

## ARTIFICIAL INTELLIGENCE-BASED PROCESSES IN SMES

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### Summary

*Artificial intelligence disseminates in business dynamically. ICT, e-commerce, marketing, HR, accountants, car industry, smart house – in almost every branch it can help to gain a competitive advantage based on a fast and efficient analysis of huge amounts of data and rapid decision making. The article depicts the possibilities of implementing artificial intelligence solutions into small and medium-sized enterprises and discusses expected benefits as well as possible threats. The aim is to analyse current literature and research on artificial intelligence-based tools that can improve companies marketing processes. Results prove that – despite likely menaces – these technologies are probably are an upcoming future.*

**Keywords:** artificial intelligence, SME, knowledge management

### Introduction

#### SME and AI's definitions

Nowadays, organizations need to handle with the huge amount of data available within ICT systems and exchanged on the Internet, in order to operate in an efficient manner [22]. This implies an increasing interest in artificial intelligence tools to improve processes performed within a company and its ability to communicate with the environment. Artificial intelligence (AI) can be defined as computer-based analytical process aimed at creation of computational intelligent systems [14]. AI is emulating the human brain's ability to study, analyse, learn and make decisions, particularly for extremely complex problems [15]. Among crucial reasons of AI-based process implementation, following can be mentioned: problem solving, reducing man's workload and a cheaper labour [11]. These processes have been usually implemented in large companies. Still, the authors of this paper tried to explore possibilities of AI integration into small and medium-sized enterprises (SMEs) that have experienced a rapid growth in recent years.

#### Importance of AI for SMEs

In other words, the AI's main scope is to earn a competitive advantage within manufacturing, e-commerce, accounting, human resources, marketing, customer relations, etc. AI-based processes tend to improve organizational performance, lower costs, raise sells, automate customer management, advanced data collection and processing, save time and limit flaws. Especially in customer-oriented times, communication with clients seems to gain increased attendee. AI-based marketing may boost marketing efficiency by directing the efforts specifically towards the right customer. In this context, AI marketing derived a form of direct marketing which leverages the techniques of database marketing along with the AI-based concepts and models [18]. AI may support improving brand awareness and reinforcement, lead to higher conversion rate as well as nurturing and customer conversion, advance customer service and up sell, deliver passionate subscribers [8].

Various AI techniques can be applied into organization's performance, including: artificial neural networks, fuzzy logic, genetic algorithms, neuro-fuzzy inference systems, expert systems, swarm intelligence based algorithms, machine learning techniques, deep learning, etc. Though, it is important that AI is a very dynamic field of study and newer solutions are often designed. Despite numerous techniques and approaches, the main aim of AI-based processes remain the same – to provide more adaptive, flexible and interactive solutions according to customers' needs and interests [8].

AI is implemented in e-commerce in a form of recommendation algorithms based on past transactions compared to huge data set of other customers. The main scope of these algorithms is to suggest a customer a possible purchase. Another solution – marketing automatization systems may implement machine learning to improve customers targeting, driving conclusions basing on their behaviours and constructing more precise communication. Marketing can be enhanced by AI in behavioural consumer analysis, especially in automatization of this process [13].

Thus, organizations may benefit from AI implementation in various areas of everyday performance and improve their competitive advantage as well as image. To enforce AI into a business, it is necessary to define core company's processes that can be optimized (analysing costs or time) or automatized. Among such tasks, there might occur ones requiring large data set analysis or driving conclusions using professional and specialized knowledge [13]. Then it should be considered whether to purchase individually designed solution or a one already existing on a market. The first is probably more suitable for large companies, while the following could be more proper choice for small and medium enterprises (SMEs). Nevertheless, implementing AI into a company's business operations is requiring a process-driven approach.

All the above presents a need for a literature review on AI implementations. The next Section reviews current state of art on AI-based solutions in business.

### **1. Literature review**

Ryszard Tadeusiewicz (2016) admits that AI for many years (from 1956, when it was given its name and was separated from the whole of science about computers and information processing) developed in a multi-directional way.

Chuck Russell (2016) has prepared diagram to show how various methods and techniques map onto our the BI, Data Science and Artificial Intelligence disciplines [25]. See Figure 1 and Table 1 below:

