ISSN 3049-317X (Online)

Evolution of Artificial Intelligence (AI) in Service Desk

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Abstract

The third decade of the 21st century is said to be the era of AI (Artificial Intelligence) as it is becoming more familiar to us, with the different and diverse ways we are making use of this technology in our daily lives. This paper seeks to examine the journey of AI in service desks and the ways it can ensure customer satisfaction and cost reduction through improving the general levels in the operational efficiency at work, creating benefits such as – solution to various customer problems, improved efficiency at work and cost effective business operations. The research findings reveal that the service desks can improve their efficiency through AI enabled automation of the routine and mundane tasks, freeing up the human personnel for tackling complex and problematic issues, where human intellect plays a key role in identification of solutions to the lacunae, enabling the provision of accurate and swift responses which enable customer satisfaction at the desired levels within the limits of the budgets allocated for the business operations. It is to be noted that there are certain challenges such as ensuring the privacy of the sensitive data, job security concerns, etc. This study contributes to the body of knowledge, providing insights for organizations who are interested in adoption of AI in their business operations and can enable them in improving the ways they use their service desks for fulfilling their numerous objectives.

Keywords: AI, Artificial Intelligence, Service Desks, AI enabled transformation, NLP, Predictive intelligence, Service Desk automation

1. Introduction

Service Desks fulfill a crucial role in businesses as they are the locations, which function as the key 'node' in the organizations as the employees and customers who are in need of data or information are served by the personnel working in these desks, who tell them where they need to go, who they need to meet or where the data/information can be accessed from and the processes involved in it, playing an important customer support, employee assistance and troubleshooting role. Of late, Artificial Intelligence (AI) has been utilized in the service desks, creating a paradigm shift where through Machine Learning/Deep Learning, the services once offered by humans are being offered by AI, leading to reduced response times, swift results and savings in cost (Smith & Anderson, 2020). This paper has placed its focus on the historical evolution of AI in the service desks and will discuss the impact of AI in this area along with the future prospects of the usage of AI in service desk operations for businesses. A significant amount of research has been done in the realm of AI and service desks, from the early automation based area to the current, AI enabled real-time era solutions era. This section will describe the key academic contributions, which will highlight the key themes, developments and changes as reported in the literature studied by the researchers for this paper, described here as follows:

1.1 Ancient Automation and Rule based systems: The earliest example of automation in organizational service desks is related with a CNC like, process rule based systems which work in a systematic, programmed script based way. The system is designed in a way which can escalate a ticket from Node LI to Node L2, in case certain programmed instructions were triggered for enabling prompt solution to the problems raised by the customers or employees, who are notified about the progress regarding the tickets raised by them, that their request

(Serial No description) is now in (Queue A) and is expected to be settled by (date/time of settlement). Such systems were designed for elicitation of basic answers from the systems, which can reduce the burden on the human agents and improve efficiency in the operations through automation of routine queries (Brown, 2018). A good example can be stated in form of the IVR System utilized by several companies, wherein a customer who calls the helpline is asked to 'Select 1 for X Service, Select 2 for Y Service' and so on, wherein the call will be directed to the appropriate dept in the organization for the settlement of the query, request or complaint. In exceptional cases, human operator assistance will be enabled, if the system is unable to respond to the customer's queries (Paramesh & Shreedhara, 2019).

1.2 Advent of ML (Machine Learning): Machine learning is an AI (Artificial Intelligence) based algorithmic model and tool which is designed in such a way, that every routine and repeated iteration task performed by the AI tool, will cause it to learn in a progressive way, through analysis of the data fed to the system and by analysis of the existing databases and information. The system becomes smarter in a progressive way through ML, enabling settlement of routine queries in a cost effective way. Unlike the CNC like rule based systems, ML can utilize the data in solving challenging queries on its own, for addressing complex problems such as prediction of the customer's responses and possible needs, based on the information presented to him on the UI screen to enable a personalized response, based on the steps taken by the customers (Johnson, Wang & Liu, 2019). The authors, Schad, J., Sambasivan, R., & Woodward, C. (2022) research in usage of AI in service desks through the prediction of the ways in which the tickets would be reassigned reveal that the usage of AI can lead to improvements in the efficiency of the service desks by ML based prediction of potential incidents enabling proper reallocation of resources as per the seriousness of the needs. Recent research in AI has revealed the capabilies of Natural Language Processing and Deep Learning in improving the overall efficiency levels of the service desks as these advanced AI based technologies with the latest generation of chatbots and virtual assistants have improved the ways in which AI is functioning in improving the ways in which the solutions are delivered enabling greater customer satisfaction through the usage of AI (Garcia, 2022).

1.3 Advanced AI (Artificial Intelligence) Technologies and Models: The latest developments in AI such as Deep Learning (DL), Encoder-Decoder architecture (Transformer) based models, Natural Language Processing, etc. for creating improvements in service desk operations and work. The usage of Large Language Models such as 'Chat GPT (3.5 and 4.0)' have improved the capabilities of AI in responding like a human with a high level of accuracy, enabling the creation and deployment of more useful AI based chatbot and virtual assistants. These models are designed to handle and solve complex and challenging questions, queries and engage the users in diverse ways by adapting to the various scenarios in which the models interact with the users. Brown, 2023 has suggested that the integration of AI with (AR) Augmented Reality and Virtual Reality (VR) technologies has opened up a brave new world for customer service, providing unique virtual and metaversical experiences that are only attainable now through the combination of AI with AR/VR technologies. Research by Widianto & Subriadi (2022) suggesta that AI enabled service chatbots can handle upto 70% of the tasks on their own, which can lead to greater cost and operational efficiency.

