Kaunas University of Technology

School of Economics and Business

Impact of Artificial Intelligence on the Transformation of the Accounting Profession

Master's Final Degree Project

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Summary

The relevance of selected topic is significant for accounting profession. First of all, the world in terms of new technologies is constantly changing. Every day something new is created. In that effect, businesses are using technology to increase efficiency and decrease costs, which means that some processes are being automated, machines are changing employees, AI tools are applied. With all this rapid technological improvement, number of professions are changing. Therefore, this research helps analyze how artificial intelligence is transforming one profession that is feared to disappear or change significantly in the future – accounting. It helps understand what aspects and areas will be affected the most, how accountants need to transform themselves and what is their perception on this transformation. In addition, such research is relevant for businesses in order to understand if they are ready to adopt such innovation as artificial intelligence in their operations.

The main matter of this research is that there is lack of research done on current situation in businesses and current accounting professionals' readiness to adapt artificial intelligence. Therefore, this study's objectives and aim are focused to fill this gap.

Aim of this study is to analyze how accounting profession is changing due to artificial intelligence and how accounting professionals perceive the need to change themselves beginning with the entry-level professionals, to experienced ones. As well as to answer the research question raised: how artificial intelligence is transforming the accounting operations in businesses and what is the perception of accounting professionals on this transformation?

The conducted research found, that there are a lot of literature on this topic, analyzing it from different angles. The primary finding was that currently there is lack of studies done on current situation in businesses and whether accounting professionals are prepared to change. Secondly, the analysis of previous studies on artificial intelligence was conducted and found that even though authors take different approches to the problem, majority of them agree on main conclusions: there are many benefits of AI implementation in business processes; artificial intelligence is not a new thing, but together with the improvement of all technologies, AI is getting more and more recognized and applied; AI is also affecting accounting profession significantly; accounting profession is changing rapidly, and accounting professionals must gain new skills and adapt to remain competitive; there are also some disadvantages of AI, such as high cost, small and lengthy return on investment, people losing jobs to machines.

Last, but not least a research in form of a questionnaire survey was conducted to understand accounting proffesionals‘ perception of transformations due to artifcial intelligence and their

readiness to adapt. Four hypotheses were raised and they were all confirmed. The conclusions showed that accounting professionals agree that they must improve their technological and IT knowledge in order to stay competitive in labour market; accounting specialists agree that they are aware about the transformation of their profession and are prepared to adapt; accounting and finance professionals are positive about using artificial intelligence in their work; top level executives are positive about investing in technological innovation and artificial intelligence integration in their businesses

Šokaitis Karolis. Dirbtinio intelekto įtaka apskaitos projesijos transformacijai. Magistro baigiamasis darbas / vadovė doc. dr. Šviesa Leitonienė; Kauno technologijos universitetas, Ekonomikos ir verslo fakultetas.

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Santrauka

Pasirinktos temos aktualumas apskaitos profesijai yra reikšmingas. Pradedant, pasaulis, iš technologijų perspektyvos, nuolatos kinta. Kiekvieną dieną sukuriama kas nors naujo. Dėl to, verslai naudoja technologijas tokiems tikslams, kaip efektyvumo didinimas, kaštų mažinimas, o tai reiškia, kad kai kurie procesai yra automatizuojami, mašinos keičia darbuotojus, įdarbinami tokie įrankiai, kaip dirbtinis intelektas. Kartu su šiuo greitu technologijų tobulėjimu, dalis profesijų taip pat keičiasi. Dėl to šis tyrimas padeda išanalizuoti, kaip dirbtinis intelektas keičia profesiją, kuri ateityje, kaip baiminamasi, gali išnykti ar stipriai pasikeisti – apskaitos profesija. Šis tyrimas taip pat padeda suprasti, kurie šios profesijos aspektai bus paveikti labiausiai, kaip patys buhalteriai turi pasikeisti ir koks jų požiūris į tokius pokyčius. Taip pat, tokio tipo tyrimas labai naudingas verslams, nes padeda suprasti, ar jie jau yra pasiruošę įdarbinti tokias inovacijas, kaip dirbtinis intelektas, jų veikloje.

Pagrindinis tyrimo dalykas yra tai, kad šiuo metu pastebimas trūkumas darbų, tiriančių dabartinę situaciją versluose in šiandieninį buhalterių pasirengimą prisijaukinti dirbtinį intelektą. Todėl ši studija fokusuojasi į šio trūkumo užpildymą.

Šio tyrimo tikslas yra išanalizuoti, kaip apskaitos profesija keičiasi dirbtinio intelekto fone ir kaip apskaitos profesijos atstovai priima poreikį keistis patiems, pradedant nuo jaunausių, karjerą pradedančių specialistų, iki patyrusių profesionalų. Kita tyrimo tikslo dalis yra atsakyti į iškeltą tezės klausimą: kaip dirbtinis intelektas keičia apskaitos rolę įmonėse ir kaip apskaitos profesijos atstovai priima šiuos pokyčius?

Atliktas tyrimas parodė, kad yra didelis kiekis literatūros šia tema, kurioje ji analizuojama iš įvairių skirtingų perspektyvų. Pirminis tyrimo rezultatas buvo tai, kad akivaizdu, jog egzistuoja tyrimų apie dabartinę situaciją versle bei buhalterių pasirengimą keistis, trūkumas. Antras žingsnis – ankstesnių tyrimų studija – parodė, jog daugelis autorių tirdami problemą iš skirtingų perspektyvų, sutinka su keliomis bendromis išvadomis: egzituoja daug dirbtinio intelekto panaudojimų versle ir jo procesuose privalumų; dirbtinis intelektas nėra naujiena, tačiau kartu su technologijų raida, jis yra vis labiau ir labiau pripažįstamas ir naudojamas; dirbtinis intelektas daro didelę įtaką apskaitos profesijai; apskaitos profesija reikšmingai keičiasi ir šios profesijos atstovai privalo įgauti naujų įgūdžių, kad liktų konkurencingi; taip pat egzistuoja ir dirbtinio intelekto trūkumų, tokių, kaip didelės kainos, žemas ir lėtas investicijos atsiperkamumas, darbo vietų mažėjimas.

Paskutinėje tyrimo dalyje buvo atlikta profesionalų apklausa, kuri padėjo suprasti apskaitininkų ir finansininkų požiūrį į jų profesijos pokyčius, kurie vyksta dėl dirbtinio intelekto raidos bei jų pasiruošimą prisitaikyti. Tyrimo metu buvo iškeltos keturios hipotezės, orientuotos į tyrimo objektą.

Rezultatai patvirtino visas iškeltas hipotezes ir parodė, kad apskaitos ir finansų profesijos atstovai pripažįstą poreikį tobulinti savo technologijų ir IT žinias, kad išliktų konkurencingi darbo rinkoje; apskaitos ir finansų specialistai pripažįsta, kad jie žino apie laukiančius pokyčius ir yra pasiruošę prisitaikyti; apskaitos ir finansų profesijos atstovai yra nusiteikę pozityviai dėl dirbtinio intelekto naudojimo darbe; aukščiausio lygio vadovai žiūri pozityviai į investicijas į technologijų naujoves ir dirbtinio intelekto integraciją jų versluose.

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Abbreviations:

Assoc. prof. – associate professor;

Dr. – doctor;

Prof. – professor;

ML – machine learning;

AI – artificial intelligence;

RPA – robotic process automation.

Introduction

In modern world information technologies are changing all parts of businesses – from robotization in manufacturing industries to smart business management systems. These changes include artificial intelligence application in businesses. AI is about to change not only how businesses operate, but also change professions, one of which is accounting. It‘s has been coming for some time already, that AI and machine learning can replace humans in some tasks, therefore, some professions are in danger of changing rapidly or even becoming extinct.

The relevance of this topic is significant for accounting profession. First of all, the world in terms of new technologies is constantly changing. Every day something new is created. In that effect, businesses are using technology to increase efficiency and decrease costs, which means that some processes are being automated, machines are changing employees, AI tools are applied. With all this rapid technological improvement, number of professions are changing. Therefore, this research will help analyze how artificial intelligence is transforming one profession that is feared to disappear or change significantly in the future – accounting. It will help understand what aspects and areas will be affected the most, how accountants need to transform themselves and what is their perception on this transformation. In addition, such research is relevant for businesses in order to understand if they are ready to adopt such innovation as artificial intelligence in their operations.

In addition, value for practice of this research is also tremendous. To begin with, it will provide information for the further analyses to see structured literature scheme about artificial intelligence changing the accounting profession. From even more practical point of view, this research provides information for accountants about how their work will change and how they should change themselves.

The problem that this research has found is that there is lack of research done on current situation in businesses and current accounting professionals' readiness to adapt artificial intelligence. Currently, many authors, such as B.K.Malviya, K.M.Bakarich, E.O'Brien and others talk about how artificial intelligence is changing the accounting profession. Others, like M.Gull, analyze how AI can be implemented in business in general. Therefore, this study's objectives and aim are focused to fill the gap of lack of research on professionals' perception of the transformation.

This research project will analyze various different papers, articles, books and other literature on the topic of accounting profession transformation by artificial intelligence. In addition, a research of current business situation and accounting professionals‘ perception will be conducted.

The research question raised is: how artificial intelligence is transforming the accounting operations in businesses and what is the perception of accounting professionals on this transformation?

Research goal: To analyze how accounting profession is changing due to artificial intelligence and how accounting professionals perceive the need to change themselves beginning with entry-level professionals, to experienced ones.

Research objectives:

1. To analyze the current perception of the impact of AI on the accounting profession and related issues
2. To analyze studies done about AI impact on accounting profession and general AI application topics, such as AI application advantages and disadvantages, the need for professionals to transform themselves
3. To formulate the research methodology in order to understand how artificial intelligence has already impacted the accounting profession and what is the perception of accounting professionals
4. Using the formulated method, conduct a study about AI impact on accounting profession, analyze the results and provide conclusions

The research method used to complete the goal of this study will be literature analysis and survey questionnaire conduction.

1. Increasing interest in artificial intelligence and potential accounting profession transformation

To understand how articial intelligence is transforming the accounting profession, firstly it is important to understand the essence and concepts of what artificial intelligence is. There are many different angles to AI definition, but this project report describes several that are agreed by different authors. Needed to mention, that AI can be closely linked to robotic process automation and machine learning definitions. As discussed in John Zerili's „A Citizen's Guide to Artificial Intelligence" „a famous definition of AI states that AI is the science of making computers produce behaviours that would be considered intelligent if done by humans. […] But nowadays AI systems are also used in many other more arcane areas to accomplish tasks whose scale or speed far exceed human capabilities. For instance, they're used in high frequency stock trading, internet search engines, and the operation of social media sites. In fact, it's useful to think of modern industrial-scale AI systems as possessing a mixture of both subhuman and superhuman abilities." (John Zerili, 2021). In other words, artificial intelligence is robotics, software, which can assist or change humans in their routine and repetitive tasks. For instance, making simple accounting entries, preparing simple data analytics tasks. AI in some extent has already been out there for quite some time, for instance, programmed robots in factories have been assembling such products as furniture or even cars, needless to mention self driving cars. Even in medical sector robots are already being taught how to do operations on humans. Other author, Herbert L. Roiblat, discusses artificial intelligence from a slightly different angle – as humans' everyday assistant, when AI is incorporated into homes for switching on lights, suggesting eating habits, regulating everyday's schedule.

So, in short words, artificial intelligence is a mind of robots and machines – it makes them do our, humans', work repeatedly, with much lower ratio of error, much faster and more accurate. "Today AI frameworks can be self-learning; they are more similar to brilliant understudies who are given instructive materials and at that point can learn without anyone else." (Maleehah Gull, 2019). It is undoubtedly changing our ways of living and, especially, our professions. And one of the professions in transition due to artificial intelligence is accounting.

After understanding what the artificial intelligence is, the paper proceeds to review different pieces of literature, analyzing the AI impact on business in general, and on accounting profession.

To begin with, Ph.D. candidate Mariana Antonescu's paper "Are business leaders prepared to handle the upcoming revolution in business artificial intelligence?", where she analyzes the businesses' and their leaders' readiness and preparation to meet AI. The author concluded, that there are two different types of organizations, in terms of view towards AI: the first type is the organizations which view the AI as huge advantage, as it helps bring business the financial advantages by either cutting or reducing certain costs, or predicting costs. While the second type is the organizations which have not yet invested in AI but fear to fall behind and become less competitive because of that. The author also separates several skills that future executives should have to develop in order to keep up with changing environment: "be able to use AI to create new business opportunities; to understand AI to do what it does best, so that they can manage better; to be able to make data-driven decisions; to use AI responsibly in order to manage a business in a legal and ethical environment; to have the ability to promote a collaborative culture, to treat AI as a colleague, to be a manager for both – humans and

AI" M.Antonescu (2018). The important thing is to change together with technology and keep improving mentioned skills.

The second piece of literature, talking about businesses need to change due to AI is a book "Management and business education in the time of artificial intelligence: The need to rethink, retrain and redesign" written by Agata Staghowizc-Stanusch, Wolfgang Aman, Hamid H. Kazeroony. In the book authors set out their expectations, of which some are already old too old for current year, but others still to come:

- by 2030, some 800 million jobs will have disappeared and taken over by machines;
- in 2019 half a billion users will save 2 hours a day as a result of AI-powered tools;
- by 2020, AI will be a top 5 investment priority for more than 30% of CIOs;
- AI technologies will be in almost every new software product by 2020;
- AI will reach human levels by around 2029. Follow that out further to say, by 2045, we will have multiplied the intelligence, the human biological machine intelligence of our civilization a billionfold" (Agata Staghowizc-Stanusch, Wolfgang Aman, Hamid H. Kazeroony, 2019).

Another author Vasu Yedevalli in his article "Are Robots Helping or Hurting the Future Workforce?", published in 2018, discusses the advantages of RPA employment ins business processes. The author talks about such advantages as the increased speed of the tasks performance and reduced number of errors, also talks about the fact that with AI employees would have more time to focus on more creative, strategic and managerial work. Also, what the author states in his conclusions, is that "while RPA is revolutionizing the way people think about their work, it will never be able to truly replace a person's intellectual and emotional value."

Moving forward, I reviewed the literature focusing more on arfiticial intelligence-based accounting, to review and understand what artificial intelligence-based accounting is, how robotic process automation works and how it can be applied in accounting, also, what changes it is bringing. The outcome of literature, explaining mentioned terms, review was very informative. As explained by Susanne Leitner-Hanetseder, Othmar M. Lehner, Christoph Eisl, Carina Forstenlechner in their work „A Profession in Transition: Actors, Tasks and Roles in AI-Based Accounting", AI -based accounting is the use of artificially intelligent software, which has such technologically advanced intelligence, that is as human, in accounting processes. Such software would be able to perform similar repetitive tasks, such as booking invoices, preparing payments and registering accounting entries in trial balance. In addition, authors found and concluded, that in the next 10 years skills and tasks for existing accounting professionals will change drastically, while their roles will remain existent, even though some will be performed by AI-based technology.

In another work „Robotic Process Automation in Accounting Systems", Steven A. Harrast talked about RPA in accounting. The author explained that it actually has nothing to do with real robots, but same as AI-based accounting software, it is a computer program, which can perform human tasks. For accountants RPA is the opportunity to change their mechanical tasks in their work into managing the software. Author also emphasizes that "as bots are implemented, a number of governance, risk,

and compliance issues need to be considered including appropriate controls on bot access to sensitive records and transactions". So, RPA is not only advantages, but there are also some risks involved.

To complement the oher disadvantages, limitations or challenges of AI, authors Heimo Lobichner, Othmar M. Lehner in their work "Limits of Artificial Intelligence in Controlling and the Ways Forward: A Call for Future Research" looks at the limits and challenges of AI, as this technology is very difficult and complex. They found that AI is very limited in terms of controlling, complex and possibly have implications in cybernetics. They found problems with a partial detectability and controllability of complex systems and the inherent biases in the complementary of human and machine information processing. So the authors suggest to further research the different agles of AI complexity and risk.

Looking further into AI and RPA impact on accounting profession and businesses' readiness for the transformation, there are many different works on this topic and the research is very broad. Therefore, for the purposes of this research, I reviewed a number of articles and papers to gain an understanding of different views and opinions and to draw a guideline for my future research.

Firstly, I looked into Kathie J. Shaffer, Carol J. Gaumer, Kiersten P. Bradley article "Artificial Intelligence Products Reshape Accounting: Time to Re-Train", which analyzes the effects of AI and the need for re-training, especially in accounting profession. As in previously mentioned article, here authors also found that in 10 years accounting profession will look noticeably different than now. As authors write, "the accountants who embrace the new technologies, like artificial intelligence, will survive and even thrive by becoming more specialized, by offering consulting services and focusing on helping clients integrate the AI technology, rather than, focusing strictly on calculating financial data. This will require training and, in some instances re-training. Organizations must be willing to absorb those development costs. [..] The biggest challenge may lie in the re-training of accountants who have been in practice for many years and managing the resistance to change." Employers will face the challenge to show the example of embracing the inevitable and accepting the changes in order to motivate, encourage and support their employees. If that's not done, employees who fall behind will face becoming incompetent for their jobs.

Another author John Thornton discusses the need to be adaptable first, in order to incorporate AI and keep up with technology in his article "Perfecting the Art of Adaptability". Author suggests that today's accountants' skills required are already different than 10, or even five years ago. He also agrees that the skillset will still drastically change in the following years. So will the number of accountants needed. Therefore, "accountants, like other professions, will prosper only if they continue to add value. [..] The biggest risk to the profession would be to fail to adapt to the new opportunities that are being created and the new realities."

However, these expected major changes in accounting are not coming that fast. Kathleen M. Bakarich, E. O'Brien conducted a research on current use of AI and RPA in accounting and discussed it in article "The Robots Are Coming… But Aren't Here Yet: The Use of Artificial Intelligence Technologies in the Public Accounting Profession". The research was responded by 90 participants in various public accounting firms, positions and service lines. As results showed, "RPA and ML are currently not being used extensively by public accountants nor by clients of public accounting firms, and frms are conducting some, but not extensive training on these technologies for employees." However, respondends were confident that AI will have a significant impact on their work and daily

tasks in 5 years, so even though the changes are now slow, they are coming. In addition, they found that the firm size was the most significant factor in responses differences. Big 4 employees showed "significantly higher expertise and greater current utilization of RPA technology than their non-Big 4 counterparts." These results show that at the moment, bigger firms are more focused towards RPA and AI technologies. Probably because of return-on-investment significance.

Talking about technology perception in firms, another study was by Hassan Damerji, Anwar Salimi in their paper "Mediating Effect of Use Perceptions on Technology Readiness and Adoption of Artificial Intelligence in Accounting", who examined if technology adoption in organizations is influenced by the education and technology readiness of students. The study resulted in positive outcomes, showing that "technology readiness has a significant influence on technology adoption". These findings complements before described study, that employees, especially in accounting firms, are open to technology and the adoption might be encouraged since the education and entry-level professionals.

Other study, described by Shilpa Vardia, Ritu Soni, Rimpi Saluja in their paper "Awareness About Emerging Trends of Robotics in Accounting: An Empirical Research" examined the awareness about RPA tools in accounting. The sample selected for the study consisted of students, academicians, accountants, entrepreneurs, and auditors. It analyzed how the new technologies affect the work of accountants. The results showed that "understanding of robotic process automation in accounting differs significantly with respect to their gender, age, qualification, and profession". Which also complement the before discussed research, that technology adoption highly depends on education.

