certain degree

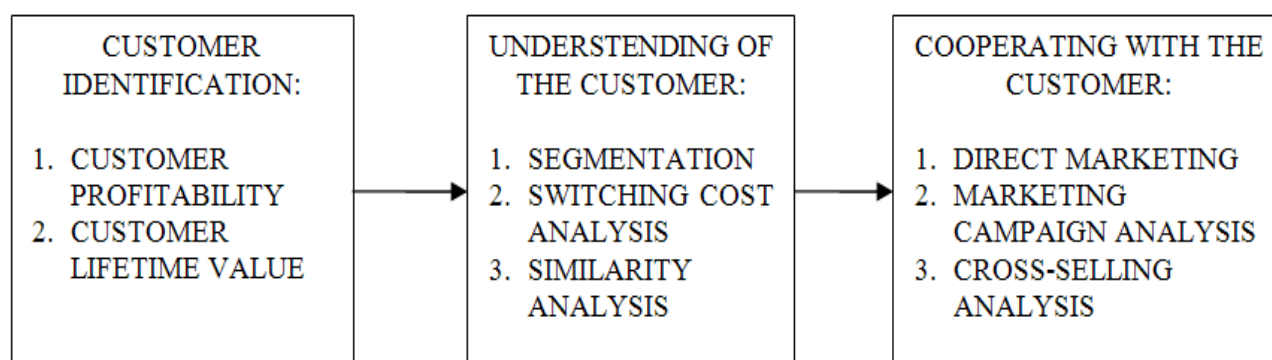


Figure 5. Business Intelligence in CRM (source:[13], pp. 20)



of similarity. This similarity causes that it is likely for these products to be purchased together. Similar analysis can be performed in relation to customers and their common behavior in the contacts with the insurance company.

Business Intelligence tools, precisely reflecting the activities consumed in the process of customer service can provide useful guidelines in the scope of adjustment of services processes to the needs and requirements of customers. Identification and knowledge of the customer leads to better communication, which is also supported by the analysis connected with the cooperation stage: direct marketing, marketing campaign analysis and cross-selling.

Direct marketing is aimed at a particular customer group – the natural consequence of performed customer segmentation. When customer segments are distinguished, Business Intelligence tools are used to research the products that will be most likely purchased by particular segments. Marketing campaigns directed at particular customer segments are designed on the basis of such information. Marketing campaign analysis is used to analyze the effectiveness of performed marketing and promotional campaigns. Effects of particular campaigns in the scope of the sales of promoted products can be tracked with the use of Business Intelligence tools.

Usually increase in sales of promoted products can cause drop in sales for similar products. Business Intelligence tools also support the identification of such relations. Cross selling is one of the main income sources for the insurance business. Insurance provider needs to highlight this data, which can lead to quick and cost-effective reaching of customers, who probably expect it, with new products. Due to this fact new products can be offered to potential customers during following contact.

#### 4.2 BI for distribution channels management

Traditional distribution channels for the insurance companies are [14]: independent insurance agents, brokers, direct sales agencies and Internet. Business Intelligence tools allow the insurers to gather information from the scope of:

- placement of agents and sales agencies,
- agent network and CRM development,
- distribution channel analysis,
- e-business development.

Placement of agents and sales agencies is based on the geographical analysis of the customer base and depends on the optimal placement of proper agent number and sales agencies in particular localizations. The analysis should include the information about potential customers for new and existing products offered by the insurer.

Agent network and CRM development can also be supported with BI tools. Sales data is analyzed according to the history of activities and sales results of agents and salesmen. Such analysis allows identifying the best agents and salesmen, what helps to prepare the salary strategy. Analysis can be extended with additional aspects of behavior and activities of the sales personnel, what can be used in designing of training programs for agents or salesmen.

Distribution channel analysis concerns the evaluation of activities of particular sales channels. Insurers can compare the results of activities in different channels and perform analysis with different level of detail – to the level of a single agent or product, with the use of Business Intelligence tools. Activities results could be continuously tracked in order to allow the insurer to make right decisions that improve the effectiveness of particular distribution channels.

Special attention should be paid to the evaluation of profitability of particular distribution channels in relation to products sold through and customers gained and serviced through these channels in the process of distribution channel effectiveness evaluation. Servicing cost analysis of particular customer segments in distribution channels and the product sharing cost analysis are the basis for the profitability evaluation and profitability improvement.

Different analysis concerning products and services can be performed on the basis of the data gathered via the Internet. It facilitates the design process of marketing campaigns aimed at the customers purchasing through the Internet, which contribute to the development of e-business. Web log files are another source of useful data that can improve the online operation services. Web log files analysis includes [14]:

- path analysis – analysis of a typical click-stream of the user during website browsing as well as analysis of the most popular pages. Such types of analysis help to optimize the website and its better adjustment to the needs and expectations of the customer,
- link analysis – determines the websites that generate

movement on insurers site through links and references,

- error analysis – reveals the errors encountered by the user in website browsing. It is especially useful in problem solving and increase of the website's quality,
- keyword analysis – analysis of the most popular keywords used in internet browsers that lead to the website of the insurer.

