Towards a Corporate Performance Measurement System

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ABSTRACT

Corporate performance measurement is focused too strongly on the traditional functional structure of an organisation and business processes are not measured systematically. Basically, business processes are designed to transform organisational strategies into operation and create a result of value to customers. As a business process is performed by a group of organisational units, processes and the organisational structure are interdependent. Consequently, their performance must not be measured in isolation. This paper illustrates how a data warehouse can be used to facilitate a Corporate Performance Measurement System by the integration of business process performance information into a traditional data warehouse that generally represents only the functional organisation. The Corporate Performance Measurement System provides a single source of information on the performance of the company. As a proof of concept in a business environment, a feasibility study has been implemented in the insurance sector. This performance measurement approach fully supports a modern organisational structure: the customer-oriented process perspective coexisting with the traditional functional structure.

Keywords

Business Processes, Data Warehouse, Performance Measurement, Workflow Management Systems

1. INTRODUCTION

 "Measurements are the key. If you cannot measure it, you cannot control it. If you cannot control it, you cannot manage it. If you cannot manage it, you cannot improve it." [4]. An organisation's measurement system strongly affects the behaviour of people both inside and outside an organisation. If companies are to survive and prosper in the information age competition they must use measurement systems derived from their strategies and capabilities [5]. One of the main shortcomings of current performance measurement systems is that business processes are not measured systematically. Even those companies that have launched business process re-engineering projects often neglect process performance measurement. Instead, measurement takes place at department or business unit level, but not at process level.

A number of authors have been criticising traditional performance measurement. For instance, Kaplan and Norton developed the Balanced Scorecard [5] due to the fact that quality-oriented performance measures such as business processes or customer orientation were not an integral part of regular management reports, and financial figures are the consequences of yesterday's decisions and not the indicators of tomorrow's performance.

In modern organisations, Data Warehouse Systems are facilitated for performance measurement. Building a data warehouse is still very much driven by technology and does not yet offer well-established strategies and techniques for the development process. State-of-the-art performance measurement theories are not associated with data warehouse development. Therefore, Data Warehouse Systems represent mainly the traditional way of performance measurement. Today, the main design focus of Data Warehouse Systems is on customer relationship management (e.g. customer satisfaction, customer retention, new customer acquisition, customer profitability, market and account share, etc.) and financial measures (e.g. turnover, cost, margin, etc.). In Balanced Scorecard terms, the financial perspective and customer perspective are tackled, but the internal business process perspective and the learning and growth perspective are not addressed at all. As a further step towards a Corporate Performance Measurement System, the internal business process perspective ought to be integrated into the corporate data warehouse. Beside the advantage of reusing corporate data warehouse management facilities, it leverages analysis advantages through conformed dimensions for business process performance measurement. This single source of information on the performance of the company also avoids inconsistent measures.

Basically, we see the Balanced Scorecard as a framework for the Corporate Performance Measurement System, but not as a foundation for business process performance measurement. The Balanced Scorecard looks at business processes only as far as they have a great impact on customer satisfaction and achieve an organisation's financial objectives [7]. It is focused on corporations or organisational units such as strategic business units, but lacks a detailed and holistic business process performance measurement approach.

This work integrates process performance measurement into the corporate data warehouse. As a proof of concept in a commercial environment in terms of usability and acceptance, a case study has been realised in a large insurance company. Workflow Management Systems are seen at this insurance group as a strategic technology to automate business processes. The workflow log provides very detailed information on the history of process instances. The core business processes of the insurance company, the proposal handling and the claim processing business process, are implemented with a Workflow Management System. This paper is focused on the measurement and analysis of the proposal handling business process.

The following section presents a brief overview of the requirements of a Corporate Performance Measurement System. In section 3 the organisational setting of the insurance company is presented. The business requirements of the proposal handling business process and the resulting data model are described in section 4. Some analysis examples are given in section 5. Section 6 presents user acceptance issues. In section 7 an overview of current research is given. The evaluation of the feasibility study and lessons learned can be found in section 8.

