Open University of Cyprus

Faculty of Economics and Management

Postgraduate (Master's) Programme of Study *MBA Master in Business Administration*

Postgraduate (Master's) Dissertation

Robots In Telecommunications: Can Call Center Agents Be Supplemented By Robots?

Athena Mouxouri

Supervisor

Dr. Daina Nicolaou

May 2020

Open University of Cyprus

Faculty of Economics and Management

Postgraduate (Master's) Programme of Study *MBA*

Master in Business Administration

Postgraduate (Master's) Dissertation

Robots In Telecommunications: Can Call Center Agents Be Supplemented By Robots?

Athena Mouxouri

Supervisor

Dr. Daina Nicolaou

May 2020

BLANK PAGE

Summary

The goal of this Master Thesis is to identify whether robots or intelligent machines could be used in call centers to supplement human element behind the customer calls. More specifically we will attempt to answer the questions: Can this familiar way of calling and expecting a human being answering your call be disrupted by replacing humans with robots? can robots meet a customer's expectations and satisfy their needs and requests better and faster than call center human agents or will this cause frustration and further delays to the already congested call center lines?

In chapter 1, we discuss the interaction marketing and technology, informations systems, artificial intelligence, and robotic process automation. To implement the marketing concept company must obtain information about customers.

In chapter 2, we discuss the customer involvement in the innovation process. We examine the information systems and innovation in telecommunications services.

In chapter 3, we examine how robotics can increase business value in telecommunication services and we examine the role of robotics in call centers.

Finally, we investigate the factors that play important role in customer satisfaction in a company with telecommunications services. Statistical analysis of a questionaire, shows that robotic systems may assist to improve customer satisfaction but not completely supplement call center agents. The main focus however should be placed on building customer value and satisfaction, which are regarded as the keys to generating customer loyalty.

Περίληψη

Ο στόχος αυτής της Μεταπτυχιακής Διατριβής είναι να προσδιορίσει εάν ρομπότ ή έξυπνα μηχανήματα θα μπορούσαν να χρησιμοποιηθούν σε τηλεφωνικά κέντρα με στόχο να αντικαταστήσουν το ανθρώπινο στοιχείο πίσω από τις κλήσεις των πελατών. Πιο συγκεκριμένα θα προσπαθήσουμε να απαντήσουμε στις ερωτήσεις: Μπορεί αυτός ο οικείος τρόπος κλήσης που περιμένουμε από έναν άνθρωπο να απαντήσει στην κλήση μας, να διαταραχθεί αντικαθιστώντας τους ανθρώπους με ρομπότ; Μπορούν τα ρομπότ να ικανοποιήσουν τις προσδοκίες ενός πελάτη και να ικανοποιήσουν τις ανάγκες και τα αιτήματά τους καλύτερα και ταχύτερα από τους ανθρώπους ενός τηλεφωνικού κέντρου ή αυτό θα προκαλέσει απογοήτευση και περαιτέρω καθυστερήσεις στις ήδη κορεσμένες γραμμές τηλεφωνικών κέντρων;

Στο κεφάλαιο 1, συζητάμε το μάρκετινγκ και την τεχνολογία, τα συστήματα πληροφοριών, την τεχνητή νοημοσύνη και τον αυτοματισμό ρομποτικής διαδικασίας. Για να εφαρμόσει το μάρκετινγκ η εταιρεία πρέπει να λάβει πληροφορίες σχετικά με τους πελάτες.

Στο κεφάλαιο 2, συζητάμε τη συμμετοχή των πελατών στη διαδικασία καινοτομίας. Εξετάζουμε τα συστήματα πληροφοριών και την καινοτομία στις τηλεπικοινωνιακές υπηρεσίες.

Στο κεφάλαιο 3, εξετάζουμε πώς ο αυτοματισμός θα αυξήσει την επιχειρηματική αξία στις τηλεπικοινωνιακές υπηρεσίες και εξετάζουμε το ρόλο της ρομποτικής στα τηλεφωνικά κέντρα.

Τέλος, διερευνούμε τους παράγοντες που παίζουν σημαντικό ρόλο στην ικανοποίηση των πελατών σε μια εταιρεία με τηλεπικοινωνιακές υπηρεσίες. Η στατιστική ανάλυση ενός ερωτηματολογίου, δείχνει ότι τα ρομποτικά συστήματα μπορούν να βοηθήσουν στη βελτίωση της ικανοποίησης των πελατών, αλλά δεν μπορούν να αντικαταστήσουν πλήρως τους πράκτορες τηλεφωνικών κέντρων. Ωστόσο, το κύριο επίκεντρο πρέπει να δοθεί στην οικοδόμηση της αξίας και της ικανοποίησης των πελατών, οι οποίες θεωρούνται τα κλειδιά για τη δημιουργία αφοσίωσης στους πελάτες.

Table of Contents

Chapter 1
Introduction

Dependence on external resources to finance fixed investment and sustainable development is a crucial feature of the economies of developed countries, consequently, such dependence has a determining impact on the ability of these countries to reach their development goals.

There are several actors in development cooperation, such as:

- Energy
- Telecommunications
- Banking/financial services
- Retail services
- Political risk
- Urban infrastructure
- Food
- Currency inconvertibility
- Credit enhancement

Many of the tensions between development actors, focus on different perspectives on the question of what development is. Rather than prescribing a single path for development, development theory has evolved through several conventional wisdoms and remains a collection of theories about how desirable change in society is best achieved. Two main divisions stand out: structuralist theory-inspired approaches tend to emphasize structural transformation and industrialization (United Nations, 2019).

Industrialization is associated with improvements in information and communication technologies (ICT) since the 1980s and the spread of economic globalization that strongly

influence the way we work. ICT improvements, especially the computerization of work, have greatly affected labor demand. The recent literature has analyzed the labor market effects of ICT improvements and has determined the role of computer capital substitutes for workers in carrying out certain non-routine tasks and has explained how computerization increases the demand for high-skill and low-skill workers to perform non-routine tasks. In USA, several studies have suggested that jobs became gradually more non-routine and less routine intensive. In other words, the routine to non-routine ratio declined over the years, as a result of changes in technology and information systems (Akcomak, et al., 2016).

The simultaneous expansion over the next years of industrial and services robotics, may have significant effects on both the work market and daily life. The forecast from experts in any field, robotics in this particular case, are an important element for the analysis of future trends. Apart from study cases, in which the actual effects of the implementation of automated and robotized systems are analyzed, it is also necessary to take into account the events that are likely to occur in the near future and it is important to investigate how industrial and services robots will change the future of work and business organizations.

Generally, the effects of automatic and robotic systems in services sector can be grouped in the following categories:
- Employment rates in those fields of activity in which tasks become automated.
- Changes in working hours, required skills and training, job characteristics.
- Changes in business organizations.
- Changes at home as a result of the coexistence with service robots.
- Change in the meaning and value of work itself.

(Pealez, 2001)

1.1 Marketing and Technology

The spectacular advances made in technology in the past decade in many fields, indicate that there is need for managers in general, and marketers in particular, to understand fully what happens to a new technology when it enters a market. It is also important to know

what happens to market when a technology enters it (Avlonitis, et al., 2006). Since technology and automation has been established in -if not to all- to the most market segments, it is a fact that automation plays an important role helping people to accomplish a variety of tasks faster and better. Technological advancements such as real time automation in customer service industry and more specifically in the telecommunication services are important as they increase customer satisfaction and retention (Yunil & Piraphong, 2018).

Technological innovation plays a crucial role in management information systems, in the e-business enterprise. The transformation of business caused by E-business and E-commerce applications of internet and related technologies demonstrates that information systems and information technology are essential ingredients for business survival and success. All companies must update their business infrastructures and change the way they work to respond more immediately to customer needs (O'Brien, 2002).

In this Master's dissertation, we will examine the benefits of using automation systems - robots in telecommunication service companies and especially in their call center and try to understand whether automation systems can supplement the human element in call centers.

1.2 Information Systems and Business Function

It is important to understand the crucial role of how information systems affect a particular business function, such as marketing. Marketing performs a vital function in the operation of a business enterprise as it is concerned with the planning, promotion and sale of existing services or products in existing markets and the development of new products and markets to better serve existing customers but at the same time to increase new customers. Business firms have increasingly turned to information technology to help them perform vital marketing functions in the face of the rapid changes of today's environment.

On the other hand, Information Technology (IT) is the bloodstream that feeds the business' process. It has become a major force for precipitating, enabling organizational and material change. It has already enabled innovative changes in managerial decision making, organizational structures, and managerial work activities. IT includes the use of internet, intranet, extranet as a primary IT infrastructure and the distribution of technology to employees, customers, suppliers. IT also includes the use of global and enterprise computing collaboration and decision support systems and is an important function for the integration of the cross-functional enterprise software that will replace the company's legacy systems. The result of IT development is customer value and business value, as it gives customers what they want, when and how they want it at the lowest cost and provides effective distribution and channel partnerships, responsiveness and accountability to customers.

Mixing the two basic industry functions mentioned above, the Marketing and the IT, Marketing Information Systems have been used to provide information technologies that support major components of the marketing function. Increasingly computers and networks, are providing the basis for sales force automation. In companies, the salesforce is being provided with computers, web browsers and sales management software that connects them to marketing websites on the internet, extranets and their company intranets. This increases the personal productivity of salespeople and speeds up the capture and analysis of sales data from the work field to the marketing managers. It allows marketing and sales management to improve the delivery of information and the support they provide to their salespeople. Many companies are viewing sales force automation as a way to gain a strategic advantage in sales productivity and marketing responsiveness (Yunil & Piraphong, 2018).

Salespeople use their PCs to record sales data as they make their calls on customers and prospects during the day. They can upload information on sales orders, sales calls, sales statistics, send electronic mail messages and access website sales support information. Network servers may download product availability data, lists of information on good sales prospects. The web-based sales force automation package supports sales lead management of qualified prospects and management of current customer accounts.

Manufacturing information systems support the production-operations function that includes all activities concerned with the planning and control of the processes producing services or goods. The production-operations function is concerned with the management of the operational processes and systems of all business firms. Information Systems used for operations management and transaction processing support all firms that must plan, monitor and control inventories, purchases and the flow of goods and services. Firms, such as transportation companies, retailers, service companies, telecommunications, must use production-operations information systems to plan and control their operations.

A variety of manufacturing information systems are used to support computer-integrated manufacturing (CIM). CIM is an overall concept that stresses that the objectives of computer-based systems in manufacturing must be to:

- simplify production processes, product designs, factory organization as a vital foundation to automation and integration.
- automate production processes and the business functions that support them with computers, machines and robots.
- integrate all production and support processes using computers, telecommunication networks and other information technologies.

(Yunil & Piraphong, 2018)

The overall goal of CIM, and such manufacturing information systems is to create flexible, agile, manufacturing processes that produce products of the highest quality. CIM supports the concepts of flexible manufacturing systems, agile manufacturing and total quality management. Implementing such manufacturing concepts enables a firm to quickly respond to and fulfill customer requirements with high-quality products and services (Yunil & Piraphong, 2018).

Computer-aided manufacturing (CAM) systems are those that automate the production process. This could be accomplished by monitoring and controlling the production process (execution systems), or by controlling a physical process (process control), a machine tool (machine control), or machines with some humanlike work capabilities (robots) (McKerrow, 1991).

Manufacturing execution systems (MES) are performance monitoring information systems for factory floor operations. They monitor, track, control the 5 essential components involved in a production process:

- Materials
- Equipment
- Personnel
- Instructions
- Specification
- Production facilities

These systems monitor, report and adjust the status and performance of production components to help a firm to achieve a flexible, high-quality manufacturing process.

Finally, computer-based manufacturing information systems help a company achieve computer-integrated manufacturing, CIM, and thus simplify, automate (robotic systems), integrate many of the activities needed to quickly produce high-quality products and services, to meet changing customer demands. Functional business information systems support the business functions of marketing, production/operations, accounting, human resource management through a variety of E-business operational.

1.3 Robotics and Artificial Intelligence

Machine control is the use of a computer to control the actions of a machine. An important development in machine control and computer-aided manufacturing is the creation of smart machines and robots where these devices directly control their own activities with the aid of microcomputers. Robotics is the technology of building and using machines - robots with computer intelligence and computer-controlled humanlike physical capabilities (McKerrow, 1991).

Robots are used as steel-collar workers, to increase productivity and cut costs and are particularly valuable for hazardous areas or work activities. Robots follow programs distributed by servers and loaded into separate and special-purpose microcomputers. The

input is received from visual and tactile sensors, processed by the microcomputer and translated into movements of the robot. (McKerrow, 1991). Robotics is a major field of artificial intelligence with several applications, such as this in call center automation.

Companies are using the internet and competitive intelligence, CI, software tools for daily operational activities. This is especially important in the dynamic world of telecommunications, where the subscribers of the services are only a few clicks away from comparing prices, product features and deals with those of other competitors. Telco's are using web-based competitive intelligence software tools and services with AI features. (Nilson, 1980).

Artificial intelligence, AI, on the other hand, is a field of science and technology based on disciplines such as computer science, biology, psychology, linguistics, mathematics, engineering. The main goal of AI is to develop computers that can think, as well as see, hear, read, answer, talk, feel. AI, deep learning, neural networks represent incredibly exciting and powerful machine learning-based techniques used to solve several real problems. A major thrust of AI, is the development of computer functions normally associated with human intelligence, such as reasoning, learning, problem solving, as demonstrated in the following table:

ATTRIBUTES OF INTELLIGENT BEHAVIOR	
Think.	Deep learning.
Use reason, think to solve problems.	Quantum computing.
Learn, understand from experience and observation. Self-learn, self-correct.	Cope with situational problems and explore solutions at same time.
Acquire and apply knowledge.	Ability to communicate.
Exhibit creativity and imagination.	Speech recognition systems.
Respond quickly and successfully to new situations.	Chatbots
Recognize the relative importance of elements in situation.	Facial recognition

Handle incomplete or erroneous information.	Processing, understanding natural language.
Rational thinking.	Plan creation and execution.
Fast decision making.	Artificial neural networks.