1.4 Predictive Analysis: Predictive Analysis is a technique wherein Artificial Intelligence (AI) is utilized for prediction of possible problems and issues, to solve them in the initial stages only and the usage of AI by service desks for this purpose has enabled organizations to maintain a high level of operational efficiency as the AI models can detect possible issues and problems through predictive analysis, through analysis of the symptoms and can prevent them from escalating by recommending prompt action for the lacunae, ensuring the delivery of customer service at the desired levels of quality. The data has revealed that the service performance of AI can be improved using historic data and information, so that the AI models can predict in a better way, in case the situation is similar to the one previously describe, enhancing the quality of the customer services provided to the customers (Wang & Liu 2020). Predictive intelligence can enhance the quality of AI empowered services, offered at the service desks as through this, AI can fore-prevent potential problems by enhanced symptomatic detection, flagging serious cases to the human users, to take decisions which can stop problems before they occur, leading to substantial improvements in the operational efficiency, leading to better customer service experiences down the road (Vyas & Vyas, 2022).

1.5 IoT (Internet of Things) and Integration with Blockchain: IoT is a technology which permits ordinary objects and appliances such as refrigerators, microwave ovens, toasters, etc. to communicate with each other and with us. The integration of IoT with the Blockchain is necessary for ensuring operational efficiency and data security as the block chain is designed to alert the members in the nodes, in case of any illegal operation, task or work which has not been approved for use onto the block chain. These emerging technologies can enhance

the ways in which the service desks work as they can identify new sources of data through IoT and by combining it with Blockchain, various services can be delivered enabling customer satisfaction in secured way, ensuring that the data/information being exchanged is only exchanged with the intended parties only, enabling the development of trust and faith in the organizations providing the service desks. Zuev & Kalistratov (2018) have stated that the quality level of the approach so described here can be further refined through the linking of Machine Learning algorithms as it can provide the desired levels of quality in the services provided on a regular basis.

1.6 Cost savings and customer satisfaction: Research by Nguyen & Tran (2019) has revealed that AI enabled service desks can deliver consistent performance, within the limits of the constraints related to budgetary allocations, processing power and resources, enabling the delivery of consistent services in real-time to the customers, anytime during the day within the desired levels of quality. Martinez (2020) has stated that AI based service desks are beneficial for companies because they are cost effective and operationally efficient, enabling re-deployment of manpower otherwise wasted for handling mundane and routine queries on more qualitative, knowledge oriented complex tasks, enabling AI based services to be deliver within the given time and in the defined quality levels, enabling the company to benefit from the economies of scale. Regarding customer satisfaction, the data reveals that AI is extremely effective in the settlement of queries, complaints and questions as per their expectations as through Machine Learning and Deep Learning large volumes of data and information can be processed, enabling the generation of results within a shorter amount of time. As an additional feature, some service desks also combine human interactions to service customers who may not feel comfortable working with machines or in cases where AI may fail in solving their queries to their satisfaction.

1.7 Possible ethical and privacy implications of Artificial Intelligence (AI) enabled service desks: Artificial Intelligence, to be effective requires access to a large and diverse, voluminous amount of data, knowledge and information. This can raise ethical concerns as a large amount of this data might be secured from the customers through ways which border the barrier between legitimate and non-legitimate uses. Several researchers have claimed that smart devices have eliminated the concept of 'privacy' as they are collecting more data than before, beyond what is required increasing the need for the creation of robust laws, rules and legislations for the protection of the privacy of the consumers and users (Smith & Jones). Clark (2019) has suggested that the pace in which AI is taking the world will require a strong and sound ethical framework for ensuring its usage in a non-biased, fair and ethical way. The experts have suggested that this can be enabled by implementation of data/information audits and checking the datasets and information banks used for training the AI to ensure that it complies with the guidelines regarding fairness and impartiality in a non-biased way (Garcia, 2022).

1.8 Implications for the employees: A persistent fear expressed by the employees is that AI (Artificial Intelligence) will take their jobs as the algorithm can do the job of ten men and when a machine is doing that, the employers won't think twice in replacing the ten men with 1 AI in the name of cost efficiency. This fear is extremely high in jobs which do not require significant mental capabilities as the machines can automate the routine and mundane work in a swift and efficient way. With reference to service desks, there is a glimmer of hope as 100% automation is not possible, due to the inability of the AI in handling significantly challenging tasks, requiring human intellect based thinking, which can require organizations to retain the highly experienced, knowledge based thinker talent for facilitation of excellence in customer service in the service desks, through servicing of customers who may wish to work with a real human or in case the AI is unable to settle their queries, questions or complaints. For employees, AI is a wakeup call for re-skilling themselves, so that they will not be seen as a replaceable overhead by their organizations. A similar view is taken by Widianto & Subriadi (2022) who state that organizations need to strike a careful balance between the needs of the employers and the employees, to ensure that AI is adopted only in the areas where it is absolutely necessary along with ensuring that the employees are given the necessary training for development of their skills, abilities and knowledge to ensure a careful synergy of both AI and human effort as it can take the organization into the future.

These parameters were identified by the researchers as they represent the multi face impact of AI on service desks in a collective way, through emphasis on the technological, economical, operational and customer orientated perspectives and by focusing these above areas, this study will provide a comprehensive view of the ways through which AI is re-molding the service desks landscape in the organizations and the following literature review will examine this topic in a detailed way, with an exploration of the historical and the contemporary developments of the roles played by AI in the realms of service desks today.

