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Analytical applications in logistics

Aplikacje analityczne w logistyce

Streszczenie: Celem artykułu jest analiza teoretycznych koncepcji w dziedzinie aplikacji analitycznych. Po analizie pojęć są omawiane poszczególne kwestie programowe. Aplikacje analityczne są stosowane w logistyce, aby pomóc menedżerom w podejmowaniu właściwych decyzji. W pracy przedstawiono kilka przykładów zastosowania niestandardowych raportów w studium przypadku logistyki. Te przykładowe raporty mogą być generowane w ramach każdego systemu ERP (Enterprise Resource Planning) oraz mogą być stosowane do monitorowania kluczowych wskaźników wydajności (KPI). Proponują nowe odkrycia w zakresie zarządzania logistycznego. Chodzi o monitoring sprzedaży 1–2 przedmiotów. Na podstawie uzyskanych informacji przewidywana jest sprzedaż innych produktów. Omawiane są również zagadnienia dotyczące inwestycji w aplikacjach analitycznych.

Słowa kluczowe: aplikacje analityczne, logistyka, studium przypadku, aplikacje, zrównoważone karty wyników.

Summary: The purpose of this article is to analyze the theoretical concepts in the field of analytical applications. After analyzing the concepts some software issues are discussed. Analytical applications are used in logistics to help managers to take correct decisions. The paper gives several examples of using custom reports in logistics case studies. These sample reports may be generated within any ERP (Enterprise Resource Planning) system and may be used for monitoring key performance indicators (KPIs). A new finding in the logistics management is proposed. The idea is to monitor the sales of 1-2 items. By using the gained information the sales of other products are predicted. Issues concerning investments in analytical applications are discussed.

Keywords: analytical applications, logistics, case studies, software applications, balanced scorecards.

1. Introduction

The value of the information stored in corporate databases is determined by its importance for managers. By analogy of fixed assets, it has more value to management than to the operational reporting. The use of specialized information systems for customer service [such as ERP systems, marketing systems and CRM (Customer Relationship Management) systems] is associated with the use of corporate information. The orientation of the management view at a particular market or a product is associated with the use of historical sales data.

The search for approaches for costs reduction and revenue increasing excites managers for decades (Kaplan, R. and Norton, D., 2013a). The orientation of management may be focused to: (1) improvement of business processes, (2) a start-up of innovative processes, (3) the reorganization of the management process and (4) other innovative initiatives. The end result in most cases is intended branding market. Manufacturing managers usually try to offer products with reasonable price/quality ratio. Theories and concepts in different directions are aimed at achieving the coveted manager's goal.A competitive advantage is usually achieved through research and analysis of the current situation in a company. From the perspective of information technology, the manager in IT (Chief Information Officer – CIO) may ask the following questions:

A competitive advantage is usually achieved through research and analysis of the current situation in a company. From the perspective of information technology, the manager in IT (Chief Information Officer – CIO) may ask the following questions:

1) Does the currently used hardware meet the needs of the installed software on it?
2) Do transaction applications (such as ERP systems) meet the needs of operational management?
3) Do analytical applications meet the needs of strategic and tactical management?

Observations in practice show that the existing hardware is appropriate for the installed ERP systems. ERP systems are mainly used for: (1) registering customers' orders, (2) materials requirements planning, (3) generating orders for suppliers and (4) calculation of costs.

2. The essence of analytical tools and applications

Analytical tools are developed in the middle of specialized software. Pivot tables and OLAP (online analytical processing) reports are popular examples of analytical tools. Managerial practice and case studies of their application exists. But a number of industries and real case studies remain unlit. Logistics managers usually keep secret of the experience acquired in the application of analytical tools. Successful analytical tools are the software products for tracking sales. Most of the web-based online sales systems provide analytical tools for monitoring (Anand Iyengar, Ketan Suri, 2012).

