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Application of Quality Function Deployment in Healthcare Services: A Review

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Abstract: ***In the face of increasingly aggressive competition in the health care industry, administrator are required to be able to build up strategies, policies or new breakthroughs related to improving the quality of their services, through improving the characteristics of hospital services, which focus on needs of patient, so that the risk of errors or discrepancies between service characteristics that are enhanced by what the patient wants can be avoided or minimized. The health care system had been receiving several customer complaints, thereby pulling the overall satisfaction index low. Since most visitors were asymptomatic, their needs were quite different from patients who visited to hospital for specific treatments. Though, the organisation had taken a few measures, it had not resulted in any significant improvement. The primary areas of Quality Function Deployment (QFD) application are product planning, process planning, production planning and services planning. Since its origin, many organisations have adopted QFD and have reaped benefits from it. In this paper author has reviewed researches pertaining to application of QFD in improving health care services..***

Keywords: Health Care Industry, Strategies, Needs of Patient, Quality Function Deployment, Services Planning

I. INTRODUCTION

This document is a template. For questions on paper guidelines, please contact us via e-mail. The quality function deployment (QFD) is a systematic technique for designing services or products that are based on the customers' needs. With the help of a hospital- based case study, this research paper discovers the possibility of using the quality function deployment (QFD) in the healthcare service.

Governments provide various public services to their citizens, and a healthcare service is one of them. It is being an essential rather than luxury service, and the governments spend a huge amount of money on it. The principle behind providing a good health service to the people is to ensure a healthy society.

According to the Prosperity Index, the United Arab Emirates (UAE) was ranked as (32nd) in (2012) while in (2015), its rank dropped down to (34th) (The 2015 Legatum Prosperity Index, 2016). That difference made the government to focuses more on the improvement of country's healthcare services. In (2016), Dubai government established the new vision to convince the people of the city to get a medical service before their tours. The program is aimed to ensure the improvement of their focus on healthcare (UAE Vision 2021, 2016).

The focus on healthcare defines the process of applying the quality function deployment (QFD) as a part of the general management of the healthcare system in the United Arab Emirates (UAE).

The quality function deployment (QFD) is a procedure to determine customers' needs and evaluate, manage, and design a mechanism to enhance the current system (ReVelle, Moran, & Cox, 1998). The research will present a case study of applying the quality function deployment (QFD) model to enhance the healthcare processes and the customers' satisfaction at the private hospitals (Hospital A) in Dubai, compared to other hospitals of a region. The study will use an organized method based on hospital customer-surveys to assess their current satisfaction level and will identify detailed actions that can be done to improve the overall quality of hospital services.

II. QUALITY FUNCTION DEPLOYMENT

The quality function deployment (QFD) is driven by customers and focuses on their needs and requirements, which needs data collection from the competitors in the business.

This practice helps to organize the resources and restructures them according to the information collected about the customers' experiences. The quality function deployment (QFD) helps to decrease the development and implementation time for the new product, which helps to minimize any design changes in the future. Other benefits of the quality function deployment (QFD) will also be introduced and demonstrated throughout this research (Bhattacharyya, 1998).

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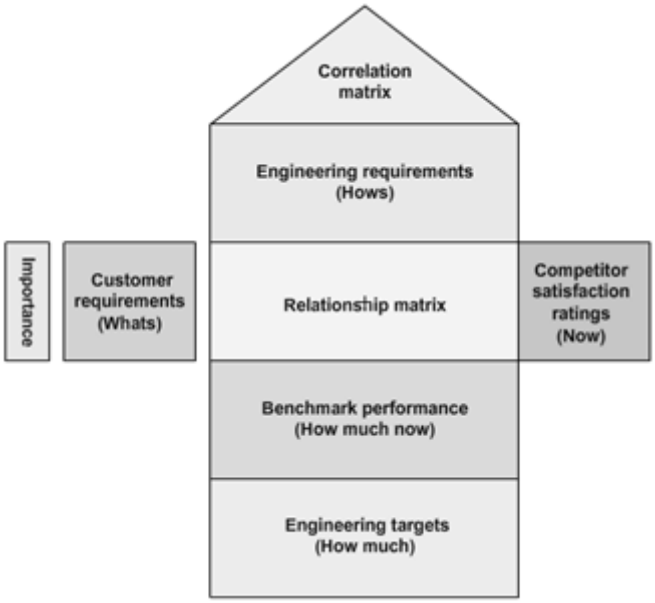

Fig. 1 House of quality.

Figure 1 shows house of quality (HOQ). The House of Quality refers to a well-known process for product / service development that is inspired by customer desires for product or process development and anchored by the capabilities and resources of the organization seeking to meet those desires.

