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Artificial Intelligence solutions for Romanian accounting companies

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Abstract. *The fast availability of data coupled with technology evolution, have brought Artificial Intelligence closer to commercial use. The relevance of AI solutions for business models worldwide was underlined by the significant investments made by internet giants such as Google, Apple, Amazon, Facebook. In the highly data driven accounting and finance industry, AI represents a solution to drive better results. The level of AI applications implemented so far is not high. This study aims to highlight the drivers and inhibitors of AI adaptation in the finance and accounting industry based on interviews with experts in Artificial Intelligence in accounting and finance. First step for this study is represented by the process of understanding the current level of knowledge on the field by conducting a literature analysis. In order to structure the results a Technology - Organization - Environment framework was used. While applying Artificial Intelligence solutions the role models and process competencies are crucial. These will assure a success in the process of training algorithms to reach the quality level to operate, without any human intervention and moral concerns.*

Keywords: Artificial Intelligence, Machine Learning, Intelligent Document Processing, Software as a Service, accounting companies.

Introduction

Nowadays the interest in Artificial Intelligence (AI) has increased due to the emergence of big data and technological developments. (Kruse et al., 2019) Some companies consider AI solutions as a disruption of business models, which will lead to fundamentally new markets. (Andrews, 2017). To provide AI based services and applications, internet giants such as Google, Apple, Facebook and Amazon are investing millions of dollars in AI.

The impact AI solutions will have on productivity could be transformative in several industries. A recent study conducted by PwC (2017) showed that global GDP has the potential to rise by 14% until 2030, which equals $15.7 billion, due to the development, use and adoption of AI systems.

Within this study, the companies with CAEN CODE 6920 - Accounting activities and financial audit; consultation in the fiscal domain, as well as software vendors emphasize the trend of customer-focused utilization of AI.

The accountants had an important role in the earlier adoption and development of business IT, finance being one of the first business functions to be automated. In big companies which re-engineered and computerized all their business processes, accountants become business partners and consultants. Digitalization together with AI solutions will bring substantial benefits to company stakeholders. Clients will benefit from improved business insights, informed decision making and an easier flow of work with the focus on generating higher income. For the employees, digitalization will bring flexibility in working practices, due to higher access to varied resources;

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more challenging work being placed at the heart of the client's company and a closer relationship with the client. (ACCA, 2020)

Literature review

Artificial Intelligence

Artificial Intelligence represents the form of intelligence which machines can demonstrate to be opposed to human beings. This field represents the study of ''Intelligent agents'', represented by every system able to perceive its environment and take actions to achieve its goal. (Poole, 1998) One case is the one in which the machine is able to achieve results by following a process similar to cognitive functions of humans. (Luo et al., 2018)

Machine learning

Machine learning represents an essential part of AI, as the application of computer algorithms used to automatically improve by experience and use of data. (Mitchell, 1997)

The learning process can be:

Supervised, in this case a human provides advice and sometimes the answers for deviations from the normal results. In this case the computer program is providing an algorithm containing all the necessary steps to solve a problem. In this case the program is speaking, not learning.

Unsupervised, in this case the machine can learn automatically. In this situation the machines are able to do what a human can do. The result of this process can be predictive or analytical (retrospective). (Harnad, 2008)

Deep Learning

Deep Learning, representing a subfield of Machine Learning, is using various layers in distinct types of neural networks (Chollet, 2017). This will provide a higher abstraction level and will make the transition from a lower level for example the ones which recognize pixels to even higher levels able to recognize faces (Ahmad et al., 2019).