Looking at how AI can be incorporated into accounting function at the organization, Rossen Petkov gives a great framework in their paper "Artificial Intelligence (AI) And the Accounting Function – A Revisit and a New Perspective for Developing Framework". The author evaluated a current ability of accounting function to incorporate AI. The paper provided a whole framework with specific tasks where AI could be adopted – from cash, accounts receivable, PPE, to expenses and revenue. So, the paper shows that there are a lot of opportunities to adopt AI and bring more efficiency and accuracy in business accounting processes. However, according to the author, "it is important to note that the initial step of identifying and recording events needs to be significantly enhanced in order to fully utilize AI into accounting. To accomplish this, we need to create "smart accountants" capable of identifying economic events from the primary documents, such as bank statements, contracts, etc., which might be evidencing such events. This process would take time and it should be viewed as a marathon we as professionals, practitioners, etc., need to travel for the common goal of achieving more quality financial statements with consistently applied rules and principles."

Dariusz Jedrzejka in his research "Robotic process automation and its impact on accounting" explained the concept of RPA and the ways it impacts the accounting profession. The author claims that the potential for automation in accounting profession is very high – the technology is not so new already, costs are also lower, and most importantly – it reduces the "monotonous, repetitive and predictable [..] tasks." Also, same as many other authors, D.Jedrzejka believes that major part of accounants' tasks will be taken over by software. It is believed that this could lead to decrease of entry-level accountant roles, as currently their almost all tasks could be perfomed by robots more time efficiently and cost efficiently. Due to this reason, according to the author, "future accountants'

responsibilities will go beyond bookkeeping and financial reporting towards business advisory and leading the RPA transition".

Other authors Paul Lin and Tom Hazelbaker in their paper "Meeting the Challenge of Artificial Intelligence" agreed to the same opinion, that accounting profession is facing the huge change in entry-level professionals required skillset and the decrease in entry-level positions, as AI is taking over their tasks.

Same idea is expanded in the research "Preparing for the Robots: A Proposed Course in Robotic Process Automation" by Nishani Edirisinghe Vincent, Amy Igou, Mary B. Burns. In their research authors also state that RPA will significantly change the skillset required for all accountants, especially entry-level. Authors argue, that accounting education needs to adapt and bet in line with new technologies, and propose the course of education. Their proposed course includes the most important skills, according to them – focusing on automation of accounting processes, and RPA tools use. In addition to this topic, author Raef Lawson, in his article "New Competencies for Management Accountants" presents the skills that management accountants will require to protect their careers. Key areas to build the skillset for accountants are:

- Strategy, planning, and performance;
- Reporting and control;
- Technology and analytics;
- Business acumen and operations;
- Leadership;
- Professional ethics and values.

In short, accountants will need to develop more soft and strategic skills, instead of technical task performance. More and more attention will paid into intellectual, creative and leadership part of work, where RPA and artificial intelligence still can not overcome humans.

Last but not least, RPA is highly important in audit field of accounting. Michael Cohen, Andrea Rozario, and Chanyuan (Abigail) Zhang did a case study on this topic in article "Exploring the Use of Robotic Process Automation in Substantive Audit Procedures". The case study examined accounting firms' audit employee benefit plan to demonstrate how RPA has the potential to improve audit quality. The study gives examples of RPA usage in audit process and showed that some RPA innovations offered the ability to connect before unintegrated audit activities. It concluded, that incorporating RPA into audit process makes it more efficient and qualitative.

To sum up, this research provided a broad review of what artificial intelligence and robotic process automation are, also helped analyze how AI could be incorporated in businesses and how it will transform business processes. In addition, this research project showed few guidelines and raised additional questions for future research.

Analysis of potential changes to accounting profession has been made. The most commonly discussed transformation is that accounting professionals need to adapt, beginning from the lowest entry-level

to experienced senior accountants. The transformation is not so quick currently, as education is a little behind. Therefore, few authors suggest changing the accounting education curriculums, to provide the required skillset background for young accounting professionals. Tehcnology is changing rapidly and the changes are inevitable, therefore businesses, their executives need to adapt. Experienced accountants need to follow this trend and train and re-train to be competitive and keep their careers.

The problem that this research has found is that there is lack of studies done on current situation in businesses and current accounting professionals' readiness to adapt artificial intelligence. It is difficult to find literature on how companies are adopting AI and how accounting professionals are adapting. Therefore, this study's objectives and aim are focused to fill this gap.

2. The perception of AI impact on accounting profession

This part of thesis analyzes previously done studies on AI impact on accounting profession. It includes the analysis of AI application and impact perception by different authors, advantages and disadvantages of artificial intelligence incorporation in businesses, challenges of AI application and challenges that accounting professionals are facing.

2.1. Artificial intelligence and robotic process automation application in business processes

To begin with, I looked at Dariusz Jedrzejka study "Robotic process automation and its impact on accounting" (2019). As mentioned before, author explained the concept or RPA and the ways it impacts the accounting profession. As the study showed, the processes most often chosen for RPA include purchase-to-pay, record-to-report and internal performance reporting, as they are routine-based and fo not require judgement or complex decision-making. In addition, it is predicted that up to 40% of current transactional accounting could be taken by machines (Axson, 2015). The study was done by selecting various cases from different industries and processes of RPA integration. Below are provided some of the selected cases and findings.

- Case of manual invoices processing in professional services company. In this case, the process was time consuming and often tended to experience errors. The company adopted robotic process automation tool for invoice processing. The outcome was that out of all invoices, 80% became processed automatically with process time reduced by 97%. Implementation only took 3 weeks to complete

- Financial report generation. Large technology company, operating globally, implemented automated tool for quarterly report generation. The result of such implementation was time cost reduction of 70% with improvements in auditing and ratio of errors

- Technology company implemented robotic tool for tax accounting and reporting. The result of such investment, which was implemented in only 12 weeks, was time cost savings of 85% in this particular process

- Automotive company implemented accounts receivablea and accounts payable processing process automation, which was implemented in 2 months and resulted in time savings of 90% in this particular process. In addition, it helped improve audit process and reduced number of errors

- Another large company implemented financial reporting process and invoice processing automation tools, which resulted in 25 employees freed from their technical tasks and transformed to more intelligence-focused roles. This also resulted in minimal ratio of errors.

- Large retail company implemented automated tool in human resource and payroll processes, which increased efficiency by 73%

- Medical technology company implemented RPA tools in payments and IT system processes, which allowed them refocus even 50 employees to different tasks of higher value and reduce time costs of 89%.

Several more examples are provided in the table below.

Table 1. RPA implementation cases for accounting tasks

Stant, USA, Manufacturing	Accounts payable team manually performed invoice matching, invoice information data validation. High workloads resulted in exceptions handling delays, reporting delays, and risk of overdue payments Invoice matching and data entry were automated by robots	80% invoice straight-through processing achieved No data entry errors 94% of invoices processed successfully Invoice matching backlog reduced from 3 weeks to 4 days	
npower, UK, Utility	Automation of invoice statement generation. The process required data from over 50 systems	Invoice processing time reduced from 20 minutes to seconds No need to hire an additional 21 FTEs	3 weeks

Source: Dariusz Jedrzejka "Robotic process automation and its impact on accounting" (2019)

These examples perfectly show that RPA impacts the efficiency of companies' documents processing and basic accounting, not to mention the significant reduction in error ratio and overall operational performance.

However, the author also sees some challenges and risks of RPA implementation. Quoting the author, "according to estimates by EY, 30% to 50% of initial RPA implementation projects failed (Get ready for robots, 2016)". One of the reasons for these fails were companies underestimating the time and costs of RPA implementation and having encountered the IT issues, complexity of the processes or unrealistic expectations (The robots are ready, 2018). Therefore, before making the decision to incorporate AI into business, it is a must for management to do proper process design and risk analysis, including operational risk, financial and regulatory risk, organizational and cultural aspects, governance and cybercecurity.

The following case study done by Michael Cohen, CPA, Andrea M. Rozario, CPA and Chanyuan (Abigail) Zhang in article "Exploring the Use of Robotic Process Automation in Substantive Audit Procedures" (2019) examined if RPA has the potential to improve audit quality. In the article authors are stating that automation is not a new concept in auditing, but it could offer the possibility to connect before unintegrated automated audit procedures. For instance, it can be used to automate the collection of audit evidence. Meaning that RPA could make the evidence collection more efficient and easier, and even perform audit tests that would be programmed simply by taking standardized data and combining it from different sources into one audit workpaper. Therefore, further RPA integration in audit procedures could increase the audit quality and efficiency, as it replaces people in the structured, repetitive, and time-consuming procedures. As a result, audit companies would need fewer people, auditors could spend more time on complex testing and accounting issues.

In order to further evaluate RPA influence on audit procedures, authors did the case study of a public accounting firm, launching RPA project. This firm was chosen because it annually performs more than 800 audits in sizes ranging from medium to large and it's specialty is EBP audits which prior to adopting RPA were extremely labor intensive and time consuming.

During the study they overviewed the whole process of RPA adoption project. At first, the objective of the project was identified, which was "to increase efficiency and enhance the effectiveness of the limited scope defined contribution plan audits because the audit procedures in this type of engagement consist of labor-intensive, time-consuming, and repetitive testing."

The second step was to identify the processes which could be automated. In this step the authors analyzed each aspect of audit procedures performed. The main idea was to find the tasks which are simple, repetitive, time consuming and have data which would be machine-readable. After discussions with auditors, it was decided to focus on the eligibility, personal data and employee loans testing.

The following steps were to understand the processes of testing, review audit workpapers and find ways how it could be automated. As a result, it was decided to select the activities which could be delegated to the RPA which included collecting the data, bringing it into the standard template, activating filters to prepare it, and copyingthe integrated data structure to transfer it to Microsoft Access.

The conclusions brought by this study were that in this case "the tasks to be automated are only those that are highly repetitive, simple, rule based, and time consuming. The tasks that require professional judgement are difficult to automate, and auditors are expected to spend more time on such tasks." (Michael Cohen, CPA, Andrea M. Rozario, CPA and Chanyuan (Abigail) Zhang, 2019). It is clear that AI could improve audits, however, audit judgement still can not be replaced, as professional scepticism is a very important part of audit work. Therefore, it is important to align process automation with the auditors' professional scepticism to maximize the benefits of technology.

Another author, studying the AI application, Bikash Kumar Malviya in his study "The changing face of accounting: Prospects and issues in the application of artificial intelligence" (2021) also analyzes several advantages brought by AI. In his article, author reviews several AI based programs for accounting, while concluding on the enhancements gained with artificial intelligence. Quoting the author, according to a survey conductedby the MIT-Boston Consulting Group, more than 80% believe that artificial intelligence gives them a competitive advantage, and 79% believe that technology boosts productivity (Bikash Kumar Malviya, 2021). Some of AI benefits, distinguished by Malviya are provided below:

- Automation
- Increased efficiency
- Increased accuracy
- Deeply involved in data
- Real-time analysis

- Cost efficiency

2.2. Prospects of artificial intelligence application in accounting processes

Another author, Rossen Petkov in their paper "Artificial Intelligence (AI) And the Accounting Function – A Revisit and a New Perspective for Developing Framework" (2020) took a slightly different approach into RPA studies, by developing a framework with specific tasks where AI could be adopted in order to evalualuate the current ability of AI to be incorporated in the accounting function. That is important because, as the author states, potentially, the most significant benefit from the implementation of AI into the accounting workforce would be reduction of costs in the long run (2020). This is so, because RPA would allow companies to rely less on human manual work, reduce the number of employees needed for accounting function and reduce the rate of error. Of course, it all comes with the high initial investment while adopting the RPA.

Nonetheless, below are provided several examples from the paper, of where and how AI could change the human function:

- *Cash:*
    - manual inputs of cash receipts and payments could be changed by scanning cash payments/receipts into GL;
    - manual bank reconciliation could be changed by training AI to perform this reconciliation.
- *A/R and A/P*: preparation of journal entries for invoices, allowance for doubtful debts based on estimations and assumptions could be delegated to AI by scanning documents and training the program to recognize required information and booking journal entries. In addition, software could be trained to make allowances and other estimations in accounting by the similar principles humans do.
- *Inventory*: manual booking of journal entries for purchases and sales, allowances for slow moving or obsolete inventory based on historic data could be performed automatically by AI.
- *Investments*: initial recording in books and later adjustments based on cost or equity method. Initial recording could be done by scanning bank statements and identifying such transactions. Adjustments could be done by training AI to analyze financial statements of owned companies and preparing journal entries automatically.
- *PPE and intangibles*: AI could automatically scan bank statements and identify acquisitions and disposals, later booking respective entries in the accounting system. Depreciation could also be calculated automatically by predefined characteristics and booked each month.

Figure 1. Potential Accounting Functions to Delegate to an AI (source: Rossen Petkov "Artificial Intelligence (AI) and the Accounting Function—A Revisit and a New Perspective for Developing Framework" 2020)

Potential Accounting Functions to Delegate to an AI

	Human Function	AI Function
Cash	• Manual Input of Cash Receipts and Payments (use of Journal Entries). • Bank Reconciliation performed by individuals reconciling outstanding checks, deposits, errors, interest, etc.	• To scan cash payments/receipts into G/L similarly to how it is done in a Bank Deposit/Withdrawal (regardless of their nature). • To train AI to perform this reconciliation by analyzing reconciling inputs and generating bank rec report for reviews by humans.
A/R	• J/E prepared based on contractual obligation (be it oral or verbal, followed by invoice). • J/E for collection based on receipt of payment. • J/E for allowance for doubtful accounts, based on estimations and assumptions.	• These tasks could be delegated to AI. Specifically, the receipt of cash payments via wire transfers or checks at the point of scanning could result in J/E in the system (similar to Bank Deposits/Withdrawals).
Inventory	• J/E for purchases and sales. • J/E based for LCM, obsolete inventory, etc. (based on historical data).	• Delegate to AI capable of identifying movement of inventory (ins and outs) and prepare automatic J/Es. • Delegate the estimation of LCM to AI by providing inputs—costs (would come directly from G/L and market, from standard created tool sheet capturing market values of inventory from third parties.
Prepaids	• J/E to record initial asset. • J/E to record period end expense based on use.	• Delegate to AI by training it to scan bank statements and identify such transactions. Humans could continue to be involved to determine duration. Make periodic timely adjustments.
Investments	• J/E for initial recording. • J/E adjustments based on cost or equity method chosen.	• AI to scan bank statement and identify such purchases, record J/Es. • To train AI to analyze F/S of invested companies and seek the activity—such as NI and Dividends and prepare J/Es automatically.
PPE	• J/E to record PPE purchases; or disposals if any. • J/E for depreciation expense, already done by AI.	• AI to scan bank statements and identify transaction related to PPE purchases and disposals.
Intangibles	• J/E to record intangible purchases; or disposals if any. • J/E for amortization expense, already done by AI. • J/E for goodwill impairment.	• AI to scan bank statements and identify transactions related to intangible purchases and disposals. • Train AI to perform impairment testing by providing key inputs from other departments.
A/P	• J/E prepared based on contractual obligation (be it oral or verbal, followed by receipt invoice from vendor). • J/E for payment to vendor.	• These tasks could be delegated to AI. Specifically, the payment of cash payments via wire transfers or checks at the point of scanning could result in J/E in the system (similar to Bank Deposits/Withdrawals).
Accrued Expenses	• AJ/E prepared based on assumptions and historical data.	• Train AI to analyze such data and make on demand J/Es based on this data.
Unearned Revenue	• J/E to record initial liability. • J/E to recognize revenue based on use.	• Delegate to AI by training to analyze budgets and tie the budgets to actual revenue order and its performance.
N/P	• J/E to record assumption and repayment of N/P. • J/E for interest payment.	• To teach AI to scan bank statements and identify such transactions. • J/E for interest payment should be based on the contract and therefore could be delegated.
Revenues	Refer to A/R and Inventory	Refer to A/R and Inventory
Expenses	Refer to A/P and Inventory	Refer to A/P and Inventory

These are just some accounting tasks that could be delegated to machines, and it is not an all-incusive list. The author's goal was to show that there are plenty of opportunities for AI to take functions from human manual work. On the other hand, not all these tasks could be easily handed over to robotics in each company, as it is not as simple, as in theory. Like it was quoted before, companies and education system need to create "smart accountants" who would be capable of identifying opportunities in their organizations and transforming themselves to keep up with technology.

Continuing the topic, another author Mariana Antonescu in her article "Are Business Leaders Prepared to Handle the Upcoming Revolution in Business Artificial Intelligence?" (2018) provided

an overview of the challenges posed by the development and implementation of AI on enterprises and society. The author distinguished 3 main aspects which in business will change using AI:

- Tasks and occupation.
- Processes.
- Business models

As all other authors agree, M. Antonescu states that these processes will not be totally taken over by machines, but they will complement the human work by taking over mechanical tasks and allowing humans to spend more time on thinking and strategizing. This came to several advantages of AI adoption to be distinguished:

- Opportunities to find new market opportunities and create competitive advantages
- Constructing new skills in developing solutions for hard to solve problems
- Opportunities to enhance production techniques and develop new ones
- Opportunities to improve customer service

One of the conclusions made by M. Antonescu is that some companies have already implemented the AI, they enjoy the advantages of cutting costs and improving their operations, while there are some inexperienced firms that are afraid to fall behind not having adopted AI, as this could affect their ability to remain competitive. Therefore, it is important for businesses to invest in training and re-training of their employees and for business leaders to improve their own skills to understand new technologies. In the opinion of author, "AI will not replace business leaders but business leaders who are prepared and understand AI will replace those leaders that do not. Furthermore, consumers will migrate toward busineses that embrace AI." (Mariana Antonescu, 2018)

2.3. Perception of AI application by public accounting firms

In another study "Meeting the Challenge of Artificial Intelligence" (2019) authors Paul Lin and Tom Hazelbaker, CPA did the research of AI projects by the Big 4 CPA firms. The study was done after seeing the tendencies that due to advancements of technology, CPA firms are hiring more nonaccounting graduates, who would help them integrate new AI tools in their activities.

In the beginning of their study, authors reviewed general AI applications in daily life, not only business. Their findings are provided in the table below.

These are just several examples of AI use in everyday life. But getting back on topic, the authors also provided their findings of AI projects in Big 4 firms. Here are some of them:

- Deloitte:
    - AI-enabled document-reviewing process – the system automates the process of reviewing and extracting relevant information from various documents. According to the firm's statement, this technology helped reduce the time spent reviewin invoices, legal contracts, board minutes and financial statements by up to 50%.

- Working with IBM, Deloitte is developing cognitive-technology-enhanced business solutions for its clients. For instance, LeasePoint uses Deloitte's knowledge and services to develop an end-to-end leasing portfolio.

- EY:
  - Applied AI to the analysis of lease contracts. The firm claims that it made it easier to capture relevant information, including lease commencement date, amounts to be paid, and renewal or termination options.
  - Australian branch of the firm adopted AI-enabled auditing technology. 50% of its bank audit confirmations were lodged this system, which can accept and confirm audit requests, process them, and provide auditors with relevant documentation for final analysis and judgement.
  - Launched an AI project using computer vision to enable drones to monitor inventory during the audit process.

- PwC:
  - Collaborating with H20.ai, the firm developed an AI-enabled system capable of analyzing documents and preparing reports. The firm claims that the system learns and becomes more capable with every audit and has already been trained on audit data from Canada, Germany, Sweden, and the United Kingdom.
  - The firm made a significant investment in natural language processing, an AI-enabled technology to process unstructured data efficiently. PwC claims that this technology can make sense of complex lease agreements, revenue contracts, and board meting minutes to generate meaningful insights.

- KPMG:
  - KMPG built a portfolio of AI tools, KPMG Ignite, to engance business decisions and processes. One of the tools, Document Compliance Assessment Engine reads documents to generate relevant information; another tool Call Center Analytics Engine converts customer calls to unstructured text, which is then streamlined to identify keywords, gauge customer sentiment, and predict future trends; AI Anomalous Event Predicting Tool predicts future business events.
  - Working wih IBM, KPMG is developing tools to integrate AI, data analytics, cognitive technologies, and RPA. Firm's goal is to consistently deliver high-quality audit services.

