

Business Intelligence and Implementation in a Small Enterprise

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Abstract: Business Intelligence (BI) systems provide users for information and analysis to better support with tactical and strategic business decision processes. This article summarizes the current trends in BI systems, discusses aspects of BI tools and BI solutions in small and medium businesses. Principles of integration of multidimensional views of business data with analytical and visualization tools are studied and described here. An example of a BI solution implementation in a small company shows how the multidimensional analytical data model and related applications can be designed, created and implemented for the small company.

Key words: Business Intelligence (BI), Analytic Report, Business Data Analysis, Small and Medium-Sized Business (SMB)

1. Business Intelligence Introduction

The accessibility of data has been increasing rapidly due to low-cost data storages and connectivity, which makes available to access data from different resources. This development has opened new questions in the companies how to arrange the most effectively interconnections among application domain, data storages, technology available, and analytical methodologies with the aim to optimize business performance. Business Intelligence (BI) combines data, analytical tools, methodologies, and new information given from data, with business knowledge, and target them into decision making process.

The basic definition of BI [Turban et al. (2011)] characterizes BI as an umbrella term that combines architectures, tools, databases, analytical tools, applications, and methodologies.

The purpose of the BI systems is to combine different data resources into information about processes in the company and provide this information in appropriate way and timely to company management. The information is usually based on analysis of enterprise operational data and serves as a basis for tactical and strategic decisions. As a source for above mentioned analysis, the internal business data are most often exploited. Thus as a main source systems can serve enterprise information systems like ERP (Enterprise Resource Planning), CRM (Customer Relationship Management), or SCM (Supply Chain Management). Also complementary data from external private or public resources can be used.

The aim of this contribution is to summarize the known ideas of BI approach and present a way in which small BI business project can be build.

The structure of the article begins with description of BI typical components. Next part of the article provides introduction to purpose and contributions of BI solutions for the company and summarizes the BI usage in enterprises across the different sizes and branches. Then brief description of technological tools and vendors follows. Theoretical part of the article ends with description of current Business Intelligence trends among small business enterprises in the last few years.

Finally, an integration of technologies with data analysis and visualization tools into BI principles, applicable in small enterprise, is suggested here. This approach presents one possibility how to arrange and process data from different resources and make them available timely for managerial decisions.

1.1 BI Components

Business Intelligence solution is technologically composed from several specific tools and components, as resources of data – databases, connectivity tools, data transformation tools, analytical

and visualization tools, BI front – end tools, measures of business impact, concepts of BI relevance and feedback measures, strategy of BI improving and development, etc.

Data transformation tools, commonly called ETL (Extract-Transform-Load) tools, are used for data extraction from source systems and subsequently for transformation and transmission these data into the specialized database. Advanced ETL suites often handle also data quality control mechanisms as well as metadata management.

Transformed data are loaded to the database suitable for consequential analytical tasks, most often to the data warehouse or to the data mart. Data staging area or operational data store may also be used for temporary data storage e.g. during transformation.

Fundamental business data analyses are often based on reporting of key quantitative indicators, or on multidimensional views on business data. Reporting comprises regularly triggered set of prearranged queries. Enterprise reports then contain several useful indicators to help manage the business efficiency and performance. Information conveyed by multidimensional view of data is enabled by OLAP (On-line Analytical Processing) technology. Statistical methods and data mining are also plentifully exploited for data analyses.

Majority of large-sized companies in different branches derives benefit from BI systems. Suppliers of related software in BI category offer extensive product scale and services nowadays. Such solutions require proper implementation and integration with enterprise's legacy systems. Implementation often takes long time (typically from three to twelve months), requires significant cost, and usually assumes continuous service and upgrades additional spending.

High price for BI tools, difficult implementation and complex deployment are the reasons, why small and medium-sized businesses are seeking for their own solutions [Grabova (2010)]. The next parts of the article show that usage of BI among small and medium enterprises is going to increase in the future as software vendors start to focus on this market segment and current technological trends are disposed to be used in small business environment as well.

1.2 BI Purpose and Contributions

Definition by [Howson (2008)] discovers the main purpose and contributions of Business Intelligence: "BI enables to employees on all sorts of positions in company access to data, work with them and analyse them in order to manage company, increase its efficiency, discover new opportunities and operation activities reengineering".

