

ICT SUPPORT FOR MEASURING CUSTOMER METRICS DEFINED BY THE BALANCED SCORECARD METHOD

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Abstract

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In the paper an approach to support of strategic management process using the Balanced Scorecard method is discussed. The main focus is primarily directed to the customer perspective as the most important determining factor of today's strategic management. The article suggests general framework for construction of individual performance indicators from this field independently on particular implementation of existing information system in the organization. Methods of gaining necessary information from organization's database and from organization's environment using customer research are considered.

Balanced Scorecard, customer metrics, strategic management support

Each company operating in the market has its mission, its objective. This objective influences all activities that the company carries. The way of achieving the objectives is defined in corporate strategies. Quality of these strategies determines the extent of achieving goals that were set.

According (Kreitner, 1989) strategic management can be defined as ongoing process ensuring sufficient competitiveness related to constantly changing environment conditions. To make strategies applicable they are divided into a few partial strategies. They serve for achieving the objectives in partial fields of business activities. One of them, marketing strategies, are related to activities in the market and cover following fields:

- customer needs knowledge
- gaining satisfactory market share
- ensuring product quality
- offering wide variety of products and product lines
- accomplishing sufficient sales turnover
- offering high quality customer service
- gaining good reputation.

Strategic management is becoming more and more important today. The main reasons are according (Košťan, Šuleř; 2002) mainly:

- increased customer expectation regarding product quality and variety
- easy accessibility to products resulting from improving processes in sales channels and from easier access to information
- increasing competition caused by easier information and cheap labor force access.

Whole strategy in any field goes through several phases:

- current state analysis – what is the position of the organization in the market, how is the organization perceived etc.
- objectives setting – what should be the future state that the organization wants to achieve
- strategy creation – setting the way of achieving the objectives
- strategy execution – execution of particular steps leading to achieving the objectives

- strategy execution control – interpretation of the results, discovering correspondence or the difference between the plan and reality, eventual correction of activities.

In order to make possible to tell the way of future activities and finding out if executed steps are leading to the objectives it is necessary to appoint comprehensible system of metrics and methods of their measuring – including information source, collection method, and time schedule. In any field, to make such measurement feasible it is necessary to set objectives that are measurable. This requirement derives from the hypothesis that it is difficult to evaluate strategy execution when it is not possible directly measure the performance and differences between the plan and reality.

Practically, many metrics can be used. However, it is important to involve metrics from all significant fields of the business. This requirement is met in the Balanced Scorecard method defined by R. Kaplan and D. Norton (Kaplan, Norton; 1992). This method divides all metrics into four main groups formed by, in practice most often appearing, financial, customer, internal business, and innovation and learning perspectives (Báča, 2003).

For Balanced Scorecard method implementation there are some software product available. One of them is e.g. E-Business Suite Corporate Performance Management by Oracle. Disadvantage of this solution is relatively high price (thousands of dollars for single user license) and non-portability of this solution. Individual metrics are bind to particular application and there exist strictly given number of metrics (about 250).

OBJECTIVES

The metrics development from financial perspective (cash flow, return of investments (ROI, ROE), on-time payments etc.), internal business perspective (production cycle length, unit costs, stock volume etc.) and from the perspective of innovation and learning (time for product innovation, Pareto analysis of product line, analysis of employees from the point of view of suitability for work etc.) can be observed from information obtained from existing ERP business information systems (eventually HRM). Although some metrics from the customer perspective can be obtained from CRM systems it is the field where information gathering is the most specific and probably the most difficult.

Customer orientation is also one of the trends in present strategic management, therefore the main attention of this paper is directed to this field. The objective

is to find the way how it is possible to set and observe indicators of business performance in customer sphere. Important requirement is that used technology shouldn't put any constraints on selected strategies and metrics and the solution should be portable (there should be no or very small impact on business database).

