POLITYKA
INSIGHT

Artificial Intelligence of the Polish economy

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POLITYKA INSIGHT

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Warszawa, May 2018

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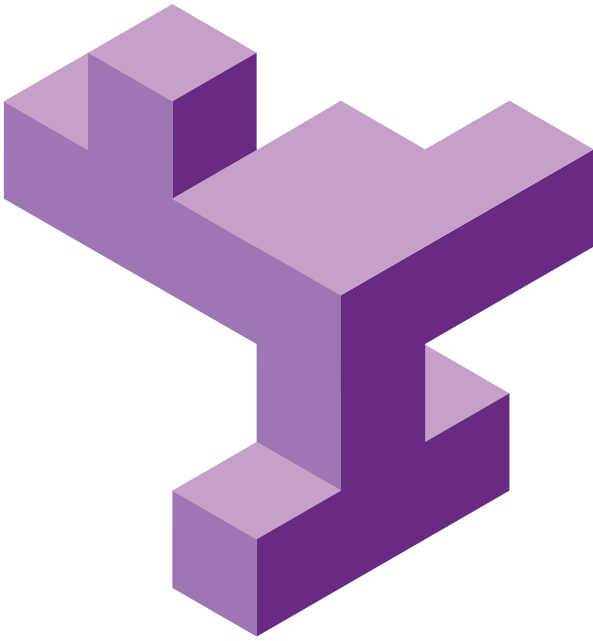


What, in fact, is AI? It is an information system that is able to perceive the external world in order to analyse it and understand it. Using such analysis, AI can increase efficiency by drawing conclusions from the effects of its own work. **Even now, it improves the efficiency of thousands of companies, allows process automation and increases profit margins. In the future, AI will only grow more significant**. World elites are aware of the importance of AI, as evidenced by huge investments in AI made by China and some of the largest American corporations, and even in the public remarks of Vladimir Putin.

Global investment in AI technology has grown exponentially: from USD 1.7 billion in 2010 to USD 14.9 billion in 2014 in the case of enterprises, and from USD 148 million in 2010 to USD 1.9 billion in 2015 in the case of Venture Capital investments. As a result, AI is influencing economic growth more perceptibly in highly developed countries. **Within the next decade, the accumulated impact of artificial intelligence on the economy may reach from USD 1.5 billion to USD 3 billion**, which will boost GDP by up to 1-2%. The economies of the USA, Finland, Sweden, Japan, Great Britain and Germany are expected to benefit the most from the development of AI.

Polish companies have similar access to the IT and communication infrastructure of the most developed countries but are still a step behind in the application of new technologies, especially artificial intelligence. These types of solutions are used in less than 10% companies from non-financial sectors, which means that AI technologies support no more than 4% of the entire economic activity in Poland. Therefore, **it can be estimated that the potential benefits of AI to Polish companies amount to PLN 10-20 billion per year**, that is, no more than 1% of the country's GDP. We assess that in recent years, artificial intelligence corresponded to 0.1-0.2% of Polish economic growth, and its share will increase in the following years. This means that AI in Poland is a growing, but still mostly untapped vehicle for growth. This potential may never be fully unleashed if the sector is not regulated wisely.

It has been clear ever since they appeared on the market that rapidly developing forms of technology, especially internet platforms and other applications that make use of the network effect, will become regulated sooner or later. **However, it is paramount to make sure that new regulations do not hinder the dynamic development of this sector or stifle its positive effect for the economy**.

Already today, a number of existing regulations directly influence the way in which AI is used by entrepreneurs, as seen through provisions of the General Data Protection Regulation (GDPR) and ePrivacy rules. **The European Commission proposed regulations that, in their current form, pose a threat to the development of new, innovative sectors such as M2M, the Internet of things, or Industry 4.0**. This risk is due to the fact that AI is developed on the basis of cloud-based solutions and on the processing of large amounts of data that are constantly moving – and this area is of particular interest to the Commission. It is definitely necessary to strengthen the protection of communication data, but the new principles should be properly balanced and propotional to the potential benefits of supporting innovation. Businesses do not like security breaches, but they also hate overregulation. **Therefore, in order to make use of the great potential of fledgling Polish technological companies, any new regulations should be coherent and transparent, and should allow the industry to develop further**.

In our publication, we present Polish companies that develop advanced products and services with the use of artificial intelligence, the potential applications of these solutions in specific industries, as well as the benefits that stem from them. In the following chapters, we describe the economic effect of AI, as well as the legal norms surrounding its development.

case studies

McKinsey reports that out of 3,000 corporate decision-makers from 10 countries and 14 different industries who are aware of the topic of AI, only 20% have implemented significant AI solutions. About 40% are experimenting with it, while the rest... just step back and watch, not entirely convinced of AI's benefits. Managers risk underestimating a technology will be crucial for the competitive advantage of their firms in the future. Nonetheless, machine learning algorithms are already being implemented in Poland, helping companies to save and earn money. Therefore, in this part of the report we will focus on specific implementations and services from the big data and artificial intelligence market. See for yourself how it works and what tangible benefits it brings to businesses.

Ant Colony Algorithms for Pharmaceutical Distribution

sertum
systemy informatyczne

Just one pharmacy can have even 7,000 products in stock. Additionally, there might be various batches of the same product. The market of pharmaceuticals is strictly regulated, but each chain pharmacy or wholesaler can record the name of the same drug in a different way.

This is completely different than the automotive market, where every part has a unique identification code. These differences force pharmacists to do manual work when placing digital orders. The self-learning, big data algorithm of the Sertum company analyses names of pharmaceuticals and their IDs in different pharmacies, chains and wholesalers, as well as the corrections introduced by pharmacists, data from the central drug dictionary and standard prescription database. This process allows it to link the names of the same drugs in different pharmacies and wholesalers with a high level of accuracy. At this moment, there are 17 million links of this type in Sertum systems.

These linkages are the basis for the most important function of this algorithm – optimizing drug inventories and wholesale purchases for pharmacy chains.

Pharmacies need to order drugs on a daily basis. If a given pharmacist owns a dozen or even several dozen different pharmacies, the use of proper algorithms can result in considerable savings.

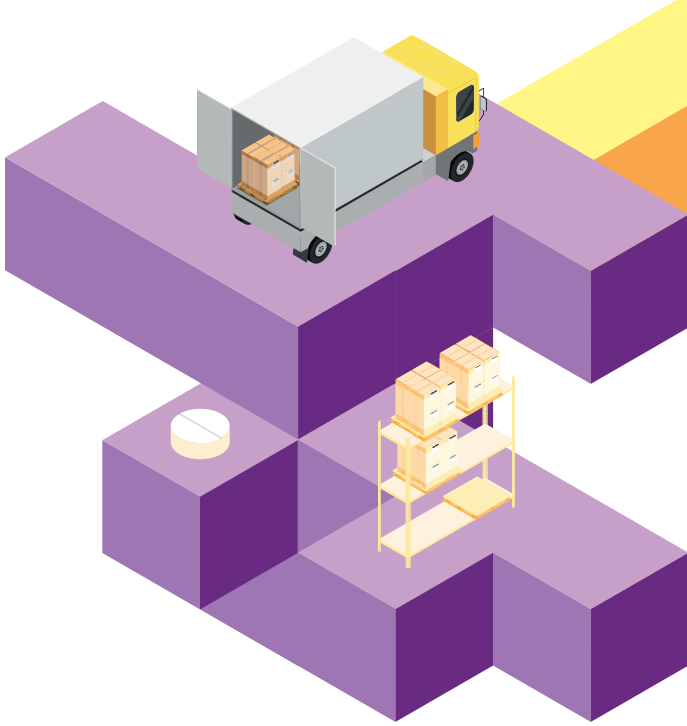
There is no need to buy another batch of a drug from the wholesaler if there is plenty of the same kind of drug in another pharmacy within the same chain. However, ensuring proper drug inventory for each and every pharmacy is not always an easy task. The algorithm predicts the sales of each drug in every pharmacy and on this basis ensures optimal distribution of supply. As it is always the case with machine learning, first the system has to train according to the historical data that is available, but then continues to learn and improve further. The Sertum software is based on the so-called "ant colony optimization" algorithms (ACO), a name inspired by the way in which the species of insect searches for the shortest path to transport food to their colony. The company's founder, Seweryn Przeździęk, wrote his thesis on the topic.

When optimizing inventory and wholesale purchases, the algorithm takes into account the current promotions or discounts for the selected products, the types of drugs (on request, subsidised, non-subsidised), the distance between pharmacies and transport costs, as well as expiry dates. Other factors taken into account are seasonal demand and requirements of certain rare drugs to be available in stock at all times. On the other hand, the system skips the optimization of products that are too cheap or too scarce to relocate, as well as the ones that are "nearly perfectly" distributed. Sertum algorithms use 2TB of data continuously.

ADVANTAGES

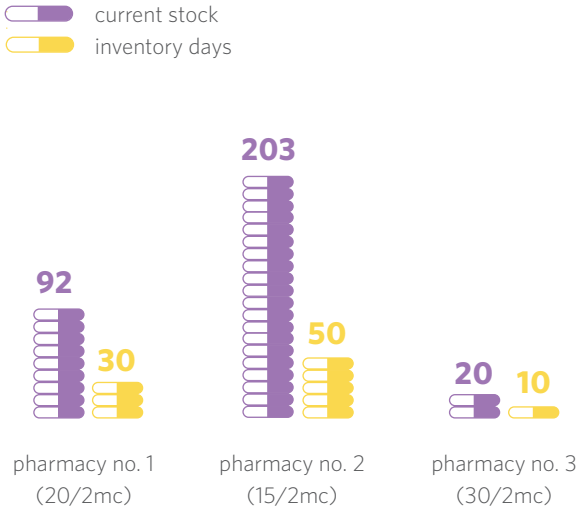
Sertum provided Polityka Insight with one year's worth of optimization results from the warehouses of 18 different pharmacies.

- There were 3,766-6,426 relocations monthly, and each pertained to a span of 8,308 to 22,383 products.
- The value of the goods that were relocated instead of ordered from the wholesaler amounted to PLN 101,000-373,000 a month.

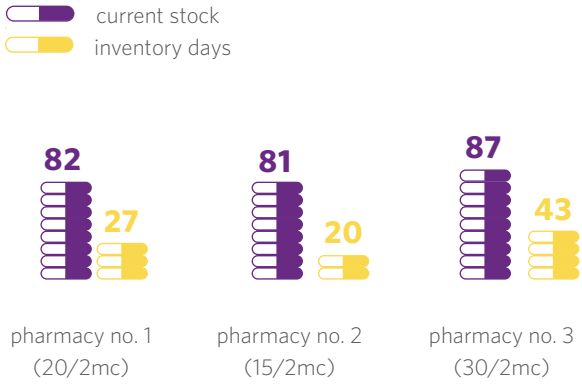


DISTRIBUTION OF GOODS – EXAMPLE

BEFORE OPTIMISATION



AFTER OPTIMISATION



20/2mc means that the pharmacy sells 20 pcs. of a drug in the span of 2 months – the image shows an example of a single product

Fix the engine before it breaks

REDNT

Artificial intelligence algorithms are used, among others, in the so-called predictive maintenance industry. That is, in diagnosing the technical state of machines and equipment in order to predict when they will break. These are exactly the types of services which are offered by a company called REDNT.

Breakdowns usually starts with some kind of minor damage i.e. a minor leakage in the engine bearing or often, simply with the machine's output dropping below peak performance. Neither industrial control systems (SCADA) nor the operator discover and react to them. The machine is working and the drop-off in performance is very slow at first, but a some point starts progressing at an alarming rate and after reaching some critical point causes a breakdown, major damage or even forces production to stop.

Huge industrial engines, generators, turbopumps and other heavy-duty machines that work at high speeds are of critical importance – fixing them and purchasing replacement part is not only expensive but can take months. In order to ensure that production keeps going you have to keep spares of the most important parts in your warehouse – just in case something goes wrong. This helps maintain continuity of production while waiting for new parts to arrive or for repairs to be performed.

Thanks to AI it is possible to monitor industrial machines much more accurately and anticipate breakdowns based on an analysis of vibrations, temperature, power usage and other parameters. Data can be collected from existing SCADA system and – in case such a need arises – from special sensors which can be additionally installed on the machines.

The systems of REDNT collect data from 1 million data points in seven mines belonging to JSW. In the largest of these mines data is collected from 300 thousand sources. Among the things being monitored are the engines of belt conveyers (using vibrodiagnostics) – the vibrations of an engine that has a badly aligned axes are different from the ones given off by an engine with a badly aligned shaft. A self-learning algorithm is being used to discover, analyze and interpret these differences. Based on thousands of hours of recordings on the vibrations of a working engine the artificial intelligence teaches itself the difference between how a broken and properly functioning machine sounds.

