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AI: Opportunities and Challenges - The optimal exploitation of (Telecom) corporate data

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This work does not necessarily reflect company's implementation plans as use cases mentioned later in this paper are in a proof-of-Concept phase.

Abstract. This paper introduces the Telecommunication's Industry approach to adopt Artificial Intelligence mechanisms into daily tasks and operations, in order to accelerate digital transformation. The scope of this paper is to analyze and explore the opportunities and the challenges that are raised for telecommunications organizations by exploiting vast amounts of data they own or handle. The opportunities and challenges that are created by AI technologies are presented through several Use Cases, that IT Innovation Center of OTE Group is investigating, and create the baseline towards digital transformation and the engagement in future markets. However, as depicted in this paper, although the numerous opportunities, telecoms in this AI journey face many challenges that they need to overcome. This work in progress is under the DataPorts project that is funded by the European Union's Horizon 2020 Research and Innovation Programme under grant agreement No. 871493.

Keywords: AI · Big Data · Services · Telecommunications · Digital Transformation

1 Introduction

Nowadays, Artificial Intelligence (AI) is the main driving force behind Digital Transformation. AI is the engine to lead this transformation and the data is the fuel to power this engine. AI algorithms and models need vast amounts of data they can rely on to produce valid results; therefore, a hand-in-hand relation is created between AI and Data. Telecoms have a plethora of available data from multiple sources such as, customer data, network, mobility tracking, billing, sales, etc. The correlation of such datasets, as well as the combination of them with external publicly available data (or other types of data that may not be publicly available), may potentially create great value for solving problems

and serving future needs. Since it is a new field of operations and since until now such data availability and correlation wasn't possible for many different reasons, the value or what needs data can fulfil may be uncertain yet. Today, Europe is considered a weak player in the data-driven market, trying to catch up to US and Asia. The volume of data that will be produced globally is expected to reach 175 zettabytes in 2025 and Europe is aiming to position itself and become a leader in this area[1].

Open data in Greece can generate an additional 3.2bn euros GDP and approximately 12bn euros in cumulative benefits within 5 years. That led researchers and other related entities in Greece, to be highly involved in order to benefit from these numbers. Telecom operators own rich sources of data that should be utilized by other sectors Use Cases as well, that will could create opportunities for new services. Incumbent telecoms often face difficulties exploiting the data they own or handle through AI-based mechanisms. In most cases it is due to the complexity of the corporate environment but also due to the lack of prioritization or digital transformation maturity. According to Tata Consultancy Services Global Trend Study[2] AI is expected to have a dramatic impact on organizations. AI functionality[3] is becoming a standard feature instead of a special capability in existing software products. Hence, the AI adoption time by the organizations will become minimum. Artificial Intelligence (AI) has come to be a great enabler for businesses on the way to their digital transformation and the number of enterprises adopting AI has increased by 270% over the past 4 years (and tripled in the past year alone!), according to Gartner[4].

In the following sections an overview of the relation between the Telecom industry and the adoption of AI-based solutions is presented, as well as the opportunities and the challenges that exist in the Telecommunications sector. Moreover, several AI-related Use Cases are presented and analyzed.

2 Related Work

At Telcos, text services have reduced by around 75%, followed by voice services and the average revenue per user as stated in [5]. This result signifies that Telecoms are being affected by digital disruption. Towards this direction, several telecommunications service providers have started implementing AI Use Case in the form of AI services. Some of these services aim to transition Network Operation Centers (NOCs), where human administrators manage the telecommunications network, to Service Operation Centers (SOCs), where analytics and AI deliver automation. Telefónica, for instance, has launched pilot SOC in several markets. Other telecommunications service providers are adopting AI in different ways. AT&T, for example, is researching how to use AI algorithms to enable drones to inspect and repair base stations. SK Telecom in South Korea is using machine learning to analyze network traffic to detect abnormalities and enhance network operations. Hong Kong telecom PCCW is testing AI-powered tools to forecast growth in network capacity and predict network failures[4].

