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**INNOVATIVE SOLUTIONS FOR IMPROVING AND
AUTOMATING BUSINESS PROCESSES FOR CUSTOMER
CARE IN TELECOMMUNICATION SECTOR – EMPIRICAL
EVIDENCE FROM SELECTED COUNTRIES**

Abstract: The effects of ERP and CRM systems in support of customer care processes have revolutionized the way data is collected and processed. In recent years, new innovative technologies have appeared that have the capacity to make an even bigger revolution. These are technologies for automating processes with robotics, speech recognition and natural language processing. These forms of automation aim to automate business processes to improve operational efficiency, reduce costs, and reduce the time employees spend performing repetitive tasks and processing huge amounts of data from different systems. Since the aforementioned structured and manual processes can be performed by robots, employees could focus their time and effort on performing analytical and creative tasks, thereby increasing the added value of business activities.

In this paper, the aforementioned types of automation of business processes in the customer care department in the telecommunication sector are analyzed. In order to investigate customer satisfaction with the presented innovative solutions for the automation of business processes for customer care in the telecommunication sector in the Republic of North Macedonia and Austria, a survey was conducted through a specially designed questionnaire for the purposes of this paper.

Key words: Business processes, Robotic Process Automation, Natural Language Processing, Customer satisfaction, Telecommunication sector

JEL Classification: M31, O32

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Introduction

The competition in the telecommunication market has opened new dimensions for the researchers to determine new strategy planning techniques through the big data analytics of the data of customer relationship management systems (CRM) of telecommunication companies. Business Support System and Operational Support System are the current systems in CRM that provide customer details containing content data and call details respectively known as contextual data.

The customer life cycle in CRM consists of six phases including customer contact to customer service representative, services provided to the customer, use of services by a customer, bill generation, bill payment, and offer of new services to customers.¹ Every cycle consists of different processes that must constantly follow the latest technological innovations to ensure quality in the delivered services to the customers. The utilization of services by the customer is a most important phase of customer cycle since it provides the behaviour of the customer. The idea is first to collect data from the existing systems and then apply pattern recognition algorithms on obtained data to find out patterns which are the behaviour of customers. Once patterns are identified, then most suitable big data clustering method is applied to attain clusters of customers who show similar behaviour in their call activities.

To achieve steady growth and survive in the long term, telecommunication enterprises must innovate continuously. Therefore, they must combine best and next business practices. Best practices ensure efficiency, while next innovative practices really lead to competitive advantages. Traditional business process automation solutions such as Enterprise Resourcing Planning (ERP), Supply Chain Management (SCM) or CRM systems focus on the implementation of best practices. Next-generation process automation allows the implementation of next innovative practices at an economically acceptable cost level. This is possible through a flexible combination of business process definition and software application support.

The issue of how to determine the right processes to automate in any business is more about asking the right questions with the right group of people, listening to their answers, and pairing them with a long-term business goal. Common business processes that can be automated in every business has

¹ Shrivastava, P., Sahoo, L. and Pandey, M.: *Recognition of Telecom Customer's Behavior as Data Product in CRM Big Data Environment*, 2018

its own process pain points. Example of customer care area where business process automation can be set in place is traditional call centre. The traditional operating model of a customer call center in telecommunication companies in most cases does not achieve the goal. Especially when call centers are faced with a sudden increase in customer interactions, it often results in the kind of message that the service time will be longer than usual that frustrates the customer. Examples of an automation opportunity would be the following:

- Deconstructing overly complex processes resulting from the diverse requirements of a wide portfolio of products and services and a diverse range of customer segments - from residential consumers to sole traders, small/domestic enterprises ending with large companies as users.
- Interacting with multiple systems, including user data systems that are implemented over time and are difficult and expensive to adapt to changing business requirements.
- Depending on the large number of call center agents - with very different training, experience, knowledge and skills - to manage complex business processes and systems can result in high overall operating costs for call center operations.