FINANCIAL CONSEQUENCES OF A BREAKDOWN - UNSCHEDULED DOWNTIME AND REPAIR COST

The costs of an emergency shutdown of the turbine prompted by a sudden increase in the bearing vibration (PLN thousands)

unplanned electricity purchase on the balancing market	1,904.30
start-up of machine operation	220.80
renovation works	999.60
parts and materials	27.20
TOTAL	**3,151.90**

The costs of a damage to the mechanical shaft seals and blockage of rotor cartridge in the primary pump of a turbopump (PLN thousands)

unplanned electricity purchase on the balancing market	530.30
replaced spare parts	87.45
purchase of parts necessary to rebuild the stock to the level from before the breakdown	300.35
outsourced services	515.36
overtime spent on removing the breakdown of an aggregate by own repair services	88.64
TOTAL	**1,522.10**

Source: J. Dwojak, "Opracowanie efektywnej diagnostyki eksploatacyjnej zespołów maszynowych w energetyce", Politechnika Opolska, 2012.

The AI then analyzes how the machine is currently running and decides if the vibrations it is giving off are within what it has taught itself to be normal and what conclusions can be drawn from these results. A model of proper engine functioning can also be created based on digitally-recorded historical data. When the algorithm discovers a trend i.e. a rise in temperature that deviates from the normal and looks similar to previous such increases which caused the engine to overheat – it alerts the appropriate repair team and also predicts what needs to be done i.e. filter replacement.

Thanks to early warnings about the likelihood of a breakdown it is possible to buy additional energy at preferential prices (lower than in the case of *ad hoc* purchases), plan for the shutdown of the affected machine(s) (eliminating the need for a repair team to be summed "after hours") and handle the repair before the breakdown causes significant and extensive damages (lowering the cost of parts and maintenance work). AI also makes it possible to extend the time between technical tune-ups of machines, because they are scheduled according to the actual current technical state of a given unit. Artificial intelligence can not only prevent a machine from breaking down but also optimize its performance. This also applies to smaller machines in the case of which less-sophisticated models are used i.e. for purposes related to increasing energy efficiency. An inefficient engine can use up to 10 percent more electricity which, over the course of a year, can often end up adding up to an expense larger than the value of the engine itself.

The algorithm allows for the monitoring of the state of element "A" based on information regarding "B" – an indirectly related indicator. The wear of energy transformers, for example, is typically determined based on the state of oil which is used in them.

By knowing that small electrical discharges are occurring in a worn transformer we can group historical data into paired sets: analysis of the oil compared to data from the sensors which are examining the small electrical discharges. Based on this information, artificial intelligence is able to create a model thanks to which it can monitor and determine the state of the battery by simply listening to it. The result is that a manual inspection of the oil can be performed much less frequently.

Edward - Intelligent Assistant for Sales Representatives

EDWARD
AI POWERED SALES ASSISTANT

Edward is a smartphone-based, intelligent assistant created by the 2040.io company. The application supports sales departments – commercial representatives and managers.

Edward monitors and tries to understand, among other tasks: e-mails, calendars, telephones and text messages. Edward combines all the information concerning a given client, which makes it easy to follow the entire context of an interaction, even if the client is handed over to another employee, or when an interaction is initiated after a long break. AI analyses content, taking into account the time of the day, and prioritizes tasks into those that require and urgent response and those that can wait. It can indicate the stage of the sales process of a given client, e.g. offer, follow-up or contract preparation, and suggest appropriate actions to be taken by the sales representative. It generates reminders several days after an offer was presented, at the right moment to contact customer X, and can also remind the sales representative that an e-mail from customer Y still hasn't been answered.

Edward initiates interactions and helps commercial departments in the arduous task of entering customer data to the Customer Relationship Management (CRM) platform.

The application can generate daily commercial reports and ask employees about completed tasks. All the information is automatically uploaded and saved in a central database. This process is easier and more user-friendly on the one hand, and other, encourages the habit of daily reporting, which is particularly important for managers who supervise sales departments and also for the Management Board. Edward helps to save time and eliminates the risk of forgetting to do certain tasks.

2040.io does not refer to Edward as artificial intelligence because clients have excessive expectations towards such systems. Edward will not find customers on its own and it will not carry out sales, especially in B2B, where relations are crucial. However, in the case of B2C, where clients are massive, and tasks can be more standardised, there is also more opportunity for automation. Edward simplifies processes, supports humans and saves time.

Edward can also transcribe spoken communication and convert it into text. Within the next few years, the company plans to teach Edward to make communication summaries by capturing the most important elements.

Edward is being used in logistics, FMCG, and insurance – in all the places where sales representatives appear. However, smaller enterprises with few representatives, working in the software-as-a-service model, also find him useful.

ADVANTAGES

STATISTICS OF ONE REPRESENTATIVE WHO HAD BEEN USING EDWARD'S ASSISTANCE FOR FOUR WEEKS – WHAT WAS SUCCESSFULLY AUTOMATED:

215
Sales opportunity updates

35
Follow-ups planned

195
Contact updates

35
Notes after conversations

130
Company updates

approx. 13 h
Saved time

Tax Fraud Detection in Real Time

Cognitum
Cognitive platform

The solution can prevent losses estimated at USD 80 million per year, in retail only.

Although financial fraud detection should happen fast, it is time-consuming, because it requires working on many sources of data, such as invoices, bills, payments and data from the company register. Moreover, the process looks different every time, and requires interdisciplinary knowledge of finance, business practices and legal provisions. The Cognitum company developed a solution to tackle this problem for one of Brazilian states. Specifically, Cognitum looked into a method to detect tax fraud related to VAT. Losses were estimated at the level of USD 80 million per year – in retail sales alone. The algorithms developed by Cognitum examined two million invoices from 60,000 merchants every day, taking into account 200 tax laws and regulations. They assessed many transaction participants, their supply chains and the statuses of individual entities, and any variation of these factors affected the way in which the entire operation proceeded.

This task was to recognize patterns that could last from several seconds to several months. The developers had to ensure that the system could work on data that was not fully structured, that is, it was able to learn that "2t-gas-cok-150dol" and "2000 kg of gas-coking coal for 150 USD" referred to the same transaction.

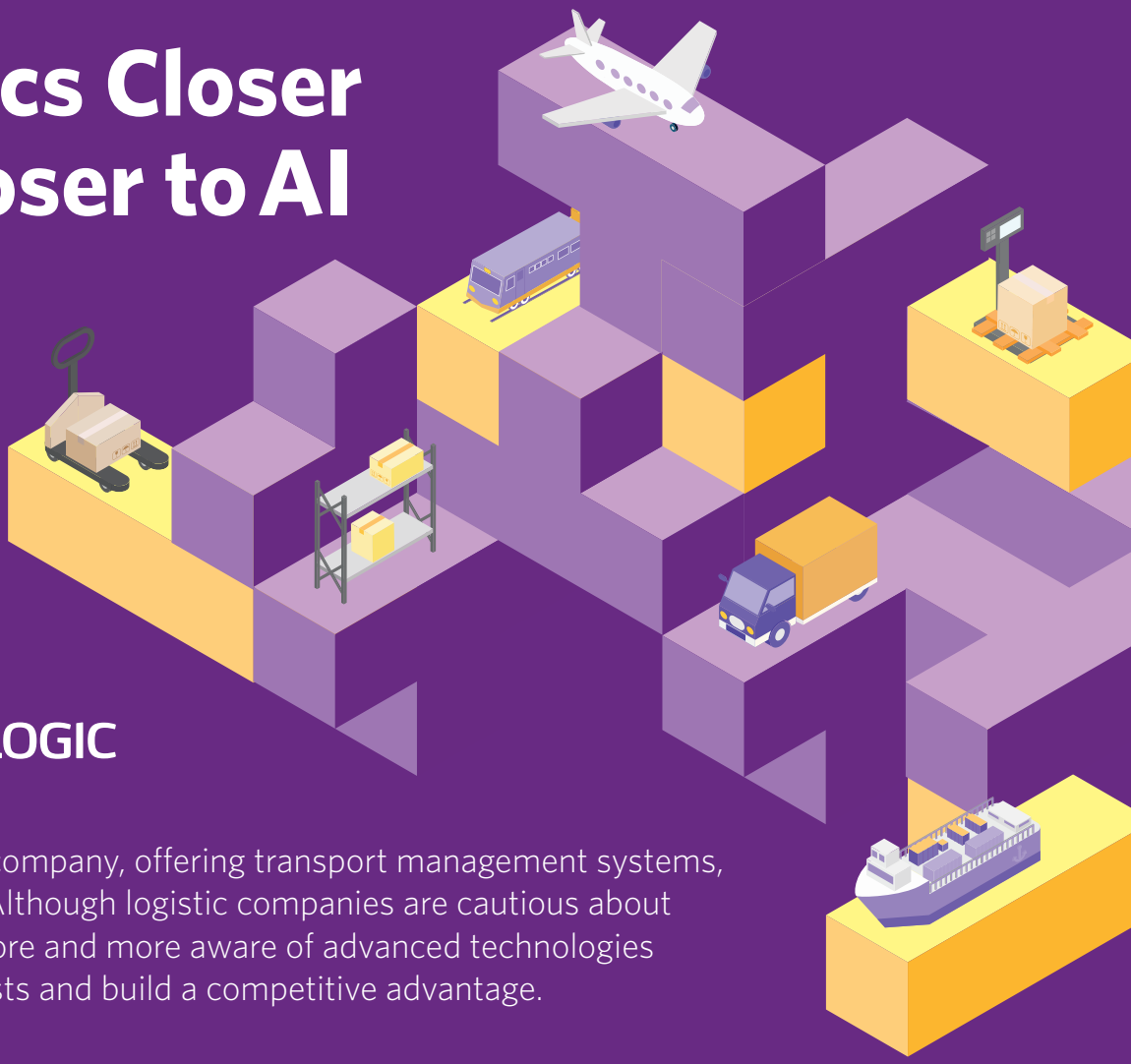
Brazilian finance specialists could also add new principles in real time, with the use of the so-called controlled natural language, and not coding. In this language, vocabulary and grammar are restricted, ambiguity is removed, and context is limited. Although since it is still human language and not coding, natural language allows people who don't know programming to work with IT systems. Simply speaking, database queries can be generated with a phrase like this: "median + sales + 2017 + product A", similarly to the internet browsers.

The Cognitum system implemented in Brazil generates visualizations and alerts when it detects anomalies. In such cases, it also collects pertinent data to gather proof that can be later used in court.

ADVANTAGES

According to data from the Brazilian Treasury, they managed to recover 25-50% of the tax gap. Additionally, they minimized the number of costly false positives – false alarms that unnecessarily triggered the machine of enforcement and tax collection. Controls became more accurate and better prepared.

Logistics Closer and Closer to AI



frameLOGIC

The frameLOGIC company, offering transport management systems, supported by AI. Although logistic companies are cautious about prices, they are more and more aware of advanced technologies capacity to cut costs and build a competitive advantage.

The transport market is highly price-sensitive, entrepreneurs operate on low margins and are still not ready to invest in advanced solutions.

Nonetheless, experts indicate that this industry will be among the most sensitive to AI. According to McKinsey, in developed countries, logistics and transport is the third sector – after finance and ICT – that has started to invest in AI, due to expected benefits*.

There are two main channels to acquire customers in shipping: through ongoing cooperation with business partners, whose orders are consistent and big, and via the so-called freight exchange system. It is a place where standardised *ad hoc* orders are being posted, and relay the demand to transport from A to B for an offered price. The dispatcher of a given transport company has several minutes to decide if the order should be accepted or rejected. In that time, they must consider many factors: truck availability, tonnage and volume, vehicle suitability for a given type of goods, distance, possible routes, etc. Another important factor is driver working time, because they need to take breaks at appropriate intervals after a specific number of hours every day, week and month. Sometimes products need to be transported very short distances, but the job cannot be picked up, because the driver who meets all the conditions can work only two hours more this month.

Such decisions are made to a certain extent intuitively, on the basis of years of experience – by experienced dispatchers, who are expensive and highly desired in the market. Such procedures, including many interrelated variables, requiring quick decision-making and experience, call for the application of artificial intelligence.

Algorithms would not only be able to evaluate whether an order should be accepted or not, but they would also be able to calculate the job's profitability and rank assignments from the freight exchange. It wouldn't be possible to replace dispatchers completely, but algorithms would be able to improve their performance,reducing the risk of employing those with less experience.

ADVANTAGES

AI support would help to:

- choose the most profitable assignments,
- reject feasible, but unprofitable ones,
- acquire additional orders previously rejected by dispatchers,
- improve the performance of experienced dispatchers,
- employ less unexperienced dispatchers without much risk for the company.