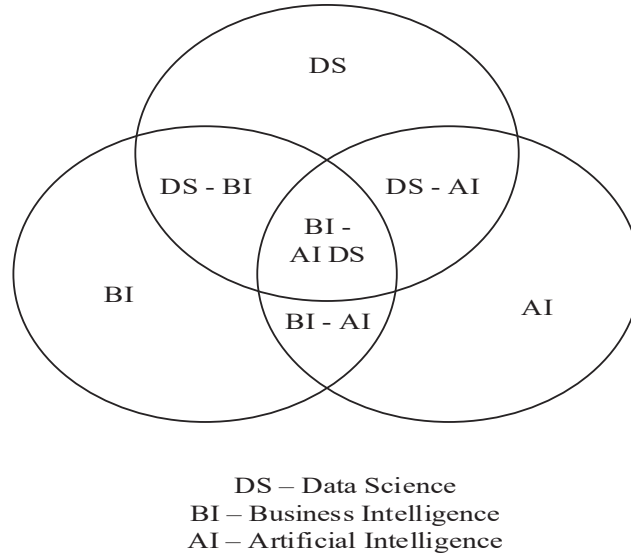


Figure 1. Data Science, Business Intelligence and Artificial Intelligence

Table 1. methods and techniques map onto our the BI, Data Science and Artificial Intelligence disciplines

Methods / Techniques	Discipline
Unsupervised Machine Learning	AI
Reinforcement Learning	AI
Reporting / Decision Support	BI
Multidimensional Analysis	BI
Natural Language (Query)	BI-AI
Data Management	BI-DS-AI
Big Data Management	BI-DS-AI
Inferential Statistics	DS
Predictive Modeling	DS
Supervised Machine Learning	DS-AI
Descriptive Statistics	DS-BI
Data Discover / Query	DS-BI
Data Visualization	DS-BI

Artificial Intelligence is something that has become a new technological phenomenon in today's business. However, it turns out that the amount of publications related to AI in SMEs is negligible. It seems that the business environment is more interested in this subject than in the academic world. Stacey Kuyf (2017) presented an article "How SMEs Can Use Artificial Intelligence to Scale Their Business" [26]. She states that AI is already incredibly effective, especially at automating the repetitive tasks that HR specialists, salespeople, and small business owners typically spend hours on every

week. She has specified a few areas where SMEs can use AI in SMEs to scale and grow their businesses such as: legal advice, big data analytics, customer relationship management and cybersecurity. Also, she claims that we can expect from this technology in nearly future to see personalised dynamic pricing, machine learning and artificial intelligence. As they are likely to be more widely implemented in the transportation industry, deep learning and machine learning to ensure that developers can design intelligent apps, chatbots will continue to gain popularity. Crucially, we can also expect AI to become more accessible to people and businesses that are not experts in the technology [27].

Chad Kutting (2016) writes that the businesses that are able to leverage AI early will achieve operational efficiencies well before others even have the chance to play catch up, and there are two reasons for this. First, AI is not a technology that can be bolted on; it should weave in throughout all your business processes. Fortunately, small businesses have much less been weaved to do when accommodating new tech.

He suggests to use in SMEs AI apps such as [28]: Amy by x.ai [29], Quill by Narrative Science [30], DataRPM [31], Textio [32], SalesforceIQ [33].

Gil Press (2017) based on Forrester's analysis, has presented the list of the AI technologies. Part of them can be used in SMEs. Moreover, he has specified sample videos for this technology. Quite interesting seems to be the solutions, assisting in performing automated decision-making [34].

Very interesting information on the use of AI in SMEs is presented by Vladimir Alekseichenko (2017) [35], [36].

Vanson Bourne recently (2017) surveyed business decision-makers from around the world and found that 80% already have some form of AI such as deep learning or machine learning in production today. 30% are planning on expanding their investments into AI within the next 36 months. Unfortunately, 91% said they can already see issues with AI implementation, with a lack of talent and poor IT infrastructure considered to be significant implementation barriers [37].

This paper aims to investigate a possibility to enhance SMEs performance by implementing AI into core processes. Due to the fact that AI is dynamically developing, it becomes achievable for such enterprises to enforce such technologies, previously reserved for large organizations due to huge financial disbursements required. Since information and communication technologies are developing in particular organizations at a different pace, non every SME will be able to benefit from AI-based processes. Even with the growing popularity of such solutions, an information technology culture at a proper level in a company is required. To reach established aim, a review of current literature on AI in business was made and technologies the most suitable for SMEs were selected for further investigation.

The problem presented above leads to a considerable need to conduct studies in SMEs area. The work has been concentrated on AI issues to the following aims:

1. To present current AI implementations in business.
2. To identify AI solutions for SMEs.
3. To present some recommendations for SMEs.

## 2. Results

### 2.1. AI-based process implementation case studies

The purpose of this section is to briefly present current AI implementations in business. To reach this goal several case studies will be provided. As AI-based solutions still require significant financial outlays, presented case studies will mostly concern large companies including: Amazon, Coca-Cola, Netflix, Under Armour, Google, Apple, Microsoft, IBM, Baidu, Bosch, General Electric, Associated Press. To emphasise a possibility of enforcing AI into SMEs also a case of iHeartRadio will be discussed [13], [12].