For the execution of customer care business processes, workers currently spend substantial time dealing with ERP, CRM, spreadsheets and legacy systems in manual repetitive tasks, merging and moving massive amounts of data from one system to another. After the revolution that CRM and ERP created, a new terms are going to revolutionize the workplace: robotic process automation (RPA), speech recognition and natural language processing.² These types of innovative technologies aim to automate business processes (BPs) with the goal of improving efficiency while cutting costs by reducing the time humans spend dealing with information systems. This means that these structured and manual tasks can be done by a robot, so that the workers can dedicate their time and effort to tasks that add more value.³ In this paper, the new innovative technologies for automation of business processes in the customer care department in the telecommunication sector are analyzed. The main research question is how these technologies affect customer satisfaction in telecommu-

² Anagnoste, S.: Robotic Automation Process – The next major revolution in terms of back office operations improvement, *Proceedings of the International Conference on Business Excellence II*, Bucharest Academy of Economic Studies, 2017

³ Agguire, S., Rodriguez, A.: Automation of a business process using robotics process automation (RPA): A case study, *Applied Computer Sciences in Engineering*, 2017, pp 65-71

nication sector. In order to investigate customer satisfaction with the presented innovative solutions for automation of the customer care business processes in telecommunication sector in the Republic of North Macedonia and Austria, a survey was conducted through specially designed questionnaire for the purposes of this paper.

1. THE FEATUERS OF INNOVATIVE TECHNOLOGIES FOR AUTOMATION OF CUSTOMER CARE BUSINESS PROCESSES

Robots execute repetitive tasks by using graphical user interface adaptors instead of application programming interfaces, without changing the information technology infrastructure, meaning that the robot does repetitive tasks that used to be done by humans faster and cost efficient. Through RPA organizations can develop robots which will lead to automation of an extensive variety of back office and front office activities, bridging thus the organization and moving people to high-value added tasks.⁴

RPA can be defined as the concept of using a software platform of virtual robots to manipulate existing application software in the same way that a human does with a process or transaction.⁵ This means that RPA uses robots to imitate repetitive tasks that humans have to perform. These robots are not physical robots, but software robots, meaning that a robot equals one software license.⁶ Therefore, since RPA addresses the automation of rule-based routine tasks using intelligent algorithms, some authors are already applying artificial intelligence and machine learning technologies to create software solutions that can understand user behaviour and automate their tasks.⁷ Customer care as

⁴ Santos, F., Pereira, R. & Vasconcelos, J. B.: Towards robotic process automation implementation: an end-to-end perspective. *Business Process Management Journal*. 26 (2), 2020, pp. 405-420

⁵ Suri, V. K., Elia, M., & van Hillegersberg, J.: Software bots - the next frontier for shared services and functional excellence. In I. Oshri, J. Kotlarsky, & L. Willcocks (Eds.), *Global sourcing of digital services: Micro and macro perspectives*. Global Sourcing 2017. Lecture Notes in Business Information Processing (Vol. 306, pp. 81–94). 2017, Springer.

⁶ Lacity M., Willcocks LP.,: *Robotic process and cognitive automation: the next phase*, SB Publishing. , 2018, pp.304

⁷ Khramov, D.: *Robotic and machine learning: How to help support to process customer tickets more effectively*, Metropolia University of Applied Sciences, 2018, <https://urn.fi/URN:NBN:fi:amk-201804124581>

department having a direct interaction with the customers may apply as one of the first for such an automation solution.

For RPA adoption, it is important that the process can be decomposed into unambiguous rules, as RPA is only suited for rule-based tasks. Standardize the process before automating is also necessary because the more standardized the process is, the fewer exceptions happen.⁸ Having not many exceptions to handle is a key success factor because having a lot of exceptions makes it time-consuming for the robot to automate. Then, it is also important that the process is mature because a mature process can be easily measured, documented and stable, with a better current cost awareness. Voluminous transactions are also suitable for RPA automation because high volume (amount of repetition) is considered as an opportunity for cost reduction. Also, if the tasks are repeated often, it means that can be done by robots faster and with less errors.

Frequent interactions with multiple systems is also a good candidate for automation, as RPA interacts with systems through the presentation layer, whereas doing the same thing with traditional automation would be more expensive and time-consuming. Another important feature is interacting with stable systems that do not change very often, so that the robot can interact with the interface without throwing exceptions that would be costly.

Tasks that are prone to human error are suited for automation because it allows reduction of costs and increase of performance, as robots do less mistakes than humans. Also, tasks with no need or limited need for worker intervention and low cognitive requirements are an important aspect because robots lack analytical and creative skills. Finally, data is important, in terms of digital availability and quality. To execute the tasks correctly, the data must be correct and available digitally.