MIT Sloan Management Review [6] predicted that 58% of all organizations foresee modifications to their business models due to AI within five years. AI-powered mechanisms are used to extract business insights from vast amounts of data from multiple data sources they own or handle. These insights are the enablers for better customer experience and process optimization towards a positive impact on companies' revenues. Telecoms worldwide invest or develop internally AI-based solutions. Deutsche Telekom has developed a chatbot that helps the company offer 24/7 assistance to customers in Austria. Tinka, the chatbot, can process about 80% of the customer requests. Globe Telecom uses ML to enhance the Omni-channel customer experience. Using predictive models based on their data sources makes decisions faster and more target specific. Telefonica uses a platform for a new customer relationship model exploiting personal data, while Nokia ML platform is used for network management purposes that improve planning and predicts service fluctuations in advance[7].

However, although AI may surpass humans in many areas it is considered impossible for computers to emulate human abilities. AI can either protect or damage people depending on how it is used and while AI technologies, remain neutral, it is on humans to determine the purposes of how AI will be used[8]. In the following sections, opportunities and challenges that emerge in the Telecommunications sector are presented in some depth. The need for transformation will force to be adopted and resolved by the industry in the upcoming period.

3 Opportunities

We have encountered many opportunities for AI adoption within the organization and many of them were tested and evaluated. These optimizations according to Deloitte[9], give several major advantages of the adoption of AI in enterprises, including, enhancing existing products and creating new ones, increasing the efficiency of internal processes, decision-making based on processed data, optimizing external operations, as well as, optimizing resource allocation by taking off routine tasks from the employees.

3.1 Network management optimization

AI will benefit network monitoring and network management for organizations. The demand for more automated processes and tasks is because of the ability to identify complex network operational problems and provide diagnostics in a very short time. In addition, AI is the process of network monitoring that is also known as AIOps (Artificial Intelligence for Operations)[10]. AIOps are capable to reduce the time-critical troubleshooting and process analysis and create an opportunity to network units to deal with network planning issues. Hence, AI can also be applied to enhance the awareness and the accuracy improving the network capacity in a cost-effective manner. The use of AI may be a valuable tool for logs analysis but also an alerting mechanism for an AI-assisted, real-time, centralized network management, which can handle multiple anomalies, including node or link failures, degradation, congestion, and overload.

3.2 Customer Centricity

Telecoms, nowadays owning and handling vast amounts of data related to their customer's services, billing information, traffic analysis, using AI are now able to provide personalized services and recommendations to targeted consented customers. An offer very appealing to the customers. The early use of AI-based applications / services related to customer support, has resulted in the ability for organizations to reduce costs and improve their customers' retention and therefore increase revenues through their customer satisfaction. Customer requests could be handled using AI technologies without a customer agent's involvement: hence, the most important benefit is ensuring expertise of them and the so-called boring jobs to truly require assistance. A survey conducted by Tata Consultancy Services depicted that 32% of major companies around the world are currently using AI customer service technologies. It is the second most common use of AI after IT-related services[11], and according to IDC[12], AI is the game changer technology across customer-facing industries, that has the power to elevate customer experience using virtual assistants, product recommendations, or visual searches. Moreover, AI as a tool for biometrics is used as a mechanism for authentication, identification and access control, or as call classification and routing at a call center. Combining the power of AI with the capabilities of human support agents gives companies the ability to provide the high level of service their customers expect and deserve.

3.3 AI for Hardware Monitoring

AI-driven predictive analytics are helping Telecoms to provide better services by utilizing data, sophisticated algorithms and machine learning techniques to predict results based on historical data. By this Telecoms can use data-driven insights to monitor the infrastructure, anticipate failure based on patterns given by internal and external datasets (e.g., weather data), and proactively fix problems with communications hardware, such as Base Stations, power lines, data center servers, and even set-top boxes in customers' homes. In the short term, network automation and intelligence will enable better root cause analysis and prediction of issues, while in the long term, these technologies will underpin more strategic goals, such as creating new customer experiences and dealing efficiently with emerging business needs.