To give an example of BI applications outputs, it can be expressed as information on expensiveness or profitability of products, expensiveness of company service activities and processes, development these indicators in time and further information, that helps to manage enterprise successfully. However, not only executive management derives benefits from BI outputs. On the contrary, BI tools expanded on all management levels of an enterprise and serve as an information support to workers solving strategic, tactical and also operative tasks.

[Watson and Wixom (2007)] point out the main effects resulting from BI implementation in enterprises:

- Cost savings on obtaining data due to data consolidation
- Time savings on delivering/exploitation data
- Higher quality of information
- Better support for decision making
- Business process reengineering
- Support for achievement of strategic business goals

All these objectives can be applied both for large enterprises and for small and medium businesses.

Analogous to other investments in ICT area, we can run into issues with difficult measurability of the BI implementation contributions. Criteria of successful implementation evaluation should be set deliberately. It is possible to use both hard and soft metrics for this evaluation. Included may be also both technological criteria and business metrics.

1.3 BI Usage Areas

BI is currently perceived as one of the key technology that may bring significant benefits to a company. According to [Gartner (2013)] research the BI implementing was the most important technological goal in questioned companies in 2012.

Usage according to industry looks as follows. Financial engineering, banking, consulting companies, insurance industry, IT companies, manufacturing concerns, health service, telecommunication and business companies are ranked among the business branches that most often derive benefits from BI. Also some public institutions use BI tools to better and effectively manage their operations.

Taking a look on the BI usage from enterprise size point of view, the majority of large-sized companies already use some kind of BI tools. As mentioned, the BI usage or implementation belongs to the one of the biggest priorities in large companies in past few years.

On the other hand, situation in small and medium businesses looks differently, as shows the research in [McCabe (2012)]. This survey remarks that the smaller company is, the less the BI usage is. As the research paraphrased in [McCabe (2012)] observes, "33% of midsize businesses currently use and 28% plan to use BI solutions, but among small businesses, just 16% currently use and 16 % plan to use BI solutions". [Techaisle (2011)] report states main reason for such low usage among small and medium business enterprises: SMB sector currently views BI solutions as too complex and expensive. However part 2 of this article shows some of the current technology trends that break down these barriers. The report also predicts BI usage increase in smaller companies as they also need and want to understand their costs, revenues and other data related to company performance and the BI technologies become more available, for example through Cloud services.

Among the company departments and business units, following summary shows where the most BI users come from:

- Marketing, Sales, Customer relationship management;
- Logistics, Manufacturing, Purchasing;
- Financial management, Controlling;
- Web analytics, Search engine optimisation;
- Human resources management;
- ICT management; etc.

Regarding to employee position BI usage, employees on all levels of company management (strategic, tactical and operational) can benefit from BI implementation. Distribution of the end users assumes e.g. [Howson (2008)]:

- Business and financial analysts,
- Managers (strategic, tactical),
- Internal Employees,
- External Employees,
- Customers,
- Vendors, etc.

1.4 BI Technologies Vendors

BI solution is usually compound of many technological components. In the marketplace we can find a lot of suppliers that state that they deliver "Business Intelligence" and it is not very easy to be quickly acquainted with such wide offering. We can find both individual components and the whole complex suites for BI solution creation in the BI vendors offer.

In the past, the BI solution was often built from the single components and each component was delivered by specialized vendor. However, this procedure considerably increases spending on integration of the components and the BI solution implementation goes quickly up in price. Today the suppliers come also with easily integrable suites and level of costs on BI building is not as high as before. However the quality of BI solution still depends on the whole project implementation process as the BI has to reflect the company's needs and peculiarities.

Even if we use the complex suite to develop BI solution, we still need to think about application integration, as it is needed to connect BI applications with the source systems. Complex BI suites also

always do not offer all analytical tools, e.g. advanced statistical analyses tools, from which could concrete company assets.

Among the BI vendors we can meet the well-known names like Oracle, Microsoft, IBM, SAS, SAP, MicroStrategy, and others. Over the last few years the smaller vendors such as Qlik Tech, Tibco Software or Tableau are going to the foreground. The complex suites for BI development are delivered e.g. by companies IBM (Cognos solution, IBM – SPSS Modeler) or Microsoft (Microsoft SQL Server, Microsoft BI Tools).

