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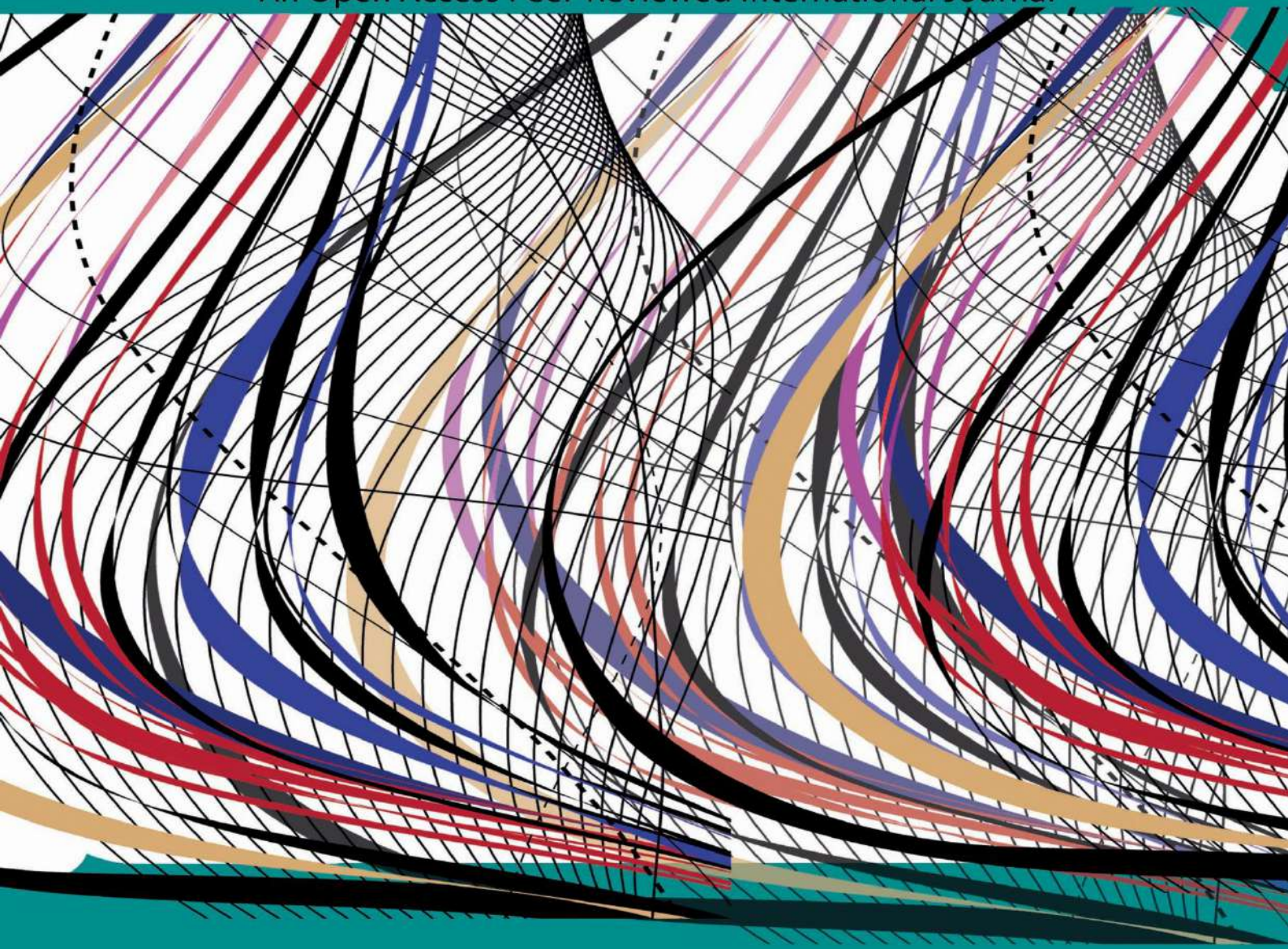

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Study on the Innovative Technologies in the Marketing Retail Sector

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Abstract— *"Retail Technology" refers to solutions that assist retailers to enhance their operations. So, these advanced technologies assist retailers in increasing their sales. Technology is transforming the way we do business. The main aim of the study is Study on The Innovative Technologies in The Marketing Retail Sector. The two primary methods of research, the quantitative and qualitative approaches, are highlighted by the explanation of the many kinds of study. The study's author concluded that, when pitted against the tried-and-true method used before the advent of ICT, the latter was more successful in fostering consumer loyalty and attachment.*

Keywords— ***Retailers, Technologies, Innovative, Consumer, Loyalty***

I. INTRODUCTION

"Retail Technology" refers to solutions that assist retailers to enhance their operations. So, these advanced technologies assist retailers in increasing their sales. Technology is transforming the way we do business.

Industries are entirely going to change the way they offer their services. The industries are moving away from archaic techniques and toward modern technology for the majority of their needs. Technology has become an urgent requirement in order to keep up with our fast-paced society. So, there are many industries that have changed a lot because of new technology, like the retail industry. Technological advancements have undoubtedly aided in the resolution of many of the issues associated with running a retail business.

The retail industry has always been one of the most challenging sectors of commerce. Retailers must keep up with changing patterns in customer preferences, new technologies, and innovations, as well as shifting economic landscapes. In this article, we'll discuss how businesses can innovate in retail with the latest technology. We'll also cover some of the most common ways that retailers are using digital technologies to improve their operations and increase revenues.

With total global retail sales projected to reach $28 trillion by 2020, companies across the board are working hard to capitalize on the growth of retail spending. This also means retail is extremely competitive right now—especially with the rise of direct-to-consumer retailers who further diversify the market.

1.2 Impact of Technology on the Fashion Industry

Technological advancements have made lives convenient for all of us. There are things which we couldn't even think of doing in previous times but in today's era, they are a piece of cake, thanks to the technological transformations. There's hardly any area that has been left untouched by technology. One such area where technology has played its magic is the fashion industry. Fashion has always been about creativity and innovation. India is anticipated to become the sixth-largest fashion market in the world in the coming times. With the changing times, the fashion industry has evolved as well.

A. Impact of Technology on Production:

Technology is significantly being incorporated into the daily processes of the fashion industry which means that production has become much smoother, quicker, and easier. The convenience with which the production is being carried out has resulted in bulk production which not only benefits the brands but is advantageous for consumers as well. Bulk

production results in a reduced cost of production which reduces the manufacturing cost for brands and ultimately leads to a reduction in the market prices which benefits the consumers.

B. Role of Technology in Enhancing the Reach of Brands

Technology has also played a fundamental role in enhancing the reach of brands. With their digital presence through websites and social media, brands are now able to establish themselves on an international level and gain clients from all over the world.

C. Role of Technology in Research and Strategy Development

A lot of software, techniques, and algorithms are available which make the research part for brands easier. These techniques help the brands in understanding consumer preferences and ongoing trends.

D. Impact of Applications Available on the Fashion Industry

The availability of a wider range of apps has made it possible for consumers to try outfits on their avatar, which helps them in understanding what an outfit would look like on them before they decide to purchase it. Fashion design software has helped in the creation of customized products. A lot of brands are offering options to customers through which they can customize their outfits from the comfort of their homes with just a few clicks.

II. LITERATURE REVIEW

B.G.J. ten Bok (2016) The proliferation of online shopping has caused a seismic shift in the retail industry throughout the world. New avenues of communication between stores and their consumers are being developed. It is anticipated that the Internet will become progressively more central to daily life during the next decade. The environment we live in will soon be filled with "smart objects," or physical items that are embedded with electronic circuitry and processing power. The term "Internet of Things" refers to the widespread use of this kind of "smart" component in modern products and services. According to the available literature, stores often play the role of innovators less frequently than those of adaptors. Instead, than concentrating on improving the quality of their services, they are busy developing new items. There hasn't been a lot of research done on the characteristics of service-based innovation. Examining the primary motivators of innovation in the retail business, this article focuses on how the Internet of Things enables retailers to develop their services in new ways. An analysis of the relevant literature and a survey of industry experts led to the conclusion that IoT has the potential to significantly boost innovation in the service retail sector. It offers several features that simplify, liven up, connect with, and individualize the shopper's time spent shopping. In addition, the IoT outperforms other methods of consumer market analysis and forecasting since it enables businesses to collect data not only on preexisting but also on hitherto unrelated operations. Using this updated information, stores may now micro-segment their clientele based on each customer's specific wants and requirements. In addition, it enables real-time analytics, which adds a new dimension of adaptability and increases the likelihood of successfully meeting the demands of a dynamic consumer market. Consumers' worries about their personal information being compromised are the largest barrier to the IoT's widespread adoption.

Javier Lorente-Martínez et.al (2022) The retail industry is undergoing a tremendous shift, and traditional brick-and-mortar retailers are feeling the effects. Although the adoption of customer-facing in-store technology (CFIST) is an integral part of the retail industry's inevitable change, the benefits of doing so may be unclear to company owners. Using a survey design and a framework influenced by the Theory of the Firm and the Theory of the Advantaged Firm, this research examines the factors that influence such choices among SMEs. The findings underscore the importance of top management in technology choices by showing that attitude toward technology is the biggest predictor of the intention to implement CFIST. This finding has substantial practical ramifications. This study paves the way for further research into the effects and prevalence of CFIST in small and medium-sized enterprises.

Dr. Prodhuturi Venkata Vijay Kumar et.al (2016) The retail industry is under pressure to innovate in order to keep existing customers and attract new ones in light of the fact that consumers are more interested in engaging and interactive retail settings. Tools for enabling the creation of novel systems with the potential to improve this procedure may be found, in particular, via the use of virtual approaches. The focus of this article is on incorporating customer feedback into the retail industry's innovation and technology development processes. Our research shows that these technologies have the potential to be a powerful catalyst for change in the retail sector.

María Fuentes-Blasco et.al (2017) The purpose of this study is to address the paucity of research and lack of agreement around innovation in the service sector, despite the significance of this topic to the success of businesses. Recent years have seen a surge of scholarly and commercial interest in the subject of retailing. The purpose of this paper is to examine the impact of innovation in retail experiences on customer satisfaction and word-of-mouth advertising

from two perspectives: marketing innovation and technology innovation. Strategy/approach/design - The purpose of this study is to examine the three key constructs of store image, consumer value, and store brand equity to determine the direct and indirect impact of marketing and technical innovation on customer happiness and word-of-mouth (WOM). A sample of 820 shoppers from food, clothes, furniture, and electronics stores is analyzed using SEM methods. Outcomes - The findings indicate that technology innovation has a greater impact on image, value, and satisfaction than marketing innovation. Conversely, consumer happiness is a crucial antecedent of WOM behavior, and shop image is the characteristic that most impacts customer satisfaction. Implications for retail managers in practice and directions for further study are discussed. What makes this work valuable is that it delves further into the study of retail innovation in marketing and technology, and how such innovations have direct and indirect impacts on customer happiness and word-of-mouth promotion through store image, consumer value, and brand equity. This is a very young field of research that is now in a disorganized and empirically-weak state.

Asia R. Locket (2018) Retail entrepreneurs that want to reach out to their local communities and their customers may do so via internet marketing. The researchers behind this qualitative multiple case study set out to learn more about how the heads of small retail businesses are putting internet marketing to use to boost sales. Information was gathered from 4 California small company owners in the retail sector who had used internet marketing effectively. This research used Rogers's idea of the spread of innovations as its theoretical foundation. Semi-structured interviews were conducted in person, as well as an examination of publicly available business records, corporate websites, social networking sites, and analytic tools. Social media platforms and techniques, online marketing strategies and problems, online content strategies, and follow-up methods were the four overarching themes that emerged from the data analysis. Business leaders of small retail businesses may choose to align with the tactics suggested in this research in order to grow revenue, stay competitive, overcome problems related with online marketing, and boost communication via the use of new technologies. The potential for small retail company owners to boost income and, in turn, create additional jobs that benefit workers and their families has far-reaching beneficial societal ramifications.

III. METHODOLOGY

3.1 RESEARCH APPROACH

The two primary methods of research, the quantitative and qualitative approaches, are highlighted by the explanation of the many kinds of study. Quantitative data are generated in the former, and then analyzed formally and rigidly using quantitative methods. The inferential, experimental, and simulated research methods are all subsets of this strategy. Building a database from which to infer population features or associations is the goal of the inferential research methodology. To identify the characteristics of a population, researchers often conduct surveys in which a subset of the population is analyzed (via questionnaires or direct observation), and it is assumed that the whole population shares these traits.

3.2 TYPES OF RESEARCH DESIGN

Preparing the research project design, often known as the "research design," is a daunting challenge that follows the job of identifying the study topic. Research design entails making choices on the who, what, where, when, how much, and how to investigate or study. "A research design is the arrangement of conditions for data collection and analysis in a manner that aims to combine relevance to the research purpose with economy in procedure." The study design is the framework for thinking about and carrying out the research itself, and it lays out the specifics of how data will be collected, measured, and analyzed. The design documents the steps the researcher will take to complete the project, beginning with the formulation of the hypothesis and continuing with the elaboration of its operational implications all the way through to the analysis of the resulting data. A well-thought-out plan for doing research is essential because it helps ensure that all of the study's moving parts go smoothly, allowing researchers to glean as much useful data as possible with as little time, money, and effort as feasible.

IV. RESULTS

4.1 RELIABILITY TEST

The researcher has done a reliability test on the 18 statements that were filled out by the 960 respondents from the main cities in Gujarat included in the study to determine the validity and reliability of the data. The Cronbach alpha, a measure of dependability, was calculated by the researcher in order to determine whether the research instrument includes sufficient statements that the 960 respondents may use to produce the intended result of the study.