(Source: Daniel Faggella, "AI in the Accounting Big Four – Comparing Deloitte, PwC, KPMG and EY" Emerj website, May 17, 2019.)

Figure 2. Examples of AI Applications in Daily Life (source: Source: Daniel Faggella, "AI in the Accounting Big Four – Comparing Deloitte, PwC, KPMG and EY" Emerj website, May 17, 2019.)

Applications	Examples	Benefits
Automatic emergency braking (AEB) on vehicles	Once an impending collision is detected, a warning is generated for the driver. If the collision becomes imminent, the system can apply the brakes without any driver input.	AEB can avoid vehicle collisions. In March 2016, the National Highway Traffic Safety Administration announced that AEB is required on nearly all new cars sold in the United States by 2022.
E-mail filters*	Google uses AI to ensure that the e-mail showing up in users' inboxes is authentic. The filters can sort e-mails into the following six categories—primary, social, promotions, updates, forums, and spam.	The filters help organize e-mails so that users can find important messages quicker. Also, Google claims that AI-powered filtering prevents more than 99% of spam from getting into users' inboxes.
Intelligent cruise control	This technology uses radar and a camera to adjust a car's speed automatically to maintain a preset distance from the vehicle ahead.	This feature, already on many new cars in 2019, allows the driver to relax, especially during a long trip.
Navigation assistance*	Google Maps can calculate the traffic time for various routes and suggest the quickest one to a destination given the real-time traffic.	Drivers can take a detour to avoid getting stuck in slow or standstill traffic due to accidents or construction.
Suicide/Self-harm prevention*	In 2017, Facebook launched a proactive detection feature that scans posts to detect patterns that may indicate if a user may be considering self-harm. Facebook supports this AI-powered program with human resources such as trained moderators, partnerships with local mental health organizations, and local first-responders when appropriate.	Detecting suicidal thinking patterns, the AI-powered program sends mental health resources to the person and, sometimes, also to friends. In one case, the local police were notified and able to locate the woman, rush her to the hospital, and save her life.

Following these findings, authors developed some suggestions on how to embrace AI in accounting profession. For instance, for accountants it is important to keep up with the technology, as they can contribute to AI projects with their knowledge of business operations and data. To start learning AI, authors are encouraging the accountants and accounting students to take advantage of free online

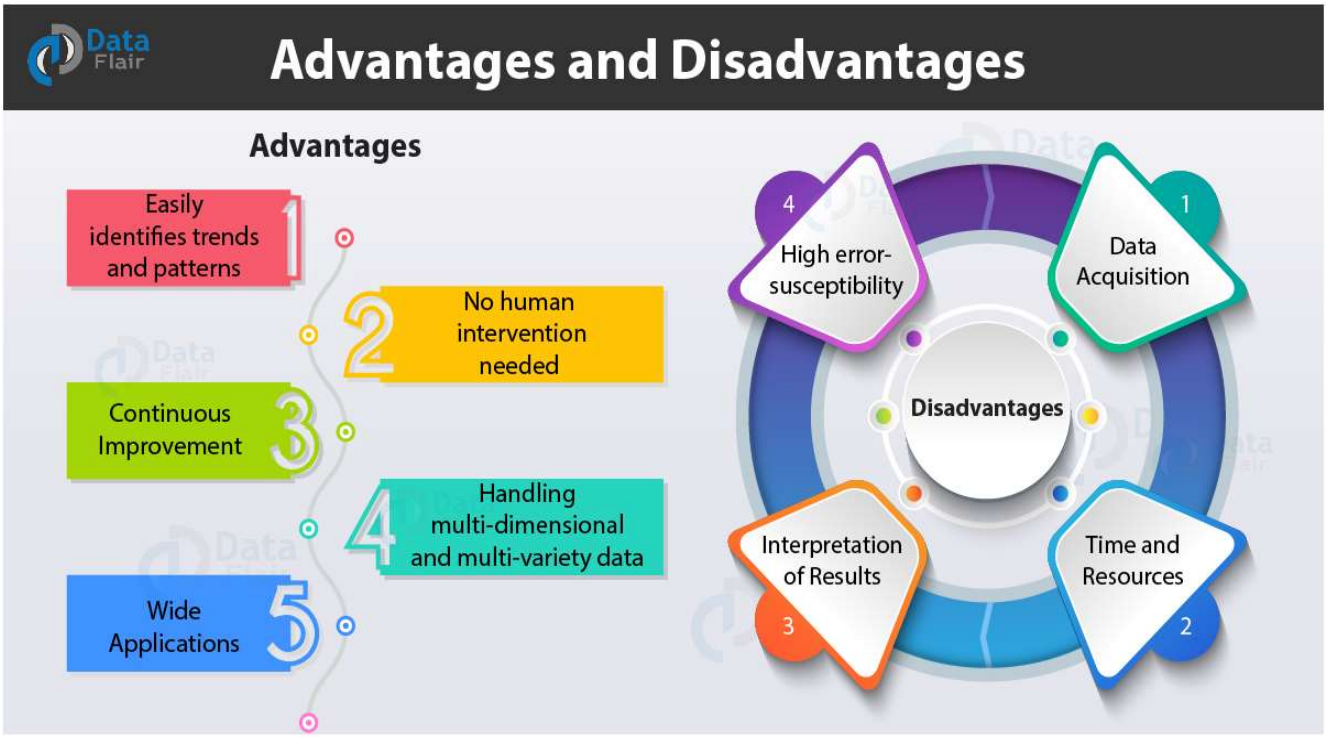
courses, which are publicly available and very often updated to be up to date with newest technology advancements. Furthermore, authors are suggesting for accounting professors to adjust the curriculum by adding topics related to AI and technology, as learning only accounting is not enough anymore. It is important because "many CPA firms' entry into the AI field may be accelerated by focusing their hiring to include recent college graduates who have been exposed to some level of AI knowledge through coursework or internship. It generally takes longer for existing staff to develop and learn new skills, and they require adequate support to complete the transformation to an AI-enabled workplace." (Paul Lin and Tom Hazelbaker, 2019)

2.4. Challenges and problems of AI application

As there are many articles and scientific studies showing that AI is changing the accounting field and its professionals, it is important to analyze the problems and challenges of AI application.

Firstly, looking at general disadvantages of AI, study has been done by Ku. Chhaya A. Khanzode in their paper "Advantages and disadvantages of artificial intelligence and machine learning: A literature review" (2020). Although, author has found many pros to AI, such as efficiency, decreased error ratio, simplification of difficult tasks, he has identified several disadvantages of AI usage which apply in general and to accounting field. Provided below is the summary of authors findings on AI pros and cons:

Figure 3. Advantages and disadvantages of artificial intelligence (Source: https://data-flair.training/blogs/advantages-and-disadvantages-of-machine-learning)



More explanations about found disadvantages are as follows:

- High error susceptibility – if programmed incorrectly, it can be misused or done opposite than commanded, which would lead to huge time and possibly financial loss
- Data adaptation and acquisition – this is a big challenge when applying AI tools, because it uses standardized data. If provided incorrectly, it could lead to errors
- Interpretation of results – so far, AI is capable to perform robotic tasks and learn to identify the required information. However, to interpret results, humans are still vital. However, humans, such as accounting professionals must adapt and keep up to technological improvement
- Time and resources – applying AI requires huge time and financial resources. In addition, this investment pays back in very long time

Problems of AI were more widely analyzed by Jiaxin Luo, Qingjun Meng, Yan Cai in their article "Problems of the Application of Artificial Intelligence in the Accounting Field" (2018). They overviewed AI in the accounting industry and analyzed the impacts of AI and derived relevant suggestions for its existing problems.

One of the problems found by authors was lack of experience. They took China as an example and explained that at current stage AI in accounting is more a robotization. The so-called robots are now taking part in operations with clear algorithms, which are sufficient for a large number of routine operations, but without the ability of learning, which should be the main idea of AI. In other words, currently RPA application in accounting is mainly on the financial reporting level and not yet reached the stage where it could lead to changes of accounting standards and broader application. As authors are explaining, artificial intelligence should eventually take over every step of accounting, beginning from documents collection and organization, to recording entries, generating reports and making suggestions for further financial and business management.

Another problem emphasized in the study is high investment with slow return. In order to apply AI in the business, a unique software system should be created, which would match the particular business' operations and situation. "First of all, capital investment is the most important guarantee; secondly, after the introduction of technology, it is necessary to adjust the management of human resources and the daily operation mode of the enterprise. Finally, when the intelligent transformation of the accounting information system is completed, a series of training should be carried out, including the training for the use of new system features and the training of information security" (Jiaxin Luo, Qingjun Meng, Yan Cai, 2018). And because of these required personalized features, businesses need enormous investments in the initial stage of application. While the return on such investment is really long-term, small businesses are not yet willing to take it and instead focus on short-term returns. On the other hand, large firms, as for instance, Big 4 accounting giants, can afford the AI application and further development costs with expectations that someday it would pay-off.

Third issue raised in the article is the need to improve the quality of professionals. Currently accounting professionals are educated mostly in accounting field with very little of technological education. But in order to successfully apply AI in business processes, "accounting personnel not only need professional knowledge in accounting field, but also need to master information

technology, acquire the skillful use of accounting software and data management, so as to adapt the changes of new work situation." (Jiaxin Luo, Qingjun Meng, Yan Cai, 2018).

One of the suggestions provided by authors after completing the study, is that governments should also take part in the process by implementing relevant plans and measures and creating favourable legal conditions for AI development in accounting. An update in policies and regulations need to be done in order to encourage companies to apply AI. "For example, enterprises that actively apply artificial intelligence technology should be given appropriate subsidies or tax reduction." (Jiaxin Luo, Qingjun Meng, Yan Cai, 2018).

Another suggestion made is for enterprises. As technology giants such as Google, Apple and Microsoft invest more and more in technology and AI, businesses should follow the trend by finding ways of cooperation with big data analytics and cloud computing technologies. The world is not standing and AI application whould enable businesses to be competitive and sustainable.

The last but not least suggestion is for education system to improve accounting programs. As mentioned before, it is crucial for accounting students to complement their studies with information technology programs.

2.5. The need for accounting professionals to transform their skillset

Another angle to look at how AI is transforming the accounting profession, is the perspective of accounting professionals. Raef Lawson, PhD, CMA, CSCA, CPA, CFA, CAE in his article "New Competencies for Management Accountants" (2019) analyzed how accountants will require to change and improve themselves to protect their careers.

The main idea provided by the author is that accountants and finance professionals will have to adapt to technology improvements, as they will become free from repetitive and ineffective time-consuming tasks – less time will be spent on collecting and organizing data and more time on evaluating, analyzing, and interpreting it. Accountants will become more like analysts, as "they will be able to spend more time looking at trends, developing insights, and connecting with leadership" (Raef Lawson, 2019).

Author reviewed what skills accounting and finance professionals will have to develop or improve in different areas of businesses with the increasing implementation of AI. For example, strategy, planning and performance won't change much, as this area is related more to decision making. On the other hand, in reporting and control procedures, professionals will do less manual work and have to focus more on efficiency and effectiveness analysis, optimization. In terms of control, they will need to develop frameworks ensuring cyber security and meet reporting requirements. In addition, soft (personal) skills will be critical for accounants, especially in areas, such as communications, change management, relationship, talent and conflict management.

The author's summary of competencies, that accounting professionals will have to adopt or improve in light of increasing artificial intelligence implementation, is provided in the figure below:

Figure 4. Summary of accounting professionals' technical skill comepencies that will be changing due to increasing implementation of artificial intelligence (source: Raef Lawson "New Competencies for Management Accountants" 2019)

Strategy, planning, and performance	Strategic and tactical planning Decision analysis Strategic cost management Capital investment decisions Enterprise risk management Budgeting and forecasting Corporate finance Performance management
Reporting and control	Internal control Financial recordkeeping Cost accounting Financial statement preparation Financial statement analysis Tax compliance and planning Integrated reporting
Technology and analytics	Information systems Data governance Data analytics Data visualization

Main competencies, emphasized by the author are those where intellectual work is still required. As mentioned, these competencies will not change much, but accounting professionals will have to improve them, as now they focus more on technical and reporting tasks.

Especially important skills to improve are leadership, professional ethics and values, business acumen. These skills focus more on quality assurance, management, communication, moral and other. These will become more and more important, as technology development will replace humans in various technical tasks. Decsriptions are provided in the figure 5 below.

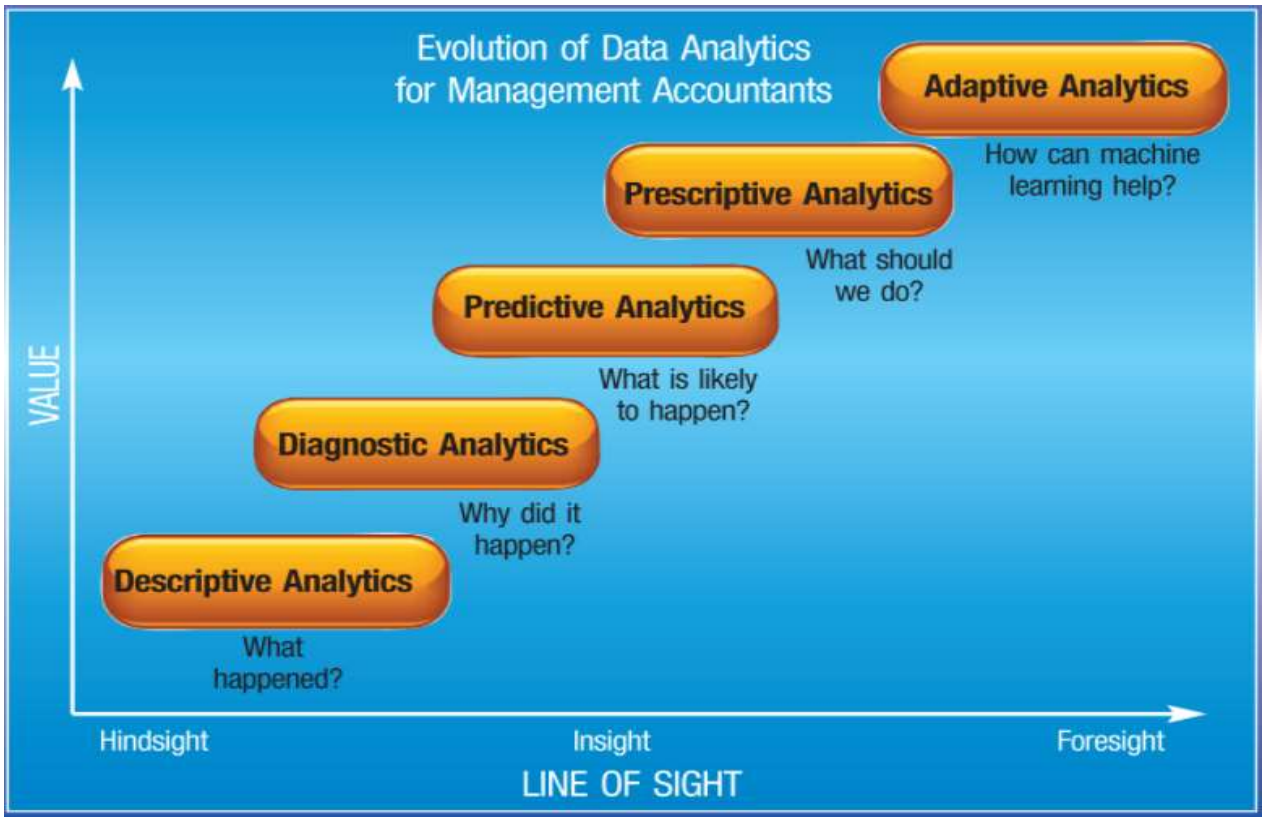
Figure 5. Summary of accounting professionals' soft skill comepencies that will be changing due to increasing implementation of artificial intelligence (source: Raef Lawson "New Competencies for Management Accountants" 2019)

Business acumen and operations	Industry-specific knowledge Operational knowledge Quality management and continuous improvement Project management
Leadership	Communication skills Motivating and inspiring others Change management Talent management Collaboration, teamwork, and relationship management Negotiation Conflict management
Professional ethics and values	Professional ethical behavior Recognizing and resolving unethical behavior Legal and regulatory requirements

As another study shows, accounting profession is moving from descriptive and diagnostic tasks to the higher end of analytics – predictive, descriptive and adaptive analytics. Professionals have to develop different set of skills than before, it becomes extremely important to not only be able to diagnose and describe, but also to deeply analyze, find reasons behind processes and make decisions accordingly.

The figure below shows results of this study in visual.

Figure 6. Evolution of Data Analytics for Management Accountants. (Raef Lawson, 2019)



In the study "A Profession in Transition: Actors, Tasks and Roles in AI-Based Accounting" (2021) Susanne Leitner-Hanetseder, Othmar M. Lehner, Christoph Eisl, Carina Forstenlechner looks at the AI effect on the workforce in the broader accounting profession. The audthors conducted a Delphi study with an objective to identify the new tasks and roles in future accounting.

To answer their research question, authors used a two-step exploratory approach for their empirical research. In the first step, they used a large-scale Delphi study with 138 respondents distributed around the globe and identified their roles in AI-based accounting. In the second step, they were allocated to AI or human actors in professional accounting roles.

The findings were that cloud computing and blockchain technology are drivers in RPA accounting and that AI-based technology will have the most significant impact on roles of accounting professionals. More detailed findings of the study on how certain accounting roles will change during time due to AI, are shown in the figure below. These were analyzed during the expert workshops which were conducted by the authors.

Figure 7. "Roles, related tasks, human and AI-based actors in accounting." Susanne Leitner-Hanetseder, Othmar M. Lehner, Christoph Eisl, Carina Forstenlechner (2021)

Roles: tasks Actor	Current actors	Actors in the year 2030
1. Transaction recorder: recording transactions, posting to account and reconciling and balancing accounts	*Humans* screen documents, post them to the correct account and manually reconcile and balance accounts supported by software tools (for example, booking software)	*AI-based technology* (for example, a smart software robot) which extracts information from machine-readable digital data formats as a self-learning system, posts it to the correct account; *humans* will supervise the results and take care of exceptional cases the AI-based technology is not able to solve
2. Data and information manager: collecting and selecting data for information gain	Due to their expertise, *humans collect and select* the data used for valuation, forecasting, risk mitigating . . ., they use mainly internal data from historical transactions and/or selected external structured data	Free data exchange standards enable *AI-based technology* such as automated feature tools to collect and suggest internal/external and unstructured/structured data relevant for the task; *humans* decide about the usage and/or *supervise* the selection of data
3. Data miner: data mining (analysing) to optimise costs, generate sales, forecast, mitigate risk or detect fraud and guarantee compliance	*Humans* fulfil this role by analysing mainly historical internal structured data using spreadsheets and descriptive analytics	*AI-based technology* (such as business intelligence tools) uses predictive analytics tools to analyse and recognises anomalies, interrelations, trends and patterns within big data; *humans* can *focus on major incidents*
4. Dashboard designer: reporting and visualisation of data	*Humans* use software tools (such as Excel, PowerPoint) and standardised formats to report and visualise the data on a regular basis	*Humans* design interactive dashboards with AI-based tools, which meet the needs of the user in an iterative way in nearby real time

Figure 7. "Roles, related tasks, human and AI-based actors in accounting." Susanne Leitner-Hanetseder, Othmar M. Lehner, Christoph Eisl, Carina Forstenlechner (2021)

5. Advisor: interpret the data and decide or advise/ communicate to stakeholders	*Humans* interpret the data due to their individual experience in the field	*AI-based technology* suggests data-driven decision options based on prescriptive analytics, *humans* interpret the AI outcome and understand the overall engagement process and have to weigh up options and decide or communicate to stakeholders and advise due to their expert knowledge and experience
6. AI technology expert: training and supervising AI-based digital technologies	*Not necessary right now*	*Humans* train and supervise AI-based technologies, such as a trainee, in a specific task and how to interact with humans to provide human and AI-based technology collaboration
7. Process manager: selecting processes for automation and the corresponding AI-based technology or components	*Not necessary right now*	*Humans* using AI-based process mining tools identify processes for automation, select the relevant AI technology or component and make sure that the collaboration of AI-based technology and humans work
8. Legal and ethical supervisor: guiding and monitoring legal and ethical requirements	*Not necessary right now*	*Humans* are responsible to guide AI-based technology and monitor whether the data-driven decisions made by humans meet legal and ethical requirements

To sum up, the most affected accounting roles will be accountant, bookkeeper, controller, data analyst, treasurer and risk and financial systems manager.