The relationship between Artificial Intelligence, Machine Learning and Deep Learning is represented in Fig. 1. This represents a simple representation of the relationship between the three concepts, accepted by most of the studies even is other studies dispute this relationships considering they overlap instead of subsets. (Cutting et al., 2021)

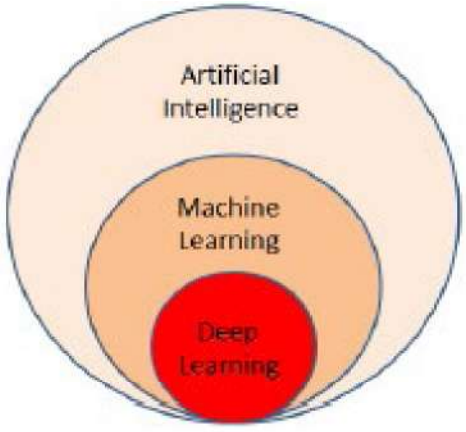


Fig. 1. The relationship between Artificial Intelligence, Machine Learning and Deep Learning
Source: Cutting et al., 2021.

The most time consuming activity for most companies is represented by data extraction. Extracting data from documents is an essential activity for most of the businesses and it is mostly specific for accounting departments. There are three alternatives for performing this task:
a) Manual data extraction;
b) Optical Character Recognition;
c) Intelligent Document Processing.

Manual data extraction

Manual data extraction requires a lot of time and effort being very laborious and the results may sometimes be of a lower accuracy due to human errors. OCR was considered a solution for manual data extraction but it also has its limitations in case of documents with colored background, improper data structuring, glaring or handwriting. As a solution to these limitations it was designed for the Intelligent Document Processing and other related technologies based on AI which have been developed over the years. (Mei et al., 2016)

Optical Character Recognition (OCR)

OCR has the role of converting a scanned image into text. It transcribes each character at a time. The end result is a machine- readable text converted from an image with text.

Intelligent Document Processing (IDP)

IDP subject brings together many opportunities and concerns related to today's society such as: automation, digitalization, artificial intelligence, ecology (paper reduction) and cost competitiveness. The researchers interest in this subject exploded over the last three years and they are focused on one each aspect of this domain, investigation aspects that are hardly accessed by the general public.

IDP represents the next-generation of automated data extraction technology. IDP can capture information from structured, semi-structured, and even unstructured documents such as email text, PDF and different scanned documents. After that it classifies and extracts relevant data used for further processing using AI technologies such as machine learning (ML) together with natural language processing (NLP). Leading IDP solutions use the AI subcategories, deep learning and machine learning technology to enhance the quality of data extraction. IDP solutions is able to improve the quality of sub-standard scanned documents using the noise reduction feature. It can also auto-classify different document types received, to extract data, and to validate it against predefined set of rules in order to ensure the maximum accuracy of data. (Ling et al., 2020)

After the data was extracted a Robot Process Automation (RPA) technology can be used for enhanced validation and then to automatically enter the data into existing applications. (Cutting et al., 2021)

The best part related to IDP solutions is that they can be perfectly integrated with company existing systems or other automation platforms. IDP enjoys a vast variety of use cases across various business functions such as claims processing, client onboarding and record management compliance.

In the following table it is presented the comparison between OCR and IDP:

Table 2. OCR vs IDP

	OCR	IDP
In which cases it is used ?	Basic structured documents which fits into a template	Complex documents as tables, pictures with too many variations.
What is it offering ?	Only data extraction	It understand the data, insights, context and generate a narrative
How is it working?	Is a manual process which optimize data extractions using a tool	It uses machine learning techniques to understand and offer accuracy overtime
Does it require templates to operate?	It needs templates which are costly to create , manage and maintain	It does not require templates

Source: Author representation based on Cutting et al. 2021.

Ground Truth

After a machine is performing his activity, the results need to be checked using a benchmark from the real world. This can be offered by a human or by using a domain expert assessment able to provide the true values. There can be mentioned the case of an OCR which processes printed documents that will be compared with the original text. (Cutting et al., 2021)

Robot Process Automation (RPA)

RPA and IDP represent complementary technologies. RPA is able to do more mechanical and the heavy lifting tasks such as dealing with structured documents. IDP will be used to complete the process in case there are less structured or less well-defined documents. (Ling et al., 2020)

Cloud computing

Small and medium companies usually lack the necessary resources to assure the necessary infrastructure and IT support for AI applications. A solution is to use cloud computing, which represents the offer of hardware and software applications in the form of service, using the Internet. (Buyya et al., 2008).