*p.21 "Artificial Intelligence. The next digital frontier?" McKinsey&Company 2017

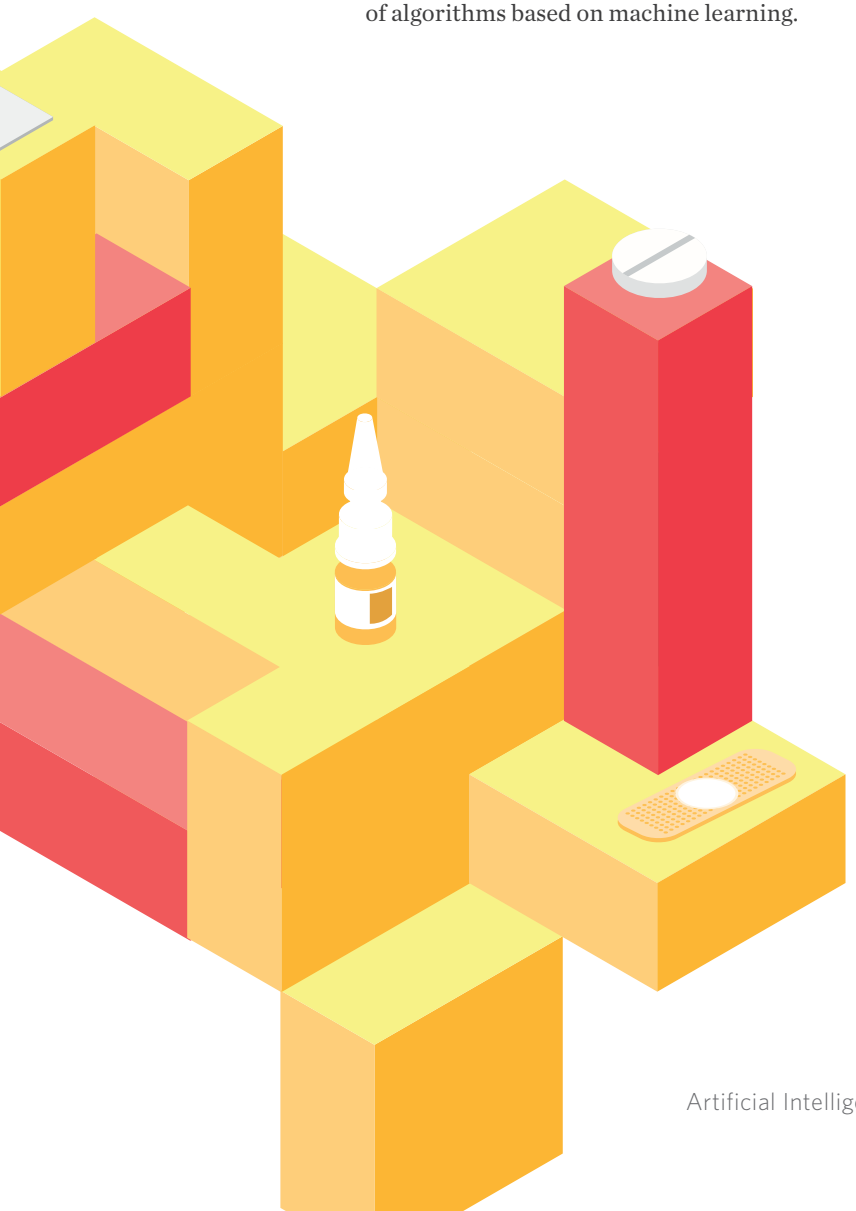
Remote, Digital Diagnostician

medapp

Until recently, a cardiac examination was performed at patient's home using the Holter method, in which patient received a diagnosis no sooner than in few weeks time. MedApp offers devices that can be used by the patient to perform, e.g. ECG, spriometry or a pulse oximetry. Collected data are streamed live to a doctor who has a constant supervision over the patient's condition.

Until recently, a cardiac examination was performed in at patient's home using the Holter method. The patient would wear a device resembling a Walkman or a thicker smartphone at their belt, and the electrodes connected to the device would be placed on the patient's chest. The exam, that lasted at least 24 hours, required from the patients to write down what they did and when (work, exercise, sleep). Then they would need to go back to the doctor who take the memory card from the Holter and copy all the data. The patient would have to wait at least a couple of days for the doctor to find time to analyse the data and compare them with the patient's notes. Several weeks later, the patient would receive a diagnosis with recommendations related to their lifestyle, and a prescription for medication.

The MedApp company has decided to enter this area. It offers 60 different devices (ECG, spirometry, pulse oximetry, among others) that – after being prescribed by a doctor – can be used by the patient at home to monitor temperature, weight, blood sugar levels or blood pressure. Data are then redirected in real time to a database and to the supervising doctor who can check the patient's status at any given moment. Information gathered by the devices is analysed with the help of algorithms based on machine learning.



In the case of heart conditions, they have been trained on three data sources: first, international medical databases containing millions of interpreted, standardised ECG tests and comments from doctors. Later, the system learns more using current patient databases and additional training from doctors who complement the database with their observations. With the knowledge of millions of hearts, the algorithm can distinguish between the electric impulses of healthy and deficient hearts with very high probability, and even diagnose the kind of disorder in question.

The system can intelligently recognize the cause of carying heart rhythms and discern, if a patient's heart is beating fast, because they are tired from normal exertion, or if it's an anomaly that should be examined closely or even a life-threatening condition requiring immediate notification of the telemedical centre employees.

Algorithms can detect the most frequent heart conditions in real time, such as: tachycardia and bradycardia, atrial and ventricular fibrillation or apnea. Of course, the algorithm does not make decisions – it only notifies the doctor of test results that require attention, in some cases suggests possible conditions. Official diagnoses are made by the doctor alone.

ADVANTAGES

According to MedApp, the system can increase the doctor's efficiency more or less six-fold, as it allows them to perform six times more tests and diagnoses. Therefore, patients don't waste as much time, doctors can attend to more patients, and they can focus on the most difficult cases. After the system was implemented in Kenya – a country suffering from a shortage of doctors and health centres – the average cost of cardiological tests dropped from USD 170 to 5.

As for health centres, more patients mean higher income – and this is what NFZ (Polish National Health Fund) incentives are all about. Thanks to this, the time of hospitalization is shorter, patients can be discharged faster after a surgery, they can exercise at home under remote monitoring, and the dosage of medication is immediately checked and adjusted, reducing the consumption of pharmaceuticals.

Predicting Customer Needs

SYNERISE

The main product of Synerise is an advanced Marketing Automation Platform (AI Marketing Cloud).

The software examines, among other things, the websites visited by internet users, as well as the products viewed and purchased by them, their behaviour in social media, real-time geotags, and data from payment terminals and smartphone apps. Companies that use the Synerise platform send anonymised data of their clients totalling around 300-500 measurements per person.

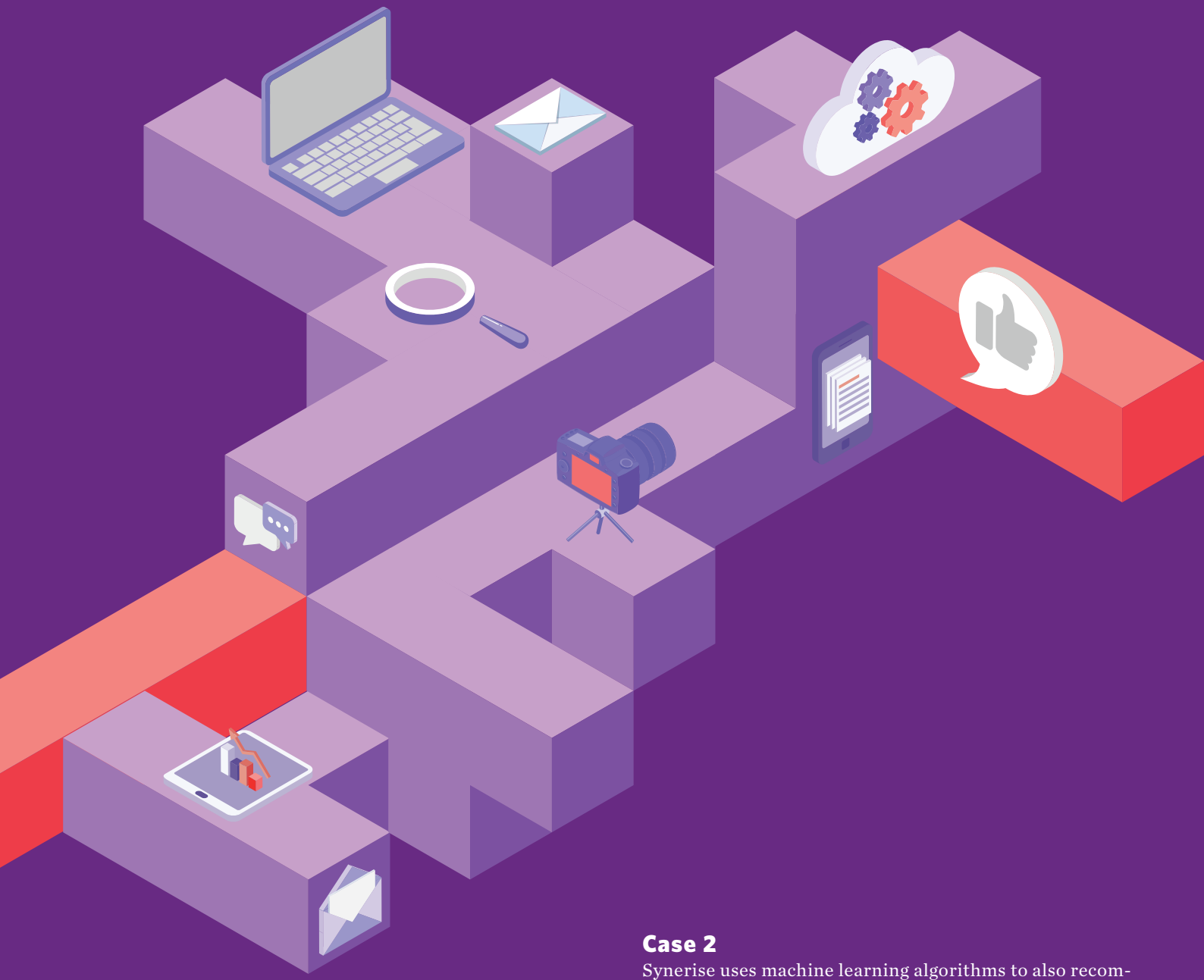
The programme analyses real user behaviour, to target campaigns according to more elaborate factors than traditional categories based on age, gender and place of residence, which are too broad and ineffective when compared to current analytical possibilities.

Algorithms create their own client categories and signal new links. It turns out that consumers who buy ecological bananas display different consumption behaviours than those who buy regular fruit. So in order to optimise the sales of bio bananas, these consumers should be classified in a separate product category.

By running self-learning algorithms on historical and current data of millions of consumers, we are able to predict – with high probability – what and when a given consumer will need and reach out to them with an adequate offer.

The clients of Synerise have diverse objectives: they want to lower the costs of marketing, target their spending on promotions more accurately, increase the average cart value, improve customer loyalty, or convince consumers to buy another brand (perhaps due to a change of vendor).

As to the use of big data and AI, the trade industry holds immense potential due to the numerous and dynamic interactions between products and customers. The algorithms have a lot of data to work with, which can translate into sales benefits.



Case 1

The company has carried out an analysis of the effectiveness of marketing channels, loyalty programmes and price promotions, as well as traditional and online sales, for a supermarket from the FMCG sector. In total, consumer purchase history corresponded to 250 million carts. It turned out that the popularity of conventional forms of marketing, such as supermarket flyers, has dropped by 40% in the last 5 years.

A decision was made to personalise the newsletter. On the basis of input data from the loyalty programme, the team used neural network algorithms to analyse the shopping preferences of individual consumers. The personalised newsletter was sent by e-mail and through a mobile app.

ADVANTAGES

- **CTR factor increased by 82%** (Click Through Rate which refers to the number of clicks compared with the number of messages sent in the campaign)
- Conversion increased by 30% (the number of transactions vs the number of user visits)
- The average cart value increased by 22%

Case 2

Synerise uses machine learning algorithms to also recommend products to customers on internet store websites. A client from the e-commerce industry wanted to increase their income, lower the costs of remarketing and improve website navigation. AI analysed online behaviour (visits to the website, product searches), customer transaction data and data from the mobile app.

As a result, it was possible to follow individual customers in real time, to know their stage within the purchase pathway, the products they viewed recently, products added to cart, as well as the time of purchase and the purchased goods.

Afterwards, the recommendation system suggested products to the customer:

- on the basis of their preferences,
- alternative products, e.g. of other brands,
- complementing products (e.g. a floor cleaning detergent for a person who bought a mop).