2. REQUIREMENTS OF A CORPORATE PERFORMANCE MEASUREMENT SYSTEM

In an empirical study, carried out at Fribourg University, Switzerland, four main shortcomings of current performance measurement systems have been identified (see [6]): 1) Performance measurement is focused too strongly on financial performance indicators. 2) Business processes are not measured systematically. 3) Performance data becomes available with a considerable time lag. In many companies performance-relevant data is extracted from many different systems and it is not unusual that manual data handling is needed. 4) Access to performance data is complicated, as the relevant data is dispersed over different functional units and performance data is stored in different formats (electronically, on paper). In addition, decentralised data management may lead to inconsistent data.

To overcome these shortcomings a Performance Measurement System (PMS) is suggested in [6]. A PMS is a system that stores and manages all performance-relevant data centrally; including both financial and non-financial data [7]. The main objective of a PMS is to provide comprehensive and timely information on the performance of a business. This information can be used to communicate goals and current performance of a business process or business units directly to the process team or the business unit to improve resource allocation and output in terms of quantity and quality, to give early warning signals, to make a diagnosis of the weaknesses of a business, to decide whether corrective actions are needed, and to assess the impact of actions taken [6].

According to [6], [8] and [9] a PMS should meet various requirements: First of all, the system must be capable of tracking both financial and non-financial performance indicators. For instance, it must be possible to introduce performance indicators that are needed to assess a company according the Balanced Scorecard. Using a broad set of performance indicators requires the inclusion of both company-internal and external indicators. This in turn means that the PMS must be able to gather data from various sources. The performance-relevant data collected must be stored on a non-volatile media (e.g. a relational database) so that the data can be analysed over a long period of time. Performance data stored in a PMS must be accessed by different levels of staff such as process owners or general managers. To lower the barriers to use, the system must be equipped with a user-friendly interface, which will support, for example, an easy data selection mechanism, free choice of data aggregation levels, and any selection of attributes to compare. Moreover, security features must control the access to the system; i.e. defining and checking which people have the right to see which data. Additionally, a PMS must take into consideration not only the level of current performance but also the target values for each performance indicator. Finally, a PMS must support the automated dissemination of results.

3. ORGANISATIONAL SETTING
3.1 Organisation
The organisation is a large insurance company, which is primarily operating in Central Europe. It is made up of a multitude of companies in Austria, Hungary, the Czech Republic, Slovenia, Slovakia, Poland and Romania. There are 11.300 employees on their payroll. The Group's biggest insurance segments are property/casualty ahead of life and health. The organization belongs to a worldwide operating insurance group comprising 58.600 employees on their payroll. It is the 6th largest insurance group worldwide by revenue and one of the largest in Europe. Deregulations of the insurance sector, the single European currency and the global European market as well as numerous mergers have been turning this sector into a competitive market. In order to cope with future challenges in the marketplace and to keep up with competitors, the insurance group's main objectives are: firstly, to improve customer value and secondly, to reduce administrative cost.

3.2 Business Process
Core business processes concentrate on satisfying external customers and directly add value to the company. They respond to a customer request and generate customer satisfaction. Core processes are crucial to the success of the company. The insurance company has got two core business processes, the proposal handling and the claim processing business process. This paper is focused on the proposal handling process (see Figure 1). The proposal handling process is limited to insurance brokers and does not interact with final customers. Each broker belongs to a region. The process covers the complete range of insurance products that are categorised by the line of business. Up to 150 users are involved in the processing of some 100.000 instances per year.