Analytical applications are used not only for sales tracking, but also for: (1) market segmentation, (2) assessing the customer value and (3) measuring the propensity for shopping. Analytical applications may be directed to assess the marketing of one or several products. Nowadays, analytical applications are used to assess: (1) product quality, (2) quality of business processes, and (3) cost structure. In recent years, a technique called "drill-down" finds broad acceptance in analytical applications. For example, if a manager clicks on the total costs for the past month, he/she sees a breakdown (detailed information) by types of expenditures. When selecting a certain type of expenditure, several directions of the costs are shown (figure 1).
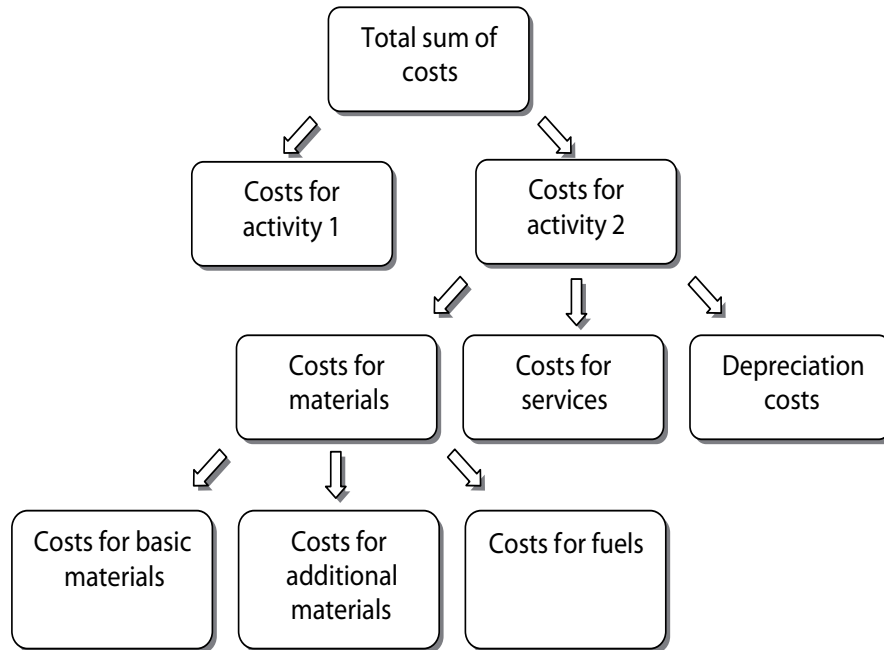
Figure 1. Drill-down of costs

Knowledge Management Systems (KMS) belong to analytical applications. The knowledge management is interpreted as a specialized information system aimed at creating a knowledge base in the context of the logistics practice. As a popular example we can mention the creation of a knowledge base for goods that are purchased together. The adaptation of KMS in distribution logistics is known in websites, where it is written: "Customers who bought item X also bought items Y and Z".

Table 1. Sales by items and stores for yesterday

Store/Item	Item 1	Item 2	Item 3	Item 4
Store 1			3	
Store 2	1	10		6
Store 3	2	5		
Store 4	8		4	
Total		7		

Looking at table 1 we may conclude that customers in store 1 buy items 1, 2 and 4. Customers in store 2 buy items 1 and 2. **Customers in store 2 may be offered item 4.** This conclusion may be made by looking at the table or generated within a software product.

Some analytical applications are used for recruitment of employees. There are software applications that analyze submitted CVs (Curriculum Vitaeos) and classify candidates. The application of such analysis software systems is limited because the skills of the candidates can be evaluated in another way (not through automated analysis of CVs) – for example through face-to-face discussion.

Another group of analytical applications are used for forecasting and budgeting. Managers focus on both future sales and cyclical fluctuations in demand and sales dynamics of key items in terms of forecasting. Monitoring sales of key products allows predicting sales of other items with a high degree of precision. The idea is to monitor the sales of 1–2 items. By using the gained information the sales of other products are predicted. This approach is innovative and it is broadly accepted among logistics managers (Vasilev, J., 2014, Evaluating...).