2. Literature Review:

2.1 Historical Background

The days before AI: Service desks as a feature have been in vogue since hundreds of years but the true role played by this often overlooked but valuable service was recognized in the last few decades with the advent of primitive automation, CNC based systems and other ancillaries best characterized by the way they function through programming via scripting (basic script systems) and rule based systems. The primary objective of these early technologies was to figure out a way for automation of the most frequent, routine and mundane, repetitive tasks via provision of standardized or scripted responses for the most common FAQs (Frequently Asked Questions), enabling greater operational efficiency by reducing human workload through automation (Brown, 2018). A good example can be cited of the 'For information in English, press '1' type' IVR (Interactive Voice Response) systems, wherein a customer can use his phone's keypad to follow a menu, enabling him/her to select the service he may desire, enabling him to be connected with the appropriate department for the object resolution of his query or complaint (Paramesh & Shreedhara, 2019). Along with IVR, email filtering systems were also developed, which sorted emails via end purpose/objective email filtering enabling emails of high value/criticality to be settled first, enabling greater efficiency in the employees' time and resources (Schad, Sambasivan & Woodardm, 2022). When compared with today's AI (Artificial Intelligence), these technologies do seem primitive, but their effectiveness cannot be overlooked as they have proved how technology can be utilized for optimization of service desk operations as in the right hands even a primitive tool like a club can be as effective as a sub machine gun, proving that automation is extremely effective in handling mundane and routine queries in a time efficient way (Johnson et. al., (2019). Such systems are being used in a very large number of organizations as they are simple to operate/maintain and cost effective (Widianto & Subriadi, 2022).

2.2 Rise of Machine Learning:

As a technology, Machine Learning (ML) was first proposed in the pioneering days of modern computing with the earliest experts in the field such as Walter Pitts, Warren McCulloch, Donald Hebb and Alan Turing proposing theoretical models, of the ways computers could be developed in a way, enabling them to learn from each iteration of the tasks performed by them. The research proposed by these authors was the earliest efforts in the foundation of Artificial Intelligence (AI) which further led to the development of supercomputers such as Deep Blue, demonstrating the true capability of Machine Learning in the way it learnt how to play chess, winning a match against Gary Kasparov (Johnson et al., 2019). Further improvements in ML led to the development of chatbots, automated response/interaction bots and other similar bots for customer service purposes to improve the ways in which the companies worked with their customers for enhancing their end experience and for operational efficiency.

ML has enabled the chatbots to be designed in ways, wherein they can emulate real conversation to a very high quality which can benefit the customers for settlement of their queries and complaints in a highly efficient way as the ML algorithms and tools are designed to learn, enabling the maintenance of the desired levels of quality through analysis of the client feedback or the conversation transcripts (Lee & Chen, 2021). Schad, Sambasivan & Woodward (2022) have shown that ML is excellent for service desk operations as its predictive nature was found to be extremely helpful for the settlement of queries, questions and complaints, as through the analysis of the graph convolutional networks, designed for prediction of desk ticket reassignments along with the ability of ML to learn from the analysis of historic and iterative data/information the algorithms were able to develop responses to the queries made to them in a way, which was conclusive to the customers. In other words, ML is able to use predictive analytics which makes them very efficient for service desk operations as they are able to perform analysis on large volumes of historic data for settlement of the queries raised to them by the customers and they can also be designed to predict possible symptoms for immediate action, preventing escalation of the manageable issues into dangerous problems and situations, ensuring the delivery of the desired levels of quality to the customers in an operationally efficient way (Wang & Liu, 2020).

Research by Vyas & Vyas, (2022) has indicated that Predictive Intelligence via ML is how service desks are able to perform symptomatic analysis of problems, troubles and issues before they get a chance to develop into a worrisome specter requiring expensive intervention in terms of time, resources and money, as through this analysis, the ML algorithms can suggest remedies for the observed symptoms to the employers, enabling decisions to be taken for the resolution of the issues in time, ensuring operational efficiency and they can also provide personalized and customized interactions with the customers, based on the analysis of their historic data enabling the delivery of high quality services. In comparision with the primitive script/rule based systems, such customization is not possible, as the system is not designed to deviate from the programmed scripts, which in contrast with Machine Learning is possible, as through iterative learning the algorithm is able to decide the best course of action for the situation, generating greater number of satisfied customers

(Nguyen & Tran, 2019). Zuev, D., Kalistratov, A., & Zuev, A. (2018) have discussed the role of ML in service desks, speaking about the changes that can be brought by the ways ML can be used for automation of the several tasks performed by the service desks, through usage of historic data/information databases, iterative learning, real time monitoring and predictive intelligence, predicting that through the usage of machine learning, service desks can be transformed into a 'one stop shop' for settlement of complex queries and questions through AI enabled automation of the routine tasks, enabling the settlement of all routine, mundane and repetitive queries, upto a level permitting autonomous handling of complex queries and pro-active symptom based issue management, improving operational efficiency along with increasing the levels of customer satisfaction due to the delivery of solutions in a highly customized and personalized way, cementing its place as a game changer in the realm of service desks in today's date (Smith & Jones). The research has revealed that further development and improvement of AI in the realm of service desks is here to stay, enabling further refinement and improvements in the ways the services are delivered to the customers in the future (Roberts & Kumar, 2021).

2.3 Role played by Artificial Intelligence in service desks today:

2.3.1. AI powered chatbots and virtual assistants: Service desks today have been enhanced through the usage of advanced technologies such as Machine Learning, Natural Language Processing and Deep Learning, enabling the generation of human like responses to the queries and questions entered into the system by the customers. This has been extended to chatbots and virtual assistants who work with the above technologies in delivering customized and personalized responses to the customers in a near human like, high degree of accuracy (Garcia, 2022). AI powered chatbots and virtual assistants provide instant, on-the-spot responses for complex customer queries through analysis of the question based on the iterative experiences (Machine Learning) and via analysis of a large, voluminous set of data/information (Deep learning) as such means enable them to understand, analyze and respond to the queries in a highly qualitative way. Also, improvements in the technologies has enabled the AI based chatbots to handle multiple queries at the same time, increasing the levels of operational efficiency to the desired levels without compromising on the service quality delivered to the customers and can lead to an increase in customer satisfaction levels upto 30% and above, increasing the chances of repeat business for the companies running such AI based systems for their service desks and chatbots. (Schad, Sambasivan, & Woodward, 2022), (Nguyen & Tran, 2019). Research has revealed that AI based chatbots and virtual assistants can perform effective analysis of the queries, questions and complaints raised, studying their contents to understand what the request is about, enabling the request to be directed to the appropriate department or settling them on the spot through the AI driven triage of the request based on the available ML/DL algorithm deployed on the chatbot, lightening the load for the human employees, enabling the delivery of high quality service to the customers (Lee & Chen, 2021). Research by Schad et. al., (2022) through the usage of graph convolutional networks has revealed that AI can predict to a fairly high degree, the effects of helpdesk ticket reassignments for maximization of the available resources in the service centers in a highly effective way.

