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Interdisciplinarity Counts

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Interdisciplinarnost šteje

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What do Owners of SMEs Think about Big Data Analytics and Artificial Intelligence Technologies in Their Operations? Evidence from North Macedonia

Mimoza Arifi, Violeta Cvetkoska, Dimitar Jovevski

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Abstract Small and medium-sized businesses can use big data analytics and artificial intelligence algorithms to fully realize the potential of big data, giving them a competitive edge. The discovered information from big data can serve as a recommendation for making better and faster decisions and creating values for those enterprises, such as higher profit, efficiency, productivity, customer, and employee satisfaction, etc. The aim of this paper is to investigate what owners of SMEs in a developing country consider about big data analytics and artificial intelligence (AI) in their operations. The data is collected for the first time by using a semi-structured questionnaire distributed by email. For descriptive analytics, we use Power BI software, and we develop a logistic regression model to find the key influencers of AI and big data automated features that completely affect staffing levels. The obtained results are visualized and analyzed. The findings are beneficial for SMEs to invest in those technologies and in the staff's skills in these areas, as well as for the nation's economic policymakers to support and boost the use of those technologies by small and medium-sized businesses.

Keywords: big data analytics, artificial intelligence, financial performance, small and medium-sized enterprises

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1 Introduction

The wave of new technologies opens opportunities for small and medium enterprises to take steps towards greater flexibility, sustainability, and productivity. Industry 4.0 is also facilitating new ways for humans and machines to work together, empowering businesses to reduce risk and make better decisions (AMFG, 2019). With the development of the digital economy and the current COVID-19 pandemic crisis, the future of the global economy will have everything to do with digitalization. Cutting-edge technologies such as blockchain, the internet of things (IoT), 5G, cloud computing, robotics, big data analytics, and artificial intelligence (AI), along with the emergence of new digitalized business models, will drastically change the global economy. SMEs are a cornerstone of economic development in the world (Abanmai, 2020). As digital technology becomes more central to every aspect of people's lives, they should be able to trust it. Trustworthiness is also a prerequisite for its uptake. This is a chance for Europe, given its strong attachment to values and the rule of law as well as its proven capacity to build safe, reliable, and sophisticated products and services from aeronautics to energy, automotive, and medical equipment (European Commission, 2020). SMEs' digitalization will not only improve their competitiveness; it will also benefit society as a whole. As the main driver of regional economic growth and innovations, SMEs' digitalization also plays a crucial role in developing a sustainable economy (Abanmai, 2020). We're in the "middle century" of a Fourth Industrial Revolution, and this one goes far beyond manufacturing. Smart and connected new technologies are transforming how parts and products are produced, designed, made, used, and maintained. And by ushering in a digital reality, they are transforming organizations themselves (Cotteleer & Sniderman, 2017). Unsurprisingly, there's a clear correlation between having a Fourth Industrial Revolution and the belief that IoT, AI, cloud computing, and big data analytics will ultimately have a profound impact on the organization (Deloitte, 2020).

Because of a data-oriented and automated workplace, data literacy will be the most in demand skill by 2023 (Most in-demand skill in the future workplace? Data literacy, February 3, 2023). The SMEs in developed countries are implementing emerging technologies such as big data analytics and AI in their operations, but what about the SMEs in developing countries, more precisely in North Macedonia? In the existing literature, we have not found any references that consider what the owners

of SMEs in North Macedonia think about the use of big data analytics and AI in their operations, and we were motivated to conduct such a study. We have created a semi-structured questionnaire that was answered by 30 owners of SMEs in North Macedonia, and we provide interesting findings from the research.

The paper is organized as follows: Section 2 is dedicated to big data analytics, while Section 3 is dedicated to artificial intelligence. The impact of those technologies on SMEs is elaborated in Section 4. The methodology and data used are explained in Section 5. The results are presented and analyzed in Section 6, while Section 7 concludes the paper.