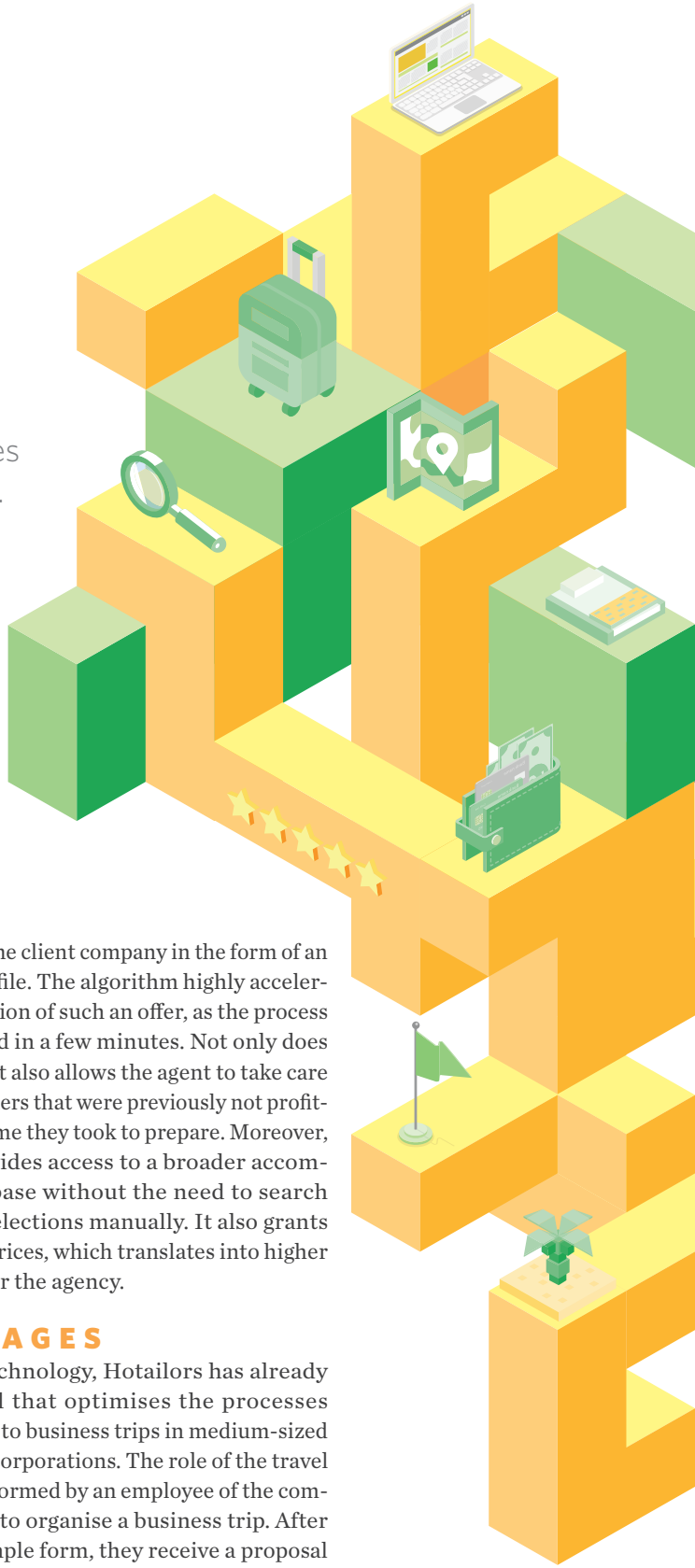
ADVANTAGES

- As a result, net revenue increased by 12%,
- the number of products viewed by the users during a single session increased by 83%,
- and the average cart value by 8%

AI Supporting a Travel Agent

Hotailors

A travel agent needs at least 45 minutes to select suitable venues and prepare an offer for a company. The AI agent can outrun him.



When a commercial travel agency receives a request to prepare a business trip offer, for example to a conference abroad, they start to search through the databases of their vendors. This system can be compared to services like Booking.com, but for the B2B sector. Such vendors buy a large amount of hotel room bookings with a single transaction – at a cost that is much lower than the market rate due to scale – and offer a variety of options to the commercial travel agent.

The agent has to juggle several factors when choosing a hotel. The perfect selection should be a convenient distance from the conference centre, at a good price and high quality, and with adequate number of single or double rooms, among various additional parameters. The selection of adequate facilities and the preparation for one offer for the client company can take about 45 minutes of the agent's work, often even longer.

This process has been improved thanks to the solution devised by Hotailors.com. This company is connected to significantly more vendors than a single agency, and instead of manually searching through a few databases, the search is performed by a self-learning algorithm that scores each hotel facility according to the indicated criteria. AI takes into account all the indicated conditions, and also the hotel star rating and customer reviews, as well as some other factors. It uses several dozen sources and weighted values. Afterwards, it presents the 15 best results from which the agent can quickly choose the optimal facilities, according to their client's needs. Additional information is included on the price of the same room on sites like Booking or Trivago to insure that the travel agency offer is either cheaper or only slightly more expensive, and convince the customer that the service is worth paying for. The algorithm learns based on the agent's choices, and the future rating of hotels chosen by people is raised accordingly. After the agent selects the hotels, the system automatically generates an offer for the client company in the form of an e-mail and a pdf file. The algorithm highly accelerates the preparation of such an offer, as the process can be completed in a few minutes. Not only does it save time, but it also allows the agent to take care of low-budget orders that were previously not profitable due to the time they took to prepare. Moreover, the system provides access to a broader accommodation database without the need to search through more selections manually. It also grants access to lower prices, which translates into higher profit margins for the agency.

ADVANTAGES

Using this technology, Hotailors has already launched a tool that optimises the processes and costs related to business trips in medium-sized enterprises and corporations. The role of the travel agent can be performed by an employee of the company that needs to organise a business trip. After completing a simple form, they receive a proposal of several hotels and the most convenient flights or land transport options (trains and coaches). When the options are finalized, the system automatically sends a confirmation request to the supervisor, and after approval is granted, the booking is done automatically. All the operations are cashless, and the corporation receives one invoice for all the employee trips in a given period, for instance once per month.

Visual Quality Control for the Industrial Sector

Future Processing

One of the most important applications of machine learning algorithms is in image recognition. These algorithms can be successfully applied in the manufacturing process of visual quality control.

It is the last stage of every production process in a factory. Until recently, a group of employees had to detect and manually remove defective products from the conveyor belt. Later, engineered vision systems appeared, made of cameras and complex algorithm sequences. These early models required explicit instructions to spot defects, that is, the machine needed an exact description of every possible product defect in order to be effective. It was necessary to define dozens of parameters and carry out tedious adjustments. And even with all that effort, those systems were not able to efficiently recognize all the defects of certain products, such as solar panels.

The most important solutions in this respect consist of systems based on machine learning. A large company from Gliwice, Future Processing, offers this kind of software. The programme analyses images from a camera installed above the production line and recognizes products that should be rejected. Self-learning algorithms are applied in two ways. After seeing a certain number of correct and defective products, with the places of defects clearly marked, the machine is able to learn to distinguish them and to recognize defects even if they are not exactly the same as the ones it saw during training. The second method consists in showing correct products to artificial intelligence and requesting it to point out divergences from the norm. The latter is more complicated from the technological point of view but can be used in situations when exact product defects are hard to define.

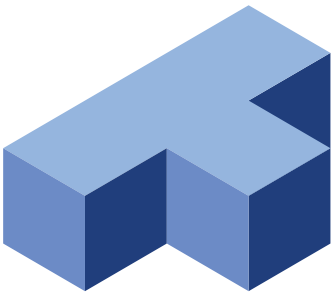
The list of products whose quality can be controlled by self-learning vision systems is practically unlimited. Future Processing is able to recognize deficient upholstery, textiles, mobile phone subcomponents, or even the wrong layout of boxed sushi, among other things.

The company from Gliwice has already sold 30 licences for their new module to create self-learning vision systems, mostly in Japan, China, South Korea and Germany.

ADVANTAGES

These newest generation systems not only allow for the potential reduction of quality control staff but are also more effective. Their implementation timeline is much shorter than those of the previous generation, and it takes less time to adjust the quality control system to changes in production. Consumers are not aware that the products they buy every day undergo so many changes: different raw materials, new vendors, production process improvement or modifications of other production parameters that in traditional systems would require a tedious adjustment of settings, virtually from scratch.

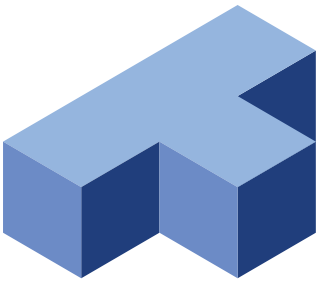
economy



How does artificial intelligence stimulate economy?

The term "artificial intelligence" (AI) has been in use since 1956, but only in the last decade did it started to operate in the everyday economy and not only in literature. According to *Artificial Intelligence Index 2017* (Shoham et al. 2017), the notion of artificial intelligence was mentioned in almost 20,000 scientific papers per year, i.e. nine times more frequently than 20 years ago. In spite of that, it is still not entirely clear what AI refers to. According to the strictest Turing test (1995), a truly intelligent machine should be indistinguishable from humans in a test of questions and answers. However, most computers that are being referred to as having artificial intelligence have not passed that test and are not even developed with the goal of passing it in mind. Therefore, nowadays, artificial intelligence is divided into weak and strong AI (Chen et al. 2016).

Weak AI refers to tools based **mainly on self-learning (machine learning) and optimisation algorithms** that are able to automate simple processes and facilitate decision making. In turn, strong AI refers to robots or complex software using many auxiliary applications with near human cognitive capabilities: they recognize voice, analyse images and texts and they are able to suggest decisions or article content on that basis. Weak and strong AI are, of course, overlapping categories because most applications fall somewhere in between the two poles described above and make use of a growing number of automation tools and ever more complex processes. Strong AI has not gone beyond the experimental phase and is rarely used by companies or consumers; only certain elements of strong AI have entered into mass use thanks to the constant development of SaaS (Software--as-a-Service) applications. The functions of such cloud-based software are made available to customers as a service, for a specific time defined in the contract, similar to delegated employees.



There are various forms of artificial intelligence, many different business applications, and, as a result, many mechanisms through which AI development impacts the economy and company profitability. From the macroeconomic point of view, we can distinguish three main mechanisms in which AI can boost the economic potential of a country.

MORE EFFECTIVE WORKFORCE ALLOCATION

The most important and widespread AI application is company process automation. Tasks that used to be carried out by one or many employees, and took a lot of time, can be carried out much faster with very little human intervention or none at all, thanks to AI. This refers to a wide range of processes, from simple bookkeeping, through warehouse stock analysis and logistics management, and ending with the monitoring of people and machines to optimise the use of resources.

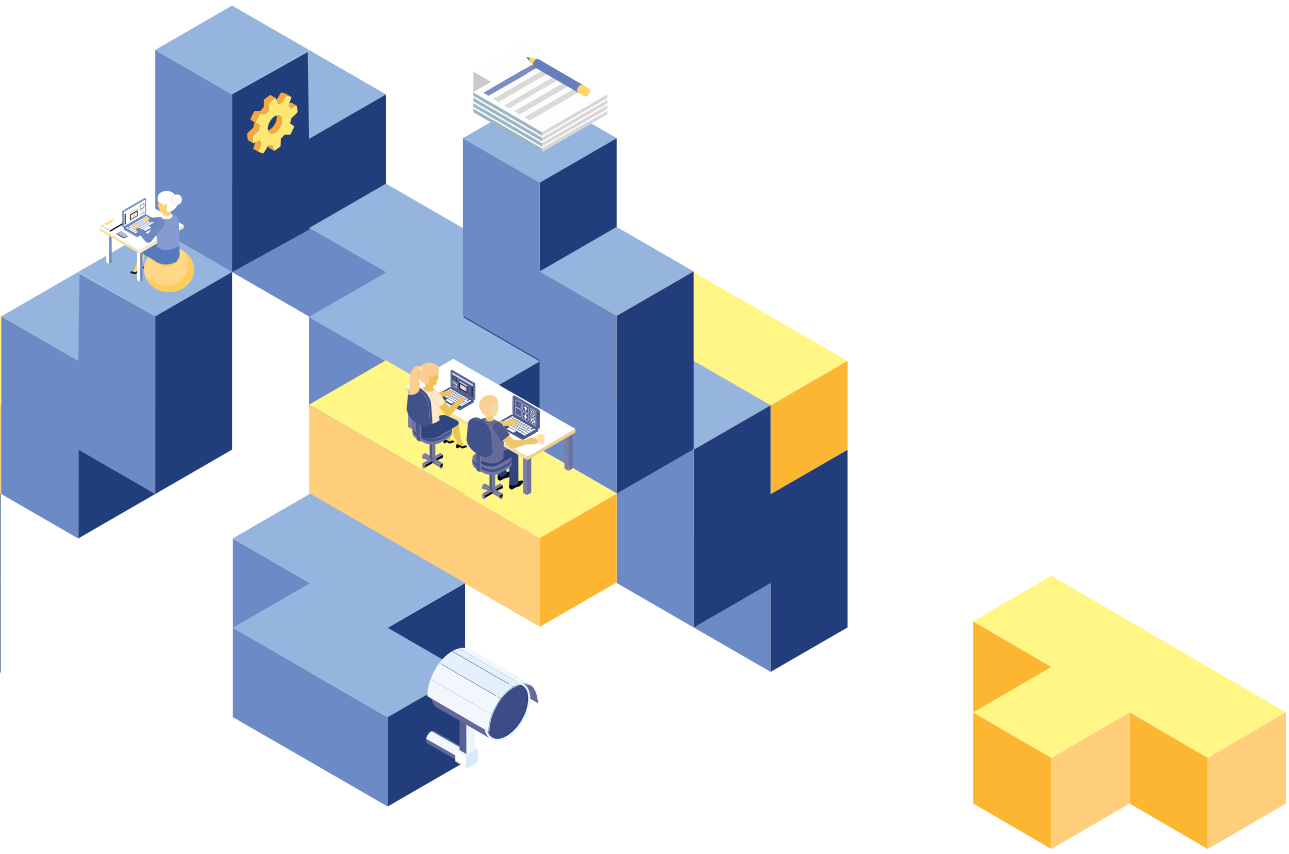
Contrary to common belief, process automation does not mean that people get replaced by machines, but rather allows people to work more efficiently, especially considering how hard it is to find well-qualified staff in many highly developed countries. People who used to waste time on repetitive, menial tasks that did not require creative thinking, can dedicate themselves to other, more demanding – and better remunerated – tasks. The examples described further in the report cofirm that thanks to the application of AI, hotel staff can dedicate more time to contacts with guests, thus increasing their satisfaction related to staying in the hotel.