Among the vendors of single component the eminent market position have in the first place the database technology vendors like Oracle, Teradata, Sybase, IBM and statistical tools vendors, or SAS Institute.

However, previously mentioned vendors are heavily focused on big enterprise solutions which are often consider too complex by small and medium businesses.

As [Robb (2011)] observes, there are already the new little-known players on BI vendors market, that offer the solutions suitable for small and medium sized companies. Such solutions are easy to install and use and are not too complex as the suites offered by the current market leaders. We can find there vendors like Bitam BI, Corda Technologies, LogiXML or Targit.

In view of the recent economic crisis also the open-source BI tools and data mining analytical tools are going to be used more often (Weka, Orange, RapidMiner, SpagoBI, Palo.net, JasperSoft, Pentaho, and others). Also knowledge discovery tools and software should be mentioned (GUHA, KEX, 4ft-Miner, Lisp-Miner, etc.). These analytic tools can be used by smaller companies to avoid high costs of the BI solution.

Cloud solutions became to be most popular and can be represented by Jaspersoft cloud analytic software which is presented as open source, or by cloud solutions which can combine proprietary software with open source.

2. Business Intelligence Trends and Technologies

This part of the article discusses Business Intelligence trends that can be beneficial for small and medium-sized companies.

According to [Techaisle (2011)] survey, half of the small and medium companies currently implemented Business Intelligence solution by using spread sheets and databases. It is not any surprise that internally developed database application with MS Excel as a client tool is still the most widely deployed BI solution in this sector. Other BI solutions seem to be too complex for these enterprises. [Canes (2009)] states other barriers to BI adoption in smaller companies: "tighter budgets, less sophistication and organizational knowledge, technology hurdles and fewer people available to spend time on planning and analysis".

The following three trends introduce technologies that expect to become popular among smaller companies in the future as they simplify BI implementation or usage of the analytical outputs. Then the three methodological BI trends are mentioned, that produce information important for most of the companies including small businesses.

Software as a Service

According to [Voříšek, et al., (2008)], Software as a Service (SaaS) or Cloud services may be defined as follows: "Specialized provider maintains, operates and provides application, IT infrastructure for application running, supports application related services and delivers it to the big number of consumers through internet as a service. Users from different organization derive benefit from that application together."

SaaS model of software delivery is common today and first providers of analytics application start to appear as well. Usually the Business Intelligence related functionality is provided and combined also with other service functionality, e.g. with Customer Relationship Management. Vendor of SaaS application often offers analytical component for analytical report creation from data that customer has saved at the service.

Moreover, [Gartner (2012)] predicts, that every major BI platform vendor should present a cloud offering by 2013. SAP CrystalReports or Pivot Link can be marked as Business Intelligence as a Service examples.

BI as a Service can be beneficial for small and medium businesses from several reasons like low cost and short duration of BI implementation, ease of use or flexible payment models for a service (according to the number of users, usage hours etc.). However, there are still concerns about usage of cloud services in some enterprises, above all because of data security and privacy. Also the language barrier makes worse SaaS adoption in the Czech companies as most of these solutions are available and provide terms of use only in a few worlds' languages.

Web 2.0 and Collaborative BI

Web technologies are still very popular due to broad availability. Most companies has built intranet or extranet for sharing information between employees and business partners. Web 2.0 conceptions include space for easy creation and maintenance of web content. Very simple is also sharing of web content with others. In connection with BI, web user can online maintain a set of analytical reports in intranet, share this content among other interested users, put comments to interesting indicators or generate dynamically ad-hoc queries directly from web application.

As [Roe (2011)] points out, Gartner research marked social and collaborative technology as one of the forces that should completely transform the BI market by 2014.

The main advantage of this technology is ease of use and fast distribution of analytic outputs. From these reasons, the collaborative BI solutions are also one of the top BI trends for small businesses according to [Techaisle (2011)].

Mobile BI

Smart phones enable to run a lot of applications that were available only on personal computers in the past. It is possible to integrate analytics output with mobile access to applications. According to the prediction for 2013 mentioned in [Kotlyar (2012)], the mobile capabilities for BI will improve as related security and performance issues will be solved.

