Chapter 16
Automating the Audit Process of Management Systems Through Artificial Intelligence Methods

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Abstract The chapter explores the impact of the COVID-19 pandemic on the extensive transformation of management processes audit, the prerequisites for this transformation and the development of models and methods to automate the management processes audit through artificial intelligence methods. The key feature of the transformation of audit processes is achieving inclusive and sustainable growth. Inclusive growth is considered not only in terms of the process itself but also in regard to its final result. Automation not only accelerates audit procedures, reduces time- and labor-intensive, mitigates the epidemiological risks to participants but also applies the findings to a wider range of processes. The impact of improvements is getting extensive for more people involved in various production operations. A detailed study has led to the development of the model for the application of artificial intelligence methods for automating the process audit of management systems. The creation of the model was prompted by the need to improve the capabilities to save both the sustainability of adaptable systems and processes and stable economic growth. The chapter identifies the most important tasks in developing an effective automated audit model, as well as the functionality of each element of the automated audit model and its implementation prospects. Also were analysed risks emerging from the implementation of this approach.

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16.1 Introduction

The analysis of the basis for applying management systems audit methods currently needs to highlight three main components: the state of management systems audit methods in the pre-pandemic period, research on-site of audit process automation and modern artificial intelligence methods in the perspective of applying them to audit management systems.

16.2 Methodology

The theoretical and methodological basis to improving quality management systems is laid in the [1–5] writings. The issues of the influence of informatization on the functioning of management systems of different levels were studied by [6, 7] and others.

The concept of management systems is specified by a number of international and national standards, including [8–20] etc. Worldwide, millions of organisations are using these standards to improve performance, efficiency and competitiveness. These standards require such an essential management system feedback and monitoring method as an internal audit. The external audits of management systems, for example in pre-contractual, 2nd party or 3rd party certification activities, follow the requirements specified in the relevant documents, such as [21, 22]. All these documents focus on-site audits, where a team of auditors carries out the field audit at the premises of audited entity, for example at an organization or a particular unit.

As far back as the pre-pandemic period there have been efforts to reduce the share on-site work in management system audits through, for example, remote audits using information and communication technology [23, 24]. The main reason for using remote audits was to reduce costs. However, remote auditing methods do not provide the only alternative on-site audits. Another approach to streamlining the audit process is its automation.

The rapid spread of coronavirus infection has led not only to huge economic losses but also to the transformation of various business processes. A large-scale study conducted by the CQI—Charted Quality Institute (UK) and Qualsys, a quality management software developer company, resulted in formulating the main trend of quality management system audits under COVID-19: an automated quality system plays the key role in solving many problems [25].

Almost all information-analytical tools can be applied in some way to automate the audit process. Such tools include database management systems, search engines, cloud technology, etc. However, applying these tools is only possible in a fragmented way and does not significantly reduce the proportion on site audits.

The application of artificial intelligence algorithms can lead to a major breakthrough in the automation of the audit process. Artificial Intelligence is "… the property of automatic systems to perform certain functions of human intelligence …

to select and make optimal decisions based on prior experience and rational analysis of external influences" [26]. The concept of "machine learning" is also used as a relative of "artificial intelligence". There are many types of artificial intelligence algorithms, and the most popular are the following:

A. K-Nearest Neighbour Algorithm

It is the identification of the class affiliation of the studied object through exploring a predetermined neighbourhood in the multidimensional space of objects with a predetermined affiliation to a certain class (Fig. 16.1).

B. Neural Network Algorithms

It relies on mathematical modelling of the structure and connections between artificial neurons transformed by processed data sets (Fig. 16.2).

C. Support Vector Machine Algorithms

It uses the transformation of numerical vectors into a multidimensional space and the subsequent search for the hyperplane that most effectively separates different objects to be assigned to a particular class of unidentified objects (Fig. 16.3).

D. Random Forest Algorithm

It allows creating a predetermined set of "decision trees" based on the structure of the data samples, which acts as a sequence of actions to compare the available data with the criterion values (Fig. 16.4).