The proposal handling process includes the following activities: A broker sends a proposal to the insurance company and has the option to add the business importance in order to influence the performance of processing. A clerk checks the proposal for completeness. When data is missing, a broker key account manager requests these from the insurance broker and the clerk checks the proposal again. After data completion and an appropriate discount the broker key account manager signs the discount and the policy is generated and archived. When the discount is too high, either a director gives his approval or a broker key account manager negotiates the discount with the

insurance broker again. When an agreement on the discount cannot be achieved, the proposal is rejected, a rejection letter is sent, the insurance confirmation is withdrawn and the proposal is archived. Incoming proposals are handled until the insurance policy is successfully generated and archived or the proposal is rejected. The rejection of a proposal is caused by missing data or discounts that are not accepted by the insurance company.
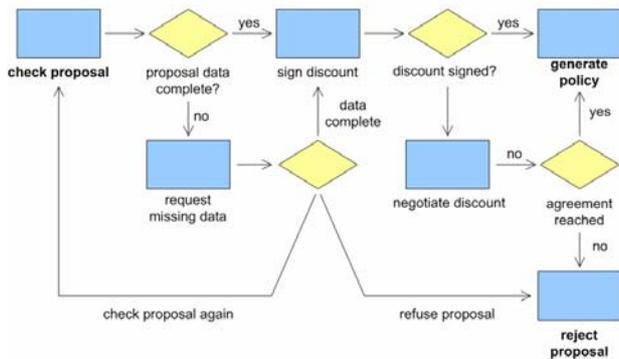

Figure 1 Proposal Handling Business Process

3.3 Workflow Management System

Workflow Management Systems are seen by the insurance company as strategic technologies to improve business processes, increase productivity, reduce cost and improve the product or service supplied. Currently, their core business processes, the proposal handling and the claim processing business process have already been automated with Workflow Management Systems.

IBM MQSeries Workflow™, a Production Workflow Management System is utilised to automate the proposal handling process (see Figure 1). The workflow is classified as a production workflow, because the business value and the degree of repetition are very high [10].

The meta-model of IBM MQSeries Workflow™ consists of a process model and an organisation model. The organisation model is composed of organisational units, roles and individuals. These entities are assigned as process performers to entities of the process model. The process model is composed of processes, process activities (sub process), block activities (loop) and program activities (application). A process type is defined in the build-time environment.

A process instance is executed in the runtime environment according to its process definition. Workflow Management Systems can be seen as state event machines; process and activity instances get through events into certain predefined states. All events in the life cycle of a process instance or an activity instance are recorded in the audit trail that is either a relational database table or a file. Each record in the audit trail contains a number of information including, but not limited to following items: date and time when the event takes place, type of event, process identifier, parent process identifier, activity type, activity state, activity identifier, started program name, role or id associated with the event, etc.

The Workflow Management System tracks any event change with a timestamp in the workflow history log or audit trail. As a consequence, workflow management systems facilitate workflow monitoring and controlling and play a key role in measuring the efficiency of business processes, which is crucial for the success of continuous improvement. The audit trail of IBM MQSeries Workflow™ is stored in a database table and can be accessed easily. Although the insurance company has launched some business process re-engineering projects and a detailed workflow history is available of all core business processes, process performance measurement is not addressed at all.

3.4 Corporate Data Warehouse

In the insurance company, performance measurement takes place at department or business unit level. The data warehouse that is used is IBM DB2™ and Cognos Power Play™ is the utilised OLAP tool. The corporate data warehouse, which consists of five data marts, serves business units and business departments with measures. Its main focus is on customer relationship management (e.g. customer satisfaction, customer retention, new customer acquisition, customer profitability, market and account share, etc.) and financial measures (e.g. turnover, cost, margin, etc.). Consequently, the financial perspective and customer perspective are tackled, but the internal business process perspective and the learning and growth perspective are not addressed at all.

The internal business process perspective identifies and measures critical processes in which the organisation must excel [5]. These business processes enable the organisation to meet customer and financial objectives. As core business processes are of fundamental importance, the next step is to incorporate process performance measurement into the corporate data warehouse in order to take a further step towards a Corporate Performance Measurement System.