According to prediction described in [Roe (2011)], 33% of business intelligence outputs will be accessible through mobile devices by 2014. First of all the existing BI reports and dashboards will be moved to the mobile platform. Then also more vendors of mobile application for specific BI tasks should appear on the market.

Mobile analytics applications are expected to be used also by small businesses as the employees are already used to the smartphones or tablets and mobile applications. [Techaisle (2011)] report even predicts that among the small and medium-sized companies, over half of them will move to use mobile BI by 2014.

Corporate Performance Management

BI tools are more and more often focused on Corporate Performance Management (CPM). CPM deals with managing and monitoring of general business efficiency. Performance indicators are usually monitored both at the corporate level and at the level of single department or division. CPM is the methodological discipline that derives benefit from best practises and knowledge from already well-known managerial approaches for business efficiency management (e.g. Balanced Scorecard or Value Based Management). According to this methodology, CPM determines metrics for verification of business efficiency development. Information technology tools, and especially tools from BI area, can support practical realization of CPM.

Smaller businesses as well as large enterprises should focus on specification of key performance indicators and their tracking to be able to improve business results and align them to the business strategy goals.

Predictive Analysis

Traditional BI analyses were focused on the historical data processing. With the data mining and statistical tools BI becomes to be more oriented also for future forecasting based on the past data.

As [Robb (2012)] noted "Gartner predicts the next big phase for business intelligence will be a move toward more simulation and extrapolation to provide more informed decisions". Traditional forecast based on the past data can be improved e.g. by using pattern identification technics available through data mining tools. Whole planning process can then become more efficient and can have positive impact on the company productivity and profitability.

As mentioned before, there are several open-source and data mining solutions that allows implementing predictive analyses to smaller companies with low cost.

Competitive Intelligence and External Data Processing

To analyse data about competitors is very important in current dynamic economic environment, regardless of company size.

In order to create complex and up-to-date BI reports with high value added it is often necessary to integrate also updated data from external sources. Data about other business subjects can be gained from several commercial or non-commercial external sources, e.g. from government databases or registers, from external information providers etc.

However, there can be an issue with quality and accessibility of such external data. The research by [Bureš & Otčenášková & Jašíková (2012)] was focused on the quality and usability of external data (mostly from Czech resources) for BI purposes. It shows among others that “majority of the resources does not prove sufficient attributes, in terms of availability, credibility, stability, update regularity, or technical accessibility, for Business Intelligence applications”.

Despite of these findings, external sources exploitation for BI purposes has a big potential when the sources are selected carefully.

3. BI Project in a Small Enterprise – An Introduction

3.1 About the Enterprise

The company, for which the smaller Business Intelligence project is realized, entered a market in the Czech Republic more than ten years ago. It is a subsidiary company of a foreign company that runs a business in the same branch. Legal form of the company is Limited Liability Company. The company carries its business in the areas of sales, lease and service after delivery of building machines. Subject of business is then according to the Czech trading register as follows:

- Purchase of goods in order to subsequent sale and sale including servicing,
- Leasing of building machines,
- Repairs of building machines, etc.

The company employs approximately ten employees and is divided into two cost centres. Clients of the company are distributed all over the Czech Republic and include both bigger, sometimes even international enterprises, and smaller companies or small businessman.

3.2 Project Goals

Main source of business data available for analysis is accounting information system. The project is focused on the following areas:

- **Receivables analysis according to customer’s place of business.** The aim is to see which customers are the most important, which are the most frequent debtors, etc.
- **Analysis of salary costs.** The goal is to analyse costs spent for employees according to each employee, cost centres, cost accounts etc.
- **Cost/Profit analysis according to the structure of Profit and Loss Account** accounting statement. Making the cost/profit analysis according to the accounting statement enables to users to compare and analyse economic activity of the company in different time periods than in common accounting cycle. Example of the implementation process for this task is shown in part 4 of this article.

3.3 BI Implementation Tools and Technologies

Tools for the project implementation are components of Microsoft SQL Server 2005. Microsoft SQL Server 2005 consists of a database system and services supporting BI solution building.

The kernel of MS SQL Server forms database management system and above all its services for processing, saving and securing of data. These services are utilized for creation and update of database tables used in BI solution.