Table No. 4.1: Case Processing Summary

		N	%
Cases	Valid	480	100.0
	Excluded	0	0
	Total	480	100.0

Cronbach's Alpha	N of Items
0.896	**18**

4.2: CONFIDENCE INTERVAL TEST

This study instrument made use of Likert statements, which rated respondents on how much they agreed or disagreed with each item. The survey was conducted using a 5-point Likert scale to assess the opinions of the target audience. Each sample is tested using a confidence interval for each of the 18 claims. Standard error and confidence interval are calculated as follows:

Step 1: P = the % of respondents who show the agreement level.

Step 2: Q = the % of respondents who show the disagreement level.

Step 3: N = Total Number of Samples surveyed

Step 4: Standard Error = $\sqrt{PQ / N}$

Step 5: At 95% Confidence Limit = P $\pm$ 1.96 S.E.

Step 6: The result thus obtained will make the researcher knows that at 95%

What is the confidence level of the respondents? How confident are they in the assertions they have made.

Table No. 4.3: Confidence Interval Test Statistics

Statements	Y	N	Total	P	Q	SE	Min Limit (Confidence)	Max Limit (Confidence)
S1	596	188	784	0.76	0.24	0.0138	73%	79%
S2	636	192	828	0.77	0.23	0.0136	74%	79%
S3	580	216	796	0.77	0.23	0.0144	70%	76%
S4	520	244	764	0.68	0.32	0.0150	65%	71%
S5	596	188	784	0.76	0.24	0.0138	73%	79%
S6	636	192	828	0.77	0.23	0.0136	74%	79%
S7	596	188	784	0.76	0.24	0.0138	73%	79%
S8	596	192	788	0.76	0.24	0.0139	73%	78%
S9	596	188	784	0.76	0.24	0.0138	73%	79%

S10	640	184	824	0.78	0.22	0.0134	75%	80%
S11	596	188	784	0.76	0.24	0.0138	73%	79%
S12	628	192	820	0.77	0.23	0.0137	74%	79%
S13	616	180	796	0.77	0.23	0.0135	75%	80%
S14	620	208	828	0.75	0.25	0.0140	72%	78%
S15	596	188	784	0.76	0.24	0.0138	73%	79%
S16	640	184	824	0.78	0.22	0.0134	75%	80%
S17	596	188	784	0.76	0.24	0.0138	73%	79%
S18	628	192	820	0.77	0.23	0.0137	74%	79%

4.3: DEMOGRAPHIC DETAILING

The questions asked to the clients questioned were tailored to their demographics in terms of age, education, profession, and household income. Below is a table displaying the results of the analysis and the conclusions drawn from them:

480 consumers were questioned throughout the main cities of Gujarat state to get insight into their opinions on the technologies used by retail establishments, as shown in table no. 4.4 below. Three hundred and thirty-six were men and one hundred and forty-four were women among the clients.

4.3.1: Gender wise Distribution of Customers

Table No. 4.4: Gender wise Distribution of Customers

Sr. No.	Gender	No. Customers	Percentage
1	Male	336	70.00
2	Female	144	30.00
TOTAL		480	100.00

Source: Primary Data

4.3.2: Age wise Distribution of Customers

In order to determine whether consumers' current ages had any bearing on their familiarity with the technologies used by the shops in the research, they were polled in a number of cities throughout Gujarat. You may see this evidence in table 4.5.

Table No. 4.5: Age-wise Distribution of Customers

Sr. No.	Age Group	No. of Customers	Percentage
1	Under 18 years	22	4.58
2	18-24 years	80	16.67
3	25-34 years	144	30.00
4	35-44 years	78	16.25
5	45-54 years	68	14.17
6	55-64 years	42	8.75
7	65-74 years	30	6.25
8	More than 75 years	16	3.33
	TOTAL	480	100.00

4.3.3: Educational Qualification wise Distribution of Customers

Customers in the cities of Gujarat that were surveyed for the research were questioned about their level of education to see whether there was any correlation between that and their familiarity with the technologies used by the establishments they frequented. Table 4.5 displays consumer dispersion by level of education.

Table No 4.5: Educational Qualification wise Distribution of Customers

Sr. No.	Education	No. Customers	Percentage
1	Primary School	24	5.00
2	High School	84	17.50
3	Diploma	74	15.42
4	Graduates	152	31.66
5	Post Graduates	146	30.42
	TOTAL	480	100.00

4.3.4: Occupation wise Distribution of Customers

Researchers in Gujarat questioned consumers what they did for a living to see whether or not it impacted their level of interest in learning about the technology employed in the businesses. Consumers are broken down by profession in table 4.6.

Table No. 4.6: Occupation wise Distribution of Customers

Sr. No.	Occupation	No. of Customers	Percentage
1	Student	82	17.0
2	Service Class	230	47.9
3	Business Class	40	8.3
4	Retired	34	7.1
5	Home Maker	95	19.7
	TOTAL	480	100.00

4.3.5: Annual Income wise Distribution of Customers

In order to determine whether there is a correlation between the customers' yearly income and their familiarity with the technology utilized in the shops in the research, surveys were administered to consumers in the various cities of Gujarat state. You can see how clients are split up by their income in table 4.7.

Table No. 4.7: Annual Income wise Distribution of Customers

Sr. No.	Income Level (Rs.)	No. of Customers	Percentage
1	Less than Rs. 30,000	10	2.0
2	30,000 to 59,999	6	1.3
3	60,000 to 99,999	6	1.3
4	1,00,000 to 1,99,999	21	4.6
5	2,00,000 to 2,99,999	194	40.4
6	More than Rs. 3,00,000	242	50.4
	TOTAL	480	100.00

V. CONCLUSION

These days, it's harder than ever to succeed in retail. Sales and income generation, not to mention keeping customers happy, become daunting challenges for merchants as cutthroat competition in the retail business heats up. Therefore, it is crucial for retailers to be aware of the value of ICT and to integrate as many relevant systems as possible into their stores.

Study findings imply the efficiency of retail store technology from the viewpoints of consumers, staff, and managers, thanks to consideration of motivating, efficient, behavioral, and training and development elements.

The study's author concluded that, when pitted against the tried-and-true method used before the advent of ICT, the latter was more successful in fostering consumer loyalty and attachment. None of this would have been feasible in the past without the widespread adoption of ICT, which made it possible to store and access vast amounts of data at any time and analyze that data in order to take appropriate action.

One of the most significant benefits of technological advancements is the rise in customer satisfaction that has resulted from the ubiquitous availability of information, both for the buyer and the merchant. In addition to raising consumer consciousness, this factor facilitates the saving of the time, money, and effort that the customer constantly seeks to get in order to achieve satisfaction. Thus, advancements in IT have been beneficial to retail sales, and this trend is expected to continue. Because of this, the retail sector desperately needs to adapt and effectively apply modern technology.

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Deep Learning Neural Networks in the Cloud

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Abstract— *Deep Neural Networks (DNNs) are currently used in a wide range of critical real-world applications as machine learning technology. Due to the high number of parameters that make up DNNs, learning and prediction tasks require millions of floating-point operations (FLOPs). Implementing DNNs into a cloud computing system with centralized servers and data storage sub-systems equipped with high-speed and high-performance computing capabilities is a more effective strategy. This research presents an updated analysis of the most recent DNNs used in cloud computing. It highlights the necessity of cloud computing while presenting and debating numerous DNN complexity issues related to various architectures. Additionally, it goes into their intricacies and offers a thorough analysis of several cloud computing platforms for DNN deployment. Additionally, it examines the DNN applications that are already running on cloud computing platforms to highlight the advantages of using cloud computing for DNNs. The study highlights the difficulties associated with implementing DNNs in cloud computing systems and provides suggestions for improving both current and future deployments.*

Keywords— ***Deep Learning, Neural Networks, Cloud Computing.***

I. INTRODUCTION

Numerous pattern recognition applications in real-world fields like e-commerce, manufacturing, medicine and health, and autonomous vehicles are now being developed using deep neural networks (DNNs). However, due to their extensive parameter requirements, DNNs pose significant computing demands, especially during training. DNNs typically have millions of parameters. As an illustration, popular DNNs like AlexNet have 60 million parameters, while VGG-16 has 138 million. A DNN with 175 billion parameters that required a lengthy seven months to train was used in a recent OpenAI project for natural language processing (NLP) [1]. As a result, it is impossible to train a large DNN using a single isolated computer. High-performance computing tools are necessary for the efficient training of DNNs.

DNN deployment on cloud platforms has increased in popularity recently. These cloud computing platforms are extremely fast and memory-capable high-performance computing systems. On a variety of cloud machine learning (ML) platforms, such as Google Colab and Amazon Web Services (AWS) Deep Learning, training can be effectively carried out in reasonable amounts of time. Centralized servers powered by cloud computing provide a lot of computing power, a lot of data storage, fast processing, low latency, and high availability. DNNs for online applications can be deployed thanks in large part to cloud computing.

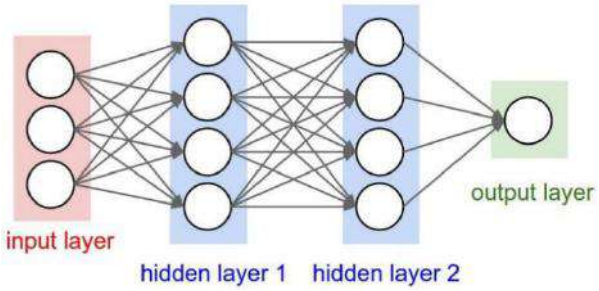

Fig.1: Deep Neural Network with hidden layers

The implementation of cloud platforms for computationally intensive tasks is discussed in various recent survey publications cited in the current manuscript. These survey papers are divided into three main categories: applications, performance improvement technologies, and security technologies. Yan et al.'s [2] study of security technologies covered a range of solutions for preventing harmful assaults, including talks of countermeasures. Recent

security methods, including encryption, access structure, and fine-grained trace mechanisms, were introduced by Nita and Mihailescu [3] and Sun et al. [4]. Gai et al.'s [5] analysis of the functionality of blockchain-enabled integrated hardware and software in cloud data centers was centered on the integration of blockchain with clouds.

Regarding performance improvement, Pupykina et al. [7] investigated memory management methods in cloud computing, and Xu et al. [6] assessed technologies for managing virtual machine performance. Offloading technologies for job optimization across cloud and edge systems were covered by Wang et al. [8]. In order to address problems and look toward the future, Xu et al. [6] provide an overview of computational distribution strategies for managing virtual machines in the cloud. Deep reinforcement learning-based cloud resource scheduling solutions were discussed by Zhou et al. [9] and Feng et al. [10].

Regarding applications, Bera et al. [12] reviewed cloud computing applications in smart grids, while Khan et al. [11] provided an overview of mobile cloud topologies and the advantages of cloud computing. An overview of cloud computing architectures for cyber-physical systems was presented by Cao et al. [13], evaluating numerous applications. Notably, the development of DNNs in cloud computing systems is not a specific emphasis of these survey studies.

This research intends to close this gap by offering a thorough analysis of cloud computing methods for DNN deployment, along with considerations of difficulties and potential future research areas. The article's remaining sections are structured to present different DNN mechanisms, the need for cloud computing, popular cloud platforms for deploying DNNs, specific DNN applications implemented in cloud systems, difficulties in current DNN deployments using cloud computing systems, and opportunities for improving current DNN deployments on cloud systems. Finally, a summary of the findings in brings the article to a close.

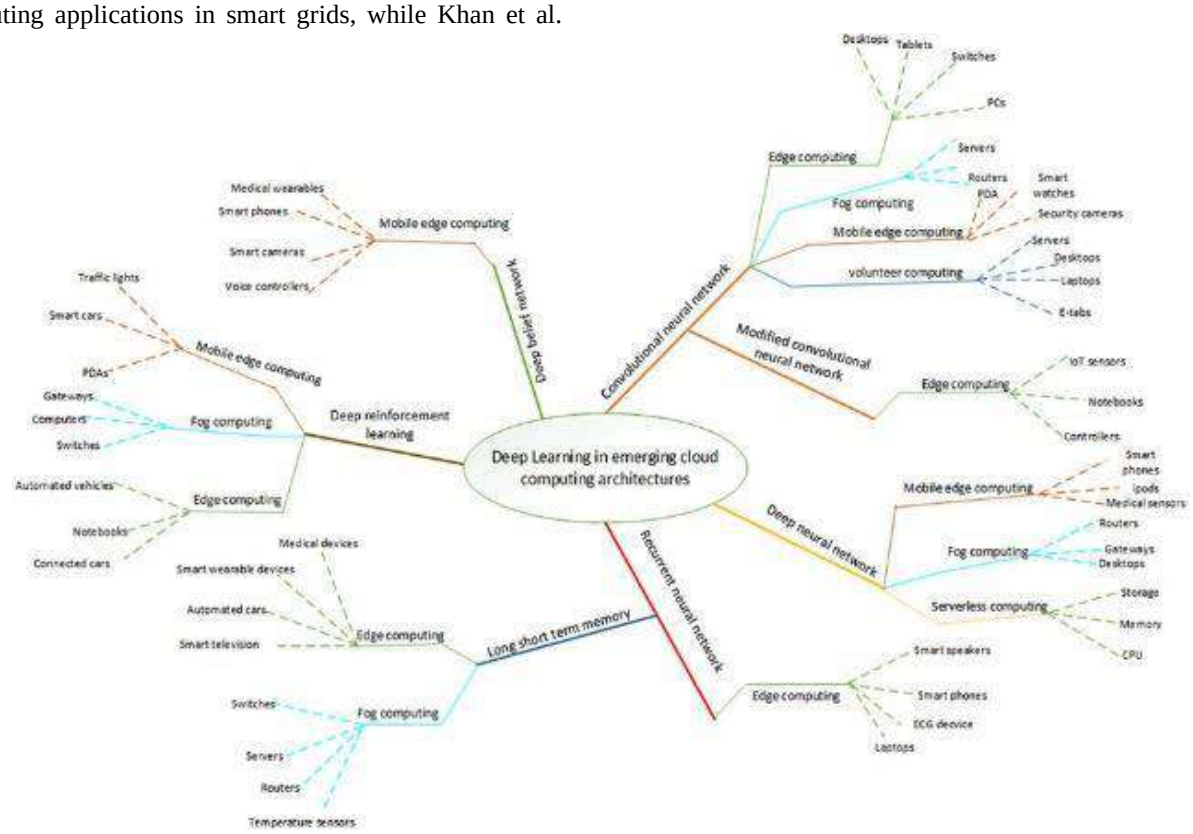

Fig.2: Deep learning architectures in emerging cloud computing architectures

(Source: Fatsuma Jauro, 2020. Deep learning architectures in emerging cloud computing architectures. Volume 96, 106582, ISSN 1568-4946, https://doi.org/10.1016/j.asoc.2020.106582)

Computational Complexities in Deep Learning

A single deep neural network (DNN) consists of a significant number of parameters, demanding a large amount of storage memory. A DNN's training and execution phases both need a considerable time commitment. This section explores several popular DNN architectures, such as multilayer perceptron's (MLPs), convolutional neural networks (CNNs), and graph neural networks (GNNs), all

of which have intricate architectural designs and a wide range of DNN parameters. Because DNN training requires extensive computation, it is impractical to use a single isolated computer for this purpose, which highlights the vital role that cloud computing plays in aiding DNN training.