2.3.2 Predictive Analytics: Artificial Intelligence (AI) powered predictive intelligence analysis has enhanced the ways in which the service desks are working in organizations as they can be tailored on an individual (customer basis) or a group (organizational basis), enabling the performance of the tasks in an efficient way. Through AI, service desks can be configured to identify possible symptoms of problems, issues and aberrations which can affect the organization, for immediate action through human decision making, so that prompt action can be taken, enabling the issue to be solved at the source enabling the delivery of the desired levels of customer satisfaction, service and operational efficiency. Vyas & Vyas (2022) have stated in their research that predictive intelligence can ensure smooth operations in the service desks by assisting in the process of preventive maintenance, reducing the chances of false positives being detected as such maintenance if not done, can increase the chances of AI to hallucinate, creating false/improper responses leading to downtime, which can cause inconvenience for the customers. A good example is AI response services such as ChatGPT encountering errors in case the user asks the ChatGPT AI algorithm to generate a response based on the name 'David Meyer'. By reducing this lacuna through predictive analysis based preventive maintenance, the AI enabled service desks can operate in a smooth way and can improve the decisions taken by them in a qualitative way, which can benefit the customers (Gilbert et. al., 2010).

2.3.3. Cross technology platform compatibility: Improvements in cross platform technological compatibility is enabling AI (Artificial Intelligence) enabled service desks to work with a diverse set of technologies such as IoT (Internet of Things), Block chain, etc. enabling the delivery of a greater range of services than before, without compromising on the integrity and the quality of the services. The combination of these technologies enables the delivery of services in a

safer, faster and in a highly qualitative and efficient way as through the integration of IoT technology enabled devices with AI, the items around us can be transformed into transceivers of data, enabling the generation of real time alerts to the service desks, in case something occurs where it should not or does not occur where it should, enabling symptomatic decision of the lacunae via predictive maintenance, enabling solutions to be applied in a swift and sure way (Roberts & Kumar, 2021). More secured transmission and reception of data is possible through integration of the service desks with block chain technology as the latter is designed to ensure that the transactions which are occurring between the service desks and the customers are only occurring within them and no unauthorized third party will be interfering in the transactions as such an act creates an alert message on the block chain, notifying all members in the block chain, ensuring seamless integrity and security of the interactions between the customers and the service desks for longer periods of time in terms of the durability and the service length of the digital and physical infrastructure (Zuev et. al., (2018), (Wang & Liu, 2020)

2.4 Beneficial effects of the usage of AI (Artificial Intelligence) on service desks in organizations:

2.4.1. Enhanced efficiency in operations: AI enabled automation can assist the organizations in optimizing their service desks to deliver results in a faster, qualitative and efficient way within the restrictions of cost. Through AI, the service desks can automate the work, enabling queries, questions and complaints to be handled in a swifter way than before, freeing up the human employees for knowledge based thinking work such as decision making as the AI can handle the routine, mundane and repetitive tasks, preventing their time from being wasted enabling tasks such as ticket categorization, FAQ, basic level troubleshooting based queries and requests to be settled in an autonomous way, improving productivity without affecting the cost (Davis & Wilson, 2020). AI based automation is beneficial for organization as the overall turnaround time for the settlement of the service requests is reduced and the algorithm based service request processing engines used by the AI based service desks can be designed to handle level 1 and level 2 service desk activities and tasks, as through the application of NLP (Natural Language Processing), complex tasks can be analyzed and studied for object resolution by the AI enabling the machines to understand and handle the most frequently requested customer issues and queries on their own, without any human intervention, enabling more efficient data backed settlement of service requests by the service desks, freeing up the human employees for handling difficult and cognitively heavy knowledge based thinking tasks such as critical decision making etc. enabling anytime/day operations in a smooth and efficient way (Garcia,2022).

2.4.2 Improved levels in customer satisfaction: Artificial Intelligence (AI) based service desks are a must for organizations, keen on ensuring high levels of quality in the services provided to their customers. AI based service desks can function anytime in the day, providing on demand resolution of questions, queries and complaints at the convenience of the customers. Location is not an issue for this as the AI based service desks are connected through the internet, enabling the customers to connect with them in any location in the world with a good internet connectivity. Machine Learning (ML) and Deep Learning (DL)algorithms, programs and tools are the core of the AI based service desks and through their power, the chatbots and the virtual assistants are able to study and analyze the iterative data along with large data banks of data, knowledge and information to understand the nature of the queries made to them, in congruence with the expectations of the customers to deliver accurate responses, designed to settle the service requests raised by the customers in a swift, efficient and final way (Nguyen & Tran, 2019). Research has revealed that organizations which utilize ML/DL algorithms with their AI based service desks have a greater chance of getting repeat customers as through the usage of such tools, the customers are able to get their service requests settled in ways and in a manner personalized and customized to their preference, increasing their comfort and satisfaction with the service provided by the company, enhancing their chances of giving repeat business to the company in the future (Paramesh. K & Shreedhara. S (2019).