Listed examples indicate that it is another area of the insurance company management, which is strongly supported by Business Intelligence solutions.

### 4.3 BI for actuary analysis

Actuary function is crucial in the functioning of an insurance company [14]. It concerns risk approximation in relation to the insured property. In case of health and life insurances it concerns the calculation of accident or death probability, basing on various demographic and environmental characteristics. Activities of actuary departments are very complex and have strategic meaning for the insurance company. Actuary uses complex mathematical models, which are used to calculate future insurance premiums and allocation of their part for reinsurance. Business Intelligence tools can also be used in this area [14]:

- risk modelling,
- reinsurance,
- profitability analysis.

Risk modelling, with the use of data mining tools, is based on building of models that identify the insurance risk profiles in different customer segments. These models include risk measures such as average value of the damage, frequency of damage occurrence, loss ratio. Various risk measures can be calculated for a customer segment and afterwards, they should be used for the calculation of a proper insurance premium.

Reinsurance institution takes on itself part of the insurer risk and in return gets part of the insurance premium paid by the customer. In case of damage the reinsurance institution pays out a suitable compensation. Actuary determines proper value of reinsurance, which maximizes the profit with an acceptable level of risk of the insurance company. Data mining tools allow building approximation models, which help to establish the reinsurance level based on the data from paid insurance compensations.

Such models identify these policies, which should be assigned for reinsurance, on the basis of experience with similar losses in previous years.

Profitability of existing products can be tracked in relation to various factors such as: product lines, geographical regions, agencies, customer segments, distribution channels etc. It is usually the first step in the prediction of the product life-cycle of new products.

Actuaries build more complex data mining models, which approximate the demand on new products and identify most profitable customer segments for the products, are based on historical profitability analyses. Profitability of insurance products can be determined on the basis of detailed product cost data (cost of activities and resources consumed in processes of elaboration, sales, administration and liquidation of insurance products). Managerial information systems, equipped with dedicated cost models based on activity cost calculation, are the basis for such analysis.

### 4.4 BI for risk evaluation and policy management

Risk evaluating teams decide whether the risk taken in the process of insuring a customer is acceptable for the company and determine the proper value of insurance premium that will be collected. Business Intelligence tools are supporting such types of analysis [14], taking into consideration such actors as: damageability of the policy, incurred losses and other data that is relevant in case of risk evaluation and policy management. Premium and losses analysis can also be used in such cases, including the support of BI tools.

Insurance premium analysis allows tracking the effectiveness of the premium level in relation to [14]:

- particular products or product lines,
- geographical regions,
- agencies, particular agents of company branches.

Results of such analysis are helpful in the determination of optimal premium value, what can influence the attractiveness of offered insurance products and the competitive position of the company in the market.

Loss analysis is especially helpful for these products or product lines, which have the insurance premium fee lower than the servicing cost. Such kind of loss can be a result of a rough estimation of the preliminary risk or higher than expected cost of servicing and administration of products. Therefore the need of the insurer



for constant loss data monitoring is necessary and obvious in order set the cost of recruiting new regaining old customers for products and product lines that are bringing losses. Such kinds of analysis are especially useful in the improvement of profitability level, risk evaluation improvement programs and financial resources protection.

#### 4.5 BI for insurance claims settlement

Quick and efficient dealing with losses creates a basis for good customer relationship management [13, 15]. At the same time the insurer needs to deal with the increasing number of insurance frauds. Insurance frauds are currently very common and most of additional costs for the insurers come from such activities what is, unfortunately, transferred to the customers in the form of increased insurance premium. This draws to a conclusion that quick payoff of compensations contributes to the increase of fraud related cost and the slowly fraud recognition process results in the increased number of such activities leading to increase of insurance premium and decrease of customer satisfaction.

Therefore proper and safe loss liquidation is extremely important for the insurance company. Experience of different institutions show that efficient and long term decrease of fraud and beguilement number is not possible without analytical tools. Business Intelligence analyzes, which can support the activities in the scope of loss liquidation, are [15]:

- loss and compensation analysis,
- fraud detection,
- loss and compensation approximation.

**Loss and compensation analysis** is one of the basic types of analysis in the scope of BI solutions for insurance companies. They concern the data analysis from the scope of compensations, connected with other data sources, such as policies and risk evaluation. In the first place they are used for the evaluation of loss liquidation process efficiency, which is directly linked to customer satisfaction. Loss and compensation analysis is also helpful in the observation of new trends, which otherwise would be difficult to spot. For example the observation of loss liquidation and sustaining losses trends allows easier optimizing of resources management with simultaneous risk level decrease and increase in resources designated for investments.