In other words, by using automated processes, artificial intelligence helps to reallocate human resources to tasks that are more effective and generate more income. What is more, process automation allows for the creation of new jobs or even new professions that used to be too costly – for example, a job for a travel agent who processes low-budget orders from small and medium enterprises.

INCREASED EMPLOYEE EFFICIENCY

Another mechanism allowing artificial intelligence to boost the economy consists in helping employees perform their usual tasks more efficiently. Within this mechanism, employees are not reallocated to other tasks and the process does not entail creating new jobs, while eliminating others; the same people simply do their job in a more productive way. For instance, finance or travel agents can contact more customers in the same amount of time, but pay greater attention to identifying their needs, while tax clerks don't waste time auditing random companies that – in most cases – do not break the law.

Thanks to AI, employees can use their working time for strategic thinking or to get more involved in "soft" tasks requiring interpersonal or management skills. For example, the use of intelligent, virtual assistants reduces the time that sales representatives spend on preparing contracts, updating calendars, or writing notes from meetings. Instead, they can concentrate on contact with customers and providing them with reliable information about the products on offer. In turn, thanks to the fact that intelligent systems can monitor machine operation and human work, mechanical engineers can dedicate themselves to the most important tasks that can disrupt production or service provision.



LOWERING THE COSTS OF CAPITAL ACCUMULATION

A factor linked to the use of AI that often goes unnoticed from the macroeconomic point of view, is the reduction of the capital consumption rate, i.e. amortization. Thanks to the possibility of monitoring machines to a degree that would be impossible to achieve by normal mechanical engingeers, failures can be predicted in advance, which eliminates downtime and major damages. For example, timely replacement of a worn-out bearing can save the engine from thermal failure. As a result, companies spend less money on capital recovery, increasing the potential of new investments.

The amortization scale effect does not only refer to fixed assets. Movable assets and especially reserves can also be used in a more effective manner, reducing the costs related to the loss of value. Optimal management of warehouse stock with the use of artificial intelligence reduces the costs related to the loss of fast moving goods such as food that can expire or medicines that can be withdrawn from circulation or electronic equipment that becomes obsolete.

Cloud-based AI solutions can lower the costs of new investments significantly. Machines can learn by using data from numerous users, and software of this kind is much cheaper. Machines that learn only in closed environments require the purchase or costly input of large amounts of data, but even in those cases they will not be able to achieve the same level of proficiency as cloud-based solutions, operating for many users at the same time. As a result, cloud development causes software prices to go down, which lowers the costs of capital and reduces amortization rates. Even if one of the clients does not use the machine, it is still constantly updated when working for other clients.

To sum up, artificial intelligence can boost economic potential by **process automation** that permits the reallocation of employees to more profitable tasks; by increasing the efficiency of employees who cannot be replaced, by supporting them in routine, time-consuming tasks; and by reducing the costs of capital, which increases the volume of investment in the economy. The last mechanism is especially important for countries with low capital reserves (savings) because it increases access to cutting-edge technologies for those companies that cannot afford to develop applications created exclusively for them. As a result, countries such as Poland can increase the rate of investment and boost their economic potential.

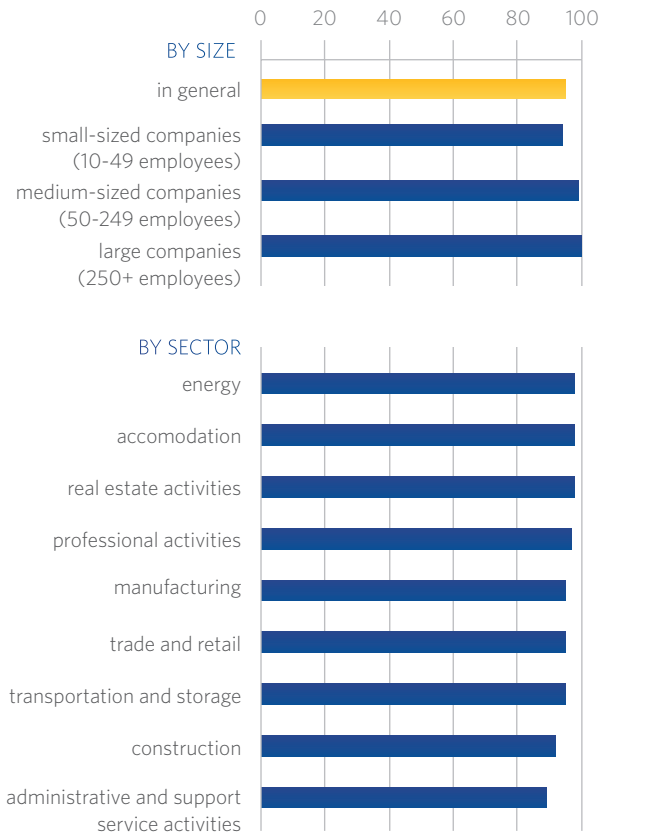
To what degree do Polish companies use artificial intelligence?

Polish companies have very good access to information and communications technology (ICT) infrastructure, on par with most developed countries, including access to computers and the broadband internet necessary to implement AI solutions. In 2017, 95% of Polish companies had access to the Internet and this ratio has been stable since the beginning of the decade. For the sake of comparison, the EU average amounted to 97%, and 98% in the eurozone; while the latter was constantly growing, and at the beginning of the decade the average access in that group was lower than in Poland. What is more, as much as 78% of companies provided their employees with remote access to their business e-mail and documents, while the average in the eurozone was only 59%.

Apart from the ICT industry, the highest percentage of companies with Internet access – reaching 98% – was found in accomodation, real estate and energy industries. One of the lowest shares was registered in companies from the construction and retail sales sectors. Similar to other European countries, access to the ICT infrastructure is more frequent in larger companies, reaching 100% in firms with over 250 employees.

In spite of universal access to the internet, Polish companies are using only a tiny fraction of the potential offered by ICT infrastructure, especially access to artificial intelligence. The degree to which Polish businesses are making use of AI potential can be analysed in four dimensions: software supporting customer relations (CRM), enterprise resource planning (ERP), cloud computing and big data. In each of these four branches, Polish companies fall short of their EU counterparts, but have been quickly closing the technological gap in the recent years.

SHARE OF POLISH NON-FINANCIAL COMPANIES WITH ACCESS TO THE INTERNET IN 2017 (%)

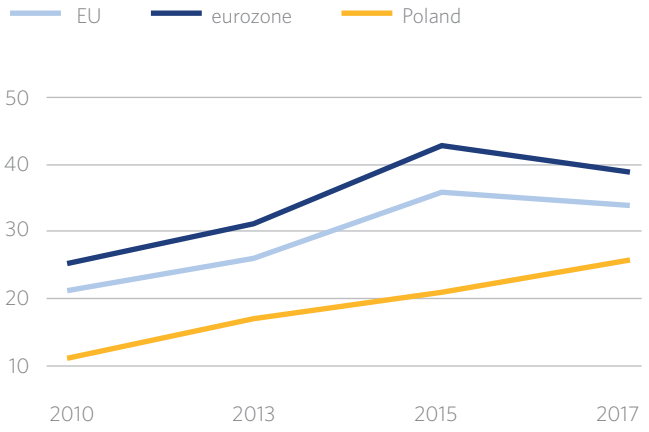


Source: Eurostat

USE OF AI IN ENTERPRISE RESOURCE PLANNING

The share of Polish companies using applications, including cloud-based solutions, to manage their resources, such as inventory, machines, cars, production materials or even ready goods, is sytematically growing. In 2017, 26% of Polish enterprises were using this kind of software, while at the beginning of the decade only 11% were. Nonetheless, as to the use of ERP applications, Poland remains far behind not only the eurozone, but also other countries from the region, as one-third of firms in the EU use tools of this kind. It is worth noting that the technological gap between Polish and EU companies is consistently getting smaller, due to both the faster digitalization of Polish enterprises and the temporary saturation of eurozone companies with ERP solutions.

SHARE OF NON-FINANCIAL COMPANIES USING ERP SOFTWARE BETWEEN 2010-2017 (%)



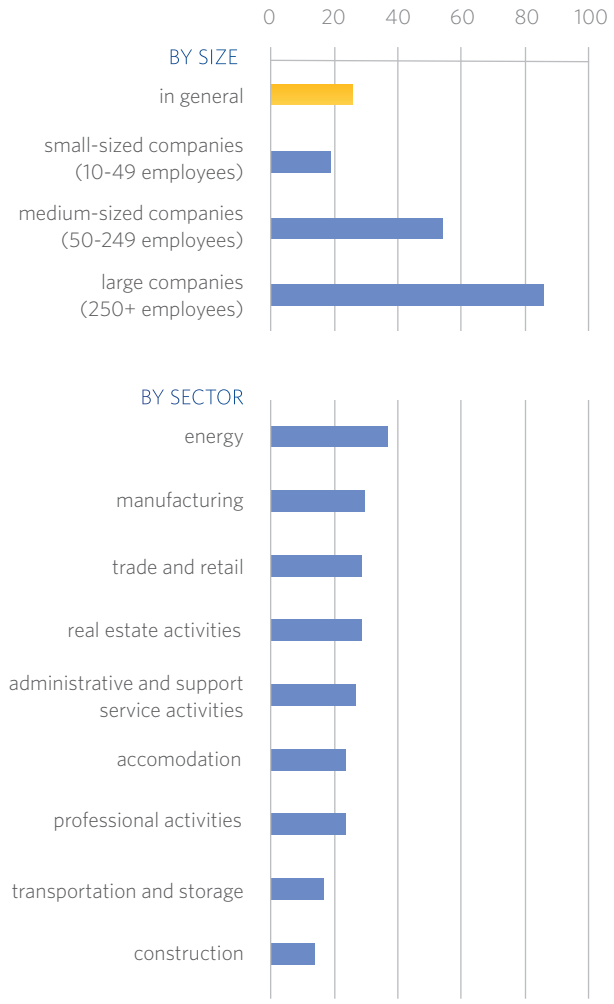
Source: Eurostat

In Poland, ERP applications are usually used by large industrial companies, especially from the energy industry. This results from the large turnover of materials and goods in companies of this kind, which translates into large benefits of AI applications that optimise inventory statuses and merchandise distribution. Similar applications are also typical for companies from Western Europe. For obvious reasons, very few construction companies make use of ERP applications, but it is surprising to see that the use of ERP in logistics is also relatively low. This might result from the fact that their stock statuses and shipments depend on their customers and, as a result, transport companies or warehousing companies themselves do not have much opportunity for resource optimisation.

USE OF AI IN CUSTOMER RELATIONSHIP MANAGEMENT

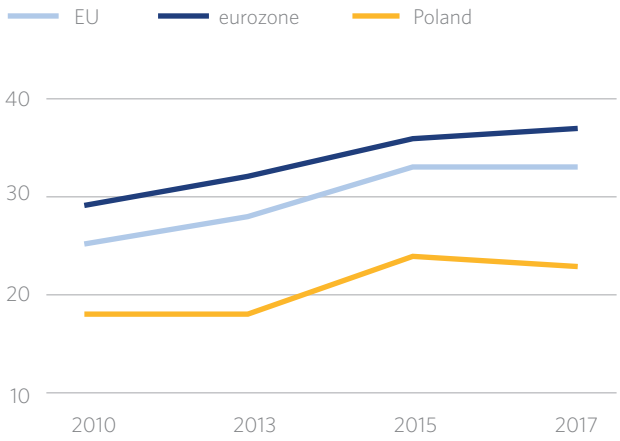
The second most popular group of AI-supported applications used by Polish companies, is CRM software – from simple tools to analyse customer databases and send newsletters, to advanced tools helping sales representatives to find new clients and stay in touch with them. These kind of applications are used by 23% of Polish enterprises, most of which (16%) are only for marketing purposes. Polish companies are also less digitalized than those from other EU countries. In the eurozone, 37% of companies use CRM applications, while the average for the entire EU is 33%.