Table 1. Attributes of intelligent behavior.

Artificial Intelligence is described as the ability to perceive information and retain it as knowledge to be applied towards adaptive behaviors within an environment or context. AI involves learning, understanding, knowledge learned to achieve the main goals in marketing-management. While human-like deductive reasoning, inference, decision-making, by a computer is still a long time away, there have been remarkable gains in the application of AI and associated algorithms (Tanimoto, 1990).

A debate was raged around artificial intelligence since serious work in the field back when it began in the 1950s: Technological, moral and philosophical questions about the possibility of intelligent, thinking machines were asked and even though much work has been done in this field since the '50s, critics believe that developing intelligence to impact true humanlike capabilities to computers is not to be fully developed in the near future (Nilson, 1980).

Artificial Intelligence applications can be grouped under three areas:

Robotics: visual perception, tactility, locomotion, navigation. AI, engineering and physiology are the basic disciplines of robotics. This technology produces robot machines with computer intelligence and computer-controlled, humanlike physical capabilities. This field includes applications designed to give robots the power of sight, visual perception, navigation, thinking, solving problems, talking, answering questions (Tanimoto, 1990).

Natural interfaces: natural languages, speech recognition, multisensory interfaces, virtual reality. This area includes the development of natural languages and speech recognition (Nilson, 1980).

Cognitive Science: This area is based on research in biology, neurology, mathematics. It focuses how the human brain works, thinks and learns. The results of this research are the basis for the development of computer-based applications in A.I.

a. Adaptive learning systems can modify their behavior based on information they acquire as they operate.

b. Fuzzy logic systems may process data that is incomplete. They can solve unstructured problems with incomplete knowledge by developing approximate inferences and answers, as human do.

c. Neural networks software can learn by processing sample problems and their solutions and will continue learning until it demonstrates a high degree of accuracy in correctly duplicating the results of recent cases. Neural networks learn to recognize patterns and relationships in the data it processes.

d. Genetic algorithm software uses randomizing mathematics functions, to generate increasingly better solutions to problems. Genetic algorithms are especially useful for situations in which thousands of solutions are possible and must be evaluated to produce an optimal solution. It uses sets of mathematical process rules-algorithms-that specify how combinations of process components, or steps are to be performed.

e. Intelligent agents use its built-in and learned knowledge base about a person or process to make decisions and accomplish tasks in a way that fulfills the intentions of a user. Intelligent agents, also called software robots, are special-purpose knowledge-based information systems that accomplish specific tasks for users. One of the most well-known uses of intelligent agents is the wizards found in Microsoft Office. These wizards are built-in capabilities that can analyze how an end user is using a software package and offers suggestions on how to complete various tasks. The use of Intelligent agents is growing rapidly as a way to simplify software use, search corporate intranets, help customers do comparison shopping among the many e-commerce sites on the web. The most common types of Intelligent agents are presented in the following table:

INTELLIGENT AGENTS	ROLE
Interface tutors	Observe user operations, correct mistakes, advice

Presentation agents	Show information, based on preferences.
Network navigation agents	Discover paths to information.
Search agents.	Help user find files.
Information brokers	Provide commercial services to discover.

Table 2. Types of Artificial Intelligence.

    f.   Expert systems are knowledge-based information system that uses its knowledge about a specific, complex application area to act as an expert consultant to end users. These systems provide answers to questions and provide decision support in specific problems, by making humanlike inferences about knowledge contained in a specialized knowledge base. They must be able to explain their reasoning process and conclusions to a user.

Chapter 2
Customer Involvement

2.1 Customer Involvement in the Innovation Process

For sustained success of a company operating in the field of telecommunications, it is crucial to constantly innovate service offerings to multiple customer segments. The basic aim of the innovation process in such a company has to be creating greater value provided to customers, both in terms of the previous offer as well as in terms of the competitors' offer (Kovarikova & Braska, 2013). In order to achieve this goal, it is desirable to involve customers in the innovation process so as to make them co-creators of the value which will be provided to them in the immediate future. Pulling customers into the innovation process is usually easier with personalized customers who purchase a large volume of services rather than involve a large number of small customers repeatedly purchasing limited services. For these customers, the firm needs to create mechanisms to identify their needs and requirements, process this information and hand it to the employees so that the innovation process takes place in a desirable manner (Wang, et al., 2004).

From the modern management perspective, maximizing customer value is the key to surviving fierce competition in the business world; and given the increasing intensity of business competition and the strong trend towards globalization, the attitude towards the customer is crucial. Driven by demanding customers, competition and rapid technological change, several companies are searching for new ways to achieve, retain, upgrade and leverage competitive advantages. Such a competitive advantage may be the ability to innovate products or services provided, so as to increase customer satisfaction. However, this implies to elaborate the form of innovation process in the firm, and rethink its links with other business processes, that will increase the likelihood of its successful implementation (Svendsen, et al., 2011).

It is important to understand, that innovation process cannot be successful without information regarding the needs and requirements of customers, whom the innovated service and product will serve. Such information is crucial to create the shape of services that will provide a greater value than the one provided by competitors (Berry, et al., 2006).

There is, also, a change in focus on how value is created. One of the basic factors of this change is the "connected customer", who increasingly expects tailor-made products and services, based on individualized and immediate feedback. This is why involving customers and suppliers is considered an important factor impacting new service success. Additionally, external communication with key customers (for example in terms of B2B area, the large businesses) has been stressed as a key success factor for service development projects. It is a fact that today's connected customer is not connected to individual firms; customer is connected with other customers through the internet and especially the social networks which leads to interaction of customers and increases the speed of converting the wishes and requirements of the customers to which the Telco provides its services (Gorry & Westbrook, 2011).

Innovating companies must decide, first, on the direction of innovation, the subject of innovation, what aspects of the service the innovation will be focused (Gladwell, 2005). Berry et al (2006) proposed the concept of market-creating service innovation and developed a matrix that identified 4 types of service innovation that offer a different way of thinking strategically about how companies create new revenue streams in the market through certain types of service innovation:

- *Controllable convenience:* this form of service innovation creates a new market by delivering service benefits through new channels. With this way, customers may enjoy the service benefits at any time and place. Service providers are able to allow consumers instant and continuous access to new information, that reduces the time and effort of processing and communicating information. Telecommunication companies with new delivery channels, can strengthen their competitive advantage by reducing the time and effort required by customers, and thus create a new revenue stream in the market.

- *Flexible solutions*: by applying flexible solutions, service providers can identify consumers' unsolved problems and integrate existing technologies and skills to offer new tailor-made solutions to them.
- *Comfortable gains:* new service benefits are directly experienced by consumers' emotional and physical comfort. The more comfortable, distinctive, enjoyable and memorable a service experience is, the more benefits a customer will get and more likely will remain attached to the service for a long time.
- *Respectful access:* this type of innovation service refers to a new process system that gives easy and quick access of the services to the consumers. This as a result creates an agile environment where the Telco can quickly adjust to the rapid consumer demand and provide full visibility to the services with respect to the customers. (Prajogo & Sohal, 2006).

2.2 New Service Development

Innovation process, the output of which is new services, consists of several basic sequential steps. According to the literature, there are four steps-stages of new service development:

1. Research and Design: research of new service ideas which are assessed, and then the better ideas are selected into service concepts.
2. Analysis: service providers identify a potential market for the service innovation concept and analyze the competitive advantages.
3. Development: in this step the concept is transformed into a marketable service.
4. Launch: establish strategies for the commercialization, launch and introduction of the new service to the marketplace. (Forehle & Roth, 2007).

The above four-stage process corresponds to the innovation value chain, which divides the innovation process into the following activities:

- knowledge gathering, that means obtaining the necessary information and knowledge.
- knowledge transformation, that means the use of information to design services.
- knowledge exploitation, that refers to creating value through the services provided.

(Roper & Arvanitis, 2012)

The definition of innovation value chain includes five stages, with the following characteristics:

1. the value-defining: selection of market target, strategic thinking.
2. the value-developing: design of channels, pricing, strategic partnership.
3. the value integrating and resourcing: technology development, finance allocation, human resources.
4. the value delivery: manufacturing, selling, communications, applications engineering.
5. the value-maintaining processes: customer linking, channel bonding.

(Svendsen, et al., 2011)

As it seems, the innovation process must begin collecting and analyzing market information and collecting inventions as ideas for innovation. This is followed by the creation of a marketing strategy to define target markets and the concept to serve various markets, including the form of the proposed telecommunication services.

2.3 Information and Innovation of Telecommunication Services

Key service design issues lie in two questions: "who are the customers?", "what do customers want?" The answer to these questions forms the basis of marketing strategy based on which companies design differentiated offers to their specific target groups (Day, 1999).

The key success factor in the implementation of innovative services is collecting the correct information about the wishes and requirements of the customers, as well as about the competition offering and strategy. Without this information, executives might easily miss market opportunities, ignore competitive threats or even promote strategies that fail to achieve competitive advantage (Kristensson, et al., 2008).

The successful innovation of a telecommunication service consists in properly collected and processed information about customers. All this information can be collected from surveys, the company's sales reports, mystery shopping metrics, website traffic data, about customer needs, preferences and customer behavior. Customer involvement also provides important information wherever possible (Customer involvement refers to the degree to which customers take part in creating, producing, delivering new services).

Another successful marketing strategy that companies follow, is to customize services based on each individual's needs. More specifically in the telecommunications field, companies tend to customize the service offering in talking minutes, number of SMSs or volume of Data each consumer gets. This customization aims at satisfying as many needs as possible for each individual customer, in contrast to conventional techniques that try to reach as many customers as possible, while satisfying a rather limited number of customer needs. It is important to clarify here that innovation is not just about new service development, but also refers to the creation of new value-added services to transform better productivity and performance (Lee & Abu Ali, 2011).

When upgrading services intended for telecommunication subscribers, it seems possible to get them directly involved in the innovation process; but involving customers in new services development, requires commitment to the relationship from both customer and supplier. This is apparent as new service development is a value creation strategy requiring actors to invest in specific assets dedicated to the relationship, having close relationship characterized by commitment and a long-term perspective (Coelho & Henseler, 2012). It became obvious that Telecommunication companies have the expertise to decide whether or not an idea is feasible in terms of a potential commercial service but do not have, necessarily, the inspiring ideas that generate feasible services meeting their subscribers' real needs. In addition, by encouraging users to adopt and consider, a new service development team is likely to develop a wider array of original and value-creating ideas for future services.

In the telecommunications industry where the services are widely used on a daily basis by the subscribers to connect, talk with each other and exchange information in the form of SMS or data, the users might experience various situations in which they encounter

difficulties caused by disconnection of services. As a result, certain emotions and cognitions are triggered. Through such experiences, users become aware of their needs that stimulate ideas that stem directly from their experience (Simonson, 2005). Information obtained in the above process may be quite helpful in managing innovation of telecommunication services. It must be finally noted that the direct interactions between customers and services providers, need high quality employees, who possess certain skills and competencies (Cheng, et al., 2012). It is important to understand that the main activity of the firm that provides telecommunication services, is to design a new service, according to the needs of its subscribers and this requires working closely with customers as prospective purchasers of the new service.

Chapter 3
Telecommunication Services and Business Value

Telecommunications and network technologies are working and revolutionizing business and society. The internet is bringing business processes and employees together and connecting them to their customers and suppliers. It also creates a public place without geographic boundaries -a cyberspace- where citizens can interact, publish their ideas, engage in the purchase of goods and services. Since the main service offered by telecommunication firms is the internet, it is evident that telecommunications is a highly technical, rapidly changing field of information systems technology.

Telecommunications is the exchange of information in any form -voice, data, text, audio or video- over computer-based networks. Major trends that occur in the field of telecommunications have an impact on management decisions, forcing the already competitive field of telecommunications to change dramatically in several countries where we have seen them changing from government-regulated monopolies to a regulated market with competitive suppliers. Companies offer now to businesses and to consumers a choice of everything: from local and global telephone services to communications satellite channels, TV, radio, phone services, internet access. The rapidly growth of internet, e-commerce and collaboration, have generated new products, services and providers and the service options available to meet a company's telecommunications needs have increased significantly.

Open systems, using internet networking technologies, are today's primary technology drivers. Open systems are information systems that use common standards for hardware, applications and networking. They create a computing environment that it is open to easy

access by end users and their networked computer systems.   They provide greater connectivity, ability of networked computers, and other devices to easily access and communicate with each other and share information. Web browsers, HTML, Web page editors, servers, network management software, network security fire walls, are some applications of open systems.

The spectrum of telecommunication-based services (information, entertainment, communications), that are available today, include:
- broadcast TV
- video on demand (VoD)
- interactive TV
- video catalog shopping
- transaction services
- telecomputing
- videoconference
- video telephony

Thus, telecommunication services are playing vital and pervasive role in electronic commerce, internal business applications that support the operations, management and strategic objectives of large and small companies.

An organization's investment in its local and global computer network can benefit the organization by cutting costs, shorten response times, support e-commerce, improve the collaboration of workgroups, develop new products and services. This makes telecommunications a complex and important decision area for businesses which seek for the best service provider in the market to collaborate with.

It is important to understand the business value of telecommunications services, in management:
1. Information technology helps a company overcome geographic, time, cost, structural barriers to business success.
2. Applications of e-commerce provide information quickly to end users, at remote geographic locations, at reduced costs.

3. Teleconference can be used to cut costs, by reducing the need for expensive business trips.
4. B2B-business to business e-commerce websites are used by the business to establish strategic relationships with their customers, making business transactions fast, convenient, tailored to the needs of business partners involved.

STRATEGIC CAPABILITIES	VALUE
Overcome geographic barriers.	Better customer service.
Overcome time barriers.	Credit inquiries can be made and answered in seconds.
Overcome cost barriers.	Reduce trips, videoconference-collaboration.
Overcome structural barriers.	Fast and convenient services lock in customers.

Table 3. Business value of telecommunications.

For any business is important to improve telecommunications services, as they play a crucial role in creating business value. In order to improve this, innovative technologies such as robotic systems, may help, due to automation of sales, operational functions, customer call centers. Focusing in the latter, we have seen that the advancement of robotics has brought many benefits in the functions of call centers, that can be automated and improved the business performance.