An extensively discussed neural network is the multilayer perceptron [24–26]. Each of MLP's levels, which include an input layer, hidden layers, and an output layer, has a collection of perceptron components, also known as neurons. An MLP with two hidden layers, an input layer, and an output layer is shown in Figure 3.

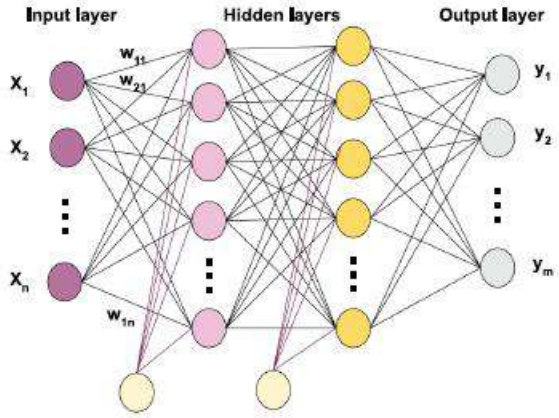

Fig.3: Multi-Layer Perceptron's Typical Topology

Longer computational times are required to optimize an MLP when number of layers are higher. Multiple apps have been created as a result of using MLP in the cloud. For instance, the study described in [28] concentrated on developing a forecasting model that made use of multiple input variables generated from several daily basic food price kinds. Using the Amazon Cloud Services infrastructure, this model sought to forecast the Surabaya consumer price index. The multilayer perceptron technique was used in the study to build a prediction system with a hidden layer, an epoch, and a set number of neurons. Similar to this, a different study [29] divided regions afflicted by cancer and stored relevant information in the cloud using transfer learning-based cancer segmentation (TL-CAN-Seg) technology. A unique MLP and an altered Levenberg-Marquardt (LM) algorithm were used to interpret complex picture patterns and accomplish precise classification of areas affected by breast cancer, improving the accuracy of breast cancer diagnosis.

Recurrent neural networks (RNNs) are more effective than MLPs at handling temporal data, including text and sequentially correlated time series. The result from the previous phase in the sequence serves as the input for the next step in RNNs' unique versions of neural processing units [30]. RNNs' hidden state, which is used for iterative processing, catches and holds onto data all the way through the sequence. RNNs have the ability to learn by storing, retrieving, and using historical data to make predictions. Model interactions at different temporal scales endow memory. Information from all earlier steps is captured by the aforementioned concealed state. In order to produce the output at a particular step in the sequence, the trained RNN can combine the input sequence and the hidden state. Despite being created more than a decade ago, RNNs still have issues with memory storage and computational time limits [31].

Figure 4 depicts a typical CNN with input/output layers, hidden layers, and a fully connected network [41,42]. Convolution, activation, and pooling layers are all included in a hidden layer. The activation function assists in learning nonlinear input patterns from the convolution output, the pooling layer consolidates the outputs of the activation function into a single value, and the convolution layer retrieves input features within this layer. To make categorization easier, relevant features are retrieved after numerous convolution and pooling procedures.

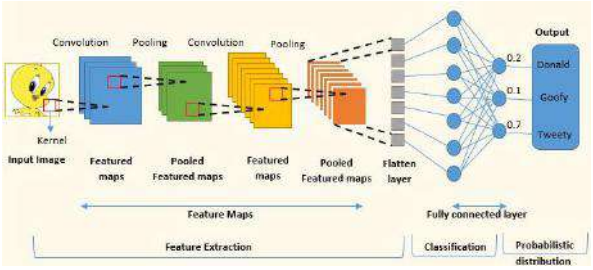

Fig.4: Typical Convolutional Neural Network (CNN)

(Source:https://www.analyticsvidhya.com/blog/2022/01/convolutional-neural-network-an-overview/)

A CNN typically consists of millions of network parameters, each of which must be determined over the course of a long period of time. In particular, ShuffleNet, GoogLeNet, DenseNet, ResNet, AlexNet, VGGNet, and ConvNet are a few CNN models that include millions of network parameters and need a lot of training time. For instance, it takes more than two weeks to train ConvNet on a machine with four NVIDIA Titan Black GPUs. Additionally, OpenAI's CNN, also known as neural architecture search (NAS), requires six months to train when using 8 P100s in parallel scaling and has a remarkable 175 billion parameters for natural language processing.

While purchasing many computers for a single CNN proves economically inefficient, training a big CNN on a sole computer is prohibitively time-consuming and unfeasible. Therefore, the use of CNNs in cloud infrastructure has been proven in a number of applications [49-56].

GNN is a result of graph representation learning [57–59], which entails transforming and comprehending nodes and edges in a graph into a continuous space with fewer dimensions. GNN treats non-Euclidean domains using elaborate data structures that reflect the relationships between these entities [60]. This is true even if it works with Euclidean 1-D sequences like texts and 2-D grids like images [61]. In GNNs, the underlying data structure is represented by a graph with the formula G = (V, E), where V denotes the set of vertices or nodes and E denotes the edges joining them. It is possible for the relationship (u, v) E to be symmetric or asymmetric. Graphs can be homogenous, like social networks like Facebook friends, or diverse, like knowledge graphs. The incorporated elements or graphic topologies may also alter dynamically over time.

GNNs' exponential node expansion increases computational complexity and memory use significantly [62]. Notably, some sizable GNNs, like GemNet-XL, include billions of parameters [69]. Existing GNN models are judged insufficient for large-scale graphs that incorporate intricate topologies because they have only been evaluated on small graphs [70]. Examples of GNN implementation in cloud infrastructure have shown that graph analysis is scalable and effective in a variety of applications, such as recommender systems, traffic flow prediction, industrial IoT, privacy preservation, and matrix completion [71–76].

It is essential to comprehend the causes of latency in the training and inference phases of various DNN architectures if you want to deploy them in the cloud with the least amount of delay possible. Using methods like dilated convolutions in CNNs, for instance, one can increase the network's receptive field without adding more parameters or layers, which lowers computational cost and inference delay [77,78]. The use of backpropagation gradients through time, which can be computationally expensive, is not necessary with randomization-based learning techniques like echo state networks (ESN) [79]. Additionally, GNN and CNN pruning strategies can reduce the amount of parameters and computations needed, resulting in quicker inference times [80,81].

Cloud computing architectures for deep learning based applications

Because deep neural network (DNN) architectures are complex and demand a large number of parameters, training and execution periods are prolonged. As a result, it is impossible to train or deploy DNN using a single standalone computer. Cloud computing offers a practical answer to this problem for these kinds of resource-intensive computations. Cloud computing meets the demanding computational needs of several DNN implementations and training tasks by offering substantial computing power and abundant data storage, eventually helping customers using DNNs in intense applications [82].

The structure and composition of cloud data centers are outlined in the next section. The next part discusses frequently used commercial cloud computing platforms for the deployment of DNN and provides an overview of public or volunteer cloud computing platforms. The section also discusses frequently used cloud streaming systems, offering light on how data streaming is implemented there. Researchers studying deep learning (DL) who are looking for reliable, affordable, and quick computing platforms for DNN development will find this comprehensive material to be of particular value.

- Cloud data centers

Data storage and computing are handled by cloud data centers or remote clouds, including backhaul and core networks [83]. A typical cloud computing architecture, shown in Figure 5, is made up of cloud users, internet network providers, and cloud service providers. Users provide computational data over network service providers, which servers then receive. This data is processed using cloud resources, ensuring that users have enough access to a shared pool of resources in response to their requests. This use of cloud resources makes it possible to offer adaptable processing power and storage, which eventually helps well-known cloud-based companies like Amazon and Google Cloud stay profitable [84, 85].

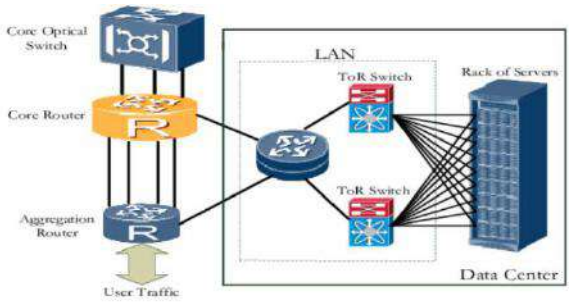

Fig.5: Typical Cloud Data Center Architecture

(Source: Elmirghani. 2018. GreenTouch GreenMeter Core Network Energy-Efficiency Improvement Measures and Optimization. Journal of Optical Communications and Networking. 10. 10.1364/JOCN.10.00A250)

Users' requests for calculations are spread across a variety of cloud platforms with numerous data centers [86]. Resource-intensive computations are made possible by resource sharing within and between data centers. To increase processing power, a distributed cloud can also be connected to hybrid clouds, public clouds, and edge

computing installations. User requests can be distributed among close-by data centers in an effort to reduce data transmission delay. The architecture of a distributed cloud consists of numerous sub-clouds. Based on the availability of resources, a central controller within the distributed cloud distributes computing workloads among various sub-clouds.

- DL in the cloud

The availability of customizable computing resources, a critical component for a variety of DL workloads characterized by different degrees of compute needs across distinct activities and datasets, is one of the main advantages of cloud computing. Numerous cloud providers offer services to meet these needs, such as the auto-scaling features of Amazon EC2 and the scale-up and scale-out capabilities of Microsoft Azure. These services make it possible to run DL workloads efficiently even while working with limited cloud resources.

Parameter server

To enable the scalability of distributed machine learning applications within cloud data centers, parameter servers (PSs) have been developed [87]. To train deep neural networks, PSs have been incorporated into a number of deep learning frameworks, including TensorFlow and MXNet. Even with developments, total reliability cannot be assured because cloud data centers may have server outages. To ensure the orderly completion of learning tasks in such contexts, preventative procedures are required to handle job-sharing and backups [88]. The collective, which consists of a server group and a worker group, is the center of the PS framework. Both have job schedulers and worker nodes, which work together in DNN training, while the latter also includes a manager and server nodes. Consistent hashing is used to express shared parameters as vectors of (key, value). Operational data created by nodes is communicated to the server, which then distributes global information to each node. This framework provides flexibility in guaranteeing consistent data when the algorithm is not sensitive to data inconsistencies, increasing the reliability of the PS framework. It allows asynchronous tasks and dependencies by initiating the necessary methods.

Due to its widespread connectivity with a sizable and dynamic resource pool, the PS architecture is more suitable with heterogeneous production data centers and public clouds than alternative techniques like AllReduce5. But the original PS architecture has some drawbacks, such as imbalances, elasticity constraints, and static parameter assignments. It is not possible to incorporate more available resources into ongoing training activities, and workload distribution across nodes frequently does not maximize resource capacity. Several strategies have been put out to deal with these limitations and improve cloud computing's capabilities. For instance, Proteus, an elastic PS framework created to scale up training on public clouds, was introduced by Harlap et al. [89]. The framework dynamically assigns PSs and personnel using three transitional stages, maximizing cost reductions, particularly when temporary revocable resources become available. Litz [90] created logical executors, which map physical nodes to control the executor states of specific applications, in an additional effort to increase elasticity. This method also includes micro-tasks for determining dependencies and assigning micro-tasks accordingly.

Advanced learning frameworks

Deep neural network (DNN) training in cloud environments will be more dependable and effective thanks to proposed improvements in learning frameworks. For workload scheduling and dynamic resource scaling, the DL-driven framework DL2 [91] combines supervised learning and reinforcement learning techniques. The DNN is initially taught offline to assimilate resource allocation patterns from prior judgments, and reinforcement learning is then used to improve the training of the DNN. An exploitation-exploration method was used by Chen et al. [92] to propose the dynamic PS load distribution scheme known as PSLD. The plan consists of three stages: gathering data on each PS, having workers create performance profiles, and choosing PSs based on performance indicators and communication time.