MATERIALS AND METHODS

The Balanced Scorecard method besides classifying individual metrics into groups also monitors their interconnection. Indicators can be expressed in a hierarchical structure in the way that all activities serve for achieving financial goals. For this achievement objectives in customer perspective must be met, for them all requirements related to internal business, that depend on innovation and growth, must be completed. Everything is based on the assumption that organization abilities determine the quality of business processes serving for satisfying the customers whose expectations are driving force for all strategies. In accordance with customer satisfaction, loyalty etc. revenues that represent financial results for stakeholders are generated (Kaydos, 2003). This implies that one of the sources of information for customer metrics are data related to business processes. On the other hand several indicators don't need to be directly linked to business processes and required information must be obtained from different source.

In general, for measuring the values of individual indicators the information can be obtained from two sources:

- internal data sources
- external data sources.

If possible it is necessary to utilize existing information as much as possible. It prevents deficiencies that appear during collecting new data, problems connected with employees training, duplicities in data etc. can be avoided. For this purpose existing data must be described in the way that the relation to examined problematic is clear.

Where the information is missing it is necessary to gain it using a research from the organization's environment. In most cases marketing research will be conducted. McDaniel and Gates (McDaniel, Gates; 2002) position marketing research as the key tool for creation and execution of long-term successful marketing strategies.

Following table contains examples of metrics related to evaluation customer relationship (Storbacka, Lehtinen; 2002), (Burnett, 2002), (Kaydos, 2003) and (Kaplan, Norton; 1992).

I: Examples of customer relationship metrics

Metric	Information source
Relationship duration	internal
The number of customers	internal
Customer loss	internal
Customer acquisition	internal
Customer costs	internal
Reference value	internal
Turnover per customer	internal
Return of customer investments	internal
Customer profitability	internal
Product profitability	internal
Customer behavior	external
Customer satisfaction	external
Market potential	external
Market share	external
External factors influencing customers	external
Product and service quality	external
Customer attitude	external
Price competitiveness	external

According to the nature of indicators the values can be presented as the sequence of spot values, changes in comparison with previous period, cumulative values or, in the best case, combining all these possibilities together. Next, values determined during the strategy creation and real values must be compared and differences must be demonstrated.

SOLUTION

The solution provides a framework for implementation of the application in its particular form. As the main angle of view three-layer architecture is selected. Data layer can be realized by any relational database, the implementation of application and presentation layer are not dependent on it. Whole system can be stand-alone application based on the web browser working with business data using a connection to business database. Because it can be also a module of existing business information system general requirements for cooperation with the module, security issues etc. must be met.

Metrics with internal information sources

In order to make possible automatic calculation of individual indicator values it is necessary strictly define what data are required for the calculation, where are these data stored, what is the meaning of indi-

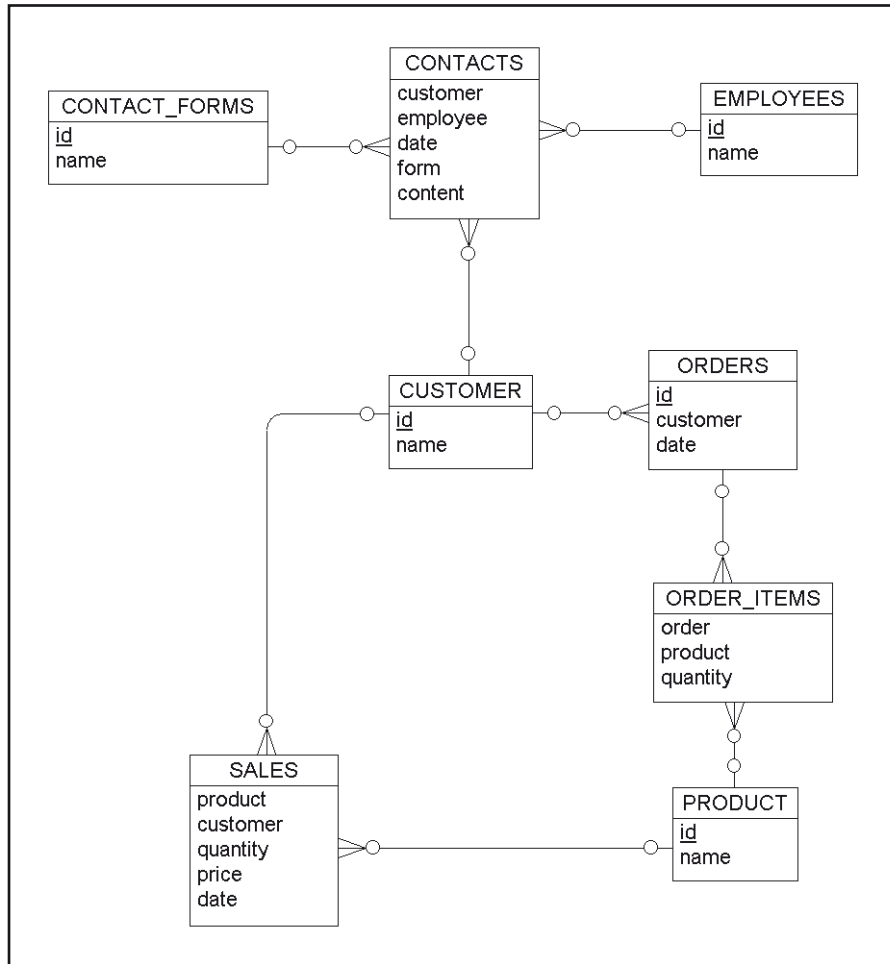
vidual data fields and what data will be used for operations.

