SELECTING KEY PERFORMANCE INDICATORS WITH SUPPORT OF ENTERPRISE ANALYZE MODEL

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Abstract: Key performance indicators (KPI) are instruments, which can help companies to get necessary information about enterprise’s conditions at current moment and also provide management with further plan of action. In addition, continuous study of metrics supports enterprises with regular development and innovation aspects. However, the main problem that acquires by dealing with metrics is their amount. Number of different indicators is so large, that the possibility of putting them together in one package, which would be used for specific company, is low. The main objective of this study is to analyze the influence of KPIs for product life management (PLM) and production monitoring systems (PMS) on production efficiency and on profit of small and medium enterprises (SME)[1]. One of the subtasks is to create an analyze model for enterprises that will help to understand, what types of KPIs should be studied and focused by management.

Key words: Key performance indicators (KPI), weight factor analyze, PLM, PMS, SME

1. INTRODUCTION

The objective of this paper is to give an overview of enterprise analyze model (EAM) and its’ main concepts and thoughts. The general idea of development the EAM is to simplify the choice of key performance indicators (KPIs) for different and specific small and medium size enterprises (SMEs). The model would help managers to make clear, what data should be collected for further studying and what improvements should be done in the future. During the enormous amount of KPIs (for example, there are databases/libraries, which include 17000 different metrics [2]), it’s very difficult to choose, what kind of indicators should be implemented for different enterprises. Despite the fact, that data collection and analyze is one of the main activities of management, the meaning of what to measure, should be the main priority. Managers should know not only what common problems, questions and situations are appearing in SME processes in different fields (not only production, but also logistic, quality etc.), but exactly the main problems in THEIR enterprises.

Through the main KPI’s for the certain company the manager can monitor the production line or unit [3], analyze different processes and techniques [4,5] depending on the availability and weight of the specified KPI’s.

2. KEY PERFORMANCE INDICATORS

2.1 Definition and meaning

Measurements are important; they are showing for managers the problematic points and are helping to solve different issues for getting benefits. It is essential for companies to determine the pertinent indicators, how they relate to the formulated goals and how they depend on the performed activities [6]. Additionally, indicators can provide managers with action plan and exactly declare, what should be done in the first place.
Company can be compared with living form/organism. When we are talking about health monitoring, then the pressure is measured, also all the results from blood test and other, that can show to the doctors exactly, in what stage the patient is, are analyzed. The same should be done in every commercial organization. Considering the thoughts written above, KPIs are measurements that show the health of company and of its business development system. They combine companies’ goals and strategies to its incomes, outcomes and provide management with information of common condition: past, current, future.

2.2 The distribution of KPIs by types
To better understand, to simplify searching and to make right solutions, KPIs need to be categorized or divided into groups or types. According to Corbin (2009) the type of key performance indicator affects how the measure is used. Additionally, the type of performance measure determines its impact on other performance measures.

From the chronological aspect, KPIs can be divided into two types: **leading indicators and lagging indicators**.

**Leading indicators** are activity or task-based metrics that are measured early and can be influenced to affect future outcomes. They are measured today to determine if goals will be met tomorrow, and they are measured early and often enough to allow for changes that can impact the predicted outcomes.

**Lagging KPIs** are historical measurements that look back to determine if success was achieved. Additionally they are affected by another indicator. Financial measures are lagging: they prove how well the firm has performed. Agency Gross Income (AGI) from new clients is a lagging indicator of business development success.

Vukomanović, Radujković, Nahod (2010) have named the set of KPIs as Key Performance Results (KPR) and have made own classification:

- KPI-leading performance measures;
- KPO-lagging performance measures;
- PerM-perceptive performance measures.

PerMs are measures that report stakeholders’ perception in projects and can be lagging or leading. Usually they are generated through interviews and questionnaires. Furthermore they have found, that many authors, who are trying to classify indicators, are confused KPIs for KPOs and only few of them, have acknowledged, that there should be additional group PerM (Vukomanovic, 2007).

There is another opportunity for classification KPIs. They can be divided into types/groups depending upon how they should be used and what exactly should they show:

- Strategic/Operational;
  - Longer term facilities (strategic) versus shorter term activity (operational)
- Result/driver;
  - Depending of the enterprise’s implemented changes and activities, metrics can show the result of those actions. The influence on understanding performance is crucial.
- Leading/Lagging (see above);
- Qualitative/quantitative;
  - The satisfaction questionnaires of customers or employees can be an example of qualitative metrics. During different surveys, the data would be stored and analyzed. Calculated values will show and describe to managers exactly, what situation is at this moment. In other words, qualitative/quantitative indicators are the real-time measurements, which help to value the situation at the certain period of time. Quantitative KPIs can be used for process optimization. Additional examples of quantitative metrics are: “Employee turnover”,

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“Units per man-hour” or Maintenance backlog \(^{[12]}\).

**Effectiveness/efficiency;**

In order to measure how much of your targets were reached, effectiveness indicators can/should be used. They compare actual to expected values e.g. actual to expected sales, saving on budget etc. Efficiency indicators can measure how "well" your resources (people, machines, money) were performed. \(^{[13]}\).

The distribution should simplify the choice of indicators. However, the groups, by which indicators are divided, are wide spreaded and include enormous amount of different KPIs. The question: „Why this or that metrics should be selected?“ is still open.