2.4.3. Efficiency in cost: Artificial Intelligence (AI) based service desks can do the work of several employees, at any time during the day. They are powerful and efficient enough to handle several queries at the same time, enabling delivery of the services to the customers in an efficient way. AI based automation is excellent for management of routine, mundane and repetitive tasks and do not require the deployment of human employees for this work, enabling more work to be done within the given resources and time (Martinez, 2020). By deploying AI based service desks, an employer can save on labor costs as new employees need not be hired, which is a major cost savings factor for organizations whose budgets may not allow them to hire new labor. The cost of deployment of AI is a bit high, but it pays back several times more to the employer in terms of work efficiency, cost effectiveness and ease of operations (Paramesh. K & Shreedhara. S (2019). Research by Wang & Liu (2020) has indicated that AI based automation can reduce operational costs by a significant extent (upto 40%) as through the predictive power of AI, symptoms can be detected at an early stage, enabling immediate action

which can lead to tremendous savings in terms of cost. Also, AI based automation can perform preventive maintenance, enabling the organization to extend the service lives of its critical software and hardware infrastructure, systems and machines. In addition, situation based re-allocation of resources is possible through AI, enabling greater savings for the employers, who can allocate the resources in areas where their usage can produce the greatest results (Wang & Liu 2020).

2.5 Possible drawbacks of the usage of AI (Artificial Intelligence) on service desks in organizations:

2.5.1 Possible impact on Digital Ethics and Privacy: AI being a part of service desks, this concept comes ironed with ethical and privacy hazards. Artificial Intelligence (AI) systems work with significant customer data, hence need to ensure privacy and security of the collected information For instance compliance on this for GDPR & CCPA as stated by (Smith & Jones, 2021). Because Artificial Intelligence (AI) is, by nature, so complex, the importance of plain and simple data management can easily be overlooked; this leads to risks for breaches or unauthorized access. This means that regular audits and compliance checks to ensure data integrity (Yandri et al., 2019) are needed in order retain customer trust. It also focuses on job displacement, as Artificial Intelligence (AI) can take the place of humans with routine tasks that would require having a reskilled and new role created so human ability could be used; (Adams 2020), (Widianto & Subriadi 2002). These require ethical standards to include bias in Artificial Intelligence (AI) algorithms and transparency of how decisions are made by which kind of Artificial Intelligence (AI) agents. If left unaddressed, machine bias can cause serious harm; we call on organizations to develop inclusive training data, implement strategies for detecting and mitigating bias in practice (Clark 2019), and maintain transparency in building Artificial Intelligence (AI) algorithms that publicly deliver services fairly across individuals based on those who are most severely impacted by them if an error were indeed present (Garcia 2022). Finally, the responsible deployment of Artificial Intelligence (AI) requires frameworks to establish ethics and regular audits (Conger 2014; Roberts & Kumar 2021) that would involve a diverse range of stakeholders.

2.5.2 Privacy and Security of Data: Artificial Intelligence (AI) requires a huge, a voluminous amount of data, in the range of a few thousand terabytes or more to work in an effective and efficient way. This has resulted in the companies which develop and work with AI to gather more data than before from the customers, sometimes buying wholesale databanks from data processing companies for training the AI to generate responses in a better way. Such data is essential for Deep Learning algorithms and is necessary for Machine Learning algorithms. Due to the intrusive nature of such data, several countries have enacted legislations creating requirements that the companies who acquire and process such data for AI purposes must protect and safeguard such information in congruence with the regulations as the consequences of failure, leading to leaks or theft of such data will not be pleasant (Smith & Jones, 2021). A good example of such legislation is the European GDPR (the General Data Protection Regulations) and the US Legislation, the CCPA (the Californian Consumer Privacy Act) which have laid down the guidelines, describing how a customer's data should/should not be processed. Smith & Jones (2021) have further stated that such complex systems could have a detrimental side effect as they can disguise the methods of data management, as if putting a mask on it, which can hinder mechanisms for data protection, increasing the risk for cybersecurity incidents and breaches of data. Khatam, D. (2022) states that companies must develop a strong level of knowledge in understanding data encryption and access control methods so that they will be in a position to protect and safeguard their data, ensuring the sanctity of the information of their customers. A step in the right direction is by conducting security audits and compliance checks, to ensure that the hardware and software systems used by the organizations for data and information security are as per the current standards so that the AI systems in use will be designed, developed and deployed in ways which meet the legal and regulations standards, regarding the usage of the AI. Yandri et al., (2019) have stated that the AI based IT Services Management Frameworks used in systems must be integrated with each other, using the latest hardware/softwares as it can ensure proper compliance with the international standards regarding data security. The authors have stated in their work in Fuzzy Information Technology Infrastructure Library frameworks, that organizations can create customer trust, if they can guarantee, to the best of their ability that they are serious about data/information security and integrity within their systems as such measures can re-assure the customers that their data is safe with the organizations and they can work with them for the long run.

2.5.3 Job Displacement: Is a major risk factor, particularly in cases of job which do not involve significant cognitive thought processes (thinking and knowledge based decision making) from the employees as the nature of such work usually involves repetitive, mechanical and rote processes, tasks and work. (AI) Artificial Intelligence has been identified as an excellent job performer for such work, which can increase the chances of organizations automating such work in the

name of work and cost efficiency. Adams, P. (2020) has stated that employees can weather through such changes brought by AI, if they take the initiative in reskilling themselves as through such efforts, the risk of such employees finding new jobs and roles can be increased, enabling the organization to consider them as valuable assets for handling complex and nuanced questions and issues, which the AI may not be able to handle as per the standards of the organizations, as AI may not be able to display human level empathy to the customers or handle problematic customers, the same way a human customer associate can as AI is excellent for automation of tasks which do not require much cognitive load (thinking) but it may not be much useful when it comes to prediction of unique needs or handling situations it may not be trained or programmed for making the roles of humans, indispensable for such tasks (Widianto, A., & Subriadi, A. P., 2021)