2 Big Data Analytics

Industry 4.0 signifies the promise of a new industrial revolution—one that marries advanced production and operations techniques with smart digital technologies to create a digital enterprise that would not only be interconnected and autonomous but could communicate, analyze, and use data to drive further intelligent action back in the physical world (Cotteleer & Sniderman, 2017). Industry 4.0 is signaling a change in the traditional manufacturing landscape. Industry 4.0 encompasses three technological trends driving this transformation: connectivity, intelligence, and flexible automation of processes (AMFG, 2019). "Big Data" refers to the exponential growth in the amount of data being created in our society (Marr, 2020). This convergence has been made possible thanks to the emergence of digital solutions and new advanced technologies. These include (AMFG, 2019): the industrial internet of things, big data, cloud computing, additive manufacturing (AM), advanced robotics, augmented and virtual reality (AR/VR), artificial intelligence, and robotics.

Big data refers to large and complex sets of data that cannot be collected and stored in traditional databases and cannot be analyzed using traditional methods, techniques, and tools. The characteristics of big data are known as the "7 V's": velocity, volume, variety, veracity, variability, visualization, and value (Cvetkoska, 2022, p. 26). Big data analytics is able to analyze and extract useful insights from vast quantities and varieties of data. Big data analytics are improving and will be more heavily used in Industry 4.0 (Zhang, 2020). These large volumes of data will be

analyzed in correlation with each other in order to identify phases with redundant processes that may be streamlined. According to Gilchrist (2016, p. 208–209), there are six Cs in big data and analytics as part of the Industry 4.0 environment: 1) connection, which pertains to sensors and networks; 2) cloud computing; 3) cyber, which involves models and memory; 4) content/context; 5) community, or sharing and collaboration between and among stakeholders; and 6) customization.

3 Artificial Intelligence

According to Sendler (2018, p. 38), the term "artificial intelligence" has existed since 1956 and predates the first courses of study in information technology. The computer had hardly entered the world stage and become economically applicable when it led to incredible expectations as to what problems it could solve. A few of the first AI experts presumed that, in a short period of time, it would be possible to store the entirety of human knowledge and more on computers. With the latest advancements in artificial intelligence and technology, achieving human-like intelligence is gradually transitioning into the realm of possibility. With disruptors like the COVID-19 pandemic ravaging the global economy, the race to achieve artificial general intelligence may have sped up significantly (Cheishvili, 2021). Artificial intelligence refers to a computer's ability to complete tasks and help undertake "good" decisions that would historically require some level of human intelligence (Epicor, 2021). According to Dang (2020), AI is increasingly becoming a part of social initiatives and every sphere of life. With its focus on solving the world's most complex problems, schools, governments, and businesses are starting to become more receptive towards AI. Artificial intelligence will become a central focus of development for every country. We couldn't overcome the new challenges it will create: cybersecurity risk, data privacy concerns, data misuse, accidental ramifications, etc. Artificial intelligence has already transformed industries across the world, and organizations are racing to understand how to integrate and implement this emerging technology (Reavie, 2018). According to Cheishvili (2021), artificial intelligence can be broadly categorized into three main types: artificial narrow intelligence (ANI), artificial general intelligence (AGI), and artificial superintelligence (ASI). Artificial Intelligence (AI), which counts potential risks or challenges such as security risks, opaque decision-making, gender-based or other kinds of discrimination, intrusion in our private lives, or being used for criminal purposes by

strangers (European Commission, 2020), Adopting AL will alter the competitive landscape of enterprises, creating winners and losers. Companies that will struggle during the AI transition may be forced to reduce their investment in AI, possibly impairing their profitability and potentially threatening their own existence in the market (Policy Making & National AI Strategies, 2019). A certain set of criteria must be fulfilled before implementing AI. The chosen criteria should be ethically sound and should be set up by an end-to-end governance authority for the country. Finally, responsible AI and data policies should be formulated and implemented by governments to ensure their ethical implementation in all initiatives in their respective regions (Dang, 2020). According to the European Commission (2020), artificial intelligence is one of the most important applications of the data economy. Artificial intelligence involves complex programming of products that cannot be explained to ordinary people. Furthermore, the algorithms of most AI-based products or applications are kept secret to avoid security breaches and similar threats. Based on this reason, there is no transparency for the internal algorithms of AI products, and this causes low credibility for customers (Dang, 2020).