SHARE OF NON-FINANCIAL POLISH COMPANIES USING ERP SOFTWARE IN 2017 (%)



Source: Eurostat

SHARE OF NON-FINANCIAL COMPANIES USING CRM SOFTWARE (%)



Source: Eurostat

Due to the character of their business, CRM applications are used most frequently in the accomodation industry, where more than a third of companies use this kind of AI technology. Usually, they use them for marketing purposes. In the energy industry, CRM applications are almost equally popular. They are used in three out of every ten companies, but instead of marketing purposes, they are usually used to manage deliveries and set prices.

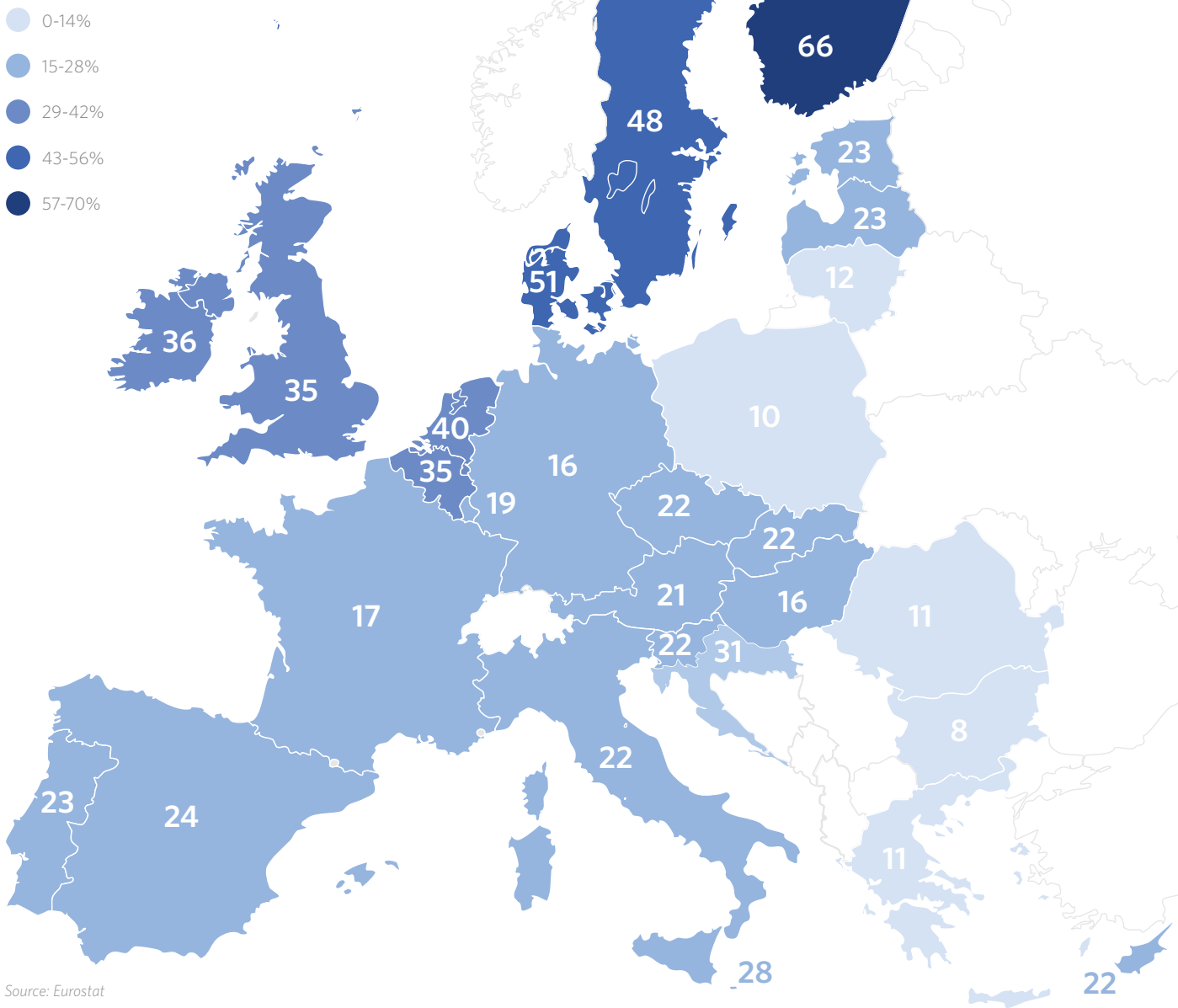
On the other hand, CRM solutions are very rare in the construction and logistics industries. They are used in less than one-fifth of the firms, mostly due to the low demand for CRM process optimisation in these sectors. This results from the structure of those two

markets, because customers tend to search for the best entity to carry out their investment project or ship their goods. As a result, these companies do not need to manage a large database of potential customers. It looks similar in the real estate industry, but in this case, only the percentage of companies using CRM for marketing purposes is low. Almost one-fifth of companies providing security or cleaning services have CRM applications at their disposal, to manage incoming orders.

USAGE OF CLOUD-BASED SOFTWARE

The use of the cloud in business in Poland is the second lowest in the entire EU, immediately after Bulgaria. Only one in ten Polish enterprises have bought access to the cloud and cloud-based applications in the previous year.

SHARE OF NON-FINANCIAL COMPANIES USING CLOUD COMPUTING IN THE EU

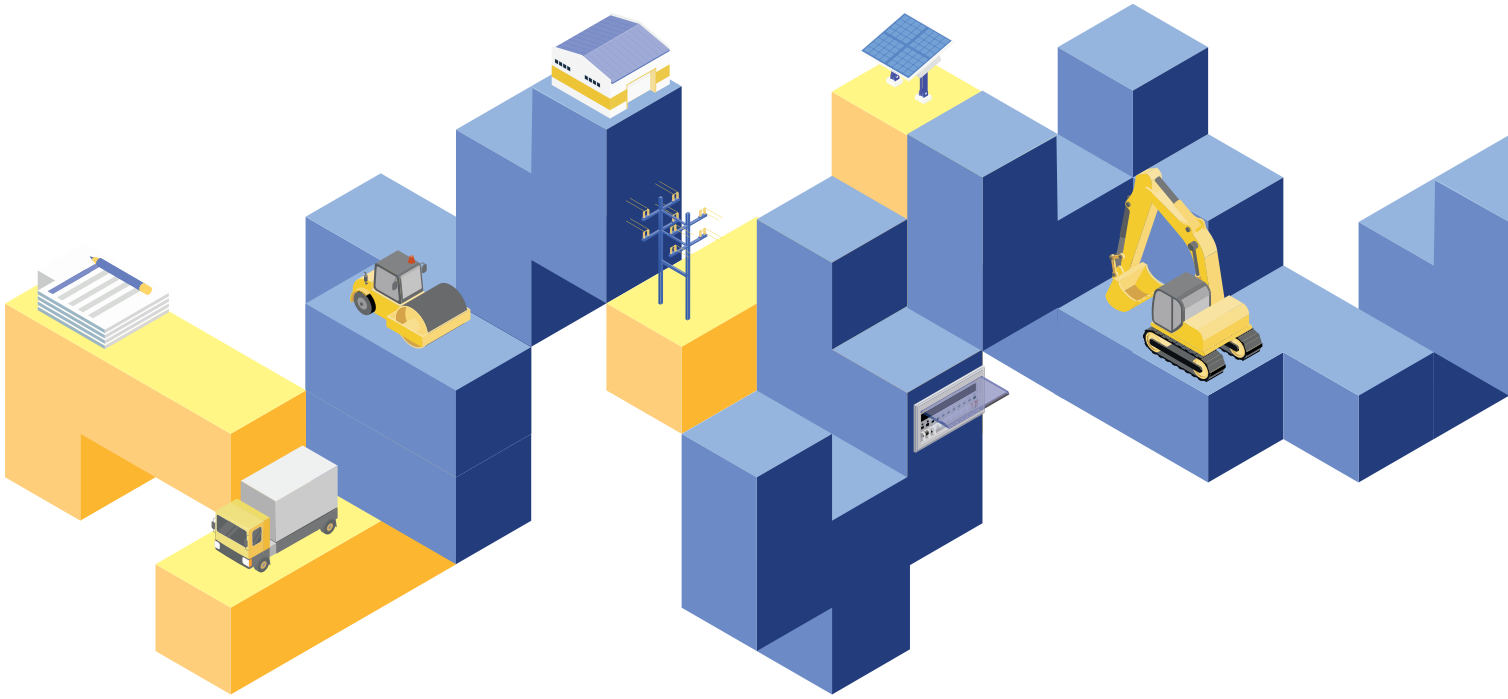


Source: Eurostat

Nonetheless, this percentage is systematically growing: 6% in 2014, 7% one year later and 8% in 2016. Most companies that buy this kind of solution (79%) use simple cloud-based functions, such as e-mail and data storage space (63%). A little less than a half of them (45%) also pay for access to at least one AI application, such as CRM or programmes for accounting. As a result, only 4% of Polish firms make use of the most efficient artificial intelligence: the cloud-based one.

POLISH NON-FINANCIAL COMPANIES USING CLOUD TECHNOLOGY IN 2017

COMPANIES BY SIZE	**SHARE OF COMPANIES USING CLOUD**	E-MAIL	OFFICE SUPPORT SOFTWARE	HOSTING
in general	**10%**	**70%**	**43%**	**43%**
small-sized companies (10-49 employees)	**8%**	68%	42%	42%
medium-sized companies (50-249 employees)	**17%**	71%	42%	45%
large companies (250+ employees)	**37%**	77%	50%	47%
COMPANIES BY SECTORS				
professional activities	**19%**	66%	38%	52%
energy	**13%**	80%	42%	40%
administrative and support service activities	**13%**	79%	47%	47%
accomodation	**12%**	64%	40%	41%
trade and retail	**10%**	68%	41%	42%
real estate activities	**10%**	88%	36%	49%
transportation and storage	**9%**	65%	41%	37%
manufacturing	**8%**	71%	42%	37%
construction	**5%**	69%	40%	41%



FILE STORAGE	ACCOUNTING AND FINANCE SOFTWARE	CRM SOFTWARE	COMPUTING POWER OF IN-HOUSE SOFTWARE	COMPANIES BY SIZE
63%	**27%**	**24%**	**20%**	**in general**
62%	29%	24%	20%	small-sized companies (10-49 employees)
63%	24%	23%	16%	medium-sized companies (50-249 employees)
70%	22%	25%	27%	large companies (250+ employees)
				COMPANIES BY SECTORS
70%	23%	33%	24%	professional activities
58%	19%	8%	7%	energy
74%	41%	39%	36%	administrative and support service activities
61%	36%	24%	11%	accomodation
65%	25%	26%	18%	trade and retail
56%	25%	13%	20%	real estate activities
45%	35%	13%	15%	transportation and storage
60%	26%	18%	16%	manufacturing
50%	41%	19%	12%	construction