The most common functions of a call-contact center of a company, are described below in Figure 1:
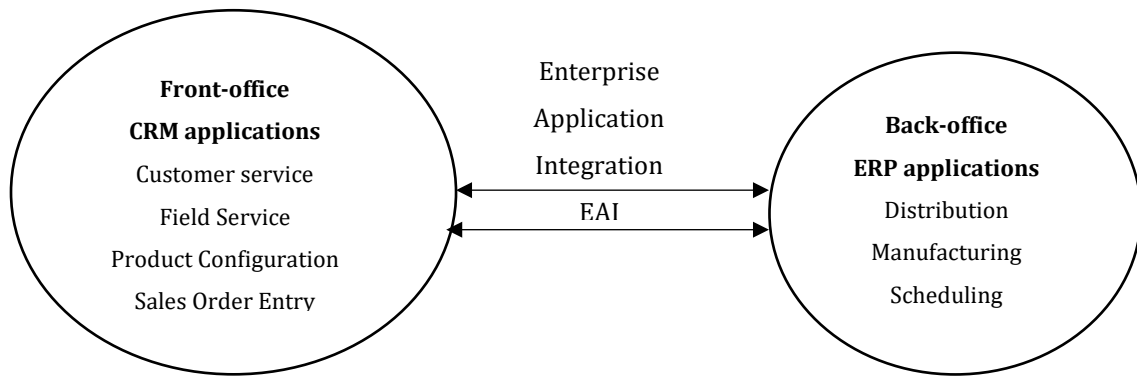
Figure 1: Contact center functions: front office, back office (Kalakota & Robinson, 2001).

3.1 Robotic Process Automation

Robotic process automation, RPA, is the application of technology that allows employees in a firm to configure software, or a robot to capture existing applications for processing a transaction, manipulating data, triggering responses and communicating with other digital systems. RPA mimics the steps of a rules-based, non-subjective process without compromising the existing IT architecture and is able to carry out prescribed functions. Process automation can expedite back-office tasks, customer service, human resources, including data entry, purchase order issuing. Automated processes in the remote management of IT infrastructures may investigate and solve problems faster and may improve service desk operations and the monitoring of network devices. RPA could be in the form of an automated assistant to employees or customers, providing answers in questions in natural language rather than in software code. The use of an RPA brings more technologically advanced solutions to businesses, operating models, cuts costs, drives efficiency and improves quality of service (McKerrow, 1991).

Robotic systems allow for the automation of some tedious repetitive processes that take valuable time from phone representatives. Robotic process automation, RPA, is moving to the forefront as an innovative solution for automating work processes -as robots learn the necessary tasks- without eliminating the value of human collaboration. Robots are prone to fewer errors, require less downtime, and they are more cost-effective.

Call center automation is valuable to assist agent efficiency, customer experience and satisfaction and overall call center ROI. Robotic systems may help to find easier all information about a client, the communication history and previous issues the customer might have had. This makes the process easier for the company, and the customer has to spend less time on the phone, which will improve satisfaction levels. Since robotic systems may be able to exchange information between systems of CRM, an automation system is easily updating customer details in real time (Brady, 1985). This has as a result more efficient and more effective customer support and at the same time improves workflow by automating common tasks. It is important to understand the effectiveness of call center automation, and because of its accuracy and its time and cost saving, as well as the positively impact on the customer experience, firms are using RPA more (McKerrow, 1991).

Robotic Process Automation, RPA, can enable the agent to enter all the data into the necessary fields with just one single entry. RPA can enable firms to make savings in both operational and infrastructure costs, saving the company money on utilities and facilities. It is widely accepted that employee turnover incurs costs for firms. Thus, by using RPA rather than recruiting new employees, companies can deploy robots in simple roles, replacing human employees. In addition, RPA software is a ready-made automation technology that can plug straight into an organization's architecture. It connects directly with call center workflows and processes and is immediately reducing operational costs.

The possible benefits by using robotic systems in call centers of telecommunication firms are the following:
- minimal investment of time and resources. (avoid the need to hire more human employees, just to handle seasonal and short-term increases in call volume. It is easier to assign as many robots as it needs to perform).
- Enhanced customer satisfaction. (better and faster customer service).
- effective upsell and cross-sell. (RPA, empower employees to complete tasks with greater speed, accuracy and efficiency, guiding them).
- flexibility. (RPA software are compatible with several types of computer platforms).

3.2 Behavior-Based Robotics

The successful development of voice function services, that are suitable and capable to replace humans in Telecommunication companies, in particular in call centers, could save businesses billions of dollars. For this reason, high-tech companies, such as, Amazon, Google, IBM, Cisco, are investing millions of dollars into research and development of robotics (to develop the smartest and more charming AI voice) and technology in call centers and other applications (Tanimoto, 1990).

It is important to mention that human communication is idiosyncratic: the human brain has the ability of adaptation quickly and understand other people. Machines -robotic systems, are developing the AI (Artificial Intelligence), so as to be capable in understanding the types of human communication, the variations of human speech and use machine learning-based on previous experiences- so as to find the right answers in each situation (Tanimoto, 1990).

The advancement of technology has brought with it many great benefits for those who operate and manage call centers. Technology helps the automation of processes that take valuable time away from call center representatives. In a telecommunication company's call center for example, robotic systems may help to change someone's password, to find out the remaining balance in their account for voice, SMS or data, to enable or disable a value-added service or even to settle a payment in a few minutes. Call center automation is extremely valuable to help improve the call center agents' efficiency, customer experience and overall call center ROI. As mentioned earlier, robotic systems help to collect information such as communication history, past payments, latest personal information about the customer and this makes the customer support process much easier and thus increases customer satisfaction (Schlesinger, 2003). Also, with robotic systems, is easier to exchange and to transfer information between two platforms -for example, one for CRM and other for service availability- so any call agent can easily initiate a pre-defined process that transfers information back and forth to different systems such as activation of a value added service on a subscriber's account. Robotic systems may also help in marketing campaigns (Chatbots), or by using messenger with customers (McKerrow, 1991).

The performance-behavior-of robotic systems, involves understanding the environment, within which the robot operates. According to the Robotics Industry Association-RIA-a robot is a re-programmable, multifunctional, manipulator designed to do several jobs through variable programmed motions for the performance of a variety of tasks. An intelligent robot is a machine able to extract information from its environment and use knowledge about its world to move safely in a meaningful and purposive manner (Tanimoto, 1990).

The birth of AI -artificial intelligence- as a distinct field is generally associated with the Dartmouth Summer Research Conference held in August 1955. This Conference's goal involved the study of a wide range of topics including language use, neural nets, complexity theory, self-improvement, abstractions, creativity. In the original proposal, Marvin Minsky indicates that an intelligent machine would tend to build up within itself an abstract model of the environment in which it is placed. Since then, AI research developed a strong dependence upon the use of representational knowledge and deliberative reasoning methods for robotic planning, where a plan is any hierarchical process in the organism that can control the order in which a sequence of operations is performed.

The classical AI methodology has two important characteristics. First, the ability to represent hierarchical structure by abstraction and the use of strong knowledge that employs explicit symbolic representational assertions about the world. AI's influence on robotics up to this point was in the idea that knowledge and knowledge representation are central to intelligence, and that robotics was no exception (Beer, 1990).

Behavior-based robotic systems reacted against these traditions. The notion of sensing and acting within the environment started to take preeminence in AI-related robotics research over the previous focus on knowledge representation and planning. Enabling advances in robotic and sensor hardware has made it feasible to test the behavior-based robotics community's hypotheses (McKerrow, 1991).

3.3 A Spectrum of Robot Control

Many different approaches for robotic control have been developed. Representational world models are generally constructed from both prior knowledge about the environment and incoming sensor data in support of deliberation (McKerrow, 1991). Deliberative reasoning systems often have several common characteristics:

- they are hierarchical in structure with a clearly identifiable subdivision of functionality, similar to the organization of commercial businesses.
- communication and control occur in a predictable and predetermined manner, flowing up and down the hierarchy.
- planning scope, both spatial and temporal, changes during descent in the hierarchy.

The intelligent control robotics community, whose roots precede those of reactive behavior-based systems, uses deliberative reasoning methods. Researchers at Drexel University have focused on the theory of intelligent hierarchical control and created a control model possessing the following characteristics:

- it correlates human teams and robotic control structures. A hierarchy of decision makers implements this idea. Autonomous control systems are organized as teams of decision makers (Beer, 1990).
- it assumes that the task is decomposable. It can result in structured subtasks.
- hierarchies are generated by recursion using a generalized controller.
- preconditions are established at each level of recursion to ensure proper execution.

Hierarchical control is seemingly well suited for structured and highly predictable environments. Reactive systems, however, were developed in response to several of the apparent drawbacks associated with the hierarchical design paradigm, including a perceived lack of responsiveness in unstructured and uncertain environments due both to the requirements of world modeling and the limited communication pathways and the difficulty in engineering complete systems as incremental competency proved difficult to achieve that is virtually the entire system needed to be built before testing was feasible (Brady, 1985).

3.4 Reactive Systems

Reactive control is a technique for tightly coupling perception and action, typically in the context of motor behaviors, to produce timely robotic response in dynamic and unstructured worlds (Schlesinger, 2003).

It is important for a system to prioritize tasks and focus sensory resources according to the current environmental context. A robotic system, with intention, determines which set of behaviors should be active based on the robotic agent's internal goals and objectives (McKerrow, 1991).

Robotic systems have reflexive behavior, that is generated by hardwired reactive behaviors with tight sensor-effector arcs, where sensory information is not persistent, and no world models are used whatsoever (McKerrow, 1991).
Several key aspects of this behavior-based methodology include:

- situatedness: the robotic system is an entity situated and surrounded by the real world. It does not operate upon abstract representations of reality, but rather reality itself.
- embodiment: a robotic system has a physical presence. This spatial reality has consequences in its dynamic interactions with the world that cannot be simulated faithfully (Schlesinger, 2003).
- emergence: intelligence arises from the interactions of the robotic agent with its environment (Turban, 1992).

A chronic criticism of traditional artificial intelligence research is that it suffers from the symbol grounding problem that is the symbols with which the system reasons often have no physical correlation with reality. Robotic simulations are often the most insidious examples of this problem, with robots claiming to be sensing and acting but instead just creating new symbols from old, none of which truly corresponds to actual events. Embodiment, as stated earlier, forces a robot to function within its environment: sensing, acting, suffering directly from the consequences of its misperceptions and misconceptions. Building robots that are situated in the world crystallizes the hard issues (Schlesinger, 2003).

A physical agent does not reside in a vacuum but is typically immersed in a highly dynamic environment that varies significantly in both space and time. Further, these environmental dynamics, except for highly structured workplaces, are very difficult if not impossible to characterize.

Scalability of the behavior-based approach has been a major question from its inception. Although these methods are clearly well suited for low-level tasks requiring the competence of creatures such as insects, it has been unclear whether they would scale to conform to human-level intelligence.

3.5 Adaptive Behavior-Robots and Learning Capabilities

Learning is often viewed as part of an intelligent system. Indeed, some argue that without this ability there cannot be intelligence present at all. Learning is linked in robotic systems with AI where AI is the science of endowing programs with the ability to change themselves for the better as a result of their own experiences (Turban, 1992).

A learning machine is any device whose actions are influenced by past experiences. Any change in a robotic system that allows it to perform better the second time on repetition of the same task or any improvement of its performance is an activity that happens due to its learning ability and its information processing ability (Turban, 1992).

Although this definition does not satisfy all, it provides us a means for measuring learning by defining performance metrics against which an agent can be measured before, during and after learning has occurred. Adaptation refers to an agent's learning by making adjustments in order to be more attuned to its environment. We can differentiate four types of adaptation:

1. behavioral adaptation: an agent's individual behaviors are adjusted relative to one another (Arkin, 1998).
2. sensor adaptation: an agent's perceptual system changes according to its environment.
3. learning as adaptation: essentially anything else that results in adapting in its environment (Parisi, et al., 1990).

Learning can improve performance in additional ways by introducing new knowledge-behaviors, rules- into the system, by generalizing concepts from multiple examples, by specializing concepts for particular instances that are in some way different from the mainstream. Also, learning helps reorganizing the information within the system to be more efficient, creating and discovering new concepts (Turban, 1992). Artificial Intelligence, AI, research is determining the mechanisms by which a robotic system can learn some of these things, including:

- neural networks: this form of reinforcement learning uses specialized architectures in which learning occurs as the result of alterations in synaptic weights. Learning in neural networks can be viewed as a form of reinforcement learning (Turban, 1992).
- learning from experience (Parisi, et al., 1990).
- memory-based learning.
- explanation-based learning: specific domain knowledge is used to guide the learning process (McKerrow, 1991).
- multistrategy learning: multiple learning methods compete and cooperate with each other, each specializing in what it does best.
- inductive learning: specific training examples are used, to generate concepts or controllers (Turban, 1992).

3.6 Call Centers and Robotic Process Automation

Robotic process automation, RPA, is a software that mimics behavior; it is digitized with structured inputs and is rules-based.

According to predictive analytics survey, more than 70% of users are not satisfied with the call center experience they get. Therefore, call center automation may assist to increase customer experience and satisfaction (Turban, 1992). By using robotic systems in call centers, the routine, repetitive and operational tasks of a company can be automated. This, as a result will free up time from the employees to focus on more critical work that requires human intelligence and decision making to be completed.

Call center management is complex, as it needs to effectively coordinate customer services and back-office and would need severe automation in order to improve the routine processes. Even though currently customer service representatives utilize a wide variety of tools to serve the customer such as CRM systems, emails, chats, it is timely and less effective to resolve a customer real-time since several business applications required to retrieve and input customer data which is time and energy consuming. Automated call centers use AI and RPA technology to solve service issues and automate elements of what the call center agent does, with computer tools that talk to customers during the call using pre-recorded audio. This automation helps in improving productivity and customer satisfaction whereas it helps companies achieve lower labor costs, by replacing human agents with robotic systems and software (Floreano, et al., 2008).