III.QFD AND HEALTH CARE SERVICES

Lieuwe Dijkstra & Hans (2002) in their research work described two cases in Dutch healthcare organisations first. Next, some complications in applying QFD were outlined and a conventional application of QFD in healthcare was presented. Then a refinement and an extension of QFD were described; both illustrated by examples from the cases. Finally, a few points were raised for discussion, including remarks on the AHP. It should be noted that the focus of this paper was on research methods in applying QFD. As a consequence, results essentially were illustrations. There was no underlying claim of presenting complete design models or integral solutions to the initial practical problems of renewal [1]. Materla, Cudney et.al in a paper provides a review of the literature on implementing the Kano model in healthcare through a systematic search of databases related to service quality improvement in the healthcare sector. The objective of this paper is to detail how the Kano model can be employed and integrated with other quality methodologies to obtain customer requirements and improve healthcare service quality. It is evident from this systematic review that customer needs and preferences vary with the type of care acquired and services offered by healthcare providers. The findings allow healthcare providers to comprehend customer needs related 5 to service quality and develop sustainable improvement strategies. This article intends to propel further research in service quality improvement of the healthcare industry [2]. Quality function deployment (QFD) may be one of the best tools in such situations.

Benjamin Dehe, David Bamford in a study demonstrated how QFD can enhance a healthcare organisation's strategic operational alignment, by synchronising the infrastructure design with the service intention. In that empirical paper, a case study of a £15 million infrastructure development had been used as the unique context to assess and test the experimental findings. QFD was utilised in order to capture and transform the requirements of decision-makers, providers, patients and local communities into both service and building design for Project K, a healthcare infrastructure, in the U.K. Two full iterations of the QFD results were presented. Using QFD generated effectiveness and efficiency by creating an information exchange platform and providing the stakeholders with a framework to optimise the decision-making. The paper made a practical contribution by empirically testing the QFD modelling and providing evidence of its implementation within the complex, dynamic and evolving nature of the healthcare built environment sector [3]. Keshtkaran Ali, et al. in a study applied QFD technique to improve the quality of the burn unit services in Ghotbedin Hospital in Shiraz, Iran. First, the patients' expectations of burn unit services and their priorities were determined through Delphi method. Thereafter, burn unit service specifications were determined through Delphi method. Further, the relationships between the patients' expectations and service specifications and also the relationships between service specifications were determined through an expert group's opinion. Last, the final importance scores of service specifications were calculated

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through simple additive weighting method. The findings showed that burn unit patients have 40 expectations in six different areas. These expectations are in 16 priority levels. Burn units also have 45 service specifications in six different areas. There were four-level relationships between the patients' expectations and service specifications and four-level relationships between service specifications. The most important burn unit service specifications had been identified in the study. The QFD model developed in the study can be a general guideline for QFD planners and executives [4].

Moores, B. M. presents a study of the potential for applying the Quality Function Deployment (QFD) method to the analysis of the framework for safety management contained in the Ionising Radiation (Medical Exposure) Regulations (IRMER) of 2000. More frequently, now, the QFD approach is being applied to health care in order to engineer clinical processes that can best fulfil the needs of the patient. In the case of diagnostic radiology, safety management must not only be concerned with radiation protection but, more importantly, with the accuracy and consistency of any diagnostic outcome. Both are important patient needs. The results of this assessment are discussed in terms of clinical, human, operational management and equipment related aspects of the radiological process. This study highlights how the QFD approach may be applied to engineer specific aspects of radiological practice that play a key role in ensuring that patients' needs are fully met. As an example, clinical audit requirements are analysed by means of the QFD method to indicate the design requirements of information and knowledge based systems that can provide the necessary information for this type of key management activity [5]. Dijkstra et.al (2002) used Quality function deployment in healthcare and suggested methods for meeting customer requirements in redesign and renewal [6].

Ida, Hendry et.al in his article provided a literature review on the use of quality function deployment (QFD) in healthcare and a case study in order to provide contextual knowledge as a means of improving applications of QFD in healthcare. The literature search was done via Google Scholar, PubMed/MEDLINE, and Web of Science using the keywords "quality function deployment" and "healthcare"; focusing on journal publications and their related citations. The case study was done within a design for Six Sigma project (DFSS) in a Swedish hospital. Empirical data were collected through face-to-face interviews and project documentation. From the case study, the application of QFD leads to an increased awareness of a complex multiple-customer concept, traceability of the improvement strategies in a more structured way, and the formation of a new process organization. A time study at one clinic (cardiology) before and after the project within which the QFD was used showed that the time spent on prescription of medication has decreased by more than 20 percent. This has increased the time that doctors can spend with their patients [7]. Radharamanan and Godoy (1996), used Quality Function Deployment (QFD) in a health care system to deploy the voices of the customers in understanding their requirements and to include them for continuous improvement of quality in services provided [8].