At the same time, Wang et al. [93] suggested the elastic parameter server (EPS), a simple solution that enables dynamic resource allocation and deallocation for increased resource use and training efficiency. To improve scalability and optimize resource utilization, this strategy incorporates heuristic scheduling modes like incoming job scheduling and running job scheduling. Additionally, more specialized frameworks have been created, with a particular emphasis on DL workloads on private clouds. In order to reduce waiting times, Hu et al. [94 - 95] implemented an optimization technique based on the idea of training progress and integer programming to handle resource scaling challenges particular to AWS and Huawei clouds.

- Data streaming for the cloud

The continuous streaming of real-time data is essential for supporting deep learning (DL) applications in various sensor networks and control systems, such as those found in autonomous vehicles or smart grids. For activities like recognition or decision-making, it is essential to acquire measurements or data as soon as possible. Lack of access to the most recent data versions may jeopardize system functionality and lower safety standards. Given the huge amounts of data volumes contained in each sample, it is

impractical to retrain deep neural networks (DNNs) using a standalone computer, highlighting the necessity of data streaming in a cloud setting.

Cloud data streaming platforms

Platforms for streaming cloud data have found use in government and academic settings for the analysis of data gathered by sensor networks. To make geographic data processing easier, the Southern California Earthquake Center, for instance, has set up a geophysical sensor network [96]. This network's tens of thousands of sensors continuously and quickly sample data. In order to better understand climate change and create systems for predicting earthquakes and inland flooding, geospatial data must be collected. Furthermore, to study seismic and hydrological features in North America, the Geodesy Advancing Geosciences and EarthScope (GAGE) GPS network uses information from more than a thousand GPS sensors [97]. Similar to this, the US National Science Foundation has provided funding for the creation of a worldwide sensor network that will largely be used to study climate change and the cycling of carbon [98].

Data-streaming approaches

Given that many deep neural networks (DNNs) operate in dynamic contexts, it is essential that they constantly absorb new information or undergo retraining. A data-streaming technique has been developed to handle this issue and determine whether streaming data is required for changing DNN parameters [101]. This method incorporates a strategic trade-off between training expenses and performance to decide if DNNs need to be updated. Its use with TensorFlowOnSpark for three online learning workloads has shown a decrease in total processing time. Similar to this, Ashfahani et al. [102] have suggested a data-streaming approach to modify network topologies in response to fresh input. This method makes it easier for network nodes to grow and shrink dynamically, improving performance while reducing complexity. In comparison to previous approaches, comparative evaluations on standard datasets have shown improved network performance and decreased network complexity [102].

A similar advancement is the introduction of an incremental high-order DL model by Li et al. [103] that is designed to adapt to high-frequency data streams. The strategy efficiently minimizes adaptation time by translating data into a high-order tensor space, and then uses first-order approximations to reduce the time-consuming parameter incrementation frequently associated with iterative procedures. DNNs may now adapt to dynamic situations better than traditional iterative approaches, effectively satisfying real-time needs. A unique fuzzy neural network has been introduced by Pratama et al. [104] that automatically incorporates fuzzy rules from data streams, using a simplification procedure to merge unnecessary hidden layers and control network growth.

Results from experiments show that this approach successfully limits network size while maintaining performance standards. In addition, Nguyen et al. [105] have developed a sensor network for gathering maritime data, using a deep recurrent neural network combined with streaming data to monitor fishing activities, spot smuggling, forecast maritime pollution, and improve maritime traffic safety and security in real time. This comprehensive method effectively handles noisy and infrequently sampled data in maritime environments by combining latent variable modeling and data streaming to capture key elements within maritime dynamics.

In order to provide real-time predictions, DNN designs in cloud environments must incorporate minimal inference latencies. Smaller DNN designs or the use of accelerators, together with the storage of data features in low-latency storage locations for offline precomputing predictions, can improve serving latency. Additionally, essential for adjusting to newly streamed data and improving DNN performance over time is the implementation of incremental training [106]. Using model artifacts from well-known, publicly accessible DNNs, this entails routine updates of DNNs based on fresh streams of data, enabling updates without the requirement for retraining from scratch.

II. APPLICATIONS OF DNNS IN THE CLOUD

Deep neural network (DNN) deployment in the cloud has become widely used in a wide range of applications. The sections that follow provide an overview of a few of these applications, including wireless capsule endoscopy, travel, natural language processing (NLP), business intelligence (BI), cybersecurity, anomaly detection, and mobile-cloud-assisted implementations. Tables that give a brief synopsis of the application's content follow these subsections. These descriptions accurately identify the complex research issues posed by the combination of cloud systems and DNNs.

- Natural language processing

The application of artificial intelligence (AI) to the interplay of computers and human language is known as natural language processing (NLP). It entails the creation of computational models and algorithms that provide computers the ability to effectively comprehend, decode, and produce human language. NLP includes a wide range of activities, including sentiment analysis, speech recognition, language translation, natural language comprehension, and more. Its uses span from text analysis

tools and chatbots to virtual assistants and language translation programs [107 - 115].

- Business intelligence

The technology, systems, and procedures utilized for the gathering, integrating, analyzing, and presenting of business information are referred to as business intelligence (BI). Utilizing a range of software tools, it entails gathering information from internal and external sources and turning it into insights that can be used to inform strategic and tactical business choices. Data mining, data analysis, querying, and reporting are just a few of the tasks included in business intelligence (BI), which frequently uses metrics and key performance indicators (KPIs) to assess an organization's or business's success. By offering historical, current, and predictive insights of corporate operations, BI's primary goal is to enable better business decision-making [117 – 120].

- Cybersecurity

The practice of defending computer systems, networks, programs, and data from online attacks, harm, or illegal access is known as cybersecurity. In order to protect information technology (IT) systems and networks from theft, damage, or disruption while maintaining the integrity, confidentiality, and availability of data, security policies and safeguards must be put in place. Malware, ransomware, phishing scams, hacking, and other types of cybercrime are just a few of the risks that cybersecurity seeks to protect against. It includes a wide range of tactics, tools, and best practices for preventing, spotting, and dealing with digital threats and security breaches [121 - 135].

- Anomaly detection

Finding patterns or occurrences within a dataset that drastically depart from expected behavior is known as anomaly detection. Finding anomalies, outliers, or abnormalities that deviate from the predicted patterns or trends in the data entails using statistical analysis, machine learning methods, and data mining approaches. The identification of anomalous or suspicious activity is critical for assuring the integrity, security, and effectiveness of operations in a number of different sectors, including cybersecurity, fraud detection, system health monitoring, and industrial quality control [140 – 154].

- Travel

AI efficiently organizes and processes large datasets produced by both clients and service providers in the tourist and hospitality industries. Notably, a sizeable portion of pertinent data used in the tourism sector comes from GPS applications and is frequently linked to social media, Internet of Things (IoT), and site traffic statistics. These huge databases are managed within the framework of the "smart" tourism industry, with the goal of providing passengers with knowledgeable and personalized services. Applying sophisticated intelligent approaches for analysis is necessary when working with datasets that are so diverse, detailed, and dispersed [157 – 176].

- Remote medical diagnosis

The use of wireless capsule endoscopy (WCE) has significantly increased over the past two years. These methods provide a level of internal human visibility for diagnostic purposes that is comparable to standard endoscopy. These technologies were initially presented in 2000, and after going through clinical studies, they were given the go-ahead by the Food and Drug Administration in 2001. Notably, these technologies provide improved portability and have numerous uses in the delivery of systemic biologics and healthcare services [177 – 190].

- Mobile-cloud-assisted applications

A developing technology with a wide range of possible applications, the idea of mobile cloud-assisted applications. The ability to transfer tasks to cloud servers, hence prolonging the system's operational lifespan, is the main goal of mobile cloud computing (MCC). The computing strain on mobile devices like smartphones, tablets, and iPads is also lessened by MCC. To ensure the effectiveness of the job offloading inference engine and to ease resource restrictions on smartphones, which often have much less processing power compared to older approaches, an extensive evaluation based on traced data is carried out [195 – 197].

Before using Deep Neural Networks (DNNs), it is urgently necessary to remove unnecessary and redundant frames during the Wireless Capsule Endoscopy (WCE) operation in order to prioritize the video content. However, there are some significant difficulties with video prioritizing in WCE, especially when there are limited resources and processing capabilities. Because of this, the integration of MCC helps to offer affordable storage, robust computational power, and software services [198 – 199].

III. CHALLENGES AND FUTURE DIRECTIONS

Cloud-based Deep Neural Networks (DNNs) have been constructed for a variety of applications requiring extensive big data analysis and high-performance computing, making use of the significant computational power and data storage capacities provided by cloud platforms. Despite the fact that DNNs are effective tools for pattern recognition, they pose a number of research obstacles, including issues with energy consumption, the length of training and execution, data security, and cloud compatibility [203 – 275].

- Energy efficiency
- Training cost
- Scalability
- Data security
- Privacy awareness
- Cloud interoperability
- Learning from non-stationary data: retraining efficiency and adaptation
- Elastic implementations of deep learning models and flexible resource allocation
- Deep reinforcement learning
- 3D vision applications
- Optimization of DNNs

IV. CONCLUSIONS

DNNs have a wide range of applications in numerous real-world fields. Deploying DNNs on solitary stand-alone PCs or mobile devices, however, is frequently problematic for huge data storage and analysis applications due to their computational complexity and the enormous number of parameters necessary in training. As a result, the use of DNNs in cloud computing systems has attracted a lot of interest. In the beginning, this review article lays out the justification for using and training DNNs in cloud-based systems. It then digs into the intricate computations of popular DNNs, such as MLP, CNN, RNN, and GNN, highlighting their high parameter and FLOPs needs.

The research also provides a thorough analysis of volunteer and public cloud computing platforms that have effectively included and applied DNNs. Researchers and software developers can use this information to choose the best cloud computing platform for their DNN-focused apps. The paper also provides information on a number of application fields, including NLP, BI, cybersecurity, anomaly detection, and travel, which have recently reaped significant advantages from the integration of DNN in cloud computing. It outlines the key difficulties involved in this approach while highlighting the benefits and efficiency of installing DNNs in cloud-based applications.

The research also suggests potential possibilities to improve current deployments using cloud computing platforms and DNNs. This thorough overview study is projected to be a useful resource for researchers and programmers interested in successfully implementing DNNs on cloud computing platforms.

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Implementation of Cyber Security in Corporate Sector of Pakistan

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Abstract— *We live in a time when knowledge is easily accessible and people are connected throughout the world. The technological improvements that modern states use to advance include streamlined online bill payments, improved healthcare systems, sophisticated transportation networks, the use of artificial intelligence, cutting-edge communication systems, and technological warfare. Despite the fact that technology has made it possible to break down geographical borders, the widespread use of technology has led to the emergence of new challenges and concerns. Hacking, bank fraud, money laundering, data breaches, unauthorized acquisition of state secrets, and targeted attacks on critical infrastructure are just a few of the criminal activities and threats that plague the digital world today. These crimes have all emerged as major facets of modern cyber warfare. Such threats can affect both wealthy and developing countries, creating a challenging situation for national security. Among these countries, Pakistan and other emerging nations are particularly at risk. The nation has a sizable population of business users who are unfamiliar with information technology, which makes it more difficult for governmental and legislative authorities to regulate the nation's digital environment. Recent catastrophic cyberattacks on Pakistani institutions' most essential websites have successfully breached significant digital installations. Legislators in Pakistan have responded by introducing cyber legislation, but it doesn't seem like they fully address the variety of online threats. This study paper is focused on creating a framework for the adoption of cyber security in Pakistan's corporate sector and investigating workable solutions to serious cybersecurity issues. In order to generate findings, a qualitative research methodology was used, gathering information from both primary and secondary sources. Finally, the study makes a number of suggestions on how Pakistan's corporate sector may implement cyber security.*

Keywords— ***Cyber Security, Corporate Sector, Implementation in Pakistan.***

I. INTRODUCTION

Fundamentally, cybersecurity is putting into place a series of policies and strategies to protect a company's critical systems and sensitive data from online attacks and breaches. The environment of cyber-attacks is becoming more complex as hackers find it simpler to get beyond traditional security measures by using cutting-edge techniques including AI and social engineering. Businesses must increase their cybersecurity precautions in line with the adoption of new technology. A strong cybersecurity strategy includes numerous levels of protection to protect your company from different types of cybercrime, such as attempts to hack into, alter, or compromise data, extort money from customers or the company, or disrupt daily operations.

Cyber strategies should consider the following elements:

- Safeguarding infrastructure
- Enhancing network security
- Strengthening application security
- Ensuring information security
- Securing cloud systems
- Providing employee security training and fostering awareness
- Establishing disaster recovery and business continuity plans

Cybercrime is now more prevalent than ever, and assaults are becoming more complicated, targeted, and frequent. Information theft is developing as the most expensive and quickly rising category of cybercrime, with criminal

elements increasingly focusing on the data repositories of corporations. The increase in organizations using cloud services to store personally identifiable information only serves to exacerbate this trend and increase its vulnerability. It is important to understand, however, that theft is not always the intent; some of the offenders choose to manipulate or destroy information in an effort to create mistrust inside businesses or governments.

Fig.1: Cyber Security Framework

(Source: https://jeremy-swenson.com/2018/05/06/key-updates-to-the-nist-cyber-security-framework/)

Ransomware and phishing assaults are common ways to compromise a company's vital systems or networks, but social engineering is still the easiest way to carry out a cyberattack. The risk posed by third parties is also increasing, as criminals target these vendors—including IT service providers—in order to acquire unlawful access to organizations to which they are connected. Collectively, these trends highlight the necessity for businesses to recognize and take cybersecurity extremely seriously.