Similarly, to other authors, one of the RPA benefits that the author distinguishes is the efficiency of the software and elimination of human errors. For instance, is one case taken by the author, RPA reduces manual operational costs by 25% - 40%. Another benefit mentioned by V.Yedevelli is also

common between other researchers – use of RPA in reporting and analysis. This way companies can significantly reduce the time spent on manual work, leaving employees to use their analytical capabilities to support management in decision making. This also benefits employees in terms of their feeling in their work – it enhances the pride and job fullfilment.

As many believe that RPA is a true threat to accounting professionals' jobs, V. Yedavalli states that "in reality, however, is that RPA – when used to its full advantage – can be complementary rather than competitive force." By overtaking manual work from humans, such as booking journal entries or preparing reports, RPA gives the opportunity for employees to focus on more important tasks. The result, as mentioned before, is happier and more fulfilled workforce that works harder and is retained longer. The article is concluded with the answer to research question, that "while RPA is evolutionizing the way people think about work, it will never be able to truly replace a person's intellectual and emotional value. It is important to look at this burgeoning technology as a helping rather than a hindering force. By utilizing software robotics and deriving value from its automation capabilities, employees are better empowered to apply their true talents at work." (Vasu Yedavalli, 2018).

2.6. Accounting professionals' perception on artificial intelligence and their need to adapt

From the studies reviewed above, it is clear that there is more than enough literature describing artificial intelligence and robotization impact on accounting and businesses in general. Many of them analyze the benefits and prospects of technology growth, some are suggesting the need to change education programs and importance of finance professionals to improve and broaden their own skills. However, there is very little literature from the accounting professionals' point of view. What is their position and perception on these changes?

Such research has been done by authors Elizabeth Johnson, Matthew Peterson, Joshua Sloan and Adrian Valencia in their study "The Interest, Knowledge, and Usage of Artificial Intelligence in Accounting: Evidence from Accounting Professionals" (2021).

The authors conducted a survey and collected responses from more 34 accounting professionals. The questions of the survey were mostly focused on the characteristics of individuals and their interest, familiarity and usage of AI.

The main results received from the survey showed, that:

- 85% of accountants are interested in the use of AI accounting
- 91% of accountants are somewhat familiar with AI (but only 12% are very familiar)
- Only 24% have used AI in the past, while 32% are using AI in accounting processes currently

Conclusions of the study were that even though majority of respondents are familiar with AI, only small part of them have actually used it. Other finding showed that the accounting professionals' interest in AI is higher at the earlier stages of their careers. In addition, general evaluation of the received answers suggest, that even though many accountants are familiar with AI capabilities

and opportunities, many show hesitatin in its practical implementation. The reason for that might be a lack of technical knowledge, fear of security risks, and large overhead expenses.

The expectation raised from these conclusions were that partners will increase usage of AI when more professionals acquire technical knowledge in AI and implementation costs decrease (Elizabeth Johnson, Matthew Peterson, Joshua Sloan Adrian Valencia, 2021).

The biggest limitation to this research is the number of respondents. Only 34 answers were collected, which by far could not represent all accountants.

To conclude the theoretical and literature analysis, there are many various studies done on how artificial intelligence is impacting the world and various professions. Many authors agree on few common conclusions:

- There are many benefits of AI implementation in business processes
- Artificial intelligence is not a new thing, but together with the improvement of all technologies, AI is getting more and more recognized and applied
- AI is also affecting accounting profession significantly
- Accounting profession is changing rapidly, and accounting professionals must gain new skills and adapt to remain competitive
- There are also some disadvantages of AI, such as high cost, small and lengthy return on investment, people losing jobs to machines

However, there still are unanswered questions and lack of literature in terms of several aspects. One of the most important gap in previous research is lack of studies done on accounting professionals' perception on artificial intelligence and technology development impact on their profession. Another point is that many authors analyze and write how accounting profession will change in the future, but little of them tend to research current situation in businesses and among professionals and how they feel about that, nonetheless, if they are even aware of that. There were also some pieces of literature found researching managers' need to adapt the new skills.

Therefore, these findings encourage the need to understand current financists' perception on accounting profession transformation due to significant AI impact. It is important to understand current level of technological knowledge, willingness to accept the change and gain new skills.

3. Research hypotheses and methodology

3.1. Research hypotheses

After conducting the literature and theoretical analysis, it is clear, that there have been many studies done on how AI is transforming the accounting profession. A lot of theories are raised, mostly in favour of this technological improvement and mostly looking forward on how accounting profession should look in the future. However, there is lack of studies done on current situation in businesses and current accounting professionals' readiness to adapt artificial intelligence. It is difficult to find literature on how companies are adopting AI and how accounting professionals are adapting.

Therefore, this study formed a problem statement: transformations due to artificial intelligence application in accounting operations is a huge challenge for businesses and for accounting professionals. Lack of technological knowledge is slowing down the willingness and process of AI implementation.

The aim of this research is to analyze how accounting profession is changing due to artificial intelligence and how accounting professionals perceive the need to change themselves beginning with the entry-level professionals, to experienced ones.

According to the raised problem and research aim, the following hypotheses were raised:

H1 – accounting professionals must improve their technological and IT knowledge in order to stay competitive in labour market. This hypothesis was raised, as some pieces of literature touch this topic when talking about technology development. For instance, R. Lawson in his paper New Competencies for Management Accountants (2019) describes what competencies accountants need to gain in order to stay up to date. Also, authors Agata Staghowizc-Stanusch, Wolfgang Aman, Hamid H. Kazeroony Management and business education in the time of artificial intelligence: The need to rethink, retrain and redesign (2019) describe the need to gain different skills.

H2 – accounting specialists are aware about the transformation of their profession and are prepared to adapt. This hypothesis was raised because several authors, such as P. Lin and T.Hazelbaker (2019) or Dr.S.A.M.Aldosari (2019) describe the challenges of AI that accounting professionals will face. Therefore, it is important to understand, whether professionals are prepared for that.

H3 – accounting and finance professionals are positive about and open to using artificial intelligence in their work. This hypothesis was raised due to lack of research on this topic. Many describe the new way of thinking and the need to adapt, but very few analyze the positivity behind these transformations.

H4 – top level executives are positive about and open to investing in technological innovation and artificial intelligence integration in their businesses. This hypothesis was encouraged by Ph. D. Candidate Mariana Antonescu, who analyzed whether business leaders are ready for technology innovation in her piece „Are business leaders prepared to handle the upcoming revolution in business artificial intelligence? " (2018). It is interesting to understand whether top level executives are open for innovation and are prepared to invest in such business solutions as AI.

3.2. Research methodology

Most studies and literature pieces done, also those mentioned in previous sections, use survey method to conduct their research. It is one of the most widely used and in many cases easily adaptable method. Most widely known types of survey are a questionnaire, interview, survey by phone or email, mass communication survey or focus group. In scientific practice, dominant survey is a questionnaire method. This way questionnaire can be provided to respondends easily and gives them the opportunity to fill it in convenient place and time. Therefore, questionnaire survey method was chosed in this paper as well.

Regarding survey sampling, online survey is selected as data collection with design of cross-sectional studies. Questionnaire will be constructed using the following six steps:

- Decide what kind of information should be collected
- Decide how the questionnaire will be conducted
- Construct the draft of the questionnaire
- Revise the questionnaire
- Pretest the questionnaire
- Edit and specify the procedures for the questionnaire

The survey is to be divided into two parts: one questionnaire targeted to different managers and directors of the companies, other to finance and accounting specialists with different background – from students or entry level specialists, to experienced accountants. The type of questions used in questionnaire will be a Likert scale, including technical and demographic types of questions.

The first survey, targeting managers, will focus on the second hypothesis and the following topics:

- Openness to invest in innovation technology and artificial intelligence
- What kind of technologies are already used in their business processes
- What are their expectations for the accounting department in their company (are they expecting to reduce the number of employees, or to change employees focus into more analytical, etc.)

The second survey for accounting professionals will focus on the following topics and hypotheses:

- What kind of technologies they have used or are using currently in their work (H1)
- Are they familiar with artificial intelligence and it’s potential in accounting (H1)
- Are they open and willing to use AI in their work (H1)
- Are they prepared to adapt to transformations that their profession is facing (H2)
- Are they already adopting new skills to improve their professional knowledge (H3)

- Do they believe that they must adopt new skills in order to remain competitive, or they are happy as they are (H3)?
- What are their perceptions and expectations for the future of accounting profession (H1-H4)

In order to conduct the research and receive reliable results, it is required to determine the number of respondents, which need to be questioned. Respondents targeted are accounting and finance professionals, as well as top-level executives working in Lithuania, different industries, and various sizes of companies. As there is no reliable statistics on the number of accounting professionals and executives in Lithuania, it was decided to use publicly available data. It was selected to take data from social network Facebook, public group "Buhalteriai vienijasi" which has 13,7 thousand active members. This number was selected as a base for the representative sample calculation. The same number was selected as a base for the sampling of executives, as in many companies' number of exeutives and accountants is similar.

Using formula, provided by V.P.Pranulis and V.Dikčius (2012), sample size could be calculated using the following formula:

$$n = \frac{p(1-p)}{\left(\frac{e}{z}\right)^2 + \frac{p(1-p)}{N}}$$

Where:

n – representative sample size

z – standard deviation. In this case it is equal to 1,96, as reliability level chosen is 95%

e – sampling error. In this case it is 5%

p – totality proportion according to dominant features. In this case it is 0,5

N – sample size

The calculated result of representative sample size is 373 respondents for each survey. This is the number of respondents required to gain reliably representative view.

Before conducting the research, it is probable, that representative sample will not be collected due to difficulty to reach enough respondents and receive their answers. Therefore, it was decided to distribute surveys by collaborating with current and previous colleagues by sending questionaires to emails and placing them in social networks (Facebook, Linkedin) in other convenient means.

Before distributing the questionnaire, it was firstly revised and tested among friends with accounting to identify missing options or errors.

The questionnaire was conducted in period from early March to late April. The form of questionnaire was constructed in Google Forms.

As results in the following section show, respondents were not active in the research, several additional requests had to be made by inquiring people personally. It is however impossible to calculate how many people had the possibility to attend the survey, as it was posted in social networks. In total, 106 answers were received from both groups of respondents.

Collected data does not give reliably representative answers, however it gives a good indication to confirm of dismiss hypotheses of the research.

Results of the conducted survey are provided in the following section.

4. Accounting and finance professionals' technological knowledge and perception of artificial intelligence impact on transformation of accounting profession research results

4.1. Review of the respondents

Data for the research on current AI perception in businesses and accounting professionals' readiness to adapt artificial intelligence was obtained using a questionnaire survey. Research was divided into two parts – one focusing on accounting professionals, second – on top-level executives. The study as a whole was conducted among Lithuanian finance professionals and executives, working in local and international companies. Data was collected from 80 accounting and financie professionals and 16 executives by distributing questionnaire to invidivuals by e-mail or inquiring to fill an electronic form. As this volume of data is too small to gain reliably representative results, it was decided to conduct a revisional research by testing research hypotheses raised earlier in the thesis. Systemic data about respondents is provided in the tables below.

Table 2. Participating accounting and finance professionals' analysis (prepared by author)

			Position in the company					
			Bookkeeper	Accountant	Chief accountant	Financial analyst / controller	Auditor / internal auditor	CFO
Age	20-30 years	No.	7	4	0	20	5	0
		%	9%	5%	0%	25%	6%	0%
	31-40 years	No.	0	12	3	1	0	4
		%	0%	15%	4%	1%	0%	5%
	41-50 years	No.	0	6	13	0	0	0
		%	0%	8%	16%	0%	0%	0%
	51-60 years	No.	0	2	3	0	0	0
		%	0%	3%	4%	0%	0%	0%
Work experience in finance or accounting	Less than 1 years	No.	4	0	0	0	0	0
		%	5%	0%	0%	0%	0%	0%
	1-3 years	No.	3	4	0	0	1	0
		%	4%	5%	0%	0%	1%	0%
	4-6 years	No.	0	0	0	8	4	0
		%	0%	0%	0%	10%	5%	0%
	7-10 years	No.	0	8	0	12	0	0
		%	0%	10%	0%	15%	0%	0%
	11-15 years	No.	0	4	7	1	0	4
		%	0%	5%	9%	1%	0%	5%
	16-20 years	No.	0	6	7	0	0	0
		%	0%	8%	9%	0%	0%	0%
	21 years and mor	No.	0	2	5	0	0	0
		%	0%	3%	6%	0%	0%	0%

According to data collected, most active participants of the survey were various levels accountants and financial analysts / controllers, who totally combined 89% responded professionals, mostly young individuals – 45% of 20-30 years old and 25% 31-40 years old. 55% of all participants have work experience of 0-10 years.

Main reasons for low participation rate, are considered as follows:

- Lack of time;
- Busyness of respondents;
- Passivness of respondents.

Table 3. Participating top-level executives' analysis (prepared by author)

			Position in the company			
			CFO	CEO	CIO	Department director
Age	31-40 metų	No.	1	0	2	1
		%	6%	0%	13%	6%
	41-50 metų	No.	3	0	1	6
		%	19%	0%	6%	38%
	51-60 metų	No.	1	1	0	0
		%	6%	6%	0%	0%
Managing work experience	1-3 metai	No.	0	0	1	1
		%	0%	0%	6%	6%
	7-10 metų	No.	0	0	0	3
		%	0%	0%	0%	19%
	11-15 metų	No.	5	0	1	1
		%	31%	0%	6%	6%
	16-20 metų	No.	0	1	1	2
		%	0%	6%	6%	13%

According to collected data, majority of participants work as a department director (44%) and CFO (31%). Also, great part of respondents have a solid managing work experience – 44% have 11-15 years of experience and 25% more.

Main reasons for low participation rate, are considered as follows:

- Lack of time;
- Busyness of respondents;
- Passivness and unavailability of respondents – it proved to be very difucult to obtain answers from executives.

4.2. Testing of research hypogheses

Testing hypothesis H1 – accounting professionals must improve their technological and IT knowledge in order to stay competitive in labour market. To understand and evaluate professionals' technological and IT knowledge, firstly it is important to understand their background – companies and industries that they work in, and their technological knowledge. According to collected data, majority of respondents work for medium (50%) and large (35%) companies. Main industries of the mentioned companies are wholesale and retail (34%), information and communication (21%) and financial and insurance services (16%) (table No.2).

Table 4. Analysis of the companies, that respondents work in (prepared by author).

Companies			Size				Total:
			Very small	Small	Medium	Large	
Industry of the company	Manufacturing	No.	1	1	4	5	11
		%	1,3%	1,3%	5,0%	6,3%	13,8%
	Wholesale and retail	No.	0	3	3	21	27
		%	0,0%	3,8%	3,8%	26,3%	33,8%
	Financial and insurance services	No.	0	4	9	0	13
		%	0,0%	5,0%	11,3%	0,0%	16,3%
	Information and communication	No.	1	0	16	0	17
		%	1,3%	0,0%	20,0%	0,0%	21,3%
	Real estate activities	No.	0	0	4	0	4
		%	0,0%	0,0%	5,0%	0,0%	5,0%
	Construction	No.	0	0	0	2	2
		%	0,0%	0,0%	0,0%	2,5%	2,5%
	Education	No.	1	0	0	0	1
		%	1,3%	0,0%	0,0%	0,0%	1,3%
	Transport and storage	No.	0	1	4	0	5
		%	0,0%	1,3%	5,0%	0,0%	6,3%
Do you use new technologies in your work?	Yes, my company is very much up to date with new technologies and constantly invests in innovations that help improve efficiency	No.	0	4	19	3	26
		%	0,0%	5,0%	23,8%	3,8%	32,5%
	Yes, technologies in my work are fully sufficient in order to complete my daily tasks	No.	3	1	20	20	44
		%	3,8%	1,3%	25,0%	25,0%	55,0%
	Yes, however, the need for innovations is significant	No.	0	4	1	5	10
		%	0,0%	5,0%	1,3%	6,3%	12,5%
	No, company can not afford them	No.	0	0	0	0	0
		%	0,0%	0,0%	0,0%	0,0%	0,0%
	No, there is no need for them in my daily work	No.	0	0	0	0	0
		%	0,0%	0,0%	0,0%	0,0%	0,0%

Also, according to collected data, majority of respondends indicated, that the company which they work in have all the necessary technologies required to complete their daily tasks (55%). There were no answers, where respondents would say, that company can not afford to invest in technology, or there is no need to. This result is promising; however, it could be so because most of respondents work in bigger companies, located in major cities of Lithuania, which usually tend to be more technologically advanced and willing to invest. In addition, only 13% of responents indicated, that there is a lack of innovations. This ratio also shows that medium and large companies mostly invest in the technology as least to keep at basic level. However, ratio of companies that constantly invest in innovations is lower than expected before the research (32.5%). It was expected that medium and large companies are willing to spend money on innovative improvements, but it is not the case. This might indicate, that either companies slowed down their investments during pandemic period to lower

cash flows risks, or they lack information about new technology updates and how they could improve their business.

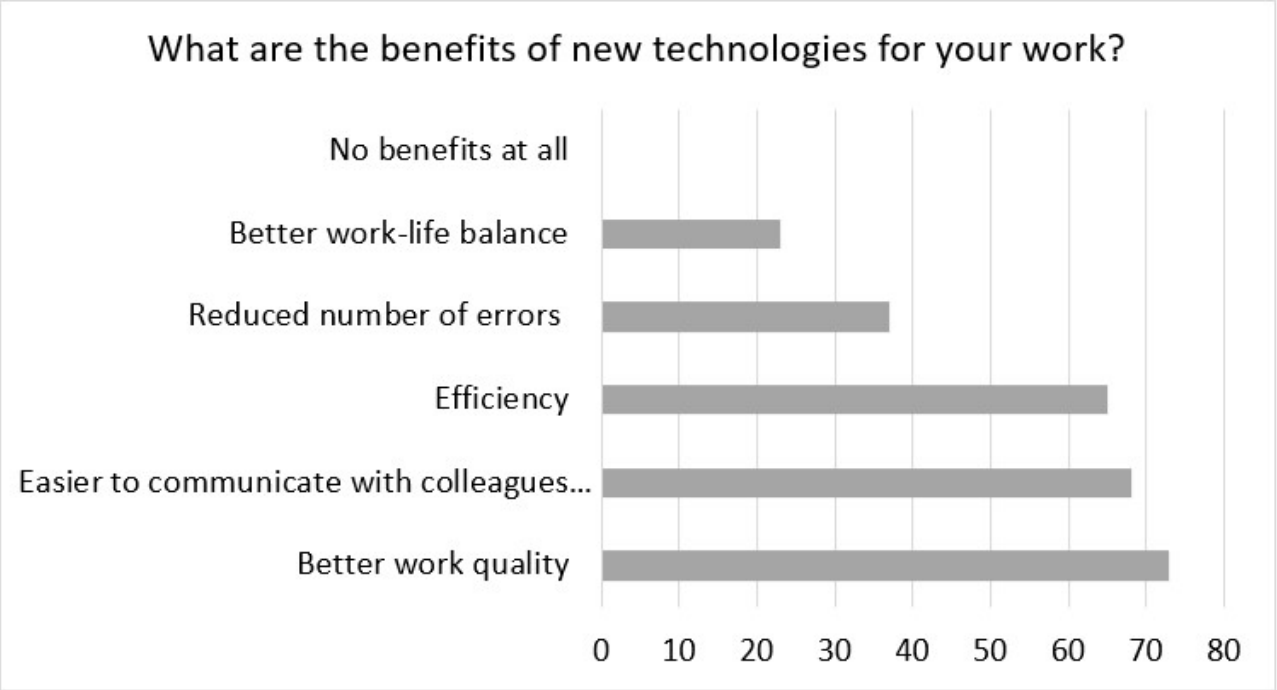
During the research, respondents were also asked, what kind of technology they use personally and in daily work, in order to understand how familiar they are. See results in tables No. 3 below.