3.1 Privacy of AI

The biggest challenge that will arise from Industry 4.0 is the disruption of labor markets through automation and improved robotics and AI technology. Computers and machines (robots) will be able to do more and perform increasingly complicated tasks, which will threaten millions of jobs. Facial recognition algorithms, as part of AI technology, are mostly used across the globe to support the functionality of different applications and products. Products like this are collecting and selling huge amounts of customer data without consent, and no one is accountable for this (Dang, 2020). Citizens fear being powerless to protect their rights and security when faced with the information asymmetries of algorithmic decision-making, but organizations are concerned about legal uncertainty. Furthermore, in addition to a lack of investment and skills, a lack of trustworthiness is a key factor hindering the wider adoption of AI (European Commission, 2020). Data security is always a major concern, and AI algorithms add a new level of complexity to tasks. The more granular the data given to an AI algorithm, the better the algorithm is at customizing a particular user experience. Consumers usually appreciate it when companies can provide a personalized experience appropriate to their needs (Policy Making and

National AI Strategies, 2019). Many functions that were previously only performed by humans can now be performed optimally by artificial intelligence. As a result, citizens and legal entities will increasingly be subject to actions and decisions made by or with the help of AI systems, which can sometimes be difficult to understand and challenge effectively where necessary. Although AI increases the possibilities and opportunities to track and analyze people's daily habits (European Commission, 2020), Tech enterprises are addressing AI and data challenges by creating responsible AI development tools that enable the creation of unbiased AI systems. These toolkits help companies develop AI applications that are transparent, explainable, and can build trust among customers, employees, business leaders, and other stakeholders with whom the company collaborates (Dang, 2020). Artificial intelligence is a strategic technology that offers many benefits and advantages for citizens, companies, and society; it is human-centered, ethical, sustainable, and respects fundamental rights and values (European Commission, 2020).

4 The impact of big data analytics and artificial intelligence on SMEs

SMEs need to rethink and redesign their business strategy with a focus on how to leverage social media, mobile connectivity, data analytics, and cloud computing and implement these elements into their business model. The digital transformation of SMEs must be integrated into all areas of the business to deliver value to customers and businesses (Abanmai, 2020). The digital transformation of SMEs has proven to be vital long before the COVID-19 pandemic, and after it, that importance only strengthened to ensure the viability of SMEs. As technologies evolve, it is a continuous process of challenge, and in order for SMEs to survive, they must integrate this process in order to grow and thrive (Abanmai, 2020).The Corporate Institute (2021) mentions the importance of small and medium-sized enterprises: they favor flexibility and innovation, create a more competitive and healthier economy, and assist big enterprises.

Organizations are trying to "merge-fuse" different technologies to organize the existing physical world differently and are preparing for the interaction between the physical and virtual worlds that this "connection" is promising to bring (Paul, 2018). Unsurprisingly, there's a clear correlation between having Industry 4.0 woven throughout one's strategy and believing that IoT, AI, cloud computing, and big data

analytics will eventually have a profound impact on enterprises. This is unfortunate, because the survey data suggests businesses with comprehensive Industry 4.0 strategies are far more successful across the globe. They're innovating and growing faster, successfully integrating all of the Industry 4.0 technologies, and doing a better job of attracting and training the staff they'll need in the future (Deloitte, 2020, p. 3). Leaders in many organizations lack knowledge on what "digital" means for strategy. They underestimate the degree to which digital technology is disrupting the underpinnings of their companies. They also overlook the speed with which digital ecosystems are blurring economic boundaries and shifting the competitive balance to another level (Catlin et al., 2018). For SMEs, it is not a question of whether they should introduce Industry 4.0 or not, but rather how they can implement it as quickly as possible to maintain or achieve a large competitive advantage all around the globe (Matt & Rauch, 2020).