4. DESIGN OF THE PMS

4.1 Goals of the Proposal Handling Process

From the company goals – improve customer value and reduce administrative cost – business process-specific goals were derived according to the Wal-Mart Model [13]. The overall goal of the proposal handling process is 'high customer satisfaction'. In order to achieve this goal the process duration for carrying out the proposal should be low as well as customer complaints should also be little. Currently the process duration is up to 2 months. This is definitely too high. The customer has the right to withdraw from the contract, if the policy has not been issued within a month's time. Because of these troubles and the upcoming deregulation of the insurance market within the European Union the board of directors ordered a reduction of the proposal process cycle time to 48 hours.

The PMS to be created is used by two categories of staff: general managers (i.e. heads of business units) and process owners. The business questions that support these people are derived from process goals and gathered with measures and data sources in Table 1. A lot of business question can be answered with audit trail data tracked by the Workflow Management System. Others require data from external sources, as Workflow Management Systems do not provide any application data. Beside the audit trail, two external data sources were included into the corporate

data warehouse. The most important external data source is the proposal and contract database. Detailed information on a proposal or a contract as well as information on changes or updates is stored there. Information on complaints is stored in the customer relationship management database, the second external data source.

Table 1. Business Questions of the Proposal Handling Process

Business Question	Measure	Data Source
How many process instances have been processed for each process and product type?	number of instances	External
What is the process cycle time?	cycle time	Audit trail
What is the process working time?	working time	Audit trail
What is the process waiting time?	waiting time	Audit trail
What is the activity cycle time?	cycle time	Audit trail
What is the activity working time?	working time	Audit trail
What is the activity waiting time?	waiting time	Audit trail
What role is responsible for the waiting time?	waiting time	Audit trail
What role is responsible for the working time?	working time	Audit trail
Does the product type influence the cycle time?	cycle time	External
Does the region influence the cycle time?	cycle time	External
Does the broker influence the cycle time?	cycle time	External
Which brokers are responsible for insufficient proposals?	number of revisions	External
Which cycle time had the process instances of lost customers?	cycle time	External
How many process instance have a bad performance ranking (the cycle time is 50% higher than the target cycle time)?	number of instances	Audit trail
How many complaints came from VIP-customers?	number of complaints	External
Does the customer category influence the cycle time?	cycle time	External
Does the business importance influence the cycle time?	cycle time	External
Does the number of revisions correlate with the number of customer complaints?	number of revisions number of complaints	External

4.2 Data Model

Product, broker, geographic, organisation and customer data are required from external data sources in order to develop a PMS that is capable to answer the business questions (see Table 1). These external sources are already represented in the corporate data warehouse as dimensions for product, broker, region, organisation and customer and can be reused. The integration of process performance measurement into the corporate data warehouse leverages analysis advantages through conformed dimensions and saves resources through the reuse of these dimensions.
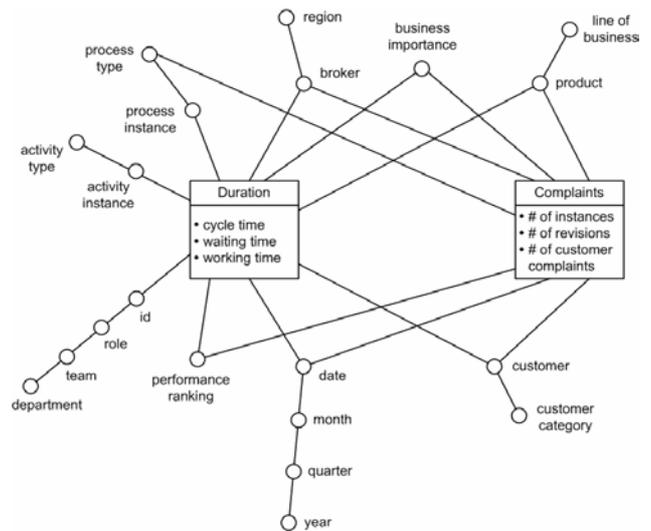

Figure 2 Conceptual Design of the Performance Data Model

We applied the Dimensional Fact Model (DFM) notation [3] to the data model (see Figure 2). The representation of reality built using the DFM is called dimensional scheme and consists of a set of fact schemes. The basic components of fact schemes are facts, measures, dimensions and hierarchies.

