CONTINUOUS ASSURED IN CONTROL

Peeking ahead in a tagged-date era

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1 THREE NEW CONCEPTS AND A NEW PRODUCT

Shareholders, financial analysts, managers and other stakeholders more and more need a continuous flow of information to cope with the ever faster, ever more complex and transparent global market. In the near future, this will expand into the continuous availability of business data that can be converted by the stakeholders into information tailored to their needs. Now that most of the Enterprise Resource Planning (ERP) systems are compatible with XML and XBRL, the technical basis is laid for the rapid, efficient and effective exchange of data. With the aid of XML and XBRL, the concept of the data warehouse can be fully utilized. Different stakeholders and different reports can use the same data. By a controlled access to the data warehouse for all stakeholders, both internal and external, stakeholders can compile themselves information what they need and when they need it. This trend has given rise to the first new concept: “continuous reporting”.

At the same time, the organization can benefit of this development by restructuring their governance and control structure to a more efficient and effective management instrument on which management’s statement on the reliability and integrity of the data in the data warehouse is based. This will be based on the second new concept: “continuous monitoring”.

As is the case with the information currently compiled by an organization, the stakeholder will only benefit from and make use of the information as long someone outside the organization continuously assures management’s statement on the reliability and integrity of the data in the data warehouse. Only if an independent expert provides that kind of assurance then it has added value for the users of that data. Because of his independence, the external auditor is the right person to provide that service. This gives rise to a third new concept, “continuous auditing” and a new auditor’s product “assurance by default”.

As one of the stakeholders, management will also need the continuous assurance that the governance and control information it has compiled for its own use is reliable. Apart from situations outside its control, a well-governed and controlled organization will perform in accordance with the strategy that the manager has in mind. If in turn this strategy focuses on the organization’s objectives, all elements are present for the organization and the manager to both be characterized as successful, a win-win situation. For these reasons, the internal control structure should guarantee the reliability of the information used by management. If so, the external independent auditor when performing his work can rely on such internal control in the

same way as he does when auditing the financial statements nowadays in the pre-tagged data era.

The question that now arises is how these three new concepts and that new product will work together to benefit all stakeholders, including the organization. The introduction of tagged-data, i.e. XML and XBRL data, will definitely change the information supply chain from a distribution of one-size-fits-all information to interactive data exchange. The form in practice cannot yet be fully defined owing to the technical problems which we will overcome in due time.

2 DOING BUSINESS IN THE FUTURE

Let's peek into the near future in which companies only provide business data electronically and the user uses these data to meet his own information requirement.

A situation, in which the above-mentioned acceleration in the information society can most easily be realized, is an organization in which all transactions are handled electronically. This might be a combination of XML data for logistic purposes and XBRL data for financial reporting. These transactions may encompass the entire business process, from receiving an order through shipping the product to collecting the receivables. The only element that remains tangible is the actual deliverable. However, if a service is concerned, the transaction takes place entirely in a virtual environment. If all company's transactions are electronic and its products have no tangible form (e.g. in the case of an insurance company), the organization moves entirely into virtual space. In the virtual space, management can rapidly disseminate the data regarding the organization's performance to the social and economic arena, which will use it to fulfill its information needs. This activates the continuous reporting concept.

To perform the governance and control of his organization, the manager will likewise have to enter the virtual space, with his set of management instruments. If he does that, he can respond to the acceleration in the desire for information of the social and economic world as described above. The speed required for the supply of data and the assurance regarding that data imposes the following condition: a level of reliability that is pre-defined and issued by management in the format of an in control statement. An assumption of this nature places the responsibility for data reliability where it belongs, with the organization. An organization should by definition supply information that satisfies that pre-agreed level of reliability. The proposition that it is sufficient to determine retrospectively whether the data supplied satisfy the specific level of reliability, for example with the aid of regular accountability reports, like the traditional financial statements, shows a lack of organizational power, as a result of which the added value of the data provided is greatly diminished for their users. It is of great importance for management that the electronic data made available meet the level of reliability they has been pre-defined and issued. This triggers the continuous monitoring concept and empowers the management's in control statement.

