Performance measurement of process-based quality management for GIS updating processes

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SUMMARY

The development of a process-based quality management (PBQM) for the production or other business processes is a common method to ensure the product quality which at high levels is aimed at maximizing the value and success of a company. This is also true for all processes related to geoinformation (GI) or geodata respectively like data acquisition or updating.

But the development of a PBQM is only expedient if a controlling and performance measurement of its implementation is also provided in order to reveal if the PBQM reaches the goals or if further modifications are necessary. For this purpose there are methods available in business economics, an up-and-coming one is the Balanced Scorecard (BSC).

The quality management of the updating process of geodata using the example of utility companies and their Network Information Systems (NIS) is investigated within a project funded by the Federation for Quality Research and Science (FQS) and carried out in the AGIS research lab of the authors [PQM/NIS]. The main goal of this project is the development of a PBQM for the updating of NIS data which can be used as a reference model but also on a methodology to control the performance of the PBQM.

In this paper we focus on a description of the update process and especially we introduce the usage of the BSC for the controlling and performance measurement of a geodata updating process. Therefore in the paper the project background is described and the principles of the BSC are roughly explained. Main focus is laid on the application of the BSC in the framework of the project. It could be shown that the difficulties during development and implementation of a PBQM can be controlled and decreased by using the BSC method. On the one hand the reason of implementation can be communicated so that willingness of the employees to work with and in a PBQM increases. On the other hand the achievement of the PBQM can be measured by ratios of strategic objectives, so one gets information about necessary modifications of the PBQM. The objectives and especially their ratios are not static. The BCS is changeable according to each situation. For the development of the ratios it is important that these have to be observable and the implementation has to make sense in a cost-benefit view.

INTRODUCTION

All utility companies are committed to document their data with respect to location and other attributes. These data like are administrated in their NIS which primarily contains these facility data extended by spatial base (cadastral) data, like buildings or land parcel borders, for the spatial reference.

After the acquisition of digital data in NIS the utilities are continuously confronted with the task to keep the data up-to-date. This updating process has been investigated in an AGIS project [PQM/NIS]. The project aims at the development of a PBQM, which enables the utilities to document and check the quality of the updating process. The process model has been developed by investigations in the network-documentation divisions of four pilot utility companies.

The guarantee of adequate quality in terms of digital data is an essential precondition for the efficiency and the economic success of each utility company, which works with network information. This quality can be achieved by different actions at diverse steps during the update process. The identification and design of these actions in conjunction with efficient and economic processes is the main result of this research. The results should be usable not only in the pilot companies but also in other utility companies.

MODEL OF THE UPDATING PROCESS

The analysis of the updating processes at the pilot utility companies has revealed great differences in the kind of documentation of the facility data and in the updating process. Without going into details, it should be mentioned that these experiences have been incorporated into the development of a generic model of the updating process (Figure 1) for the home connection and net extension tasks. This model describes the related workflow.

In the generic model the following roles as part of the updating process have been introduced:

- Contractee: The contractee can be a utility company or a department which concludes the contract of a utility.
- Planning
- Construction of work
- Surveying
- Updater: The updater checks the new data at last before input in NIS. He has to investigate data correctness.

The workflow in short: The process is initiated through the contractee and continued with the planning of the specific task. These roles provide the planning documents and the guidelines for the documentation, specific to the construction of work, related to the two tasks, home connection and net extension.

The construction of a home connection links a building with an existing main line. It is a special part in the workflow, because in the majority of the cases this work has to be surveyed and documented directly by the construction worker. Since the documentations require a rudimentary knowledge of surveying and in many cases the construction worker is not adequately trained, the collected data are very often of inadequate quality for the NIS. Obviously the deficiency of surveying knowledge of the construction worker is thereby the main cause of failure.

Larger projects like e.g. a net extension usually make the service of a specialized surveyor necessary, which is a guarantee of a good data quality. Here problems arise in the organisation of the different workflows. For the surveying of subsurface lines, objects are only visible for a short period of approximately 3 – 6 hours, because after that time the service trench is usually filled in. A surveyor can only deliver the desired service if there is the possibility to survey the open service trench (visibility of the facility). According to this the surveying has to be done in the abovementioned short period which is hardly the case in praxis. Here the main problem is the communication between the roles and the inadequate process coordination.