Loss and compensation analysis facilitates fraud detection due to detailed analysis of money pay outs accord-

ing to different factors such as: localization, insurance agent, customer, insurance type.

**Fraud detection** during loss liquidation can be detected through multilevel analysis of compensation data connected with other internal and external data such as: payment history or risk evaluation. Data mining tools used for the construction of models, which detect fraud and beguilement patterns, are extremely helpful.

**Loss and compensation estimation** is relatively difficult due to the fact that the real value of losses is unknown before the introduction of new products into the market. In such cases the estimated value must be saved in the form of cash reserves and such funds cannot be used in the process of long-term investments. Therefore the precision of such estimations has a major influence on the profitability of the insurance institution. Multidimensional OLAP analysis can be used for the compensation data analysis according to customer segments or geographical factors in order to estimate future compensations more accurately. In order to reach a better accuracy of such analysis, one can use data mining tools and their advanced compensation estimation models.

#### 4.6 BI for finance management

Financial resources eared from investments used to be the main source of income for insurers in the past and they generally determined the profitability of the insurance company [15]. At the same time the risk evaluation cost was decreasing the profitability of the company. Therefore insurers need to increase the return of investment and decrease the risk evaluation cost and preparation of policies. This requires a direct access to financial data in order to perform the analysis. Many institutions try to improve the financial reporting and decision making, through interfering into financial data in the Financial Data Warehouse (FDW).

Budgeting is an example of another process, which can be supported with the Business Intelligence system. Data warehouses allow performance of analyses that compare cost recorded in the budget to actual cost of promotional campaigns, risk evaluation expenses, provisions etc. Equipping data warehouses with BI tools, based on well-established cost analysis methods (ABC/M) and sharing the analytical models, allow deepening of the OLAP analyzes what allows analyzing cost increase causes in many different aspects.

Moreover the analysis results can be used in budget determination processes for following financial periods. Budgeting based on demand and activities and resources usage effectiveness indicators became possible due to the ABC/M models implemented in the BI solutions. This element is crucial in the improvement process of planning and budgeting quality. Budgeting of various analysis based on the cost models (ABC/M) is useful in control improvement and better cost allocation.

Property management can be also supported by the managerial information systems. Models based on BI tools can be built in order to measure the level of exposure to risk of the insurer to various risk factors such as: share structure change, instability of stock market etc.

Designed models help to predict the effectiveness of the portfolio in different established economical scenarios as well as the future need of the insurer for working capital.

Financial indicator analysis such as: debt and liquidity indicators can be performed for particular time periods. Ability to provide detail and enclose various related report and analyses, provided mainly by OLAP multifactor analysis, allow simplifying the analysis and making it more intuitive.

Profitability analysis – individual products, product lines, customers and their segments, distribution channels and investment activities are also supported by BI solutions. The main factor of profitability analysis is the direct and throughout analysis of cost taken in customer gaining activities, risk evaluation and policies preparation, which are the main factor of insurance institution overall cost reduction. Activity cost analysis is the basis for cost calculation of those and other processes in the insurance company.

#### 4.7 BI for human resources management

Business Intelligence solutions are especially helpful in human relations management strategy in the overall strategy of the enterprise [15]. They present the integrated picture of the employment and facilitate the employee maintaining schemes, productivity increase and cost reduction. BI application usage in HR departments includes mostly [15]:

- human resources applications and reports,
- workforce allocation analyzes,

- introduction of HR portal,
- training and career path planning.

Reports and analyzes concerning human resources support the integrated data revision concerning employment. Various analyzes can concern migration and staff accomplishments, employee resignation, employee accomplishments and other adjusted to the needs of analysis and reporting. Human resources data can be connected with set employment criteria noted in the insurance business, what allow generating various reports that reveal the employment data in comparison with data from the whole industry.

Analyses that present workforce allocation are based on the introduction of new products into the market. People employed in the sales departments, according to the growing demand, can be allocated in various regions, which have the demand higher and it is likely to grow in the future.

Training and career path planning can also be supported with BI solutions. Detailed data on the competence level of the staff can be stored in a data warehouse. It is useful in competence improvement plan design and effective career path planning for particular employees.

#### 4.8 BI for insurance company management

High management of insurance company has specific requirements towards Business Intelligence [15]. Usually the information management department is responsible for provision of all necessary reports. The department is also responsible for provision of different reports required by various agencies and preparation of information necessary inside and outside of the organization, designated for customers in the form of analyses and reports. Business Intelligence environment is aimed at collection of data from all elements of the value chain, what seems to be the most efficient and reasonable solution for the department.

Reports prepared for the top-management have direct influence on the efficiency and effectiveness of the corporate management. Effectiveness measures such as product or product line profitability as well as customers and distribution channels, total cost of main processes and activities, ROI for investment portfolio etc. can be presented in the reports designated for top-management, which supports the decision making processes.

