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Full Length Research Paper

A model for measuring an ISO 9000 internal audit outcome

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This paper developed a model for quantitative assessment of a quality management system internal audit findings showing their potential to contribute to the business performance. This potential is evaluated for each of four groups of company's strategic goals according to the balanced scorecard approach and for the company as a whole (all four groups of goals included). Literature review showed that no method existed that could be used to monitor and quantitatively evaluate such internal audit findings' potential. However such a measurement tool has been searched for by professionals and practitioners. The developed Audit Record Assessment Model (ARA model) has wide possibilities of its application. Model results are easily understood by managers and useful for internal audit planning, for comparison of internal audit outcomes through the time and for benchmarking. Model is easy to implement and to use and its results could be used for monitoring the work of the auditors as one of the criteria for their motivation, selection, training, etc.

Key words: ISO 9000, internal audit, business performance measurement, quantitative assessment, balanced scorecard.

INTRODUCTION

For companies that have developed a mature quality culture and a mature Quality Management System (QMS) the ISO 9001:2000 should contribute to an improvement in business performance and therefore the purpose of the internal audit (IA) should also be related to improving the effectiveness and efficiency of the company. IA represents one of the important activities required by the ISO 9000 in order to maintain and develop the QMS. The general purpose of IA is to determine whether the established QMS conforms to the requirements of the ISO 9001 and to eliminate any detected non-conformities and their causes. In order to stimulate the interest of companies' management in the business perspective of IA, researchers are searching for different approaches to their implementation so that they deliver the greatest benefit to the company.

Empirical research shows that the motivation for introducing the ISO 9001 has an important effect on the actual results of implementing the ISO 9001 (Leung et al., 1999; Huarng et al., 1999; Singels et al., 2001; Heras et al., 2002; Llopis and Tari, 2003; Arauz, Suzuki, 2004; Martinez-Costa et al., 2008). The impact of quality standards on a company's competitiveness and economic performance is bigger with those companies that were internally motivated (improvement reasons) to gain ISO 9001 certification. On the contrary, the impact of the ISO 9001 on the company performance is smaller in the companies that were forced to introduce the quality standard due to external pressure (marketing reasons). This relates to the results of some other studies which show that the motivation and support of the management are important elements affecting the result of implementing the ISO 9001 (Abraham et al., 2000; Leung et al., 1999; Singels et al., 2001; Gore (1994) in Heras et al., 2002). Such support is more common in the case of an internal motivation for introducing the ISO 9001.

The relationship between the company's quality objectives and strategic objectives is another element with a significant impact on how an implementation of the

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ISO 9001 affects the company's performance. Empirical research (Rao et al., 1997; Chapman et al., 1997; Dimara et al., 2002; Sharma, Gadenne, 2002) shows that QMS contributes to company performance by implementing the vision and mission of the company and through the strategic goals associated with both of them.

Based on results of empirical research related to the ISO 9000 we defined our target group of companies. In the paper we focused on companies that have a mature "quality culture" and a mature QMS since such companies are internally motivated for the introduction and efficient performance of the QMS. So they expect that the results of an IA should contribute to their business performance. In such companies, quality objectives are connected to business objectives. Consequently, IA objectives are connected to business objectives through quality objectives (management review). The findings (non-conformities, recommendations and possibilities for improvement) as the main result of such an IA can be used as a foundation for setting measures not only to ensure conformance with the standard, but also to assure effective process implementation and business improvements leading to better company's efficiency. The positive contribution of IA to company performance has been confirmed by many authors (Karapetrovic, Willborn, 2000; Landin, 2000; Chaudhuri and Acharya, 2000; Hutchins, 2002; Lucas et al., 2003; Neidermeyer, 2005).

The results of conducting IA and their potential for setting measures that contribute to better company performance therefore depends on the company's purpose or motivation for introducing the QMS and consequently on the purpose of the IA. In the companies introducing a QMS merely due to pressure from customers the usual goal is simply to acquire a certificate. These companies implement only a compliance IA to satisfy the minimum certification criteria. Such an IA only checks formal conformity with the quality standard and normally has no impact on improving company's effectiveness and efficiency. As the QMS becomes more mature, management expect the IA to be more "business oriented" (ISO 9001 Auditing Practices Group, 2004). So the purpose and orientation of the IA should shift from a compliance IA to a continuous improvement audit (searching for improvement possibilities) and to a management audit (assessing effectiveness of the QMS and its business benefits) (Karapetrovic and Wilborn, 2000; ISO 9004:2002, Ch. 8.2.1.3).

Our research question was therefore related to the possibility of measuring benefits of IA in case company strives to use IA as a tool within the ISO 9001 QMS which can contribute to the achievement of quality goals, and thereby also to the achievement of business goals where these quality goals are connected with the strategic goals of the company. Measuring contribution of IA to achievement of the company's business goals (CBG) is relevant for companies that have a mature "quality culture" and a mature QMS as it improves the possibilities of using IA as a helpful managerial tool. The importance and effects of QMS' IA are largely dependent on the management's understanding of IA, on management's attitude towards the IA, and on how management responds to IA findings (Razzetti, 2003; Bauer, 2005). With the development of the standard ISO 9000 there is a real opportunity for IA to become a managerial tool for improvement (Hoyle and Thompson, 2001). We researched the possibility of measuring contribution of IA to the achievement of company's business goals in a Slovenian company Mercator. Mercator is the biggest Slovenian company, having large number of heterogeneous organizational units. Mercator is a retail company, but it included their own transport and logistic units, some food production units, restaurants, a hotel, immobility management, information support with its own development team, etc. All the Mercator's units and processes were a subject of the IA. We chose Mercator as an appropriate company for testing the possibility of measuring potential contribution of IA results to CBG because of its size and heterogeneity of its units: we assumed that if we succeed in measuring contribution of IA to CBG in such company, the approach will be even more valid for smaller, less complex and more homogeneous companies.

Besides requirements regarding the implementation of an IA, the current foundations for implementing it (quality standards and available theoretical literature) offer more or less detailed guidelines for its effective implementation and the measurement of its effectiveness.

They also list the IA benefits and their levers (performance drivers) which can be used to enhance these benefits while, on the other side, the standards and the literature do not offer a method for measuring these benefits. Therefore, the purpose of our paper was to develop a model for evaluating IA findings (as IA's main result) and to test the model's performance.

The model assesses the quantity and quality of the findings focusing on their goal orientation, importance (possible benefits) and financial impact. So it shows the "value" of the IA findings (for each finding separately and for the IA as a whole) as their potential for gaining business benefits.

This information relates to a potential contribution of the IA findings to achieving the company's business goals (CBG) that can be gained if appropriate improvement measures are taken upon each IA finding. The use of such a model will provide useful information for both company management and the manager responsible for the QMS.

The first section sets the theoretical background needed to develop the model by determining the key performance drivers of the QMS as the basic assessment parameters of the model.

In the following sections we present the model's

structure and validate the model.

LITERATURE REVIEW

We have emphasised that a QMS can contribute to the efficient performance of a company if it is effective and connected to its business strategy. In this case, the QMS represents the implementation of a quality strategy that supports the basic business strategy. Quality policy and quality objectives derived from this strategy are related to the company's strategic objectives. The result is an effective and efficient QMS which enables organisational improvements, rationalisation, business improvements (especially with a decrease in the cost of quality), and an increase in company incomes that follow the improvements in product quality. This can be realised by meeting the standard criteria from the content point of view and by applying the quality management principles on which the ISO 9001 is based. Such a system contributes to attainment of the business goals and an improvement in the overall organisational performance.