However, there were some studies of applying artificial intelligence algorithms to analyse management systems [26], but the main focus was on analysing data for management processes.

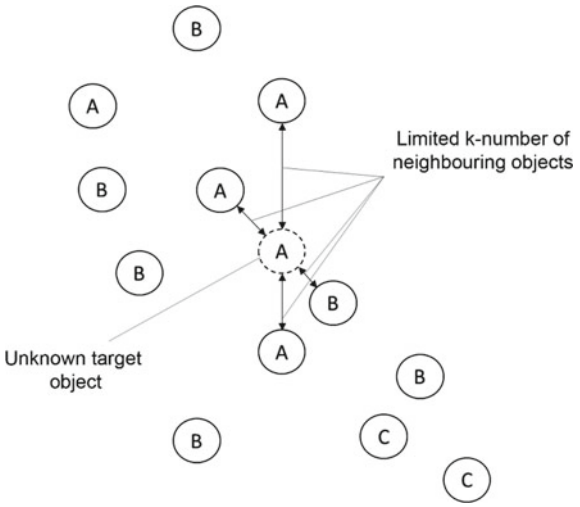

Fig. 16.1 Example of a K-Nearest Neighbour scheme. *Source* Developed and compiled by the authors

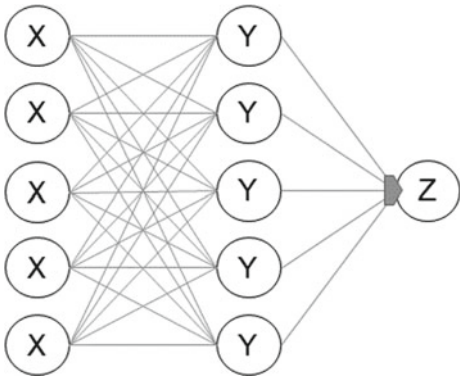

Fig. 16.2 Example of the Neural Network Algorithms simplified scheme. *Source* Developed and compiled by the authors

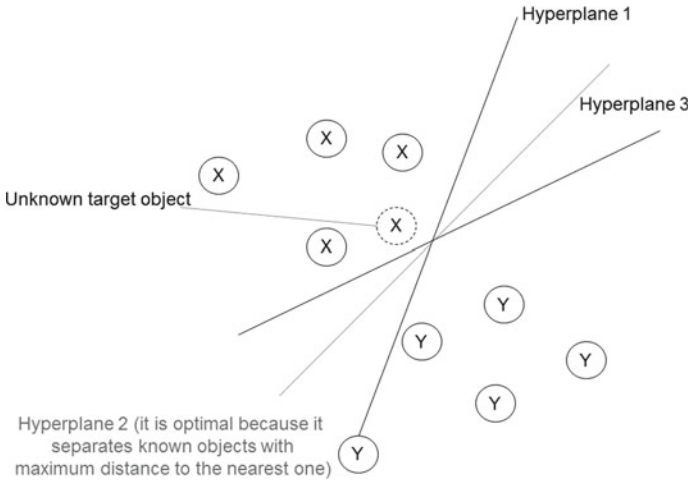

Fig. 16.3 Example of the Support Vector Machine Algorithms simplified scheme. *Source* Developed and compiled by the authors

16.3 Results

16.3.1 Model for Applying Artificial Intelligence Algorithms to Automate the Process Audit of Management Systems

To achieve the goal of streamlining the audit process through its automation [27] it is necessary to structurally link the following elements:

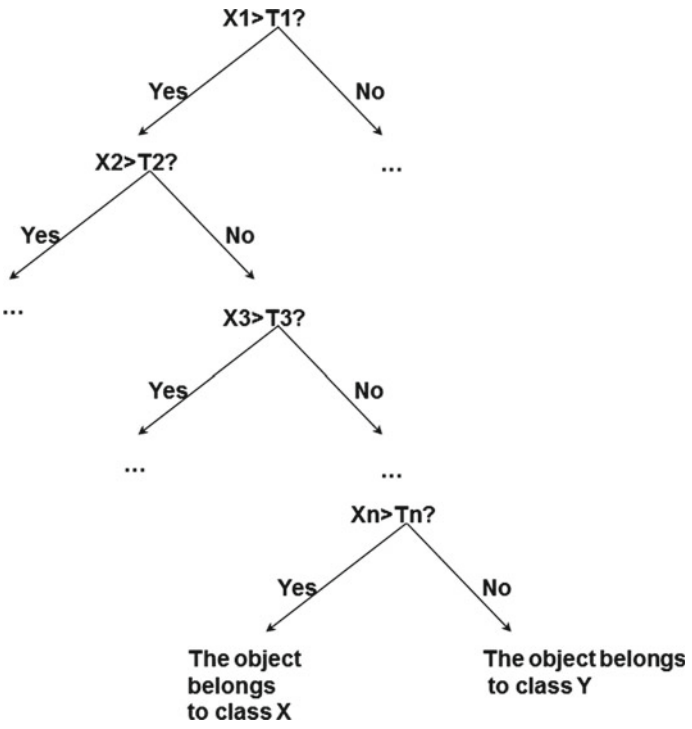

Fig. 16.4 Example of the simplified scheme of Decision Tree class algorithm. *Source* Developed and compiled by the authors

- Intelligence is important to create a core system, based on artificial intelligence methods, which is capable of comparing objective evidence of compliance with established criteria, e.g. the requirements of one of the previously mentioned international standards and of making a compliance/non-compliance decision through rapid real-time reconfiguration.
- Mobility is essential to provide the auditee with a quick and easy interface to the analytical system.
- Activity is the ability of the system to independently communicate with the auditee, to actively dialogue with the auditee pursuing the audit objectives.
- Adaptability is the ability of the analytic system to adequately identify and respond appropriately to non-standard words and phrases of the auditee during the dialogue and correctly relate them to the evidence of conformity/non-conformity [26].

To realize these objectives, the authors developed a model of an intelligent system to perform automated audits of management systems (hereinafter "systems") (Fig. 16.5).

The model consists of the following elements:

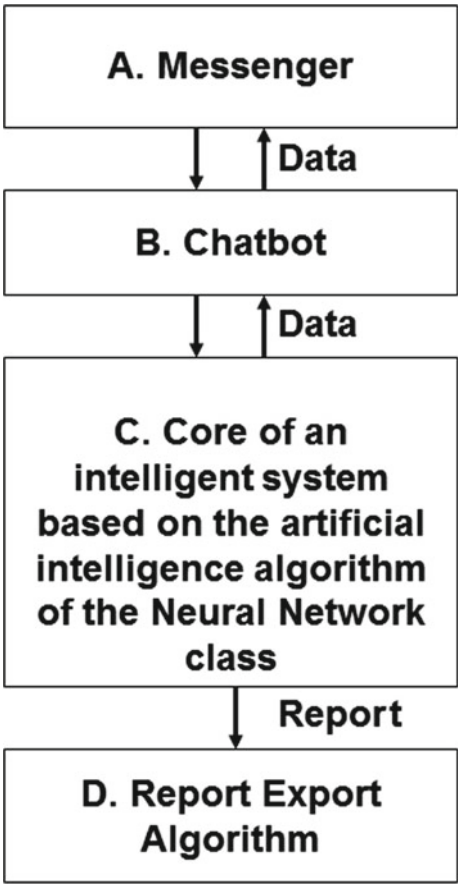

Fig. 16.5 Model of intelligent system for automated management system Audits. *Source* Developed and compiled by the authors

A. Messenger

The most important challenge in developing an effective automated audit model is to ensure its high mobility. Traditional approaches involving the deployment of specialized software on the auditee's equipment entail an unreasonably high cost in terms of technical, time, human, and financial resources. There are also significant risks of incompatibility between software and hardware. It is suggested that any of the popular messenger programmes installed in almost any modern mobile or desktop computer or mobile phone may serve as an interface between the auditee and the system.