3. ENTERPRISE ANALYSE MODEL (EAM)

The enterprise analyze module is a preparatory phase in KPI selection. It should help to create necessary points for further studying and should show to managers and owners the weakest spots of an enterprise. Concluding from the above written thoughts, the main goals of EAM are:

1) getting common information about enterprise;
2) making clear weak spots;
3) letting know what data should be collected and for what purpose (taking into account weak points).

EAM is module that consists of enterprise mapping and of questionnaire. When we talk about enterprise map (EM) approach, then it was created in 1998 by John Wu and has been used to support different US government agencies and private industries. EM can be compared to geographical map and gives information about location, size, field of actions, missions, visions and etc. of company \(^{[14, 15]}\). Received from mapping, data could be used in getting know what fields are important for company. In addition, with this we can get general information of firm and also make conclusions about necessary actions and points, which should be analyzed during the process. In figure 1 is presented map, which would be used during research for getting data for analyzing. It’s a template and during research can be adapted to various SMEs and additional fields can be added.

**Fig 1. Enterprise map (adapted from \(^{[13]}\))**

Questionnaire is one of the oldest and mostly spread tools for data collection. The advantages of this research instrument are availability (cheap), quality and standardized answers what makes it really comfortable to use and do not need much effort. Opportunity to choice is guarantying to receive necessary data for further research.

In this study, questions are constructed in this way, that by responding on them, the potential critical fields would be brought out. In addition, to the each query would be added weights to determine significance of the issue. Every answer would have own scale to judge the impact on selecting KPIs. This would provide management with information about state of company on concrete moment and simplify the choice of metrics.

Figure 2 shows the example of questions, which would be used. The questions are form HR block and KPI „turnover rate“ is linked to them.
The high turnover rate is not only problem, that companies in Europe and in other countries should face. The Boston Consulting Group in their research is mentioning that in the nearest future, companies will face five critical HR challenges: managing talent, managing demographics, becoming a learning organization, managing work-life balance and managing change and cultural transformation \[16\].

Fig 2. Example of questions and matrix
According weights in right column the matrix can be constructed. This way the impact on indicator „turnover rate“ can be evaluated. Furthermore, the classification of KPIs, which were suggested in previous study \[1\], would be used for questions’ formation.

4. CASE STUDY

The EAM would be tested on real enterprise and data would be collected for further studying. On Figure 3 is illustrated all process/model of selecting KPIs for company. EAM is first phase and during it, the KPI, according collected information, should be selected.

Fig 3. KPI selecting model
The second phase is measurement. First of all the fields of measuring should be selected. Knowledge of critical points from the first phase will reduce the searching sphere and configured metrics will focus attention of management on themselves. There are two ways of collecting information: the manually and automatically.

However, there are 3 general issues that appear during data collection: untimeliness, inaccuracy and bias. Taking into account that this raw information forms the basis for production reports - and according to them, decisions are made - any problems with the primary data collection can start a chain reaction, which will have crucial impact on enterprise \[17\]. Taking into account disadvantages of manually information gathering, the automation should be first priority. During manual collection, different questionnaires, surveys will be filled: for example employees before leaving could evaluate employer and fill forms about pluses and minuses of work place. After that data should be sorted and transferred to main database. If forms were on paper, then step by step all should be migrated into electronic format.
In automatic data collection, support of PMS and PLM would be used. During the monitoring process, data in real time from different machines would be received. Wireless sensors will be preferred. PMS, based on wireless sensor nodes, are relatively inexpensive and it can be installed on old and modern manufacturing equipment \[^{[18]}\]. Those sensors can eliminate the cost of cables and simplify the installation. Wireless monitoring is used rarely in the shop floors \[^{[19]}\].

During PLM the data about products, pre-production processes will be collected. It’s a huge complex of IT tools and applications, which support digital design and manufacturing practices in several ways \[^{[20]}\].

In addition, all the information about incoming materials, outgoing goods are fixed by scanners (barcodes) and stored in enterprise resource planning (ERP) system. Modern ERP system, if it already has KPI module, can provide management with necessary data, otherwise, it could be directly connected to the database.

Third phase is analyzing. In process of it, KPI will get numerical values, which will be used by management for evaluating of enterprises’ condition. Improvements and testing should be done. The process is cycle, so it should be continuing even if goals were achieved.

5. FURTHER RESEARCH

The EAM would be used for collecting data of real company. Taking into account, that the amount of various companies (different field of actions, different structures and etc.), next points/steps should be analyzed:

- optimization of EAM (mapping + questionnaire) for possibility of using by various SMEs;
- optimization and automation of data collection (e-module via Internet for surveys);
- support of PMS and PLM for additional data.

6. CONCLUSION

Considering the productivity, HR and other issues in SME, the measuring, process of collecting data and comparing them with previous (continuous improving), still remains main priority and is real challenge to the management. The EAM and selecting KPIs process in total (figure 2 and 3), were described in this paper. Further steps were defined for next research.

Described methodology and model/module, first of all, would be a good assistance for managers to simplify and automate metrics’ selection and secondly, can be used for further studies in this field (process and model development).

Testing and correcting of the model in addition with data flow optimization, have been foreseen as next tasks.

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