Amazon provided a first queue-free shop basing on an Amazon Go system. Thanks to deep learning, system is available to identify products removed from shelves and add it to a virtual basket if a customer is willing to purchase it. The whole store is monitored permanently what allows implementing a “just walk out” model into shop’s performance. After completing the basket, the customer leaves the shop and Amazon sends a receipt and charge consumer’s account.

Coca-Cola invests in AI technologies to improve content, media communication and trade. While creating advertisements, AI will be involved in the whole process, including developing music theme, scenarios or placing spots on social media. Whereas, Associated Press is the first press agency that has implemented AI in the content creation process. Some of the published news is no longer written by a human but by AI.

Companies like Amazon and Netflix mentioned above have deployed AI-based recommendation systems that simplify customer’s purchasing decisions. Suggestions like: “You may also like...”, “Check also...”, “Other customers that bought this product have viewed also...” or “Selected especially for you...” are the visible signs for a consumer of such processes supported by AI.

Under Armour in cooperation with IBM Watson designed an application called Under Armour Record. It tracks users’ habits and performance in the area of fitness and wellbeing: daily activity, diet, sport performance and sleep. The collected data are used to build users profile and suggest a personalized workout programme as well as wellbeing tips. WayBlazer is also a solution developed in cooperation with IBM Watson. It is a platform for travellers, allowing users to share and find pictures, recommendations and comments. WayBlazer is perceived as a first digital travelling concierge counselling destination and services by analysing users’ queries built in a natural language.

Google developed RankBrain – an AI-based solution to improving search results. It is able to connect similar phrases and filter results, but most of all it possesses the ability to learn. The Chinese equivalent of Google, called Baidu, use AI in example by implementing speech and image recognition techniques.

AI speech recognition techniques are also used by Microsoft and Apple. They implemented digital agents, Cortana and Siri respectively. These solutions are capable of recognizing and interpreting user’s voice, answering questions, starting phone calls, sending text messages, checking the calendar and search information on the Internet.

Bosch has adopted AI for so called predictive marketing based on big data. Implementing AI-based services allowed this company to connect and verify data from different sources, remove duplicates, improve analysis as well as personalize and optimize communication with clients. General Electric designed AI solutions for ramjets service. Damages are detected faster and human mistakes are reduced.

The last example of recent AI implementations is an internet radio called iHeartRadio. In cooperation with OnStar Go, they designed AI-based system for content in emergency situations. This solution is capable of learning driver's habits and react in atypical circumstances, but also play music according to the user's preferences. iHeartRadio is a quite small company comparing to previous ones, so it constitutes a great example of possibilities of AI intrusion into smaller organizations as well.

## **2.2. AI solutions for SMEs**

This section describes selected AI techniques that can be implemented in large and small organizations. Based on current literature, following solutions were picked: deep learning, speech and language recognition, customer targeting, chatbots and dynamic pricing.

## **2.3. Deep learning algorithms**

Deep learning as AI area encompasses a wide range of neural network architectures designed to complete different tasks, these algorithms are used to extract complex abstractions (by formulating first simpler ones) as data representations through a hierarchical learning process [15], [21]. In this process a massive amount of unsupervised data is used to automatically extort complex representation invariant to the local changes in the input data [2]. The idea of this technique is to imitate the deep, layered learning process of the primary sensorial areas of the neocortex in the human brain [1]. Deep learning is also believed to work efficiently while analysing social media content [19].

One of the core benefits of deep learning implementation into a company is a possibility of efficient analysis with a high level of abstraction received of massive amounts of unsupervised, unlabelled and uncategorized data. The second is that these algorithms learn data representations in a greedy layer-wise fashion [7]. Shallow learning methods, including decision trees, support vector machines, as well as case-based reasoning may fail when attempting to extract useful information from complex structures and relationships. Deep learning algorithms are free of these flaws [15]. Despite the numerous benefits, deep learning can bring also some mistakes during analysis. That is why there is a long way before they can simulate a human brain, despite the fact that they are believed to be the most promising [24].

## **2.4. Speech and language recognition**

Speech and language recognition is distinguished as a core for flexible and effective human-machine interfaces [17]. These systems are quite well disseminated with evident commercial utilization, still they are not free of flaws [5]. AI based speech and language recognition is based on recognizing each part of a word and then putting them together, matching with a dictionary and interpreting. Modern solutions are able of understanding whole sentences not only single phrases, still speech segmentation is perceived as a crucial step in speech recognition due to additional analyses performed for each framed speech segment [9].

For this AI solution recognition the main challenge is to reject and differentiate closely spaced versus acoustically far spaced languages [20]. Emotions, sentiment or speaking and breathing concerns may also lower analysis efficiency and generate flaws.

In companies' speech and language recognition may be important in the area of tasks such as branding, product positioning, corporate reputation management, and social media marketing [16].