II. LITERATURE REVIEW

Over half of the world's population may now exchange data over connected networks thanks to cyberspace, a conduit that humans have developed for international communication and infrastructure interconnection. Cyberspace risks are always changing, posing fresh problems for all civilizations with the potential to jeopardize personal security (Hussain, 2022). The debate over cyber dangers began in the late 1980s, picked up steam in the 1990s, and then spread to different countries. Due to the reliance of industrialized economies and national security on a trustworthy, globally interconnected software system, cyber dangers first appeared on political agendas in the middle of the 1990s. Cyber threats now pose a threat to cultural ideals, economic stability, and overall well-being. A new, nameless foe that transcends state lines was introduced by internet-connected computers carrying out cyberattacks. This threat paradigm extends to critical infrastructure, turning relatively minor incidents into serious security concerns due to the availability of user-friendly and sophisticated hacking tools for easy download (Cavelty, 2010).

Although the terms "internet" and "cyberspace" are sometimes used interchangeably, the internet is simply one part of the larger concept of cyberspace (Cavelty, 2015). The world has become a "virtual global village" because to the internet (Yamin, 2014). Basically, "communication through an electronic medium, such as websites and emails, involving computer command and control" is what is meant by the term "cyberspace" (Futter, 2016). Different definitions of cyberspace have developed over time, falling short of a common understanding and neglecting some crucial elements (Lorents & Ottis, 2010). A thorough description of cyberspace as a network of linked, time-dependent information systems and the people interacting with them was put out by Lorents and Ottis (2010).

Cyberspace is a brand-new area that is essential to the daily lives of states, groups, people, enterprises, and organizations—all of which are competing for dominance. Conflicts have emerged in cyberspace, taking the form of cyber conflict, which pits different entities against one another there while one launches a cyberattack on the other. Depending on the players' goals, such as the acquisition of sensitive information, nefarious financial gain, or the rapid damage of an adversary's vital infrastructure, the nature of cyber conflict can change (Lorents & Ottis, 2010).

The vulnerabilities it creates necessitate immediate attention from those in positions of authority given the growing reliance of a nation's key infrastructure on cyberspace, since unchecked vulnerabilities could undermine Pakistan's sovereignty (Khan, 2019; Shad, 2017). Cyberthreats and cybercrime incidents are both on the rise. Over the past three years, Pakistan's social media platforms have seen a considerable increase in cybercrimes such harassment, financial fraud, bogus profiles, hacking, defamation, and blackmail. The second-highest category of cybercrime in the nation is harassment complaints. Among the most frequently used platforms for cybercrimes include Facebook, email, and WhatsApp (Abbasi, 2021).

Although both developing and developed countries rely significantly on the internet for e-services to improve the lives of their population, vulnerabilities and cyber dangers still exist (Sharma, 2010). For instance, financial transactions are susceptible to cyber theft, when offenders use computer code instead of firearms to commit robbery and exploit weak passwords. Additionally, malicious hackers have the ability to access or alter confidential military data, jeopardizing national security and vital public infrastructure, and negatively affecting people who

frequently communicate online. Traditional security methods are ineffective against these non-traditional cyber security threats (Harknett & Stever, 2011).

Billion-dollar sums are transported or stolen illegally, private data is revealed, state secrets are jeopardized, and crucial public infrastructures are breached in the field of cybersecurity (Syed, Khaver & Yasin, 2019). In line with international trends, Pakistan has to deal with cyberthreats and challenges such as hacking, serious and organized cybercrime, cyberterrorism, and cyber warfare (Shad, 2017), computer malware, identity theft, economic data breaches, cyber fraud, and espionage attempts on critical infrastructures (Rafiq, 2017), as well as ransomware, spyware, social engineering, and tampering with physical devices (Syed, Khaver, & Yasin, 2019). The media's inaccurate portrayal of cyber security initiatives, the lack of pertinent institutions, the length of security debates, a traditional security culture, and the exclusion of the audience from the discourse are additional obstacles to Pakistan's successful securitization of cyberspace (Rafiq, 2017). Additionally, different e-government services face a variety of difficulties, such as technical difficulties, human factors, and problems with service delivery (Awan, Memon, Shah, & Awan, 2016). A high-level organizational structure was proposed by Tariq, Aslam, Rashid, and Waqar (2013) for setting up crucial cybersecurity bodies at various levels that would be in charge of protecting the nation's cyberspace.

These organizations include the Ministry of Information Technology's Computer Emergency Response Team, the National Response Centre on Cyber Crimes, and the National Cyber Security Division, all of which, though now working, may use more efficiency. According to Tariq, Aslam, Rashid, and Waqar (2013), academics agree that it is urgent to identify cyber threats and their possible effects as well as put in place efficient reaction systems to protect against these threats.

III. CORPORATE CYBER SECURITY

Significant cyberattacks can affect a wide range of business entities and types of businesses. For instance, a large volume of private and sensitive data is managed by financial institutions and insurance companies, needing strict security procedures. This emphasizes how crucial cybersecurity is in the business world. The idea of optimizing the use of information technology in several stages of commercialization and operational duties is the foundation of digital advancement, which goes by different names across industries. The developing and increased requirement for information and technology security is one result of this digital transition. As diverse systems communicate, new difficulties arise. Big Data, the Internet of Things, and API technologies have advanced technology, making it simple to develop ground-breaking solutions without running into technological challenges. Since everything is connected, it is possible to store and process all data to produce extra value.

Fig.2: Role of Corporate Cyber Security

The ability of a business to effectively use technology to automate repetitive operations, simplify reporting, and harness data for better strategic decision-making is key to maintaining its competitive edge in the modern day. However, as a company relies more on information technology, it is more vulnerable to security breaches carried out by criminals experienced at locating flaws in the organization's IT infrastructure. Malware, phishing, endpoint security breaches, and ransomware are typical cybersecurity risks. The biggest threat facing corporate entities right now is probably the rise in cybersecurity events. A corporation may go bankrupt if a catastrophic disaster occurred in addition to the financial losses brought on by a breach due to operational disruption and reputational harm.

It is essential for companies and their IT divisions to develop information security policies. In the past, installing firewalls and antivirus software was sufficient. This is no longer the case, though. In order to prevent future attacks, modern businesses must proactively identify and reduce risks at an early stage.

Regulations and norms governing businesses are becoming more detailed. The likelihood of assaults, data breaches, interruptions, and breaches should decrease as a result of these steps. The guidelines underscore the essential security protocols that must be created and implemented to reduce the IT and security risks that financial institutions must deal with, among other directives. It is essential to understand that these regulations have legal effect, requiring the covered businesses to justify any variation from their application.

In reality, businesses must invest in comprehensive cybersecurity policies that protect staff communications, customer contacts, and relationships with outside vendors and suppliers. Every online activity and social media engagement adds a new cyber danger because of how intertwined modern commercial supply chains are. Businesses need to put in place improved procedures that

will allow them to spot and stop sophisticated hostile activity before any potential harm is done, maintaining operational continuity and preventing data breaches. The availability of hacking tools and software has made it possible for hackers of all skill levels to successfully compromise business computer systems. In the current global environment, there are more internet-connected gadgets than ever before; predictions indicate that 27.1 billion devices will be globally connected this year. If these devices don't have proper security measures, cybercriminals trying to get into a company's networks and steal sensitive data may be able to take advantage of them.

Corporate Security Best Practices

In order to identify, mitigate, and avoid future cybersecurity threats, your company's risk management policies can be improved by adhering to best practices. Understanding the exact dangers your firm confronts is crucial before addressing cybersecurity issues. Start this process out with a thorough evaluation of potential dangers. Start by defining the information that has to be protected within your organization. This can be done more easily by reviewing pertinent compliance standards that are specifically customized to your industry. To avoid unwanted access, make sure that sensitive data is stored in a highly secure setting. Security professionals should also frequently backup this data, and backups should be kept in a different, equally safe location.

Fig.3: Best Practices Classification

(Source: Lykou, Georgia & Anagnostopoulou, Argiro & Gritzalis, Dimitris. 2018. Implementing Cyber-Security Measures in Airports to Improve Cyber-Resilience. 1-6. 10.1109/GIOTS.2018.8534523)

Cybercriminals have a great opportunity to compromise your infrastructure while using outdated software. A simple way to close this particular vulnerability in your company is to update all programs on a regular basis, especially if security products are being used. Many forward-thinking companies have implemented 2FA (two-factor authentication) to strengthen access control since they realize that passwords alone are no longer sufficient to protect user information. This is simply made possible by user-friendly applications that are accessible on employees' mobile devices for authentication approval, guaranteeing that access requests are valid.

You can strengthen your defenses by creating a mandated security policy that specifies the level of password complexity required. It is crucial that every person in the business is aware of and follows cybersecurity policies. Employees can learn about company security standards through required training sessions, and acknowledgment forms can be used to track their compliance.

Consider replacing BYOD (Bring Your Own Device) regulations with security measures that demand the usage of company-approved, secure devices and private Wi-Fi networks for work-related tasks if your workers work remotely. Expect the best, but be ready for the worse, as the saying goes. Your organization's capacity to respond and keep running after a cyberattack depends on adequate planning for all possible outcomes.

Determine probable dangers throughout your risk assessment, then create precautions to prevent any negative effects. Using technology to support your organization's cybersecurity program and experienced third-party service providers may be necessary to put these best practices into practice. Depending on the size, resources, and specific risk profile of your company, either advanced software, security experts, or both may be necessary.

Furthermore, relying simply on cybersecurity software won't guarantee success over the long run. It's crucial to implement a risk management solution that keeps your business ahead of developing risks in response to changing security threats. As threats change, risk management and cybersecurity coexist. Risk management, which tackles possible hazards across multiple parts of organizational activity, is crucial for managing short-term risks. The best way to protect your business from cyberattacks is thus to integrate both programs.

IV. PAKISTAN'S CORPORATE CYBER SECURITY

The cyber threat environment of a state or organization is strongly shaped by how vulnerable its ICT-dependent facilities are. The technical and social environment both have an impact on this susceptibility. A state that struggles with a hostile sociopolitical environment brought on by internal or external conflicts and lacks effective cybersecurity measures is more vulnerable to numerous cyber threats, including cyberwarfare. In this context, Pakistan's increasing reliance on internet-based governance and service delivery, combined with its susceptibility to cyber risks due to inadequate cybersecurity preparedness

and the difficult socio-political environment it faces domestically and regionally, shape Pakistan's cyber threat landscape.

Pakistan is one of the growing nations where both governmental and commercial organizations are gradually implementing online administration and service systems. The National Database and Registration Authority (NADRA), which serves as the main repository for the national Identity Documents (ID) database of Pakistani nationals, is noteworthy for its crucial role as a sensitive public body. Banks, the Pakistani Election Commission, the departments of immigration and passports, mobile networks, and security agencies are just a few of the organizations with whom NADRA distributes the internet information of its users.

A number of Pakistan's state enterprises are increasingly providing e-services in a range of economic, social, and security areas in an effort to modernize and increase efficiency. The Pakistan Computer Bureau's merger with the E-Government Directorate in 2014, which was founded in 2002 under the IT Ministry and later renamed the National Information Technology Board, highlights the expanding use of ICT-based services in the nation's economic sector. This includes the implementation of internet banking, online payment methods, and digital stock markets in addition to Automatic Teller Machines (ATMs). Additionally, some social sectors in Khyber Pakhtunkhwa, such as educational institutions, hospitals, and police departments, are offering e-government services.

Pakistan needs an integrated institutional framework that integrates the infrastructures and services of relevant agencies and promotes coordination and collaboration between them in order to handle difficulties. Pakistan should also place a high priority on raising internet users' computer savvy and understanding of cybersecurity. The former calls for the efficient use of trained human resources, while the latter entails teaching and raising awareness of cybersecurity among the general public. Political, social, and private boundaries are not exempt from the spectrum of cyber vulnerability. Our development is inextricably linked to cyberspace as the globe moves into a more technologically advanced and economically intertwined period. Nations are paying closer attention to cyber laws and policies due to the rapidly changing standards and technologies. Pakistan has increased its emphasis on cybersecurity both at home and internationally. The nation faces similar difficulties in the world of online as the global community does. These dangers are rising and taking on more complex patterns. These attacks have also targeted the military and other public institutions. To address these problems and obstacles, a variety of tactics and methods have arisen globally.

Cyber dangers are predicted to continue to be prevalent as Pakistan develops and increases its online presence. Pakistan has actively contributed to the growth and development of cyberspace over the years. However, extensive legislation and regulations are still needed to properly actualize the success of such efforts. Effective management of Pakistan's cyber domain requires a deliberate focus on law and policy creation, as well as cooperative efforts and community commitment.

V. IMPLEMENTATION RECOMMENDATIONS

Here are some suggestions for putting cyber security into practice in Pakistan's corporate sector:

- Develop and implement thorough training programs for staff members at all levels to better their knowledge of cybersecurity best practices, such as threat identification, prevention, and response procedures.
- Regular Security Audits and Assessments: To find weaknesses in the company's network and systems, conduct routine security audits and assessments. To remain ahead of potential risks, this should also include penetration testing and risk evaluations.
- Advanced Encryption and Authentication Protocols: To secure sensitive data and stop illegal access to corporate systems and databases, implement strong encryption and multi-factor authentication techniques.
- Establish Cyber Incident Response Plans: To reduce the impact of possible cyber-attacks, develop thorough and efficient cyber incident response plans. A defined line of command, rules for communication, and tactics for containment and recovery should all be part of this.
- Adoption of Security Frameworks and Standards: To build an organized approach to cybersecurity and ensure compliance with worldwide best practices, adopt internationally recognized cybersecurity frameworks and standards, such as ISO 27001.
- The most recent security patches and fixes should be applied to all software and applications on a regular basis to address any known vulnerabilities.
- Implement reliable data backup and recovery procedures to guard against data loss in the case of a cyber-incident. Test these precautions' effectiveness on a regular basis to ensure prompt data restoration.
- Employee Vigilance and Awareness: Promote a culture of cybersecurity awareness among staff members through ongoing instruction and training. Encourage staff members to be on the lookout for phishing scams, social engineering tricks, and other typical cyber risks.