Brief description of services useful for BI implementation according to [Microsoft (2011)] follows:

- **Analysis Services** offer online analytical processing of data as well as functionality for data mining tasks creation. In order to create OLAP structure, Analysis services make possible design, implementation and processing of multidimensional data structures gained from data in relational databases. For data mining and for trends and figures discovering in current data, analytical services offer functionality for design and implementation of such models from the given data. There is a set of standard algorithms for data mining available.
- **Integration Services** provide a platform for data integration, extracting, transformation, and loading. Implementation of ETL processes is enabled by easy-to-use graphical editor.
- **Reporting Services** offer above all functionality for report creation from several data sources, its publishing, and delivery to users.
- **Notification Services** provide an environment for implementation of applications that generate and send notice (about changes in data, application, etc.) to users.

The applications Business Intelligence Development Studio and SQL Server Management Studio are used for BI components development.

Client part of BI solution is incorporated into MS Excel document, as MS Excel application includes support of analysis services and it is possible to work with OLAP structures both online and offline.

Advanced analytical task is implemented by using R language [R Project (2013)]. R is an open-source statistical programming language that can be useful for performing predictive analytic tasks. There is Excel plug-in called RExcel that allows running analytical task directly from the spreadsheet environment.

3.4 BI Implementation Approach

A brief description of implementation process for the project follows.

Source Data Description

Source business data for BI solution can be obtained by their export from accounting system Helios Red. Exported documents will be in the MS Excel sheet form. Following data are exported:

- **Account book** data containing number of record, date, operation description, Debit side of an account, Credit side of an account, account number
- **Receivables** data containing variable symbol, customer number, text, total amount, maturity date, total amount refunded, etc.
- **Partners** data about customer in following structure: identification number, title, business identification number and address
- **Definition of Profit/Loss account structure** containing information about connections between account numbers and their cost / income type

External data sources are used only for geographical data obtaining. Documents and code lists are downloaded from Czech Post, Ministry of Agriculture or Czech Statistical Office portals.

Multidimensional Analysis

Multidimensional database model is broadly used to analyse a big amount of data. Contrary to the relational database model, multidimensional model deals with un-normalised tables for obtaining aggregated and summary data. These data are usually related to several dimensions.

For the multidimensional structures building, two kinds of data are needed - Dimensions and Facts. They are defined by [Lacko (2009)] subsequently:

- **Facts** are the numerical business metrics.
- **Dimensions** contain logically or organizationally hierarchical structured data

Each area of BI solution should have set related Dimensions and Facts after this analysis.

Data Warehouse Schema Creation

There are two major approaches for the ordering of Facts and Dimensions tables in data warehouse, so called multidimensional schemas:

- Star schema usually contains un-normalised dimensions tables, but is relatively well-arranged and transparent.

- Snowflake schema in contrary contains multiple normalized and related dimensions tables.

There is a centralized Facts table connected to the related dimensions tables in both cases.

ETL Tools Implementation

Data pumps are created with the help of MS BI Development Studio that contain graphical editor for easy design and implementation of data transformation and integration of data from different sources. Source data can be in different formats, plain text, XML, MS Excel documents or relational database. Data can be transformed and loaded to different destinations. In case of BI projects, transformed data are most often loaded to data warehouse.

Mostly used editor tool for design of data pumps is called **Data Flow** task. Data Flow task is in charge of data extraction from source destinations, data transformation and data loading to target destinations. We always define source and target destinations in the task, and also we can choose from the set of transformation operations. Common transformation functions are described by [Lacko (2009)]:

- **Aggregate** function applies aggregation function (minimum, maximum, average, sum etc.) on the incoming set of data.
- **Conditional Split** function divides the set of data into more subsets.
- **Copy Column** function adds new columns, which are the copies of columns from input data set.
- **Data Conversion** function offers possibility to change data type of a column during the transformation.
- **Derived Column** function makes it possible to create new column derived on the basis of values in input column.

Data Loading to Warehouse

After the data warehouse schemas creation and data pumps implementation it is easy to load data into data warehouse tables. Data in the warehouse are fully prepared for online analytical processing.

OLAP Structures Implementation

Creation of OLAP structures from data warehouse can be also done by MS BI Development Studio.