Speech recognition is another innovative technique that could support business process in customer care departments. Speech recognition could be defined as the ability of a machine or program to identify words and phrases in spoken language and convert them to a machine-readable format.⁹ The rudimentary speech recognition software has a limited vocabulary of words and phrases and can only identify them if they are pronounced very clearly. More

⁸ Lintukangas, A.: Improving indirect procurement process by utilizing robotic process automation, Lappeenranta University of Technology School of Business and Management, 2017, Master's Theses

⁹ Zhong M., Yashesh G., Jinyu L., Yifan G.,: Character-Aware Attention-Based End-to-End Speech Recognition, IEEE Automatic Speech Recognition and Understanding Workshop (ASRU); 2019, IEEE

sophisticated software has the ability to accept natural speech. Speech recognition works using algorithms through acoustic and language modelling. Acoustic modelling represents the relationship between linguistic units of speech and audio signals, while language modelling matches sounds with word sequences to help distinguish between words that sound similar.

Although convenient, speech recognition technology still has a few issues to work out as it is constantly evolving. The pros of speech recognition software are that it is easy to use and readily available. Speech recognition software is now often installed on computers and mobile devices, allowing for easy access. The downsides of speech recognition include its inability to pick up words due to pronunciation variations, lack of support for most languages outside of English, and inability to sort through background noise. These factors may lead to inaccuracies.

Optimal Automatic Speech Recognition takes place when the evaluation is done under circumstances identical to those in which the recognition system was trained. In the speech applications demanded in the actual real world this will almost never happen. There are several variability sources which produce mismatches between the training and test conditions. Depending on his physical or emotional state, a speaker will produce sounds with unwanted variations transmitting no acoustic relevant information. The phonetic context of the sounds produced will also introduce undesired variations. Another source of variability is constituted by the changes produced in the speaker's environment and the characteristics of the channel used to communicate. The strategies used to eliminate the group of environmental sources of variation are called Robust Recognition Techniques. Hence, Robust Speech Recognition is recognition that is as invulnerable as possible to changes that occur in the evaluation environment. Robustness techniques constitute a fundamental area of research for voice processing.

Good speech recognition programs let users customize them to their needs. The features that enable this include¹⁰:

- *Language weighting.* This feature tells the algorithm to give special attention to certain words, such as those spoken frequently or that are unique to the conversation or subject. For example, the software can be trained to listen for specific product references.

¹⁰ Gaikwad, S., Gawali, B.W., Yannawar, P.: A Review on Speech Recognition Technique, International Journal of Computer Application, Vol. 10, No. 3, 2010, pp. 16-24

- *Acoustic training.* The software tunes out ambient noise that pollutes spoken audio. Acoustic training software programs with can distinguish speaking style, pace and volume among the chatter of many people talking in an office.
- *Speaker labelling.* This capability enables a program to label individual participants and identify their specific contributions to a conversation.
- *Profanity filtering.* Here, the software filters out undesirable words and language.

There are several advantages to using speech recognition software, including the following:

- *Machine-to-human communication.* The technology enables electronic devices to communicate with humans in natural language.
- *Readily accessible.* This software is frequently installed in computers and mobile devices, making it accessible.
- *Easy to use.* Well-designed software is straightforward to operate and often runs in the background.
- *Continuous, automatic improvement.* Speech recognition systems that incorporate Artificial Intelligence (AI) become more effective and easier to use over time. As systems complete speech recognition tasks, they generate more data about human speech and get better at what they do.

While convenient, speech recognition technology still has a few issues to work through. Limitations include:

- *Inconsistent performance.* The systems may be unable to capture words accurately because of variations in pronunciation, lack of support for some languages and inability to sort through background noise. Ambient noise can be especially challenging. Acoustic training can help filter it out, but these programs aren't perfect. Sometimes it's impossible to isolate the human voice.
- *Speed.* Some speech recognition programs take time to deploy and master. The speech processing may feel relatively slow.
- *Source file issues.* Speech recognition success depends on the recording equipment used, not just the software.

Natural Language Processing (NLP) is another innovative supporting technology for business processes from customer care departments. NLP could be defined as a software process that transforms structured data into

plain-language content.¹¹ It can be used to produce long-form content for organizations to automate custom reports, as well as produce custom content for a web or mobile application. It can also be used to generate short blurbs of text in interactive conversations (chatbots). An efficient and effective system for natural language processing was developed for improving free text analysis and establishing a virtual assistant. The virtual assistant is a software, which is designed to imitate a natural conversation. The way a chatbot or virtual assistant function works is by recognizing the user's input or utterance, by pattern matching. This pattern matching occurs due to the fact that the software is trained to recognize these sentences using machine learning methods.¹²

After matching it to a pattern, it checks the response set for that pattern and gives the output. The major difference from classical programming is the fact that a chatbot can understand the context of a sentence. This means that the input and output of the first question will be carried over and matched to subsequent questions, just like a natural conversation. Although this is a big leap in the computation of natural language processing, chatbots still cannot process complex questions and perform complex activities. Since chatbots require a huge amount of computing power, hence consumer based software is offered as a service by the major tech giants like Google, Microsoft, Facebook, and IBM. These companies do the computation on their servers, and offer the software as a cloud-based service on their platform.