Source: Eurostat

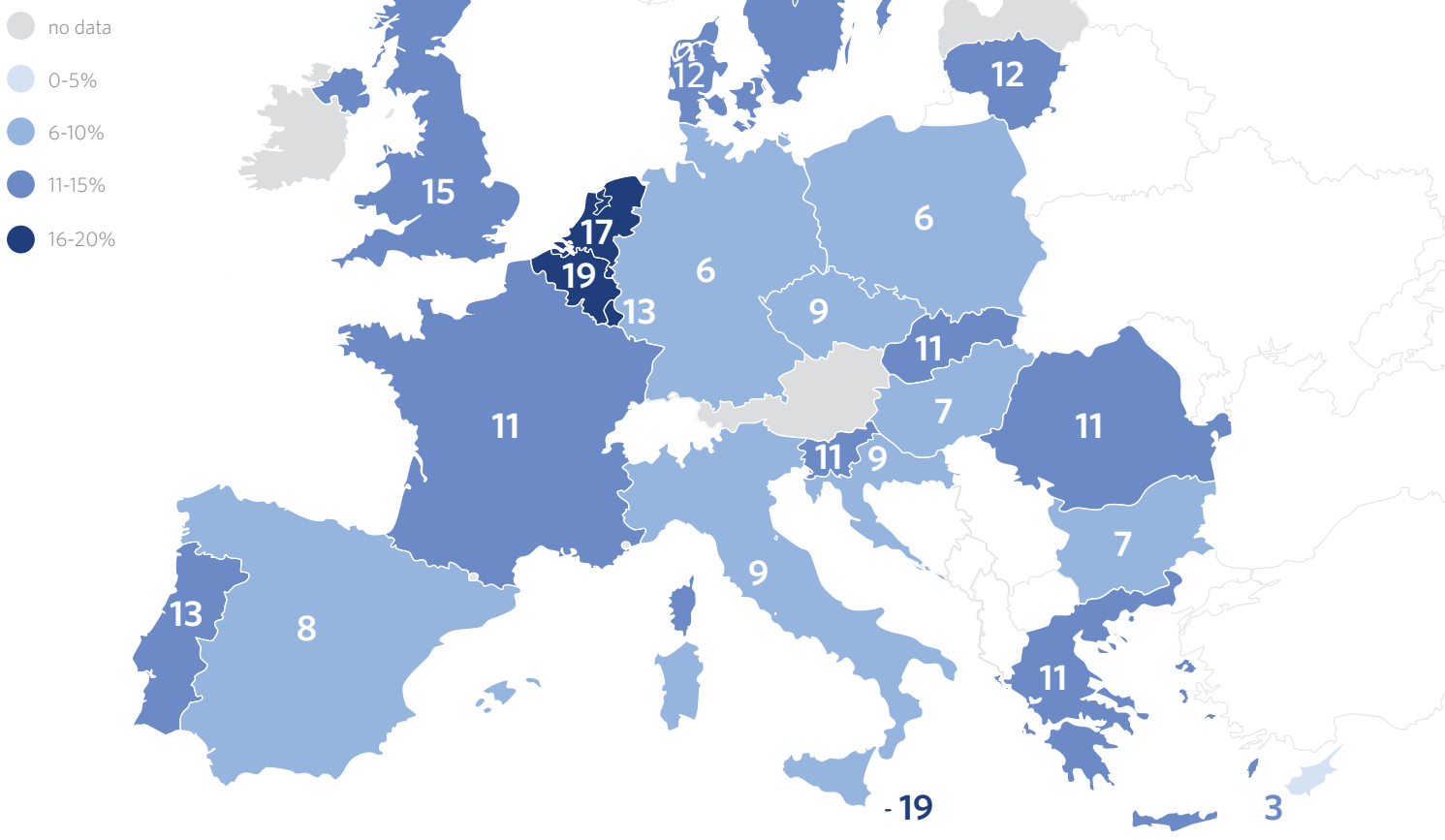
The cloud is usually used by companies who provide professional business services: consulting, legal, accounting and other specialised services. Almost one in five companies from this sector make use of the cloud, and over a half of them has access to the most advanced solutions offered by Internet platforms. On the other hand, in the second most digitalized sector, energy, where 13% companies declare cloud access, companies use the cloud mostly for simple internet applications such as e-mail and storage space. Only one in four energy companies that have access to the cloud have bought AI applications, which is the lowest share out of all the sectors.

The construction industry is also interesting. Although the share of companies using the cloud is low (5% of the entire industry), the ones who do opt for the most advanced AI solutions to support their accounting department, customer relations or business management, e.g. by monitoring the degree of usage of construction equipment. The retail industry presents a very similar profile – if AI is used, usually businesses go for the most advanced applications.

BUSINESS ANALYSIS ON BIG DATA SETS

Although the topic of big data is very popular in the public discourse concerning new technologies and artificial intelligence applications, it is still very rare to find a Polish company that uses big data analysis. Research shows that big data is used by only 6% of Polish enterprises, the second to last result in the EU, just before Cyprus, and only a half of the eurozone average. As a result, this application of artificial intelligence

SHARE OF NON-FINANCIAL COMPANIES USING BIG DATA IN THE EU



Source: Eurostat

is the least popular among Polish companies. Interestingly, big data applications are equally rare in Germany, where only 6% of businesses use this kind of analysis.

Energy and – oddly enough – logistics, are the leading Polish sectors as far as big data usage is concerned, which might be surprising considering that they are usually lagging behind the rest in the remaining AI applications under analysis. This phenomenon can be explained if we look at big data statistics, taking into account the type of data set under analysis: as much as 94% of logistic companies analyse big sets if geolocation data providing information on the locations of trucks or goods and thus optimizing transport of products and materials. In turn, the energy industry quite often uses big data analyses other than geolocation data sets and namely internal data, such as parameters from sensors monitoring the operation of power blocks (in half of the energy companies that use big data analysis).

USAGE OF BIG DATA IN THE POLISH NON-FINANCIAL COMPANIES IN 2016

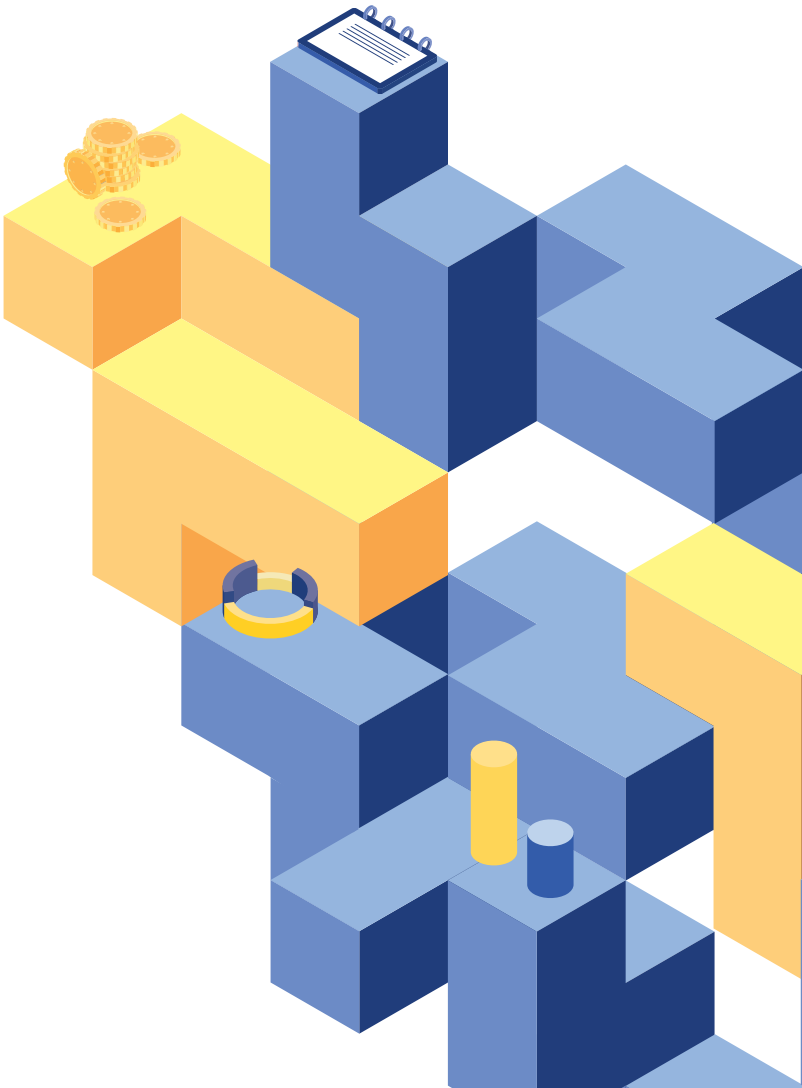
COMPANIES BY SIZE	**SHARE OF COMPANIES USING BIG DATA**	INTERNAL DATA (INCLUDING SENORS)	GEOLOCATION DATA (PORTABLE DEVICES)	SOCIAL MEDIA	OTHER
in general	**6%**	**30%**	**67%**	**36%**	**4%**
small-sized companies (10-49 employees)	**5%**	21%	70%	38%	3%
medium-sized companies (50-249 employees)	**8%**	45%	62%	31%	5%
large companies (250+ employees)	**18%**	60%	56%	27%	8%
COMPANIES BY SECTORS					
energy	**13%**	50%	82%	3%	6%
transportation and storage	**10%**	20%	94%	5%	0%
administrative and support service activities	**8%**	42%	74%	38%	10%
accomodation	**6%**	16%	26%	84%	0%
manufacturing	**5%**	43%	63%	32%	3%
construction	**5%**	5%	85%	20%	2%
trade and retail	**5%**	26%	55%	54%	4%
real estate activities	**4%**	71%	36%	32%	1%
professional activities	**4%**	20%	70%	40%	2%

Source: Eurostat

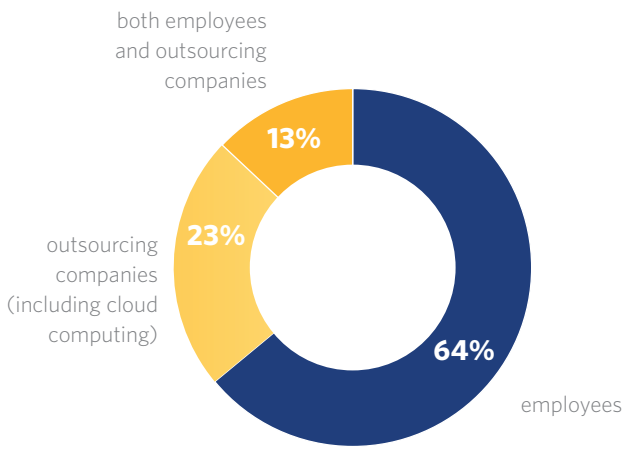
The third industry as far as big data analysis is concerned is the administration sector and companies providing other auxiliary services, who are not very likely to use AI-based solutions. However, when they do use data analysis, it is for unusual data sets: either internal or external, with unique characteristics (tax data or third company registers). As much as one in ten companies in this sector use unusual big data sets in their analyses. The hospitality industry is another interesting, although a bit less surprising case. Hospitality companies are the most likely, out of all businesses, to analyse information from social media. The results of those analyses are used by them for marketing purposes and to improve customer acquisition.

To conclude, it is worth mentioning that Polish enterprises are not eager to use big data analyses carried out by external entities, including cloud-based services (SaaS). Two-thirds of Polish companies carry out big data analyses on their own, and only 36% of them outsource this kind of services. This is due, on the one hand, to low awareness of this possibility, and on the other hand, to the fact that such analysis is often carried out on internal data sets that are not willingly disclosed to third parties.

In-house data analysis is often carried out by energy companies, as well as businesses from the retail and wholesale sectors. On the other hand, hospitality and real estate firms tend to outsource these services. In this case, usually small or medium enterprises outsource because they cannot afford to hire employees who can perform such a task. What is more, these kinds of enterprises tend to benefit the most from cloud-base data analysis applications, because they do not have enough own resources for effective machine-learning.



WHO ANALYSED BIG DATA FOR THE POLISH NON-FINANCIAL COMPANIES IN 2016



Source: Eurostat

What is the impact of artificial intelligence on the Polish economy?

No research has been carried out to date concerning the economic impact of artificial intelligence. On the other hand, a series of studies have been carried out to measure the expected economic impact of AI globally (Chen et al. 2016) and within selected highly developed economies (Purdy, Daugherty 2017). However, the results of those studies were not definitive, as they presented the scale of possible AI impact on GDP quite roughly. According to Chen et al. (2016), the use of AI in business within the next decade will probably increase global income by USD 1.49-2.95 trillion, but the actual economic effect can exceed even this broad range.

The assessment of the scale of AI's economic impact poses two kinds of problems. First of all, we have very little data on the scale of use of AI by businesses. What is more, economists find it difficult to translate this scarce data set into the economic indices that they use on a daily basis, because they are from a completely different order. As a result, Purdy and Daugherty (2017) have even postulated that artificial intelligence should be considered as the third factor of production, next to capital and work. But even this approach generates more questions than answers, because adding a third factor of production is not easily feasible in the macroeconomic models used nowadays.

Secondly, even if we managed to achieve reliable data on the scale of use of artificial intelligence, we would still lack information on the degree of AI's impact on the productivity of companies, rentability of invested capital or work performance. To obtain credible predictions, we would need to make estimations within a long timeframe. For this reason, Chen et al. (2016) used existing studies related to the effects of introduction of previous technological innovations – broadband internet, mobile phones and industry robotization – in order to assess the future impact of AI on economy.

On the basis of the above, it can be concluded that predicting the influence of artificial intelligence on Polish economy is practically impossible at this moment, due to the lack of data and former studies that we could base such an assessment upon. Nonetheless, it is possible to make qualitative predictions concerning the influence of AI on GDP, using information concerning the use of various ICT technologies by Polish companies.

Compared to Western Europe, Poland is still lagging behind in the application of new technologies, especially artificial intelligence. This kind of solution is used by no more than 10% of Polish enterprises from non-financial industries, and after taking into account such sectors as agriculture, education or healthcare, and especially the self-employed – where the use of AI is negligible – the scale of use of artificial intelligence for the optimization of economic processes in Poland would not exceed 4% of total economic activities.