B. Chatbot

A chatbot is created to enable the intelligent system to communicate with the auditee using the basis and means of a specific messenger. To control the chatbot, the system exchanges the relevant data. The chatbot solves the problem of system

activity. Chatbot communicates with the audited staff by exchanging text messages and uploading data files from the audited party. He initiates the audit interview by contacting the auditee by sending a message via an appropriate messenger. Next, the chatbot provides the interview process by taking the lead, i.e. the role of the auditor asking questions and reacting appropriately to the answers of the auditee, providing an interface for downloading documents requested from the auditee for further transmission to the system for analysis. There are plans to develop a system capable of providing voice communication during audits in the future. Another task of the chatbot is to ensure the debriefing of the interview and the correct farewell to the auditee.

C. The core of an intelligent system based on Neural Network class algorithms

The analysis showed that the most effective class of artificial intelligence algorithms for solving the problem of automating the audit process of management systems is the Neural Network. Appropriately structured, configured, pre-trained and equipped with additional interfaces, amongst which you can distinguish the interfaces for collecting statistics and administration, it allows you to adequately apply pre-prepared audit scenarios, quickly switching between them and combining them. The system can retrain during each new interview with the verified party and can draw the right conclusions from a wide range of user messages that are not identical to the scenarios originally laid down in the system. It provides for the system administration, including the management of additional training.

This can be extremely useful, for example, when in the course of additional training, the system makes incorrect conclusions due to the inadequate behaviour of the audited staff. It is proposed to equip the system with a modified module for automated compliance analysis of documented information with the established criteria.

D. Report Export Algorithm

It is proposed to equip the system with an additional module for generating and exporting a report containing, according to the requirements of [22]:

- an audit purposes;
- an audit scope, in particular, information about the organization (auditee) and verified functions or processes;
- the information about the audit client;
- the list of participants from the audited organization;
- the name and version of the system;
- the full name of the system administrator(s), if applicable;
- dates and the electronic tools used for the audit activities;
- audit criteria;
- audit conclusions and related evidence;
- audit findings;
- an application for the degree of compliance with the audit criteria;
- any objections of the audited organization to the conclusions made by the system;

- a clarification that audits are inherently selective in nature; thus, there is a risk that the received audit certificates do not provide a complete and accurate picture;
- an audit plan, including schedule;
- a summary of the audit process, including any encountered obstacles that could reduce the reliability of the audit findings, including technical failures;
- the confirmation that the audit purposes were achieved within the audit area following the audit plan;
- everything that was not covered by the audit, but was covered by the audit scope, including all problems with obtaining certificates, resources, or confidentiality with appropriate justification;
- an agreed follow-up plan, if any;
- an application for the confidentiality of the contents;
- any implications for the audit program or subsequent audits.

16.4 Conclusion

Inclusive and sustainable growth is based not only on long-term strong economic growth but also on social integration and providing conditions and opportunities for decent work and working environment for all.

The authors proposed the intelligence system of automated auditing of management systems that can significantly reduce the costs and risks associated with face-to-face audits. These include the following:

- transport and other related expenses (e.g. accommodation, meals, etc.);
- payment in relation to non-productive in travel time;
- risks on-site of environmental protection, associated with the movement of auditors' risks in the on-site of occupational safety and professional security associated with the presence of auditors on the audited organization's site;
- epidemiological risks;
- risks of the transregional and transboundary restrictions related to political, epidemiological and similar events and phenomena;
- risks to impartiality (e.g. corruption risks, etc.).

The model of the intelligence system of automated auditing of management systems was implemented as an integrated software product. It is tested in the course of AEConformity Pty Ltd consulting projects implementation around the world.

The approaches and methods in this chapter were applied by the authors in the development of GOST R 59,424-2021 "Guidelines for remote production condition analysis and management systems auditing".

These approaches and methods are currently used to develop international standards ISO/IEC 23,894/"Information technology. Artificial intelligence. Risk management" and ISO/IEC 42,001 "Information technology. Artificial intelligence. Management system" at the international level.

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