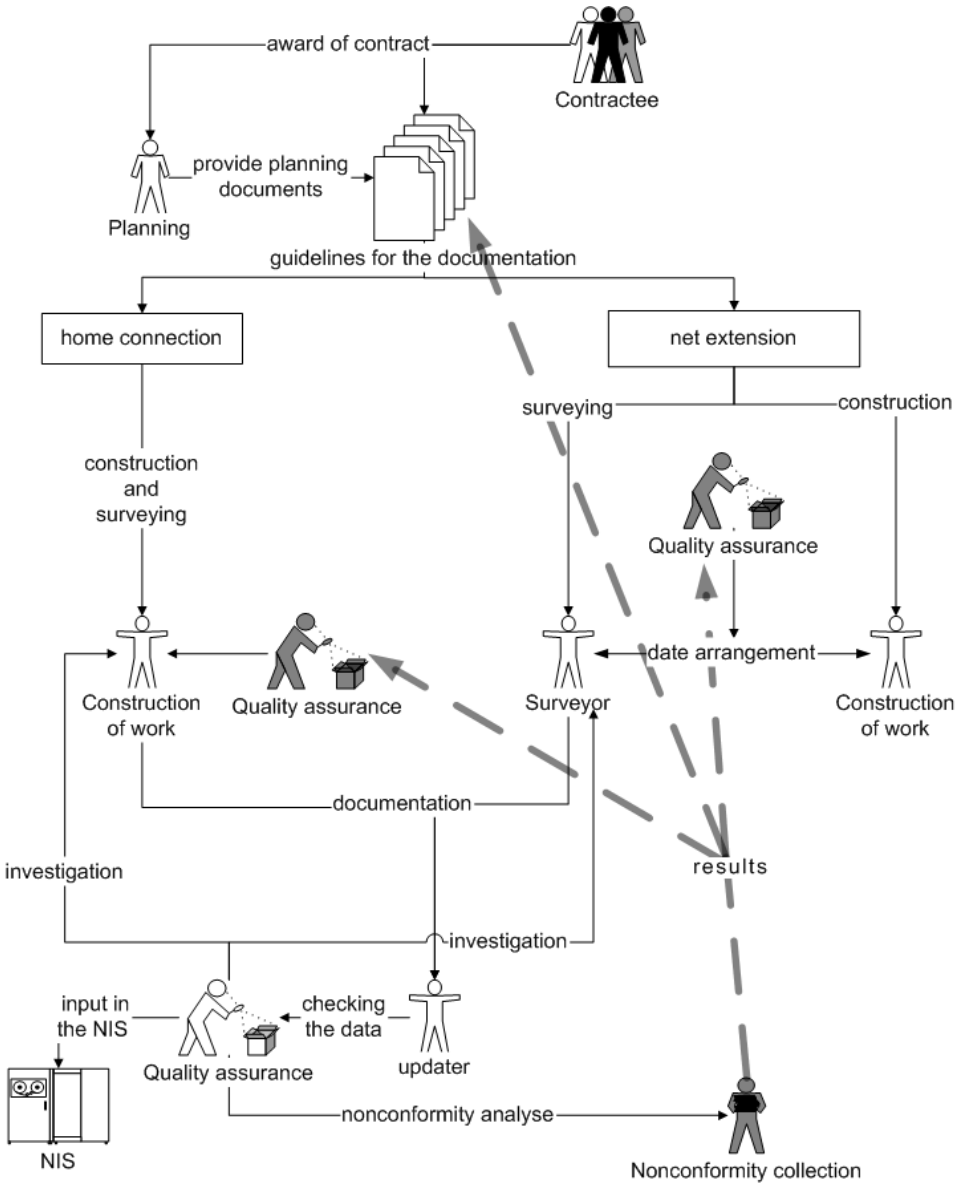

Figure 1: Model of the updating process for the tasks home connection and net extension

The updater executes a check of the new data, before the input in the NIS. Thereby the error analysis (according to ISO 9000 in the following the term nonconformity is used instead of error) and correction of incorrect data is very time consuming. The period of time between data acquisition and data check has an essential influence on a successful investigation and correction. The larger the time period, the less incorrect data can be investigated.