5 Methodology

The data in the research is collected for the first time in our country by using a semi-structured questionnaire distributed online over the course of one month (from November to December 2022) to 50 randomly selected owners of SMEs. The questionnaire consists of 21 questions. The first part of the survey has general questions about the company and the demographic characteristics of the participants; the second part of the questionnaire was designed to identify how much participants are acquainted with the concept of artificial intelligence and big data, how much they trust those technologies, and how AI and big data will affect staffing levels; and the last, i.e., the third part of the questionnaire, is formed to identify factors and challenges while implementing and using AI and big data analytics and how important they are for SMEs. The questionnaire was completely answered by 30 participants. For descriptive analytics, we use the Power BI software, and we develop a logistic regression model in the same software. The obtained results are visualized and analyzed.

6 Results and Analysis

In our sample of 30 owners of SMEs, 22 are females and 8 are males (Figure 1(a)), while based on the age group, 14 respondents are between 31 and 40 years old, 8 are between 41 and 50 years old, and 7 are up to 30 years old, while only one participant has over 50 years of age (Figure 1(b)).

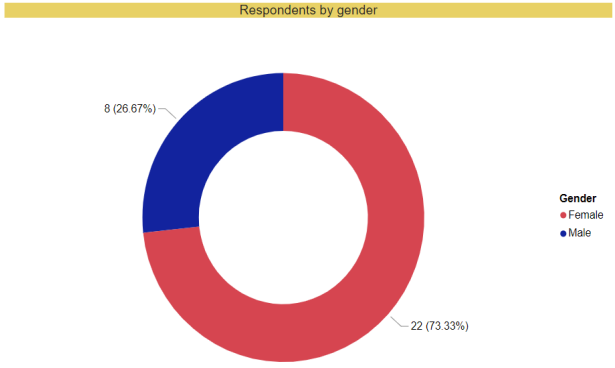

Figure 1(a): Respondents by gender

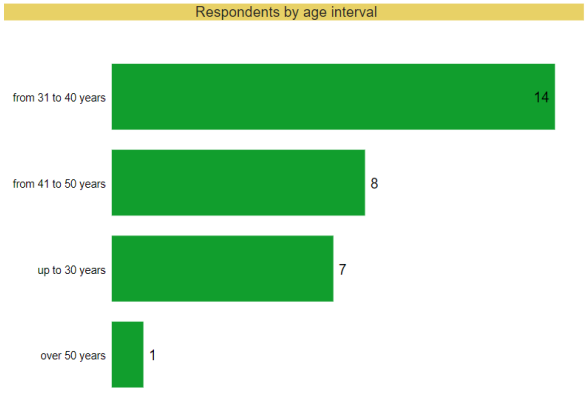

Figure 1(b): Respondents by age interval

Figure 3(a) shows that 18 respondents (60%) have a bachelor's degree, 10 respondents (33.3%) have a master's degree, and 2 respondents (6.67%) have a doctoral degree. Regarding the level of experience, nine respondents are in the group

with five to ten years of experience, seven respondents are in the group with three to five years of experience, etc. (Figure 3(b)).