Figure 2 shows the process performance data model used for the company described in the previous section. In the center the facts *Duration* and *Complaints* are shown. Each cube has its own measures, e.g. cycle time for the fact *Duration*. The measures for the fact *Duration* consists of: *working time, waiting time* and *cycle time*. The fact *Duration* is based on process and activity instance level and the fact *Complaints* is based on process type level. Furthermore, the facts are attached through conformed dimensions. As shown on the *Process* dimension several hierarchies can be built (for instance *Process type* and *Process instance*). For each hierarchy the aggregation path is shown. Starting from the bottom element, which is the closest to the fact to the next higher aggregation level.

5. ANALYSIS CAPABILITIES

In the next step the conceptual data model (see Figure 2) was implemented physically with a star schema in the corporate data warehouse. The construction phase was performed smoothly and on time, because the audit trail and all other data sources provided very high and stable data quality.
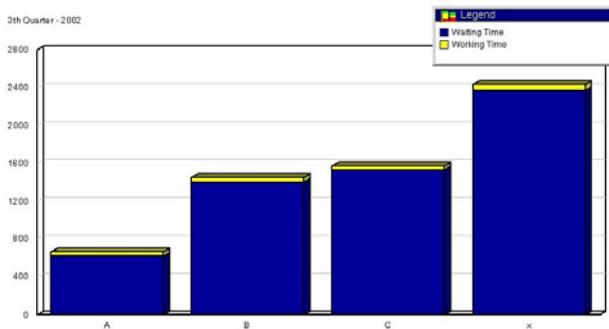
Figure 3 Average Process Cycle Time per Customer Category

Figure 3 shows the average cycle time per customer category of the proposal handling business process in the third Quarter 2002 and compares working time (bright) and waiting time (dark). Customer categories classify customers by their importance for the insurance company. Category A is more important for the insurance than B, C and X. Therefore, the waiting time and also the cycle time is the lowest for category A.
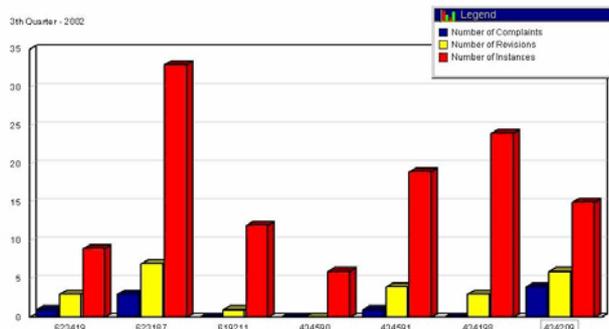

Figure 4 Number of Complaints compared to Instances

Figure 4 shows all measures of the fact *Complaints*. Basically, there are only few complaints, although they increase with the number of revisions. Revisions represent missing customer data on the proposal. As a consequence of missing customer data the broker is requested to refill the form. An analysis of the average waiting time of the process by broker could show, whether certain brokers work very imprecisely. This could lead to an incentive system for brokers. For the insurance company it is very important to identify those brokers who are responsible for insufficient proposals. Insufficient proposals cause additional revisions, increased cycle times and finally increased costs. Figure 4 shows the number of complaints, the number revisions and the number of process instances for each broker in the third quarter of 2002. It is presented that most of the brokers caused one ore more additional revisions and only a few customer complaints happened. Broker 434209 is responsible for 15 instances but also for six additional revisions. Therefore, a more detailed inspection of this broker respectively the associated process instances should be done.