A check of the data quality does not only occur at the end of the data acquisition process. The analysis of the pilot utilities has shown that they use diverse methods and procedures in different positions of the data acquisition process to correct the known nonconformities. But two clear weak points in the quality assurance have been detected. On the one hand the detected nonconformities are corrected and not documented for later analysis. The results of such a nonconformity analysis could be inserted in the workflow as improvement (dashed line in Figure 1). On the other hand a sufficient involvement of the customer or user does not exist in any of the pilot utilities in order to achieve a PBQM aligning with ISO 9000 (ISO, 2005).

THE BALANCED SCORECARD METHOD

The BSC is a management system (not only a performance measurement system) that enables organizations to clarify their vision and strategy and translate them into an action. The BSC was developed in the early 1990's by Drs. Robert Kaplan and David Norton, because of the main orientation of traditional measurement systems on financial and past focused ratios (Kaplan, Norton, 1996). In this research the BSC is used to measure and manage the performance of a PBQM.

The implementation of a PBQM is normally associated with reorganisations in the company. The result of this is additional work, which often encounters resistance by the company's employees. This results on the one hand from the one-time reorganisation and on the other hand from the regularly controlling. To decrease this resistance it is necessary to communicate the reason of implementation. The motivation of the employees can be increased by explanation and knowledge about the objectives and this can be achieved by using the BSC Method.

The method starts with the main objective called vision, in which the primary aim of the company is formulated. Afterwards a strategy is formulated, which can achieve the vision. In the next step perspectives are defined and are specified for each strategic objective with ratios. These ratios are then used to measure the successful implementation of the strategy, the achievement of the vision as well as the successful implementation of the PBQM.

BSC FOR NIS

For the success measurement of a PBQM and the involved actions, a BSC has been developed for the NIS application domain with the support of the pilot companies. Thereby, at first, a vision for all companies had to be defined and that was chosen to be the expanding of the usage of the NIS within the companies. It was further assumed that this vision can be achieved with an assurance and if necessary also an increasing of the data quality. As in precedent research projects the data quality was detected as the most important criteria for the usage of the data.

To develop a BSC for NIS, the BSC perspectives have to be defined (adapted to the specific application) and afterwards these perspectives have to be refined and connected to specific objectives which are explained in the strategy map. These two steps are explained in the following

BSC PERSPECTIVES FOR NIS

The four original perspectives of BSC are the financial, the customer, the process and the potential perspective. One possibility to adapt the BSC to the specific requirements of an application is the modification of these perspectives, which has been done (see fig. 2).

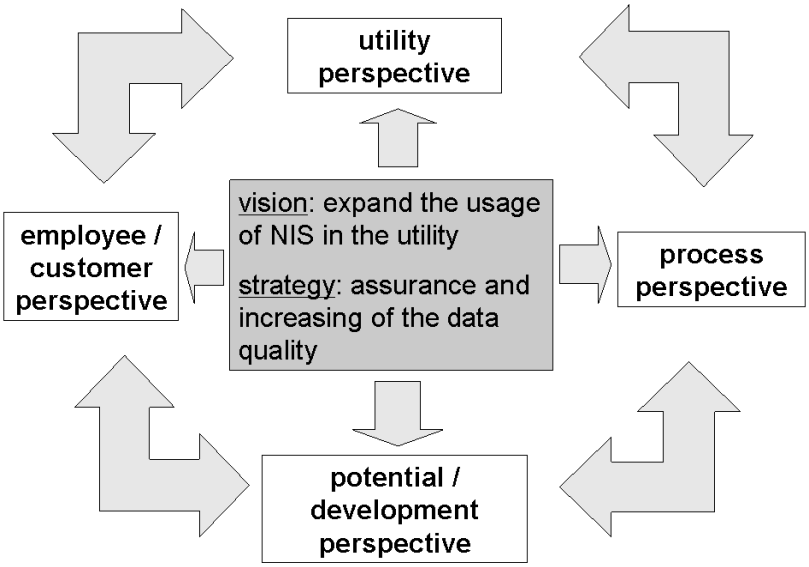

Figure 2: BSC perspectives for NIS in utilities

The name "financial" perspective was changed to "utility" perspective to express a wider view than only a monetary one; the name "customer" perspective was extended to "employee/customer" to consider the (internal) employees as well as the (external) customers and the potential perspective was named as potential/development to include this aspect also.