Ahmed Salem This research paper elaborates on the reasons the quality function deployment (QFD) is selected as a technique to develop a total quality healthcare model. With the help of a hospital-based case study, this research paper discovers the possibility of using the quality function deployment (QFD) in the healthcare service. The paper showed some limitations of the conventional quality function deployment (QFD) outside the physical industrial production and presented modifications as an extension of the quality function deployment (QFD) in the healthcare service. Based on the outcomes, a total quality model was developed to guide the healthcare management in their total quality development [9]. Hatice et.al describes how quality function deployment (QFD) methodology was employed for translating customer needs and expectations into the quality characteristics in a private healthcare setting. Their case study illustrates how an existing approach of SERVQUAL and QFD integration can be applied for quality improvement. Integrating SERVQUAL into QFD to set the success factors to improve quality in the healthcare industry is the main aim of the research. A privately-held university hospital, within the city of Istanbul in Turkey, was selected as the sampling frame. A SERVQUAL-type of questionnaire was used and a total of 250 questionnaires were distributed and 210 of them were received. Usable responses were 170, comprising a response rate of 68 percent. From the results of the QFD application it is seen that behaviour and attitude of staff has the highest weight score, meaning that when behavior and attitude of staff is improved there will be almost 25 per cent of improvement in the hospital. Another finding was that there is strong relationship among skills of physician, behaviour and attitude of staff, and having enough modern equipment [10].

Akram, Iqbal et.al (2018) did a study in Bangladesh. The objective of the study was to speculate upon a method for the improvement of healthcare service quality provided in the outpatient department of Government hospitals. Through the systematic random survey, 50 patients were selected and interviewed at exit point using face to face interview technique. Process analysis had been done, and QFD had been used to understand the requirements of the patients and to deploy their voices for the continuous improvement. The importance of service characteristics was calculated using QFD. A database management system (DBMS) has been developed to computerise the front office management which is user-friendly, simple, fast and more cost effective. Through process analysis inconsistencies and problems with the existing system had been identified. Process analysis had enlisted some corrective actions for improvement of the service quality of the outpatient department. By using QFD, the importance of service

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qualities had been identified. DBMS provides data which can be very useful to the health statisticians and hospital authorities to track different public health parameters and further service improvements. Mistakes done on calculators are dispensed out entirely by this method. It works with the assembly of patient's info, diagnosis details etc [11].

Wood, L. C et.al in a paper aims to study the quality function deployment (QFD) concept and technique when implemented in the construction industry with a particular focus on supporting green hospital design by identifying the end-user factors (concerns) that affect the design. This research develops QFD tools for green hospital designs known as the house of quality green design (HOQGD). Data were collected using a questionnaire survey distributed to public and private hospital end-users in Klang Valley, Malaysia. Findings revealed that end-users perceived "safety mechanisms during emergency" as being of the utmost importance and also the feature they were most satisfied with. The other demanded qualities were at an average degree of satisfaction; however, the end-users considered that green hospital design must make efforts to maximize the use of natural light and ventilation while considering the building orientation; materials should be free from toxicity and be environmentally friendly; the landscape should be strategically designed and the facilities should increase the sense of a healing environment, and water efficient equipment should be installed. Accordingly, these were prioritized and incorporated in the developed HOQGD to inform green hospital design for both public and private facilities [12]

Abdurrozzaq Hasibuan et.al, did research at the Government General Hospital (RSU). From the results of research conducted there are 21 variables of patient needs from a health service. Whereas the patient's research on the service quality of the Government Hospital is one variable that has fulfilled the needs of patients, namely that they are satisfied with the quality of hospital services. Variable is the state and completeness of modern medical facilities. Whereas for other variables there are gaps so that they cannot meet patient expectations until the highest quality limit is very satisfied, it is necessary to have a direction of improvement. To obtain the suitability, the technique used to improve the characteristics of the service is the application of the QFD method. The QFD method in this study is in the form of a quality service matrix at the Government General Hospital. From the HOQ matrix, the service quality of the Government Hospital is obtained from the input of the Government Hospital/management that there are priority variables needed to improve their quality, which is generally the patient's needs related to the recovery of patients, including the knowledge and abilities of doctors, medicines the treatment given in the healing of patients, the service of examination, treatment and care that is fast and precise, guarantee of security and trust in the services provided and the completeness of the readiness and cleanliness of the equipment used. So there are 33 service quality characteristics prioritized for further improvement, with the main priority being patient recovery [13]