First of all the dimensions should be generated. If the data warehouse contains correct tables schema and relationships between tables are set correctly, there is no need to do any additional adjustments to the automatically generated dimensions tables. Also the Time dimension can be generated automatically in the Development Studio.

To create an OLAP cube in the Development Studio, it is necessary only to select related dimensions and facts objects and cube will be also created automatically.

End-User Applications Implementation

Creation of output analyses proceeds in the application MS Excel, as lot of employees can deal with it. MS Excel in the version 2007 includes functionality for external data connection and OLAP cubes created in Development Studio can be used as a source as well.

MS Excel can communicate with Analysis Services on a client-server basis: OLAP server included in Analysis Services does the calculation requested and Excel serves as a browser.

OLAP cubes can be also exported to offline format with *.cub* suffix and can be used with Excel application in case that analytical server is not accessible.

Analytical data are displayed in Excel in the form of contingency tables or graphs. Common Excel functions can be applied on data as well, e.g. filtering or conditional formatting.

R language add-in for Excel allows advanced data analysis tasks executions. Data exported from multidimensional output can be used for further examination, in this case for time series decomposition and forecasting of some indicators. It is possible to call R code directly from Excel worksheet or from Excel macros written in VBA.

4. Cost / Profit Analysis Implementation Example

As an example of one BI task implementation, the analysis according to Profit and Loss Account structure is chosen. Costs and income information are very important for both company owners and company managers. It is also possible to gain key indicators like Return on sales from the Cost / profit analysis.

4.1 Source Data Description and Multidimensional Analysis

Source data for the task can be fully obtained from the accounting system; especially data from Account book are useful. It is possible to export from the accounting system also the definition of the Profit and Loss Account accounting statement.

During the multidimensional analysis, dimensions and facts related to the task are investigated. Facts are represented by indicators shown in Tab. 1. Two main dimensions that are necessary for multidimensional view are figured in Tab. 2.

Tab. 1: Indicators (Source: First author)

| Indicator | Unit | Source | Calculation |
|--|------|---|--|
| <i>Profit and Loss Account Balance</i> | Kč | Account book | $\Sigma\text{Credit} - \Sigma\text{Debit}$ |
| <i>Return on Sales (ROS)</i> | | Account book, Profit / Loss Account Definition | Net profit / Turnover |

Tab. 2: Dimensions (Source: First author)

| Dimension | Source | Structure |
|--------------------------------|-------------------------|------------------------|
| <i>Time</i> | Automatically generated | Year – Quarter - Month |
| <i>Profit and Loss Account</i> | P/L Account Definition | See Fig. 1 |

Creation of Profit and Loss Account dimension is not trivial. Its hierarchy is shown in the Fig. 1. Some hierarchy levels include totals of other levels and some reference to a specific group of accounts. The utility table for Profit and Loss Account hierarchy creation was created to formulate relationships between cost/profit accounts and other entries.

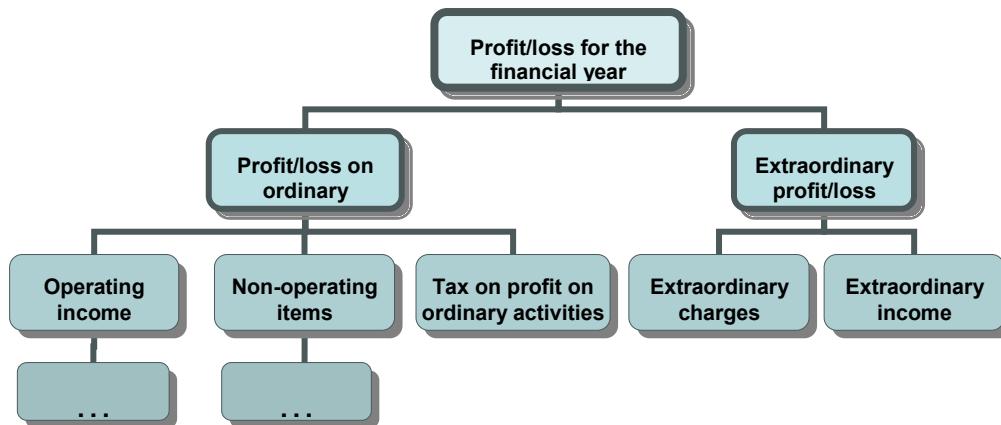


Fig. 1: Profit and Loss Account Structure (Source: First author)

4.2 Data Warehouse Schema Creation

MS SQL Management Studio tools are used for empty database tables creation on the database server. Relationships between tables by foreign keys specification should be also done in this project phase.