The most common call center automation software is:
- jacada agent scripting.
- westpac, designed a speech-based call classification system and selected Cyara platform for testing. Cyara platform has been tested in order to understand the customer experience in terms of voice quality, problems solving, and emulating live calls without requiring live agents.
- radio systems corporation, that deployed Aspect contact center solution, with increased average speed of answer.

RPA together with AI can simulate some behaviors associated with human intelligence so as to solve complex problems. Using AI robotic systems, the call centers develop the ability to imitate a human way of sensing things, making decisions and communicating, thinking and acting like a human would (Floreano, et al., 2008).

RPA may be unattended or attended:
- unattended, works behind the scenes to complete sequential tasks, so as to automate large volume of work, or integration data across various systems.
- attended, is triggered by specific events, actions or commands within a particular workflow.

(Floreano, et al., 2008)

As with RPA, there are two types of AI:

- Narrow AI: that appears to learn how to carry out simple tasks without being programmed. Virtual assistants can perform tasks and answer questions.
- General purpose AI: refers to a machine that could simulate human learning, understanding and intelligence.

By combining AI with RPA, there are some benefits for call centers:

- AI assistant can relieve frontline agents of recurring tasks like categorizing and tagging the types of questions from customers.
- AI saves agents time, by replying to frequent inquiries. AI assistant learns from the agent the appropriate responses for different types of issues.

It is known that human emotions cannot be reflected and captured by a robot, neither a robot can feel and empathize with the human being talking on the other end of the telephone line.

The main disadvantage of chatbots are that they could not deal with complex requests, neither deliver personalized offers as well as humans, since they are not able to capture and understand human emotions (Schlesinger, 2003). Additionally, a robot doesn't have creative mind to adjust to the complex customer requests and it cannot think by itself; it can only work according to the program (Zelinsky & Kuniyoshi, 1996). Other disadvantages are the disability of specific thinking and from a humanitarian aspect, the loss of human jobs. Finally, the AI of robotic systems is extremely expensive to fully implement and when used, is a complement to existing contact center operation, rather than an alternative (Schlesinger, 2003).

On the other hand, another recent study (2018 state of chatbots), has shown that the benefits of chatbots are: the 24-hour service (64%), instant responses (55%), and that they can give answers to simple questions (55%). Also, the major benefits of using robotic systems in call centers are the lower cost compared to human labor, it is time saving, and it eliminates human errors.

As mentioned earlier, RPA has already been used in call centers but with limited functionality, as complementary to the existing operations. This is because RPA requires long term planning in order to pass to full adoption of technical automation. At this time, call center agents, will continue to play an important role in customer service-satisfaction, and technology will help to deliver more effective and value-added experiences. Robotic systems technology in a call center, may give the best results if it increases speed and the productivity of human call center agents and makes them more effective and efficient. It is believed that in the future, artificial intelligence, AI, will be fully utilized for customer service in contact centers.

Robots, digital assistants, virtual assistants, bots, chatbots, metabots, are some types of AI systems in a call center (Zelinsky & Kuniyoshi, 1996) As of today, virtual assistants are the most mature group. Mature versions allow secure access to web portals and are able to dynamically populate web pages. They are at the leading edge in terms of natural language understanding and learning.

Bots are built upon the rising tide of Slack and Facebook Messenger platforms. The addition of natural language recognition, to our IVR, provide customers with easier self-service options. It is estimated that 25% of customer service and support operations will use chatbot technology by 2020, up from less than 2% in 2017 (Gartner Customer Experience & Technologies Summit, 2017). According to the Aspect Consumer Experience Index, 61% of consumers feel that having chatbots in customer service is the way of the future.

RPA, robotic process automation, technology is helping staff to spend more quality time with customers. This digital technology helps making call centers smarter, evolving from a voice-only call center into a multi-channel contact environment, that focuses on increasing customer experience and satisfaction. Customer satisfaction is essentially the key goal of a call center performance, as good customer experience management leads to increased profitability and success (Schlesinger, 2003).

Robotic systems help the improvement of customer satisfaction, while increasing long-term revenue potential. Advances in digital technology provide new opportunities for

customer experience and revenue growth. This is why companies are embracing new customer journey models, using a range of communication channels. By equipping companies with digital technology to interact with customers, businesses can grow customer loyalty and improve their image (Schlesinger, 2003).

Chapter 4
Research and Methodology

4.1 Research Problem

The aim of this Master's dissertation is to understand whether robotic systems using AI and machine learning can supplement call center agents in telecommunication operators. More specifically, will investigate whether customers of telecommunication companies in Cyprus are ready for disrupting technology of robots as opposed to humans for call center agents.

Currently, selfcare applications exist in the markets where customers can perform several actions such as activations/deactivations of services, change of plan, bill payments, view their balance details etc. Since these applications are customized based on each subscriber's contract, displaying unique information per subscriber, it would be expected to have high penetration an being the first option of a customer before interaction with humans.

However, it is still common within consumers and especially business customers to call at the call center seeking for a direct discussion with humans, ask questions, report issues and even request for immediate solutions. Can this familiar way of calling and expecting a human being answering your call be disrupted by replacing humans with robots? can robots meet a customer's expectations and satisfy their needs and requests better and faster than call center human agents or will this cause frustration and further delays to the already congested call center lines?

4.2 Research Design

A quantitative research is used this Master's dissertation with two satisfaction surveys. The questionnaires refer to the customer satisfaction and to the work satisfaction of customers and employees respectively of a telecommunications company in Cyprus, "epic".

According to Williams, M. (2003) the questions in a questionnaire are determined by how and from whom the data are about to be collected. For this Master's dissertation, he questions will be collected in the form of an anonymous online survey which means that when building the questions, the type of the questions as well as their sequence in the questionnaire are important for the collection of valid results. It is also important to keep the questions short and simple (Williams, 2003).

The questionnaires have been conducted based on the Likert Scale to measure opinions, perceptions and behaviors. Most questions use a 5-point scale, that referred as satisfaction scale and ranges from one extreme attitude to another. Likert Scales are the most reliable ways to measure opinions (Allen & Seaman, 2007). The data have been collected using the free tool Google Forms and results were gathered through the internet, anonymously.

To make the customer satisfaction survey valid and the analysis of the data representative to the customers of the telecommunications company, while being able to generalise the findings of the research, we will request to collect data from more that 70 customers of the company. On the other hand, to make the employee satisfaction survey valid and the results representative, due to the small number of company employees at the call center of epic, we will request to gather data from all of them.

Finally, the statistical analysis was based on Google Forms and by using IBM SPSS software.

4.3 Research Objectives

The main objective of the employee satisfaction survey is to assess the job satisfaction of the call center employees based on the below components:

- Pay and compensation salary

- Work conditions
- Manager
- Development opportunities
- Colleagues
- Repetitive job actions

The main objective of the customer satisfaction survey is to assess the satisfaction of the call center customers based on the below components. These components refer to the call center representative/agent who answered call:

- Call Responsiveness
- Knowledge
- Training
- Polite
- Problem resolution
- Response time
- Recommendations for improvement

4.4 Research Limitations
The limitations of this survey are:
1. Data collected from 52 call center customers and 42 call center agents.
2. The research is only conducted for one telecommunication company in Cyprus.
3. The company does no longer have a dedicated call center for the business customers (B2B).

4.5 Validity and Reliability
"The idea of validity hinges around the extent to which research data and the methods for obtaining the data are deemed accurate, honest and target" (Denscombe, 1998) (p.241). Validity can be grouped in three different situations: content validity, internal validity and external validity. Content validity refers to the questions and whether they can reveal the participants' thinking and behavior. Internal validity refers to the questions again and

whether they help the researcher collect relevant and accurate data. Lastly, external validity refers to the extend which the results can be generalized for the whole population of the survey.

To make sure of the internal and content validity of this survey, both questionnaires were distributed to initially 5 different people each. Furthermore, based on the results of the sample, the reliability and consistency of the questionnaires were measured.

Cronbach's alpha, α, was developed by Lee Cronbach in 1951 and is used to measure the reliability or the internal consistency of Likert scale surveys. The result will show if the designed survey is measuring the variable of interest in an accurate way. The formula for Cronbach's Alpha is:

$$\alpha = \frac{N \cdot \bar{c}}{\bar{v} + (N-1) \cdot \bar{c}}$$

The questionnaires' reliability was measured with Cronbach's Alpha function to provide the internal consistency. With the 5 samples collected of each of the two questionnaires, the reliability result was computed using the SPSS software and measured 0.914 which is excellent based on the table shown in Figure 3.

Cronbach's alpha	Internal consistency
α ≥ 0.9	Excellent
0.9 > α ≥ 0.8	Good
0.8 > α ≥ 0.7	Acceptable
0.7 > α ≥ 0.6	Questionable
0.6 > α ≥ 0.5	Poor
0.5 > α	Unacceptable

Figure 2. Cronbach's Alpha Consistency Results Table (Statistics How To, 2014).

Chapter 5
Results

5.1 Employee Satisfaction Survey

The employee satisfaction survey aims to analyze the human element behind the call center support lines and whether these agents, working *for* the customers, can be supplemented entirely by robotic systems. We have identified that when employees are happy with their work environment, they tend to have good results, they can think outside of the box and answer complex questions posed to them by the customers. Additionally, when employees are satisfied by their work environment, they assist their customers and provide better and faster solutions to them. The below questions 1 to 8 present the responses of epic call center employees about their job satisfaction.

As demonstrated in Graph 1 and 2 below, most of the employees agree that they are happy with their work and believe to have good work life balance.

I am happy with my work at the call center.

    1 = Strongly disagree
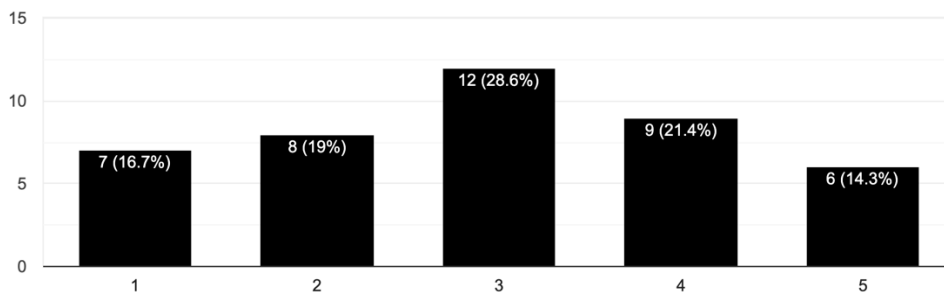
    5 = Strongly agree

Graph 1. Employee satisfaction survey – Question 1

I have a good work life balance.

       1 = Strongly disagree

       5 = Strongly agree
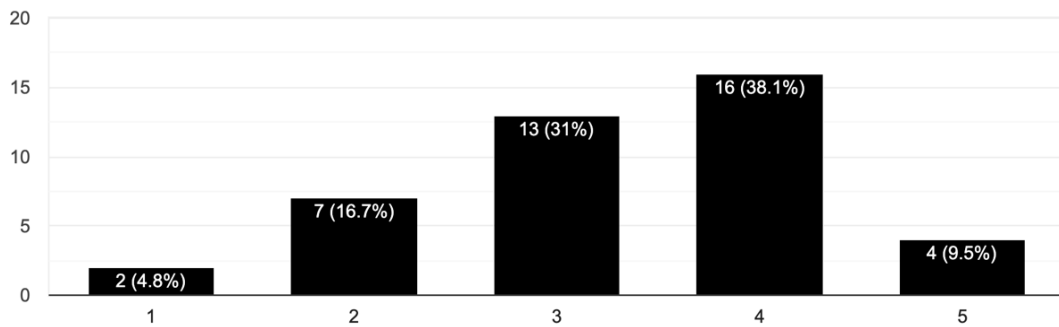
Graph 2. Employee satisfaction survey – Question 2

The call center agents could refer their friends to work for epic call center (Graph 3) and believe that the salaries are significantly low and could improve (21.4%). They also have the support of their managers and co-workers which reflects a healthy work environment, where people tend to help each other. This could mean that when a call center agent is not able to immediately reply to a customer question, can either ask co-workers for assistance or escalate the problem to their manager.

I would refer my friends to work here.

       1 = Strongly disagree
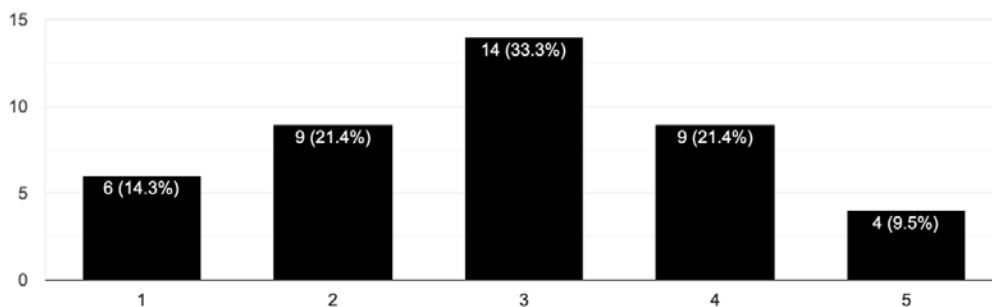
       5 = Strongly agree

Graph 3. Employee satisfaction survey – Question 3

My pay and compensation are fair

    1 = Strongly disagree
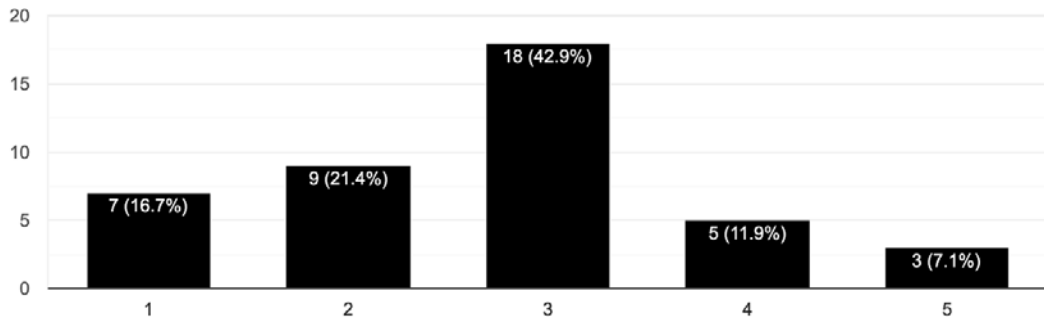
    5 = Strongly agree

Graph 4. Employee satisfaction survey – Question 4

My manager encourages me.