We need to identify the positive effects of an appropriately implemented QMS as such effects will be used as a basis for assessing the IA findings potential to contribute to achievement of CBG and thus to improved company efficiency (In the following text "potential" means "potential to contribute to achievement of CBG"). Where the ISO 9001 is appropriately implemented it can contribute to the meeting of different CBG. Different authors mention different types of benefits that result from the effective and efficient introduction of the ISO 9001 (Leung et al., 1999; Ho, 1999; Karapetrovic and Willborn, 2001; Magd and Curry, 2003; Mathews, 2005). The different benefits mentioned by researchers can be divided into groups (considering four perspectives) in accordance with the balanced scorecard approach (Kaplan and Norton, 1996). A QMS can contribute to the improved performance of a company by affecting all four groups of the company's objectives defined in the balanced scorecard approach, which has also been confirmed by empirical research (Tari and Sabater, 2004; Leung et al., 1999; Claver et al., 2002; Sharma and Gadenne, 2001; Magd and Curry, 2003): assuring the satisfaction of customers, ensuring effective process implementation, assuring employee and business development, demonstrating a positive economic effect through lower costs, higher income, higher profit and return on assets. The positive effects of QMS implementation which contribute to achievement of CBG are named QMS performance drivers.

The introduction of a QMS strengthens different key successes factors of a company which represent the foundation for choosing the assessment parameters in the model for assessing the IA potential. An IA is a tool used for assessing a QMS through its findings (non-conformities and recommendations). This way it affects the QMS performance drivers and the strength of their positive impact on QMS efficiency. Therefore IA indirectly contributes to attainment of CBG, as QMS performance drivers are factors via which the IA potentially affects achievement of different CBG. Table 1 shows three to five key QMS performance drivers that were selected for each of the four groups of goals. These selected QMS performance drivers contribute to achievement of a specific group of goals (IA perspective-oriented potential) and, as such, represent elementary evaluation attributes used as parameters for determining the potential value of an IA finding (IA potential). Each IA finding from the IA report can be assessed regarding its impact on a specific QMS performance driver. We added a variable name to all of the QMS performance drivers that will be used later in the model. Although the selected performance drivers are general enough to be applied to companies from different industries, companies can choose to replace or use other, more specific drivers. However, increasing the number of performance drivers should be done selectively as this makes the model more complex. The table also shows the literature used as a basis for selecting the different performance drivers. The "Other drivers" category has been added to each group of selected drivers in order to cover those drivers that have not been included.

A QMS based on ISO 9001 requirements ensures monitoring of achievement of quality objectives through a review by management. IA findings are one of the inputs to the management review. They set the stage for taking adequate corrective and preventive actions to achieve different quality objectives, which can be related to the four groups of strategic goals in line with the BSC concept. By allowing the potential for corrective and preventive actions, an IA can contribute to a QMS improvement and to achievement of related CBG.

In relation to this, the implementation of the IA should be upgraded to contribute to achievement of the company's efficiency and strategic goals through a reorientation from a pure determination of the conformity with the standard's requirements to a search for possibilities for improvement. We can talk about IA that adds value (Liebesman, 2002; Hutchins, 2002; West, 2003; Pivka and Smogavc Cestar, 2004; ISO 9001 Auditing Practices Group, 2004).

Most companies monitor the effectiveness of an IA by controlling realisation of the IA programme and by measuring different indicators related to effectiveness such as: number of organisational units audited, time spent on auditing activities, number of auditors involved, number of IA findings, number of corrective actions). However, the measurement of an audit's efficiency is not common. Companies sometimes use evaluation questionnaires as part of an IA or as a supplement to it (like the ISO 9004 and the ISO 10014 questionnaires) in order to gain some kind of qualitative assessment, but we were unable to find methods that would enable an

Table 1. List of QMS performance drivers.

List of selected QMS performance drivers	List of non-selected QMS performance drivers	Reference
QMS performance drivers that can affect achievement of goals related to the customer perspective:		Claver et al. (2002:1015); Ho (1999: 205); Magd and Curry (2003:386); Krasachol et al. (1998); Lee (1998); Porter (1996:163-164); Kaynak (2002:410-413); Mathews (2005:15-19)
1. Improved communication with customers (CCom)		Sharma and Gadenne (2001:441); Karapetrovic and Willborn (2001:121)
2. Improvements in product and service mix (CMix)		Magd and Curry (2003:386); Singels et al. (2001)
3. Improvement of product and service quality (CQua)		Sharma and Gadenne (2001:441); Ho (1999: 205); Magd and Curry (2003:386); Karapetrovic and Willborn (2001:121); Llopis and Tari (2003:313); Mathews (2005:15-19)
4. Improvements in meeting regulation's requirements (CReg)		Singels et al. (2001)
5. Other drivers (COth)	1. Improvement in meeting customer's requirements; condition for being present in the market	Singels et al. (2001)
	2. Improved retention and loyalty of customers	Ho (1999:205); Leung et al. (1999:685); Mathews (2005:18)
	3. Increased sales volume, export possibilities	Ho (1999: 205); Singels et al. (2001)
	4. Co-operation with suppliers	Claver et al. (2002:1015); Sharma and Gadenne (2001:441)
	5. Environment protection	Claver et al. (2002:1015)
	6. Improved public relations	Magd and Curry (2003:386)
QMS performance drivers that can affect achievement of goals related to the process perspective:		Claver et al. (2002:1015); Ho (1999: 205); Magd and Curry (2003:386); Stahl and Grigsby (1997:175); Kaynak (2002:410-413)
1. Improvements in visibility of procedures - documents and records (PVis)		Sharma and Gadenne (2001:441); Magd and Curry (2003:386); Porter (1996:163-164); Leung et al. (1999:685-689)

Table 1. Contd.

2. Improvements in organisation and conditions of work (POrg)		Sharma and Gadenne (2001:441); Ho (1999: 205); Karapetrovic and Willborn (2001:121); Singels et al. (2001);
3. Improvements in deficiency management and decreasing of work interruptions (PInt)		Sharma and Gadenne (2001:441); Ho (1999: 205); Leung et al. (1999:685-689); Singels et al. (2001);
4. Improved workers' productivity (PPro)		Sharma and Gadenne (2001:441); Ho (1999: 205); Magd and Curry (2003:386); Stahl and Grigsby (1997:175); Leung et al. (1999:685-689); Singels et al. (2001:62); Frost (2005:35-36);
5. Other drivers (POth)		
	1. Management commitment, leadership	Claver et al. (2002:1015); Sharma and Gadenne (2001:441); Porter (1996:163-164); Rao et al. (1997)
	2. Decision-making based on facts	Claver et al. (2002:1015)
	3. Planning of quality	Claver et al. (2002:1015);
	4. Improved control over processes	Ho (1999: 205); Karapetrovic and Willborn (2001:121); Llopis and Tari (2003:313); Singels et al. (2001:62)
QMS performance drivers that can affect achievement of goals related to the learning and development perspective:		Magd and Curry (2003:386); Kaynak (2002:410-413)
1. Improved employees' competences for the implementation of work tasks, and transfer and dissemination of knowledge among employees (LQua)		Sharma and Gadenne (2001:441); Ho (1999:205); BVQI (2001:4.3-4.4); Karapetrovic and Willborn (2001:121); Kostman and Schiemann (2005:37-42); Mathews (2005:15-19)
2. Improved communication and relationship among employees (LCom)		Claver et al. (2002:1015); Sharma and Gadenne (2001:441); Magd and Curry (2003:386); Leung et al. (1999:685-689);
3. Enhancing business improvements (LImp)		Claver et al. (2002:1015); Sharma and Gadenne (2001:441); Karapetrovic and Willborn (2001:121); Krasachol et al. (1998); Porter (1996:163-164); Leung et al. (1999:685-689); Frost (2005:35-36); Mathews (2005:15-19)
4. Other drivers (LOth)		
	1. Involvement of all employees	Claver et al. (2002:1015); Sharma and Gadenne (2001:441); Ho (1999:205); Mathews (2005:15-19)
	2. Team work	Claver et al. (2002:1015); Leung et al. (1999:685-689)

Table 1. Contd.