For workers not only from the management it is necessary to create a tool which can be used for obtaining the information from business internal information sources. This tool is represented by simple structured language producing expressions consisting of simple operators and operands where most of the operands are data entities and their attributes. Examples of prescriptions for obtaining the values of a few metrics follow (Parts of the expressions in square brackets represent data entities, after symbol \rightarrow there are names of attributes. E.g. [Customer] \rightarrow date is attribute date related to entity [Customer].):

- Customer relationship duration
MAX([Customer] \rightarrow date) - MIN([Customer] \rightarrow date)
- Customer loss
COUNT([Customer] \rightarrow date AFTER period) = 0
- Customer acquisition
COUNT([Customer] \rightarrow date BEFORE period) = 0
- Customer relationship frequency
COUNT([Customer] \rightarrow contact IN period)
- Customer profitability
SUM([Customer] \rightarrow revenue) - SUM([Customer] \rightarrow cost)
- Product profitability
SUM([Product] \rightarrow revenue) - SUM([Product] \rightarrow cost).

Information required for calculation of values of such indicators is stored in business database (this paper works with most prevalent relational database

management system). Very simple example of business database structure is shown in Figure 1.



1: Simple example of business relational data model

For the purpose of data sources description a meta data model specifying information sources in busi-

ness data with following structure (for description of this model Backus-Naur form was used):

```

<DATA_SOURCE> ::= <ENTITY> „.” <ATTRIBUTE>
<ENTITY> ::= <IDENTIFIER> <DATA_SOURCE>
<DATA_SOURCE> ::= [<SCHEMA>] <TABLE> <COLUMN> <INFORMATION_PATH>]
<ATTRIBUTE> ::= <NAME> <DATA_SOURCE> <DATE>
<DATE> ::= <DATA_SOURCE>
<INFORMATION_PATH> ::= {<TABLE> „.” <COLUMN> „=” <TABLE> „.” <COLUMN>}
  
```

Before making this tool available for users it is necessary to define individual data entities and their attributes. This step must be performed in relation to particular physical data representation (or there must be a layer between logical and physical data representation). It doesn't matter if it is business database or a database specially created for the purpose of observing the indicators defined by the Balanced Scorecard method.

Each data source must have a date/time value associated to it – only in such case it is possible to monitor the development of indicators during the time (it is one of basic requirements for strategies execution). Particular values are represented by attributes of data entities, therefore each attribute must be linked to a date/time information. Each entity and attribute have their identifiers that are used in expressions describing the calculation of individual indicators. They also con-

tain a definition of location of required information in the database. In the case of relational database these information consist of particular tables and columns. If necessary information is result of more than one joined tables the information path is required.

For particular database structure (the example in Figure 1) the definition of some data entities and their attributes can be defined as shown in Table II (because of the width, the table is spread into three parts).