Facts table contains data about account balance.

Dimensions are built by two tables: Profit / Loss Account dimension table and Time dimension table.

For the Profit / Loss Account dimension the Star schema is chosen and the table references itself.

4.3 ETL Tools Implementation

ETL process includes data extraction from source destinations, data transformation and data loading to target destinations.

The utility table is used as a source of data to be loaded into the dimension table and data from Account book represents source for facts table. Transformation function is applied during the facts table loading. The function adds a new column with the identification related to the record of Profit and Loss Account dimension.

4.4 OLAP Implementation

After the settings of correct parameters for a new dimension in Development Studio, the dimension Profit and Loss Account was successfully automatically generated. Preview of this dimension is shown on Fig. 2. Time dimension can be generated automatically in the Studio as well.

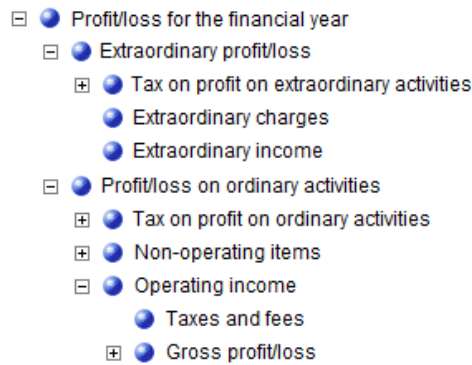


Fig. 2: Profit and Loss Account Structure Preview (Source: First author)

4.5 End-User Application Implementation

Preview of the resulting BI analysis follows:

| Profit and Loss Account 2010 | Calendar 2010 | | | | Total 2010 |
|---|-------------------|------------------|------------------|-------------------|--------------------|
| | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | |
| Profit/loss for the financial year | -1122618,7 | 217781,34 | 204862,43 | 1980488,11 | 1280513,18 |
| Extraordinary profit/loss | -0,04 | 0,4 | 0,2 | -40825,75 | -40825,19 |
| Extraordinary charges | -0,04 | -0,1 | | -41588,32 | -41588,46 |
| Extraordinary income | | 0,5 | 0,2 | 762,57 | 763,27 |
| Profit/loss on ordinary activities | -1122618,66 | 217780,94 | 204862,23 | 2021313,86 | 1321338,37 |
| Tax on profit on ordinary activities | | | | -73530 | -73530 |
| Non-operating items | -21317,28 | -14596,32 | 22035,26 | 151716,42 | 137838,08 |
| Interest payable | -21736,57 | -24861,19 | -23153,12 | -169354,01 | -239104,89 |
| Other non-operating charges | -3405,71 | -13672,43 | -7270,31 | -25291,98 | -49640,43 |
| Other non-operating income | 3825 | 23937,3 | 52458,69 | 346362,41 | 426583,4 |
| Operating income | -1101301,38 | 232377,26 | 182826,97 | 1943127,44 | 1257030,29 |
| Taxes and fees | -18107,41 | -9226,6 | -26431,18 | -62227,24 | -115992,43 |
| Gross profit/loss | -138293,86 | 230448 | 4443,67 | 959952,48 | 1056550,29 |
| Cost of sales | -673647,69 | -132652 | -11848 | -1800105,69 | -2618253,38 |
| Turnover | 535353,83 | 363100 | 16291,67 | 2760058,17 | 3674803,67 |
| Depreciation and amortization | -158341,8 | -307120,96 | -224333 | -223807 | -913602,76 |
| Personnel costs | -973265 | -880295 | -924511 | -890565 | -3668636 |
| Other operating charges | -89398,52 | -55891,07 | -59061,66 | -152868,56 | -357219,81 |
| Other operating income | 4524,15 | -6025,48 | 734,05 | 219186,75 | 218419,47 |
| Income from fixed assets sold | 528738,46 | 750393,81 | 673565,67 | 925333,38 | 2878031,32 |
| Production consumption | -1253382,84 | -1667514,47 | -1868117,46 | -1962237,79 | -6751252,56 |
| Production income | 1479757,19 | 2781288,87 | 2916435,54 | 4013795,59 | 11191277,19 |
| Changes in reserve funds and corrective entries | 37981,5 | | | -457741,9 | -419760,4 |
| Residual cost of fixed assets sold | -521513,25 | -603679,84 | -309897,66 | -425693,27 | -1860784,02 |
| Total | -1122618,7 | 217781,34 | 204862,43 | 1980488,11 | 1280513,18 |