	3. Work morale, commitment to the company	Claver et al. (2002:1015); Karapetrovic and Willborn (2001:121); Porter (1996:163-164);
	4. Social condition of employees, employment stability	Claver et al. (2002:1015); Karapetrovic and Willborn (2001:121)
	5. Motivation, satisfaction of employees	Ho (1999:205); Magd and Curry (2003:386); Singels et al. (2001); Mathews (2005:15-19)
	6. QMS development	Magd and Curry (2003:386); Llopis and Tari (2003:313)
QMS performance drivers that can affect achievement of goals related to the financial perspective:		Foster and Jonker (2003:324); Ho (1999:205); Karapetrovic and Willborn (2001:121); Taylor (2004:20); Singels et al. (2001); Porter (1996:163-164); Kaynak (2002:410-413); Dimara (2004:85)
1. Decrease in actual and potential damage due to identified non-conformities – 4 sub-drivers: actual and potential costs, expressed in evaluation points (FAC, FPC) and in a monetary value (FACV, FPCV)		Sharma and Gadenne (2001:441); Magd and Curry (2003:386); Karapetrovic and Willborn (2001:121); Stahl and Grigsby (1997:175); Porter (1996:163-164); Leung et al. (1999:685-689); Dimara (2004:85); Singels et al. (2001);
2. Savings resulting from suggested improvements – 6 sub-drivers: actual and potential loss of income based on the finding or money saving due to suggested improvement, both expressed in evaluation points (FALI, FPLI, FImp) and in a monetary value (FALIV, FPLIV, FimpV)		Foster and Jonker (2003:324); Ho (1999:205); Karapetrovic and Willborn (2001:121); Buzzell and Wiersema (1981:135-144); Leung et al. (1999:685-689); Dimara (2004:85); Mathews (2005:15-19)
3. Other drivers (FOth)	-	-

assessment of the added value of IA. The review of the literature on the methods used to monitor the IA efficiency shows that no method exists that could be used to monitor and quantitatively evaluate their potential to contribute to achievement of CBG (Rajendran and Devadasan, 2005). Accordingly, there is no method available to appropriately assess the potential benefits of an IA that has been performed. Upon realising this, it was our goal to develop such a model and to test it.

METHODOLOGY

The model is based on the assumption that IA findings represent a potential for taking counter-measures which could have an impact on achievement of different groups of strategic goals by affecting QMS performance drivers related to these goals. In developing the model we used the QMS performance drivers presented in Table 1. The objects of the assessment are all the records - findings (in the following text both expressions are used, but here only the IA written findings are meant) of an IA: non-conformities, recommendations, suggestions for improvement and identified examples of good practices. Using this source of information enables an evaluation to criteria and measures. In order to make their work easier each value of both five-point scales used at this evaluation level has been qualitatively described (not included in the paper). This guarantees that the model will be better understood and more consistently used by different assessors. If the assessors work in a group, they should be calibrated first (e.g. by making a test assessment on the same sample of findings and discussing the outcomes).

The purpose of such a calibration is to test all the assessors' understanding of the evaluation criteria and measures. Assessors should have other properties of good assessors be repeated. In accordance with the

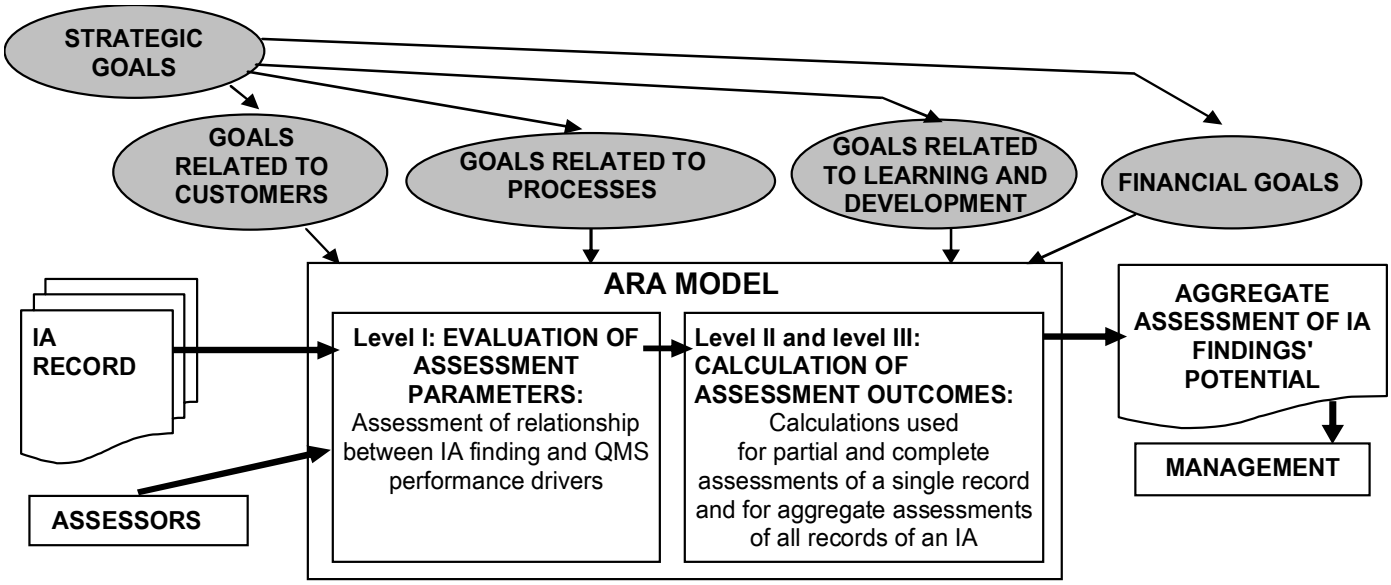

Figure 1. ARA model evaluation process.

assessment object and source of data the model is called the Audit Record Assessment Model (ARA Model).An assessment of a potential of an IA to contribute to achievement of CBG (IA potential) represents a complex assessment problem which can, however, be structured based on a multi-attribute assessment model used to support the assessment procedure. Therefore, the assessment method used to develop the model was a multi-attribute assessment. This method is based on decomposition of a complex problem to smaller sub-problems (Chankong and Haimes, 1983; Bohanec et al., 2000) and further down to the IA records as assessment units including the lowest elements - assessment parameters, which need to be evaluated by assessors. These assessment parameters represent the leaves of an evaluation tree. They contain the input data of the assessment model. They show the evaluated characteristics of each assessed IA finding. The assessor evaluates the degree of each characteristic by his opinion or preference. The measures for evaluating each of them should be clearly defined.