Cloud computing presents a significant benefit for the business as compared to traditional accounting, in case it uses the software as a service (SaaS). (Christauskas et al., 2012) In this case the software and IT support is offered by the cloud supplier, in comparison to the need of introducing the software on the client's computer and the need for an IT department. (Dimitriu et al., 2015). In the case of traditional accounting the data is stored and managed using their own infrastructure.

Software as a service (SaaS) represents one of the three types of cloud computing business model. In this case the end-user, that could be a private user or business user, chooses to pay the software provider a subscription fee to use the service. This service is hosted directly on the software providers' servers and can be accessed by the end user through the Internet. (Christauskas et al., 2012)

Methodology

In order to conduct an in depth analysis on the process of AI solutions implementation on the Romanian accounting companies was used the *The Technology-Organization-Environment Framework (TOE)*.

As a research approach, the first step is represented by an extensive analysis of scientific and business literature concerning organizational issues raised by Artificial Intelligence solutions. Such an approach is motivated mainly by the current scarcity of organizational solutions or applications based on AI.

In order to deal with data scarcity, interviews will be conducted with financial professionals and digital solutions vendors, in order to understand the impact of AI in their organizations on the financial department results as well on the financial professionals careers.

Results and discussions

The Technology-Organization-Environment Framework (TOE)

To better understand the current level of knowledge related to challenges faced by the financial and accounting industry, this study uses the TOE framework which was developed by Tornatzky and Fleischer in 1990 in the technological innovation context. The TOE framework represents an organization-level theory, which contains three elements: technology, organization and environment. These elements have the ability to impact the adoption and implementation technology process within a firm. This method has achieved solid empirical approval for studies in the context of innovations.

The technology context is represented by internal and external technologies relevant for a company. (Zhu et al., 2004) Internal technologies represent the company existing technologies which set a broad limit on the scope and pace of technological change that a company can undertake.The external technologies represent the market availability of new technologies.

The organizational context contains a range of measures which characterize the company: size, managerial structures and human resources. (Backer, 2012)

The environmental context is represented by the regulations and structures of the respective industry. This framework dimension includes more factors such as: customers, competitors, government and the community. (Zhu et al., 2004)

In order to attain a more comprehensive level of knowledge related to the challenges faced by financial and accounting companies an analysis using the TOE framework reference to Tornatzky and Fleischer (1990) was conducted using the current literature on the field.

Table 1. Challenges faced by accounting companies

Technological context	
Technological readiness	Qualitative and available training data; Lack of clarity on the availability of AI enhanced solutions and products for finance and accounting industry; Restrictive IT infrastructures.
AI Characteristics	AI specific characteristics, mostly represented by its lack of transparency, are considered “black box”, due to: compliance, security risks, and ethical standards of AI made decisions. (AlSheibani et al., 2018)

Technological context	
Organizational context	
Organizational readiness	Current professional expertise level in AI skills; Changing process competencies; Hierarchical structures and the employees' readiness to change; (IFAC, 2020) Agility to adjust firms resources (financial, human, technical)
Top management support	Support provided by the top management in the AI technologies adoption process
Environmental context	
Industrial Characteristics	Traditional data protection that is part of core business; Pressures coming from a competitive environment (FinTechs);(Inn, 2016) The customers and community's support is lacking due to moral concerns and uncertainty.
Governmental Regulations	Tax declarations and other official forms together with legislative instability.

Source: Kruse et al. 2019.

In order to help the accounting companies willing to implement AI solutions, a practical guideline using the TOE framework reference to Tornatzky and Fleischer (1990), was designed based on a current literature assessment.