3.4 Process Automation

AI is indented to free up employees for more value-added activities, aiming to enable employees to perform more efficiently, to enhance existing processes, to adapt quickly and eventually to improve business results. The most obvious and common use of AI when it comes to processes and operations is the automation of tasks. This implies to the use of 'robotic process automation' (RPA) technologies. RPA is considered the easiest form of AI to implement since it operates across multiple back-end systems. It is not a new form of AI but lately, it is adopted by more and more organizations.

3.5 Management Support

Prior to the resurgence of AI and its eventual commercial application, executives have had to rely on inconsistent and incomplete data. With AI, they have data-based models and simulations to rely on. Today's AI systems are trained based on substantial amounts of data. This is augmented intelligence in action, which eventually provides executives with sophisticated models as basis for their decision-making. AI models can analyze vast amounts of data and therefore provide critical insights to management and business owners as well as make critical decisions for businesses autonomously. AI exploitation can provide extremely helpful forecasts and predictions. Reasonably, it is undoubtedly better than relying only on experience, or intuition and hypothetical scenarios. Humans now play the role of the final processor, relying on accurate figures and insights.

3.6 New Products and Services

Since people are able of consuming products and obtaining services using the internet, a widespread usage of AI has played a major role in that. AI creates an opportunity for organizations only if they pursue the right Use Cases, build analytics capability and finally embed the analytics in the day-to-day processes. It is perfectly understood that the more data it is consumed the greater insights AI can provide, especially in Telecoms where, a plethora of data from many different sources exist. As a result of AI, services can be more personalized and could match real customers' needs. The AI-driven mechanisms used to analyze corporate data create an opportunity for better exploitation towards the monetization of those data and set up a new revenue stream for the organizations. However, in order to achieve monetization of data there are several prerequisites that should be met. AI may be applied only on proper/accurate datasets, otherwise, the results may end up disastrous for the organization.

4 Challenges

Despite the numerous potential benefits of AI technologies for Telecoms, there still exist several challenges in the successful adoption of it. AI technology is still in its infancy, and this creates different challenges for Telecoms that aim to break into AI. One of the main problems many data owners face is the quality of the data. So, before the presentation of the identified challenges it seems reasonable to demonstrate the below figure. A process that could be followed in order a data owner to prepare and exploit data toward AI-based service creation is depicted in Fig. 1. This presents the stages that not only a Telecom organization, but also, any other industry that owns vast amounts of data should follow, in order to benefit from the power given by data.

4.1 From Data to Business Value

In the State of Data Culture Report by Alation[13], several challenges were identified as important by companies in their AI transformation. Alation performed



Fig. 1. Data Exploitation Process

a quantitative research study among 300 Data and Analytics leaders. The study identified eight major challenges in using data to drive business value. More specifically, lack of analytical skills among employees emerged as the top challenge in 42% of the responses. Data democratization, the fact that not everyone can access data on their own, also ties for the first place at 42% of the responses. Closely related comes the challenge of organizational silos, the fact that data is not shared among different groups, at 41% of the responses. As in many Telecom Operators, OTE is addressing this issue by reskilling and training its employees. Additionally, IT Innovation Center forms cross functional teams and onboards experts from other units on all AI-related PoCs.

4.2 Lack of Technology Maturity

Due to the relative infancy of AI technology, perhaps the biggest obstacle for AI adoption for Telecoms is lack of technology maturity. With the number of commercial AI solutions growing every day, it is hard to identify the best solution for your company's individual needs. As an Innovation Team, we have faced the challenge of constantly evaluating the potential value of external AI solutions and collaborations with innovative partners. Moreover, according to McKinsey[14], one of the challenges to Supervised Machine Learning is the need for large amounts of human effort to label training data. In addition, the large amounts of data required for Deep Learning may be challenging to collect or may even not be available.

4.3 Lack of Expertise

Another barrier for the adoption of AI in Telecoms is lack of AI expertise. Companies have only recently started investing in AI talent. In addition, people specializing in AI and Data Analytics are in short supply. Currently, the demand for such talent certainly exceeds supply. This alone is a challenge and a threat that Telecoms must deal with in order to keep their competitive advantage. They need to provide career incentives and proper growth opportunities to attract data scientists and data analytics experts.