The evaluation tree describes the hierarchical structure of the assessment model. The model defines aggregation rules (calculations) used to aggregate the values of assessment parameters bottom-up level by level to the root of the tree, which represents the final (total) value. These aggregation rules are built into the internal logic of the model, so the user (assessor) needn't think about them. He should only prepare the basic input assessment data to fill-in the leaves of the tree. Afterwards these input data are used to calculate the IA CBG-potential through the following model outputs: partial perspective-oriented and complete potential of separate IA findings/records and the aggregate (average and total) potential for the whole IA.

Model framework

The ARA model includes five steps of assessment carried out at three different levels. The basic scheme of the model with its input and output data, evaluation process levels and participants is presented in Figure 1.

Figure 1 shows that each record which results from the conducted IA is evaluated from the point of view of its potential to contribute to each group of goals. The five steps that have to be taken on the presented levels are shown in Figure 2 and demonstrated in Figure 3 and in Appendix 1.

Appendix 1 presents one part of the model structure to demonstrate the approach employed in the evaluation. Due to space limits, it shows only a part of the model related to the customer-related goals, but the approach is the same for the other three groups of goals. These five steps of evaluation in the ARA model are explained below:

Level I/Step 1 – Evaluation of assessment parameters for each record of the IA

Two sets of important assessment parameters are evaluated in this step: potentials of the finding for strengthening the selected performance drivers for each group of goals (Table 1) and the expected frequency of a situation related to the IA finding (Figures 2 and 3). Appendix 1 shows that a five-point scale is used (1 - no impact; 5 - very strong impact) for evaluating the driver-oriented assessment parameters and (1 - never; 5 - very frequently) for frequency evaluation. However, the financial parameters are evaluated in EUR. The model allows that some parameters receive no value (zero value).

Other assessment parameters are employed in the model, such as weights of groups of goals (CGWgt, PGWgt, LGWgt, FGWgt), number of IA findings (n), number of organisational units audited (m), number of auditors that participated in conducting of the IA (a) (Figures 2 and 3 and Table 2).

An assessment with the ARA model may be carried out by one or more assessors. Assessors have to know the company, its strategic and business goals and their priority. They have to know the ARA model, its evaluation like independence, objectivity, accuracy etc.

Level II: Calculation of the partial assessment outcomes for a specific IA record

By using the ARA model assessment variables, rules and scales presented in Figure 3 and explained in Appendix 1:

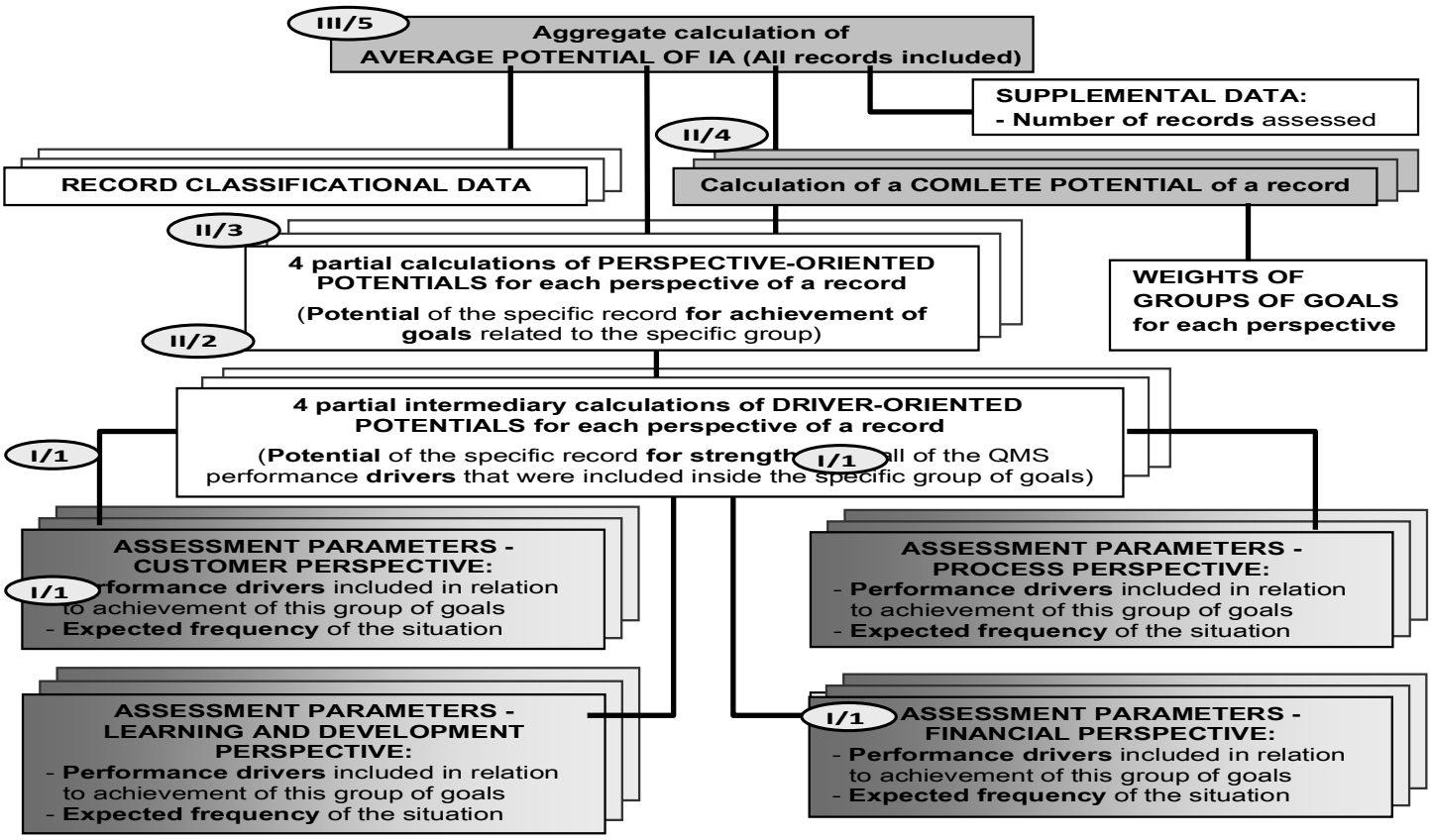

Figure 2. Steps in the ARA model evaluation process.

Step 2 - Calculation of four driver-oriented potentials of each IA record: These intermediary calculations show the aggregate potential of a specific record for strengthening a group of QMS performance drivers related to a specific group of goals or a perspective (CDrv, PDrv, LDrv and FDrv in Figure 3). These calculated values are the maximum (highest assessed) values of the IA finding's potential to strengthen each performance driver in each perspective. The model assumes that an IA finding which strongly affects several QMS performance drivers within a group of goals should be attributed a higher grade than another IA finding which affects only one QMS performance driver to the same extent. In such cases the calculated potential value is increased by 1 (however not above 5 – the scale is the same as in the step 1) (see more explanation in Appendix 1).

