Uses of Data Fusion Technology for Establishing Scalable Data Solutions in the Marketing Sector

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Abstract— Data fusion involves code-free and fully managed data-integration service, which assists users in marketing sector to manage and build ELT/ETL information pipelines. Data-fusion is all about integration of different data–sources for production of accurate, useful and consistent information, which is more efficient as compared to data provided by individual information sources. Data-fusion on web user interface allows organisations in marketing sectors to establish a system of scalable information integration for preparing, transferring, preparing, blending without the need for managing infrastructure. This will remove the need for managing a robust information infrastructure within organisations while proper integration of the data-sources. It enables users to use graphical interface, which is inferable easily and allows marketers to use faster data transfer system. Aim of this study is to analyse the impact of using data-fusion technologies to establish scalable data-solutions in marketing sector. In literature-review chapter of this study, concepts regarding technological advancements, data-fusion sensors and their impact on easy transfer and management of information have been analysed. Further, in methodology chapter of present study, the data-collection method, research design and data-analysis method have been analysed in an effective manner. This study has considered implementation of mixed data-collection for collecting information from various secondary and primary sources. Interview has been conducted for collection of primary information in this study and in the analysis and results chapter of this study; positive relations between use of data-fusion and establishment of scalable data-solutions have been found.

Keywords— Internet-of Things, Pre-configured connectors, Cloud data-fusion, machine learning, Sensory information

I. INTRODUCTION

Research Overview

Data fusion is a process of integrating various data sources for producing more consistent, useful and accurate information that is provided by individual data [1]. This process is mainly categorised as low, high and intermediate, depending upon processing stage, where fusion takes place. Commonly, these technologies are powered by AI ("artificial intelligence") because AI can be performed more quickly and easily [2]. In case of marketing sector, digital marketing companies are using DF for managing social media platforms.
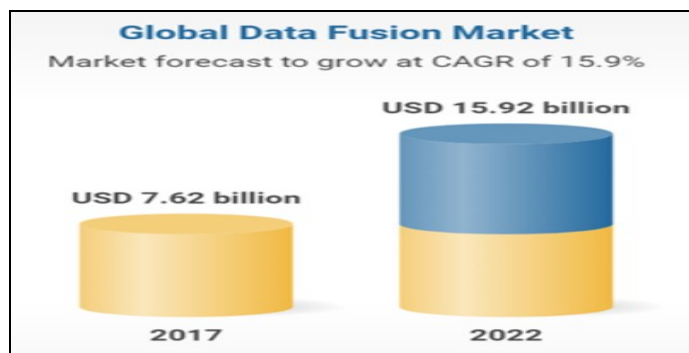

Figure 1: Market share of Data fusion
(Source: [3])

According to figure 1, in 2017, global market share of DF was 7.62 billion USD and it was estimated that by 2022, it would increase to 15.92 billion USD.

Figure 2: Global market of DF (2020 -2027)
(Source: [4])

Moreover, another market research from 2021 shows that in 2020, market value was 11.15 billion USD and this market share will increase to 30.30 billion USD. Therefore, above two figures indicate there is a significant growth in DF technology and in forthcoming year's demand of this technology will increase more.

Aim and Objectives

Aim

This research paper aims to analyse in which ways the use of data-fusion (DF) technologies can establish scalable data solutions for marketing sector.

Objectives

- To identify different DF technologies and their utilisation process for effective data solutions

- To understand benefits of data fusion technologies such as artificial intelligence in the marketing sector

- To evaluate key challenges for implementation of various data-fusion technologies

Problem statement

Nowadays, amount of data is increasing exponentially and there are huge challenges with this massive data because inappropriate storage and management can damage this data. Thus, DF technology helps to bring all data together in a single way so that it can be easily accessible to marketing experts and they understand the current market trends.