Another group of analytical applications are used to display costs by type of activity (activity based costing). Using analytical applications the management objectives are aimed at the added value (value based management). It is known that companies with good logistics withstand competition, i.e. their added value is appreciated by the other participants in the supply chain.

A specific aspect of the analytical applications is the Balanced Scorecards (BSC). Using the Balanced Scorecard (Kaplan, R. and Norton, D, 2013a) to measure the financial performance is a hit in the last 10 years. Most BSC focus on financial indicators (Niven, P., 2010). Some BSC (Vasilev, J. 2014, Creating...) are created for making customer profiles in credit institutions.

Over the past two years BSC are used in practice mainly for measurement of non-financial indicators such as customer experience, binge shopping, bullwhip effect and information transparency in the supply chain.

3. Investments in analytical applications

Investments in analytical application are a usual practice for medium and big enterprises. The costs in analytical applications are connected with the expectations of managers for quick return of investments. Small and medium enterprises rely mainly on (1) "small" analytical applications (e.g. Business Intelligence (BI), Business Dashboard – www.crazybikes.com) and (2) open source software analytical applications (e.g. Pentaho BI – www.pentaho.com).

The use of analytical tools should be studied in the following areas: (1) how to use analytical applications to improve the management process and (2) what restrictions are imposed. Most analysis tools work with complete and structured information. Some analytical applications (as example neural networks) can work with incomplete and unstructured information.

Analytical software applications are directed in tracking of certain activities, such as:
1. Quantify the customer profitability. There are published studies in measuring the profitability of the customer in the field of hotel services;
2. Quantification of the level of service (Service Quality Analysis);
3. The transfer of data from the system for automation of sales (Sales Force Automation) to analytical applications.

There are a lot of examples from the fields of medicine and economics, showing the adaptation of analytical applications. It is possible to adapt the creative approach in analytical applications. For example, it can be said the following statement about BSC: (1) what key performance indicators (KPIs) to monitor and (2) where to retrieve data. In this case the analytical application is an upgrade over a corporate database. In most cases, analytical applications only read data from the database and display them without sending signal information back to the database.

It is known that **a company spends about 4% of its profits to invest in IT** (Information Technology). It is normal to have companies that are willing to invest in IT and companies that do not invest in IT. There are also companies that have significant investments in information and communication technologies. Companies invest with highest priority in software systems for customer relationships management (CRM). The propensity to invest in analytical applications is relatively low. Information about failed IT projects makes managers to be extremely cautious. According to reputable studies (Scott Nelson, Seven Reasons Why CRM Fails, Gartner Group Report) 70% of organizations have implemented expensive CRM software systems. But most of these CRM systems cannot provide positive results of their implementation due to the fact that investments in software systems are usually not associated with a change in the managerial process.

Investments in analytical applications can be considered in two aspects: (1) replacement of a software application to another and (2) use of a new software system. It is known that companies operating in the IT sector (as well as companies engaged in hardware, and companies engaged in software) invest their own funds for the improvement of existing products and development of new systems through the application of new IT.

Organizations aimed at reducing costs, tend to invest in transactional software applications and relatively less money in analytical applications. Organizations that are oriented towards the development of new software products are more likely to invest in analytical applications than in transactional ones. The measurement of investments in analytical applications is an easy task. Usually the following indicators are monitored:
1. The investments in analytical applications divided by the total amount of investment in software;
2. Importance of investments in analytical applications against investments in transactional applications (Investments in analytical applications divided by investments in transactional applications).

The focus of IT managers is directed to monitoring the investments in IT by type. The assessment of the importance of the investment in analytical applications is done according to the future investment returns in analytical applications. The management focus shifts from "Business Process Management" to the use of analytical applications for business management.

4. Analytical applications in the field of logistics

The use of analytical applications should be regarded as the application of the software tools in practice. Significant contribution to the practice has the development of methodologies for the application of analytical software tools in different types of business. Management of IT costs is an issue that concerns a number of managers. If a company wants to be perceived as a reliable business partner, it must be able to show other participants in the supply chain, that (1) it applies best logistics practices and (2) it is a reliable partner for the application of IT for business process management, and it has the needed information for inclusion in the supply chain. In this sense, best practices for the application of analytical tools in business are considered to be a competitive advantage.