OBJECTIVES IN THE STRATEGY MAP

Figure 3 shows the strategy map, in which the strategic objectives are displayed in relation to the corresponding, above developed BSC perspectives. The arrows describe the influence between the objectives to communicate the meaning of the strategy. For all objectives explicit ratios have to be found. These ratios have to be observable and the implementation has to be sensible with regard to the cost-benefit calculation.

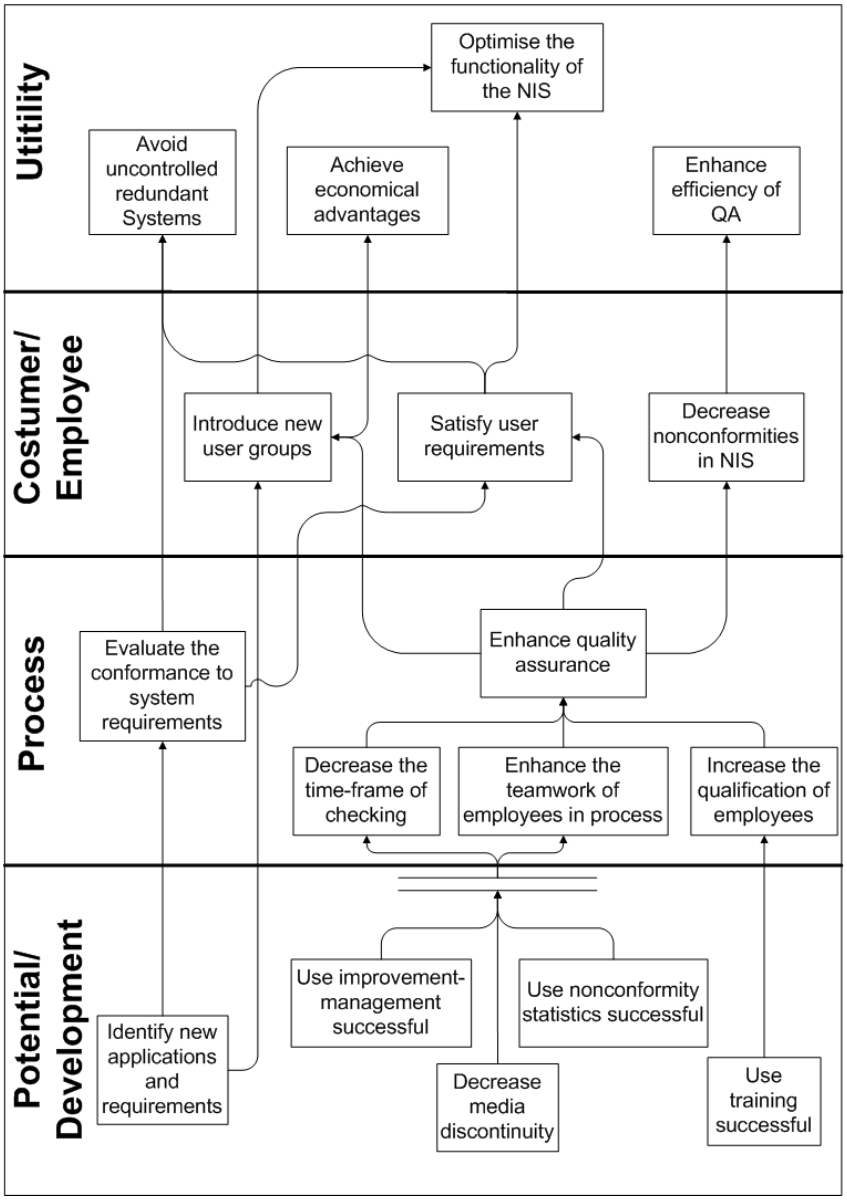

Figure 3: Strategy map

CONCLUSION AND OUTLOOK

In this paper we have introduced the BSC as an instrument to control the performance of the implementation of a process based quality management for the example of a NIS. This can be easily transferred to other GIS applications. Main focus of the paper was the description of the development of the BSC perspectives and the objectives in the strategy map which has been done together with employees of the pilot companies in a project. In future we have to show how the objectives can be

measured through operating figures / ratios and we have to present the result of its application in pilot studies.

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