II: Example of data entities and attributes definition

ENTITY			
ID	DATA SOURCE		
	TABLE	COLUMN	INFORMATION PATH
Customer	customer	id	-
Customer	customer	id	-
Customer	customer	id	-
Customer	customer	id	-
Product	product	id	-

ATTRIBUTE			
NAME	TABLE	COLUMN	INFORMATION PATH
date	contacts	date	contacts.customer = customer.id
contact	contact_forms	name	contact_forms.id = contacts.form contacts.customer = customer.id
revenue	sales	price	customer.id = sales.customer
order	orders	id	orders.customer = customer.id
revenue	sales	price	product.id = sales.product

ATTRIBUTE		
DATE		
TABLE	COLUMN	INFORMATION PATH
contacts	date	contacts.customer = customer.id
contacts	date	contacts.customer = customer.id
sales	date	customer.id = sales.customer
orders	date	orders.customer = customer.id
sales	date	product.id = sales.product

The possibility of obtaining the information in spot and continuous form is very important. Therefore, the date/time values must be able to be defined as spot figures with particular date like

- day
 - week
 - month
 - year
 - period between two particular dates,
- and also like the same time periods without particular dates (relative specification).

Individual data sources are subsequently connected by operators and the result of such expression repre-

sents the value of observed metrics for each customer (or any other objects, like products). By aggregation or classification of these values figures for all customers or customer groups for the metric can be calculated. Operators can be divided into a few groups:

- Arithmetic – addition, subtraction, multiplication, division, SUM
- Statistical – minimum, maximum, average etc.
- Logical – logical conjunction, disjunction, and negation
- Date/time – IN (information is related to given period), BEFORE (information is related to peri-

od preceding given period), AFTER (information is related to period following given period)

- Relational – for comparison of two values, the result is a logical value.

Converting the information described by above presented meta model into particular database query and algorithmization of required calculation is not a big problem. Because of portability of the solution it is better to perform only data selection at data layer and data processing according to used operators at application layer.

On example for calculating customer relationship duration the SQL query can be constructed as follows (based on information from Table II):

```
SELECT contacts.date, customer.id
FROM contacts, customer
WHERE contacts.customer = contacts.id
```

At the application layer maximal and minimal values from such values are selected and then these values are subtracted. Subsequently these information can be classified, presented in a table or a graph.

The advantage of this solution is that once defined data sources can be used repeatedly for definition of the structure of several metrics.

Metrics with external information sources

Indicators with information sources in the organization's environment have mostly qualitative character and their measurement is based on a research. The most prevalent used method is marketing research. Data collected in such way can be used as the input for several marketing models. Examples of some of them are mentioned later.

Requirement for the basic research module is that all phases of marketing research must be supported. In phases that can be realized in more than one way as many choices as possible should be enabled (particularly information gathering). The research administrator must be able to define and influence individual research phases. He or she determines from what source the information are collected (e.g. by selection on the respondents sample), in what time period and what kind of the information (the type and the structure are given at the moment of questionnaire creation). More about marketing research software module can be found in (Dařena, 2004).

Customer satisfaction index

For survey of various fields of organization/product perception by customers the approach used in calculation of the European Customer Satisfaction Index can

be used (Foret, Stávková; 2003). This model introduces seven hypothetical variables:

- image
- expectations
- perceived quality
- perceived value
- customer satisfaction
- complaints
- loyalty.

Each of these hypothetical variables has assigned several measurable variables represented by individual questions whose answers can be quantified (e.g. on a scale from 1 to 10 where 1 is the worse evaluation and 10 is the best). During the survey respondents reply to all questions and according them indexes for all hypothetical variables for each customer can be calculated according to following formula:

$$I_i = \frac{\sum_{j=1}^n MV_j^i \cdot w_j}{\sum_{j=1}^n w_j \cdot X}$$

where I_i customer satisfaction index for i^{th} customer

MV_j^i value of j^{th} measurable variable for i^{th} customer

n the number of measurable variables

X scale range (typically 10)

w_j weight of j^{th} measurable variable.