Table 5. Technology use in daily life and work (prepared by author)

Technology use		I use it daily, not only for work	I use it only for work	I use it only for personal needs	I do not use it, but would like to use it	I do not use it, there is no need	I do not use it because it is impossible in my work	I do not know this technology
Accounting program	No.	0	80	0	0	0	0	0
	%		100%					
Enterprise Resource Planning (ERP) Systems	No.	0	61	0	0	19	0	0
	%		76%			24%		
Smart mobile devices (mobile phone, tablet, watch, etc.)	No.	80	0	0	0	0	0	0
	%	100%						
Big Data tools	No.	0	13	0	12	34	19	2
	%		16%		15%	43%	24%	3%
Cloud	No.	64	8	0	0	8	0	0
	%	80%	10%			10%		
Artificial intelligence	No.	0	4	0	28	40	0	8
	%		5%		35%	50%		10%
Cybercecurity software	No.	76	4	0	0	0	0	0
	%	95%	5%					
Online learning	No.	40	32	4	0	4	0	0
	%	50%	40%	5%		5%		
E-Banking system and mobile payment apps	No.	71	0	9	0	0	0	0
	%	89%		11%				
E-Shoping	No.	1	0	79	0	0	0	0
	%	1%		99%				
Online communication apps (i.e. Facebook, Teams, Zoom, Whatsapp,	No.	73	2	5	0	0	0	0
	%	91%	3%	6%				

According to collected data, absolutely all respondents are using accounting programs in their work. This answer was well expected, as all respondents work in accounting and finance. Also, all respondents answered, that they are using smart mobile devices, cybercecurity tools, e-shopping, online banking systems and online communication applications for either their work or daily life. This shows that absolute majority of respondents are familiar with technology, and it is part of their daily activities. However, analysis of more complex technology use is different – big data, artificial intelligence and cloud services are used much less. Even 10% of respondents answered that they do not even know what artificial intelligence is, same for 3% of respondents regarding big data. Going deeper into the answers of these respondents, it is clear, that those answers were from older professionals, who are probably slower to catch up to innovations and do not receive relevant trainings. Also, great part of respondends answered, that they do not have any need to use such technology as big data (43%) or artificial intelligence (50%). These results show, that either respondents do not have enough information of how such technology could chage their job, or they do not want any change. In addition, some finance and accounting professionals do not see additional benefits of such technology in their work, which also might be the case due to lack of information and IT knowledge. To test this assumption, questionnaire included question about benefits, that professionals identify about having using technology in their work. Majority of respondents identified that the greatest benefit of technology in work is better work quality (73 respondents), easier communication (68 respondents) and efficiency (65 respondents). This indicates that the assumption of lack of information most likely is correct, because main benefits of big data and AI tools are to increase quality by reducing number of errors and increase efficiency. Please see results of the answers in figure below.

Figure 8. Benefits of technologies in work (prepared by author)

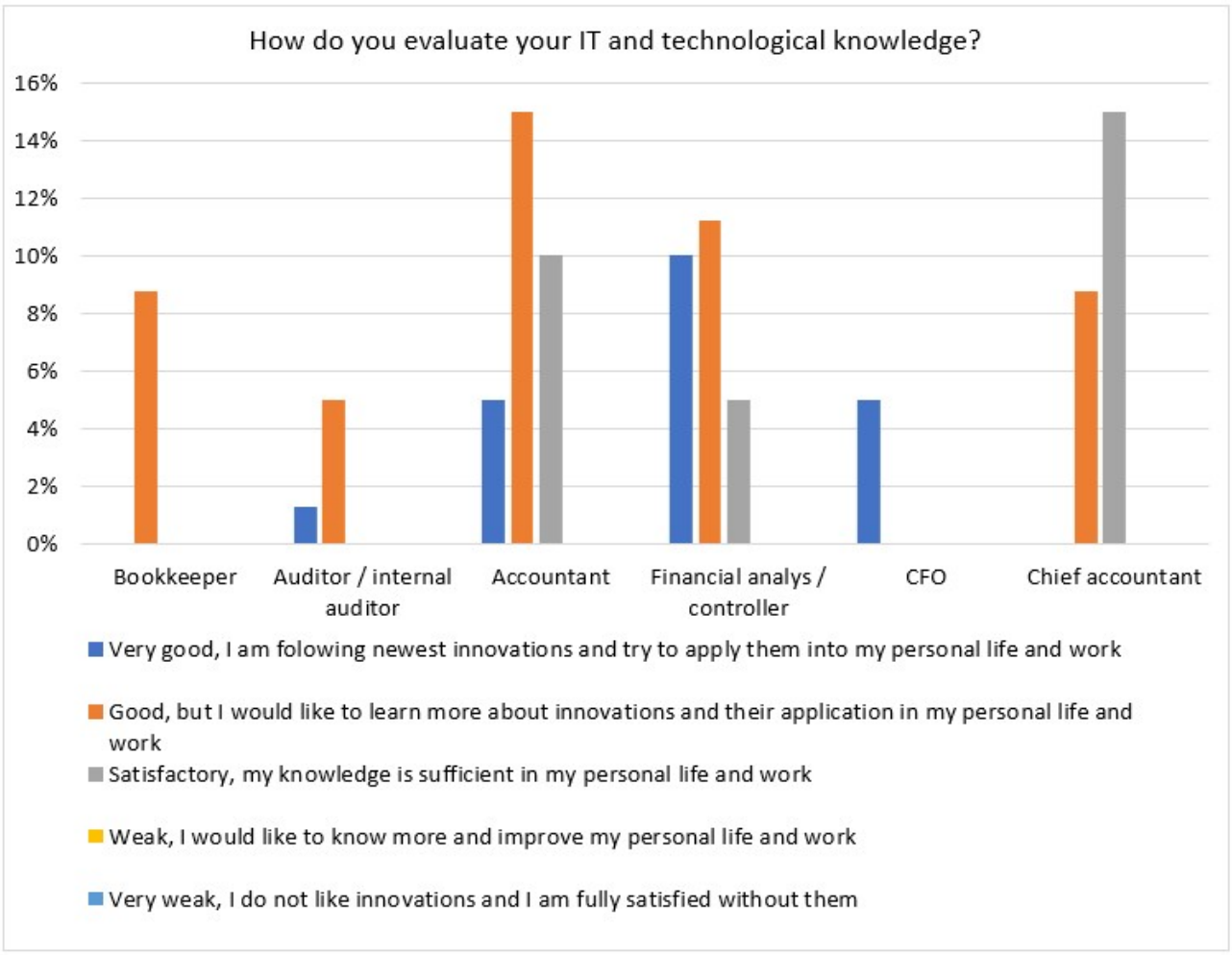


When asked, how they evaluate their own IT knowledge, vast majority of respondents (49%) answered, that their knowledge is good, but they would like to improve it and learn more about innovations and their potential application. Same answer came from various levels of expertise (15% accountants, 11% financial analysts, 23% chief accountants and others). Only 21% answered, that their knowledge is very good, and they constantly follow what is new and try to implement it in their life. These answers were the most popular between younger respondents, who mostly work as analysts, controllers, and finance directors, some from younger accountants. Results deviated by age were as follows:

- Out of the 21% who answered that their IT knowledge is very good, 76% were between 20-30 years old, the rest were 31-40 years old
- Out of the 49% who answered that their IT knowledge is good, but they would like to learn more, 49% were between 20-30 years old, and 40% were 31-40, while others – older
- Out of the 17% who evaluated their IT knowledge as only satisfactory, 54% were 41-50 years old. However, in this section, even 17% of respondent were young – between 20-30 years. They combined 5% of total population.

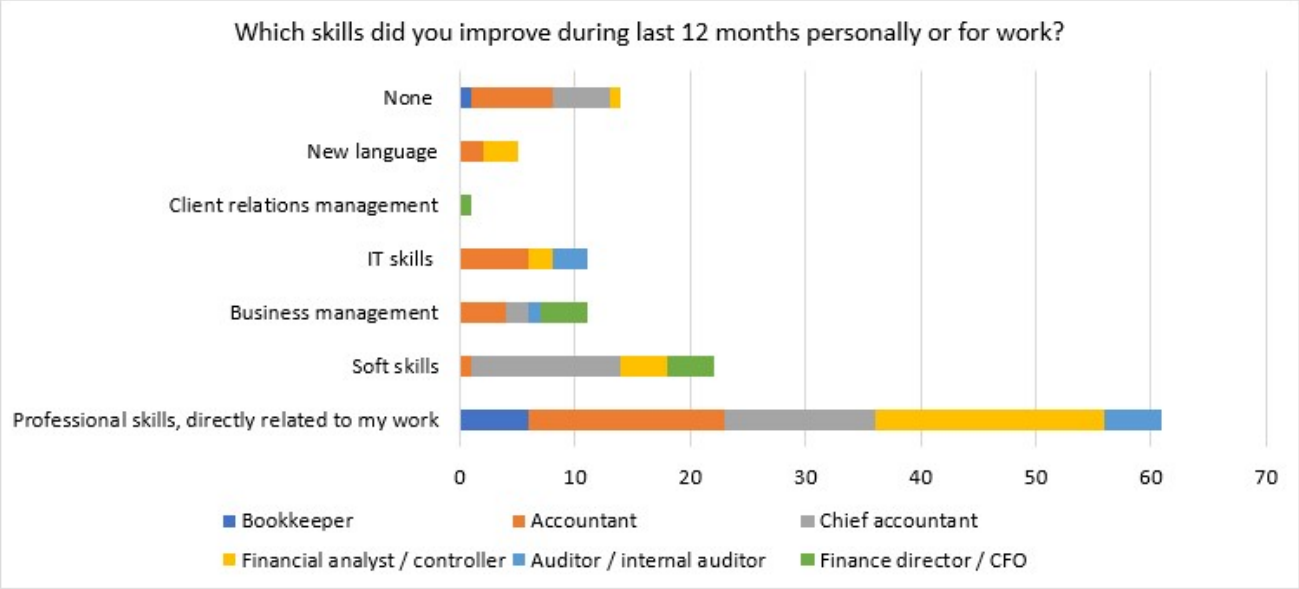
This result also indicates a proof to above mentioned assumption, that there is a lack of IT skills and knowledge among most of accounting professionals (79%) and that they are willing to learn more in order to improve their work quality. See figure below, showing how IT knowledge distributes among different roles.

Figure 9. Respondents' evaluation of their IT and technological knowledge (prepared by author)



Following, questionnaire asked respondents which skills they improved during last 12 months. Looking at the chart of skills, it does not seem that finance professionals are very enthusiastic about learning new skills. See figure 9 below.

Figure 10. Skills which respondents improved during last 12 months (prepared by author)



As it is noticeable in the graph above, vast majority of respondnets improved professional skills directly related to their role. Such high time investment into professional skills, rlated to work, is most likely caused by the fact, that most respondents work in medium and large companies, which are usually initiative to invest into their employees and their professional expertise. For instance, such companies as Big4 audit firms, AB Vilniaus Prekyba group companies, other international firms have sepatare budget for employee training. In this case, people tend to invest their time in skills improvement, because it is usually free of charge or compensated by the company. In many cases it is even made mandatory by empoyer for employees to keep improving their skills, such as gaining ACCA or other qualifications.

Time investment into skills improvement is the highest among financial analysts or controllers and, who are usually very young, between 21-30 years old. Older professionals tend to choose soft skills, or business management, as they already have solid technical knowledge baggage and are higher in their careers.

However, according to collecte data, one of the most important – IT training – is put aside by the most professionals – only 14% answered, that they have improved their IT skills during last 12 months. Having in mind, that great part of respondents evaluate their IT knowledge as good, but would like to improve it, it is necessary to search for reasons, why only insignificant part of them actually take actions and choose learning in this area. One of the assumptions is cost. As mentioned above, usually employees go for additional training, which is compensated by employer or strongly required. Therefore, it would be a question for future research to analyze businesses' willingness to improve their employees IT skills.

Last, but not least step in testing H1 hypothesis, was to ask respondents if they agree with assumptions that technology development will rapidly change the role of accountant. See results in table No. 4 below.

Table 6. How many respondents agree with assumptions that technology will rapidly change the role of accountant (prepared by author)

		Strongly agree	Agree	Undecided	Disagree	Strongly dissagree
Accounting and finance profession will change in the future due to technology innovation and artificial intelligence	No.	40	40	0	0	0
	%	50%	50%	0%	0%	0%
Accounting and finance professionals have to adapt to new technology development	No.	56	16	8	0	0
	%	70%	20%	10%	0%	0%
Accounting and finance professionals have to improve their IT skills and knowledge in order to stay competitive in labour market	No.	17	51	12	0	0
	%	21%	64%	15%	0%	0%
Accounting and finance education should be supplemented with teaching IT skills	No.	21	55	4	0	0
	%	26%	69%	5%	0%	
I am prepared to learn new skills and adapt to new technology development	No.	21	34	13	12	0
	%	26%	43%	16%	15%	0%

First assumption was, that accounting and finance profession will change in the future due to technology innovation and artificial intelligence. All 100% of respondents either strongly agree or agree that it is true. In addition, even 90% agree, that they must adapt to new technology development. These answers indicate that accountants are aware of technological development and its effect on their roles. High approval rate on the statement that they must adapt to these changes indicate their willingness to change.

On the other hand, when asked if they agree to the statement that accountants have to improve their IT skills to stay competitive in the labour market, majority of respondents were slightly more hesitant – only 21% strongly agree, but even 64% tend to agree with this assumption. Very similar answers were provided to question whether accounting curriculums should be supplemented with teaching IT skills. This also indicates that respondents tend to agree with idea, that accountants need to gain additional knowledge, even though IT discipline was relatively distant from accounting.

Last question was, if they are ready to gain new skills to adapt technology. Here even more hesitation is noticeable – 15% of respondents say that they are not prepared to learn IT, even though they agree that there is a need for that. This answer was mostly provided by older individuals, around 50 years old and more, which is perfectly understandable. On the other hand, 69% of respondents strongly agree or agree that they feel prepared to gain new skills and knowledge.

To conclude, the research about accounting professionals' lack of technological knowledge was conducted. Results found that great part of accountants feel the need to improve their IT skills, even though they use tech solutions every day. Majority of respondents indicated that they would like to gain more skills and majority agreed that technological development is changing their profession rapidly. And most importantly, majority of responsers that they need to gain additional IT skills in order to stay competitive. Therefore, according to conducted research, H1 hypothesis is confirmed.

Testing hypothesis H2 – accounting specialists are aware about the transformation of their profession and are prepared to adapt. To understand if accountants are aware of the changes that AI is bringing to the profession, fistly its is important to understand how much they know about artificial intelligence and robotic process automation. From the literature review, it was found, that AI implementation into accounting role is inevitable, it will most probably replace some employees by completing their tasks faster and more accurate. Therefore, first step to test the hypothesis was to inquire accounting and finance professionals, whether they know what artificial intelligence is and how it could change their role.

Even 35% of all respondents answered, that they know what artificial intelligence is and are perfectly aware how it could change the accounting profession. In addition, 26% what AI is, but would like to know more. The most significant difference between these two groups, is that out of those 28 people stating to know very well about AI, 24 are very young – between 20-30 years old. There is more variation in the second group – people from various age groups indicate knowing about AI but wanting to learn more.

31 % of respondents state that they only know the definition, but not how it could be applied in business solutions, while 8% do not know anything about AI at all.

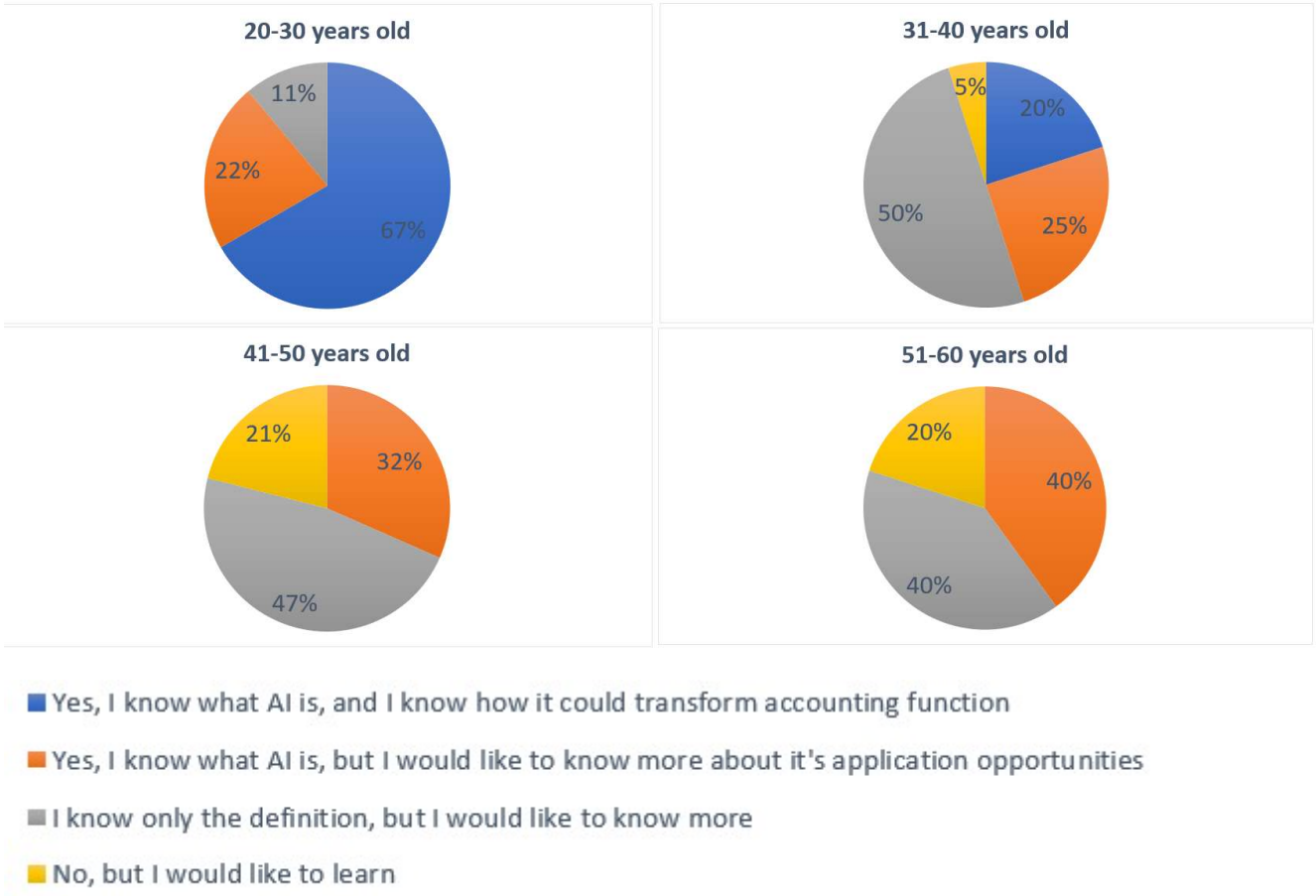
Please see results in the table No. 7 and figure 11 below.