II.   LITERATURE REVIEW

Concept of data fusion and its types

Concept of DF has evolved from capacity of animals and humans to incorporate information from multiple senses for improving ability to survive. Purpose of using DF technology is obtaining lower detection error probability as well as higher reliability through utilising data from several distributed sources [5]. DF is used in different technologies, for example, AI, IoT ("Internet of Things"), machine learning and cloud-based data fusion. DF has three major types such as feature level, observation level and decision level. Another research has found that DF methods and algorithms are presented by utilising different categories such as data association, decision fusion and state estimation [6].
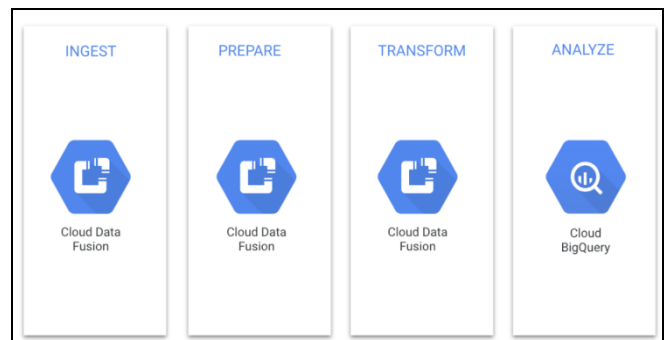

Figure 3: Cloud Data fusion
(Source: [5])

Content curation and recommendation capabilities of AI and ML

AI responds like humans and it can think as humans, which helps to build intelligent machines. AI-based DF significantly helps in content curation as well as atomisation. One of earliest utilisation towards curating content from multiple sources was built from newsletters [7, 8]. Additionally, ML-based DF enables prediction and classification on basis of known data and that can achieve reliability and high accuracy that makes this more probable to inform correct decisions. Moreover, ML in DF can effectively improve performance as well as offer satisfactory fusion outcomes [9]. Recommendation capability of AI and ML helps to predict users' choices and offer appropriate suggestions to users.

Companies using DF for enhancing marketing and sales

Several India companies use DF technologies for improving their sales and marketing. In India, **Accenture** uses cloud DF technology for improving marketing because this DF technology effectively builds scalable information integration solutions for cleaning, blending, preparing, transforming and transferring data without having to manage infrastructure [10]. Since DF technology works with a large amount of data and brings it into a single place, businesses use data to make direct marketing strategies because with help of data, companies can know every individual has different attitudes towards a single item. Additionally, **TCS** uses Cloud DF by Google, for building and managing data pipelines as well as building scalable data integration solutions as a part of organisation's wide data moderation efforts [11].

Major limitations and underlying challenges

Although current business sectors are effectively utilising different DF technologies, it also has several challenges that work as a barrier regarding implementation of this technology. Major challenge with DF is lack of performance in real-life conditions as well as there is limited usability that is applied to Smartphone-based and wearable fall detectors [12]. Another challenge is lack of publication for acceptability and practicality of modern fall detection technologies [13]. Besides this, several issues are primacy concerns, limited experimental conditions, and lack of human contact.

Literature gap

On this selected research topic, a literature review has been conducted, where it has discussed concept of DF and its different types, recommendation capability and content creation of ML and AI and various companies that are using DF in order to enhance their sales and marketing. While collecting information on these subtopics, the paper has found that there is a lack of sufficient data on data business and its role in enhancing marketing of companies. Additionally, there is a lack of primary research-based data.

III. METHODOLOGY

Research Paradigm

Research paradigm is the model for a research, which is considered standard by a substantial number of studies in field based upon practice or verifying some research studies or topic [14]. This paper has selected a deductive research approach because it has allowed the paper to develop some research objectives and based on that collect information and analyse research aim. Additionally, it has chosen interpretivism research philosophy and with help of it, paper has considered subjective experiences of people of other authors regarding a particular issue. That means, interpretivism has allowed the paper to use previous research papers to get insight on research topic [15]. Finally, the paper has selected descriptive research design and it has helped the paper to obtain information systematically for describing any phenomenon, or situation.
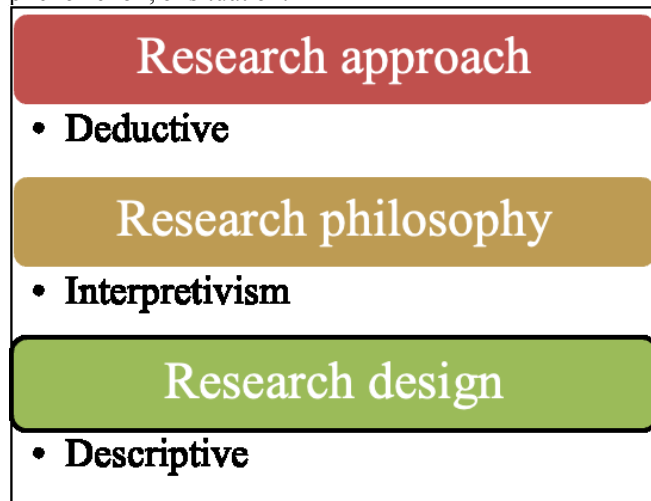

Figure 4: Research Paradigm
(Source: Self-created)

Data collection method

Regarding collecting relevant data for this paper, it has been considered a mixed research method, where it can collect both primary and secondary data. Regarding primary data, it has considered primary qualitative data and that is why an interview has been conducted [16]. It has interviewed two IT experts and one marketing manager to understand both technological and marketing perspectives. Additionally, for collecting secondary data, it has used previous study journals, articles, books, tech magazines and industry reports.