Step 3 - Calculation of four perspective-oriented potentials of each IA record: These calculations represent a potential of an IA finding to contribute to achievement of one specific group of goals (CGoal, PGoal, LGoal and FGoal – Figure 3). The calculation takes in account the driver-oriented potential of an IA finding (the result of step 2) and the expected frequency of a situation related to this finding (CFreq, PFreq, LFreq, FFreq – Appendix 1 and Figure 3). The calculated values of all the calculations in this and following steps (steps 3 to 5) are real numbers between 1 and 5 (1 - no potential; 5 - a very strong potential to contribute to CBG).

Step 4 - Calculation of a complete potential of each record: This is the final calculation at the single record level showing the potential of an IA finding to contribute to the total mix of CBG in accordance with the BSC approach (BGoal in Figure 3). It is calculated as a weighted average of all four perspective-oriented potentials of the IA finding (the results of step 3) (see Appendix 1). In this calculation weights (CGWgt, PGWgt, LGWgt and FGWgt) show the importance of specific groups of goals within the overall range of a company's strategic goals.

Level III/ Step 5 – aggregation of the results of steps 3 and 4 - calculating total and average potential of the IA (including all its records)

This last step leads to aggregated assessment outcomes: the sums of (BGoal_Sum in Figure 3) or averages of (BGoal_Avg in Figure 3) assessments of single IA records (for the whole IA, for a single auditor etc.). See Appendix 1 for a more detailed explanation and Table 2 for an explanation and meaning of the different assessment outcomes that could be calculated from the model.

RESULTS

The model can be used to calculate a potential of separate IA findings/records and their different aggregate outcomes which yield different information about the IA as a whole and its potential.

The decision to use a specific aggregate assessment outcome is based on the purpose of the assessment. Different aggregate assessment outcomes with their description and their possible usage are presented in Table 2.

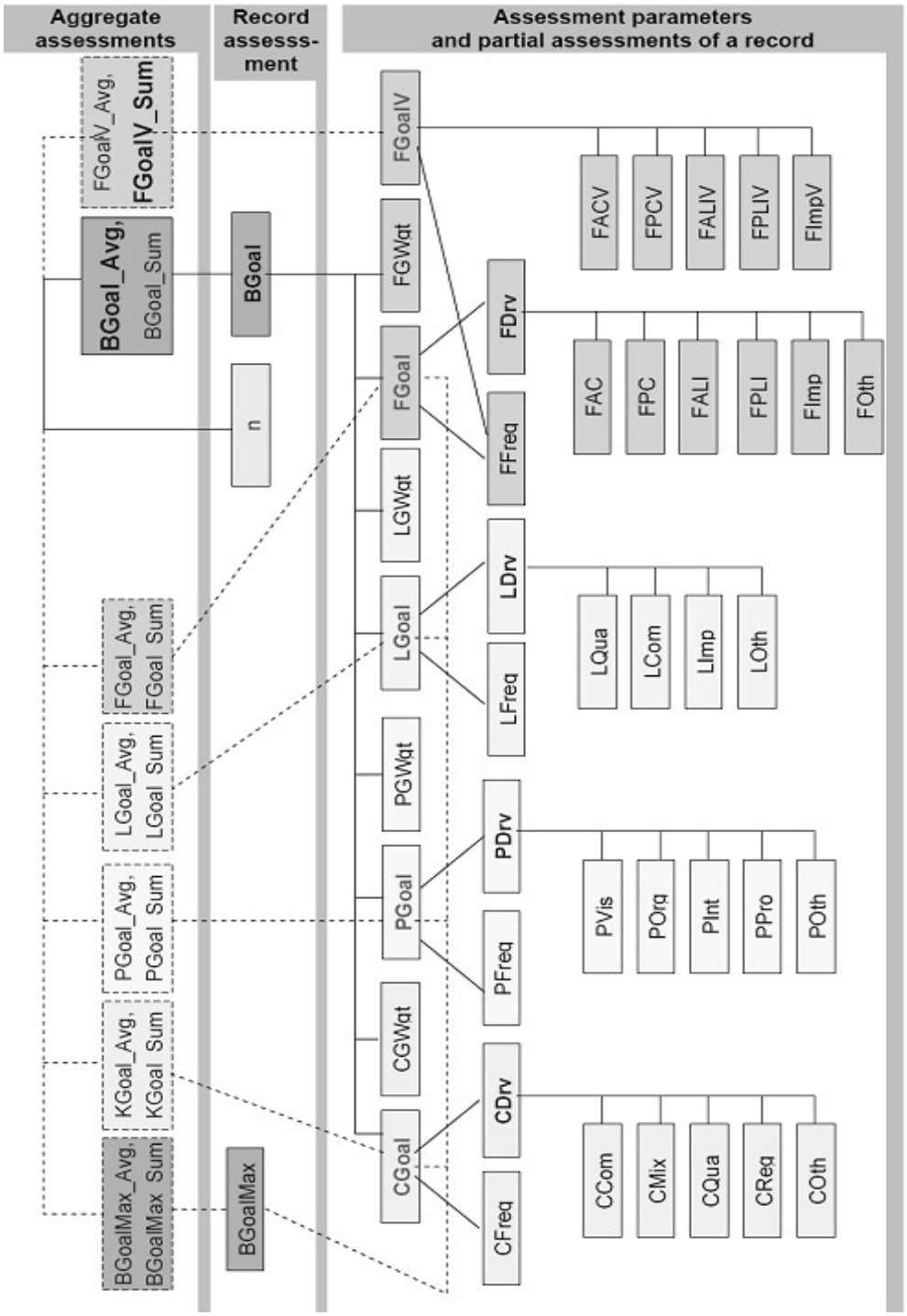

Figure 3. Tree of the ARA model variables.

Testing of the model

Choice of empirical research approach

To test the applicability of the developed ARA model we time of this research, Mercator had 8,000 employees and 600 retail units for its market programme ("every day articles") and 400 units with specialised programmes (furniture, technique, textile, sport etc.). Mercator was chosen as it belonged to a group of companies, which represented the focus of our interest (a mature QMS and quality culture, motivation for an efficient QMS). As its QMS reached a high level of conformance, there was a requirement from company's management that IA should

Table 2. Possible aggregate assessment outcomes.

Assessment outcomes	Mathematic expressions	Description of assessment outcomes	Examples of possible use of assessment outcomes
Average benefit or potential of the IA findings	BGoal_Avg = (Σ BGoal) / *n* BGoalMax_Avg = (Σ BGoalMax) / *n*	Average of all the IA finding's complete potentials (related to all four groups of CBG)	-For a rough assessment of benefits of the IA - useful for management; -For a comparison of IA results among the companies; -For a comparison with IA results obtained with the use of other methods.
	CGoal_Avg = (Σ CGoal) / *n* PGoal_Avg = (Σ PGoal) / *n* LGoal_Avg = (Σ LGoal) / *n* FGoal_Avg = (Σ FGoal) / *n*	Average of all the IA finding's perspective-oriented potentials (related to one group of CBG)	
	FGoalV_Avg = (Σ FGoalV) / *n*	Average of all the IA finding's financial effects	
Total benefit or potential of the IA	BGoal_Sum = Σ BGoal BGoalMax_Sum = Σ BGoalMax	Sum of all the IA finding's complete potentials (related to all four groups of CBG)	For a comparison of IA results in consecutive years inside the same company (information for management)
	CGoal_Sum = Σ CGoal PGoal_Sum = Σ PGoal LGoal_Sum = Σ LGoal FGoal_Sum = Σ FGoal	Sum of all the IA finding's perspective-oriented potentials (related to one group of CBG)	
	FGoalV_Sum = Σ FGoalV	Sum of all the IA finding's financial effects	
Total benefit or potential of the findings of a single auditor	$BGoal\_Sum_i = \sum_{i=1}^{n_i} BGoal$	Sum of all the IA findings' complete potential for a single (i-th) auditor, who has n_i findings	As one of the criteria used for monitoring the work of auditors, their motivation, selection, training etc.
Average benefit or potential of the findings of a single auditor per organisational unit	$BGoal\_Sum_{ei} = BGoal\_Sum_i / m_i$	Average of all the IA findings' complete potential for a single (i-th) auditor per organisational unit in case he/she carried out the IA in m_i units	
Average benefit or potential of the findings of a single auditor	$BGoal\_Avg_i = BGoal\_Sum_i / n_i$	Average of all the IA findings' complete potential for a single (i-th) auditor, who set n_i findings	