Figure 5 shows that there are two brokers (G and I) who have a very high average waiting time. This could be a sign of imprecise proposal data that has been conveyed to the insurance company. A drill-down to the waiting-time of the activity *request missing data* will provide more evidence.
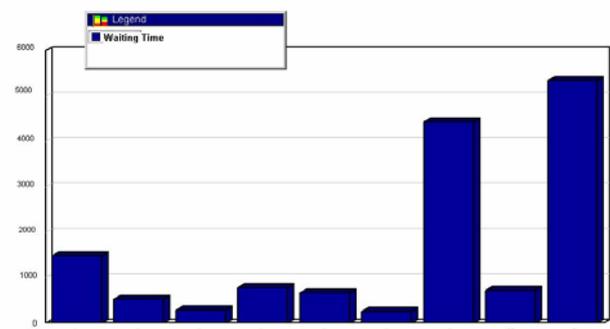

Figure 5: Waiting time per Broker

Figure 6 shows the development of the process cycle time over time. Each workflow participant processed only a few instances during the pilot phase of the system from September 2001 until March 2002. In April the complete operational process was started. Workflow participants were becoming familiar with the new application that supports the process during the pilot phase and at the beginning of April. The development of the cycle time curve shows that the process duration is steadily declining due to the workflow participants' experience gained. The knowledge of workflow participants is developing with time, through experience! Constant process durations represent well-qualified process participants and a well-designed process. From this point on the process cycle time should be monitored to spot any increase due to a lack of motivation. This occurrence would provide indication of non-motivated workflow participants and a job rotation initiative has to be considered.
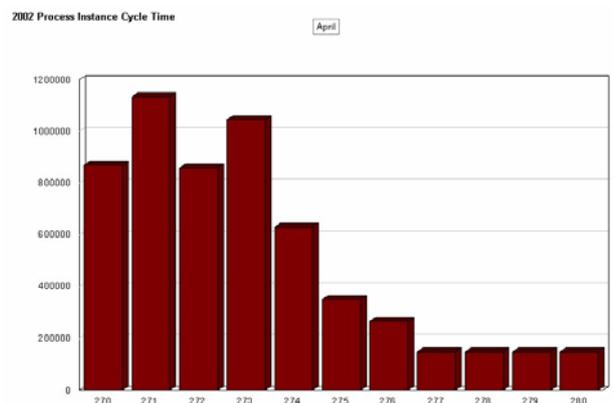

Figure 6 Process Instance Cycle Time

Figure 7 goes away from the process perspective and moves towards business unit measures. It shows the number of contracts per category. Category A has a low number of contracts but generates very high revenue. Category A customers are of major importance to the insurance company. Therefore, it is essential that these contracts are speedily processed. If the proposal handling business process works well, high profits will be generated. If category A customers are unsatisfied with the process, the economic success of the organisation will be even put at risk.
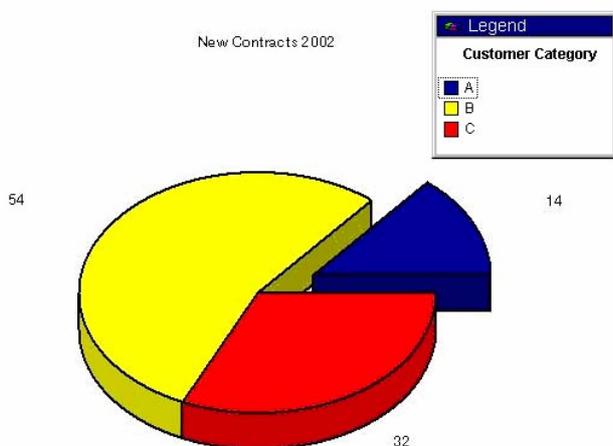
Figure 7 Number of new Contracts per Customer Category

Figure 8 moves also towards business unit measures. It shows the revenue of contracts per customer category. Although the number of category A contracts is low, the revenue is quite high. The revenue of category B is rather low compared to its large number of contracts.
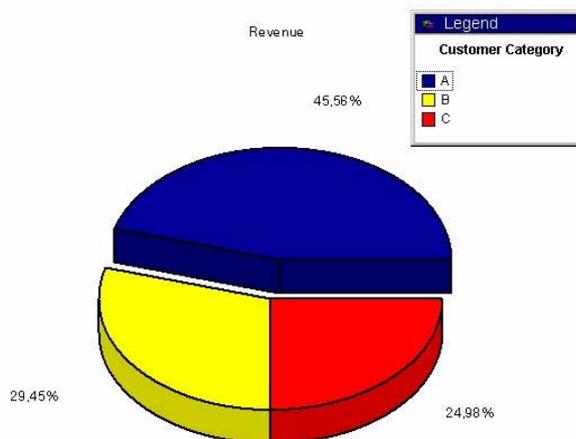