Naturally, such a development will have consequences for the independent auditor. He, too, will have to enter virtual space with his audit approach so that he can quickly provide the management's statement regarding the reliability of the data with the necessary assurance. The only way the independent auditor can achieve this is by implementing the continuous auditing concept. In his audit approach, the independent auditor can rely on the continuous monitoring process as he did on the internal control process in the pre-tagged data era. Within the contours of the virtual space, and in an appropriate manner, the details must be decided upon for the requirements and needs of the users of the organization's data, the management's reliability statement and the assurance provided for it by the independent auditor. After a full scope implementation of the continuous auditing concept the assurance the independent auditor can provide will be continuously and a new auditor's product is born: assurance by default. The user of the data made continuously available by the organization may take it for granted that the data is reliable and audited by an independent auditor.

In order to realize the two new concepts and the new auditor's product, management and independent auditors should be supported by sophisticated software tailored to the specific characteristics of the governance and control structure related to the type of organization concerned. The design of this sophisticated software should ensure that the management's reliability statement and the auditor's report can keep pace with the business processes. The type of sophisticated software that can be used is based on knowledge technology. Instead of processing real data this kind of software extracts knowledge out of the real data accumulated and recorded in and through the organization's business processes. This software is referred to as data mining software based on the research done in the area of artificial intelligence and will be explained in paragraph 3.2..

Since every organization has its own specific business processes, and governance and control structure, and since every manager has his own preferred way of performing governance and control, it is not possible within the scope of this article to address all possible configurations of the continuous monitoring and auditing processes. Accordingly, this article only describes one form of the continuous monitoring and auditing processes in broad terms. In the following sections, we address first the accounting system prerequisites that should be fulfilled if the organization is to profit from the advantages of the continuous monitoring and auditing processes. Next, the operation of the continuous monitoring and auditing processes is explained. Then we address the procedures that the auditor should perform in order to provide assurance by default. The article concludes with a summary, including some outstanding issues for future research.

3 INFORMATION SYSTEM PREREQUISITES

The process of continuous reporting imposes a number of prerequisites. These will need be satisfied if an implementation is to bear the fruit that may be expected of it. These prerequisites relate to:

1 availability of reliable data

2 software support
3 organizational support.

These issues will be addressed below.

3.1 Availability of reliable data

If reliable information is to be available continuously, then the data that underlies it should also be reliable and available continuously. To be able to help the stakeholders selecting the information they need, the organization should be familiar with their information needs and approve the supply of the underlying data. To guarantee the continuity of the information to be compiled by the users themselves it is necessary that the data that forms the basis of the information to be compiled is continuously available in an unambiguous format, such as XML and XBRL. Given that the quality of information depends heavily on the quality of the underlying data it is very important that, at a minimum, all requirements typically imposed on the security of computer systems are satisfied. Without presenting an exhaustive summary in this article, the kinds of controls, often called the Information Technology General Controls, that should be considered are those concerning physical and logical access control, change management, data communication and the full range of controls applying to data integrity and knowledge management.

If assurance needs to be provided on the management's statement regarding the reliability of the business data arising from a business process and regarding the organization's physical product or service then data derived from the production process (process data) as well as derived from the content of the product or service (product data) should be both involved in the assessment. Both types of data, process and product data, should be viewed in relation to one another. It is not possible to pass judgment on a business process without considering both types of data in relation to one another. Considering the two types of data in this way is necessary given the simple fact that a good product could be produced in completely the wrong way and a faulty product can be the logical outcome of a sound production process. By considering both types of data in relation to one another, the continuous monitoring process concerning both the performance of the business process and the product produced can in itself be given continuous assurance for management decisions internally. In this way, within the continuous monitoring process the best possible use is made of process data and product data, wherever possible at the transaction level. As explained in the remainder of this article, the individual data items will be used repeatedly, in particular when creating the standards that are used to assess the new virtual transactions.

Before the XML or XBRL data can be used in the continuous monitoring process the process and product data should be made available as such. The tags should be constructed in a way that they include the internal controls related to the integrity of the data. Those controls should resemble the transaction data controls in the traditional internal control procedures in the pre-tagged data era. Manipulation of data can not only take place by manipulation of the data itself

but also through the manipulation of the XML and XBRL components, such as the taxonomy and style sheets. For this reason, it is important that the XML and XBRL environment in which the data have been embedded is sufficiently robust and secure so that the integrity of the data is ensured.