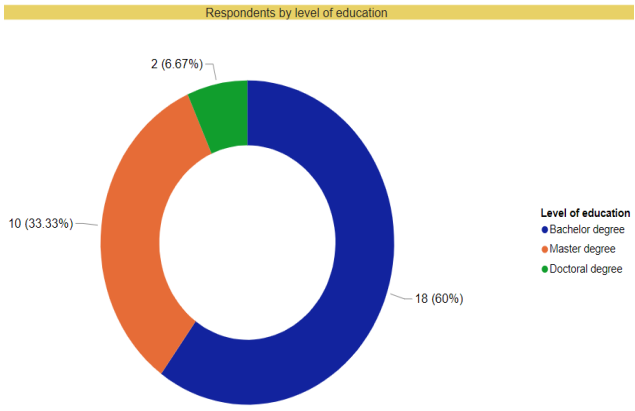

Figure 3(a): Level of education by respondents

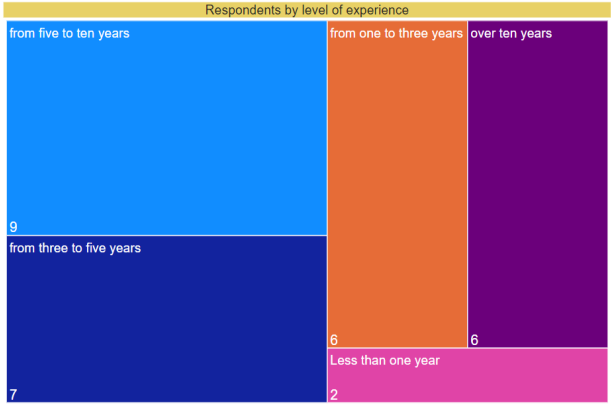

Figure 3(b): Respondents by level of experience

According to Figure 4(a), 25 respondents are familiar with the concepts of AI and big data, while 5 are not. Additionally, Figure 4(b) shows that 22 respondents are interested in learning more about AI and big data because they may affect the future of their careers, while 8 are not interested.

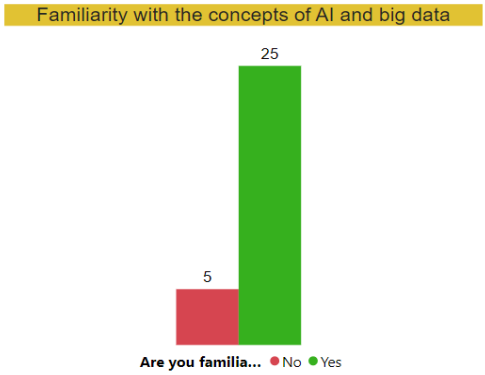

Figure 4(a): Familiarity with the concepts of AI and big data

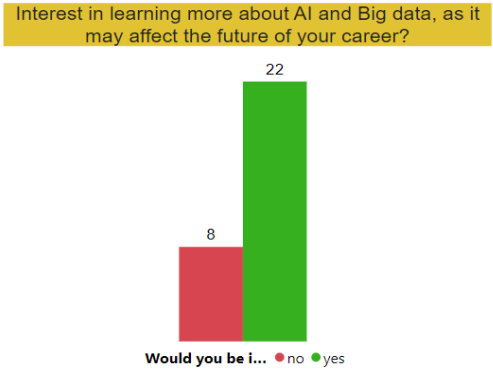

Figure 4(b): Interest in learning more about AI and big data

Based on our findings, the majority of respondents (22 respondents) have very little trust in AI and big data analytics automated features at work; six respondents completely trust them, while two do not trust them at all (Figure 5).

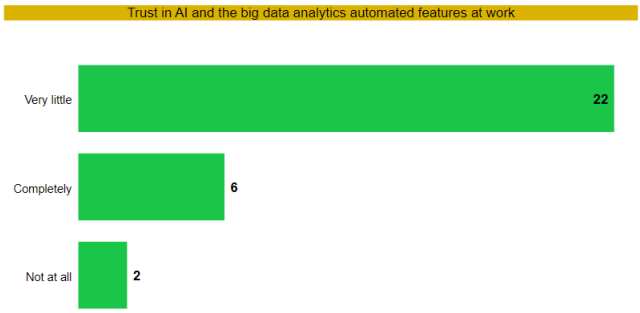

Figure 5: Trust in AI and the big data analytics automated features at work

Six factors are identified as the main factors that influence the use of big data and AI in SMEs: implementing new technologies (9 respondents), technological changes (7 respondents), personal skills and abilities (6 respondents), opportunity for career advancement (4 respondents), lack of a digital strategy (3 respondents), and financial opportunities (1 respondent) (Figure 6).