Table 7. Do accountants know what AI is and how it could change their profession? (prepared by author)

	Age				
	20-30 years	31-40 years	41-50 years	51-60 years	Total
Yes, I know what AI is, and I know how it could transform accounting function	24	4	0	0	28
Yes, I know what AI is, but I would like to know more about it's application opportunities	8	5	6	2	21
I know only the definition, but I would like to know more	4	10	9	2	25
No, but I would like to learn	0	1	4	1	6

Looking at the distribution of AI knowledge levels in the charts below, a significant difference is noticed. As expected, young people have much better knowledge about artificial intelligence, while older respondents tend to know just a little, or none.

Figure 11. Knowledge about AI level distribution between age groups (repared by author)



Next step in H2 hypothesis testing was to find out if there are companies already using artificial intelligence solutions in their businesses. Answers were analyzed in two different cuts – by company size and by industry in which the company operates.

Table 8. Artificial intelligence use by industry (prepared by author)

Company type		No, there is no need	No, but there is a need	I do not know	Yes, AI is used in at least one business process	Yes, artificial intelligence tools are used in finance operations	Total
Manufacturing	No.	5	4	2	0	0	11
	%	6%	5%	3%	0%	0%	14%
Wholesale and retail	No.	5	22	0	0	0	27
	%	6%	28%	0%	0%	0%	34%
Financial and insurance services	No.	0	8	4	0	1	13
	%	0%	10%	5%	0%	1%	16%
Information and communication	No.	7	7	1	1	1	17
	%	9%	9%	1%	1%	1%	21%
Real estate activities	No.	3	0	1	0	0	4
	%	4%	0%	1%	0%	0%	5%
Construction	No.	1	0	1	0	0	2
	%	1%	0%	1%	0%	0%	3%
Education	No.	1	0	0	0	0	1
	%	1%	0%	0%	0%	0%	1%
Transport and storage	No.	4	0	1	0	0	5
	%	5%	0%	1%	0%	0%	6%
TOTAL	**No.**	**26**	**41**	**10**	**1**	**2**	**80**
	%	**33%**	**51%**	**13%**	**1%**	**3%**	**100%**

Table 9. Artificial intelligence use by company size (prepared by author)

Company type		No, there is no need	No, but there is a need	I do not know	Yes, AI is used in at least one business process	Yes, artificial intelligence tools are used in finance operations	Total
Large	No.	5	21	2	0	0	28
	%	6%	26%	3%	0%	0%	35%
Medium	No.	15	19	3	1	2	40
	%	19%	24%	4%	1%	3%	50%
Small	No.	3	1	5	0	0	9
	%	4%	1%	6%	0%	0%	11%
Very small	No.	3	0	0	0	0	3
	%	4%	0%	0%	0%	0%	4%
TOTAL	**No.**	**26**	**41**	**10**	**1**	**2**	**80**
	%	**33%**	**51%**	**13%**	**1%**	**3%**	**100%**

Table 8 and table 9 summarize the findings of which companies use artificial intelligence tools.

In total, 2 companies (3% of total) already use or are testing artificial intelligence tools in their finance operations. Both companies operate in financial and insurance and information and communication markets, which is not unexpected, as such companies usually deal with more complex transactions and usually are more innovative. Also, both of these companies are medium in size. In addition, one recipient answered, that their company, operating in information and communications industry, also medium in size, use artificial intelligence tools in at least one business operation (non-financial). The results are not surprising, as AI is still very new and not widely used globally.

Even 51% of respondents indicated, that they are not using AI tools in their work, but they see a need to. This indication is positive in relation to topic of this thesis and in H3 testing, as it shows professionals' willingness to adopt such tools and maybe improve their work. However, this proportion does not yet show if the respondents and companies that they operate in, are prepared for that. Results also show that majority of the companies, where professionals would like to employ AI tools, are in wholesale and retail business (28%). Others are financial and insurance services (10%) and information and communication services markets (9%). While looking at the size of these companies, also majority of those who would like to use AI, are large companies (26%) and medium (24%). On the other hand, 33% of respondents still do not see any need to apply such innovations. They represent companies from all types of industries and all sizes, mostly medium (19%).

Last step in testing H3, questionnaire asked respondents if they agree with raised assumptions about AI and accountant's role relation.

To understand how accounting and finance professionals feel about AI role in accounting, questionnaire answers are presented by their position in the company.

Table 10. Respondends view on artificial intelligence role in accounting, based on their position in the company (prepared by author)

		Do you agree that artificial intelligence could replace humans in various accounting tasks?				
Role in the company		**Strongly agree**	**Agree**	**I don't know**	**Disagree**	**Strongly disagree**
Bookkeeper	No.	0	7	0	0	0
	%	0%	9%	0%	0%	0%
Auditor / internal auditor	No.	4	1	0	0	0
	%	5%	1%	0%	0%	0%
Accountant	No.	4	0	14	6	0
	%	5%	0%	18%	8%	0%
Financial analyst / controller	No.	12	9	0	0	0
	%	15%	11%	0%	0%	0%
CFO	No.	4	0	0	0	0
	%	5%	0%	0%	0%	0%
Chief accountant	No.	0	7	8	4	0
	%	0%	9%	10%	5%	0%
TOTAL	**No.**	**24**	**24**	**22**	**10**	**0**
	%	**30%**	**30%**	**28%**	**13%**	**0%**

		I recognise a risk, that my position could be replaced by AI				
Role in the company		**Strongly agree**	**Agree**	**I don't know**	**Disagree**	**Strongly disagree**
Bookkeeper	No.	0	7	0	0	0
	%	0%	9%	0%	0%	0%
Auditor / internal auditor	No.	4	1	0	0	0
	%	5%	1%	0%	0%	0%
Accountant	No.	0	16	4	4	0
	%	0%	20%	5%	5%	0%
Financial analyst / controller	No.	0	4	2	13	2
	%	0%	5%	3%	16%	3%
CFO	No.	0	0	0	0	4
	%	0%	0%	0%	0%	5%
Chief accountant	No.	0	8	3	8	0
	%	0%	10%	4%	10%	0%
TOTAL	**No.**	**4**	**36**	**9**	**25**	**6**
	%	**5%**	**45%**	**11%**	**31%**	**8%**

Table 10. Respondends view on artificial intelligence role in accounting, based on their position in the company (prepared by author) (cont.)

		I am prepared to use AI in my work				
Role in the company		**Strongly agree**	**Agree**	**I don't know**	**Disagree**	**Strongly disagree**
Bookkeeper	No.	4	3	0	0	0
	%	5%	4%	0%	0%	0%
Auditor / internal auditor	No.	4	1	0	0	0
	%	5%	1%	0%	0%	0%
Accountant	No.	4	0	12	4	4
	%	5%	0%	15%	5%	5%
Financial analyst / controller	No.	12	0	9	0	0
	%	15%	0%	11%	0%	0%
CFO	No.	4	0	0	0	0
	%	5%	0%	0%	0%	0%
Chief accountant	No.	0	8	11	0	0
	%	0%	10%	14%	0%	0%
TOTAL	**No.**	**28**	**12**	**32**	**4**	**4**
	%	**35%**	**15%**	**40%**	**5%**	**5%**

First assumption raised was that AI can change humans in various accounting tasks. 30% of responders strongly agreed and 30% agreed with this assumption. Majority of those who agree were financial controllers and analysts (26%), bookkeepers (9%) and chief accountants (9%). While disagreement rate was relatively insignificant – only 10% by various levels accountants. Also, great part of respondents – 28% - did not have an opinion in this question. The results were as expected from literature review and previous research analysis – main part of respondents see that in future some tasks can be replaced by robotization.

Second assumption raised was that accoutants see a risk that their role could be overtaken by AI. Here results were similar – even 50% of respondents agreed with such statement. Majority of these were various levels of accountants – the exact role, which is mostly targeted by AI tools. Also, as expected, majority of higher role individuals do not see any risk to their position in the near future (CFOs, financial controllers and chief accountants).

The last assumption raised was “I am prepared to use AI in my work”. Here answers differ – majority of individuals marked that they do not know yet, while 50% of respondents feel that they are ready. Only 10% are not prepared to take this new challence, which also understandable, as this answer was mostly provided by older or lower position professionals.

To conclude, the research about accounting professionals’ awareness and perception of their profession transformation was conducted. Results found that great part of accountants already know what artificial intelligence is and how it could change their role. What is more important, even 50% feel prepared to use AI in their work, even though many still lack sufficient skills and knowledge. Therefore, according to conducted research, H2 hypothesis is confirmed.

Testing hypothesis H3 – accounting and finance professionals are positive about and open to using artificial intelligence in their work. After finding that accounting professionals are prepared for changes and prepared for technological developments, including artificial intelligence incorporation to business solutions, the question rises – whether they are really positive and open for this transformation? To understand that questionnaire inquired the exact question to respondents – are they positive about this change? The results were analyzed in two different cuts – by age groups and by current position in the company.

Table 11. Number of respondents feeling positive about AI replacing humans (prepared by author)

		Strongly agree	Agree	Undecided	Disagree	Strongly dissagree
I am positive about the idea that AI could replace humans in accounting functions	No.	21	25	19	15	0
	%	26%	31%	24%	19%	0%

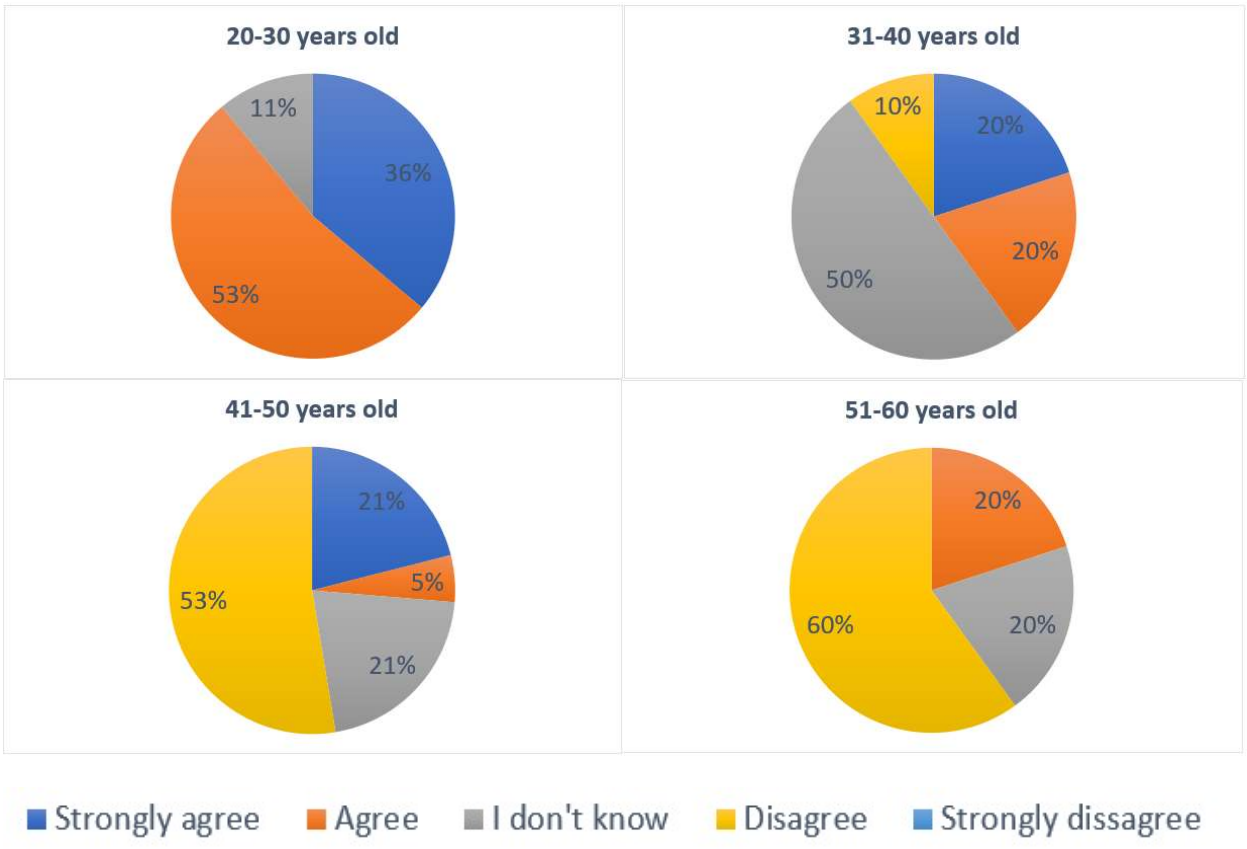
To begin with, even 57% of total respondents are positive about the idea that AI could replace humans in various accounting functions.

Looking at the split by age groups, most positive respondents about the idea that IA can replace humans, are in age group between 20-30. That was also expected, as this group of people generally are more passionate about innovations and would more likely give away technical tasks, rather than do themselves. Even 89% of individuals from this age group agree strongly agree with this idea.

Looking at older recipients' group, 31-40 years old, more scepticism is noticeable –26% agree with the question statement and 50% are neutral. One of assumptions for such result is general uncertainty of how artificial intelligence works and how it could be applied in business solutions.

In age groups 41-60 years old, majority of individuals are on the negative feeling side about AI replacing humans – 53%-60% state that they view it negatively and 20%-26% are positive. This indicates that middle age and older people are even more uncertain about what artificial intelligence can do in business. There are many assumptions to why they feel that way, for instance, lack of technological knowledge, mistrust of technology and simply old habbits, which they would need to change.

Figure 12. "I am positive about the idea that AI could replace humans in accounting functions – split by age" (prepared by author)



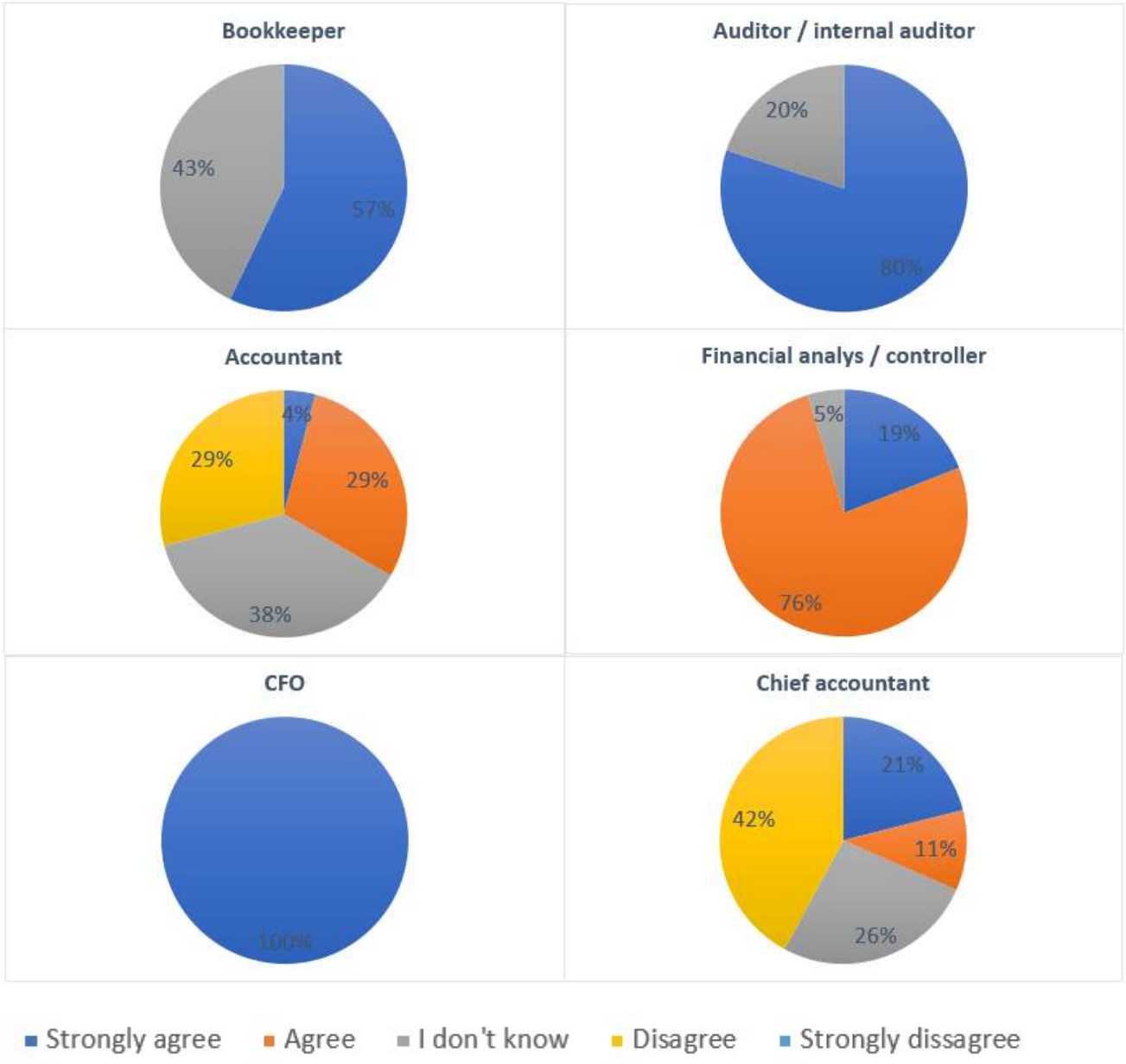
Looking at the positivity split by position in the company, most positive are bookkeepers (57%), auditors (80%), financial analysts / controllers (76%) and CFOs (100%). It perfectly correlates with above split by age groups, as those positions are usually taken by younger employees, or in CFOs case – those that are always seeking efficiency and innovation in their companies.

On the other hand, most negative for AI replacement of humans, are chief accountants (42%). Assumption was raised, that people working in this position are not so open for changes and not that willing to employ new unknown technologies.

Most uncertainty are between respondents working as bookeepers (43%), accountants (38%) and chief accountants (26%), who answered that they feel neutral about this potential change.

The results show that most open and positive view is found among those, whose role is not probably going to change due to AI, or as in bookkeepers' case, will change the most. This can be explained by the fact, that CFOs and analysts are working towards better work quality and efficiency, and they constantly look for ways to save money for the company and spend more effort on those tasks that really matter. Bookeepers are so positive because they are usually young and just starting their careers individuals, who do basic accounting tasks, which are often boring and routine, so it would be great opportunity for them to change the course of career by becoming more like data managers.