3.2 Software Support

Given that the continuous monitoring process is expected to guarantee a pre-defined level of reliability of the data, the before mentioned sophisticated software programs suitable in this respect can be used to develop and maintain criteria against which individual transactions can be measured. These criteria, hereafter called standards, should do justice to the objectives of the continuous monitoring process. As long those standards represent a large continuously changing data set out of which the are extracted they will change as well over time. As a rule, these standards are derived from empirical data. Given that in continuity, judgment will be passed about the data derived from both the performance of a process and the product itself, and transactions affecting the empirical data will be performed, it seems logical that in continuity the framework of standards will be assessed whether that framework continues to satisfy the requirements to which it is subject.

Artificial intelligence software programs and specifically those based on neural techniques, are developed to make these standards dynamic. On the one hand, such programs can create standards independently analyzing the process data and product data supplied as input. They do this with the aid of supervised and unsupervised learning methods. On the other hand, such programs can apply these standards to each individual transaction and indicate the points where a transaction deviates from the standards. This is achieved by employing the concept of pattern recognition. Software programs like these are capable, therefore, of generating knowledge patterns from a large quantity of data. Given the quantity of data involved, pollution in the data files (such as the lack of data elements or discrepancies in data elements) will not be an obstacle. The pollution of the basic data, however, will adversely affect the value of any knowledge pattern generated. Working with these types of software program has a number of organizational consequences, since the generated knowledge patterns can be considered an asset, the organization's core "knowledge", the very "knowledge" with which revenue is actually generated. Working with knowledge as an asset of an organization will have an impact on the organizational structure; a knowledge management should be responsible for the developed and maintenance of the organizational knowledge.

3.3 Organizational support

As mentioned in paragraph 2 as well as above, a knowledge management structure should be set up to manage the knowledge patterns. The roles needed to perform the activities are very largely the same as those found in a database management organization. To ensure the

reliability of the organization's "knowledge", there should be a proper segregation of duties between the roles of the knowledge administrator and the knowledge base administrator.

Furthermore, suitable organizational controls must be implemented to ensure that the discrepancies detected by the continuous monitoring process can be assessed at all times and, if necessary, corrected and reported. Clearly, the assumption underlying the continuous monitoring concept is that the electronic data supplied meets management's pre-defined level of reliability.

4 A CONCEPTUAL CONTINUOUS MONITORING PROCESS

As stated earlier, continuous monitoring uses:

- process data
- product data
- dynamic standards.

This paragraph explains the main features of the continuous monitoring and continuous auditing processes related to a virtual business process.
We examine the continuous monitoring process as shown in Figure 1, "The main features of the continuous monitoring process" at the end of this paragraph. The numbers below refer to the figure.

Conceptually the continuous monitoring process consist of the following steps:

1 The start of the continuous monitoring process lies in the development of the first two standards, one for the production process and one for the product. These standards are the knowledge patterns based on data derived from both the production process and the product produced as described in paragraph 3.2.. A knowledge pattern consists of the entirety of the prototypical attributes that best describe a certain object, in this case the production process and the product.

A database containing all the necessary data elements in XML or XBRL format is a very useful starting point for compiling such knowledge patterns. With the aid of data-mining software programs based on neural techniques, the knowledge patterns can be extracted from the database relatively easily. The better the knowledge patterns describe an object, the better the distinctive power of the system. The development of this distinctive power depends on the extent to which the attributes included in the knowledge pattern are prototypical for the object. Before the knowledge patterns are used as the standards, the subject matter experts should perform a validation. They should confirm that the knowledge patterns are a correct reflection of the knowledge level and the knowledge segment that

was the most appropriate to them. In this way, the first two standards in the standards process are established.

The compilation of a knowledge pattern of prototypical attributes that describes a product will often be easier than the compilation of the knowledge pattern of prototypical attributes of the production process that produces the product. Nevertheless, it is essential that both knowledge patterns are compiled. All sorts of non-financial data might be of importance, especially when compiling the knowledge pattern of the production process. For example, these non-financial data will be data such as production times, downtime and waste percentages or software programs used and programming lines hit.

2 After the first knowledge patterns or standards have been compiled, then for every individual transaction a pattern of attributes should be established in exactly the same way, derived from both the production process data and the product data.

3 The patterns of attributes derived in step 2 are compared with the knowledge patterns compiled in step 1. This is done for both the production process and final product patterns. Here, too, artificial intelligence software programs can be used, in particular pattern recognition software.