4.4 AI Ethics and Trust

An ethical perspective of AI is the ability of algorithms and models to optimize tasks by learning from large available amounts of data without any human intervention. Another important consideration that has to do with the explainability

of AI algorithms and possible algorithmic bias. Regarding AI and trust, according to Accenture[15], several risks arise in this context. These include unethical or even illegal use of insights, amplifying biases that stem from issues of social and economic justice, and using data for purposes to which its original disclosers have not given their consent. Moreover, risks of AI adoption also include lack of transparency, biased algorithms, unclear liability for actions and decisions taken, loss of control, loss of privacy, the great influence of big data-driven AI companies like Facebook and Google, impact in the labor market, and the emergence of deep fake videos and fake news, among others. Thus, organizations should carefully consider the ethics behind the data collection, manipulation, and use.

4.5 Data Security and Privacy

A risk that Telecoms should mitigate has to do with how they handle security and privacy issues related to their data. For instance, as stated by SAS in [16], especially in Europe, General Data Protection Regulation (GDPR) in many cases restricts or, at least, complicates the process of personal data in the context of Analytics and AI. This is another challenge that European Telecoms must overcome. GDPR may eventually help create the trust that is necessary for AI acceptance by consumers and governments as we continue to progress toward a fully regulated data market. According to Accenture[15], AI risks that are left unchecked can severely damage the consumer trust in a brand. Interestingly, digital trust is difficult to build but easy to lose.

4.6 Data Infrastructure

For enterprises to transition from proofs of concept to deployed AI, existing data infrastructure and data management should be reconfigured. Machine learning systems require large amounts of data to function meaningfully, and it is not uncommon that the data needs to be in real-time, streaming format. Typically, most enterprise application systems are not set up this way. In contrast, AI adoption requires a highly flexible technology stack that can support big data volumes and cloud-native solutions. This also brings in additional costs related to the storage of large amounts of data and machines with the capability to process it. Moreover, another challenge related to data infrastructure is the scalability of models in production. Moving a model to production and having it scale to large amounts of data is a challenge that enterprises must overcome before they reap the real benefits of AI[16].

4.7 AI in the Change Management Process

In order AI to move to production and influence or automate day-to-day decisions, it should also convince C-executives about the positive Return on Investment (ROI). The business owners of a final product should stay in close contact with the people that are building the AI solutions, since relatively inexpensive

proofs of concept get the green light but never make it to production when the associated costs of such a move are increased. AI requires a transformation in the mindset of enterprises not only technologically but also from a business point of view. A solution could be the involvement of outsourced experts that have already adopted AI in their enterprises and can help with the transition through the learnings they have acquired[17]. This cultural transformation is one that many Telecoms have started and should continue investing in the future.

5 Use Cases

Since the opportunities and challenges of the adaptation of AI technologies have been thoroughly presented in the sections above, the next logical step is to demonstrate the Use Cases that we are experimenting with, in order to evaluate AI technologies and measure potential benefits. Fig.2 presents those Use Cases and illustrates their connection with the opportunities and challenges as we have previously identified.

Use Cases In Telecoms	Opportunities	Common Challenges to overcome
Chatbot & NLP	Customer Centricity	Lack of analytical skills among employees Lack of Technology Maturity Lack of Expertise Ethics & Trust Security & Privacy Infrastructure
Robotics	Process Automation Customer & Employee Centricity	
Sentiment Analysis	Customer & Employee Centricity	
Machine Vision	AI Monitoring	
Sales Forecasting	Decision Support New Products & Services	
Predictive Maintance (Network / Customer)	Operational Support Optimization AI Monitoring	

Fig. 2. Use Cases mapping

The potential for AI to drive revenue and profit growth is enormous. Marketing, customer service, and sales were identified as the top three functions where AI can realize its full potential according to a survey of more than one thousand executives by Forbes[18]. One of the biggest goals is to incorporate AI solutions in the daily operations of the company with a slow but certain and steady growth in the upcoming years. Of course, similar Use Cases have already been and will continue being experimented and tested within our organization, since there is efficient support and documentation that AI and Big Data Analytics projects bring financial and operational gain[19].