2.5.4 AI and Ethics: Artificial Intelligence (AI) is only as fair, impartial and non-biased in congruence with the training material databases used for training the AI. If there are biases in the training material, there are chances that the AI will become biased as well, bringing into mind the importance of training the AI in a way which will product results, seen as ethical, impartial and fair. Clark (2019) has stated that biases in the training data used for training the AI could lead to unfair treatment towards certain customer groups. For example, the AI may not favor the minority groups and could treat them in a cold way, such as sending technicians for one type of service request, rather than the actual service request, they had raised the ticket for with the AI increasing the need for the AI developmental companies to develop their products in a responsible way, keeping the needs of the customers in mind by ensuring that the training data it is developing or acquiring is inclusive and fair along with mechanisms for the detection of possible biases and unfairness in the training material archive before using it to train the AI as such an approach can reduce the possibility of bias in the AI, making it more ethical for the customers (Garcia, 2022). Conger (2014) has discussed the importance of ethical guidelines for AI enabled service desks, due to the crucial role played by the service desks for organizations in his research, where he has stated that organizations can benefit from the creation of AI specific ethical guidelines, for deployment of such tools into the service desks, enabling the generation of more ethical, fair and socially acceptable outputs from the AI enabled service desks. Such guidelines, if created at the policy making level can lead to beneficial outcomes for the organizations through the incorporation of Fair, Accountable and Transparent (FAT) Guidelines for the AI deployed for customer service purposes in the organizations. An additional level of ethics can be ensured by conducting regular audits of the AI to make sure that the AI is indeed working in a fair, non-biased and ethical way, as such an approach can benefit the organizations into the long run and for greater effectiveness of such audits, a diverse range of experts and stakeholders for greater ethical parity for the AI (Roberts & Kumar, 2021).

2.6 Future Developments

2.6.1 Further Artificial Intelligence (AI) Progress: Researchers have indicated that the service desks in the future will be very highly dependent on Artificial intelligence (AI) than before, and in some cases, eliminating the human all together in favor of the machines, enabling the delivery of services at levels not seen before as the advancements made in the realms of AI, algorithm and model development, AI learning etc. especially in the core areas such as Natural Language Processing (NLP) and predictive analytics will make it possible for such developments to happen in the future as companies will adopt such systems keeping cost and operational efficiency in mind. Harris (2021) has stated that improvements, refinements and further developments in the realms of AI, Machine Learning and Deep Learning will make service desks more efficient, capable and effective in settling and solving almost all queries, complaints and issues raised before them faster than today, in the future. Examples of such technologies are already in use as in case of AIRBNB, the renting service provider which is using 'human like' AI based on NLP in generating more human like responses to the queries raised before it by its customers (Vyas & Vyas, 2022). The usage of such tools is a cold truth as the companies, in their interest for the provision of quality and efficient service will be making use of AI in their service desks as it will truly make the bottom line for them today and in the future (Wang & Liu,2020).

2.6.2 Increased Customization: The potential of Artificial Intelligence (AI) for performing analysis in the case details entered into it for a more accurate, targeted response based on the specific needs mentioned by the customers can enable greater levels of service desks assistance and as found in Lee (2022)'s research, this level of customization can enhance the customer's satisfaction creating greater levels of trust for the company. The way AI is developing today, it will be possible for the generation of almost human like responses by the AI in the future as the enhanced technical and technological capabilities can assist the AI to draw meaningful insights from the very large volume of the customer's data including his/her transaction and business history with the company for identification of any past preferences or behaviors of interest which can be used by the AI to identify the recurring customers, with a history of prior issues so that it can use this information to

deliver the desired levels of quality in the services provided to the customers as per the specific requirements and preferences. Paramesh & Shreedhara (2019) have stated that AI enhanced personalized services can bring the 'wow factor' in a customer's experience and lead to greater time management efficiency as the issues can be understood and solved within the given time. The increased level of maturity in AI will lead to a greater spectrum of customization opportunities in the future, which will change how service desks are seen by the organizations, the employees and the customers in ways unlike before, leading to a radically new experience with the AI enabled service desks in the days ahead (Nguyen & Tran, 2019).

2.6.3 Adoption of New Technologies: Developments, improvements and enhancements in technologies and software programming has enabled the integration of Artificial Intelligence with emerging technologies such as Augmented Reality (AR) and Virtual Reality (VR), enabling the development and deployment of a 'blended reality' like solutions for the customers, increasing the chances for highly interactive, immersive experiences. Brown (2022) has stated that the combination of AI with AR/VR in the context of service desks can lead to radically new results. For example, the service desk interface could overlay digital information onto real life surfaces (through compatible devices such as projection enabled smart devices) giving the customers a unique experience, as they can see information around them in a similar way as seen in case of Iron Man's HUD helmet as seen in the 'Iron Man' movie. A good use case for this technology is in case of complex wiring repair or plumbing repair as the correct repair design can be 'overlayed' on the work area, enabling seamless solution to the problems by solutions provided by the AR/VR enabled AI powered service desks. Kekkonen & Arasmo (2016) have stated that AR/VR technology can be excellent for interactive support interactions with the users, for identification of solutions for complex problems as the AI can guide the user through the overlayed information displayed using the AR/VR technology for solving the issues on hands and state that the technology can be particularly useful in case of training and development scenarios, in areas where a lot of complex and expensive technologies are used such as nuclear research and development, fighter aircraft engine maintenance, etc. as the scenarios can be presented in a useful way, allowing the trainees to explore the situations without causing much damage on hand, in case someone makes mistakes. The AI powered service desks can be further secured through the utilization of block chain technology for seamless and secured data transfer, enabling the service desks to become more safe, secure and reliable for the convenience of the customers. Robert & Kumar (2021).