4 If the production process and product patterns of attributes both fall within the tolerances set for the standards, no further action is taken. Individual transactions showing a discrepancy between the individual patterns of attributes and the standards that exceeds a pre-defined threshold are assessed and validated by the subject matter experts. In this way, the “management by exception” approach is upheld. This approach also uncovers any fraudulent actions, since they result in discrepancies in the transaction data belonging to either the operation process or the product patterns with respect to the two standards.

5 Until now, the two standards seem to be very stable but that is not the intention. As long the economic live is changing rapidly, production processes and their products will change accordingly. For that reason, the standards developed in step 1 are also subject to changes. Once a pre-defined number of transactions have been processed, for example after the daily production run has ended, the standards in use are archived and new standards are compiled in accordance with step 1. The newly standards compiled are based on the data collection from the preceding day including the changes from the current day’s production. This reflects the dynamic character of the standards; from now on the standards will be called “dynamic standards”. Every time a number of transactions has been processed, new dynamic standards are established against which the subsequent transactions are assessed.

6 The deviation from the newly compiled dynamic standards and the archived dynamic standards is determined. If the discrepancies concerned are small and fall within a pre-defined threshold, they can be accepted. While these discrepancies will have no influence, the high-frequency occurrence of small discrepancies can certainly cause large

discrepancies over time. As mentioned above, the dynamic standards are derived from the process data and product data. If these data sets were manipulated, then the dynamic standards would also be affected. If repeatedly, over a very long period, small amounts of manipulated data are included in the data warehouse; these manipulations will not be discovered during the automated inspection of the transaction. Over the longer term, however, they definitely will affect the dynamic standards. By tracking the trend of changes in the dynamic standards very closely and by looking in particular at the shifts in the values of the prototypical attributes, this manipulation can be detected. A shift in the dynamic standards should be the consequence of a strategic choice. This is because the dynamic standards have been compiled from a very large number of data. Only a strategic choice related to the production process or the process produced will yield a large number of new data. If nothing has been changed strategically, the dynamic standards ought to be reasonable stable.

7 The trend in the dynamic standards should be evaluated with the same frequency as the compilation of those dynamic standards. This is an activity for the subject matter experts, since it concerns the basis of the assessment of new transactions and lies at the heart of information reliability control. If the new dynamic standards are better, in terms of their distinctive power, than the archived standards, the newly dynamic standards are released for the subsequent operations.

Since new dynamic standards are identified and validated continuously, the dynamic standards keep pace with any change in the production process or the product in so far as these changes do not disrupt the trend. This entire process of compiling dynamic standards, analyzing deviations from these dynamic standards over time and releasing new dynamic standard periodically so that they on their term may contribute to the validation of new individual transactions is the process that is necessary to make the standards dynamic. The dynamic standards may change, but they follow, with some time delay, the strategy accepted and pursued by the organization. This strategy is the basis of the management information. The governance and control of the dynamic character of the standards therefore contribute to the reliability of the continuous reporting process. They can be seen as a new elements in an organization's control and reporting function. If the individual transaction data underlying the information can be considered reliable in real time, management can express their in control statement regarding the real-time reliability of the reports compiled from the data.