5.1 Chatbot and NLP

Today's natural language processing systems can analyze unlimited amounts of text-based data in a consistent and unbiased manner. They can understand

concepts within complex contexts and decipher ambiguities of language to extract key facts and relationships[20]. Given the huge quantity of unstructured data that is produced every day this form of automation has become critical to analyzing text-based data efficiently. The basic concept here is the creation of chatbots that takes advantage of NLP systems in an interactive layout. Telecoms are among those that adopted chatbots at early stages. This innovative trend offered value to the customers as well as to the employees. Conversational AI chatbots in Telecom industry can reduce the waiting time of internal and external customers to a few seconds. Especially for external customers, apart from operating in simple and repetitive customer demands, chatbots can redirect complex cases enquires to appropriate departments on complex cases. Through chatbots a customer support center can operate effectively and minimize costs, while at the same time can allow agents to focus on their selling campaigns.

5.2 Robotics

The next AI area that it is believed that will be a future trend of Telecoms is the area of robotics applications. The adoption of their communication skills and the fast-operating tasks will make them an ideal assistant to Shop agents. Physical stores of the future will either be digital or at least have a high volume of digital flavor. Not far from now, humanoid robots will assist Shop agents in their tasks to interact and serve customers. Tasks that until now are difficult or even time consuming will be carried out by humanoid robots. Humanoid robots are being tested and used to enhance customer experience and engagement. Such robots can capture emotional cues from people and adapt their behavior appropriately[21]. Leading organizations should be planning on using intelligent robots to inform customers about their offerings in an interesting way, ensuring increased engagement.

5.3 Sentiment Analysis

Sentiment analysis is extremely important because it helps businesses quickly understand the overall opinions of their customers. By automatically sorting the sentiment behind reviews, social media conversations, and more, you can make faster and more accurate decisions. In today's Big Data environment and especially in Telecoms there is quite often a data overload issue created by customer feedback. Reasonably, it seems rather impossible for individuals to analyze the data manually without any sort of error or bias[22]. Thus, sentiment analysis could be used in order to sort/filter the data at scale by providing answers into what the most important issues are. Furthermore, by using a centralized sentiment analysis system, companies can apply the same criteria to all their data and minimize bias caused by subjectivity and opinions that are influenced by personal experiences and beliefs. Sentiment analysis can be used by companies to gain insights about how customers feel about certain topics, the company in general and finally it enables them to detect urgent issues or crisis in real time before they spiral out of control. By doing so, Telecoms can automatically

organize incoming support queries (verbal and textual) by topic and urgency in order to route them to the correct person or department. This application also increases efficiency and ensures that customers are not left waiting for support and as a result decreases churn rate.

5.4 Machine Vision

Due to the existing covid-19 pandemic, several actions were forced to be adopted by large organizations. AI through Machine Vision mechanisms came to assist on issues such as the social distancing between the employees, as a mechanism to count people in a meeting room or even in stores. The fact that the exploitation of such Use Cases demonstrated a rapid volume of usage due to the pandemic, most definitely does not mean that their usage is limited to the existing situation. Evidence that supports the above statement can be found in multiple types of Organizations and Markets. The brightest example is Amazon[23] which has more than 25 autonomous stores scattered across the United States. One of the benefits from the implementation of computer vision in Telecom's retail stores is Stock visibility[24] (the awareness of what is basically happening at the Shop). The camera system intertwined with AI technology can detect all kinds of fraudulent attempts. It is also worth mentioning the stock visibility in the context of stock replenishment. The camera system can record deficiencies in specific products and inform the management in real time.