2.6.4 Regulatory and Ethical Developments:

As a technology, Artificial Intelligence (AI) is extremely powerful, sometimes reaching God like levels, in terms of the outputs generated. Such perfection creates fear, increasing the need for regulation of this power, to ensure that it will not be misused. AI has a real fear for employees as it is increasing the risk of employees losing their jobs to the machines increasing the need for ethical overview of such technologies. Many experts have indicated that for an AI to be fair and non-biased, the training material used for developing the capabilities of the AI has to be fair and biased as such efforts are necessary for the AI to be seen and felt as ethical compatible in organizations (Clark, 2019). The need for transparency, fairness and nonpartisanship for AI tools will increase in the future, requiring the development of specialized tools and mechanisms for enabling the above as such efforts can lead to the generation of fair, accurate and non-biased results through the AI, which is a must in case of AI powered service desks as they could be identified by the customers as one of the 'faces' of the companies and the way they receive the services can lead to the development of a sense of comfort with the services provided, increasing the chances of repeat businesses in the future, bringing to mind the importance of the development of a complete ethical framework for the AI enabling it to be comfortably deployed into the service desks in the tenets of the FAT Standards (Fairness Accountability and Transparency) which can act in the right direction that the AI will be working for the greater welfare of the customers. Regular ethics audits can be beneficial as such efforts could check and verify whether the training material being used for the AI is on par with the organization defined ethical standards, ensuring that the interests of the stakeholders are respected by the AI (Garcia, 2022).

We can summate the above by stating that AI in service desks has a bright future as the integration will cause us to witness several paradigm shifting changes in the future with increasing levels of personalization and amalgamation of technologies through the combination, benefiting the customers through the services provided by the AI enabled service desks. It is to be noted that ethical and regulatory concerns could be raised, increasing the need for organization to guarantee that the AI they are deploying on their service desks is indeed, fair, transparent and non-biased.

3. Research Methodology:

The researchers have employed the methodology of 'comprehensive literary review' for analyzing the impact of AI on service desks and have grounded their research in an extensive study of the available research literature with a key focus on terms such as Machine Learning,

Predictive Analytics, Customer Satisfaction, Cost efficiency along with the advanced AI technologies deployed on the service desks. The literature was identified for this study using a systematic approach, covering research papers, articles and other literature published between the years of 2010 to 2023 and this time frame was chosen, as a number of significant innovations have taken place in the realm of AI in this time period. Following review process strategy was used:

3.1 Selection of keywords and identification of good research databases: The researchers identified quality databases of value such as the SCOPUS database, the IEEE database, the Springer Journals database, the Emerald database, the Taylor & Francis database, etc. for identification of research literature pertaining to the topic, published in the time period of 2010 – 2023. Keywords such as 'AI, AI in service desks, AI enabled service desks, Machine Learning, Predictive Analytics, Customer satisfaction, Cost savings, cost effectiveness, etc. were used for identification of the articles.

3.2 Inclusion & Exclusion criteria: An Inclusion / Exclusion criteria was developed by the researchers, wherein the research literature so found in the databases using the keyword search terms, were narrowed down by including research literature which was highly relevant to the search terms, which were shortlisted for the study. Research literature which was not relevant was not selected for the study. The research made efforts to search for quality, peer reviewed research literature for the study.

3.3 Data extraction: The research papers so shortlisted by the researchers were studied for identification of key points such as research objectives, the methodologies used, sources of the data, findings and conclusions in the research paper for further interest based categorization on the parameters of interest.

Both, quantitative and qualitative studies were used by the researchers which covered diverse methodologies in their purview for assessing the impact of AI in the performance of the service desks in form of surveys, statistical analysis, empirical studies along with qualitative research studies based on semi structured interviews and case studies. The purpose of these studies was to understand the experiences of the service desk managers and employees, who were working with AI technologies in the process of running the service desks. A few studies also included a combination of 'mixed method' approaches, combining the above to assess the operational impact of the usage of AI in service desks to understand the effect of AI on the human factor elements such as employee job satisfaction, levels of adaptation, etc. The researchers made efforts to identify relevant research literature which were based on studies involving real life service desk operations in the organizations along with other relevant criteria such as operational cost details, customer feedback regarding the services provided from the desks, performance metrics and other data, etc. A few studies were also included which were based on AI based tool simulations and predictive models for evaluation of the potential benefits of the integration of AI in the service desks.

4. Hypothesis statements:

The researchers have developed the following hypothesis statements, based on the literature review. The hypothesis statements so developed were tested using the survey data collected from the service desk managers contacted by the researchers across various industries and locations. The hypothesis statements are as follows:

- **Hypothesis 1:** A significant reduction in the average ticket resolution time can be experienced through the implementation of AI in service desks.
- **Hypothesis 2:** AI-driven customer interactions increase overall customer satisfaction.
- **Hypothesis 3:** AI implementation in service desks results in cost savings for organizations.
- **Hypothesis 4:** The adoption of AI in service desks could raise ethical concerns of significant nature, related to the possible impact on data privacy and job displacement due to the usage of AI.

5. Findings and Conclusions:

This research has synthesized the findings from a diverse collection of research literature for the performance of a comprehensive overview of the impact of Artificial Intelligence in service desks and the following results were identified, based on the parameters of interest. The hypothesis statements were verified through the gist of the study, leading to the following results –

- **Hypothesis 1:** A significant reduction in the average ticket resolution time can be experienced through the implementation of AI in service desks. The findings in the research revealed that the integration of Machine Learning (ML) based AI algorithms into service desks can lead to significant improvements in the efficiency of the working of the service desks. Research by Schad, Sambasivan & Woodward (2022) has confirmed that the application of ML in service desks have led to significant level improvements in the efficiency of operations in the AI enabled service desks, reducing the time the customer would have to wait, for resolution of their complaints, queries and questions. The research suggests that the MLs capability to learn from each iteration with the

customers could be responsible for this, proving Hypothesis 1 through the evidence as the utilization of ML is indeed reducing the overall ticket resolution time, increasing the convenience for the customers.