be used not only to formally meet the requirements of the standard (ISO 9001:2008, ch. 8.2.2) but with a broader purpose to help managing the work and attaining the business objectives of the company. In accordance with this Mercator's management had a real interest to improve IA implementation process, and there was a consensus within the company, that in order to use the IA as an effective managerial tool, there is a need for appropriate approach that would enable measurement of the business results of implemented IA.

The object of our research was the IA of Mercator conducted in 2004/2005. The IA was carried out in 317 organisational units. It was realised by 10 leading auditors and 127 internal auditors. It resulted in documented findings including 67 non-conformities, 145 recommendations and 6 examples of good practice.

The first level of validation

This level of validation had two purposes:

a) To check the variability in parameter assessments among different assessors as we were interested in

Table 3. Test of variability in parameter assessments (input data to the ARA model) among different assessors.

Hypothesis about the extent of deviation			Statistical test						Rejecting the null hypothesis	Conclusion
ID	Assumption	Assumption (description)	α	n	M_0	M_1	t	P		
HM1	$M_{dev} < M_0$	The average deviation of the value of all nonmonetary assessment parameters (inputs to the model) between the test assessment and the control ones is lower than a limit value M_0.	0.05	8640	0.15 point	0.10 point	-9.1665	0.0000	HM1-2_0 rejected	$M_{dev} < 0.15$

whether the model assessment measures (Appendix 2) guaranteed appropriate precision and accuracy in the assessment of model input data; and

b) To check the reliability and validity of the model's calculated outputs (the findings' complete potentials and their aggregates) by comparing them with their evaluated values (given directly by assessors) from other assessments.

In testing the ARA model we first concentrated on the accuracy and precision of the findings' parameter assessments (input data), as these represented a basis on which reliable and valid and consequently useful assessment outcomes could be calculated. In the first testing of the model we tested the model's sensitivity to a choice of different assessors. The testing based on assessments carried out by a group of 13 members. The group consisted of experienced internal leading auditors in that IA. The model was explained to them and they all assessed the same random sample of 30 IA records/ findings. The sample included 10 non-conformities, 19 recommendations and one example of good practice and represented 13.7% of all the IA findings. Every assessor assessed 34 parameters for each record/finding (24 of them were input parameters to the ARA model and 10 were its calculated outputs).

In order to carry out the first level of validation we chose one of these 13 parameter assessments prepared by the 13 assessors as a test assessment. Since we wanted the test assessment to be positioned centrally regarding the other assessments, we chose the assessor who had the minimum deviations as the test assessor. Parameter assessments from the remaining 12 assessors represented the control assessments. We identified our test assessment by calculating the assessment deviation among the assessors. To do it we calculated 720 averages (for 24 assessment parameters and 30 sample records) of 13 parameter assessments (of the 13 assessors) and then for each assessor we calculated a sum of the squared deviations of his 720 parameter assessments from these related calculated averages.

To test the variability among the assessors we tested the hypothesis that the average deviation of all non-monetary assessment parameters (inputs to the model) between the test assessment and the control ones is less than the limit value M_o (M_o = 0.15). The results of the *t*-test used to test this hypothesis are shown in Table 3.

Table 3 shows that, since the null hypothesis is rejected, we can conclude that the average deviations of all non-monetary assessment parameters between test assessment and the control ones are less than 0.15 (on the scale 1 - 5). This means that the variability in the parameter assessments is relatively low among the 13 assessors. It shows that the level of understanding of the assessment method among all participating assessors was high enough and that there is similarity among them in understanding the problems that were the object of the assessments. This result can be attributed to the thoughtful choice of assessors (appropriate skill level and familiarity with the company), to clarity of the model assessment measures, the appropriate training of assessors before the assessment and the assessors' seriousness in realisation of the assessment.

Therefore our first conclusion is that the model assessment measures enable a high level of assessment objectivity and accuracy, and consequently low model sensitivity in relation to the choice of assessors assuming that assessors are appropriately prepared for the assessment. Considering this result we made the next step of testing by taking the test assessment parameters as an input to the ARA model and calculating the test assessment outcomes (complete potentials of the 30 records in the test sample) by using the model (model output data - CDrv, PDrv, LDrv, FDrv, CGoal, PGoal, LGoal, FGoal, BGoal, BGoalMax- Figure 3 and Table 2). The calculated test assessment outcomes were then compared with the outcomes directly assessed by the control group in order to test the reliability and accuracy of the model performance and sensitivity of the model results to deviations in the model input data (assessment parameters).

Table 4. Test of reliability and validity of the model's calculated outputs.

Hypothesis about the extent of deviation			Statistical test						Rejecting the null hypothesis	Conclusion
ID	**Assumption**	**Assumption (description)**	**α**	**n**	**M_0**	**M_1**	**t**	**P**		
HM2-1	$M_{dev} < M_0$	The average deviation of the value of all nonmonetary assessments of IA contribution to the groups of business goals (outputs of the model) between the test assessment and the control ones is lower than a limit value M_0.	0.05	3600	0.20 point	0.17 point	-3.1803	0.0007	HM2-3^0 rejected	$M_{dev} < 0.20$
	$M_{dev} < M_1$						-0.2633	0.3962	HM2-3_0 not rejected	Can not be confirmed: $M_{dev} < 0.17$
HM2-2	$M_{dev} < M_0$	The average deviation of the calculated final assessment of IA contribution to all the business goals BGoal (output of the model) between the test assessment and the control ones is lower than a limit value M_0.	0.05	360	0.20 point	0.17 point	-1.7263	0.0426	HM2-4_0 rejected	$M_{dev} < 0.20$

To test the reliability and validity of the model's performance we tested the hypothesis that the average deviation of the calculated nonmonetary outcome values (resulting from the test assessment) from the directly assessed ones (resulting from the control assessments) is less than the limit value M_o (M_o = 0.20 of a point). The results of the *t*-test used to test this hypothesis are shown in Table 4.

Table 4 shows that, since the null hypotheses are rejected, we may conclude that the average deviations of the calculated nonmonetary outcome values (resulting from the test assessment) from the directly assessed ones (resulting from the control assessments) are less than 0.20 (on the scale 1 - 5). These results confirm the high level of reliability and validity of calculations implemented in the ARA model.

Tests of variability in model input data among assessors and tests of variability in model's outcomes (output data) confirm low sensitivity of the model results to variability in the input data. Errors in the parameter assessments (input data) do not result in high variability of the model results (output data) as the average deviations of both assessment parameters and assessment outcomes between the test assessment and the control ones is significantly less than 0.20.