    1 = Strongly disagree
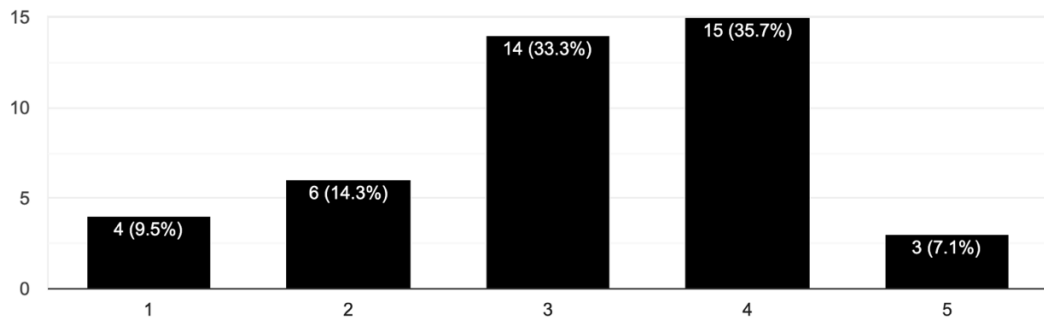
    5 = Strongly agree

Graph 5. Employee satisfaction survey – Question 5

My co-workers and teams support each other.

    1 = Strongly disagree

    5 = Strongly agree
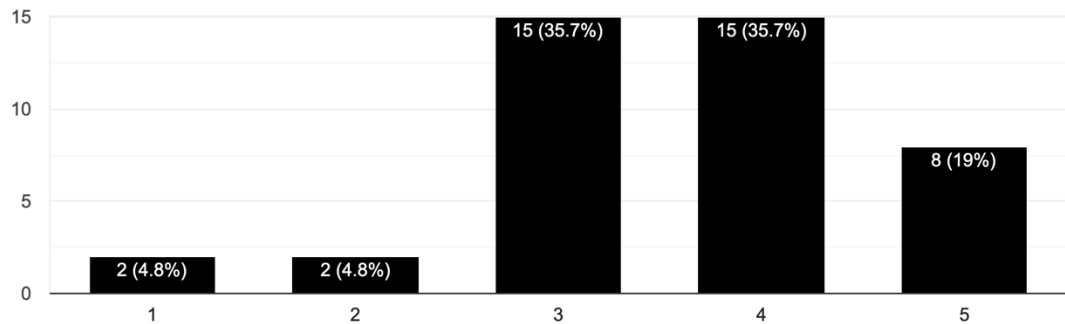
Graph 6. Employee satisfaction survey – Question 6

As demonstrated by Graph 7, the call center agents believe that the epic telecommunications company is a good place to build a career, since we know that the company covers a broad spectrum of science fields, varying to marketing, technical, IT, finance and sales.

My company is a good place to build a career.

> 1 = Strongly disagree
>
> 5 = Strongly agree
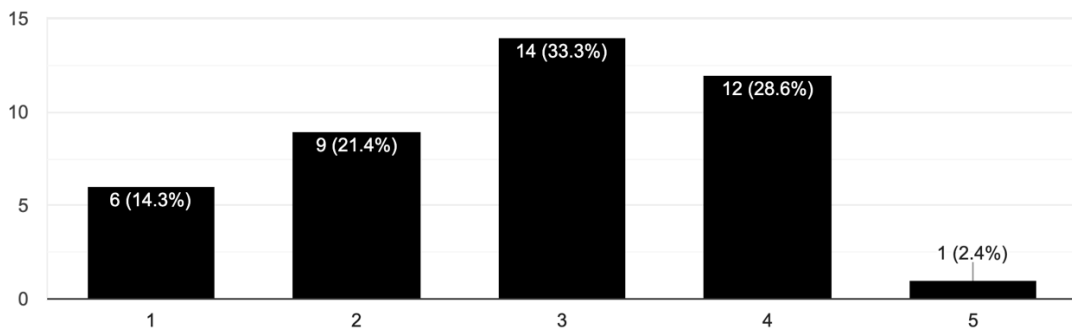
Graph 7. Employee satisfaction survey – Question 7

Overall, the job satisfaction level is high at the call center with a percentage of 33.3% of employees answering that they are satisfied with their job as shown below in Graph 8.

Overall, i am satisfied with my job.

> 1 = Strongly disagree
>
> 5 = Strongly agree
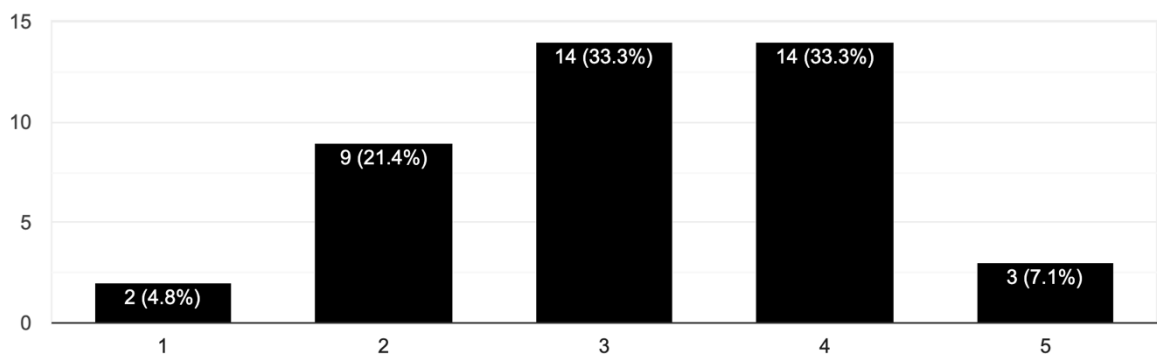
Graph 8. Employee satisfaction survey – Question 8

In order for us to be able to understand the type of questions the call center agents often get from their customers, questions 9 to 11 try to analyze the possibility of supplementing the agents with robotic systems. As it seems by Graph 9 the majority (46.3%) of the call center employees believe that the questions they receive from the customers on a daily basis can be categorized to have standard answers. Furthermore, as demonstrated by Graph 10, the 48.8% of the employees believe that these questions can be answered by any robotic system or a self-service application, instead of a human.

The customer questions received can be categorised to have standard answers.
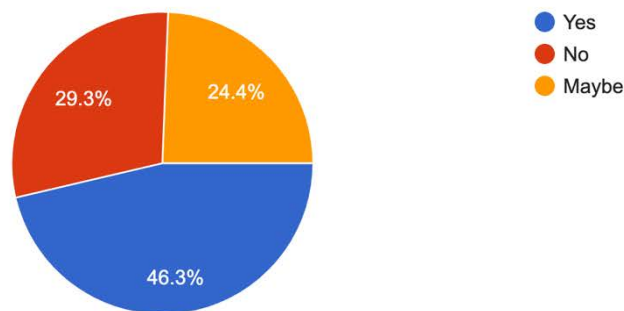
Graph 9. Employee satisfaction survey – Question 9

Customers call to ask specific questions that can be answered by any robotic system or self service application.
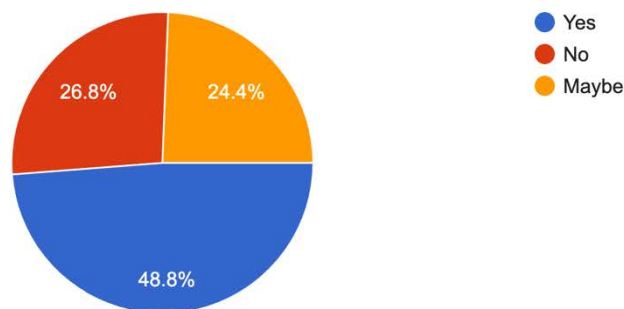
Graph 10. Employee satisfaction survey – Question 10

Finally, the call center employees remain neutral in the question if by adding robotic systems to answer customer calls will improve customer experience and satisfaction (31%). But the majority of them (28.6%) agree that by having a robotic system answering the calls can assist in their job and a significant percentage ()26.2%) strongly agrees with this as shown in Graph 12.

Using robotic systems to answer customer questions will improve customer experience and satisfaction.

      1 = Strongly disagree
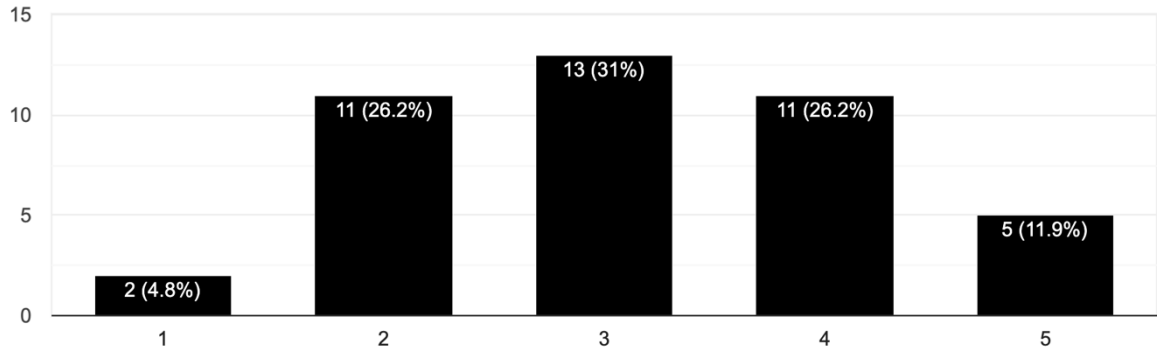
      5 = Strongly agree

Graph 11. Employee satisfaction survey – Question 11

Using robotic systems can assist in my job as call agent.

      1 = Strongly disagree

      5 = Strongly agree
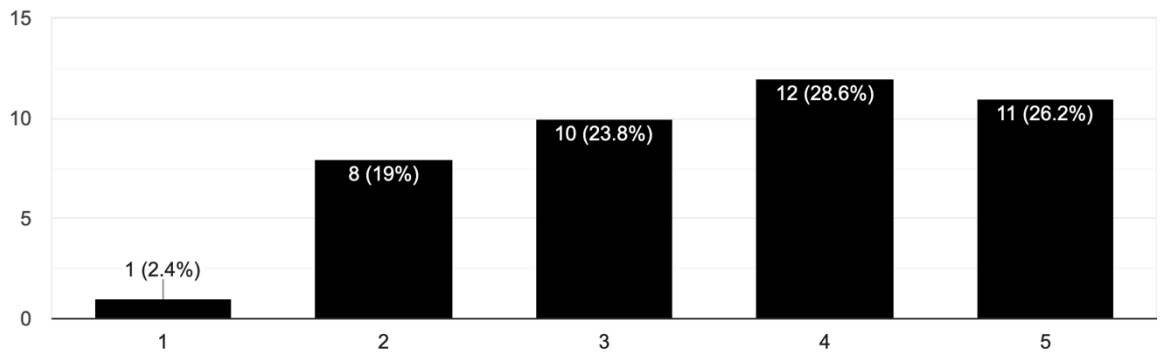
Graph 12. Employee satisfaction survey – Question 12

5.2 Customer Satisfaction Survey

The customer satisfaction survey aims to analyze whether existing call center services provided by humans, keep the customers of the telecommunication company satisfied.

Initially, customers were asked whether they used the call center in the past. As demonstrated by Graph 13, 69.2% of the customers replied positively to this question.

Have you used epic's call center in the past?
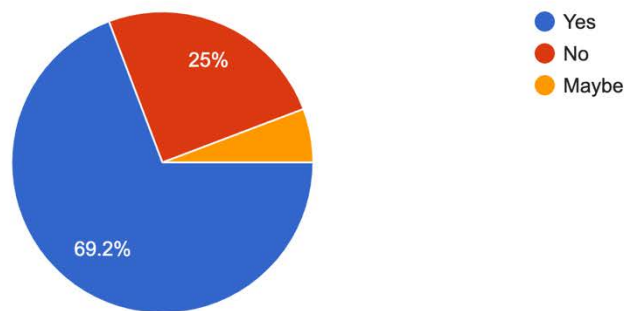
Graph 13. Customer satisfaction survey – Question 1

From the second question we can see that the majority of epic customers (48.1%) does not follow epic on social media. This is a significant component to be considered for this Master thesis, because we have seen from the literature review Chapter 3.6, that currently robotic systems (chatbots) are built upon the rising tide of Slack and Facebook Messenger platforms.

Are you following epic on social media? If so, on which platforms do you follow epic?
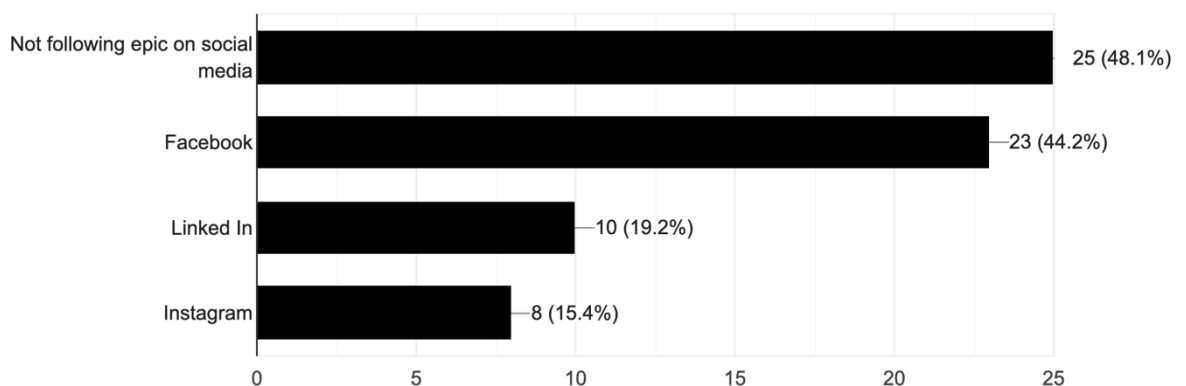
Graph 14. Customer satisfaction survey – Question 2

Question 3 identifies whether customers of epic are using self-service application as opposed to the call center. As demonstrated in Graph 15, a little more than half (53.8%) of the customers use the self-service application named "myepic" which indicates that a lot of customers still need the human interaction to answer their questions.