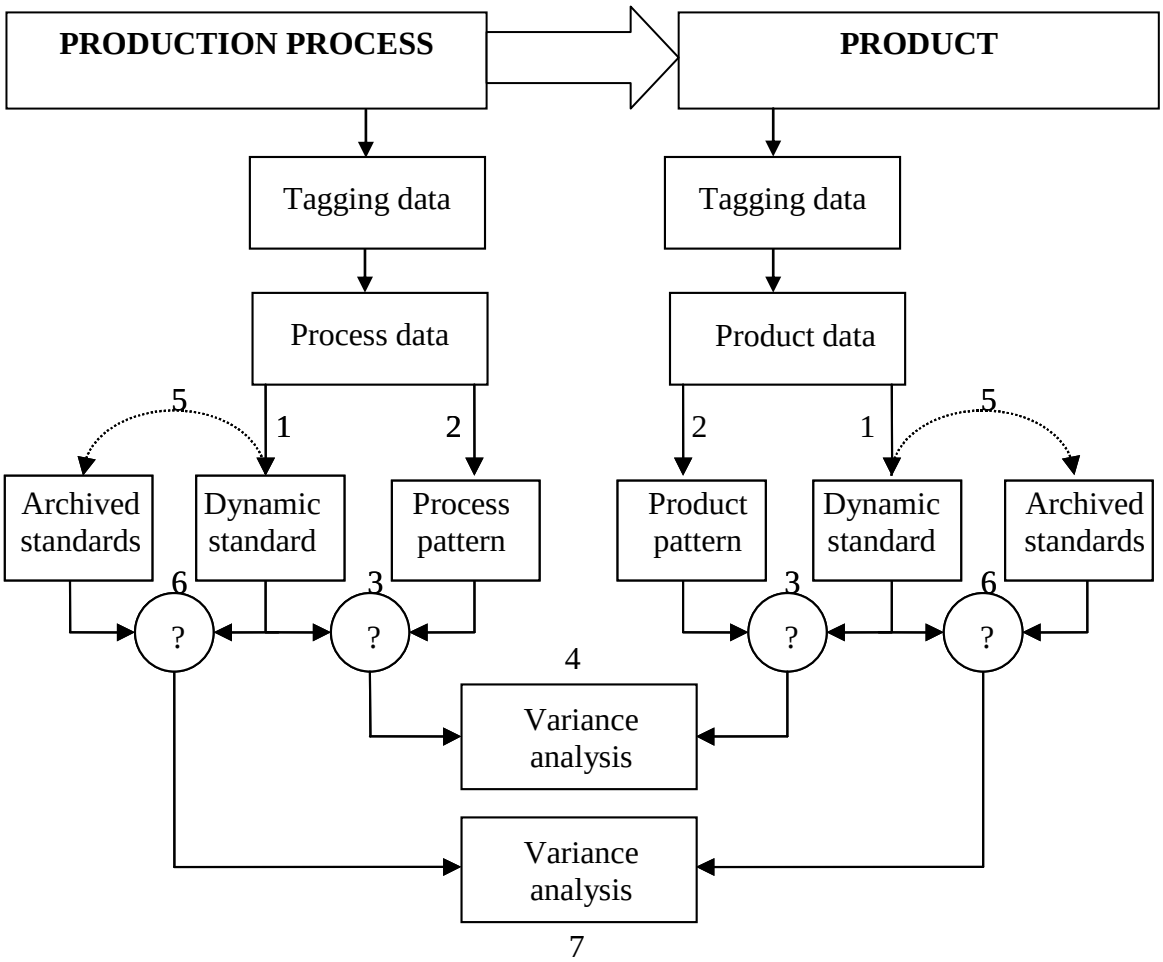

Figure 1. The main features of the continuous monitoring process

5. A CONCEPTUAL CONTINUOUS AUDITING PROCESS

In the pre-tagged data era, the object of the audit performed by the independent auditor was clearly defined; it was a responsibility statement issued by the management of the organization. Yearly, it had the format of a financial statement compiled using general accepted accounting principles (gaap), like US GAAP or International Financial Reporting Standards (IFRS). After the independent auditor had performed his audit he issued an auditor's opinion in confirmative with the general accepted auditing standards (gaas), like US GAAS or the International Standards on Auditing (ISA's). The base behind those auditing standards was: reliance on the internal control processes as much as possible. In the tagged data era this will not change; it will even be far more dominant. The independent auditor can not concentrate his work effort in a specific point in time like in the pre-tagged data era; the audit of the internal control during the interim audit

roughly in the third quarter of the business year and the balance sheet audit in the first quarter following on the moment the books were closed. He has to do his audit continuously, in real time, on the moment a transaction is processed.

The independent auditor runs a major risk. He might be absorbed into the continuous monitoring process and loosing his independence. Management will post a statement on the Internet to confirm that the data that they have made available is reliable; claiming reliable by default. The independent auditor will be forced to perform in the same manner and must issue an assurance by default statement. This now puts the auditor's work under great pressure. He will have to convince himself continuously of the reliability of the data that the organization publishes. For this, the independent auditor would like to rely as much as possible on the internal control structure of the organization. To do this, he needs to ascertain whether that internal control structure satisfies all the requirements to which it would be subject at all times. As part of this audit approach, the independent auditor will have to enter the virtual space in order to find sufficient audit evidence to provide a sound basis for his assurance by default statement. The independent auditor has to realize that an tagged data audit does not focus on a responsibility statement from management but on the data continuously made available through the internet. The object of his audit will be the data instead of the information. Were in the pre-tagged data era the audit opinion reflects a true and fair 'view' of information provided through a responsibility statement, there is no 'view' anymore. The stakeholder who has received the underlying data form the organization will construct the 'view' by himself. Those data will be used several times for different stakeholders as a basis for different information 'views'. The independent auditor should be aware of the fact that the materiality concept does not exist anymore. It was a concept related to the view-concept. Because the view-concept is not existing anymore as a consequence the materiality concept has vanished.