Moreover mentioned reports provide signals about reaching of alarming level of particular effectiveness measures what triggers performance of corrective actions. The reports are also the basis for external expert and researchers reports.

Insurers are required to provide a number of reports to external agencies, government institutions and branch consortiums. Reports required by law can also be easily generated with Business Intelligence tools.

Customer information system is also one of the elements of managerial information system. Historical compensation data can be essential for the institutional customers, which are offered the employee insurance in case of accidents. Such data might help the customer to identify main trends in accidents and damages in order to start corrective actions to limit such events. Customer information system not only reduces cost connected with damage liquidation, but also significantly improves the preservation of customer-insurer relations.

## 5. Methodology of building BI System

There are three necessary conditions for successful managerial information system implementation:

- experience and knowledge of the designing and implementation team,
- intensive cooperation between designers and users in the whole design and implementation period,
- use of proper implementation methodology, which includes the process break down into smaller projects.

According to [8] the managerial information system design methodology should consist of six stages divided into particular steps (Fig. 6).

### Stage 1 – Justification

#### Step 1 – Business case assessment

Managerial information system is an extremely complex project, which needs to be carefully prepared and managed. Business Intelligence is not only an IT tool, but also a collection of techniques, business solutions and a number of processes, which should be properly implemented. It is connected with organizational changes, management system and serious IT system structure and architecture changes. This leads to high financial resources consumption and, similar to other major IT implementations, huge investment risk.

Therefore a detailed goal definition and indication of measurable and immeasurable profits of such implementation is necessary.

Questions that need to be asked and issues that need to be solved at this stage are [8]:

- information access:
  - what is the origin of information necessary for decision making?
  - what information is accessible and what information is missing?
  - what is the quality and is the information up-to-date?
- business and financial project aims:
  - what are the business aims for the managerial information system realization? are there Business Intelligence applications functioning in the company and can they help in the realization of established business aims?
  - what financial resources are designated for this endeavour?
- who is responsible for financing of Business Intelligence projects in the company?
- evaluation of the company readiness for the Business Intelligence system implementation:
  - is the company ready for Business Intelligence implementation?
  - was the readiness evaluation performed and what results did it provide?
  - what is missing for the better implementation preparation: purchasing hardware and software, standard implementation or maybe hire new employees?
- risk evaluation:
  - what is the risk connected with the construction of managerial information system?
  - what negative impact will be brought by the cancelling of managerial information system implementation?
- cost evaluation:
  - are the predicted profits exceeding the estimated costs of the project?
  - is the total cost of BI implementation known?
  - does the new hardware need to be purchased?
  - does the computer network need to be modernized?
  - are any new software tools necessary?
  - is a Business Intelligence advisor necessary?