Analytical applications are continuity in strategic management. For example, managers can describe the goals they want to achieve and the indicators to be monitored (e.g. using a spreadsheet). The idea of analytical applications in this case is a graphical representation (through balanced cards and electronic boards – dashboards) the dynamics of certain indicators. Performance analysis of business processes may be done by comparing the planned values of indicators (e.g. sales volumes of certain items) and actual sales (for a selected period). Strategic objectives may be the following: reduction of costs, increase in revenue, increasing the number of customers, increase in market share and developing new products.

Analytical applications in logistics can be studied in several areas. It is considered necessary to predict the need for inventory in the field of **manufacturing logistics** (inventory forecasting). Receiving orders from customers means organizing logistics so as to obtain quantities which provide cruising renewal of stocks (inventory replenishment). Pulling logistics systems are increasingly popular. The leading role of customers and satisfying their needs are the basis of marketing analysis. The focus of the analysis is on the customer-oriented transactional data (customer-specific transaction data).

The adaptation of the new logistics strategy "**quick response**" (QR) means a reduction in the levels of stocks held. The implementation of such a strategy is impossible without the use of enterprise software systems. Establishing the timetable for delivery and integration of goods are among the most common analytical applications in the area of **distribution logistics**.

Analytical applications include functionality to generate plans for consolidating loads (load consolidation plans) in the field of **transport logistics**.

A wide range of software products allows the use of analytical applications in all functional areas of logistics. Analytical applications aimed at producing information to support operational management. In most cases, the expectations of logistics managers are oriented to the use of tools for producing reports from stored information in databases. Most software products support built-in functionality. The user has the chance to put predefined reports – such as volume of sales items for the current and previous month.

Some software applications provide the end user the opportunity to define the layout of new reports. New reports can be saved as templates. They may be used subsequently by all employees. The process of creating a custom report is very similar to the creation of a Pivot table within a spreadsheet. Most often the end user has access to the columns of the table with completed transactions. By selecting indicators for grouping data (often they are placed in rows) and indicators for aggregation (often selected sales volume) a simple two-dimensional reference is formed. A typical example may be mentioned. A custom report may contain lines items (stock keeping units) as rows and a second column with total sales for the current year.

The presented example of a custom report may be extended as columns show different months. Such cross-reference is very convenient for managers because it shows the intersection of performance "month" and "article". Cells with data as well as cells with no data are shown.

It is permissible for grouping several attributes of lines. For instance, lines may appear commodity groups, within each group – individual items. The examples above reflect the technology analytical data processing – online analytical processing (OLAP).

In order to analyze the dynamics of sales it is often required a reference to the quantities sold of a particular item by date. In this case the feature grouping date and aggregated data refer to quantities sold. In this case, the data are very suitable for conducting time series analysis (Vasilev, J., 2014, Time series...), correlation and regression analysis. In certain cases, managers in practice try to detect seasonality in sales and trend.

5. Conclusion

Solving specific tasks in logistics practice requires the use of specialized software. Analytical applications are used in all functional areas of logistics. They support both the operational and strategic management. Most often they are used for analysis of sales in order to predict future sales. Analytical tools are adequately reflected in the software for the visualization of key indicators of activity in the form of balanced cards and electronic dashboards. In recent years, there is a growing interest in non-financial indicators of logistics activities.

Few companies invest in analytical applications as software tools. These tools may be used for monitoring indicators within a balanced scorecard or a dashboard. The willingness to invest in analytical application is highly correlated with the size of a company. Small enterprises usually focus on transaction processing software applications where as middle and big companies focus is transaction processing software applications as well as on analytical software applications.

Future research may be focused on discussing case studies in different fields of economics. Future research may analyze the application of certain software in a specific type of business.

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