- **Hypothesis 2:** AI-driven customer interactions increase overall customer satisfaction. The findings have revealed that AI powered chatbots and virtual assistants have been found to play a catalyzing role in improving customer satisfaction through the provision of instant, highly accurate responses to the common queries and questions asked to the chatbots and virtual assistants. Research by Nguyen & Tran (2019) has revealed that organizations which introduced AI powered tools such as chatbots experienced an increase of customer satisfaction levels by 25%, which was primarily due to the wait time being reduced by the AI, leading to provision of instant replies for the queries entered along with the provision of customer support mechanisms at the customer's own convenience and such findings have been found to be consistent across the various research papers, reports, book chapters and other literature reviewed by the researchers, proving Hypothesis 2 that AI-driven customer interactions can increase overall customer satisfaction.

- **Hypothesis 3:** AI implementation in service desks results in cost savings for organizations. The findings in the research have revealed that implementation of AI in the business operations can lead to an increase in the operational efficiency, which has a reduction on the cost overheads for the organization. Research by Martinez (2020) can be cited as evidence for this statement as he has reported that organizations who have implemented AI technologies in their operations have reported significant savings in terms of cost, in their business operations (upto 40%) by automation of the routine tasks and other low cognitive load applications which is also facilitating the ways in which the organizations are optimizing their tactics for resource allocation plans. The findings also align with other studies which state that AI can save large amounts of money, proving the hypothesis with the evidence that AI implementation in service desks results in cost savings for organizations.

- **Hypothesis 4:** The adoption of AI in service desks could raise ethical concerns of significant nature, related to the possible impact on data privacy and job displacement due to the usage of AI. The findings reveal that the concerned raised by the researchers regarding the ethical concerns raised by AI are indeed true, as the technology is powerful enough to motivate organizations to replace human employees with machines in the name of cost efficiency. Also, the voluminous amount of data required for training the AI also raises significant data privacy concerns and were highlighted by Smith & Jones (2021) in their research who highlighted the need for more stringent data protection/security mechanisms for ensuring compliance with international level regulations like the European GDPR. In addition research by Adams (2020) has stated that AI can replace human jobs, particularly low cognitive load (thinking) and repetitive jobs making the technology extremely attractive for organizations who are looking for cost cutting options. He has stated that reskilling of the employees could increase their chances to transition into new roles, in case they were to be replaced by AI, proving the hypothesis which states that The adoption of AI in service desks could raise ethical concerns of significant nature, related to the possible impact on data privacy and job displacement due to the usage of AI.

The finding confirm that AI does indeed have a transformative impact on the service desks, but the side effects of this technology in case of data security/privacy and possible loss of jobs need to be looked into so that a sense of balance can be made, enabling both the hawk and the eagle to perch on the same branch as such an approach can mitigate the possible side effects, paving the way for a bright future.

6. Implications for Research, Practice, and Society:

There is scope for future research into the topic of AI in service desks as Artificial Intelligence is expected to become faster, smarter and better in the future. The integration of advanced technologies such as AR, VR can transform the service desks into a more customer friendly solution provider system and by further integration with the block chain technology, data privacy and security can also be assured and can be examined in the course of future studies. There are practical application for AI Powered service desks in the financial sector – Banking, Financial services, Financial asset trading services etc. There is a good scope for the AI powered service desks in the stock and share trading industry and the healthcare industry as these industries often receive clients and customers whose time is limited and organizations can benefit tremendously by the deployment of the AI powered service desks with Machine and Deep learning capabilities, increasing the chances of conversion of customers into long time business providers for the organizations.

AI in service desks has substantial economic and commercial implication as organziations which have 'AIfied' their service desks through Machine and Deep Learning can achieve substantial benefits in terms of cost efficiency. In some cases, cost reductions upto 30% have been reported post deployment of AI driven service desks, which is a substantial amount and the money so saved, can be re-invested in the areas of business of immediate need. In addition, the AI itself can be used for enabling cost effectiveness by making it study very large voluminous datasets and banks of the accumulated data and information for prediction of possible changes and trends in the future, which can assist the stakeholders in taking wise, data based decisions, which could lead to beneficial outcomes down the road, improving its commercial position in the market through AI driven analysis of the customer data for discovering future customer needs along with suggesting ways in which the resources could be used in an optimum way, for greater cost and operational efficiency.

There is scope for AI based service desks in the realms of public policy and education, which have both benefits and drawbacks. The need of the hour requires the stakeholders and policy makers to consider the ethical implications of AI, so that a balanced approach can be derived which can bring forth the benefits of the AI tools for the common man, through the development of policies, encouraging the responsible use of AI for the greater good to ensure that the AI stays within its bounds ensuring that the data of the public is not misused for training the AI based decision making as such efforts are necessary to bring the benefit of this technology in a larger way. The scope of AI is excellent in the educational sector as the AI enabled service desks can benefit the educational and higher educational institutions in settling questions, queries and complaints related to the courses offered in the institutes along with the other administrative/non administrative formalities by the students, teachers, parents, etc. enabling the discovery of the in-demand skills which can lead to increased employability of the students, for securing their future.

In conclusion, the researchers would like to state that the future is bright for AI in service desks and the prospects for further research is also bright and the future research studies could investigate new areas where AI based service desks could be deployed, which can lead to several interesting research studies and papers in the future, which can lead to the identification of the best practices, S.O.Ps and other standard practices regarding the usage of such technologies for the greater good of the organizations and the public.

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