Fig. 3: Profit and Loss Account Analysis Output (Source: First author)

Time series analysis and forecast application has been built for the Profit and Loss Account table by using Excel ActiveX controls and R add-in. Drop down menu allows to select an item from Profit and Loss Account, e.g. Sales of material. The related time series data are stored as R variable by pressing button. RExcel contains command line to call R functions/scripts above the stored R variables.

The company's business is connected to the building industry and the seasonality is evident in the sales results data. R functions for seasonal data decomposition were applied in order to find out the trend, seasonal and irregular components of time series. In order to forecast future sales of material, the HoltWinters function according to [Coghlan (2010)] was called. One of the advantages of R language is an advanced graphics, Fig. 4 shows an example.

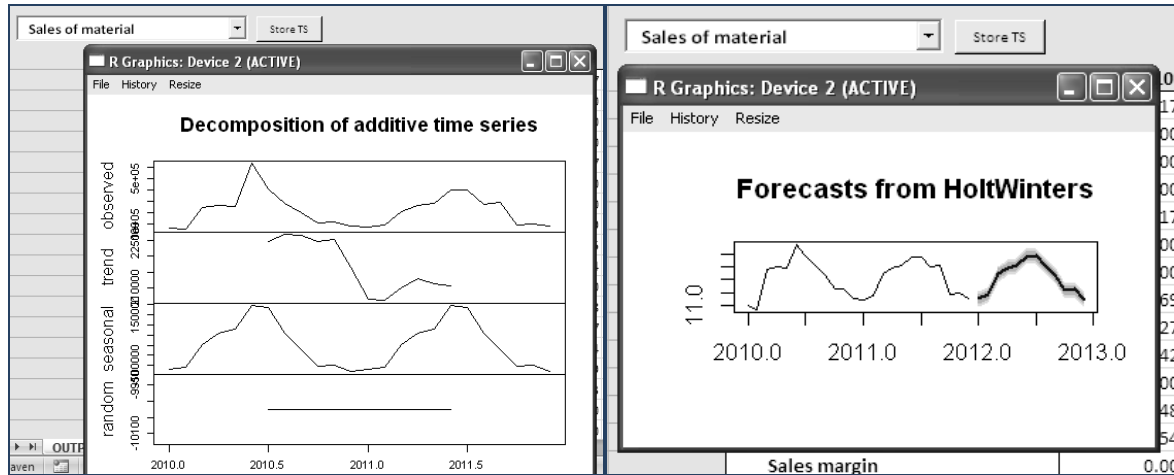


Fig. 4: Time Series Analysis and Forecast graphical output in RExcel
(Source: First author)

5. Conclusions

BI tools provide access to data and their analyses in order to effectively manage enterprises across all sizes. However, the usage of BI in small and medium businesses is lower than in large companies as common BI solutions seem to be too complex or costly for small business's needs.

The first part of this contribution described several trends, which can positively affect the BI usage rate in SMB sector. For example cloud computing BI provides several advantages for smaller companies like lower implementation cost and ease of use. Another option how to decrease BI implementation cost is to use open source tools and applications.

The second part of article presented a possibility, how business intelligence project can be built in a small company. The solution takes an advantage both from commercial software and open-source.

The BI solution and implementation for the small Czech company included multidimensional analysis, data warehouse and data pumps implementation and creation of OLAP model and application for end-users. BI basis for the company was built up and now it is not any problem to add another dimensions or indicators useful for decision making in the company. We can mention possible future enhancements like implementation of offered products and services and their margins analysis or implementation of another accounting statement model. Predictive time series data analysis or other advanced statistical analyses can be also executed directly in Excel integrated with language R.

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