- Fostering collaboration with government organizations and law enforcement agencies can help you remain current on the most recent cybersecurity risks and will make it easier to respond quickly to any potential cyber crises.
- Investment in Advanced Security Technologies: To defend the corporate network from complex cyber threats and attacks, make an investment in advanced cybersecurity technologies such as intrusion detection systems, firewalls, and endpoint protection solutions.

The corporate sector in Pakistan may dramatically improve its cybersecurity posture and better safeguard its crucial assets and sensitive data from new online threats by putting these recommendations into practice.

VI. FUTURE RECOMMENDATIONS

It is crucial to concentrate on a number of critical areas in order to guarantee a strong and efficient implementation of cyber security in the corporate sector for the future. The corporate sector should first and foremost place a high priority on ongoing, focused training programs that keep staff members up to date on the most recent cybersecurity threats and best practices. To quickly identify and mitigate any security breaches, proactive steps are required, such as the adoption of real-time threat monitoring systems and frequent security audits. In order to prevent unauthorized access to sensitive data, it is essential that strong data encryption techniques and strict access restrictions be integrated. Adopting AI-driven security solutions can also greatly improve the cybersecurity framework's overall resilience and threat detection capabilities. To stay current on the newest trends and best practices in the cybersecurity field, collaboration with peers and industry professionals is essential. Additionally, it is essential to incorporate thorough incident response plans that specify precise measures for containment, mitigation, and recovery in the case of a cyber-attack. Allocating funds for the purchase and adoption of cutting-edge security tools and technologies that provide heightened protection against sophisticated cyber-attacks is also essential. To keep the confidence of stakeholders and customers, compliance with international compliance standards is essential. Creating a resilient and secure cyber environment for the business sector will depend on encouraging regular employee engagement in cybersecurity projects and actively seeking input to continually enhance the security architecture and procedures.

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Contribution of Kumba City Councils to the Emergence of Small Businesses in Kumba Municipality, Small Business Owners Perception

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Abstract— *This research assesses the perception of city councils´ contribution in the success of Small businesses by small business owners, case of Kumba City Council. 150 questionnaires were administered to these owners by convenience. The Statistical Package for Social Sciences (SPSS 2022 version) was used to analyse data. Results reveal that the majority of small business owners (51.3%) believe that the City Council is not doing enough for the sustainability of small businesses. It was recommended that the City Council should act more as facilitator for small businesses instead of being a threat to them.*

Keywords— ***City Council, Small Business, promotion of small businesses, sustainability of small businesses, local government***

I. INTRODUCTION

According to Kozarzewski (2006) cited by Negou et al. (2023), the experience accumulated by countries like Poland or Germany, shows that the role of local authorities in small business development is rather significant. This is because the quality of the functioning of the whole system of support of entrepreneurship is determined regionally and locally, taking into account the specificities of each locality. For instance, the local authorities of Poland put a lot of effort to coordinate the system of small business development support and to increase its quality. In Germany for instance there are many institutions to promote small businesses both at the national and at the local level. In Belarus, the 'quality' of the business climate is to a great extent determined by the authorities at a national level, where the overall regulatory environment is shaped. However, many aspects are still governed by local authorities. The latter are able to set up local tax rates, to grant various permits, to exercise controls and to conduct inspections, to register new prices, etc. Also, their power to use and to privatize communal property, to provide information and consultation aid has to be particularly emphasized.

The promotion of Small businesses in Cameroon is a little bit similar to that of Belarus with the promotion of economic development both at the national and at the local levels (Negou et al., 2023). At the national level, the government has created a Ministry in charge of Small Businesses, the bank of small businesses, centres for business creation formalities and has constructed dams to reinforce energy supply. According to Yombi et al. (2018), at the local level, the constitutional revision of 18 January 1996 consecrates two main decentralized communities namely the regions and communes. Also, Lyonga (2020) observed that Law No. 2004/17 of July 2004 on the Orientation of Decentralization10.2b, Law No. 2004/18 of

July 2004 comprising Rules Applicable to Councils, Law No. 2004/19 of July 2004 comprising Rules Applicable to Regions and Law No. 1987/015 setting up city councils came to translate the reforms into law. The region is one of the innovations of the 1996 Constitution revision. Its missions are identical to those of the communes but the difference lies in the scope which is larger for the region. The National Dialogue (2019) in Cameroon gave a push to decentralisation with the examination and adoption of the bill on the General Code on Decentralisation and Local Authorities in Parliament and its subsequent promulgation into law by the President of the Republic, the organisation of elections of Regional Councillors scheduled for December 6, 2020, the creation of the National Advanced School for Local Administration, NASLA, the fast tracking of the decentralisation process with the replacement of Government Delegates by City Mayors with an elective mandate, the Creation of the Ministry of Decentralisation and Local Development (Negou et al., 2023).

According to Negou et al. (2023), decentralisation has become more effective since the National dialogue of 2019. It was therefore important to find out from the community perspective how these decentralised entities have contributed to their economic development. The selection of City Councils and very small businesses is motivated by their importance in many cities of Cameroon and their vital role in fighting unemployment. Henceforth, the objective of this study is to determine small business owners´ perception of the role of City Councils in the emergence of their business.

Small and Medium Size Businesses are a unique asset for development, serving as both a motor for growth and a tool for redistribution of wealth (Economic Support Fund, 2009, p.1). Goudreault (2013) cited by Negou et al. (2023) noted that through their investments and consumption, Small and Medium Size Businesses create value and produce a plethora of goods and services, thereby playing a significant role in funding public services and creating a dynamic local economy. This was confirmed by the World Bank (2014) which affirmed that Small and Medium-Sized Enterprises are regarded as vectors for job and wealth creation in all economies. In Sub-Saharan Africa, the Small And Medium-Sized Enterprises sector accounts for more than 90% of all firms (Negou et al., 2023). Between 70% and 80% of Small and Medium-Sized Enterprises are micro-firms or very small firms. They are the main source of jobs and income for Africans, after subsistence farming (Tadesse, 2009). If the African countries wish to speed up their economic growth and development, they would certainly gain from supporting the emergence and growth of small businesses. Some have understood this, and have set up dedicated small business agencies and ministries. In addition, growing numbers of researchers are suggesting that political decision-makers who wish to strengthen the private sector should focus on the legislation, regulations and institutional mechanisms that condition or shape economic life (World Bank, 2014). The emergence of small-scale businesses is tantamount to the emergence of entrepreneurs as Small businesses are used to foster entrepreneurship. This would make the nation to be self-reliant, economically viable and socially balanced, and there will be jobs for so many people. They are identified as instruments for improving standard of living in a country.

According to Negou et al. (2023), in Cameroon, many individuals undertake businesses for their survival. Their areas of activity include various types of service industries operating in the informal sector, such as repairing, passenger and cargo transportation, personal and home services, social services, catering, micro-finance and computer related activities, etc. The number of enterprises or individuals under this category is hard to estimate, but has grown steadily. There are many such enterprises involved in the "conventional" distribution sector, which include street marketers, trading with nearby residents at street stands or small shops, small-size retailing at a central market or markets specialized in specific products such as food, daily necessities, sundry goods, soap, and batteries for radios, etc. Unfortunately, the business environment appears to have deteriorated in Cameroon. In the World Bank report entitled Doing Business, Cameroon's ranking felled by ten places between 2014 and 2015, from 148th to 158th and continued falling to the 166th rank in 2018 from 163 in 2017. However, this decline does not on itself, provide sufficient information on the mechanisms and pitfalls that encourage or hinder business development in the country. First, it is important to note that there has been a strong political will since the 1960s, when the country achieved independence and began to introduce various structures to stimulate and support business creation. While this institutional infrastructure originally produced good results (emergence of many firms of different sizes), it subsequently began to decline. It is in this regard that Cameroon's enterprises are still finding it hard to consolidate their growth and survival. The last general business census in Cameroon found that the average age of the country's firms was just 10 years (National Institute of Statistics, 2011), in spite of decades of effort and incentives (some cut short by the economic crisis). There is therefore good reason to wonder whether Small and Medium-Sized Enterprises in Cameroon can still act as vectors for growth, job and wealth creation.

Kumba, Departmental Capital of Meme, the town of green and businesses and the case of this study is not left aside. Many small businesses are created and closed every day

(Ministry of Small Business, 2022). The reasons behind these closures are numerous and it is in an attempt to identify some that this paper aims at assessing the role of Kumba City Council in the creation and sustainability of small businesses and determining some challenges faced by these businesses.

The concepts involved in this study include: City Council, emergence of Small Businesses

City Council

A city council is a local government body. Local government refers to the operations of corporations, municipalities, district boards, panchayats in a country, and other bodies that are entrusted with the execution of functions relating to and concerning the residents of a given area locality (Negou et al., 2023).

According to Godwin (2014) cited by Negou et al. (2023), local government consists in the management of local affairs by the people of the locality where they are. In his book "Elements of Politics", Sidgwick (2012) considers local government as government of some sub-organs that have special powers to issue regulations or rules within the area that they manage. So Sedgwick connects government with its legislative character. Local Government is the sphere of government where local authorities are allowed by law to issue acts or decisions to adjust the way of governance (Hasluck, 2010). Local government is the government of difference, responding to different needs, and realizing different aspirations. "There must be a definite power to do things in a different manner from that followed in other areas within the same state area. If some local body has it in its power to govern in a different manner from other local bodies, there we have Local Government" (Hesluck 1936 as quoted in Stewart, 2000).

Types of Local Government Bodies in Cameroon

According to Negou et al. (2023), Cameroon is divided into ten administrative regions which are in their turn divided into divisions and sub-divisions respectively corresponding to the 374 local government councils. There are four main types of councils: Regional councils, City councils, sub-divisional councils (within a city council) and councils in rural areas.

Regional councils: councils lack the status granted to city councils. All councils are headed by a directly elected mayor who is supported by a team of councillors; their number depends on the population size. The council can appoint commissions to work on any relevant issues, and membership can include non-councillors and must be convened during the council's first year. Typically, their remit would include planning, public works, education, markets and other facilities, or health (Cameroon country profile, 2019; Negou et al., 2023).

City councils: they serve urban areas; their territory overarches that of sub-divisional councils. They are headed by City Mayors appointed by the President of the Republic. They mirror all the duties and powers of mayors. They are assisted by an executive team composed of persons appointed by order of the president. The deliberative body of the city council comprises the executive team, the sub-divisional council mayors and one additional councillor designated by each of the sub-divisional councils (Cameroon country profile, 2019). Kumba has a status of an urban area. It has both a city council and sub-divisional. The city councils board comprises of mayors of sub-divisional councils and representatives designated from mong sub-divisional councils. Kumba is made up of three sub-divisional councils which consist of; Kumba 1 (Kumba Town-Kake, a part of Buea Road), Kumba 2 (Kosala, Hausa-quarters and Fiango) and Kumba 3 (Three Corners, Mambanda and a part of Buea Road) with each having a local mayor. However, the fall under the jurisdiction of the city council. According to Law No 2019/025 of 24 December 2019, on Bill to Institute the General Code of Regional and Local Authorities, the city council has jurisdiction over any action pertaining to inter-council collaboration, major works and structuring projects. The city council is responsible for the creation and management of municipal public facilities, in areas concerning: preschool and basic education; non-formal education and apprenticeship; vocational training; health, Public hygiene and sanitation; road and communication infrastructure classified under the council's domain; public transport and traffic plans; water and energy; trade fairs and markets; youth affairs; sports, arts and culture; issuing building· and demolition permits; the acceptance and rejection of grants, subsidies and legacies; loans and loan guarantees or endorsements; and small-scale exploitation of council mineral resources (Negou et al., 2023).

Sub-divisional councils: these are council areas created within any city council area. Most city councils have two or three sub-divisional council areas, but Yaoundé and Douala have seven and six respectively. The sub-divisional councils are headed by directly elected mayors (Cameroon country profile, 2019).

Many scholars have conducted research on local government. Negou et al. (2023) for instance conducted a study on small business owners´ perception of the role of City Councils on the creation of small businesses in Kumba municipality. Using a quantitative approach to collect and analyse data from 150 small business owners, findings reseal that the Kumba City council is not working enough

to encourage the creation of small businesses in its jurisdiction.

Rogers Rugeiyamu (2021) also conducted a research aimed at exploring the role of Local Government Authorities in promoting Local Economic Development and service delivery to local communities in Tanzania. The study is conducted along Community Economic Development and Service Support Approach to be used in assessing the role of Local Government Authorities in promoting Local Economic Development and service delivery at the community level. The approach provides a guideline for Local Government Authorities regarding where to focus in order to become active in playing their role. The study uses documentary review of reports, books, articles and newspapers. The collected data from 90 Local Government Authorities and were analysed through secondary data analysis approach. The findings revealed that Local Government Authorities promote Local Economic Development by providing soft loans, improving business infrastructure and local investment support. In addition, Local Government Authorities promote service delivery by ensuring supply of water, supporting electricity supply and school improvements. Challenges toward playing a more effective role were identified including non-performing loans and failure to provide entrepreneurship skills. The study urges Local Government Authorities to put more effort toward solving the identified challenges, e.g., addressing non-performing loans, completing unfinished business infrastructure, and becoming innovative toward service delivery and economic liberation of local communities. This research is to some extent similar to this research work as it looks at how local government promotes local economic development. However, development also entails that small businesses should be promoted and sustained in order to grow. Like the research under study, it also looks at challenges faced by small businesses. However, this research uses more of primary source of data while Rogers Rugeiyamu used secondary data.