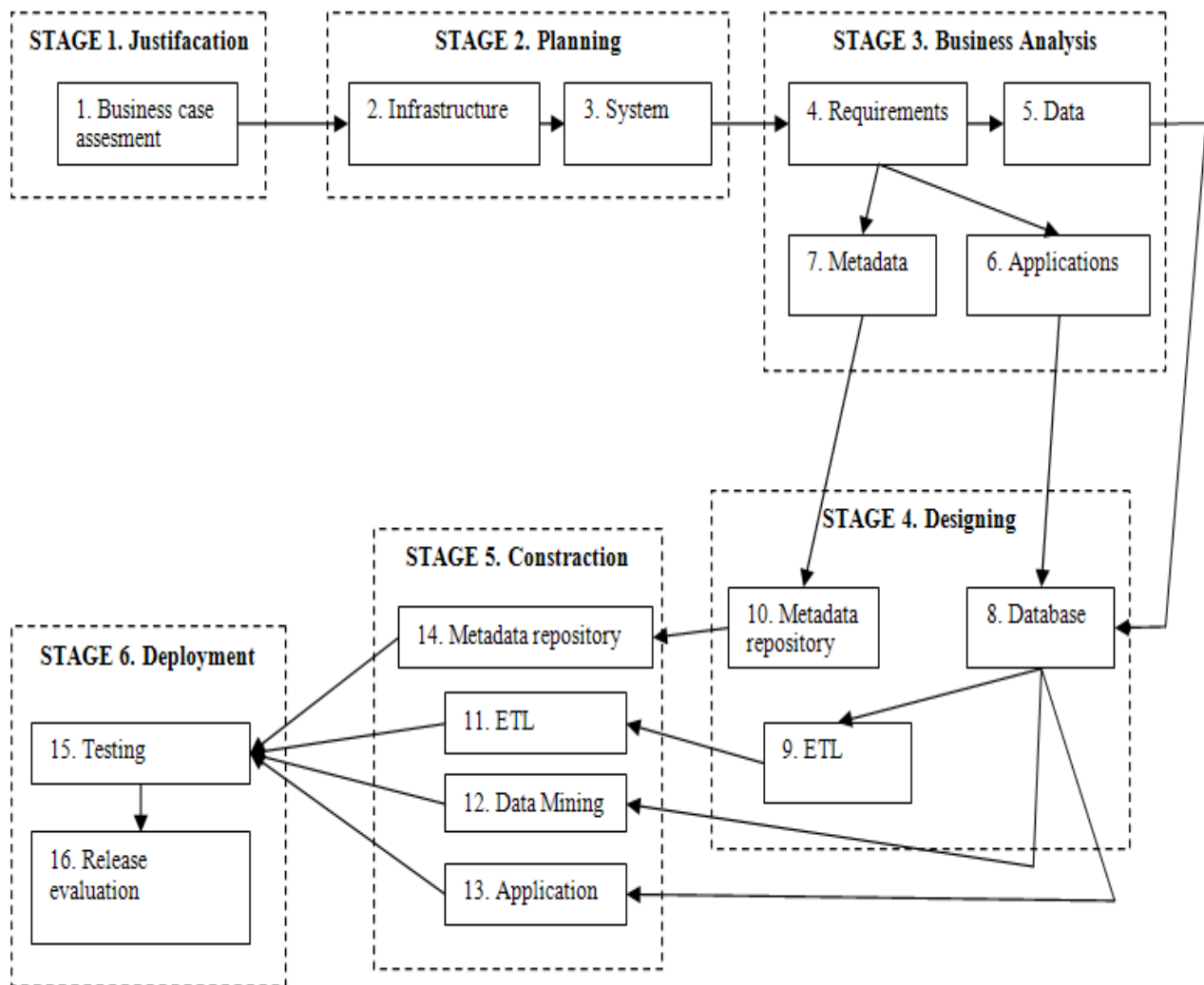


Figure 6. Methodology of building Business Intelligence System (source: [8], pp. 27)

- return of investment – calculation of the ROI indicator on the basis of:
  - influence of the implemented system on customer service department performance,
  - influence of the implemented system on customer satisfaction,
  - influence of the implemented system on increase of company's profits,
  - influence of the implemented system on strategic decisions effectiveness,
  - influence of the implemented system on cost reduction,
  - influence of the implemented system on market share increase.

The list above should be treated as an analysis plan, which needs to be performed in the company before the final decision about the implementation of the managerial information system in the company is made. Broad scope of questions allows to determine the **readiness** of the company for the implementation and the possibility of the realization of such investment.

### Stage 2 – Planning

#### Step 2 – Infrastructure design

Whole infrastructure of the enterprise needs to be adjusted to the realization of the project, because managerial information system includes the whole organization. Some of the infrastructure elements re-

main intact but some of the elements need to be adjusted to the project specification. Infrastructure includes two types of components:

- technical infrastructure: hardware, software, network cables, peripherals, database systems, operational systems, network components, metadata repository, user applications etc.,
- non-technical infrastructure: metadata standards, data mining standards, logical database model, methods, textbooks, testing procedures, change control procedures, change management procedures etc.

#### Step 3 – System design

It is crucial that the project is dynamic and adjusted to the organizational, personal, budget, technological, production with sales and cooperation possibilities of the company. The design needs to be detailed, complete and updates in relation to current changes that emerge in the enterprise.

### Stage 3 – Business Analysis

#### Step 4 – Business requirements analysis

Adjustment of the project, on one hand to the needs and on the other to the organizational and financial possibilities of the company, is one of the most difficult steps in the implementation of managerial information system. It is difficult to limit the natural strive of the user to creation of the system, which would include all necessary information at once and on the other hand, what results from previous experience, such complex implementation are usually unsuccessful.

It is important to divide the managerial information system implementation project into smaller stages, which will service particular subject areas and simultaneously each successive stage of implementation will become a scientific element for both designers and system users.

#### Step 5 – Source data analysis

Quality of source data is a major challenge for every managerial information system implementation project. Poor quality of data, difficulties with data integration, problems with access to source databases – all of it contributes to the extension of time scheduled for the design stage and usually means the increase of project cost. Some data, which supply the managerial information system decide about its effectiveness and usefulness for the user, therefore proper amount of time and attention needs to be put into this stage by the design and implementation team.

#### Step 6 – Application prototype

Analytical system, which will function as a part of the project, can be successfully constructed with the method of prototyping, because it is a combination of applications and IT tools. The prototype allows better communication for designers and users as well as speed up to determine the final form and functionality of the analytical system.

#### Step 7 – Metadata repository analysis

Increase of the number of IT tools used in the system means the increase of technical data amount in relation to business metadata, which is supported with these tools. Technical metadata need to be mapped on business metadata and next transferred into metadata repository. All metadata, which is introduced and stored in the repository, needs to be documented in logical metadata model. Additionally all metadata requirements need to be accessible to the user through online help function.