Do you use myepic self-service mobile application?
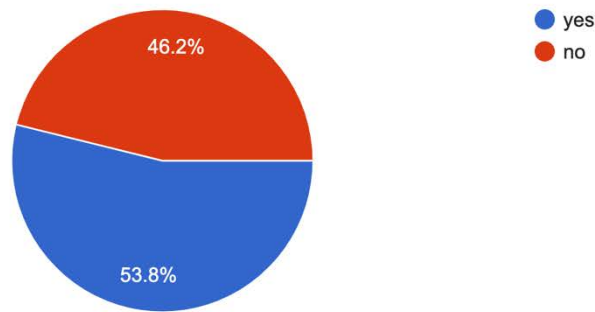
Graph 15. Customer satisfaction survey – Question 3

Question 4 up to question 7 indicate that the majority of the customers are satisfied with the call center and the way their issues were resolved. The majority of the customers (32.7%) they positively rate their experience with epic and believe that call center agents have the knowledge to deal with customer requests (34.6%). Compared to other telecommunication companies of Cyprus, they believe that epic has a better call center (36.5%).

How you would rate the process for getting your issues raised and addressed with epic?

      1 = Poor

      5 = Exceptional
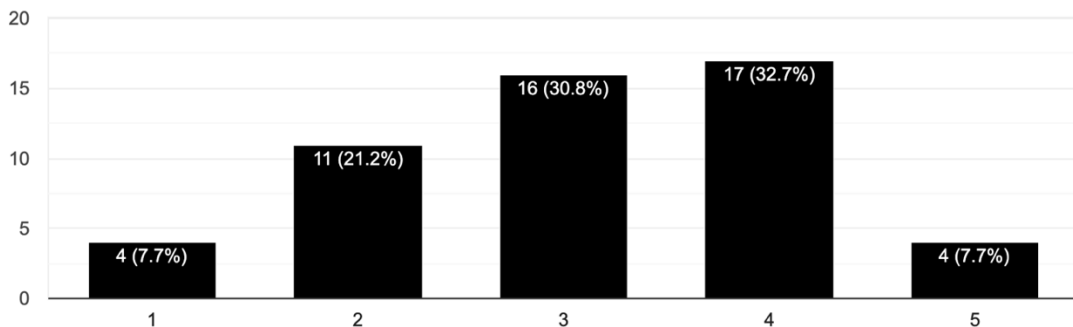
Graph 16. Customer satisfaction survey – Question 4

How you would rate the knowledge level of the call center agent that dealt with your request?

    1 = Poor

    5 = Exceptional
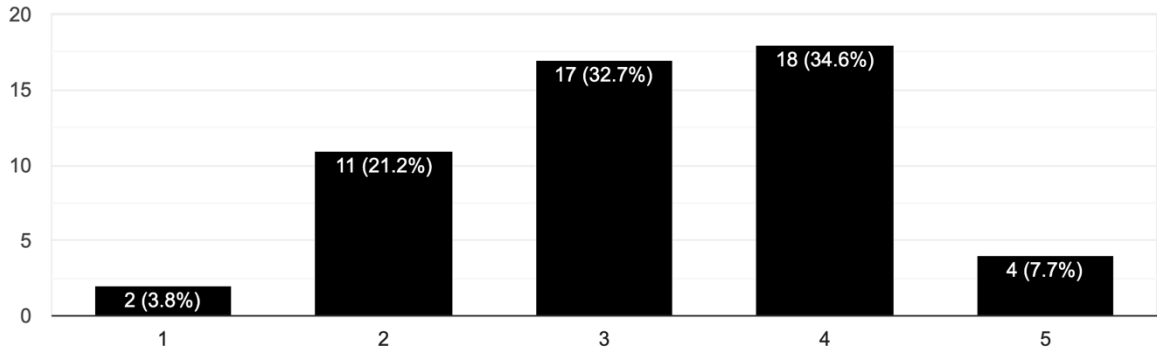
Graph 17. Customer satisfaction survey – Question 5

How would you rate epic's call center in comparison to other telecommunication companies?
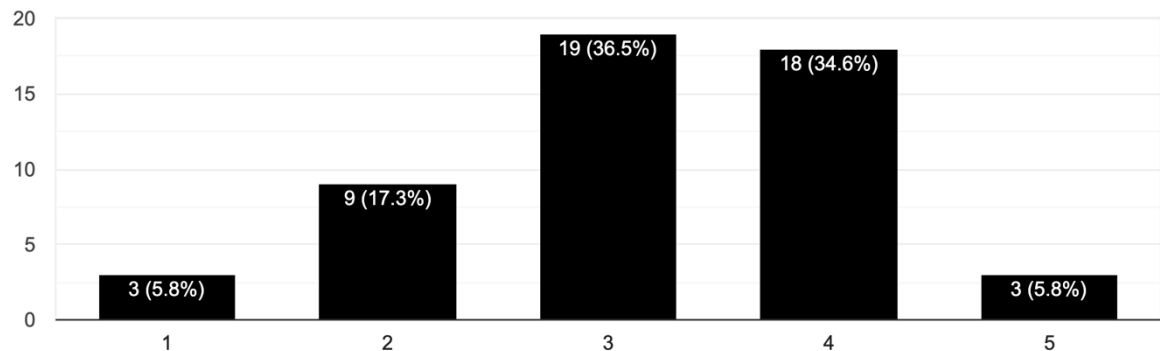
    1 = Poor

    5 = Exceptional
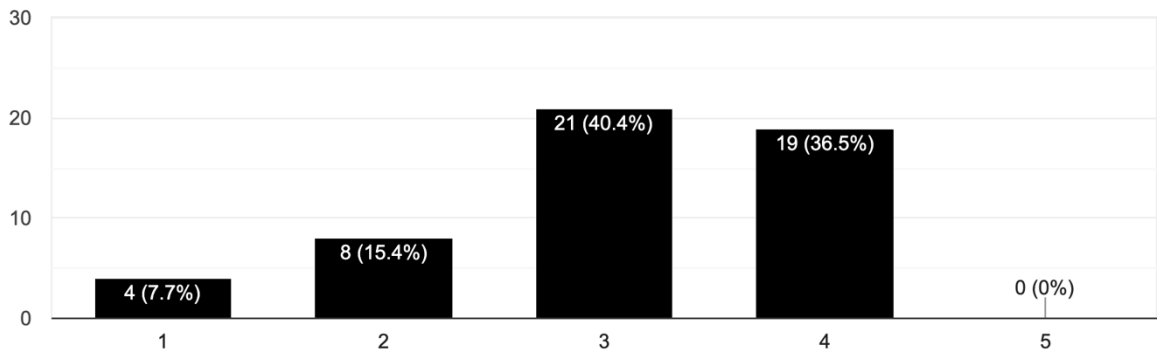
Graph 18. Customer satisfaction survey – Question 6

Overall, how satisfied were you with call center services?

      1 = Poor

      5 = Exceptional

Graph 19. Customer satisfaction survey – Question 7

A short text open-ended question was asking customers to propose improvements to the call center. From the answer we received, it is evident that epic needs to make some improvements to its call center and invest in further training to improve the knowledge of its call center agents mainly about technical aspects. The most frequent answer of the customers was a suggestion to epic to make calls faster. Answers from customers vary but can be categorized into the below short answers:

What do you propose to improve epic's call center service? (short answer)
- Training for more Technical knowledge
- To improve the services they provide to the customers
- Escalate issues to Management
- Improve call center representative's knowledge
- Less pushing the customer to buy new epic products
- Improve the signal
- The problems are with se service itself not the call center.
- Less waiting time
- Understand who the customers are and what knowledge they have to help them better

Note: *More answers were given from the customers but not all of them are presented here even though all of them are along the lines of the points above.*

45

The participants answered that they would recommend epic's call center to their friends, as illustrated by Graph 20. A small percentage (7.7%) would definitely not recommend the service, 38.5% provided a neutral answer and 26.9% of the participants will recommend epic call center to their friends.

Based on your most recent experience with epic's call center, how likely would you be to recommend epic to your friends?

    1 = Definitely not

    5 = Definitely will
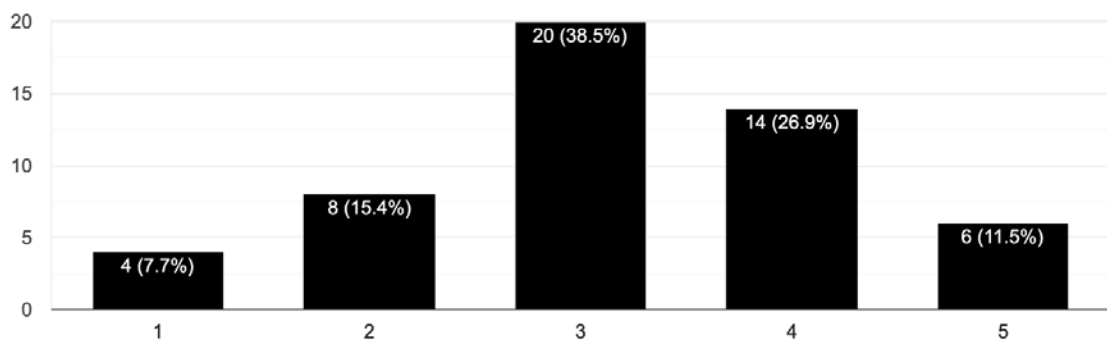
Graph 20. Customer satisfaction survey – Question 9

As demonstrated by the below questions 10 – 13, customers are overall satisfied with the knowledge of the call center agents, where they were able to assist resolve the customer issues and replied that the agents were professional and acted in customer's best interest (30.8%). Finally, we can see from Graph 24 that participants agree that the quality of epic's call center is good (46.2%) whereas 9.6% of the participants believe it was exceptional as opposed to 7.7% who strongly disagree with this statement.

Call center agents have good knowledge of epic's products-services.

    1 = Strongly disagree
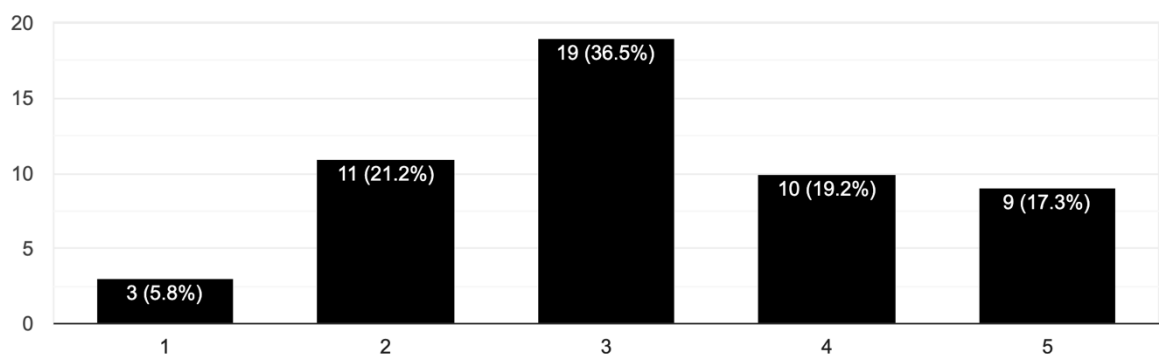
    5 = Strongly agree

Graph 21. Customer satisfaction survey – Question 10

Call center agents were able to solve my problem, or they were able to get me to the right resource that could solve my problem.
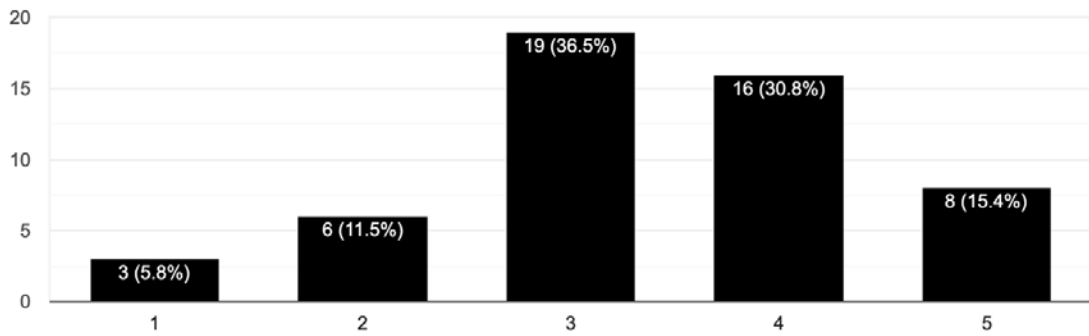
    1 = Strongly disagree
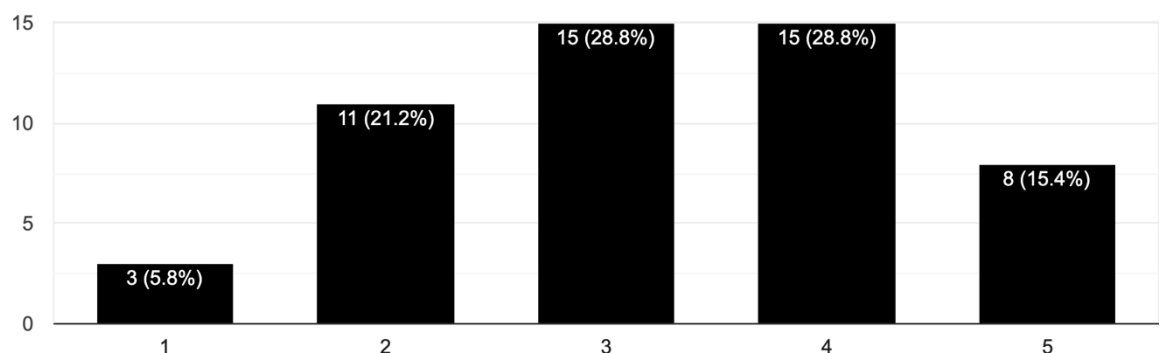
    5 = Strongly agree

Graph 22. Customer satisfaction survey – Question 11

Call center agents were professional and acted in my best interest.
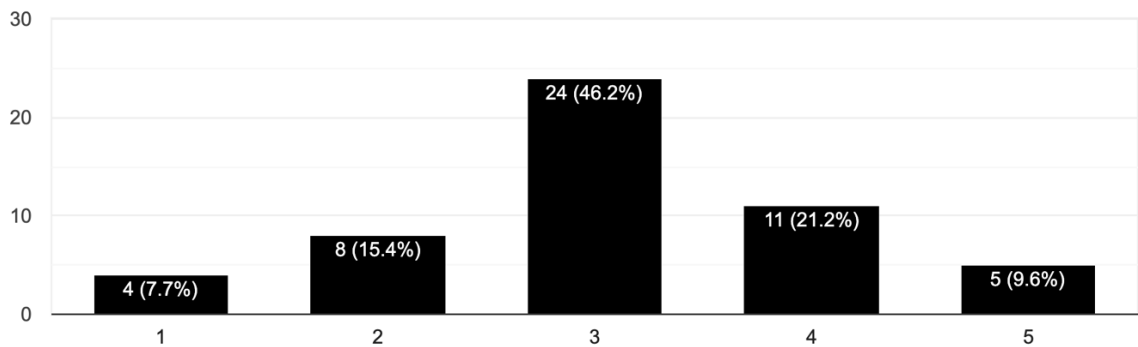
     1 = Strongly disagree

     5 = Strongly agree

Graph 23. Customer satisfaction survey – Question 12

Would you agree that the quality of epic's call center service was exceptional?