If we assume the optimistic viewpoint of Purdy and Doughertym (2017) that the use of artificial intelligence raises work efficiency by 11-37%, we could estimate the scale of additional AI-related benefits for Polish companies at the level of PLN 10-20 bln, i.e. no more than 1% of the potential GDP. However, these calculations should be treated very carefully, due to the many assumptions made to perform the calculations, as well as the inherently imperfect nature of data gathered through surveys, which have been used by Eurostat to assess the scale of ICT solutions in Polish companies.

In spite of the fact that the scale of influence of artificial intelligence on the potential of Polish economy is small, it should be noted that the dynamic increase of the number of companies using AI solutions in the last two years had a significant impact on GDP dynamics. Therefore, it can be assessed that the input of AI proliferation into the economic growth amounted to 0.1-0.2% in the recent years, and will continue to grow, becoming one of the motors for further potential growth, especially in view of the decreasing labour force and generally low investment activity of enterprises.

PLN 10-20 bn

estimated value added of AI application in the Polish companies

regu
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Legislative challenges related to AI

One of the first proposals to regulate the operating principles behind AI was presented by I. Asimov in his science fiction book. In "Catch that Rabbit", a story from 1942, he formulated three fundamental principles:

1. A robot may not hurt a human being, or let a person suffer harm by failing to act.
2. The robot must obey the orders of humans, unless they are in conflict with the First Law.
3. The robot must protect itself, as long as this does not conflict with the First or Second Law.

Asimov's proposal focused on ethical issues, as did subsequent concepts of regulating human-robot relations. They were concerned with the treatment of robots as if members of human society.

However, with the increasing use of self-learning algorithms and the so-called "weak" AI in everyday life, as well as taking into account the first tragic consequences of AI use - the question of whether there is a need to enact new laws on AI is becoming more and more relevant. The application of AI affects a number of areas of law, such as:

- civil law - who is liable for any damage suffered because of AI
- criminal law - who is criminally liable for offences committed by AI, if indeed it is possible to speak in terms a criminal offence,
- protection of personal data - which personal data should AI be allowed to collect and analyse
- intellectual property law – the issue here is whether AI may be regarded as an author in terms of copyright and, if not, who would be the author of a work produced by AI.

The European Commission has recently published its communication on the "Artificial Intelligence for Europe", in which it proposes a consistent European approach to this matter and to making the best use of the opportunities offered by AI, while also addressing the challenges that are associated with this technology. The Commission proposes an approach based on three pillars: increasing public and private investment (for research and innovation in particular); preparation for socio-economic changes caused by Artificial Intelligence; providing the correct ethical and legal framework. In Poland, as in the rest of the EU, no legislative work has been undertaken to regulate this new area of law (some documents, such as the "Strategy for Responsible Development," have mentioned it). Poland is, nevertheless, the initiator of the Visegrad Group's latest position on AI and maximizing its benefits.

The absence of detailed legislative solutions does not mean that AI presently functions in isolation from any legal framework. More and more of the EU's legal texts affect the AI-based sector indirectly, for example the GDPR, the draft regulation on ePrivacy and the draft regulation on the framework for the free flow of non-personal data in the European Union. In an age of a data-driven economy, more and more emphasis is placed on the protection of the right to data privacy and the right to privacy of communication, while ensuring the effective use of data. These are obviously important and legitimate goals. Taking into consideration, however, previous experience of the over-regulation of new sectors and thus creating barriers to development, we must be particularly attentive to new regulations.

In this report, we would like to tackle one of the proposals currently being discussed at the European level, that is the draft ePrivacy regulation. According to this proposal, the requirements for the protection of the confidentiality of communication are to include not only traditional telephone calls and emails, but also more advanced e-mail services and VOIP communication. The development of the latter is mostly based on AI technology, as are most applications based on cloud computing. AI technologies are based on continuous communication and exchange of data which are constantly being transmitted. The amount of data processed is so vast that data and algorithms are located on external servers. That is so because the technologies require the considerable computing power available in the cloud (both centralised and distributed – so-called edge computing), where data processing requested by the end user takes place. This technological challenge makes it extremely important to prepare astute regulations that will protect privacy and the privacy of communication without blocking innovation. The example of the draft ePrivacy regulation shows that "the devil is in the detail" and the European legislator could quite accidentally block the development of one of the most promising technologies.

POTENTIAL EFFECTS OF THE E-PRIVACY REGULATION ON SECTORS BASED ON DIGITAL TECHNOLOGIES

In January, 2017, the European Commission published its draft regulation on "Respect for private life and the protection of personal data in electronic communications".

The new regulations are to strengthen the protection of privacy and the confidentiality of electronic communication in the light of technological and social changes and to replace the existing directive on the processing of personal data and the protection of privacy in the electronic communications sector. The privacy of communication is an important issue from the perspective of consumer protection and fundamental law, arising directly from the Charter of Fundamental Rights of the European Union (Article 7). However, as pointed out by the Court of Justice of the European Union in a judgment of 2008, this right is not absolute and should be protected while taking into account other rights, such as the freedom to conduct a business, security or freedom of education (Judgment C-275/06).

As mentioned at the outset, the ePrivacy regulation, like GDPR and the draft EU regulation on the framework for the free flow of non-personal data, will have a significant impact on the functioning of the new technology sector in Europe. Although at the moment it is difficult to determine what the consequences for business, citizens and administration of adopting the new law will be, we indicate the potential risks and legal challenges for the further development of industries based on digital technologies, especially AI. The debate on the challenges as well as the ways of addressing them is only just beginning and it is extremely important to avoid creating unnecessary barriers that will result in the halting of this sector.

FOUNDATIONS OF EPRIVACY

The basic principle of the ePrivacy Regulation, as well as the existing directive 2002/58 is to ensure the confidentiality of data coming from electronic communication, which involves, first and foremost, the prohibition of unauthorised interference, eavesdropping, storage or interception. This rule includes, for the first time, not only the protection of the privacy of electronic communication, but also extends to the processing of data deriving from this communication. Thus, the protection provided by the draft ePrivacy Regulation permeates the regulations regarding the protection of personal data, protected separately on the basis of Article 8 of the European Charter of Fundamental Rights and on the basis of Article 7 of the European Charter of Fundamental Rights, which has already been mentioned. Rights related to the protection of personal data and the processing of personal data itself have a crucial impact on innovation in the field of Artificial Intelligence. The draft legislation provides for a number of exceptions that allow access to and processing of data, but according to some representatives of the digital technology market these are far too narrow and subsequently inadequate as well as incompatible with the current development of the technology.

According to the ePrivacy Regulation, it is permissible in principle to process data from electronic communications, including metadata and the content of electronic communications (i.e. the voice, sound or the content of the message itself). In the course of work, the approach to the scope of data protected by the regulations has changed as a result of the practical difficulty of grasping the difference between protection against unauthorized processing of data in transit and those that are already in storage. At the same time, the provisions vary the level of protection depending on the nature of the data, so different exceptions apply to the processing of metadata and the content of electronic communications. The processing of electronic communications content is now more limited than of metadata. The noteworthy idea is to standardise these principles to ensure that the confidentiality of communications is protected equally for both content and metadata.

Each of the examples described in the first part of the report is based to a greater or lesser extent on the innovative processing or storage of data from electronic communications in order to support sales processes, health care, supply management or enterprise resource optimisation. This data is transmitted via electronic communication services and processed using algorithms and Artificial Intelligence.

LEGAL RISKS OF THE EPRIVACY REGULATION FOR THE INNOVATIVE SECTOR: LIMITATIONS ON PERMISSIBLE DATA PROCESSING

Although the list of situations in which data processing is acceptable was extended during the work on the Regulation, and the processing itself was specified as being data in course of transmission (although this proposal may also be withdrawn), the scope of acceptable data processing still seems to be inadequate for the needs of innovative and digital industries, especially AI. Particularly important in this context is the introduction of clear rules on data transmission, so that regulations related to the protection of personal data and the protection of confidentiality of communication do not overlap. The following examples illustrate how the proposed ePrivacy Regulation may adversely affect various technologies, especially when obtaining the user's consent as the only permitted way of processing data can prove difficult or impossible.

LEGAL RISKS OF THE EPRIVACY REGULATION - SELECTED CASE STUDIES

Information about cars (OBDII)

An interesting example in this area are all the services related to the processing and transmission of vehicle data to the end user (e.g. OBDII). In such situations, there is undoubtedly a transfer of data between the user's telephone and the device connected to the OBDII interface and it is unclear how consent for such data processing should be expressed. While in the case of the latest car models, which resemble modern smartphones in functionality, this can be relatively simpler by introducing appropriate approvals (although here too it is unclear who should give the consent, if the vehicle belongs to a legal person or is used by more than one person), in the case of older models of systems and vehicles, it is unclear how and in what form such consent should be expressed. It is also worth stressing that these data are in transmission practically all the time - from the moment the key is turned in the ignition.

Application of self-learning algorithms in industry - M2M communication

Self-learning algorithms in industry are based on communication between devices known as M2M, or the Internet of Things, where electronic communication networks are necessary for the efficient exchange of data. The ePrivacy Regulation may adversely affect business models that use such solutions because of:

- limitations in the processing of data originating from electronic communications apply equally to communication between terminal devices as to the interpersonal communication. Although the Regulation does not cover electronic communication in non-public networks, in the case of the cloud it is fully applicable. As a result, it is unclear who should consent to the processing of data derived from such communication;
- limitations to the freedom to conclude contracts between two entities conducting business in situations where there is no restriction of confidentiality of communication between individuals.

As a result, instead of supporting innovation and the development of such solutions, the Regulation may result in a regression in their application, in particular by creating difficulties in the use of technological solutions in which the analysis of data by an algorithm is done in the cloud and not in a closed network. A remedy for this problem may be to modify the provisions of the Regulation so as to strengthen and concentrate on the protection of the privacy of electronic communication itself.

Wearable medical devices

Because of imprecise definitions of data derived from electronic communications, it is not clear how to treat data from the wearable devices that are increasingly used in medicine or sports. Such data is not a text, voice, video recording, image or sound (see the definition of "electronic communication content"), and it would be hard to class them as "metadata from electronic communications", because they perform basic rather than additional

functions, that is to say they do not constitute content transmitted "using electronic communication services" as required by the definition. As a result, companies which provide services based on such wearable devices do not have legal certainty as to whether they are subject to the provisions of the Regulation in the first place, and consequently risk severe penalties for non-compliance.

The problem of defining entities that process data from electronic communications. The processing or storage of data from electronic communications is only possible by service providers and electronic communications networks, and reasonable doubts may arise therefore as to whether other types of businesses, in particular providing information society services, may process or store data from electronic communications. That is because such entities may be open to sanctions for non-compliance with the principle of confidentiality, as unauthorised entities. This issue certainly needs further clarification during further work on the legislation.

POSITIVE ASPECTS OF THE EPRIVACY REGULATION

The ePrivacy Regulation may also bring a number of benefits related to the protection of privacy of communication and one cannot speak negatively of all the solutions. There is no doubt that protecting the privacy of communication requires revision to take into account current and future technological development and to adapt the provisions to the new regulations included in the draft European Electronic Communications Code and GDPR. This is particularly important in communication, whether through traditional telephony or the so-called OTT (Over the Top) service providers, to ensure the confidentiality of communication between people on the one hand, and allow the use of solutions such as AI on the other. That is why the introduction and extension of solutions that protect the privacy of electronic communications should be assessed positively. The strengthening of protection against undesired marketing is also undoubtedly a positive aspect of this project.

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Summary

The draft ePrivacy Regulation is a good launch pad for a debate on the effects of such comprehensive regulations, necessary to avoid any negative impact on the development of new, innovative economic sectors such as additional services within services based on processing in the cloud, M2M, the Internet of Things, Industry 4.0. Legal uncertainty concerning the possible legal restrictions on running an enterprise may reduce innovation in business, which can be particularly severe in areas where there are no threats to the protection of privacy of communication, as in the case of M2M communication. Initiatives to strengthen communication protection are undoubtedly requisite and necessary, but regulations must be balanced, proportional, and preventing backward steps in digital development.

It is worth refining the following elements at least:

- limit the scope of ePrivacy, so as to protect the actual privacy and confidentiality of correspondence and electronic communications, but not focus on data processing. This means that new regulations should focus on the protection of communication itself, not on issues related to data processing;
- exclude M2M communication from regulation, where there is no threat to the privacy of individuals. Much of the communication and exchange of data by robots in no way affects the privacy of individuals, so it is worth considering the exclusion of such situations from the scope of the Regulation. One solution may also be a more systemic change of regulations, so as to limit the proposed regulation only to protect the privacy of communication (see above);
- separate the scope of the GDPR and the ePrivacy Regulation clearly, so that the latter concerns the protection of the privacy of electronic communication and its security. It is worth refining the proposed provisions in order to ensure clarity of the actual situations in which ePrivacy should be used and those in which the GDPR should be applied.

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