OLAP ANALYTICAL SOLUTION FOR HUMAN RESOURCE MANAGEMENT PERFORMANCE MEASUREMENT AND EVALUATION: FROM THEORETICAL CONCEPTS TO APPLICATION

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Abstract — Human capital provides organizations the ability and readiness for adaption to turbulent changes in the business environment. Human resources are the only active and creative part of work process. For this reason, the strategy of human resources development is one of the most important segments of the strategy of organization development. Organizations can improve their business performance by developing analytical systems. Using the analytical systems, organizations are able to continuously measure and assess its performance, take corrective actions and provide stable position in today's competitive environment. The system should enable easy and efficient monitoring and analysis of data. Comparing planned values with actual achievements of management, organizations can identify critical points in terms of achieving the goals. This paper will present a theoretical and methodological foundation of human resource management, and describe developed OLAP analytical solution for human resource management performance measurement and evaluation.

I. INTRODUCTION

The emergence of information systems as a key factor in business operations analysis and a tool for reduction of business operating costs has significantly changed the approach to business management. Companies are forced to constantly measure and evaluate their performance and undertake corrective actions in order to retain their position in the competitive environment. Since in majority of companies employee earnings account for almost a half of business operating costs, it is possible to conclude that one of the most vital factors in gaining competitive advantage is exactly the contribution of labour force to a company’s performance. The use of functional and powerful system for human resource management increases the possibilities of a company’s potential growth and development. The application of analytical systems enables companies to manage business operations more efficiently and hence improve business performance, increase profitability through more efficient cost control and optimize the number of employees. The use of analytical systems to track labour force performance allows managers to gain an insight into employee contributions to achievement of company’s goals and shows which employees possess suitable competencies that are required to build competitive advantage.

II. THEORETICAL AND METHODOLOGICAL FOUNDATIONS OF THE DEVELOPMENT OF A SYSTEM FOR MONITORING THE PERFORMANCE OF THE PROCESS OF HUMAN RESOURCE MANAGEMENT

A. The Purpose and Nature of Human Resource Management

The majority of authors agree that a company cannot function without human resource support. With their knowledge and skills, the employees greatly impact the company’s performance and its position in the market. Human Resource Management - HRM represents a strategic, integrative and coherent approach to recruitment and development of employees so that they can contribute to the achievement of the company’s goals, [1]. HRM comprises a variety of processes and activities, such as human resource planning and organizing, recruitment, education and training of employees, assessing the effectiveness of HRM strategies and undertaking corrective actions. The scope of HRM covers five main activities:

• increasing the effectiveness of the process of recruitment
• optimising the process of employee training
• controlling labour costs
• managing employee attrition
• measuring and assessing employee performance

Unlike other company resources, human resources are the only active and creative component of a work process. Therefore, a strategy for employee development represents one of the most important segments in company development.

B. Measuring and Assessing Human Resource Management Performances

Performance can be viewed as a company’s ability to achieve its goals, [4]. However, a more accurate definition of performance would be: a company’s success in achieving its established goals and accomplishing its mission.

Business Performance Management – BPM refers to a continuous cycle of setting goals, planning, measuring and
analysing, providing feedback, and improving performance, [4]. In order to ensure the success of BPM, the company has to fully understand its own business operations and activities in the process of reaching its strategic goals. Besides that, it is necessary to define duties and responsibilities correctly in order to facilitate tracking progress in achieving the established goals. Hence, BPM requires the existence of key performance indicators (KPI) which should be available at the right time and the right level of decision-making. The experts from this field have critical importance in identifying relevant indicators of business operations. Without good indicators of business operations, the effects of measuring and assessing performance will definitely not be satisfying. Therefore they will not represent a reliable source of information for making high-quality decisions. The process of managing business performance could comprise the following activities: (i) Performance planning: (1) defining the expected performance (outcome/behaviour), which is connected with strategic company goals, (2) identifying critical factors of success, (3) determining performance indicators, (4) establishing performance standards, (5) identifying and analyzing performance risk; (ii) Monitoring, measuring and assessing performance: (1) observing performance, (2) measuring and assessing performance, (3) comparing achieved goals with those established, identifying discrepancy, (4) providing feedback about performance; (iii) Continuous performance improvement: (1) performance improvement planning, (2) implementing performance improvement plan, (3) tracking progress of performance improvement, [5].