Also, a similar study carried out by Ngalle Joseph (2016) with the purpose of assessing the financial strategies and resources that small lodging business owners use to help their businesses survive beyond 3 years. Fiedler's strategic contingency theory was the conceptual framework. There were 5 owners from 5 separate successful small lodging businesses in Kumba, Cameroon, who participated in the face-to-face interviews. The results from computer-aided qualitative data analysis, methodological triangulation of the interview data and company document analysis, following Yin's 5 step analysis led to the emergence of 3 major themes: passion and dedication of the owner, preparing for the seasonality of the business, and hiring the right employees. These findings could be of interest to small business owners interested in improving financial strategies to avert future failures. This study promotes positive social change as improved business success may lead to a decrease of unemployment and improve living conditions in Cameroon and other local communities. This is related to this research in that if businesses can assess their resources they can overcome their challenges.

Omoniyi Victor Ajulor and Busayo Ibikunle (2016) conducted a research with the main aim of examining the theories of Local Government and their relevance to Nigeria experience. The three major theories of local government that have featured prominently in various literature in recent time and under consideration in this paper include Democratic participatory school, Efficient-service school, Developmental school. The paper relies on content analysis of relevant literature such as books, journals and internet source. The paper discovered that the working of local government in Nigeria defiles the principles and prescriptions of any theory. The trajectory of Nigeria local government has been on try and error from the beginning. This has been attributed to the hundred years of colonization, which distorted our local government in Nigerian autochthonous societies growing in the embryo and replaced them with the indirect rule and native authority system by the colonial master in order to achieve their purpose of exploitation and domination. There are also military and political factors. Most of the local governments were created for political patronage and the interest of the people in the locality was not considered. There is an issue of 774 local governments created by the military on a uniform basis without considering the peculiarity of the cultural value of each territory calved as local government. The adaptations of the local governments and the relationship with the local people are in doubt. This study, therefore, recommends environmental theory of local government where the local government will be understood from the influence of the environment. These include the cultural value and the tradition of the people which should be appreciated and accommodated for any meaningful theory that will properly capture the Nigeria situation for effective, efficient purposeful and viable local governments in Nigeria. If the city council understand the influence of its environment, they can easy provide was to promote small businesses.

The Concept of Small Businesses

Small business occupies a vital place in the national economy. Entrepreneurs invest their own money, time and ability in their business and contribute substantially to the community in terms of jobs and goodwill (Ela Zaman, 2020). Though small in size, small business activities cover almost any area of business for instance manufacturing, wholesaling, retailing, service and the like. According to

Small Business Act (1934), "a small business is one that is independently owned and operates and not dominant in its field." A Small Business which functions on a small level, involves less capital investment, less number of labour and fewer machines to operate is known as a small business (JU's, 2022). The classification of small businesses vary from one country to another.

In Cameroon, according to Law No. 2010/001 of April 13, 2010 as completed by the law N° 2015/010 of 16th July 2015 on the promotion of small and medium-sized enterprises or companies in Cameroon, Small and Medium-Sized Enterprises include Very Small Enterprises (TPE), Small Enterprises (PE) and Medium Enterprises (ME). Following Articles 4, 5 and 6 of the said law, a very small business is a business that employs no more than five (05) people and whose annual turnover excluding taxes does not exceed fifteen (15) Millions of CFA Francs. The small business is a business that employs between six (06) and twenty (20) people and whose annual turnover excluding taxes is greater than fifteen (15) Millions of CFA francs and does not exceed one hundred (100) Million CFA francs. The medium-sized company is a company that employs between twenty one (21) and one hundred (100) people and whose annual turnover excluding taxes is greater than one (10) million CFA francs and does not exceed one (01) billion CFA francs. In the event of difficulty in classifying a company in one of the categories determined in Articles 4.5 and 6 above, the predominant criterion is the turnover annual excluding taxes.

Several scholars also carried out research on small businesses. Muritala Taiwo et al. (2012) conducted a study which seeks to investigate Small and Medium Enterprises as a veritable tool in Economic Growth and Development. A survey method was used to gather data from 200 Small and Medium-Sized Enterprises /Entrepreneurial officers and Managers from five selected local government in Nigeria namely; Ijebu North, Yewa South, Sagamu, Odeda and Ogun Waterside Local government. Data was collected with a structured questionnaire and analysed with several descriptive statistics to identify the perception of the roles of Small and Medium-Sized Enterprises in Nigeria. of training and experience, poor infrastructure, insufficient profits, and low The results of the study therefore reveals that the most common constraints hindering small and medium scale business growth in Nigeria are lack of financial support, poor management, corruption, lack demand for product and services. Hence, it therefore recommends that Government should as matter of urgency assist prospective entrepreneurs to have access to finance and necessary information relating to business opportunities, modern technology, raw materials, market, plant and machinery which would enable them to reduce their operating cost and be more efficient to meet the market competitions.

Assessing the contribution of local governments in the success of Small businesses

According to open access government (2023) cited by Negou et al. (2023), local government can contribute to the success of small businesses by:

organising online and physical hubs where representatives of local businesses could come, network with each other, exchange good practices and ideas, and identify ways of supporting each other.

dedicating spaces where local businesses could come and promote themselves and interact with customers and business partners. They could also grant them access to advertising physical and online space (the website and social media pages of the Council) and initiate 'shop local' campaigns and incentive schemes.

ensuring better access for main street businesses that could be in various forms.

informing small business owners about numerous opportunities for funding.

offering financial advisory and facilitating access to grants and small business loans for local businesses.

organising systems of raising funding for local businesses that could go into grants.

reducing taxes and pressure on tax payment.

offering in partnership with local schools and universities entrepreneurship programmes to stimulate and support local potential and existing entrepreneurs.

According to Steve (2023) and Forbes (2023) local governmental tools used to promote small businesses tax incentives, financial incentives, job training, infrastructure improvements, provision of stable energy and consulting services to small businesses, making it easier for small businesses to contract with the government.

In this paper, the contribution of the city council will be examined: tax exemption information, training, organisation of trade fairs, development and improvement of infrastructures, search for funding.

II. MATERIALS AND METHODS

This study adopted a descriptive research design and took a quantitative approach to collect and analyse data. The descriptive research design will be used in this study to describe the different respondents' opinions of the support they receive from the Kumba city council. The quantitative approach is chosen because data is gathered using questionnaires and this involves a large sample size.

The population of this study is the Kumba City Council. Similarly, the target population is made up of small business owners. The sample will be drawn from this target population considering that they are the ones who can better inform on the role of city council.

Following the sampling technique, a sample of 150 small businesses were selected and sampled conveniently and in quotas (a group of 50 in Kumba 1, 2 and 3 each).

Data for this study was collected through self-administered questionnaires distributed to respondents of the selected small businesses in Kumba Municipality. During the administration phase, some of the respondents requested for explanations before they could answer but the majority easily understood the requirements.

Data obtained for final analysis was mostly quantitative. It was first sorted by rearranging the collected data to bring some order. It was systematically handled and then edited to eliminate irrelevant information and then classified in a tabulated form. The computer aided package known as Statistical Package for Social Sciences (SPSS 2022 version) was used as a statistical tool to measure the sample population. Quantitative data collected from the respondents was analysed using descriptive and inferential statistics.

Descriptive statistics is the term given to the analysis of data that helps to describe, show or summarise data in a meaningful way (Stony, 2012).The descriptive statistics included frequencies, percentages and graphical description (charts).

III. RESULTS

These results will be divided into positive and negative perceptions.

Positive perceptions

Provision of spaces to small business owners to exhibit their products

Table 1: Provision of space to small business owners to display their product

Responses		Frequency	Percent
	Yes	88	58.7
	No	62	41.3
	Total	150	100.0

Source: Field Survey (2023)

Table 1 shows that 58.7% of small business owners support the idea that the city council offers venues for small enterprises to exhibit their goods or services by organising trade fairs, 41.3% disagree. This implies that for this service, the city council does a lot of sensitization to create awareness and to stimulate small business owners to adhere to the project.

Improvement of infrastructure

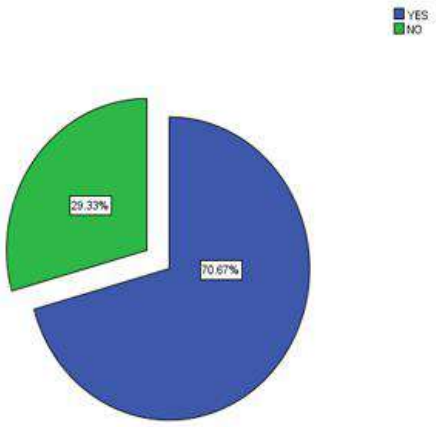

Fig.1: Perception of the role of the city council in the improvement of infrastructure

Source: Field Survey (2023)

Figure 1 show that the majority of respondents, 70.7%, agreed that city council assist in enhancing the infrastructure necessary for small enterprises to succeed, such as roads, electricity supply, water, and buildings, while just 29.3% disagreed.

Negative perceptions

Provision of tax exemption facilities to newly created small businesses

Figure 2 below presents the opinions of small business owners on tax exemption facilities provided by the Kumba city council.

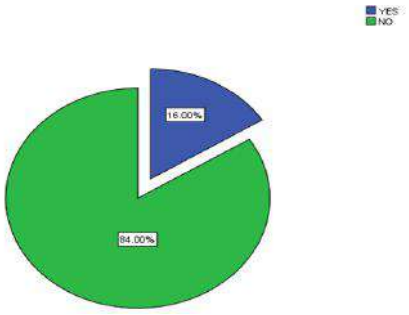

Fig.2: Opinion of small business owners on the provision of tax exemption to new businesses

Source: Field Survey (2023)

Figure 2 shows respondents' opinion on whether or not the city council granted tax exemption when they started their business. Finding reveals that a vast majority, 84% of small business owners disagreed to have benefited from tax exemption when they started their business while the

remaining 16% of respondents agreed. This means that the information does not circulate appropriately and the city council is not working closely with the Centre of Business Creating and the taxation office to get such information.

Provision of training programs for small business owners

Table 2: opinions on the provision of training by the city council

Statements	Frequency	Percent
The city council provides training programs for small business owners	43	28.7
The city council does not provides training programs for small business owners	107	71.3
Total	**150**	**100.0**

Source: Field Survey (2023)

Table 2 demonstrates that 71.3% of small business owners disagree to have ever received training from the city council against 28.7% who agreed. This shows that such programs exist at the city council but are not appropriately used. This poses once more the problem of information asymmetric.

Funding of research and development projects to assist small businesses

Table 3: funding of research and development projects for small businesses

Statements	Frequency	Percent
The City Council funds research and development projects	35	23.3
The City Council does not fund research and development projects	115	76.7
Total	**150**	**100.0**

Source: Field Survey (2023)

Table 3 depicts that majority of respondents 76.7% were not in agreement to the fact that the city council funds research and development projects and work with private investors to raise funds to provide assistance for small businesses whereas the remaining 23.3% of the respondents were not against this statement.

General opinion of small business owners of the support of the city council

Table 4: general opinion about the City Council support to small businesses

Statements	Frequency	Percent
The City Council supports small businesses	45	30
The City Council does not support small businesses	105	70
Total	**150**	**100.0**

Source: Field Survey (2023)

Table 4 reveals that 70% of small business owners are of the opinion that the city council is not doing enough to support them against 30%. This means that as one of the central city development agencies, the city council is either not aware of its immense role in business enhancement in its municipality or the communion with the business community is not good enough.

IV. DISCUSSIONS

Finding reveals that a vast majority 84% of small business owners disagreed to the fact that City Council gives a two-year tax exemption when they started their business. This result is in contradiction with that of Binla (2010) whose finding showed that the government provides new businesses with 2 years tax exemption so they can be able to survive in the early stage of their businesses and make a little profit for sustainability. Also, after the grace period, the owners declare the businesses' revenue to the government. If it has improved, the business advances to a higher tax bracket. Still if the turnover has not improved, then the business cannot be classified.

Also, findings demonstrate that 71.3% of small business owners disagree that the City Council provide educational and training programs to equip them with the necessary mind-set and skill set needed to run their businesses successfully. This finding is different from that of Kakdeu et al. (2020) which findings reveals that the government supports entrepreneurship through the provision of training opportunities. Entrepreneurship training is a structured program that aims to equip participants with the necessary skillset and mind set for identifying and launching new business ventures in Cameroon.

Furthermore, findings show that (58.7%) of small business owners support the idea that City Councils offer venues for

small enterprises to exhibit their goods or services, such as trade fairs.

Also, results show that the majority of respondents, 70.7%, agreed that the City Council assists in enhancing the infrastructure necessary for small enterprises to succeed, such as roads, electricity supply, water, and buildings. In addition, finding depicts that a large proportion of respondents 76.7% were not in agreement to the fact that the City Council funds research and development projects and work with private investors to raise funds to provide assistance for small businesses. Also, this finding is different from that of Kakdeu et al. (2020) whose findings reveals that the government provides grants to academic institutions working to develop new technologies, government also fund research and development projects and work with private investors to raise funds. For instance, the setup of the AfDB (the African Development Bank) in 2013.

Lastly findings, reveals that a substantial proportion of respondents (46.6%) believed that, the City Council should exempt them from paying taxes as a way of sustaining them in the business so that they can be able to maybe use the money they were supposed to use to pay tax to increase capital, followed by 19.3% of small business owners who think the council should give them funding and subsidies. Additionally, 14% of the respondents think that City Council should review small business laws as a tool for fostering the growth and sustainability of small businesses.