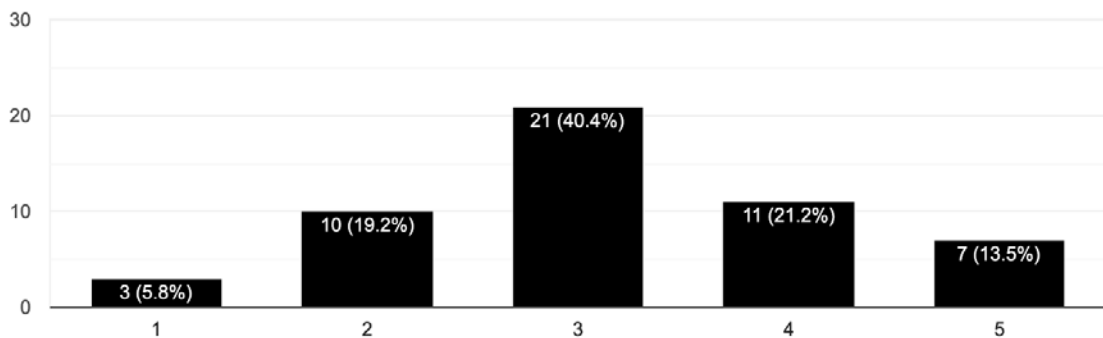   1 = Strongly disagree

     5 = Strongly agree

Graph 24. Customer satisfaction survey – Question 13

The process for getting your concern resolved was simple and easy.

  1 = Strongly disagree

  5 = Strongly agree

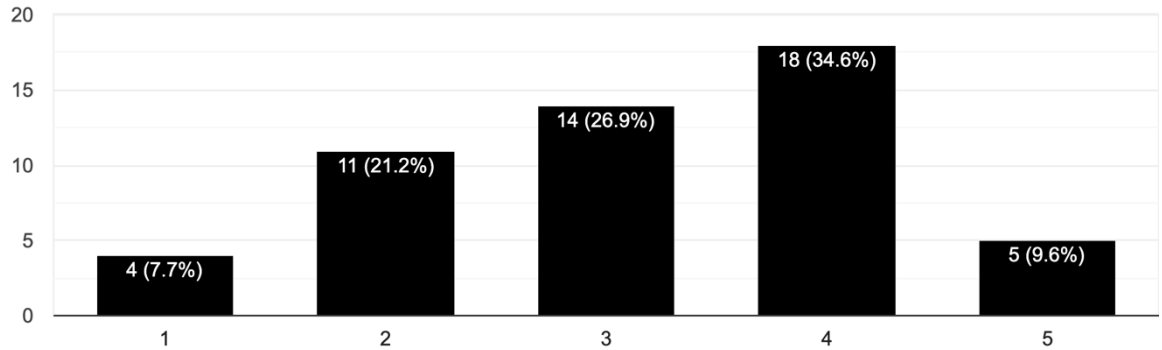**Graph 25.** Customer satisfaction survey – Question 14

In question 14 the participants were asked whether they believe that the process for getting their issue resolved was simple and easy. As demonstrated by Graph 25 above, a very small percentage (5.8%) of participants strongly disagree whereas on the other hand 13.5% strongly agree with this statement. The majority of them (40.4%) answered neutrally in this question. This indicates that there is still room for improvement to the way the call center agents handle the customer concerns, and they should focus in providing more simple and easy solutions to the customers.

Following question 15, was aiming to identify whether the product for which the customer needed support was well designed and worked well. The reasoning for this question lies upon the actual products rather than the service provided by the agents. As demonstrated by the below graph, the majority of the customers (34.6%) answered that they agree that product is well designed and working well, implying that should they have any issues with the call center support provided it relies upon the agent (the human element) rather than the product itself.

The product for which you called the call center for, was well designed and worked well.

   1 = Strongly disagree

    5 = Strongly agree

Graph 26. Customer satisfaction survey – Question 15

Furthermore, call center customers were asked if they would recommend this service to others (question 16) and how would they rate their experience (question 17). As per the majority of the replies it seems that customers are overall happy with how the call center agents handle their calls, they will recommend the service to others and they would rate their experience as good (38.5%) and very good (32.7%). The results are demonstrated in the below graphs 25 - 28.

Would you recommend the product/service to others?

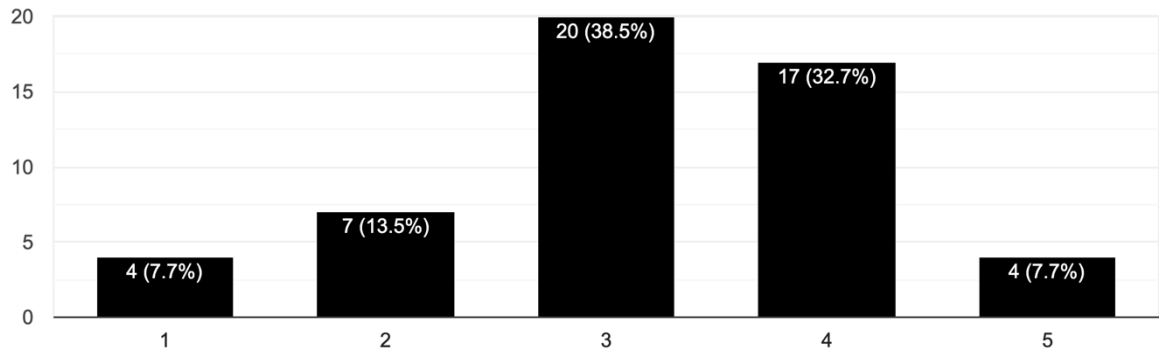   1 = Definitely not

    5 = Definitely will
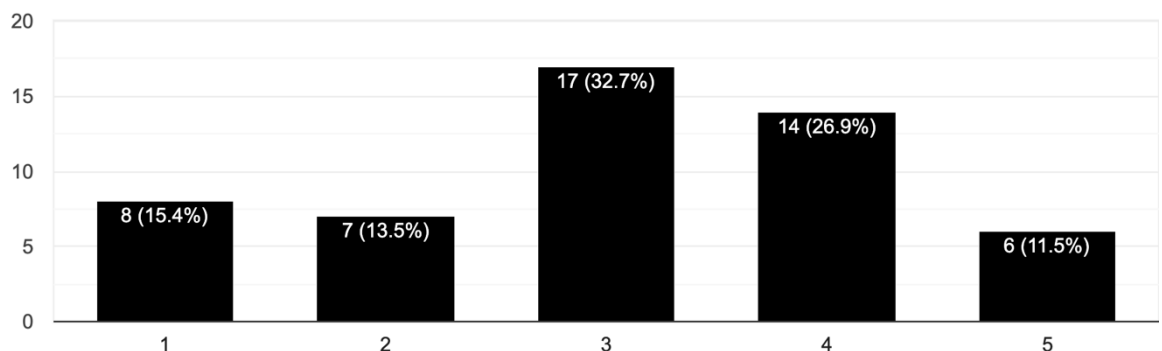
Graph 27. Customer satisfaction survey – Question 16

Thinking about your most recent interaction with epic's call center, how you would rate your experience?

   1 = Poor

      5 = Exceptional

Graph 28. Customer satisfaction survey – Question 17

The below questions 18 and 19 refer to the call center agent and their human interaction with the customers. As demonstrated by the below Graphs 29 and 30 participants agree that the agents are well trained, and the majority of the customers replied that the agents handle the calls politely.

The call center agent that answered my call was well trained.

      1 = Strongly disagree
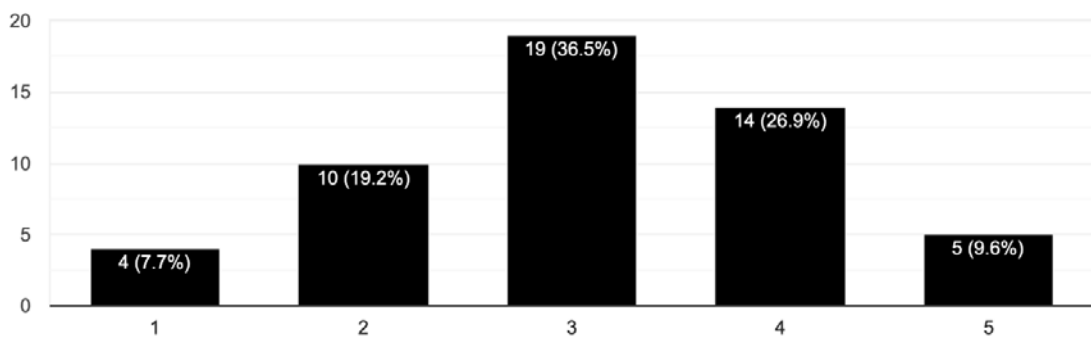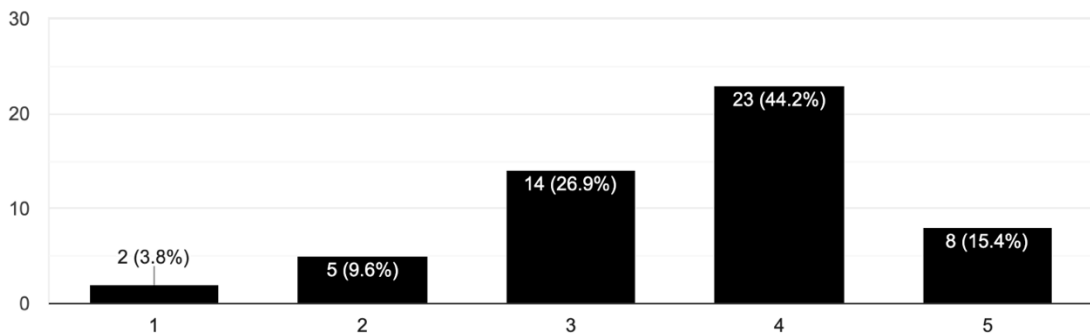
      5 = Strongly agree

Graph 29. Customer satisfaction survey – Question 18

The call center agent that answered my call was courteous and polite.

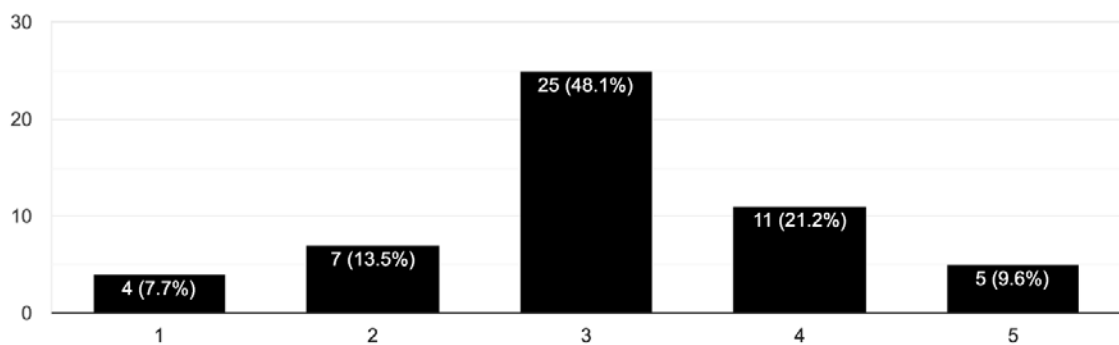   1 = Strongly disagree

      5 = Strongly agree

Graph 30. Customer satisfaction survey – Question 19

The next question aims to identify if speed improvements in the already congested call center lines can be made to increase customer satisfaction. As per the below Graph 31, customers neither agree nor disagree that their call was handled at an appropriate speed. A small percentage (7.7%) strongly disagrees and 9.6% strongly agrees that the call has handled at an appropriate speed.

My call was handled at an appropriate speed.