Managing human resource performances leads to a sustainable company success through employee performance improvement. Regular performance control provides feedback about employee results and detects the need to undertake corrective actions in order to improve performance by offering training or other activities which can help to solve the identified problems, [3]. The impact of HRM process on company performance is difficult to measure. Therefore, it is necessary to design innovative systems for assessing and measuring human resource performance which will help to present the impact of this process on the company’s general success, [6]. The system for measuring and assessing human resource performance should contain the following activities:

- setting goals for tracking and assessing performance
- determining components for assessing employee work performance (quality and quantity of work accomplished, attitude towards work, relationship with other employees...)
- defining key activities for the process of assessing work performance
- selecting methods which will be applied to measure and assess performance
- appointing a leader for the above mentioned process
- detecting problems and errors in the process of measuring and assessing performance
- undertaking corrective actions in order to improve the above mentioned process

C. The Role of IT in Human Resource Management

The efficient business operations management is not possible without suitable IT/IS support. The IT/IS platform enables companies to increase productivity and profitability, and at the same time leads to cost reduction. Business operations data are usually recorded in Enterprise Resource Planning systems – ERP systems. These systems belong to a category of transactional systems. They represent modular solutions, i.e. they are made up of applications independent of each other, and offer an integrated platform for all business processes in a company. The greatest contribution of ERP systems is that they enable integration of data of different business processes and provide clear overview of transactions that have occurred between them. ERP systems are limited in terms of data analysis which is necessary for the decision-making process because they are not developed to serve that purpose. A thorough investigation of information requires the introduction of new software solutions whose main purpose is data analysis and which help to obtain credible and timely information. Reporting systems play an important role in this field. Their main task is to enable performing careful business analysis through offering credible and timely information, which increases business process efficiency. By using data obtained from transactional systems, reporting systems can create reports in all forms, textual, tabular or graphic.

Since data availability has noticeably increased in business environment recently, companies need to be ready to respond to a newly created challenge. From the point of view of system performativeness, transactional systems are not suitable for storing a large amount of data. Data warehouses – DW have been designed to perform that task. A DW is an analytical database which is convenient for storing multi-annual data. It represents a central repository for both internal and external data, and is particularly suitable as a basis for business operations analysis. Since company’s business operations are highly complex and comprise several business processes, DW can be divided into different data marts, where one data mart usually corresponds to one business process, and in that way they enable in-depth analyses. Unlike DW, data marts can, in addition to detailed information, contain aggregate information as well and thus ensure faster data analysis. Speaking of systems that are suitable for working with data warehouses, reporting systems are not as good as solutions created in OLAP (On-Line Analytical Processing) environment. The software designed in OLAP environment focuses on the analysis of business data, i.e. detecting trends through (available) aggregate and detailed data. The core of OLAP system is a multidimensional cube, which enables analysts to interactively manipulate a large amount of detailed and consolidated data, and to investigate them from various perspectives. Since multidimensional view is hierarchical, the analyst can observe data from a hierarchical perspective. Such structure allows data segmentation within the database, which entails data slicing according to a criterion given in the query, dicing, aggregation and disaggregation of data along the analytical hierarchy and the like. When compared with reporting systems which enable static reporting through presentation of data formatted and organized according to specific business requirements, OLAP software allows dynamic data analysis by creating advanced reports such as scorecards and dashboards. Scorecards are used to measure...
accomplishments compared to established goals. They are created with the aim to show KPIs, of which each indicator represents one aspect of organizational performance. Taken together, these KPIs offer a view of the company’s performances at a specific point in time. A dashboard represents an aggregated view of different types of reports, including scorecards too. It can contain reports of different business processes in order to give an insight into the whole business.