5.5 Sales Forecasting

Nowadays, where data availability, artificial intelligence (AI) and machine learning (ML) technologies are at their peak[25], accurate forecasts can most certainly become reality. Next to generic demand drivers like expected revenue, sales, and transactions, retailers would want to know the estimated foot fall, call centers the number of calls to expect and warehouse the number of orders. In addition, demand forecasting can form the foundation on which businesses can execute their supply chain systems, from procurement and inventory and warehouse management to distribution management[26]. Companies that utilize demand forecasting, can easily find themselves getting ahead of competition and assess their own performance. Improvement in supply chain efficiency is probably the most essential reason to use demand forecasting in operations management. Given the forecast of the level of sales and when they will occur, management can better schedule the procurement, warehousing, and shipping. This even enables management to plan scheduled maintenance shutdowns and most importantly to have adequate materials and labor on hand throughout the year. The need for such models became even more important during the pandemic. It is of vital importance that customers can purchase the products that they want, when they want them, and without delays.

5.6 Predictive Maintenance (Network/Customer)

Predictive maintenance is a technique that collects, analyzes, and utilizes data from various manufacturing sources like machines, sensors, switches, etc. It applies intelligent algorithms to the data to anticipate equipment failure before it happens[27]. In the Telecom industry insights on internal data to generate cost optimization in maintenance, analyze extra streams of revenue and their potential, and establish comparative advantage against competition is of essential value. An efficient AI-based alerting notification solution can be introduced in order to preserve the high QoS provided as a contractual requirement conforming to customer Service Level Agreement (SLA). Advanced ML techniques could be used in business context exploiting big data analytics or prediction capabilities. To do this, Petabytes (PBs) of data streams in real-time coming from core network backbone, log files from back-end infrastructure monitoring applications, anonymized subscribers' Call Detail Records (CDRs), etc. in daily basis in conjunction with a vast amount of historical data proceed to predictions on potential service degradation based on probabilistic models and ML techniques. A predictive maintenance example in research is the Typhon H2020 project[28] where its architectural components were deployed by using Telecom data. The project strives to anticipate equipment failures to allow for in advance scheduling of corrective actions, thereby preventing unexpected equipment downtime and improving customer service quality. By that, it enables proactive scheduling of corrective work, and thus prevents unexpected failures.

5.7 Research Collaborations

An industry that owns and handles vast amounts of data like mobility, sales, demographic, and traffic data, should search for the right methods and services to benefit from. A common and successful approach is through participation of research and innovation projects and partnerships to benefit from third parties' expertise in certain fields. For example, on the seaport transformation journey, the Telecommunication industry (also actively involved in ICT services) can have a significant role and perhaps become a key player towards the transformation success. Telecom holds the backbone of the data-driven environment[29, 30] through its networks. DataPorts H2020 project[31] is such an example, where OTE offers anonymized mobility data to be used for seaport related analytic services and by that enhance the offered analytic services to the ecosystem.

6 Conclusions

Undoubtedly, AI is in our daily routines and is an integral part of our work environments. Therefore, it is a reality and not a trend idea. AI is a tool for large organizations to leverage their assets and begin their digital transformation journey. A continuous journey that besides the numerous opportunities, there are many challenges and risks needed to be overcome. The digital transformation will

emerge if the entire organization clearly plans the next steps and use AI as the technology that will push the organization forward. As it has been stated above, several beneficial use cases have already been implemented. It may be pointed out and verified by OTE as a Telecom Operator that more complex applications, such as traffic management and 5G related issues, are being considered for the foreseen future[32]. Thus the intention of large organizations should be to form and to establish innovation teams with data science and AI engineering capabilities. However, most organizations strive hard to match existing business problems/needs with AI initiatives. What is needed is to set a concrete strategy, to on-board personnel with AI-related skillsets and in parallel to follow an AI lifecycle that fits properly with the organizations' business needs, otherwise the results might prove harmful for the organization. As in every case, there are considerations and risks that should be considered. Since the adoption of AI is today's reality, the legal and regulatory environment should be clearly understood, especially when data contains private or sensitive information. Regarding offering data service offering, entering a new area always demands careful business approaches. Since this contains data sharing, trust should also be considered, not only from a technological perspective but also from an ethical. The benefits of AI solutions in today's organizations have become more evident than ever, and many of them have already drive their digital transformation journeys.

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