Computational linguistics has improved so much in scope and speed in the past decade that it is now able to be incorporated into consumer based products. Some of the fundamental factors that have made these possible are the exponential increase in computer processing power, the vast language datasets available, the development and research of machine learning algorithms and the research and development in understanding the semantics of human language and conversation.

Natural language processing platforms provide what is contextually called a virtual assistant. These virtual assistants or chatbots are programmed using machine learning algorithms. The primary purpose of these tools is to mimic natural human conversation.

¹¹ Dale, R.: *Classical Approaches to Natural Language Processing*. In Handbook of Natural Language Processing, Chapter I, 2010, pp. 3-7,

¹² Nimavat K. and Champaneria T.: *Chatbots: An overview types, architecture, tools and future possibilities* International Journal for Scientific Research and Development, 5 (7) (2017), pp. 1019-1024

This field is still in a very early stage of development. Businesses are experimenting with it, such as the telecommunication sector and various other industries, which use chatbots as the first point of contact in the online support system. One major advantage of these tools is that they can be trained from the mistakes they make, and hence they are continuously improving. The amount of data being fed into the system is increasing day by day, which only making these platforms better. Understanding human language is a very complicated feat because there are underlying layers of logic in conversation, but with virtual assistants being implemented in consumer technology, human-computer conversations are only going to get better.

2. ANALYSIS OF USER SATISFACTION FROM AUTOMATED BUSINESS PROCESSES FOR USER CARE IN THE TELECOMMUNICATION SECTOR IN SELECTED COUNTRIES

When tracing development directions, telecommunications companies need a detailed understanding of the needs of users of their services. It is also essential to provide users with the most appropriate products and services they need. Failure to meet this goal can significantly affect the company's competitiveness. For these reasons, understanding and measuring user satisfaction is of great importance to telecommunications companies. Satisfaction is a widely accepted concept despite the real difficulties associated with measuring and interpreting the usual approaches to its assessment. The most common approach is to use general satisfaction surveys conducted within the telecommunications sector after each call for service from a customer care center. If the experience with the service exceeds the expectations that the customers had from the service, then the satisfaction is high and vice versa.

The subject of the research performed for the purposes of this paper aims to analyze the current state of knowledge of new technologies by users in the telecommunications sector who had the opportunity to use the services supported by innovative technologies in the customer care sector, as well as their satisfaction with the same services. The research covers the services supported by the innovative robotics process automation solutions, then the virtual expert services (software that is designed to imitate natural conversation or stimulate written communication) and virtual agent support when a technical problem occurs on the services used. Also, the research should answer several research questions, namely:

- How familiar are the customers with the new analyzed technologies?
- What is their satisfaction after using the services?
- Would the customers choose a service from an agent (a natural person) or a service offered with new technologies?

For the purposes of the research, a questionnaire survey was used as a quantitative method that serves to collect primary data. Bearing in mind that based on previous research, users of different age groups may have different views on their satisfaction with the use of new innovative technologies, in this paper the connection of the age group with the acceptance of the use of services supported by innovative technologies is analyzed. For this reason, a random selection of users from different age structures was made to ensure representativeness of the data.

In addition to age, the survey questionnaire also contains respondents' data on gender, place of residence and level of education as generic demographic data. The survey questionnaire was answered by a total of 264 respondents, with 170 respondents residing in the Republic of North Macedonia and 94 respondents residing in the Republic of Austria. In terms of gender representation, 60% are female, while 40% are male.

The foundations of this research are based on the research question whether innovative solutions in the customer care department are still in the development and experimentation phase and do not reach the expected level of acceptance and satisfaction by service users. The majority of the respondents, 67%, answered that they would prefer direct contact with an agent, while the rest of the respondents declared that they would choose a service offered by a solution from digital innovative technologies.

The research showed that even among respondents in the age groups up to 45 years old, the majority of people would not accept a service from digital technology if they were also offered the option of direct contact with a physical person, although the data indicated that the majority of respondents in the lower age groups were familiar with the innovative technologies that are analyzed in this paper. According to the results obtained from the answers, respondents from all levels of education would prefer contact with an agent rather than any of the innovative technologies.