III. OLAP ANALYTICAL SOLUTION FOR MEASURING AND ASSESSING HUMAN RESOURCE MANAGEMENT PERFORMANCE

A. The Purpose of the Analytical System for Measuring and Assessing Human Resource Management Performance

The analytical system for measuring and assessing HRM performance is used as an information platform whose aim is to improve the given process. The system should enable easy and efficient tracking and analysis of data related to established and achieved goals of HRM in order to identify critical points in meeting objectives, [6]. Questions concerning HRM that have frequently been asked are as follows:

- What are the current and future HR needs in a company?
- How to attract, retain and motivate inventive employees?
- How to help employees give their best in terms of productivity?
- Are salaries and perks in accordance with responsibilities related to a position?
- Does employee training meet company needs?
- What is the superordinate-subordinate relationship between employees? How does that relationship change over time?
- Is there a suitable assessment tool of employee performance and is it used efficiently?

Seeking answers to the above listed questions entails devising and undertaking a number of activities which will lead to the achievement of objectives. It is necessary to investigate how successfully these activities are accomplished so that discrepancies can be detected on time, which allows for timely response. This requires defining the framework for activity accomplishment, which contains deadlines and planned outcomes. The aim of the analytical system which measures and assesses the performance of human resource is to enable monitoring of these activities through measuring and assessing the accomplishment of planned activities in HRM. This system should be able to provide the following types of information:

- employee attrition analysis
- analysis of earnings compared to positions held
- analysis of costs of working overtime
- analysis of employee training costs
- analysis of employee qualifications and their suitability for the position
- analysis of employee productivity

These information requirements have a strong analytical feature, so it comes as natural to seek responses within the analytical system based on the integrated analytical data repository (DW).


The architecture of the system for measuring and assessing performance of HRM comprises data sources, ETL (Extraction, Transformation and Loading) processes, DW and software designed in OLAP environment. Dimensional modeling has been applied for designing this analytical system. It represents a compilation of techniques which are used to create OLAP analytical solutions and analytical database schemes. The ETL processes extract data from source systems, transform them and load them into the analytical database. A layer of data between the source (transactional) system and the analytical database contains normalized data which enable division of an ETL process into two parts. The first part is the responsibility of a company where the system has been implemented, and is related to extracting data from source systems and their formatting. The responsibility for the latter falls on software suppliers and comprises cleaning, mapping, restructuring and loading of data. The application for final users is designed in Microstrategy OLAP environment and allows transformation of data into attractive and easy to understand control tables and reports.

C. Functionality of the System for Measuring and Monitoring the HRM Performance

The aim of the designed system is to enable efficient performance analysis which will contribute to high-quality HRM. The analysis of information requirements has led to identification of subsystems of reports. Some of the subsystems are as follows:

- Attrition Analysis – The aim of this analysis is to maintain the attrition rate at an acceptable level and to minimise the loss of key employees (loss of talent).
- Compensation Analysis – The analysis of this group of reports is related to company compensation costs. Performing these analyses enables companies to follow trends in cost movement and to detect significant discrepancies from standard values on time.
- Recruitment Analysis – This analysis optimises the recruitment process through identification of employee profiles, company demand for employees, and employment trends.
• Workforce Development – This group of analyses helps to match the skills required to perform certain activities with employee qualifications.

• Productivity Analysis – This analysis refers to employee performance analysis in terms of achieving individual goals, and rewarding employees based on their accomplishments.

The analysis of information requirements also contributes to identification of KPI of certain HRM segments. Out of several dozens of indicators, the following KPIs best illustrate the effectiveness of specific groups of analyses:

• employee attrition
• average employees’ salary
• hiring rate
• average training costs
• work productivity

A variety of KPI monitors are used to illustrate KPIs. KPI monitors are aimed at owners of HRM processes and provide instantaneous visual view of the state of a company in terms of achieved results compared to those planned. KPI monitors offer guidelines for decision-making related to future company business operations.

A subsystem of data which will represent the basis for obtaining results. In addition to attributes, metrics, filters and other OLAP objects which allow users to perform ad-hoc analyses, the applications for final users comprise predefined reports. These reports help to carry out more thorough analyses so as to discover causes of the detected problems, and they represent the basis for undertaking corrective actions. If predefined reports are not sufficient for identifying causes of problems, users can always do an ad-hoc analysis and create new reports.