Data analysis

Since the paper has selected a mixed method to collect data, it has chosen thematic analysis to analyse information. Therefore, thematic analysis has allowed us to make some themes from collected information and analyse with interview responses to get clear insight and give an appropriate research conclusion [17].

IV. RESULTS AND ANALYSIS

Interview transcript

Interview Questions	IT Experts 1	IT Experts 2	Marketing manager
How do you think Data fusion can help companies to improve their marketing sector?	Data fusion helps businesses to analyse previously gathered data. If companies can access more that it can be beneficial to predict customers' demand and build marketing strategies	DF's high data analysing capability helps to explore different dimensions of a issue and it can predict customer base and improve marketing strategies	Since DF combines and joins a massive amount of data, it becomes very easy to improve decision-making and predicting consumer behaviour to make suitable marketing strategies
What is the role of AI-based data fusion in enhancing marketing sector?	AI is beneficial for improving marketing and AI-based DF can access a lot data and brings new approaches like automate marketing process	AI is capable of using data on consumers, this AI-based DF can effectively improve marketing sector by spotting current trends	AI-based DF improve marketing sector as it avoid promotion of some particular products that customers do not prefer
What do you think about sensor DF technologies? Does it have any	Sensor fusion brings together all data from various radars and	A cooperative sensor data fusion is difficult for designing	Sensor fusion collects data on people's location and predicts lifestyle

limitations?	more accurate results and major limitation is low latency to detect objects	because data is sensitive and lead to inaccuracy	behaviour and based on markets can use digital marketing strategies; however sometimes sensors can be ineffective

Table 1: Interview Transcript

Thematic analysis

Theme 1: DF explores different dimensions of market and predict market scenario by assessing customers' demand

DF involves integration of various data sources for ensuring accuracy, relevance and consistency of information. This has become an essential tool regarding several businesses as it helps to manage, combine and schedule various data platforms. Additionally, it holds critical information on daily operations or organisations. For instance, digital marketing organisations leverage DF for managing social media platforms as well as automate posting to all of them [18]. Cloud DF uses pre-configured connectors that are legacy and modern systems and with help of these connectors, users can make scalable production data pipelines. Altogether, this system helps businesses in analysing previously gathered data [19]. It means companies can explore various dimensions by utilising DF tools as well as it helps to enhance prediction on market scenarios.

Interviewees stated that with help of DF previous information can be analysed, which can give organisations better idea on customers' demands and trends so that companies can make appropriate marketing strategies to meet those demands. Moreover, interviewees mentioned that since DF works with a huge amount of data it helps to make marketing decisions by predicting consumers' behaviour. Therefore, it can be discussed that DF has proven beneficial for improving marketing sector due to its capability of working with large data by exploring different dimensions and predicting appropriate results.

Theme 2: AI-based DF uses ML and other technologies for analysing historical data and making decisions on failed ideas

AI is extensively used in marketing sector for making automated decisions on basis of data collection, analysis and observations of economic trends as these influence-marketing efforts [20]. Nowadays, organisations are using AI-based DF that holds an important role in helping businesses connect with their consumers. It helps to bridge gap between huge amounts of consumer data and actionable steps that would be applied in future. ML is a major part of AI that works with computer algorithms and analyses information. It analyse new information in context of historical data, which can make informed decisions regarding marketing that have failed in past [18, 21].

Interviewees explained that AI-based DF could effectively enhance marketing sector because by collecting and analysing data, this technology can predict most suitable marketing strategies that would be beneficial for meeting customers' demands. According to them, since AI accesses and analyses a massive amount of data, it can avoid promotion of unnecessary products or that are not in demand. Therefore, it can be discussed that repurposing content via automotive procedure breaks long format content into many short formats and then turns from one to another and in this case, AI helps to leverage content production optimally.