The second level of validation

The purpose of this validation step was to test the accuracy of the model and hence the applicability of the ARA model assessment outcomes. To achieve this purpose we compared the assessment of the IA potential to contribute to CBG based on the ARA model with its assessment resulted from a survey study.

As the first-level validation showed the stability of the model in relation to the choice of assessor, we carried out the assessment for the whole 218 records of the 2004/2005 IA in accordance with the requirements of the ARA model. Based on this input data, we employed the ARA model to calculate assessment outcomes (CGoal_Avg, PGoal_Avg, LGoal _Avg, FGoal_Avg, BGoal_Avg and BGoalV_Sum - Figure 3) representing the IA potential to contribute to achievement of CBG.

We needed a control assessment, so an anonymous survey study was carried out in Mercator. The empirical research collected subjective opinions about the impact of the IA among the three target groups of employees: internal auditors, auditees (audited persons) and managers of the audited organisational units. 119 questionnaires were sent out to 52 internal auditors (38% of all the internal auditors involved), 50 auditees (16% of all the auditees) and 17 managers (all the managers of the audited units). 95 questionnaires were received back and 18 out of them (incomplete or wrongly and inconsistently answered ones) were eliminated. Therefore 77 questionnaires were used for the analysis (36 auditors, 31 employees, 10 managers). The questionnaire included 13 questions regarding the noticed realized effects of the 2004/2005 IA, which included 317 organisational units

Table 5. Structure of the questionnaire.

Thematically related blocks of an impact of the IA on CBG	Assessed factors of business effectiveness and efficiency on which the IA has an impact		
	Positive effects of the IA **IA Improves:**	**Variable**	**Assessments value**
1. Impact on working with customers	- Communication with customers - Products and services mix - Quality of goods and services - Meeting the regulation's requirements	CAvg	1-5, do not know
2. Impact on internal processes and their performance	- Visibility of procedures - Organisation of work - Containing work disruptions - Workers' productivity	PAvg	1-5, do not know
3. Impact on learning and development	- Skills of workers and sharing of good practices - Communication and relations among employees - Stimulus for improvements	LAvg	1-5, do not know
4. Impact on performance from the financial point of view	- Decrease in actual and potential business loss resulting from inappropriately implemented activities that were discovered in the IA - savings resulting from proposed improvements	FAvg	1-5, do not know

Table 6. Comparison of the ARA* model assessment results with the survey study outcomes.

IA contribution to business performance	Scale	ARA* model			Survey study		
		Variable	**Average value**	**Standard deviation**	**Variable**	**Average value**	**Standard deviation**
Customer perspective	1-5	CGoal*	3.67	1.53	CAvg	3.72	0.48
Process perspective	1-5	PGoal*	4.09	1.28	PAvg	3.76	0.26
Learning and development perspective	1-5	PGoal*	3.83	1.42	LAvg	3.79	0.31
Financial perspective	1-5	FGoal*	3.20	1.54	FAvg	3.60	0.22
All goals perspective (balanced)	1-5	BGoal*	3.67	0.96	FinalContr	3.72	0.34

(over one third of all the organisational units in the company). A structure of the questionnaire is shown in Table 5.

Groups of questions from 1 - 4 include questions about the positive effects of the 2004/2005 IA that resulted in improvement of different performance drivers which were identified in the literature research in the theoretical part of the paper. A five-point Likert scale is used for assessment (1 - completely disagree; 3 - neutral; 5 - completely agree), with the possibility "I do not know" added as a possible answer. Partial perspective-oriented assessments (CAvg, PAvg, LAvg, FAvg) for each group of goals (thematically related blocks in the questionnaire) are calculated for each questionnaire as a simple average of individual assessments within the block (Table 5). An assessment of the IA contribution to all strategic goals (FinalContr) is calculated for each questionnaire, too. It is calculated as a weighted average of CAvg, PAvg, LAvg, and FAvg. The weights used are the same as those used to calculate BGoal in the ARA model. To obtain aggregate assessments of the survey, average assessments (average value of CAvg, PAvg, LAvg, FAvg and FinalContr) are calculated (Table 6).

The outcomes of the ARA model assessment were compared with the control survey outcomes. To assure a proper comparison between both of them we had to transform the ARA model results to the survey assessment scale. Both scales include grades from 1 - 5, but they have different meanings. So in the survey scale (Scale1) grade 3 means undefined (neither agree nor disagree), higher grades mean agreement with the IA contribution to the business performance. On the

Table 7. Results of testing the dependence of the assessments' results in relation to the assessment method.

Hypothesis about dependence of assessment results in relation to assessment method			Statistical test				Rejecting The null hypothesis	Conclusion
Assumption	**Test**	**Variable**	**α**	**m**	**χ^2**	**P**		
There are no significant differences between the results (positive effects of the IA) of the 3 target groups in the survey study and the assessment of IA contribution to the business goals using the ARA* model.	HM3-1_0	Cgopal*, CAvg	0.05	12	0.9562	1.0000	HM3-1_0 Not rejected	The assessment results are not dependent on assessment method.
	HM3-2_0	Pgoal*, PAvg	0.05	12	2.1646	0.9991	HM3-2_0 Not rejected	
	HM3-3_0	Lgoal*, LAvg	0.05	12	1.3841	0.9999	HM3-3_0 Not rejected	
	HM3-4_0	Fgoal*, FAvg	0.05	12	1.5534	0.9998	HM3-4_0 Not rejected	
	HM3-5_0	Bgoal*, FinalContr	0.05	12	2.3251	0.9987	HM3-5_0 Not rejected	

contrary, in the ARA model (Scale2) all grades with a value higher than 1 show some level of an IA finding's potential to contribute to the business performance. So we made a linear transformation of Scale2 to Scale1 which transferred an open interval [1..2) to open interval [1..3) and a closed interval [2..5] to an open interval (3..5]. The transformed ARA model and its outcomes are marked with an asterisk (e.g. BGoal*). The comparison of both assessment outcomes (the ARA* model and the survey) is presented in Table 6. On the basis of this comparison we tested relationship between the assessment method used and the assessment outcome (Table 7) using χ^2 test. In the next step we tested the differences between outcomes of both assessments using *t* - tests (Table 8).

We can conclude that the assessment of the IA potential to contribute to achievement of CBG does not significantly depend on the choice of method used (the ARA* model, survey among employees). The test of the relationship between the ARA model outcomes for specific groups of goals and their related survey outcomes (CGoal* and CAvg, PGoal* and PAvg, LGoal* and LAvg, FGoal* and FAvg, BGoal* and FinalContr - Table 7) supports this conclusion.

The average deviations between the ARA* model and the survey outcomes are significantly less than the 0.20 (on the scale 1 to 5) for individual group of goals (including deviations of CGoal* from CAvg, PGoal* from PAvg, LGoal* from LAvg, FGoal* from FAvg) and significantly less than the 0.15 for aggregate (average) assessments (deviations of BGoal* from FinalContr) (Table 8). These significantly small deviations of the ARA* model assessments from the results of the surveystudy conducted in Mercator reveal the model's high level of accuracy (with a tolerance of the assessment values of up to 4%). Therefore, the results of the ARA model can be confirmed as valid. These results point to the appropriateness of the developed ARA model for use in an assessment of an IA potential to contribute to achievement of CBG.