### Stage 4 – Design

#### Step 8 – Database design

Source bases for the managerial information system can have various structures, not include multidimensional character and not be adjusted to real informational needs of the system users. Database structure design of the warehouse must include present source data resources, organize it in a manner that fulfills the informational needs of all analytical and reporting modules of the designed system.

#### Step 9 – ETL process design

Extract-Transform-Load process, also known as data integration process, is the most difficult element of the whole project. It also decides about the success of implementation and business usefulness of the whole project. The following elements influence the complexity level of the process:

- number and quality of data sources supplying the system base,
- source data access,
- informational scope included in the designed system,
- number and complexity degree of prepared reports,
- requirements of system users (number and complexity degree of “ad-hoc” report).

Properly designed and realized ETL process can reveal the previously unknown informational power of the data gathered by the enterprise.

### Step 10 – Metadata repository design

If one decides to purchase a ready product the metadata repository design includes only the consideration of these logical features of the model, which are necessary for the realization of designed system, and were not included by the license provider.

In case of dedicated metadata repository, the design must meet the requirements of the logical meta-model, which is based on the relational structure or the object structure.

## Stage 5 – Construction

### Step 11 – ETL process construction

Many tools available in the market are designed to implement the ETL process. According to the degree of complexity of the cleanup and transformation of data (see Step 5) and the data analysis (see Step 9) different tools can be more or less useful in particular cases. Realization complexity of mentioned processes and determination of specific requirements is necessary in order to select a proper ETL solution.

### Step 12 – Application construction

Whenever the application prototype, created in Step 6, fulfills functional system requirements, it is possible to start the work on the development of access and analysis environment development. Constructed application can be only a simple transformation of the prototype into a fully functional system or a much more complex new project based on different IT tools. However in both cases this stage runs simultaneously to the ETL process implementation.

### Step 13 – Data mining

Many enterprises, which use the managerial information system, do not fully use the possibilities of their analytical environment and limits the use only to the collection of redefined reports that are most frequently used by the users. Meanwhile the true power of the system and maximal return on investment lies in the hidden data of the enterprise. These are not visible in the standard report group but are possible to gather if one uses such methods of multidimensional analysis like data mining. It is connected with the need to purchase and application of tools dedicated to mining analyses.

### Step 14 – Metadata repository construction

If the metadata repository is created for the system, instead of purchase of a ready product, separate taskforce team needs to be established. It is justified, because the

repository development project is usually a broad sub-project, which needs to consider: strategic goals, development strategy, business and market conditionings, predicted competition activities and many other aspects of enterprise development, which trigger the development of managerial information system, thus developing the metadata repository.

## Stage 6 – Deployment

### Step 15 – Testing

When the managerial information system application tests are finished it is necessary to start intensive training for all the people involved, which will use the application or metadata system. Trainings include:

- user application servicing,
- maintenance and development of the database,
- scheduling and ETL process start-up,
- database scaling planning and control.

### Step 16 – Implementation evaluation

It is crucial to draw conclusions and use the experience gathered in previous stages of its application, in the following stages of the system realization. If a considerable infringement of the budget or the project realization deadline took place, the root-cause should be closely researched so that such mistakes can be avoided in the following stages. Any kind of tools, methods and practices, which were not useful or disturbed the proper realization of the project, should be eliminated before the start of next implementations.

Many stages of the implementation can be performed in parallel, which allows shortening the entire time necessary for the realization of the project. Project realization time is also decreased due to the increasing experience of the design and implementation team. Success and effectiveness of future implementations can be built upon such bases.

Summing up three necessary conditions of successful managerial information system implementation can be listed:

- experience and knowledge of the design and implementation team,
- intensive cooperation of designers and users during the whole period of design and implementation of the project,
- division of the project into smaller subprojects.

Apart from that the managerial information system design needs to be developed during the whole period

of its exploitation and in order to successfully support the enterprise management process it should:

- include the information life cycle: gathering, storing, cleanup, integration and analysis,
- use not only the information management technology, but also the information management policy,
- maintain the high quality of data, safe access to data and clear responsibility rules.

## **6. Examples of implementations BI in the insurance industry**

### **AIG PTE – example taken from the experience of the IBM Global Services [2]**

AIG Universal Retirement Association (AIG PTE) is a part of the American International Group Incorporation (AIG) capital group. The customers of the AIG PTE are the members of the AIG Open Retirement Fund (AIG OFE) managed by AIG PTE. AIG OFE is obligated by law to provide a number of reports to the Polish Financial Supervision Authority. Apart from that AIG PTE, similar to other commercial endeavors, needs to perform a number of analyses and research of different parameters of managed business. Additionally the fund wants to create current reports about the usage of its electronic access channels (IVR, Internet). Obviously the realized similar analyses and reports in these three areas but even within one area it was using different IT tools. It required an IT system that would allow:

- realization of current reporting and analytical functions in a consistent and efficient manner,
- distribution of reports and analyses results in the intranet,
- performing of analyses to the employees with no IT experience (knowledge of SQL or RPG programming languages) in different departments of the company,
- maximal usage of previous experience and software – protection of AIG PTE IT investigation.