Dori et.al plan and define a methodological tool able to be applied to a general process in a health structure. The general problem of process control requires a big commitment in terms of technologies and specific capacities about plenty of aspects that must be controlled, according to trial complexity and particularity of the health structure. Requirements for this kind of tools are related to the possibility to produce numerical, synthetic, and objective indexes, according to the idea that a numerical index has the intrinsic property to give a synthetic and comparable kind of information, especially when it's linked to a qualitative definition. Hence, we propose a methodological tool based on QFD (Quality Function Deployment) approach and characterized by a "semi-quantitative" and at the same time objective approach to quality measurement in health care structures. Such an instrument may be applied to several processes of the health care area or, given a "target process", more times to the same process in distinct moments (for example before and after particular changes on critical aspects), to assess the contribution supplied by this improvements on process performances [14].

Neven Saleh et.al suggested a new model for preventive maintenance using QFD. The management and control of maintenance activities are equally important to perform maintenance. As the variety of medical equipment increases, accordingly the size of maintenance activities increases, the need for better management and control become essential. This paper aims to develop a new model for preventive maintenance priority of medical equipment using quality function deployment as a new concept in maintenance of medical equipment. We developed a three-domain frame work model consisting of requirement, function, and concept. The requirement domain is the house of quality matrix. The second domain is the design matrix. Finally, the concept domain generates a prioritization index for preventive maintenance considering the weights of critical criteria. According to the final scores of those criteria, the prioritization action of medical equipment is carried out. Our model proposes five levels of priority for preventive maintenance. The model was tested on 200 pieces of medical equipment belonging to 17 different departments of two hospitals in Piedmont province, Italy. The dataset includes 70 different types of equipment. The results show a high correlation between risk-based criteria and the prioritization list [15].

Chintala et.al uses Quality function deployment (QFD) along with AHP for quality achievement in health care is a methodology that extracts client demands (CDs) and inducting them in the final service/product. Once CDs are extracted from client the traditional

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QFD approach uses absolute importance to identify the degree of importance for each CD. Direct evaluation of CDs based on absolute weighting without tradeoffs is easy to perform, but may lead to serious deviations from reality. An alternative to avoid this problem is to adopt the analytic hierarchy process (AHP) approach. In this paper, an integrated model combining AHP and QFD has been delineated as a quality achievement tool in healthcare. A case study is performed on the healthcare services provided by government general hospital, Indore District, Madhya Pradesh, India and data has been analysed to benchmark the proposed framework by computing the degree of relative importance for CDs through AHP and incorporating them in subsequent deployment matrices [16]. Hsu-Shih Shih et.al in the research sets up a conceptual design of a future mobile or portable healthcare device using the quality function development (QFD) with the analytic network process (ANP) and the theory of inventive problem solving (TRIZ). We propose a three-stage QFD in order to consider customers' requirements, extend the whole design process, and calculate the priorities of the left-hand-side elements in the houses of quality (HOQ) by implanting ANP. Some contradictions at the roof of the second "house" are able to be overcome by TRIZ. Going through the integration of the three methods, the analysis results characterize the features and their priorities for the future mobile device. We believe that this conceptual design of the mobile healthcare device can provide a new direction to the healthcare industry [17].

Anuraj et.al designed a food trolley for hospital use. Healthcare industry is a wide and intensive form of service which is related to the well being of individuals. The Indian healthcare industry is one of the fastest growing sectors. The patient's perspective towards hospitals is also changing. They expect better facilities from the hospital management. One of the most common issues patients encounter is the quality of food which they get during their stay in the hospital. Equipment is required to keep the food fresh from the kitchen to the ward. A food trolley is a cart which will keep the food hot and fresh during transit. Food trolley maintains the acceptable texture and temperature of the food. This project is an attempt to bring a better solution for hospital food service by understanding issues in the existing design. Quality Function Deployment and Product Design Specification were generated based upon data analysis. Concepts were generated with respect to the derived Product Design Specification. Various issues and needs identified through data collection have been addressed in developed concepts. Final concept was selected by weighted ranking method. The product name has been chosen as 'Steamfresh' which highlights the function of the product in an efficient manner. A half scale mock-up model has been made to validate the final concept and feedback was collected from users. Major user needs such as handles for usability, modular design shelves, ergonomics and aesthetics were satisfied by the final design. User response on final design was positive and satisfying [18]. Sinem et.al did research using QFD regarding blood collection. Although hospitals are important facilities for human health, they are not the places that people usually want to be in. It is necessary to create an environment that will make people feel like they are at home rather than at the hospital in order to break this feeling. In order to provide this environment in hospitals, patient-oriented service approach should be taken and appropriate processes should be designed. In this context, the opinions of the patients should be taken into account. In this research, the patient expectations regarding the blood collection process in a private hospital were evaluated. The current situation of the hospital, the relationships between expectations and requirements, and the competitors are taken into account and a quality function deployment technique is used [19].