DISCUSSION

We showed that there is extensive empirical research about benefits of ISO 9001 implementation and that introduction of the ISO 9001 does not automatically bring business benefits; instead, certain conditions should be met. If the ISO 9001 is well applied it is expected to make a significant improvement to a company's performance (Singels et al., 2001). We identified different possible benefits of ISO 9001 implementation, classified them according to BSC groups of strategic goals and used the identified positive effects of the QMS as a basis for assessing the internal audit's contribution to the achievement of business goals and improving company efficiency. Therefore our approach is based on identified importance of appropriate integration of a QMS within strategic management system of the company.

Different researchers claim that the IA can be a useful managerial tool. It can help in assuring the effective and quality work of employees, in spreading knowledge and good practices among employees, in monitoring business performance, in the identification and solving of problems and in encouraging business improvement (Razzetti, 2003; West, 2003; Weiler, 2004; Lin Z. Jun and Johnson, 2004). Different researchers call for measurement of the IA's effects in their research (Beckmerhagen et al., 2003; Van der Wiele and Brown (2002), Heath and Milne (2002) in Rajendran and Devadasan, 2005). We related the possible benefits of IA implementation to the purpose of QMS implementation and consequentially identified positive effects of IA results associated with all four

Table 8. Results of testing the differences between the ARA* model and the survey results.

Hypothesis about the extent of deviation			Statistical test					Rejecting the null hypothesis	Conclusion
ID	Assumption	Assumption (description)	α	n	M_0	t	P		
HM4-1	(CGoal*, PGoal*, LGoal*, FGoal*, BGoal*) - (CAvg, PAvg, LAvg, FAvg, FinalContr) < M_0	The average deviation between the ARA* model and survey study results - testing aggregate ARA* (CGoal*, PGoal*, LGoal*, FGoal*, BGoal*) and survey (CAvg, PAvg, LAvg, FAvg, FinalContr) assessment results - is lower than a limit value M_0.	0.05	15	0.20 point	-1.9654	0.0348	HM4-1_0 rejected	(CGoal*, PGoal*, LGoal*, FGoal*, BGoal*) - (CAvg, PAvg, LAvg, FAvg, FinalContr) < 0.20
HM4-2	BGoal* - FinalContr < M_0	The average deviation between the ARA* model and survey study results - testing the ARA* (BGoal*) and survey (FinalContr) total - is lower than a limit value M_0.	0.05	77	0.15 point	-2.5732	0.0060	HM4-2_0 rejected	BGoal* - FinalContr < 0.15

groups of BSC strategic goals. Such approach is appropriate for our target group of companies that have a mature “quality culture” and a mature QMS as such companies expect that the results of an IA should contribute to their business performance. Finally paper developed a model for the quantitative measurement of the positive effects of implemented IA related to a potential contribution of the IA findings to achieving the company’s business goals.

The ARA model has been developed and empirically tested, however it has only been validated by using a single case study research. Further cross-sectional empirical research is needed to statistically confirm generalization of applicability of the model. The basic question, related to single case validation is whether the model’s criteria are suited to the needs in some other sectors and industries. On the other side the model has been flexibly structured in order to allow choice of different criteria in other industries. As mentioned, the purpose was to develop a tool with wide possibilities of application (in different environments), so the performance drivers as the key elements of the model were chosen upon extensive study of literature and research to meet the needs of broader group of companies, but only further empirical research can prove if this choice of drivers was a general one, or on the other side which drivers should be included for particular industries.

First level of validation confirmed the high level of reliability and validity of calculations implemented in the ARA model and with that it confirmed that the model works properly. However as the purpose has been to develop a model for practical use in improving the IA results, there is a need for further testing of the practical usefulness of the model. Longitudinal study within a specified company would answer the question whether the model actually ensures or enables the improvement of the IA process. We further explain practical usefulness of the model in the next chapter.

In relation to the practical usefulness of the model the second level of validation confirmed the accuracy of the model and hence the applicability of the ARA model assessment outcomes. In this level of validation subjective assessment of the impact of the IA results were used. In order to confirm opinion based results future studies could also use available data related to achievement of different groups of strategic goals.

Conclusion

The paper developed a model for assessing a potential of an IA to contribute to achievement of CBG as such a model is needed by companies that have a mature QMS and quality culture and are therefore motivated for an efficient QMS. Companies within this group are interested in making an effort to use IA as a managerial tool; therefore they are interested in a contribution of the IA to their business performance and in measuring this contribution.

The developed model is attractive to managers since management needs an assessment that is relevant, short and easily to understand. Managers don't have time to read lengthy reports including IA findings; instead they need summary information about the benefits of the implemented IA. By introducing a quantitative assessment (as a supplement to or instead of the current qualitative one), the model can be supported by standard software tools - for example Excel, which ensures that the implementation of such a model is not technically demanding and that the model is user-friendly. The model's results have also been validated in terms of meeting the criteria of accuracy and reliability.

The ARA model assessment outcomes can become a basis for planning and controlling the efficiency of the IA process and hence for its development. The calculated assessment outcomes can be employed as indicators of the IA efficiency. The assessment outcomes can be used to measure the efficiency of an IA and of the auditors involved in the same environment (organisational units, company) in the course of time. Further, these assessment outcomes can be used to compare and benchmark the efficiency of different auditors, organisational units and companies. These comparisons would ensure continuous development of the IA process. Positive trends in efficiency indicators would indicate that the process of conducting the IA is being appropriately developed while, on the other hand, negative trends would require a detailed analysis of the causes of lower grades. However, lower grades can result from less IA records and their decreased potential for improvement (e.g. if the QMS has achieved a high level of conformity with the standard). In such cases IA effectiveness and efficiency should also be confirmed by external audit results and by the company's other monitoring systems.
On the contrary, if lower grades are the result of decreased IA effectiveness and efficiency, IA process should be reconsidered and counter -measures taken to improve it.

An advantage of the developed assessment method is its possibility of calculating different aggregate outcomes. Both (average and total) IA potentials are important for decision-making related to the development of the IA process and to the selection and training of the auditors. As these aggregate assessment outcomes yield different information, they are used for different purposes and are used by different decision-makers (Table 2):

1. Average IA potential: Here, the value of the aggregate result does not depend on the number of IA records and therefore enables a comparison of organisational units with different complexity (having consequently very different number of IA findings). Average assessments show the average potential (applicability) of an auditor's findings. These assessments enable quick approximate evaluations of the potential based on sampling of IA findings, too.
2. Total IA potential: Here, the assessment is useful for simultaneous monitoring of a number of records and their potential (applicability). These assessments may be used to compare the IA results over time within the same organisational unit.

The results of the ARA model can be used as one of the criteria for selection, training and rewarding of internal auditors as the model enables an evaluation of the contribution of a specific auditor. This leads to the identification of appropriate training for those auditors who achieved poor results and possibly also the replacement of specific auditors. The results also provide an orientation to the auditors how to carry out an IA in a way that leads to more content-oriented findings (not to formalities) and therefore contributes more to achievement of CBG. Consequently, the applicability or potential of an IA to contribute to achievement of CBG would improve.

The same model can also be used for evaluating applicability or a potential of external audits. Assessment results would represent the basis for establishing the requirements to certification bodies (external organisations performing external audits) and for the mutual co-ordination of expectations between the two parties. The results would also provide the certification bodies with good feedback information that could be used in the development of audit processes and auditors.

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