It is also implemented in digital agents mentioned in a previous section. It is also perceived as a gold mine for marketing experts while analysing social media content [6].

### **2.5. Customer targeting**

Customer targeting is mostly disseminated among algorithms aiming at increasing conversion rate. In other words, the main goal is to deliver a selected content to a potential customer that will increase a chance of purchase. AI techniques are implemented into targeting process to make it more possible that consumers will click on an online advertisement. Traditional methods like rebate coupons and bulk buy discount offers aimed at influencing customers in purchasing a greater number of products are slowly displaced with targeting methods.

Targeting requires finding association rules, including: frequent patterns, associations and correlations in a customer database. Among common algorithms a priori and frequent pattern can be mentioned. The first one calculates the likelihood of an item being present in a frequent set, given that another item is present, while the second one multiple transactions are being reduced by forming a tree structure which contains the frequent item sets [23].

Google and Facebook are the most well known as companies using targeting to deliver personalized content. Google designed a recurrent neural network to improve this process. Analysing with AI techniques to social media content, comments and user's online activities would greatly improve targeting methods.

### **2.6. Chatbots**

Chatbots are used, among others, by marketers that are willing to improve their communication with consumers. Chatbot can be defined as a programme that makes interactions between man and machines using natural language possible [10]. In other words, chatbots respond to natural language text and (or) to voice inputs in a human like manner [3]. Some chatbots have implemented AI features, while other remains quite simple solutions [13]. The main aim is to create an impression for a customer that he or she is communicating with a human not a computer.

Companies may use chatbot to improve delivering corporate information on their websites, social networks or through mobile applications.

### **2.7. Dynamic pricing**

Numerous variables influence a product price and its proper estimation and forecasting can be a difficult task. AI may be implemented to find correlations between price and sells and to monitor price changes, enable dynamic real-time pricing and demand response optimization and – as a result – maximize total welfare. AI-based dynamic pricing is a system in which prices react to supply and demand pressures in a real-time [4].

AI-based dynamic pricing allows also monitoring prices of selected products and remaining up-to-date with other companies offer. AI helps also to automatize the whole process of price analyses.



### 3. Recommendations and future work

Adopting AI is fundamentally no different than deploying actionable data or even making the switch from paper processes to email and digital processes a generation before that. The keys are to have the right mindset and to take each change step-by-step. It's important to normalize the idea of using AI. It's not a job destroying, sentient being that teams should be afraid of; they're using apps that learn how to gain efficiencies over time [38].

The main challenge of AI in SMEs is that no businessmen teach machines how to perform specific tasks because they learn to do the tasks by themselves using obtained data from the computer systems. An important goal for AI would be creating a machine that could replace a human being in many everyday business activities.

### 4. Conclusions

AI systems are getting more popular and widely disseminated. That is why SMEs can start to benefit from technologies previously reserved for large companies.

Still, there are some difficulties that have to be taken under consideration. AI solutions remaining quite expensive investments, although this argument will depreciate with time and further development of these technologies. To operate efficiently, AI-based implementations need to work on well prepared data from credible sources. AI investments also require possessing by a company a good IT infrastructure. What is more, AI-based solutions may contribute towards job positions limitation as work performed traditionally by a human will be substituted by a machine [13]. AI is able to collect, process and apply data from customers quickly and accurately. That can be also a source of risk for consumers.

The conducted analysis proves that the majority of publications on AI in SMEs are elaborations of IT and business professionals. Unfortunately, it is very difficult to find scientific studies in this area. This work can be used in both business and academic environments by both professors and students. A large number of examples and references to real solutions can become a starting point for detailed research and analysis.

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## PROCESY WYKORZYSTUJĄCE SZTUCZNĄ INTELIGENCJĘ W MAŁYCH I ŚREDNICH PRZEDSIĘBIORSTWACH

### Streszczenie

*Sztuczna inteligencja wkracza dynamicznie do biznesu w niemal każdej branży: ICT, e-handlu, marketingu, HR, księgowości, motoryzacji czy budownictwa. Pomaga ona osiągnąć zupełnie nowe korzyści wynikające z szybkiej i efektywnej analizy olbrzymich zbiorów danych oraz podejmowania decyzji. Artykuł omawia możliwości wdrożenia sztucznej inteligencji w małych i średnich przedsiębiorstwach, jak również wskazuje oczekiwane zyski i zagrożenia. Na podstawie analizy literatury dokonano wyboru wybranych rozwiązań, które mogłyby usprawnić funkcjonowanie takich przedsiębiorstw. Rezultaty wskazują, iż sztuczna inteligencja może stanowić wsparcie organizacyjne najprawdopodobniej w najbliższej przyszłości.*

**Słowa kluczowe:** sztuczna inteligencja, małe i średnie przedsiębiorstwa, zarządzanie wiedzą

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