AIG Universal Retirement Association decided to entrust the data warehouse and Business Intelligence system implementation to IBM Polska. AIG PTE indicated the business areas, which require the creation of reports and analyses. AIG PTE employees closely cooperated with the implementation team, providing necessary information on AIG PTE data sources. The result of this cooperation three layer system architecture was created:

- data sources: iSeries data server, Lotus format files and data in other formats of relational databases,
- repository layer realized at the iSeries server (SQL Views) and DB2 UDB database version 7.1 (on dual-core xSeries server),
- analytical layer, allowing the performance of multi-dimensional analyses, realized with the Business Objects software.

IBM Data Warehouse Center was used to manage the process of data flow between the layers of the system as well as metadata management (stored in DB2 UDB database). Creation of most aggregates as well as the loading of, so called, dimensions is performed through a repository. Data loading between layers is performed offline. Analysts use the online system while working in data storages prepared with Business Objects software.

Created system corresponds with the technical requirements of AIG PTE and the whole implementation fulfilled the basic success criteria. It is important that in the creation of the efficient and stable system technologies, known and admired by AIG PTE (IBM iSeries, DB2), were used to full extent. BI system at AIG PTE is the example an optimal use of four technologies to create an efficient and scaled reporting and analysis system. It is a successful combination of the following technologies: IBM DB2 for OS/400, IBM DB2 UDB at xSeries and IBM DataWarehouse Center with Business Objects package.

### **Allianz Austria – example from the experience of SAS Institute [12]**

Allianz Elementar Versicherungs AG (Allianz Austria) provides a wide variety of insurance products that includes life, health, cars and property insurance. The enterprise hires 3000 employees that include direct sales personnel, agents and brokers. Private and enterprise customers are serviced through sales agents spread across the country. Allianz Austria, similarly as many other insurance companies, needs to fight to maintain customers in an extremely competitive market. Currently customer maintenance and profit protection is the highest priority for the company. SAS software provides Allianz Elementar with tools for gathering of knowledge about customers, supports sales activities and protects profits.

Allianz Austria has been using the SAS software, for the business activities support – especially in launching new products to the market and customer relationship



management, for ten years. SAS software is used in analysis and reporting. Using the SAS Enterprise Miner program for the customer segmentation, basket analysis or prediction of customer behavior and preferences is very useful.

Profit Protection Program (PPP) was elaborated in 2003. It focused on the customer recognition and analysis, which are bringing high profit but are likely to change the insurance company (e.g. due to the expiration of the policy). Program assumed investments in such customers in order to keep them in the company so they could provide further profit. SAS Institute became a strategic partner in the realization of the program.

First stage included construction of data warehouse, which gathered and shared the following customer data:

- demographical – age, sex, customer contract data,
- insurance – name and type of the insurance product, value of the insurance premium, insurance period, history of paid premiums,
- trade – distribution channel of the insurance products purchase.

PPP program focused on short-term products and individual customers. First research was based on a 10% of selected customers. Customers, who provide the highest profit and are most likely to change the insurer (due to the expiration of current policy), were selected from the group. The project managed to lower the average quitting pace by 25%. Profit increase of 2% was observed during six months of the research (generated by the observed group of customers).

The possibility of more precise prediction of growth and formulation of profit, which transforms into better enterprise planning, was also of high importance. Due to the high effectiveness of the PPP program, the researched customer group was extended in 2004. Customer Service Department was provided with a list of customers, which were to be treated in a preferred way. Therefore a tool that allows a better control over customer rotation and company's profit was created. Two SAS Institute tools were used for the analysis and reporting: SAS Enterprise Miner and SAS Enterprise Guide.

#### **AXA Insurance - example from the experience of InspireTech Sp. z o.o. [4]**

InspireTech Sp. z o.o. together with ABC Data Educational Centre created and implemented a unique Busi-

ness Intelligence system in Avanssur S.A. - AXA Insurance.

AXA is one of the biggest insurance groups in the world. AXA brand appeared in the Polish market in 2006 and through the acquisition of Winterthur Group it emerged also in Polish insurance and retirement fund market. AXA Group performs its insurance activities in Poland through the following companies:

- AXA Insurance (Avanssur S.A. Polish Division) – offers the full scope of communication insurance,
- AXA Universal Retirement Association,
- AXA Open Retirement Fund – active in Poland since 1998 as a II pillar of Polish retirement system managed by AXA Universal Retirement Association,
- AXA Life Insurance Association - active in Poland since 1994. Leader in Polish insurance market. Providing modern solutions to individual and corporate customers in the scope of: life insurance, protective and health insurance and insurance with capital funds gathering financial resources for future retirement,
- AXA Insurance Company active in Poland since 1995 in the scope of personal and property insurance.