Figure 8 Revenue of Contracts per Customer Category

6. USER ACCEPTANCE

At the end of the project, the implemented prototype was presented to a small group of potential users (process managers and department managers). Those, who were involved during the design process, already knew the basic functionalities of the system. But not even one of those had an idea of the enormous potential of the system.

Most people were very much impressed by the capabilities of the system. Especially the integration of the process performance measures into the corporate data warehouse convinced the users that the prototype provides an added value to the organisation. In some cases the results of our analyses examples led to new conclusions, in other cases existing assumptions have proved successful.

The users got familiar with the system easily. We got a lot of suggestions how to further improve the prototype (i.e. adding a *process state* dimension that separates successful and non-successful process instances). The enormous user acceptance provided evidence that the prototype was a success. Finally, the system has been implemented for a new and fast growing business unit of the insurance company. The new system is considered a success and is included into the operational environment.

7. RELATED WORK

Corporate Performance Measurement Systems have received relatively little coverage in the related literature. Most publications in this area address this issue with a very limited perspective.

The Process Warehouse is defined as a separate read-only analytical database that is used as the foundation of a process-oriented decision support system in order to analyse and improve business processes continuously [11]. The Process Warehouse is a data warehouse approach applied to workflow history data. Four case studies based on three development methodologies [12] – a user-driven, a data-driven and a goal-based approach – have tested the Process Warehouse concept. The goal-based approach translates the business process strategy into balanced measures. Its aim is to support the long-term goals of the organisation in terms of business processes. The data-driven approach aims at narrow monitoring. All approaches integrate external data sources. The focus of the Process Warehouse is entirely on business process measurement and it does not address the integration into a Corporate Performance Measurement System.

Eder introduces in [2] a concept and the prototypical implementation of a data warehouse applied to workflow logs. Starting point for the data warehouse architecture is the meta model of the workflow management system @enterprise and some characteristic process information needs. External data sources beside the workflow log are not involved. This bottom-up approach represents information that is suited for close monitoring as well as for mining purposes and represents the tayloristic measurement approach. The aspect of designing an information system which satisfies special user needs or supports long-term business goals is not considered.

A related approach is called workflow data warehouse is described in [1]. The goal was to develop a software solution, which was an extension to the HP Process Manager (HPPM) but the basic architecture could be applicable to any workflow management system. Like [2] the design is not optimised for needs of specific users. The design should only satisfy general customer needs. The integration of external data sources is not intended.

8. CONCLUSION

It has been shown that a Corporate Performance Measurement System requires the integration of business process performance information into a traditional data warehouse. The Corporate Performance Measurement System provides a single source of information on the performance of the company. It makes a holistic and consistent assessment of performance available to its users.

The feasibility study, implemented in the insurance sector can be also seen as a proof of concept of this approach in a commercial environment in terms of usability and acceptance. This performance measurement approach fully supports a modern organisational structure: the customer-oriented process perspective coexisting with the traditional functional structure.

In addition, the corporate data warehouse approach enables the use of different analysis and reporting tools. In our example, we used IBM DB2™ and Cognos Power Play™, but other tools could be employed instead. Both tools facilitate the creation of web-based user interfaces, and this in turn, lowers the barriers of managers against the adoption of a new performance measurement system. The integration of process performance measurement into the corporate data warehouse leverages analysis advantages through conformed dimensions and saves resources through the reuse of these dimensions and analysis tools.

All in all, we believe that the approach of incorporating a process perspective into a corporate data warehouse represents a step forward towards a sound and integrated performance measurement which in turn represents a prerequisite to improve business processes on a continuous basis and achieve long-term organizational goals.

9. ACKNOWLEDGEMENT

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