The focus of the audit of the independent auditor will be on the effectiveness of the continuous monitoring process. This can be done by focusing on the general controls and the meta data and meta process controls.

Conceptually the continuous auditing process consists of the following steps:

1 The auditor has to make sure that he is continuously informed about the Information Technology General Controls as mentioned in paragraph 3.1.. Those controls should be in place and every deviation of the standards set out for them should immediately be reported not only to the responsible management but also to the independent auditor. Responsible management should keep the independent auditor informed about the actions taken continuously. On top of that, all intended changes in the XML and XBRL components, such as the taxonomy and style sheets, and in the internal control structure to assure the reliability of the data and included in the tags, should be reported to the independent auditor instantly.

2 Performing a first time audit, the independent auditor should start his audit by an in-depth audit of the tagging process including the general taxonomies and extensions in use.

3 Next to that, he has to evaluate the robustness of the Information Technology General Controls and the communication protocols through which the independent audit will be informed about even the smallest deviation of the Information Technology General Controls.

4 Further more, the independent auditor should have in-depth knowledge of the internal controls included in the tags securing the data integrity. To perform this part of the audit, the independent auditor should have in-depth knowledge of the entire internal control structure of the organization, not only regarding the financial data but also regarding the non-financial data.

5 The independent auditor should perform audit procedures to form his opinion on the knowledge management of the organization. For that reason, he should look into the process of creating dynamic standards, maintaining them and the process of analyzing the deviations of the transactions regarding the dynamic standards.

6 The auditor should perform audit procedures to form his opinion about the trend in the development of the dynamic standards in relation to the strategic choices the organization has made related to the production process and the products produced.

It will be clear that sophisticated software programs should support the audit the independent auditor performs. Changes or problems have to be detected automatically and brought to the attention of the independent auditor electronically without any delay. The auditor can decide to withdraw his assurance by default statement for a short period or issue an 'adverse assurance by default' statement if the situation is serious. Independent of the actions taken by management, the auditor should form his own opinion regarding the effectiveness of those actions in relation to the problems detected.

If the independent auditor looses his independence the added value of his independent audit will vanish without any delay, so the auditor should foster his independence as never before.

6 CLOSING REMARKS AND CONCLUSIONS

As its subtitle indicates, this article presents a vision of the future. It examines in more detail the control of the company's virtual processes. This vision assumes an organization that has a XML and XBRL environment at its disposal. The use of sophisticated software programs and dynamic standards is added to that environment. Moreover, it is assumed that the organization wishes to report continuously and reliable. The benefits of continuous reporting for the stakeholders are that they will receive the information they actually need; no more, no less. This does not imply that the organization will make all her information general available to her stakeholders. The

internal stakeholders, by contrast, will have more access rights than the external stakeholders. Since the management of the organization implemented a continuous monitoring process, management can easily issue an in-control statement regarding the reliability of data stored in the data warehouse.

The development of this concept enables the organization to respond to the demand that emerges from social developments. The stricter control achieved with the assessment of each transaction will make it possible to inform the social and economic arena more quickly of developments in the organization, which may well make it possible to recognize at an earlier stage business failures comparable to those in recent cases, and to take appropriate action.

As should be evident from the foregoing, for the time being the concept is only workable in highly advanced computerized environments. Moreover, it is necessary that the data be recorded in an unambiguous manner such that the switch to analyzing it can be easily made. For the time being, the concepts of XML and XBRL has a clear role to play here. For the compilation and development of the dynamic standards and the testing of the individual patterns, software is required whose development is based on neural techniques derived from the developments of artificial intelligence. This also has far-reaching consequences for the way the entire continuous monitoring process is embedded in the organization. The incorporation and maintenance of a "knowledge" management structure is a necessity.