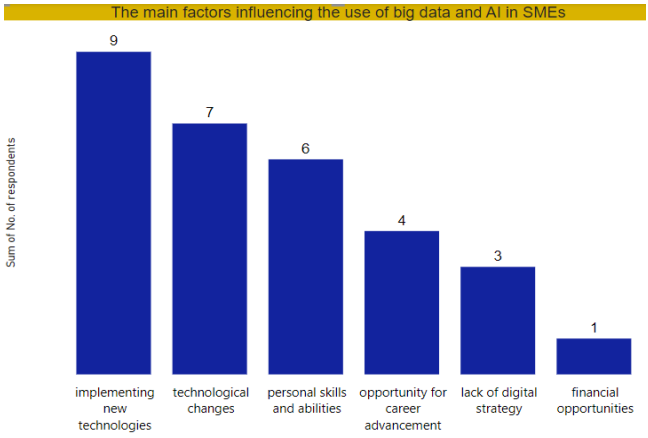

Figure 6: The main factors influencing the use of big data and AI in SMEs

16 respondents consider that AI has very little impact on automation of staffing levels; 12 consider that it has a completely impact on automation of staffing levels; and 2 consider that AI has no impact at all on automation of staffing levels (Figure 7).

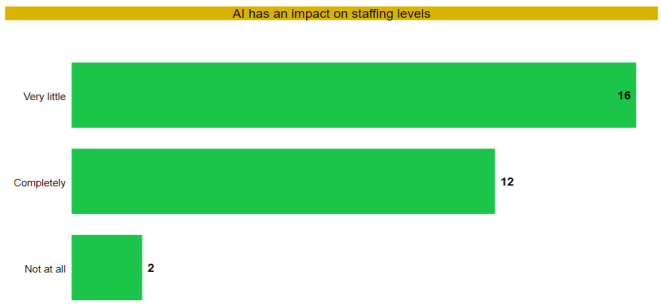

Figure 7: The impact of AI on staffing levels

We have created a logistic regression model woven with an AI-driven tool in Power BI known as "key influencers" where we have analyzed the answer to the question: "How do you think AI and big data automated features will affect staffing levels?" As independent variables, we were using age, gender, years of experience, and the highest earned level of education. Based on the solved model, we have found only one key influencer, i.e., when the age is in the range 41–50 years, the likelihood of the answer being completely correct increases by 2.50x (Figure 8).

Figure 8: Key influencers for affecting staff levels by AI and automated big data features

2 Conclusion

The aim of this paper was to investigate what owners of SMEs in North Macedonia consider about big data analytics and artificial intelligence (AI) in their operations. 30 owners have completely answered the questionnaire sent to them by email. Their responses were considered for analysis, i.e., conducting descriptive and diagnostic analytics by using Power BI software.

Based on our findings: 1) most of the respondents (25) are familiar with big data and AI; 2) most of the respondents (22) would like to learn more about those emerging technologies as they may affect their career; 3) 22 respondents have trust in big data and AI-automated features at work; 4) Six factors were identified as the main factors that influence the use of big data and AI in SMEs (implementing new technologies, technological changes, personal skills and abilities, opportunity for career advancement, lack of a digital strategy, and financial opportunities); 5) 12 respondents consider that staffing levels will be automated by AI; 6) The key influencer of the complete staffing level determined by AI is the age interval between 41 and 50 years, so that in this case the likelihood increases by 2.5x.

The limitation of the study is the small sample which we plan to increase in our future research where we want to explore the performance improvements by SMEs that are implementing big data analytics and AI in their operation and what are the main challenges they face in the implementation.

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