Theme 3: Offering high accuracy data by using multiple sensors major benefit of DF while data imperfection and inconsistency are major drawbacks

DF systems collect data by multiple sensors by aggregator and hub sensor and these sensors have tolerance errors. Thus, by utilising multiple sensors, reality of data analysis can be increased as well as it can give resilience towards failures [13]. Existing data has shown that sensor data fusion, for example, can create information with high accuracy and it successfully handles issues that are related to big data generated by IoT systems [22]. Additionally, operating cost of this system is low because it extends application and range of devices, for example, robotics in marketing sector. However, it also has some drawbacks, for example, it can lead to data imperfection and inconsistency that must be dealt with, and otherwise it can lead to wrong data analysis and predictions [23]. Moreover, it can lack data alignment and correlation, which can again result in working predictions about marketing.

In this context, interviewees stated that sensor DF has low latency to detect any objects, as well as sometimes it may not handle sensitive data, which can lead to inaccuracy. Moreover, major use of sensor DF is the GPS that can locate and navigate people and it can predict people's lifestyle behaviour and based on that companies can take marketing strategies. However, sometimes sensors can be ineffective and could collect sufficient data, which can give wrong predictions.
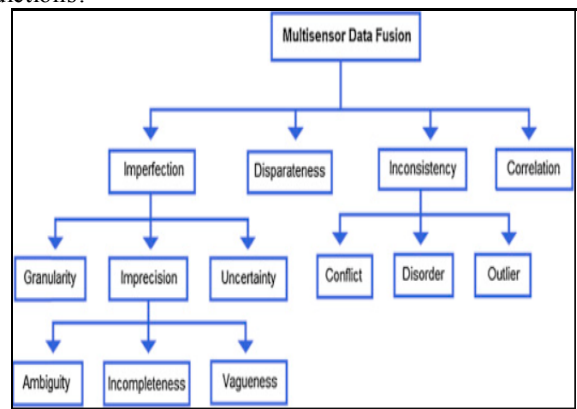

Figure 5: Multi-sensor Data Fusion
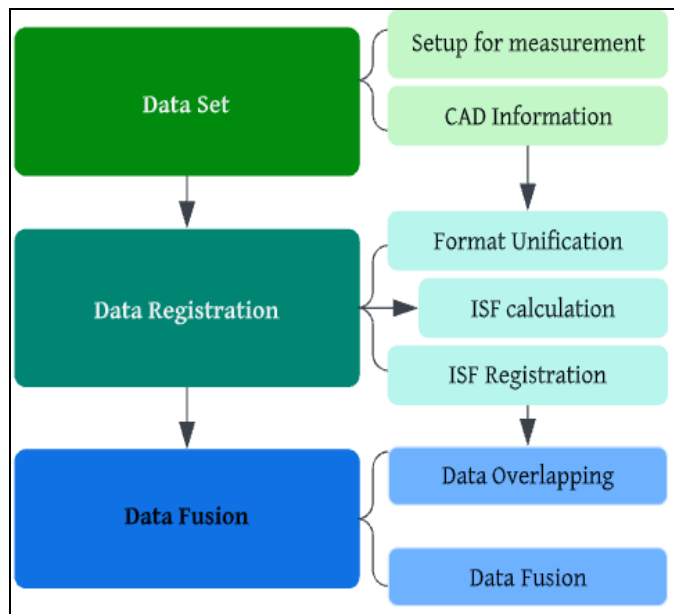(Source: [24])

Research algorithm

Figure 6: Proposed algorithm of DF implementation

Proposed algorithm shows that this paper will set data and for that it will set up for measurements and use information on "computer-aided design" and after collecting data it will do ISF ("Information Security Forum"), calculation, and registration. Finally, it will do overlapping data and then data fusion to enhance marketing.

V. CONCLUSION

Data-fusion technologies help to manage, combine and schedule multiple data platforms to hold critical information on daily operations of an organisation. This paper aimed to analyse use of DF for establishing data solutions for marketing industry. Literature review has highlighted concept of DF, various DF technologies and their role in offering appropriate solutions. From that information it can be concluded that DF is capable of improving marketing sector because it works with a massive amount of data and by utilising ML, IoT and AI technologies, it can analyse data and predict future of a current problem. Therefore, based on that prediction, businesses can consider appropriate marketing strategies for solving a particular issue of their business. However, it has some issues that need to be considered before utilising these technologies, otherwise it could make it difficult to improve marketing sector.

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