The weights of individual measurable variables (the impact of particular variable onto the entire index) can be entered or can be calculated as the covariance between values MV_j^i and y_i , where y_i is the sum of values of all measurable variables for i^{th} customer.

$$w_j = \sum_{i=1}^n (MV_j^i - P_j) \cdot (R^i - R^t)$$

where w_j weight of j^{th} measurable variable

MV_j^i measurable variable for i^{th} customer

n the number of respondents

P_j the average from values of j^{th} measurable variable for all respondents

R^i the average of values of all measurable variables for i^{th} respondent

R^t the average of values of all measurable variables for all respondents.

It is not necessary to include all fields into the survey – e.g. American Customer Satisfaction Index operates only with five hypothetical variables (ACSI). However, the same approach can be used also for

determining the satisfaction in other fields than that are defined in terms of European Customer Satisfaction Index.

Price sensitivity test

The customers express their opinions related to price levels according perceived quality (if they consider the product with given quality as cheap or expensive) and vice versa (if they consider the quality of the product with given price low or high). The result are marginal point of cheapness, marginal point of expensiveness, optimal and indifference price (Foret, Stávková; 2003).

Segmentation research – cluster analysis

Segmentation research using cluster analysis means creating groups of customers according their characteristics. The groups are created in the way that they are as much homogenous as possible inside and as much heterogeneous as possible outside (Minařík, 1998). The result is information about the structure of customer basis that serve for better understanding of customer behavior.

Product/organization/brand perception research – position map, semantic differential

According collected values for given product/organization/brand characteristics a graphical interpretation of results is provided. The information are often presented in the form of position map – according two key characteristics the coordinates of the product/organization/brand are displayed which helps to realize the comparison with competitive products/organizations/brands. Another way of presenting such characteristics is the semantic differential – values of individual product/organization/brand characteristics are interpolated by a curve demonstrating their relative standing (Foret, Stávková; 2003).

CONCLUSION

The importance of high quality marketing strategies in present days is undisputable. For the management of strategies execution it is necessary to choose a method that is able unambiguously evaluate if everything is proceeding according the plan. One of such methods often used is the Balanced Scorecard method defining a set of indicators from four main business perspectives (financial, customer, internal business, and innovation and learning). It is much easier to perform the definition, management and measuring of values of these metrics using information and communication technologies.

The paper discusses only the indicators from customer perspective in detail because the customer basis is the most critical factor for success today. Information sources for individual indicators are divided into internal and external and methods of data collection for both groups are proposed.

For internal sources a data meta model describing data entities and their attributes and a set of operators enabling calculating metrics values from attribute values are suggested. The foundation for indicators with external data sources that have mostly qualitative character is represented by marketing research. Information collected using the marketing research module is consequently used in marketing models whose results are the values of given indicators.

The emphasis is laid on the universality and portability of the solution which is given by the nature of the environment where the method can be used. Individual organizations have different strategies, priorities and capabilities on one hand and different technologies (database system, application software etc.) on the other hand. Therefore, proposed solution must be applicable independently on its specific implementation.

SOUHRN

ICT podpora pro měření zákaznických ukazatelů definovaných metodou Balanced Scorecard

Článek se zabývá podporou strategického řízení podniku s využitím metody Balanced Scorecard. Metoda Balanced Scorecard je již delší dobu používána v oblasti sledování ukazatelů výkonnosti podniku ve čtyřech hlavních oblastech podnikových aktivit. Práce se zaměřuje na její zákaznickou perspektivu jakožto hlavní oblast určující strategické řízení v dnešní době, kdy je nejdůležitější loajální zákazník uspokojený na základě dokonalé znalosti jeho potřeb vyplývající z dlouhodobého oboustranného kvalitního vztahu.

V práci jsou analyzovány informační toky, které souvisejí se soustavou ukazatelů ze zákaznické oblasti. Je navržen postup, jakým je možné ukazatele konstruovat na základě údajů uložených v podnikové databázi. Pro tento účel je specifikován datový metamodel, na jehož základě je možné popsat výpočet hodnot jednotlivých ukazatelů a zároveň získat tyto hodnoty v databázi.

Pro informace získávané z vnějšího prostředí je stručně navržena struktura systému pro jejich sběr. Základem je existence modulu marketingového výzkumu, díky němuž lze obdržet data přímo od zákazníků.

Balanced Scorecard, zákaznické metriky, podpora strategického řízení

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