IV. CONCLUSIONS

The main aim of this paper was to review of researches in health care services using Quality Function Deployment (QFD). As the competition is increasing day by day in hospital industry, so it is necessary to understand need of patient report to hospital for primary check up and also of those required to be admitted for duration. Quality Function Deployment plays an important role in improving service quality of health industry

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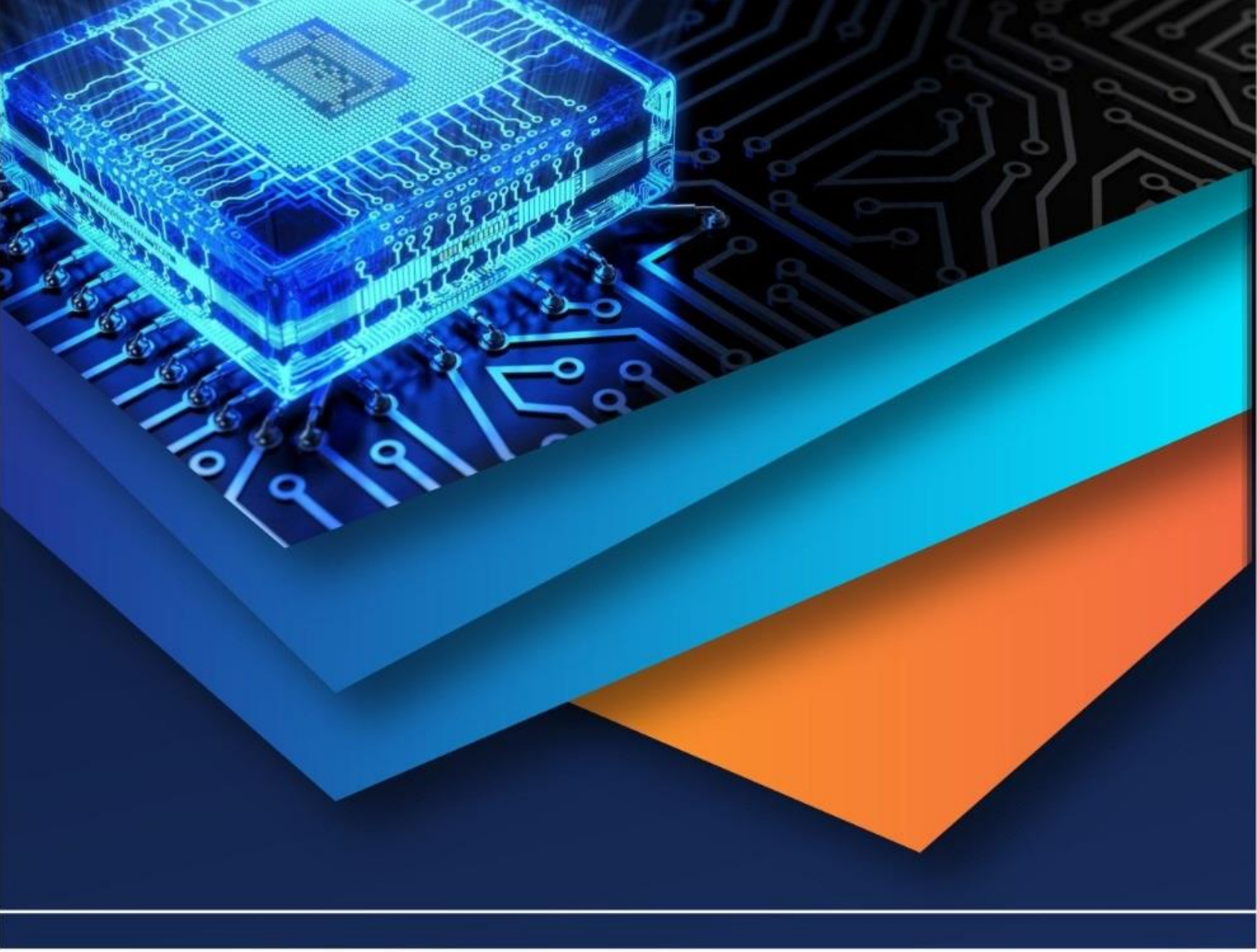

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