Table 2. Practical guideline for accounting companies

Technological context	
Technological readiness	Provide sufficient training data by carefully evaluating each use case and avoid structural biases from training data; (Prove et al. 2017) Enhanced market overview of AI solutions and products obtained by an extended market analysis; Modernize IT architectures.
AI Characteristics	The AI "black box" characteristics mostly refer to the organizational context. From the technological perspective utilization of improved algorithms (dependable on previous training) would provide better results. (Chen et al. 2016)
Organizational context	
Organizational readiness	Hire and invest in developing AI professional skills; Offer to the new and existing employees a working environment where they can promote technological innovation while overcoming hierarchical structures; (Lin et al., 2019) Guarantee ethical standards by AI governance: AI compliance management & AI risk management; Adapt firms resources (financial,human, technical) by promoting agility.
Top management support	Create awareness in the company's top management team to allocate budget to fundamentally digitize and modernize their business. The top management has

Technological context	
	the ability to stimulate and enable organizational change.
Environmental context	
Industrial Characteristics	When AI will become explainable and valuable, companies will not be afraid of data security and be able to use external data resources to compete with FinTechs;(Inn, 2016) From an ethical point of view, AI code of conduct can help companies to build trust in AI. In this way they will change their moral concerns about AI.
Governmental Regulations	Financial and accounting institutions need to achieve space for innovation inside their working circumstances and despite governmental regulations.

Source: Kruse et al., 2019.

Romanian application using IDP

In order to better understand the technological context in the Romanian financial and accounting industry further analysis will be conducted. At the current level an in depth interview conducted with the owner of Cassa Digital Software. Based on his research conducted on Romanian companies with CAEN CODE 6920 - Accounting activities and financial audit; consultation in the fiscal domain, the following solution was developed.

The research behind the application made by the company team took into consideration more than 7000 Romanian accounting companies, representing 50% of the companies using this CAEN CODE. They did this research to better understand the needs of the accounting companies and to present their business solution. Five interviews with business owners which already implemented this application, were published online on the blog.

A Romanian application wants to change accounting by offering the possibility to accounting companies to use an integrated application. This application is focused on solving the noticed issues in accounting activity nowadays:

a) *rigid communication with clients;*
b) *time lost organizing the files send via more channels;*
c) *repetitive and time consuming activities i.e. invoice processing;*
d) *risk of losing data or expensive backup solutions.*

What Cassa Digital Software is offering is a platform which represents a solution to reduce or to mitigate those issues. This platform is using cloud computing as SaaS which arranges the folders and simplifies communication between accounting companies and entrepreneurs. It was designed in 2019 as a solution for accounting companies.

The research conducted behind the application showed that accounting implies a lot of manual work, data operations representing 60-70% out the total work of an accountant. At the same time, nowadays accountants need to exchange documents based on more communications tools: printed versions via courier, attached to an email or other communication platforms such as Whatsapp or Facebook messenger.

This application is an integrated solution willing to simplify communication and on the other side to offer a dashboard of the company which contains invoicing services, archivation, financial reporting and a notification system.

The elimination of manual work of accountants is realized using a technology based on Intelligent Document Processing (IDP). Before using IDP the application designers tested the

available OCR solutions on the Romanian market and the technology used for this application is more performant and scalable than those solutions. OCR permits the transfer of scanned documents , photos, PDFs in editable documents. Based on this system the application permits accountants to export in their own accounting softwares the invoices issued from the application or the ones received via application. (Kruse et al. 2019)

The communication between accountants and companies is realized in a feed similar to the one offered by Facebook. In this way the utilizers can comment, like, share or download the documents.

This application is based on computer vision and machine learning technologies used for processing and operating the accounting documents but it also integrates business prognostics, risk evaluations for clients and future contracts. This application is meant to digitalize the communication between accounting companies and entrepreneurs and in this way they will be able to better scale.

In October 2020 the application had 500 utilizations and at the end of 2021 they had almost 1000 represented by the accounting companies and their clients. The platform is B2B2B which is addressed to accounting companies but they can also become resellers of the application due to the Whitelabel service. One of the factors which increased the migration to these types of solutions is represented by the Coronavirus pandemic because companies started to migrate to online services and to diminish the need of getting in touch with printed documents.

In the following table are presented the activities of accounting companies before and after using the platform.