      1 = Strongly disagree
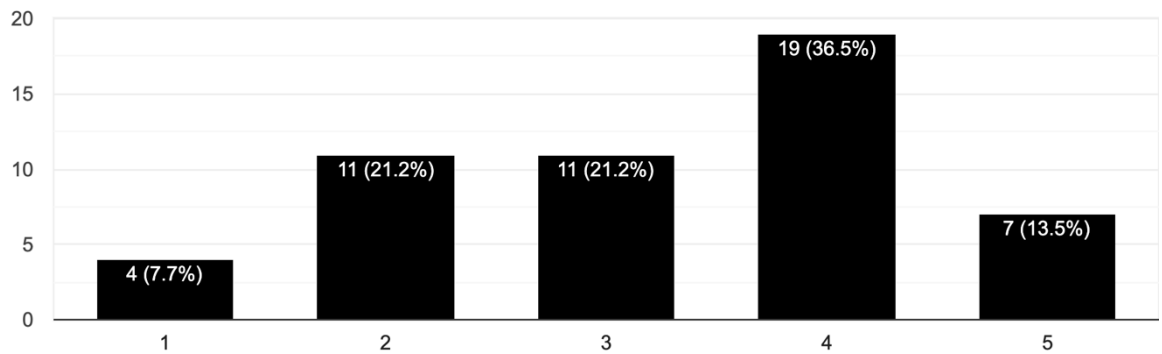
      5 = Strongly agree

Graph 31. Customer satisfaction survey – Question 20

My issue was resolved during the interaction.

   1 = Strongly disagree

    5 = Strongly agree

Graph 32. Customer satisfaction survey – Question 21

As demonstrated by the above graph 32, the majority of the participants (36.5%) agree that their issue was resolved during the interaction with the call center whereas only a small percentage of participants (7.7%) strongly disagrees with the above statement. Following this, 9.6% of epic customers are not satisfied at all with the quality of the service they receive from epic (in general the services and not in particular the call center service), as opposed to 32.7% of the customers who are satisfied and very satisfied. These are demonstrated by the below Graph 33.

How satisfied are you with the quality of the service you received from epic?

    1 = Not satisfied at all
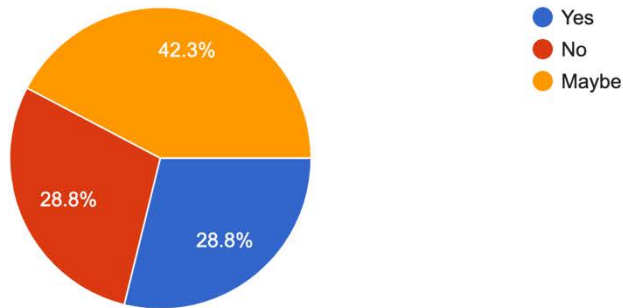
    5 = Extremely satisfied
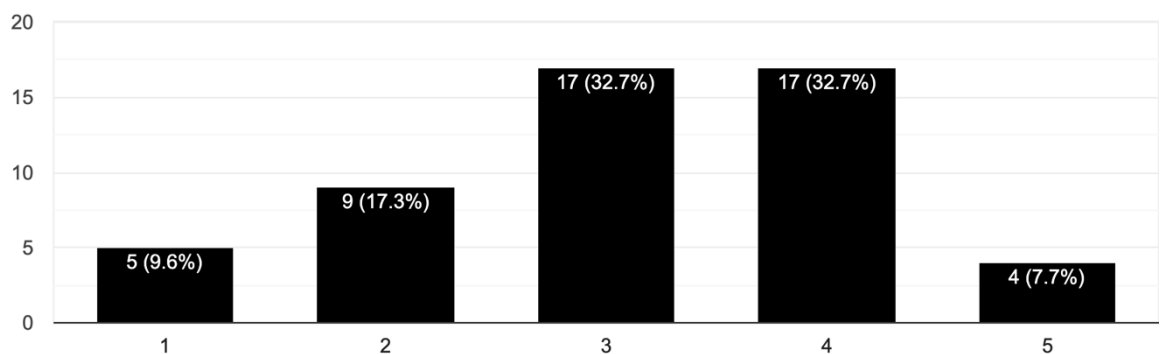
Graph 33. Customer satisfaction survey – Question 22

Finally, participants were asked whether they would buy similar products or services from epic, and 42.3% replied that maybe they would by, whereas 28.8% replied yes and 28.8% replied no.

Will you buy similar products or services from epic?

Graph 34. Customer satisfaction survey – Question 23

Chapter 6
Conclusion

6.1 Discussion

In hypercompetitive environments, companies should focus on delivering value propositions to their customers superior to those to their rivals. This in short, encompasses large fragments of the modern marketing philosophy and culture.

Customers prefer the products of a company versus those of competitors as long as these products offer higher perceived value than the competitive ones. Therefore, for customer-oriented companies the customer satisfaction is both an objective and a strong marketing tool. In order to measure customer satisfaction, a company can deploy a varied set of methodologies such as customer satisfaction surveys, lost customer analysis and ghost shopping. Setting the emphasis on customer value and customer satisfaction along with the discussion of how company can deliver a superior value proposition against its competitors, epic company measures customers satisfaction, using a call center customer satisfaction survey after every call they receive from a customer.

As examined in previous chapter, call center automation is valuable to assist agent efficiency, customer experience and satisfaction and overall call center ROI. Robotic systems may help to find easier all information about a client, the communication history and previous issues the customer might have had. This makes the process easier for the company, and the customer has to spend less time on the phone, which will improve satisfaction levels. This has as a result more efficient and more effective customer support and at the same time improves workflow by automating common tasks.

It is important to understand the effectiveness of call center automation, and because of its accuracy and its time and cost saving, as well as the positively impact on the customer

experience (McKerrow, 1991). As per the according to the findings-results of this Master's dissertation customer satisfaction survey, customers prefer epic services in comparison to other telecommunication companies (40,4%), because they are satisfied (36,5%). They belive that call agents have good knowledge of epic products and services (36,5%), and they are well trained and professional, (36,5%). Most of the customers are satisfied with the experience of call center agents (38,5%) and with the quality of service provided (32,7%). But, in order to improve customer satisfaction, it is important for the company to develop further the skils and knowledge of its call center employees and to answer the customer calls faster.

On the other hand, it seems that most employees would refer their friends to work for epic (33,3%), and they are happy with their work in call center (28.6%). The employees believe that there is a good working environment (35,7%), (33,3%), and they are satisfied by working for the company (38,1%). As shown however by the employee replies, the salaries are significantly low and could improve (21.4%).

Also, from the statistical analysis, it seems that there is ground for further improvements for the services and products offered by epic at this time. In order to improve more the satisfaction level to customers and to employees of the company, it is important to do some things, such as:

"What can epic do to improve call center services?"
- Trainings on technical matters
- Better customer-oriented approach
- Train the agents to answer more complex questions.
- Answer the questions more directly and become aware of the products and services.
- Understand who the customers are and what knowledge they have to help them better
- Provide Faster service with less time to answer the calls

6.2 Recommendations

As it seems from the survey results, both employees and customers are satisfied with the call center service of epic company. However, robotic systems with machine learning and RPA, may improve call center services, due to automation, to faster answer calls, anytime, and thus provide more time to employees in order to effectively resolve customer problems. It is however evident that RPA cannot be a standalone service for call centers but could be used to assist the call center agents instead of supplementing them.

Ending up, to answer the initial questions posed by this Master's thesis, in the future company itself could perform the customer surveys to gather more data about their customer satisfaction levels and face-to-face interviews could be conducted in order to grasp the customers' concerns on whether a robot could meet their expectations and satisfy their needs and requests better and faster than call center human agents. Moreover, as this research is focusing on the customer call center, another research could run to identify the ability of the robotic applications from I.T. perspective to efficiently and effectively answer customer calls in any form and language. Finally, another important element that needs to be addressed in the future is the willingness of a telecommunications company to invest in such an advanced technology and whether this could increase the customer and employee satisfaction levels as well as the profits of the company.

References

Pealez, L., 2001. Trends of automation and robotic systems in manufacturing and services, Industrial Robot. *Emerald Group Publishing Limited,* 28(4).

United Nations, 2019. *The least developed countries report.* Geneva, United Nations.

Akcomak, S., Kok, S. & Rojas-Romagosa, H., 2016. Technology, offshoring and the task content of occupations in the United Kingdom. *International Labour Review,* 155(2), pp. 201-230.

Avlonitis, G., Papavassiliou, N. & Papastathopoulou, P., 2006. *Sustainable Marketing Leadership.* Athens, 35th EMAC Conference.

Yunil, M. & Piraphong, F., 2018. Study of the relationship between marketing mix, service quality, customer satisfaction and customer loyalty in the smartphone. *UTCC International Journal of Business and Economics,* 10(3), pp. 79-95.

O'Brien, J., 2002. *Management Information Systems.* 5th Edition ed. New York: McGraw-Hill.

McKerrow, P. J., 1991. *Introduction to Robotics.* Boston: Addison Wesley Longman Publishing Co.

Nilson, N., 1980. *Principles of Artifilial Intelligence.* Palo Alto CA: Tioga.

Tanimoto, S. L., 1990. *The elements of artificial intelligence.* New York: Computer Science Press Inc.

Kovarikova, P. & Braska, L., 2013. Customer Involvement in the Innovation Process in a Company Providing Telecommunications Services. *Recent Advances in Business Management and Marketing,* pp. 152-158.

Wang, Y., Lo, H., Chi, R. & Yang, Y., 2004. An integrated framework for customer value and customer-relationship management performance: a customer-based perspective from China. *Managing Service Quality,* 14(2/3), pp. 169-182.

Svendsen, M., Haugland, S., Gronhaug, K. & Hammervoll, T., 2011. Marketing strategy and customer involvement in product development. *European Journal of Marketing,* 45(4), pp. 513-530.

Berry, L., Shankar, V., Parish, J. & Cadwallade, 2006. Creating new markets through service innovation. *MIT Sloan Management Review,* 42(2), pp. 56-63.

Gorry, G. & Westbrook, R., 2011. Can you hear me now? Learning from customer stories. *Business Horizons,* Volume 54, pp. 575-584.

Gladwell, M., 2005. *Blink: The power of thinking without thinking.* Newport Beach, California: Penguin Books.

Prajogo, D. & Sohal, A., 2006. The integration of TQM and technology/R&D management in determining quality and innovation performance. *The International Journal of Management Science,* Volume 43, pp. 296-312.

Forehle, C. & Roth, A., 2007. A resource process framework of new service development. *Journal of Production and Operation Management,* 16(2), pp. 169-188.

Roper, S. & Arvanitis, S., 2012. From knowledge to added value: A comparative, panel-data analysis of the innovation value chain in Irish and Swiss manufacturing firms. *Research Policy, Elsevier,* 41(6), pp. 1093-1106.

Day, G. S., 1999. The Market Driven Organization. In: New York: University of Pennsylvania, pp. 60-85.

Kristensson, P., Matthing, J. & Johansson, N., 2008. Key strategies for the successful involvement of customers in the co-creation of new technology-based services. *International Journal of Service Industry Management,* 19(4), pp. 474-491.

Lee, J. & Abu Ali, M., 2011. Innovative product advanced service systems, I-PASS: methodology, tools, applications for dominant service design. *Int J Adv Manuf Technol,* Volume 52, pp. 1161-1173.

Coelho, P. & Henseler, J., 2012. Creating customer loyalty through service customization. *European Journal of Marketing,* 67(1), pp. 14-28.

Simonson, I., 2005. Determinants of customers responses to customized offers: conceptual framework and research prepositions. *Journal of Marketing,* 69(1), pp. 32-45.

Cheng, C. C., Chen, J. & Tsou, H. T., 2012. Market-creating service innovation: verification and its associations with new service development and customer involvement. *Journal of Services Marketing,* 26(6), pp. 444-457.

Kalakota, R. & Robinson, M., 2001. *E-Business 2.0, roadmap for success.* Boston, MA: Addison-Wesley Longman Publishing Co..

Brady, M., 1985. Artificial intelligence and robotics. *Artificial intelligence,* 26(1), pp. 79-121.

Schlesinger, M., 2003. A Lesson from Robotics: Modeling Infants as Autonomous Agents. *Adaptive Behavior,* 11(2), pp. 97-107.

Beer, R. D., 1990. *Intelligence as adaptive behavior: an experiment in computational neuroethology,.* 1st Edition ed. s.l.:Academic Press.

Turban, A., 1992. *Expert systems and applied artificial intelligence.* New York: MacMillan.

Anderson, J., 1995. Associative networks, The Handbook of brain theory and Neural networks. *MIT Press,* pp. 102-107.

Lyons, D. & Hendriks, A., 1992. Planning for reactive robot behavior. In: *Proceedings of the IEEE International Conference on Robotics and Automation.* Nice, France: s.n., pp. 2675-2680.

Arkin, R., 1998. *Behavior-Based Robotics.* London: MIT Press.

Hayes-Roth, B., Pfleger, K. & Laland, P., 1995. A domain-specific software architecture for adaptive intelligence systems. *IEEE Transactions on Software engineering,* 21(4), pp. 288-301.

Mataric, M., 1992. *Behavior-based control: main properties and implications, Proceedings of workshop on Intelligent Control Systems.* Nice, France, IEEE International Conference on Robotics and Automation.

Zelinsky, A. & Kuniyoshi, Y., 1996. Learning to coordinate behaviors for robot navigation. *Journal of Advanced Robotics,* 10(2), pp. 143-159.

Parisi, D., Cecconi, F. & Nolfi, S., 1990. Econets: Neural networks that learn in an environment. *Network,* Volume 1, pp. 149-168.

Parisi, D. & Cecconi, F., 1995. *Learning in the Active Mode.* London, UK, Proceedings of the Third European Conference on Advances in Artificial Life, pp. 439-462.

Floreano, D., Durr, P. & Mattiussi, C., 2008. Neuroevolution: from architectures to learning. *Evolutionary Intelligence,* Volume 1, pp. 47-62.

Gartner Customer Experience & Technologies Summit, 2017. *Gartner Customer Experience & Technologies Summit,* London: s.n.

Allen, E. & Seaman, C. A., 2007. Likert scales and data analyses. *Quality Progress,* Volume 40, pp. 64-65.

Statistics How To, 2014. *Cronbach's Alpha: Simple Definition, Use and Interpretation.* [Online]
Available at: https://www.statisticshowto.com/cronbachs-alpha-spss/
[Accessed May 2020].

Williams, M., 2003. *Making sense of social science research.* London: SAGE Publications, Ltd.

Denscombe, M., 1998. *The Good Research Guide for Small Scale Social Research Projects.* 1st Edition ed. Maidenhead: Open University Press.