V. CONCLUSION

This research intended to investigate the role of Kumba city council play in the sustainability of small businesses in its locality. Based on the findings, it can be concluded that Kumba city council is averagely involved in the sustainability of small businesses in its jurisdiction.

Based on findings and conclusion, the following recommendations have been formulated:

Kumba City officials

- As observed from the results of study, the general level of Kumba City Council involvement in the success of small business is very low. The 2 years tax exemption law is not being follow. This could be because they are corrupt officials in the post of responsibility in the City Council. Therefore, the government should put in place a special committee with the main aim of ensuring that all laws put in place by the city council are followed to the later. This is to ensure that small businesses can flourish in Kumba without much problem and hence improve the general standard of the people involved and the community at large.
- In addition, the City Council should invest more on educational and training programs that will equip small businesses and provide them with right skills and mind set needed to survive their small businesses and also give room for innovation and development of Kumba. Furthermore, City Council should also improve its services on fast tracking authorization and licensing for small businesses to facilitate their creation
- Once more, City Council should reduce the rent of small businesses owners in Kumba so that they can be able to open their businesses in strategic areas and thrive without many complications. Equally, City Council should promote corporation between researchers and private sector investors to raise funds to provide assistance for small businesses.
- The City Council should not also relax on its responsibility to create awareness of the important of small businesses in its locality by outlining all the possible advantage that all small businesses which are registered have.
- Furthermore, the City Council can provide IT tool for small businesses, which can help them to reach a large customer base online and hence facilitate their growth rapidly.

Additionally, research studies can be carried out on the Role of Sub Divisional Council in the promotion of small businesses, case of Kumba City Council to grape the growth and sustainability of small businesses in the three Sub Divisional Councils.

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Analyzing IT Workflow Management by Queue Management

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Abstract— *The proposed workflow management executed in the research work can be stretched out at cloud services condition to improve the its management services. To Study It Workflow Management by Queue Management At present distributed computing offers different types of assistance. The greater part of the money managers is intrigued to tackle their concern through distributed computing technologies.*

Keywords— ***Management, Queue Management, Data Mining, Techniques and Application***

I. INTRODUCTION

According to our revised definition of Queue Management (above), a Queue Management System is then a system that manages the waiting experience of the customer throughout their entire journey, from before they arrive until after they leave. In order to aid organizations with customer access, customer flow management, and data collection for better customer experiences, the solution may include either software or hardware. Words like "annoyance," "lots of people," and "waste of time" immediately come to mind when we think about lineups and waiting lines. But in a scientific sense, what exactly is a queue? People in a queue are waiting in line to get whatever it is they are waiting for.

In economic terms, it's even easier – a wait is a classic instance of wants surpassing supply. Queues form when there are more customers waiting to be served than there are available employees to assist them. When supply falls short of demand, people have to wait longer to get what they want. Then, how does one define queue management? The goal of queue management is to regulate client flow and improve the waiting process. Although normally we only take into consideration the consequences of lengthy lineups on ordinary visitors, everyone — from consumers to manager and top-level administration — benefits from efficient queue management. Waiting in line has probably existed since the beginning of time.

Queues, according to some scholars, have been around since prehistoric times. When the hunters returned with fresh meat, everyone had to line up for a mouthful. Most likely, these "waiting lines" mimicked animal queuing, where tribal hierarchy determined the sequence. Thankfully, queueing procedures have improved since then. Waiting in line is just another facet of human life that has changed throughout time. It wasn't until the early 19th century that they established a societal standard. The term "queue" was first used in print in 1837; it derives from the Old French "cue," which means "tail."

II. LITERATURE REVIEW

Matthew, Ugochukwu & Yunusa (2019) Data Mining assumes significant jobs in numerous associations particularly the client assistance arranged foundations like banks. It is useful in examining the gathered data and conveying it into a reasonable example. In the current situation, banking is a developing division where huge volumes of electronic data are being kept up. The significant errand in banking is dealing with colossal value-based data and making decisions in regards to client maintenance, misrepresentation discovery and avoidance, hazard and promoting management. Yet, making decisions by manual is tedious and mistake inclined. To handle these data in a powerful way, data mining strategies and methods are appropriate. By utilizing these methods a few fascinating examples and information base can be recovered.

Mathew, S. & Abraham (2018) Information Mining Techniques-The progress in the field of Information advancement has brief broad proportion of databases in

various zones. Likewise, there is a need to store and control basic information which can be used later for fundamental initiative and upgrading the activities of the business.

Hussain, Sadiq (2017) The paper studies various parts of data mining research. Data mining is useful in procuring information from enormous domains of databases, data stockrooms and data shops. Extraordinary and current territories of data mining additionally examined. Issues and difficulties of data mining alongside different open-source devices are tended to also. Data mining is a significant and advancing research territory and utilized by the scholars to analysts and PC researchers also.

Hammarström, Pär & Herzog, Erik (2016) In all events, by utilising models and software building methods and devices, it is a test to establish software-oriented well-being fundamental frameworks. This paper addresses the difficulties faced by the traditional device engineering approach to the improvement of the Gripen E contestant aircraft with the software of Domain Focused Design. Engineering structures and the domain focused architecture are linked to known similarities and contrasts. Areas are recognized where uniqueness is necessary. The key problem is that the layout of the system differentiated cannot be adapted to the known domain structure using the domain focused design approach. Further, to oblige the Systems Engineering Architecture design measure to perform a valid domain test, the analysis must be extended and generalized to benefit from the benefits of Domain Focused Design.

Alnoukari, Mouhib (2015) ASD-BI reflects a smooth "marriage" of perspective and data extraction. The Adaptive Software Development (ASD) approach is one of the big efforts to incorporate a corporate information system. The primary strengths of the ASD-BI methodology are flexible to adjust situations, to enhance collection and exchange of information, and to help to upgrade and complete the association structure. The aim of the section is to demonstrate how agile techniques can improve the integration of data mining within the context of business insight. The article offers two contextual analyses, one on advanced and the other on bibliographic (Bibliomining), and describes ASD-BI attributes. The key impact of this article is to create a step of inferred knowledge and raised the vital element in the use of knowledge revealment measure by using organised methodologies to integrate market insight and data mining frameworks.

III. RESEARCH METHODOLOGY

The group head goes about as an analyst, audits the solicitation, examines the solicitation and afterward apportions the solicitation to the colleague who can have the option to deal with that sort of solicitation.

In this sort of solicitation dealing with, there might be an opportunity to happen flood in the line while putting away the solicitation. In that circumstance, the client needs to trust that quite a while will deal with their solicitation; even it might be a basic one. To evade this downside, the proposed research methodology handles it productively by overseeing and keeping up the line appropriately. The line is kept up appropriately by parting the line into sub-lines regarding the need for the service demand. The service demand, upon presented by the client has been put away in the primary line. The solicitation in the line is ceaselessly checked by the group chief. The solicitation might be put away alongside the client relegated need for handling the solicitation. In view of the client doled out need and the SLR time headed determined for preparing the solicitation, by the group chief or analyst thus, the solicitation is allocated to the sub-line. The commentator keeps up three sorts of sub-lines: one for demand with high need, one for demand with medium need and another for demand with low need.

After ascertaining the time bound, the solicitation is moved to one of these sub queues. While moving the solicitation, if the client relegated need for the solicitation, it might likewise be thought of. Hence the commentator upon audits the solicitation in the principal line, moves the solicitation to one of the sub-lines. The need-based sub lines are Pictorially spoken to in this figure 1

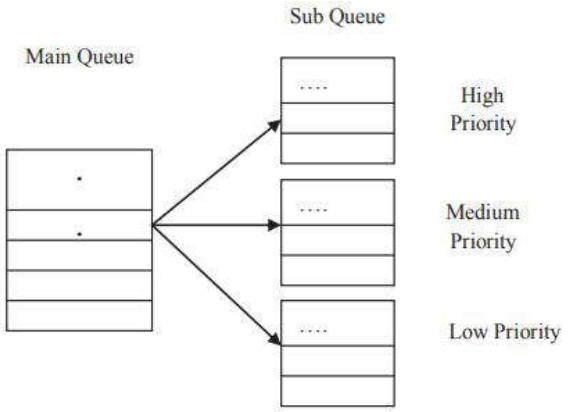

Fig.1 Queue Management for Workflow Maintenance

Subsequent to relegating the solicitation to the sub-lines, the analyst searches for the colleague to appoint the solicitation for preparing. The time bound is determined by the beginning time and the greatest and least an ideal opportunity to finish the cycle. In light of the time bound count, the solicitation is assigned to the sub-line. On the off chance that the determined time bound is less, at that point the solicitation is moved to the line with high need. On the off chance that the determined time bound is typical, at that

point the solicitation is moved to the line with medium need. On the off chance that the determined time bound is more, at that point the solicitation is moved to the line with low need.

The solicitation in the high need line is handled first, since the solicitations have been prepared in a less timespan. Likely, after preparing the solicitation in high need, at that point the solicitation in medium need line is handled lastly, the low need line has been prepared. By preparing the solicitation dependent on the need, the client can have the option to get the reaction in a proficient timespan. The client presenting the solicitation with less timeframe is handled first as opposed to preparing the solicitation with additional timespan. In this way the line is overseen effectively and the work process is looked after effectively.

IV. DATA ANALYSIS

The proposed ITQMWFM Algorithm imbalanced in the java program maintains an successful testing of the work stream in an IT association per line management. In an IT association the exploratory agreement is completed by taking several requests and multiple asset persons. At the start, the request is sorted in a standard line and is intended to illuminate the individual asset. The biggest time frame expected to complete the application was calculated and noted. There was also a chance to address any customer order.

Following that, the next step for the review of the method proposed is completed by measuring the time needed to process the request. In view of the time limit, the demand has been separated and divided into three sub-lines according to the service requirement. The application has been prepared and the time to complete the cycle has been identified and noted after the request has been transferred from the main line to the sub lines.

For methods the current range, the example data found by the banking algorithm subtleties are used just like the proposed system seems to be working well and the application is effective and successful.

In the current system, only two asset persons are allocated physically based on the presence of the demand in the line. Table 1 presents a rundown of the current system in the asset mission. According to the service demand sorted in three sub-line models, the proposed ITQMWFM is allocated as individual properties. The distribution of each rundown and the number of tickets is shown in table 1 and 2.

Table 1 Resource Person List (rplist)

RP ID	Status
RP1001	Free
RP1002	Allocated
RP1003	Allocated
RP1004	Free
RP1005	Free
RP1006	Free
RP1007	Free

Table 2 Tickets

Ticket No	User Name	Request
T101	ABC	Account Creation
T102	XYZ	Net Banking Request
T103	SKV	Recover Password
T104	MNP	Senior Citizen FD Details
T105	VND	Account Details Updation
T106	SSD	Account Information
T107	PQR	Online Transfer

Table 3 Priority Setting

Ticket No	Time Bound	Priority
T101	30 – 40	Low
T102	45 – 50	Low
T103	10 – 15	High
T104	10 – 15	High
T105	20 – 25	Medium
T106	10 – 15	High
T107	25 – 30	Medium

Table 4 Queue-1 (with High Priority)

Ticket No	Status
T103	RP1001 (Processing)
T104	RP1004 (Processing)
T106	RP1005 (Processing)

Table 5 Queue – 2 (with Medium Priority)

Ticket No	Status
T105	RP1007 (Processing)
T107	Waiting (until RP free)

Table – 6 Queue – 3 (with Low Priority)

Ticket No	Status
T101	Waiting (until RP free)
T102	Waiting (until RP free)

Table 1 documents the time-dependent setting for each ticket. The concept of line management is illustrated in table.

The tables demonstrate the method proposed by separating the program from the basic line in time-bound sub-lines. In these areas the method proposed performs well and this study has carried out the purpose of the work proposed effectively.

The system proposed considers the control of the ticket time with line management where line management for the tickets is not regarded as established method.

In Table 7 the present and proposed method for calculating line management by the time allotted is closely examined. The outcome of the table indicates that the proposed solution to handle the line work process reduces the optimal ticket handling capacity.

Table 7 Processing Ticket based on queue management

No. of Tickets	Time to process without Queue Management(seconds)	Time to process with Queue Management(seconds)
10	20	5
50	100	25
100	300	40
200	450	45
500	980	50

Figure 2 displays the line management layout outlines. The diagram of the X hub refers to a number of 10-500 tickets and the Y hub refers to the presentation volume. The bar graph demonstrates, of course, that it takes longer for tickets to plan without line management than for tickets with line management.

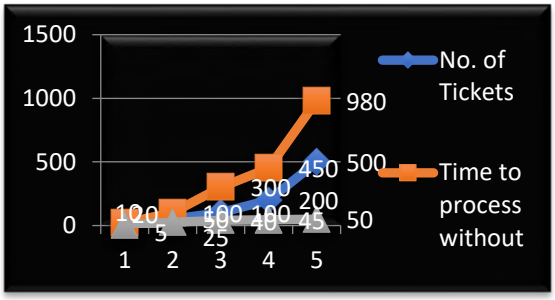

Fig 2 Performance chart of queue management

V. CONCLUSION

This research work gives three kinds of structure which have been effectively executed. The primary system is to deal with the IT infrastructure by arranging in a tree like structure to relegate the service solicitation to the asset individual in this situation. The remaining task at hand can likewise be overseen and the way toward doling out the ticket to the asset individual is additionally robotized with the goal that the manual exertion is decreased. The subsequent system is ITQMWFM level engineering is to keep up the line dependent on the need and time bound to finish the cycle, and furthermore it gives better reactions to the client presenting the solicitation.

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