Dedicated solution for Avanssur S.A. was based on two pillars:

- data warehouse,
- reporting system.

Project was based on the Microsoft Solutions Framework methodology. Microsoft Solutions Framework is a technical project approach based on a defined set of rules, models, disciplines, ideas, guidelines and best practices of the Microsoft Corporation. MSF methodology includes:

- foundational principles – main rules that are the basis for the whole structure; includes standard common for all MSF structures,
- models – schematic descriptions of team model and process model project organization,
- disciplines – practical application of specific sets of methods, terms and approaches (e.g. project management, risk management, readiness management),
- key concepts – ideas that support the MSF principles and disciplines and are introduced on the basis of proven practices,

- proven practices - practices, which turned out to be effective in real-life projects and in changing conditions,
- recommendations – optional, but suggested practices and guidelines.

InspireTech Sp. z o.o. constructed data warehouse for Avanssur S.A. with the use of Microsoft SQL Server 2005 64-bit Edition platform and Microsoft Windows Server 2003 Enterprise Edition server platform.

One scaled information repository was created through the integration of heterogeneous data sources.

Second pillar for Avanssur S.A. was based on Reporting Services and extended with individual needs Avanssur S.A. with the use of ASP.NET and C# on the Microsoft .NET 2.0 platform.

### **Samsung Life Insurance - example from the experience of Sybase [11]**

Samsung Life is the branch leader in South Korea. Company sells individual and group life insurance through a gigantic network of agencies and over 30 thousand salesmen.

Samsung Life Insurance was in need of an integrated view of its IT system – enterprise was using 10 data storages, which were usually non-compatible and extra data was placed in different locations. The company launched a data warehouse construction project in order to integrate current databases.

Main task was the elaboration of quick, reliable process, which would allow the field users a common data view as well as integration of ten independent collective databases. Samsung Life had three targets of the project:

- increase of the field-workers competences, allowing them to perform their own analyses,
- providing access to highly compatible data with a common viewer,
- shortening of report generation time.

Products from various providers were simultaneously tested, including: NCR, Oracle, IBM and Sybase. Sybase IQ, database designed for data warehouses, was awarded first place due to the speed of inquiry processing and compression ratio. Higher compression ratio results in more disk space and lower cost of mass memory, what in terms of few TB is of significant meaning. If the corporate database was built on the basis of other database type, perhaps a hard drive of 3 – 4 times greater capacity would be required.

With the use of Sybase IQ system the enterprise integrated 8 out of 10 different collective databases and created corporate data warehouse. The company limited the need for disk space and lowered the cost of mass memory due to Sybase IQ system functions — advanced data compression and unique row indexing mechanism.

Sybase solution assures quick data access and minimizes disk space required to record huge data collections. Moreover Samsung Life is prepared for the increase of the amount of data – high efficiency of Sybase IQ system – provides room for development.

Analytical responsibility in the scope of contract status, customer characteristics and people who prepare financial plans etc. was moved from the IT team to particular business teams, which allowed saving resources and increasing the general operational capacity. Field workers in need of greater amounts of data can gain easy access to the data warehouse in order to download current and reliable information from an accessible and usable environment. After the implementation the new system did not cause any business processes delays.

Main benefits reached through the project were:

- considerable increase of the operational capacity of the enterprise,
- easy access to strategic data,
- 25% reduction of disk space in comparison with other data warehouses.

## **7. Summary**

The main task of managerial information systems is the data analysis and provision of high quality information to all management levels. It is a common view that implementation of managerial information system is a success factor for enterprise activities. Demand for such solutions is constantly rising, what enforces easy access to precise and reliable information that support management processes. Another advantage of such solutions is the possibility of use for person in charge, due to its user-friendliness and easy access.

When observing Polish insurance market, one can observe that more insurance companies is using analytical tools and recording systems. Therefore not only ownership and gathering of processed data is important but also proper usage of such data becomes of great significance. Such usage of data is possible after the implementation of managerial information system and the data becomes valuable insurance information.

Identification of the need of using an effective Business Intelligence environment, based on proper architecture, becomes crucial. Therefore it is the first step in the system implementation. Aim of enterprise activities should be the drive to integrated BI environment with the decision making process.

Efficient gathering of required information of all user groups is a significant stage in the creation process of integrated BI system. Ability of precise business targets, which are planned to reach through the use of Business Intelligence as well as full support of the high management for realized projects, is crucial. One of the primary targets of the implementation and Business Intelligence systems' development in insurance companies should be precise and detailed analysis of profitability and preparation of relevant project adjusted to the needs and requirements of the user.

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