Figure 13. “I am positive about the idea that AI could replace humans in accounting functions – split by position” (prepared by author)



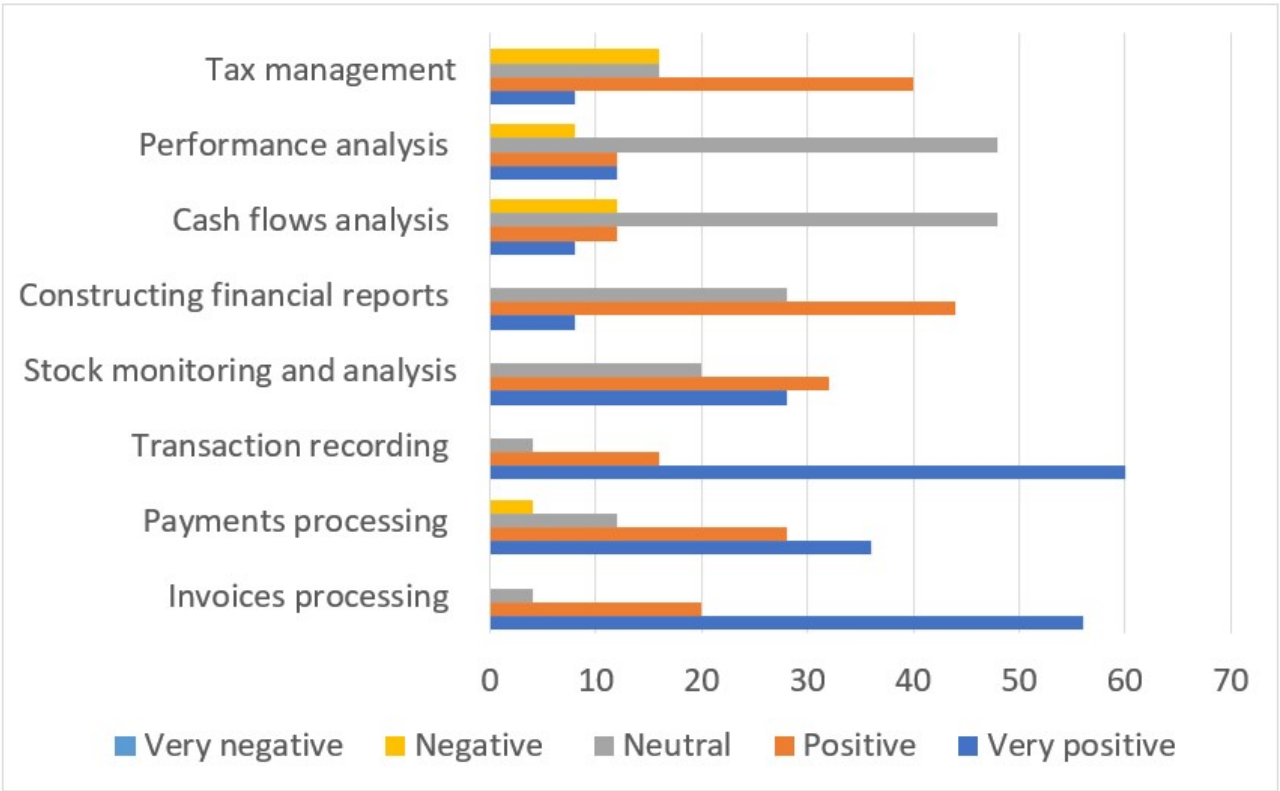
However, some negativity amongh acountants – 42% of chief accountants and 29% of accountants do not feel positive about the idea that AI could replace humans in some accounting tasks. One assumption for such outcome is that these participants feel insecure about their role and the need to adapt themselves. Such feeling could be changed with required additional training and knowledge improvements.

The final approach in testing H4 hypothesis was to understand how would accounting and finance professionals feel if certain accounting functions which are commonly done mannualy, would be replaced by automated robotic processes (also known as artificial intelligence). Please see results in the table and figure below.

Table 12. How do you feel with AI replacing humans in listed areas of accounting? (prepared by author)

		Very positive	Positive	Neutral	Negative	Very negative
Invoices processing	No.	56	20	4	0	0
	%	70%	25%	5%	0%	0%
Payments processing	No.	36	28	12	4	0
	%	45%	35%	15%	5%	0%
Transaction recording	No.	60	16	4	0	0
	%	75%	20%	5%	0%	0%
Stock monitoring and analysis	No.	28	32	20	0	0
	%	35%	40%	25%	0%	0%
Constructing financial reports	No.	8	44	28	0	0
	%	10%	55%	35%	0%	0%
Cash flows analysis	No.	8	12	48	12	0
	%	10%	15%	60%	15%	0%
Performance analysis	No.	12	12	48	8	0
	%	15%	15%	60%	10%	0%
Tax management	No.	8	40	16	16	0
	%	10%	50%	20%	20%	0%

Figure 14. How do you feel with AI replacing humans in listed areas of accounting? (prepared by author)



Visuals above show, that respondents very positively view the idea that artificial intelligence would replace humans in transaction recording (75%) and invoices processing (70%) tasks. Also, financial reporting (55%), tax management (50%) and payments processing (35%) tasks takeover is greeted positively. All in all, most respondents answered positively to idea that artificial intelligence would

replace them in very basic and simple tasks. These results show, that when asked generally, some individuals are hesitant to be positive about such transformations. But when asked about certain tasks, they would be happy to give them away. This trend also proves the point, that accounting professionals still lack knowledge about artificial intelligence and how it could help them. With sufficient knowledge, probably their approval rate would increase.

It is also worth mentioning that tasks which require more intellectual efforts, such as cash flows or performance analysis get much lower positivity ratings. This outcome was expected after literature and previous research analysis, as so far artificial intelligence is not as advanced to take over the complex thinking and decision-making part of work.

To conclude, the research on accounting professionals' perception and willingness to accept changes and use AI in their work, was conducted. Results found that accounting and finance professionals tend to be more hesitant and reluctant to approve innovations when they do not know how they will impact their work. However, when given some information, they tend to be more open and positive about artificial intelligence. Therefore, this research confirms the H3 hypothesis, as great majority I positive about and open to AI use in their field, especially in certain non-complex and technical tasks.

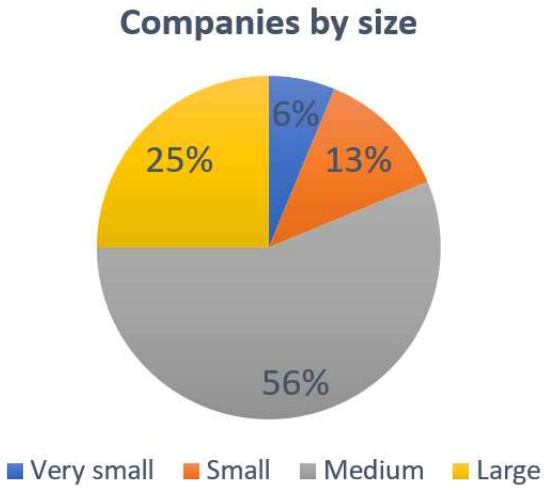
Testing H4 - top level executives are positive about and open to investing in technological innovation and artificial intelligence integration in their businesses. Last hypothesis in this thesis was tested with different respondents than three previous – here questionnaire targeted only top-level managers (CEO, CFO, CIO, department directors, other). To begin with, at first it is important to analyze what size and industry companies are represented by this survey respondents, as well as technology use in those companies. Same criteria were applied as in the first questionnaire.

As it is seen from the table below, majority of respondents work in medium sized (56%) or large (25%) companies.

Table 13. Analysis of the companies, that respondents work in (prepared by author).

	Very small	Small	Medium	Large
Accommodation and Food Service Activities			1	
Wholesale and Retail		1	1	1
Electricity, Gas, Steam and Air Conditioning Supply			1	
Health Care and Social Work			1	
Information and Communication		1	1	
Manufacturing				1
Professional, Scientific and Technical Activities	1		1	
Real Estate Activities				1
Construction			1	1
Technological Solutins and Services			1	
Transport and Storage			1	

Figure 15. Analysis of the companies, that respondents work in (prepared by author).



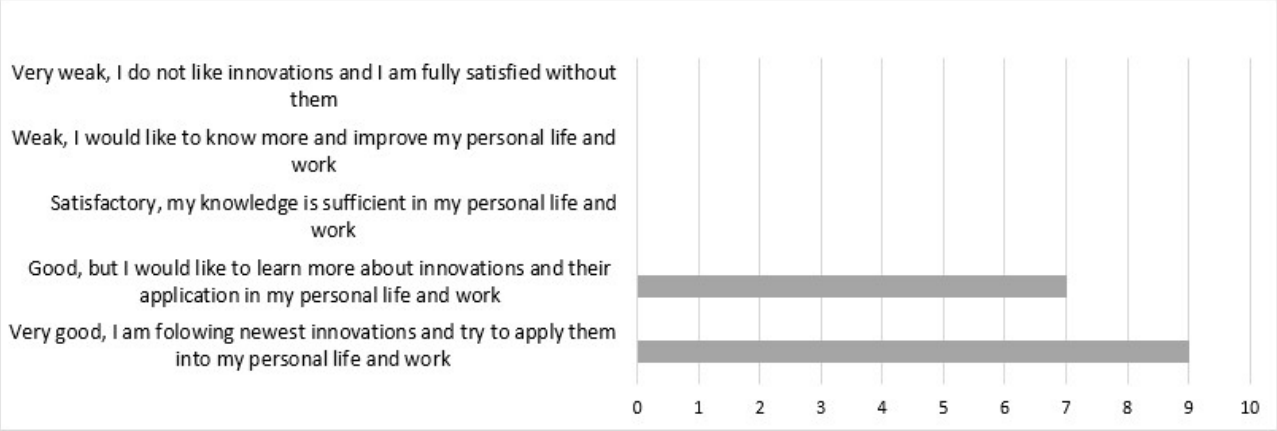
As it is seen in the table No. 12 below, majority of managers (9 of 16) answered, that their company is constantly investing in new technology to improve efficiency. Others mainly keep the level of technology use at the level which is enough to fullfill main needs. However, 3 out of 16 respondents stated that they lack innovation and would be willing to invest more.

Table 14. Technology use in the companies where respondends work (prepared by author)

	Very small	Small	Medium	Large
Yes, my company is very much up to date with new technologies and constantly invests in innovations that help improve efficiency		1	5	3
Yes, technologies in my company are fully sufficient in order to complete operations		1	2	1
Yes, however, the need for innovations is significant	1		2	

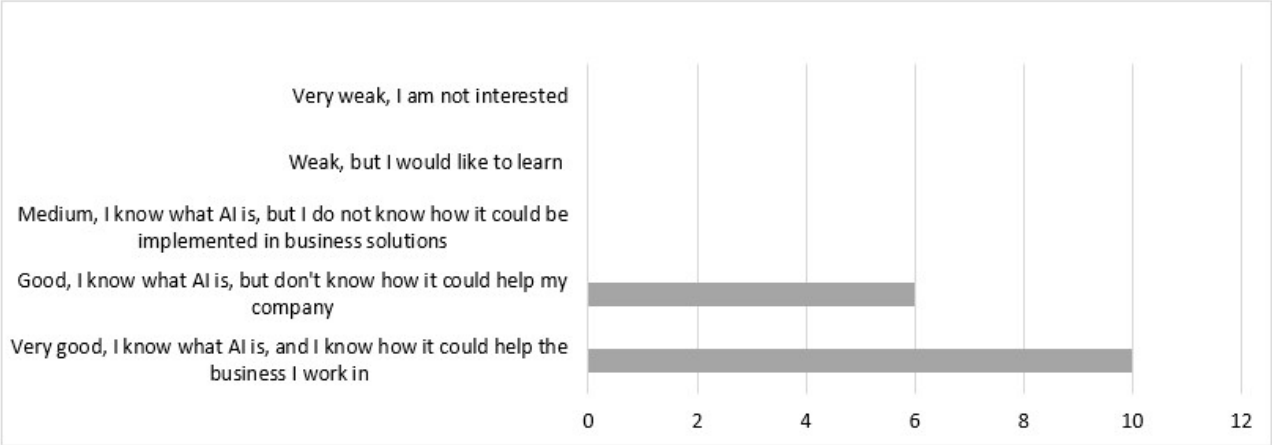
Following, managers were asked to evaluate their personal technological knowledge and whether they are familiar with artificial intelligence.

Figure 16. How do you evaluate your IT and technological knowledge? (prepared by author)



Results show that absolute majority of managers evaluate their IT knowledge very good or good, but with space to learn. The results that people in top management positions tend to be more receptive on innovations and they easily adopt them.

Figure 17. How do you evaluate your knowledge about artificial intelligence (AI) and how it could improve your company? (prepared by author)

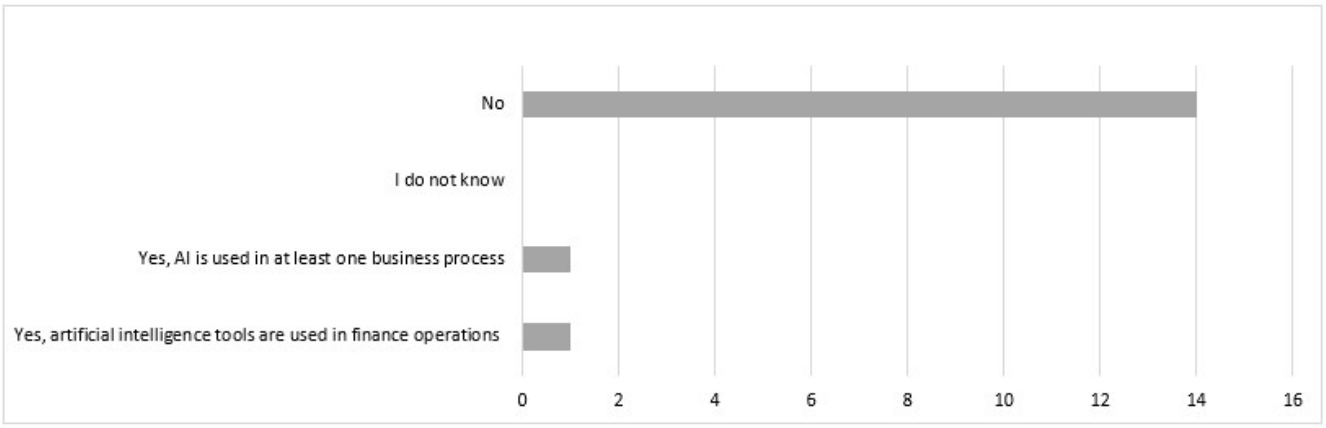


Results on artificial intelligence knowledge are also satisfactory, as all respondents answered to have good or very good knowledge of how AI could help their businesses.

All in all, the two figures above show very good technological advancement of the respondents, which is what was expected to conduct this research.

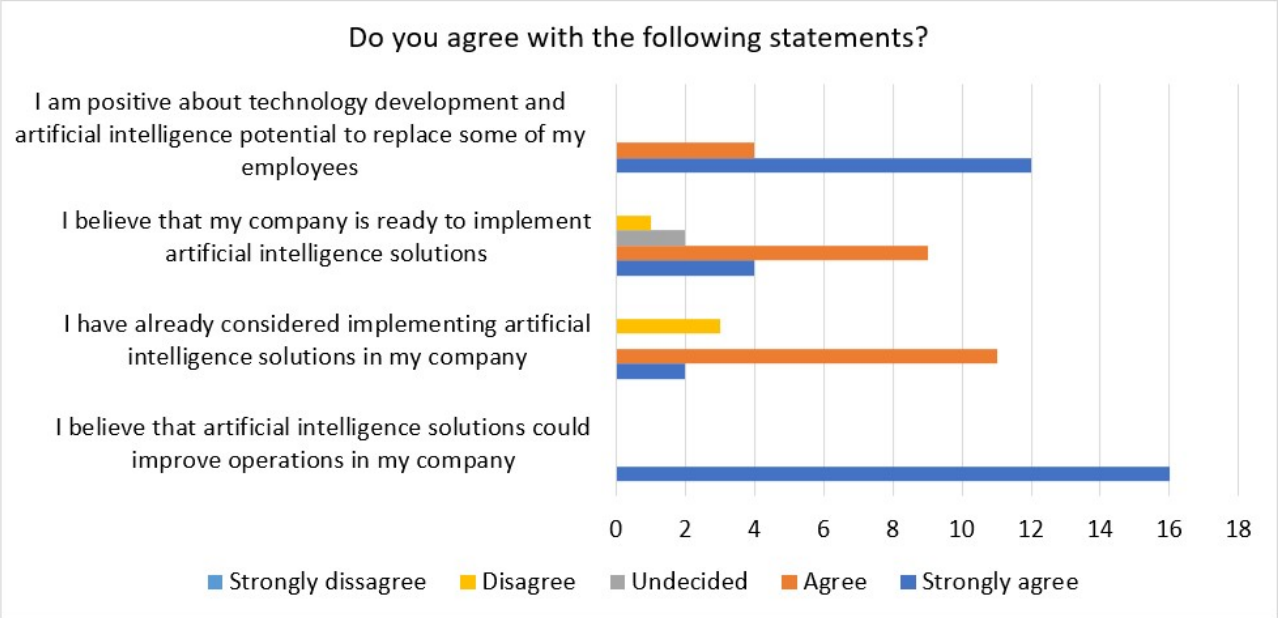
Nevertheless, even though knowledge is strong, very small number of companies already use AI. This is also proved by the results of questions, whether respondents' companies use such technology. Almost all – 14 out of 16 – managers responded as "No". On the other hand, good news is that some companies are trying – one company is already using, or testing AI in finance operations (operating in wholesale and retail market), and one in other business processes (operating in technological solutins and services business).

Figure 18. Does your company use any artificial intelligence tools? (prepared by author)



Having understood respondents' technical knowledge and advancement, questionnaire focused on the main important question of the hypothesis, whether executives are positive and open to artificial intelligence employment in their business. Results are provided in the chart below.

Figure 19. Top level executives view on artificial intelligence solutions in their companies (prepared by author)



The results of questionnaire provided clear view, that executives are very positive about what artificial intelligence can bring to business. All executives agree or strongly agree that they are positive towards technology development and AI solutions which can improve their operations. What is more, they all believe that AI can replace some of their employees. These results are important for the future development of RPA and AI, because it is the managers who make decisions. Their positivity shows willingness to move together with development and invest in better solutions. Another strongly positive sign towards technological improvements in companies is that majority of executives (13 out of 16) stated that their company is already considering AI tools implementation. What is more, most respondents believe that their company is already prepared to move towars this next step.

To conclude, research on H4 hypothesis was conducted. Research found that top level executives mostly have strong technological knowledge and are well familiar with artificial intelligence. Their answers to a survey showed strong positivity towards this technological development and willingness to take on such investments. With that, H4 is also confirmed.

4.3. Review of research results

The aim of this research was to analyze how accounting profession is changing due to artificial intelligence and how accounting professionals perceive the need to change themselves beginning with the entry-level professionals, to experienced ones.

Firstly, thorough analysis of literature and previous research was performed. This analyis helped understand current technological development and especially, artificial intelligence development, in businesses and in general world. After conducting literature analysis, it was seen, that there still are unanswered questions in this topic, especially there is lack of studies done on current situation in businesses and accounting professionals' perception of AI and readiness to adopt it in their work.

Therefore, according to research aim, four hypotheses were raised. Those hypotheses then were tested, using survey questionnaire method by collecting answers from total 116 participants – finance and accounting professionals, as well a top-level executives. Therefore, two different surveys were prepared, targeting both groups of respondents.

The research answered main questions raised which helped test hypotheses.

H1 – accounting professionals must improve their technological and IT knowledge in order to stay competitive in labour market. This hypothesis was confirmed when research found that majority of respondents agree to the idea, that they must improve their IT and technological skills. Many of participants indicated, that their knowledge is well, however they would need to improve it. In addition, survey showed, that currently only small part of accounting professionals invest time into additional learning, related to IT.

H2 – accounting specialists are aware about the transformation of their profession and are prepared to adapt. This hypothesis was confirmed as research found that majority of respondents are aware of term artificial intelligence and its impact on accounting profession transformation. In addition, most of them recognize a risk for their job to be taken over by AI – mostly accountants – however, are prepared to adapt and learn how to use AI in work.