Fig. 2. KPI monitor system for measuring and assessing the performance of HRM

Fig. 2 shows KPI monitor (scorecard) which illustrates KPIs of different subsystems of reports. A subsystem of reports that deals with employee attrition analysis is represented by employee attrition indicator, which is calculated by comparing the number of employees who have left the company during the past year with the total number of employees. All values up to 1.5% are considered acceptable. In compensation analysis, the average employees’ salary is compared to average market earnings. The higher indicator value, the better company position in the market. Also, the more developed a company, the more it invests in its employees, which means that employee training analysis has to show higher values. A work productivity indicator shows the importance of human factor in a company, and is counted by comparing employee performance with the number of working hours. Hiring rate as an indicator is counted by comparing the number of newly hired employees with the total number of active employees.

In this example, the acceptable values are marked green. The red zone represents unacceptable values and indicates that there has been a problem in reaching the established goals. The yellow zone also shows unacceptable values which, however, do not pose a threat to the overall business operations of a company. If there are any discrepancies (yellow and red zone), users can obtain detailed reports which help to perform an analysis at the level of an organizational unit, employees etc. Such reports contain much larger number of performance indicators, whose analysis can reveal causes of those discrepancies. In order to carry out these analyses, users can employ OLAP objects such as metrics, attributes, hierarchies, filters and so on. Within a system, KPIs are manifested as OLAP metrics which contain formulae to count their values. The perspectives from which KPIs can be observed in the system are represented as dimensions of business operations with their attributes. By choosing an OLAP attribute, users choose the perspectives from which they want to get an insight into results of the company’s operations. Hierarchies enable users to observe the same data at different levels of complexity (in terms of details). By listing data filtering conditions, users determine a subsystem of data which will represent the basis for obtaining results. In addition to attributes, metrics, filters and other OLAP objects which allow users to perform ad-hoc analyses, the applications for final users comprise predefined reports. These reports help to carry out more thorough analyses so as to discover causes of the detected problems, and they represent the basis for undertaking corrective actions. If predefined reports are not sufficient for identifying causes of problems, users can always do an ad-hoc analysis and create new reports.

Fig. 3 illustrates a predefined report which represents the ratio between employees’ salaries and average salaries prescribed by standards for different positions. This analysis shows whether the amount given as a salary is suitable, which can easily tell us something about employee compensation satisfaction. A potential bonus shows the level of compensation in cases when employees do not reach the established goals. The level of potential bonus is defined within the strategic company goals. It needs to be mentioned that the illustrations do not use data from practice but from the test base, which means that they do not necessarily show the usual values in practice. By using a large number of components of the analytical solution, such as tabular and graphic reports, scorecards and dashboards, users can easily use the delivered OLAP solution.

With technological advancements, analytical solutions
offer a powerful information distribution. There is a possibility to automatically generate reports and send them via e-mail, mobile phones and other mobile devices, or by personalized control tables.

IV. CONCLUSION

The challenge that companies face today is how to develop and apply agile and high level of competency of employees and maintain cost efficiency at the same time. Therefore, companies need analytical solutions which, together with other solutions, offer proactive analyses and timely observations of events which are important for a company to function successfully. Research have shown that more than 20% of users use BI proactively, [2]. Analytical solutions help companies to improve management efficiency and enhance performance by increasing profitability through more efficient labour cost control. Companies who see their employees as a developmental potential and the basis for competitive advantage, and consider HR management a part of their strategy and policy, will succeed not only in adapting to changes more rapidly, but in becoming proactive as well, i.e. they will be bringing about changes and their competitors will have to adapt.

This paper has offered theoretical and methodological foundations of the development of a system for measuring and assessing HRM performances. It has also presented the main functions of the designed software and shown its technical and technological architecture. At this stage of development, the system supports only measuring and assessing performance. Our plan is to add more functions so that the future systems can support all activities that are related to HRM performance.

REFERENCES