Of the total number of respondents, 49% had the experience of communicating with a chatbot or virtual expert. The percentage of all age groups for knowledge of the use of digital solutions such as robotics is also high (over 70% in all age groups). But it should be stated that the percentage of accep-

tance of automation with robotics decreases significantly with the increase of the age structure because the results show that there is a greater lack of understanding of new technologies among older respondents. In absolute numbers, 208 out of 264 respondents are familiar with the background work and use of process robotics technology and 205 respondents declared that they have no objection to the automation of human procedures with robotics.

The last part of the questionnaire covers the topic of virtual support of an agent in case of a technical problem of the client. Respondents' responses show that the majority, 73%, would agree to virtual support from an agent for a technical issue rather than waiting for a physical visit to provide adequate on-site service. The analysis by age groups shows that the only exception to this attitude is the age group over 56 years old, where the majority of respondents would prefer a visit to a physical person on the spot of the problem. But the percentage of respondents who used this technology of virtual support during a technical equipment problem is relatively low, and amounts to only 20%.

The conclusion of all the obtained presented results in this part of the paper is that the respondents are partially familiar with the new technologies, while the knowledge of robotics technologies is more common, while the new experimental services of virtual experts and service support are in the familiarization and awareness phase. However, the significant percentage of use of these services should not be left out.

Conclusion

Telecommunications companies are actively using the latest digital technologies to support their business processes in customer care sectors. One big advantage of these technologies is that they can be upgraded through the mistakes they make, that is, they can learn from historical data and constantly improve. The amount of data that is stored in these systems increases significantly day by day, and thus new technologies enable more sophisticated and better solutions.

Based on the analysis of the characteristics of new innovative technologies used to support business processes in the customer care sector in telecommunications companies, as well as the results obtained from empirical research, it can be concluded that agents are accepted as the best solution if they are works for a specific and more complicated problem, while digital solutions are accepted as a service that has 24/7 availability and is suitable for solving easy and recurring problems.

Lower age groups more easily accept digital technologies as a simple process of communication, while higher age groups practice and accept contact with a physical person more. It can be concluded that innovative solutions in the customer care department are still in the development and experimentation phase. Although they are improving daily in different aspects, they still do not reach the expected level of acceptance by the users of the services.

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ANNEX

Questionnaire

A.) Basic data

* Required questions

1. Years *

- up to 18 years
- 18-25 years old
- 26-35 years old
- 36-45 years
- 46-55 years
- 56+ years

2. Place of residence *

- Republic of North Macedonia
- Republic of Austria

3. Gender *

- Men
- Female
- Neutral

4. Education *

- Primary education
- Secondary Education
- Higher education (undergraduate studies)
- Higher education (Master's or Doctor of Science)

B.) New technologies as services

Innovative information technologies for the automation of business processes for customer care in the telecommunications sector

1. If you have a problem with a service from a company in the telecommunications sector and need to get in touch with the customer care department, would you prefer contact with an agent or would you accept a digital technology solution (virtual agent, chatbot, robot, etc.)? *

- Agent
- Digital technology solution

2. Please briefly explain your answer to the previous question!

3. Have you heard about the “chatbot / virtual expert” service (artificial intelligence technology that simulates human conversation through written communication or voice command) of telecommunication companies? If not, please continue to question number 6! *

- Yes
- No

4. If you answered “yes” to the previous question, have you had the experience of communicating with a “chatbot / virtual expert”?

- Yes
- No

5. If you have had the experience of communicating with a “chatbot/virtual expert” please explain in more detail and would you use the service again?

6. Do you know that digital solutions such as robotization of certain human procedures are often used in the back-end operation of service delivery in the telecommunications sector?*

- Yes
- No

7. Are you against the automation of human actions with a robotic solution? *

- Yes
- No

8. If you answered “yes” to the previous question, please briefly elaborate on your answer!

9. Virtual support in the event of a technical problem of the service is established when the agent with whom you communicate via telephone contact will get access to the camera of your smartphone device, during which you will be able to show him the router in real time and accordingly the agent will be able to give you instructions on how to fix it. This makes the service instantaneous instead of waiting for a technician to visit your home to repair the router. Would you agree to this procedure or would you still choose a physical person to check the technical equipment? *

- Yes, I would agree with virtual support
- No, I would still like a physical person to check the technical equipment

10. Please briefly explain your answer to the previous question!

- Yes
- No

11. Have you ever heard of a service in the telecommunications sector for virtual support in the event of a technical equipment problem (for example, a malfunctioning Internet router)? *

- Yes
- No

12. If you answered “yes” to the previous question, have you had the experience of using a virtual support service during a technical problem with a service from a company in the telecommunications sector?

- Yes
- No