Overall, five new auditing research areas can be detected:

1 the feasibility of the assurance by default concept;

2 the consequences of the disappearance of the 'view'-concept and as a consequence the disappearance of the materiality-concept;

3 the benefit of data mining and learning protocols to create dynamic standards;

4 the concept of dynamic standards;

5 the independence of the independent auditor.

Literature

- Alles, M.G., Kogan, A., Vasarhelyi, M.A., *Feasibility and Economics of Continuous Assurance*, Auditing: A Journal of Practice & Theory, Vol. 21, No. 1, March 2002.
- Bédard, J., *The Effect of Practice on Content and Structure of Auditors' Knowledge*, Paper, 17th Annual Congress of the European Accounting Association, Venice, April 1994.
- Bonner, S.E. and P.L. Walker, *"The Effects of Instruction and Experience on the Acquisition of Auditing Knowledge"*, The Accounting Review, Vol. 69, No. 1, January 1994.

- Elliot, R.K. *Twenty-First Century Assurance*, Auditing: A Journal of Practice & Theory, Vol. 21, No. 1, March 2002.
- Hall C., *Data Mining: Tools and Reviews*, Cutter Information Corp., Arlington, 1996.
- International Accounting Standards Committee Foundation, *Building an IAS/IFRS taxonomy using XBRL, A new language for corporate reporting,* IASB Insight, October 2002.
- Lacey A.R., *Een woordenboek van de filosofie: Begrippen, stromingen, denkers,* Bert Bakker, Amsterdam 1989.
- Libby, R, *The role of knowledge and memory in audit judgment, Judgment and Decision-making research in accounting and auditing*, Cambridge University Press, New York, 1995.
- Rezaee, Z., Sharbatoghlie, A., Elam, R., McMickle, P.L., *Continuous Auditing: Building Automated Auditing Capability*, Auditing: A Journal of Practice & Theory, Vol. 21, No. 1, March 2002.
- Rosch E., *"Principles of Categorization"*. In: *Cognition and Categorization*, edited by E. Rosch and B.B. Loyd, 28-48 Hillsdale, New Jersey: Lawrence Erlbaum 1978.
- Swagerman J., "*Data mining een belangrijke ontwikkeling voor de accountantspraktijk"*, de Accountant, May 1994 and September 1994.
- Swagerman J., *"Exploitatie van de verborgen kennis in databases"*, Informatie*,* volume 33, no. 4, pp 258 - 263, 1991.
- Verkruijsse, J.P.J., *"The future of XBRL",* Addressing XBRL, moving business and financial reporting into the digital age, Ernst & Young LLP, December 2008.
- Verkruijsse, J.P.J., *"Het einde van de jaarrekening en het begin van de Google-verslaggeving",* Regels voor de toekomst Kansen voor een duurzaam ondernemend Nederland, Royal NIVRA, December 2008.
- Verkruijsse, J.P.J., *"Er is geen enkele reden waarom een accountant zich moet beperken tot financiële informatie"* , Trends in Accountancy, Branchverkenning 2008-2009, Royal NIVRA, November 2008.
- Verkruijsse, J.P.J., *"Concepts of XBRL",* Inform three publications, Ernst & Young, February, July and November 2008.
- Verkruijsse, J.P.J., *"De 'continuous assurance'-verklaring bij 'continuous reporting' het werkterrein van de toekomstige accountant"*, Handboek Accountancy, Kluwer, June 2003.
- Verkruijsse, J.P.J., *"Het Continuous Assurance-proces"* Handboek Automatisering van de Informatieverzorging, Kluwer 2002
- Verkruijsse, J.P.J., *Continuous Assurance-Proces, een eerste antwoord op frequenter afleggen van verantwoording*, Inform, Ernst & Young, 2002.
- Verkruijsse, J.P.J., *Knowledge Management: een bezigheidstherapie voor onbegrepen managers?* Inform, Ernst & Young, 2001.
- Verkruijsse, J.P.J., *"Expertsystemen: een betrouwbare ondersteuning voor managers en accountants?"* Handboek Automatisering van de Informatieverzorging, Kluwer, 1998.
- Verkruijsse, J.P.J., *"Data mining, het control-ei van Columbus"*, Handboek Automatisering van de Informatieverzorging, Kluwer, 1997.
- Weiss S.M. and C.A. Kulikowski, *Computer systems that learn*, Morgan Kaufmann Publishers Inc., San Mateo, California, 1991.

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