H3 – accounting and finance professionals are positive about and open to using artificial intelligence in their work. This hypothesis was conluded as confirmed. The research found, that 57% of repondents are positive about the changes with AI. Also, great part was indecisive – 19% - due to lack of knowledge how this could change their career.

H4 – top-level executives are positive about and open to investing in technological innovation and artificial intelligence integration in their businesses. This hypothesis was confirmed, as research found that top-level executives are passionate about technology and are very positive towards innovation and AI use in their companies.

Conclusions and recommendations

1. Firstly, current perception of the AI impact on transformation of accounting profession and related issues was analyzed. The research of literature provided a broad review of what AI and RPA are, also helped understand how these technologies could be incorporated in businesses. The most commonly discussed transformation of accounting profession is that accounting professionals need to adapt to technological developments, as technologies are cahnging rapidly. The primary research found that currently there is lack of studies done on current situation in businesses and whether accounting professionals are prepared to change. Therefore, this study was focused on that.

2. Secondly, analysis was conducted of previous studies on AI impact on accounting profession and general AI application topics. The analysis found that there are many various studies done on how artificial intelligence is impacting the world and various professions and that great part of authors agree on few common conclusions:

    - There are many benefits of AI implementation in business processes
    - Artificial intelligence is not a new thing, but together with the improvement of all technologies, AI is getting more and more recognized and applied
    - AI is also affecting accounting profession significantly
    - Accounting profession is changing rapidly, and accounting professionals must gain new skills and adapt to remain competitive
    - There are also some disadvantages of AI, such as high cost, small and lengthy return on investment, people losing jobs to machines

3. After thorough literature and previous studies analysis it was found, that there is lack of studies done on current situation in businesses and accounting professionals' perception of AI and readiness to adopt it in their work. Therefore, according to research aim, four hypotheses were raised to be tested. Testing method was chosed as a survey questionnaire, and data was collected from accounting professionals and top-level executives, working in Lithuanian and international companies.

4. The research was conducted and helped confirm all four of the raised hypotheses:

- **H1** – accounting professionals must improve their technological and IT knowledge in order to stay competitive in labour market
- **H2** – accounting specialists are aware about the transformation of their profession and are prepared to adapt
- **H3** – accounting and finance professionals are positive about and open to using artificial intelligence in their work
- **H4** – top level executives are positive about and open to investing in technological innovation and artificial intelligence integration in their businesses

This research is a great supplement to research done previously by other authors. As mentioned before, what is different about the research conducted in this thesis, is that most authors focus on the changes that artificial intelligence and technology development are bringing to accounting profession, however, very few analyze the perception from professionals themselves. So, what was found new in this research, is that accounting professionals do see a need to improve their skills and knowledge. They also are mostly willing to adopt new technologies and transform together with the profession.

Recommendations for future research

- For future research it is recommended to conduct more broader survey, as in this thesis data was not sufficient to provide reliably representative results
- For future research it is recommended to focus not only on answers provided by respondents, but conduct also focus groups or interviews to understand reasons for their answers. As it is seen in the research, there was left a lot of assumption as to why respondends feel positive or negative about tehnology development and artificial intelligence impact on accounting profession.

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Appendices

Annex. No. 1. Following are provided the two questionnaires constructed specially for this research. The first questionnaire targets accounting and finance professionals, while second one targets executives.

Dirbtinio intelekto įtaka apskaitos profesijai

1. 1. Kiek jums metų?

   Pažymėkite tik vieną ovalą.

   - 20-30 metų
   - 31-40 metų
   - 41-50 metų
   - 51-60 metų
   - 61 metai ir daugiau

2. 2. Koks jūsų darbo apskaitos / finansų srityje stažas?

   Pažymėkite tik vieną ovalą.

   - Mažiau nei 1 metai
   - 1-3 metai
   - 4-6 metai
   - 7-10 metų
   - 11-15 metų
   - 16-20 metų
   - 21 metai ir daugiau

3. 3. Kokios jūsų pareigos dabartinėje darbovietėje?

Pažymėkite tik vieną ovalą.

- ◯ Apskaitininkas (-ė)
- ◯ Buhalteris (-ė)
- ◯ Vyr. buhalteris (-ė)
- ◯ Finansų analitikas (-ė) / kontrolierius (-ė)
- ◯ Auditorius (-ė) / vidaus auditorius (-ė)
- ◯ Finansų vadovas (-ė)
- ◯ Kita: _____

4. 4. Kiek laiko veikia įmonė, kurioje dabar dirbate?

Pažymėkite tik vieną ovalą.

- ◯ Mažiau nei 5 metus
- ◯ 6-10 metų
- ◯ 11-15 metų
- ◯ 16 metų ir daugiau

5. 5. Kokio dydžio yra įmonė, kurioje dabar dirbate? (pasirenkant dydį, turi atitikti ne mažiau kaip du kriterijai paskutinę finansinių metų dieną)

Pažymėkite tik vieną ovalą.

- ◯ Labai maža (turto balansinė vertė iki 350 000 Eur; metinės pardavimo pajamos iki 700 000 Eur; vidutinis metinis darbuotojų skaičius iki 10)
- ◯ Maža (turto balansinė vertė iki 4 000 000 Eur; metinės pardavimo pajamos iki 8 000 000 Eur; vidutinis metinis darbuotojų skaičius iki 50)
- ◯ Vidutinė (turto balansinė vertė iki 20 000 000 Eur; metinės pardavimo pajamos iki 40 000 000 Eur; vidutinis metinis darbuotojų skaičius iki 250)
- ◯ Didelė (turto balansinė vertė daugiau nei 20 000 000 Eur; metinės pardavimo pajamos daugiau nei 40 000 000 Eur; vidutinis metinis darbuotojų skaičius daugiau nei 250)

6. 6. Kokia veikla užsiima įmonė, kurioje dirbate?

Pažymėkite tik vieną ovalą.

- ◯ Apgyvendinimo ir maitinimo paslaugos
- ◯ Administracinė ir aptarnavimo veikla
- ◯ Žemės ūkis, miškininkystė ir žuvininkystė
- ◯ Meninė, pramoginė ir poilsio organizavimo veikla
- ◯ Statybos
- ◯ Švietimas
- ◯ Elektros, dujų, garo tiekimas ir oro kondicionavimas
- ◯ Finansinių paslaugų ir draudimo veikla
- ◯ Sveikatos priežiūra ir socialinis darbas
- ◯ Informacija ir ryšiai
- ◯ Apdirbamoji gamyba
- ◯ Kasyba ir karjerų eksploatavimas
- ◯ Profesinė, mokslinė ir techninė veikla
- ◯ Viešasis valdymas ir gynyba; Privalomasis socialinis draudimas
- ◯ Nekilnojamojo turto veikla
- ◯ Transportas ir saugojimas
- ◯ Vandens tiekimas, nuotekų valymas, atliekų tvarkymas ir regeneravimas
- ◯ Didmeninė ir mažmeninė prekyba
- ◯ Kita: _____

7. 7. Ar naudojate naująsias technologijas savo darbe?

Pažymėkite tik vieną ovalą.

- ◯ Taip, įmonė, kurioje dirbu, aktyviai seka naujųjų technologijų raidą ir investuoja į inovacijas
- ◯ Taip, įmonė turi visas technologijas, reikalingas atlikti mano užduotims
- ◯ Taip, bet poreikis joms yra didesnis
- ◯ Ne, bet yra poreikis
- ◯ Ne, nėra poreikio

8. 8. Kokias naująsias technologijas naudojate?

Kiekvienoje eilutėje pažymėkite tik vieną ovalą.

	Naudoju ne tik darbui	Naudoju tik darbui	Naudoju tik asmeninėms reikmėms	Nenaudoju, bet turiu poreikį	Kol kas nenaudoju, nes nejaučiu poreikio	Nenaudoju, nes to neįmanoma pritaikyti darbe	n a tec
Apskaitos programa							
Verslo valdymo sistema							
Išmanūs mobilieji įrenginiai							
Didieji duomenys (Big Data)							
Debesis (Cloud)							
Dirbtinis intelektas							
Kibernetinė sauga							
Elektroninio mokymosi sistemos							
Elektroninės parduotuvės							
Elektroninė bankininkystė ir mobiliosios mokėjimų aplikacijos							
Internetinių komunikacijų programos (Teams, Facebook,							

Zoom,
Whatsapp,
kt.)

9. 9. Kokius įžvelgiate naujųjų technologijų privalumus darbe?

Pažymėkite viską, kas tinka.

- [ ] Efektyvumas
- [ ] Geresnis darbo-laisvalaikio balansas
- [ ] Patogesnė ir paprastesnė komunikacija su bendradarbiais ir klientais
- [ ] Mažesnė klaidų tikimybė
- [ ] Geresnė darbo kokybė
- [ ] Nematau jokių privalumų
- [ ] Kita: _____

10. 10. Kaip vertintumėte savo IT ir naujųjų technologijų žinias?

Pažymėkite tik vieną ovalą.

- ◯ Labai gerai, seku naujausias inovacijas ir stengiuosi jas pritaikyti drabe bei gyvenime
- ◯ Gerai, bet norėčiau žinoti daugiau
- ◯ Patenkinamai, man šių žinių užtenka darbui ir asmeniniam gyvenimui
- ◯ Silpnai
- ◯ Labai silpnai, bet esu pilnai patenkintas (-a) ir nenoriu žinoti daugiau

11. 11. Kokiose srityse tobulinote savo įgūdžius per pastaruosius 12 mėnesių? (galite pasirinkti kelis)

Pažymėkite viską, kas tinka.

- [ ] Profesiniai įgūdžiai, tiesiogiai susiję su darbu
- [ ] "Minkštieji" įgūdžiai (soft skills)
- [ ] Vadovavimo ir verslo valdymo įgūdžiai
- [ ] IT įgūdžiai
- [ ] Santykių su klientais įgūdžiai
- [ ] Nauja kalba
- [ ] Netobulinau jokių įgūdžių
- [ ] Kita: _____

12. 12. Ar žinote, kas yra dirbtinis intelektas ir kaip jis galėtų pakeisti buhalterio profesiją?

Pažymėkite tik vieną ovalą.

- ◯ Taip, žinau, kas tai yra ir manau, kad dirbtinis intelektas gali reikšmingai pakeisti buhalterio profesiją
- ◯ Taip, žinau, kas tai yra, bet norėčiau žinoti daugiau apie jo pritaikymo galimybes
- ◯ Žinau tik apibrėžimą, bet norėčiau sužinoti daugiau
- ◯ Nežinau, bet norėčiau sužinoti
- ◯ Nežinau ir man neįdomu

13. 13. Ar įmonė, kurioje dirbate, naudoja dirbtinį intelektą?

Pažymėkite viską, kas tinka.

- [ ] Taip, dirbtinis intelektas naudojamas finansų skyriuje
- [ ] Taip, dirbtinis intelektas yra naudojamas bent viename verslo procese
- [ ] Ne, bet yra poreikis
- [ ] Ne, nėra poreikio
- [ ] Nežinau

14. 14. Ar sutinkate su žemiau pateiktais teiginiais?

Kiekvienoje eilutėje pažymėkite tik vieną ovalą.

	Visiškai sutinku	Sutinku	Nežinau	Nesutinku	Visiškai nesutinku
Apskaitos ir finansų profesija ateityje reikšmingai pasikeis dėl technologijų raidos ir dirbtinio intelekto					
Dirbtinis intelektas galėtų pakeisti žmones įvairiose buhalterijos užduotyse					
Jaučiuosi pozityviai dėl dirbtinio intelekto potencialo pakeisti žmones įvairiose buhalterijos užduotyse					
Įžvelgiu riziką, kad mano darbo vieta vieną dieną gali būti užimta dirbtinio intelekto					
Apskaitos ir finansų srities atstovai turi prisitaikyti prie naujųjų technologijų raidos					
Apskaitos ir finansų srities atstovai turi tobulinti savo IT žinias bei įgūdžius, kad išliktų konkurencingi darbo rinkoje					
Apskaitos ir finansų studijų programos turėtų būti papildytos IT kursais					
Esu pasiruošęs įgyti naujų įgūdžių, kad prisitaikyčiau prie technologijų raidos					
Esu pasiruošęs naudoti dirbtinį intelektą savo darbe					

15. 15. Kaip jaustumėtės, jei dirbtinis intelektas pakeistų žmones žemiau išvardintose buhalterijos srityse?

Kiekvienoje eilutėje pažymėkite tik vieną ovalą.

	Labai pozityviai	Pozityviai	Neutraliai	Negatyviai	Labai negatyviai
Sąskaitų apdorojimas	◯	◯	◯	◯	◯
Mokėjimų vykdymas ir apdorojimas	◯	◯	◯	◯	◯
Transakcijų registravimas	◯	◯	◯	◯	◯
Atsargų valdymas	◯	◯	◯	◯	◯
Ataskaitų rengimas	◯	◯	◯	◯	◯
Pinigų srautų analizė	◯	◯	◯	◯	◯
Veiklos rezultatų analizė	◯	◯	◯	◯	◯
Mokesčių apskaita	◯	◯	◯	◯	◯

16. 16. Kurias roles, jūsų nuomone, galėtų pakeisti dirbtinis intelektas?

Pažymėkite viską, kas tinka.

- ☐ Apskaitininkas (-ė)
- ☐ Biuro administratorius (-ė)
- ☐ Buhalteris (-ė)
- ☐ Personalo skyriaus asistentas (-ė)
- ☐ Vyr. buhalteris (-ė)
- ☐ Finansų analitikas (-ė) / kontrolierius (-ė)
- ☐ Auditorius (-ė) / vidaus auditorius (-ė)
- ☐ Finansų vadovas (-ė)
- ☐ Nemanau, kad dirbtinis intelektas galėtų pakeisti žmogaus darbą
- ☐ Kita: _____

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Dirbtinio intelekto įtaka verslui

1. 1. Kiek jums metų?

   Pažymėkite tik vieną ovalą.

   - 20-30 metų
   - 31-40 metų
   - 41-50 metų
   - 51-60 metų
   - 61 metai ir daugiau

2. 2. Koks jūsų vadovavimo darbo stažas?

   Pažymėkite tik vieną ovalą.

   - Mažiau nei 1 metai
   - 1-3 metai
   - 4-6 metai
   - 7-10 metų
   - 11-15 metų
   - 16-20 metų
   - 21 metai ir daugiau

3. 3. Kokios jūsų pareigos dabartinėje darbovietėje?

   Pažymėkite tik vieną ovalą.

   - Generalinis direktorius
   - Finansų vadovas
   - Veiklos padalinio vadovas
   - IT vadovas
   - Kita: _____

4. 4. Kiek laiko veikia įmonė, kurioje dabar dirbate?

Pažymėkite tik vieną ovalą.

- Mažiau nei 5 metus
- 6-10 metų
- 11-15 metų
- 16 metų ir daugiau

5. 5. Kokio dydžio yra įmonė, kurioje dabar dirbate? (pasirenkant dydį, turi atitikti ne mažiau kaip du kriterijai paskutinę finansinių metų dieną)

Pažymėkite tik vieną ovalą.

- Labai maža (turto balansinė vertė iki 350 000 Eur; metinės pardavimo pajamos iki 700 000 Eur; vidutinis metinis darbuotojų skaičius iki 10)
- Maža (turto balansinė vertė iki 4 000 000 Eur; metinės pardavimo pajamos iki 8 000 000 Eur; vidutinis metinis darbuotojų skaičius iki 50)
- Vidutinė (turto balansinė vertė iki 20 000 000 Eur; metinės pardavimo pajamos iki 40 000 000 Eur; vidutinis metinis darbuotojų skaičius iki 250)
- Didelė (turto balansinė vertė daugiau nei 20 000 000 Eur; metinės pardavimo pajamos daugiau nei 40 000 000 Eur; vidutinis metinis darbuotojų skaičius daugiau nei 250)

6. 6. Kokia veikla užsiima įmonė, kurioje dirbate?

Pažymėkite tik vieną ovalą.

- Apgyvendinimo ir maitinimo paslaugos
- Administracinė ir aptarnavimo veikla
- Žemės ūkis, miškininkystė ir žuvininkystė
- Meninė, pramoginė ir poilsio organizavimo veikla
- Statybos
- Švietimas
- Elektros, dujų, garo tiekimas ir oro kondicionavimas
- Finansinė ir draudimo veikla
- Sveikatos priežiūra ir socialinis darbas
- Informacija ir ryšiai
- Apdirbamoji gamyba
- Kasyba ir karjerų eksploatavimas
- Profesinė, mokslinė ir techninė veikla
- Viešasis valdymas ir gynyba; Privalomasis socialinis draudimas
- Nekilnojamojo turto veikla
- Transportas ir saugojimas
- Vandens tiekimas, nuotekų valymas, atliekų tvarkymas ir regeneravimas
- Didmeninė ir mažmeninė prekyba
- Kita: _____

7. 7. Ar naudojate naująsias technologijas savo darbe?

Pažymėkite tik vieną ovalą.

- Taip, įmonė, kurioje dirbu, aktyviai seka naujųjų technologijų raidą ir investuoja į inovacijas
- Taip, įmonė turi visas technologijas, reikalingas atlikti mano užduotims
- Taip, bet poreikis joms yra didesnis
- Ne, įmonė neturi galimybių jų įsigyti
- Ne, nėra poreikio

8. 8. Kaip vertintumėte savo IT ir naujųjų technologijų žinias?

Pažymėkite tik vieną ovalą.

- Labai gerai, seku naujausias inovacijas ir stengiuosi jas pritaikyti drabe bei gyvenime
- Gerai, bet norėčiau žinoti daugiau
- Patenkinamai, man šių žinių užtenka darbui ir asmeniniam gyvenimui
- Silpnai
- Labai silpnai, bet esu pilnai patenkintas (-a) ir nenoriu žinoti daugiau

9. 9. Ar žinote, kas yra dirbtinis intelektas ir kaip jis galėtų pakeisti buhalterio profesiją?

Pažymėkite tik vieną ovalą.

- Taip, žinau, kas tai yra ir manau, kad dirbtinis intelektas gali būti naudingas įmonėje, kurioje dirbu
- Taip, žinau, kas tai yra, bet norėčiau žinoti daugiau apie jo pritaikymo galimybes
- Žinau tik apibrėžimą, bet norėčiau sužinoti daugiau
- Nežinau, bet norėčiau sužinoti
- Nežinau ir man neįdomu

10. 10. Ar įmonė, kurioje dirbate, naudoja dirbtinį intelektą?

Pažymėkite viską, kas tinka.

- [ ] Taip, dirbtinis intelektas naudojamas finansų skyriuje
- [ ] Taip, dirbtinis intelektas yra naudojamas bent viename verslo procese
- [ ] Nežinau
- [ ] Ne

11. 11. Ar sutinkate su žemiau išvardytais teiginiais?

Kiekvienoje eilutėje pažymėkite tik vieną ovalą.

	Visiškai sutinku	Sutinku	Nežinau	Nesutinku	Visiškai nesutinku
Tikiu, kad dirbtinis intelektas gali prisidėti prie įmonės, kurioje dirbu, procesų tobulinimo	◯	◯	◯	◯	◯
Įmonė, kurioje dirbu, jau svarsto dirbtinio intelekto panaudojimo galimybes	◯	◯	◯	◯	◯
Tikiu, kad įmonė, kurioje dirbu, jau yra pasirengusi ir galėtų pritaikyti dirbtinį intelektą savo veiklos procesuose (pvz. apskaitoje, operacijose, vadyboje)	◯	◯	◯	◯	◯
Pozityviai žiūriu į technologijų raidą ir dirbtinio intelekto potencialą pakeisti kai kuriuos darbuotojus	◯	◯	◯	◯	◯

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