Table 1. Comparison between accounting companies before and after using the platform

Type of activity	**Before using the platform**	**After using the platform**
Reporting	It takes minimum 2 Hours	Instantly
Data storage	Expenses and space	Virtual and free
Communication	Information and lost documents	Everything on a personalized feed
Organizing	Excel and other inefficient methods	Digital and automated
Work with clients	Unorganized	Automated process and efficient
Documents	Manual processing	Automated processing

Source: Cassa Digital Software.

The following advantages are highlighted:

a) Communication type feed

The communication between the accountant and his clients will be improved because having multiple communication channels the risk of not answering on time is low. In business, time is precious and it is inefficient to wait days to answer an email. It offers better communication with the clients because it has a communication feed similar to the one used by Facebook, it is easier for accountants to check all the clients.

b) Electronic archive in the provider's cloud

On the documents archive the accountant benefits from an intelligent search due to the way documents are archived by date and folders or by processed documents. It is managing the accountant agenda and is automatically transferring the data on cloud. It offers the software on cloud so there is no need to download anything on a personal computer. It can be accessed from anywhere anytime, even from a mobile phone. It is also a mobile app which can be easily downloaded from the App store.

c) *IDP technology for managing the invoices*

The invoices from the archive can be directly on the accounting software and this does not imply manual work. The client portfolios will be easier managed by this application. Clients can issue invoices directly from the application using a built-in invoicing software. It uses intelligent document processing (IDP). The IDP used for this application offers the following opportunities: visually process documents, automatically extract data, classify and validate data, automatically process data, export data into the accounting software. This process will eliminate 75% of the accountant workload as the owners of the application noticed in collaboration with their clients.

How the IDP technology works in case of this application:

1. The accountant receives the invoices which are automatically processed ;
2. Is validating the information ;
3. Is exporting the document in the accountant software.

d) Document upload

The documents accountants need will be transferred easier and faster in this way. The clients will easily upload on the platform the invoices and all the invoices will be automatically back-up.

e) Automated generated reports

The application is also generating reports and in this way the clients can benefit monthly from performance reports downloaded easily from the application.

f) Fast search

The clients can take advantage of the invoicing solutions, administration and inspection. What this application offers to accounting companies is an integrated solution for their most time consuming activities. Accounting processes , portfolio management, document flow , company check-up and client efficient communication are in only one application. All the documents are organized and archived in one place. The reporting part is also easier because the application is generating reports for clients with just one click. This application promises that the overall efficiency of the accounting company will increase due to this application. It can improve the relationship between accounting companies and their clients.

Conclusion

The accounting company's decision of implementing AI solutions is influenced by technological, organizational and environmental contexts.

AI solutions' level of implementation and success depends also on the other digitalization and automation solutions already implemented, such as cloud computing Saas, RPA, OCR. While implementing AI solutions companies might face several challenges related to: technological or organizational readiness, AI and industrial characteristics, top management support, governmental

regulations. In order to face these challenges AI solutions provided together with company's representatives and researchers tried to find some practical guidelines. In order to overcome these challenges, it is not enough only the involvement of business representatives, even if they represent an important actor in the organizational context.

The AI solutions successful implementation will focus on the three dimensions presented in the TOE framework. The available AI solutions on the market at affordable prices and with a clear description will increase the chances of accounting companies to migrate to these solutions. The interest of top management in improving the activities in their companies using AI solutions instead of outsourcing some activities in less expensive labor markets. The level of knowledge and digital skills of the current employees and the ones which can be hired to support the digital transformation. Clear guidelines and training for the new solutions will considerably reduce the security risks or underperformance. The education system together with certification entities and organizational training can better prepare the work force in the accounting industry. The government can support the education systems as well as the companies willing to invest in AI solutions by providing better regulations or even financial support.

The AI solutions adaptation is a long journey which brings together IT developers and vendors, companies, regular employees and executives, clients, educational systems, competitors and government. Only a constant and clear relationship between all these stakeholders will guarantee the end success.

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