Implications of GDPR on Emerging Technologies in Healthcare

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Abstract

In the present digital era, organizations worldwide, including healthcare institutions, are facing several opportunities and challenges in safeguarding and preserving significant data that are essential in the efficient functioning of organizational activities. Organizations have realized and understood the importance of data collection and analysis to influence target achievements and meet futuristic demands. Many small-scale enterprises and start-ups have also initiated decisions to implement technologies that enable a positive long-term impact. Due to these requirements, the General Data Protection Regulation (GDPR) implementation has become a necessity to ensure future sustenance and functionality of existing and growing organizations. The operational activities in the organizational environment are forced to comply with the general data protection regulation policies and framework. The European Union general data protection regulation, which was imposed in May 2018 (European Union General Data Protection Regulation, 2016), has proven to be effective, both within the country's internal boundaries and globally. However, many organizations are still not familiar with the general data protection regulation compliance policies. The emergence of general data protection regulation has been a recent interest in the activities of various organizational sectors as they are attempting to understand the policies and compliance requirements on the implementation of GDPR applications. The research intends to explore the implications between the GDPR and emerging technologies and suggests various recommendations for organizations to implement and follow the GDPR guidelines that could enhance organizational activities.

Keywords

General Data Protection Regulation (GDPR), Healthcare, Emerging Technologies, Organizational Environment, Data Protection, Technological Advancement.

1. Introduction

The business environment in the present digital economy has experienced a total transformation in the operational networking of activities by implementing real-time data analysis and artificial intelligence applications that help gather and analyze relevant data required to perform and achieve desired objectives. Businesses can obtain a competitive advantage over their competitors by forecasting requirements surrounding consumers' decision-making process related to the demand for goods and services [1]. Other areas of business operational activities such as supply chain management systems interlinked with various departments and business domains such as warehousing, transportation, suppliers, retailers, and other firms have been influenced greatly by the reliance on data analysis gathered by Data Analytics processes.

The European Union's general data protection regulation, which has been in source in a reasonable time, has been proven to safeguard the data collected from various sources with the use of digital technologies such as big data analytics, artificial intelligence applications, a cloud computing software, and Virtual/Augmented reality devices that have produced relevant and real-time data that are very significant for decision making in regards to the organization's operational activities [2]. The key to innovation by several organizations will be implemented with accumulated data to cope with the growing economy. The European Union's general data protection regulation deals with gathering, analyzing, and storing volumes of data from individuals and resources that exists inside the European Union and to safeguard the interests of the public by giving rights on giving away personal information accessed by digital devices, known as the right to be explained [3].

Although many argue that general data protection regulation only deals with the citizen or the European Union, it is bound to indirectly affect the international market as an organization linked with the European

markets connecting the global economy. The general data protection regulation allows the consumer to have control over the information provided on a personal basis and give consent to collect data and resources that could benefit the organizational activities, thereby protecting personal information and relevant data from the citizens of the European Union [4].

2. Methodology

The research conducted for this paper was purely based on secondary sources of data analysis. The research study has also implemented the three-phase method of collecting data that includes identifying a research question, frame keywords to match the research question, and conducting an advanced search to extract information [5].

Research question:

1) What are the implications of GDPR on emerging technologies specifically related to artificial intelligence applications?

2) Do GDPR parameters help reduce the misuse of accumulated data?

2.1. Research Criteria - Inclusion and Exclusion

While collecting information from various articles through search using keywords, they were about 1280 journals, research papers, and articles. I have reduced the search criteria by including and excluding certain criteria to help narrow data accumulated through secondary research sources. Criteria by Inclusion and Exclusion are shown in Table 1.

Table 1

Criteria by inclusion and exclusion

Sl. No.	Criteria for Inclusion	Criteria for Exclusion
1	Gathered data that addressed the research questions	Data gathered from non-English literature were excluded.
2	content related to GDPR impact on emerging Technologies	Content not related to emerging Technologies excluded
3	research articles and conference papers were used for references	reviews from the conference, editorials notes, and textbooks
4	research publishing year: 2016 to 2020	Source: trade journals and books
5	Area of focus: content related to subject areas on Digital Technologies	Area of focus: content related to other subject areas apart from digital Technologies with Excluded.

Various research papers were removed from extracting data because the abstract did not connect with providing specific information that could provide information on the research question, even though the research paper title and keywords seemed relevant [6]. The following steps were utilized to narrow down the literature, and the result is shown below in Figure 1 as follows.
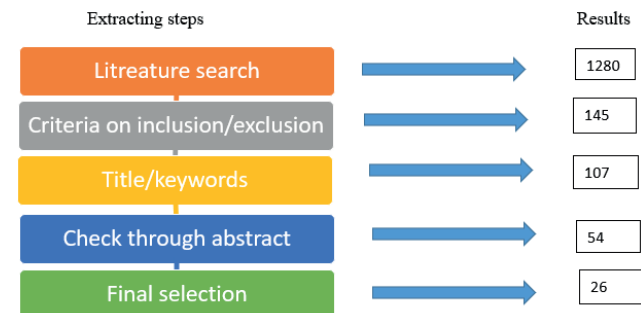

Figure 1: Various steps in extracting information from literature search and results

I searched for various publications with the keywords "GDPR" "emerging technologies" and identified 1280 publications, some of which were included in this review. I also searched with the keyword's "implications," "GDPR and emerging technologies," but found very few research papers. Using the same keywords, I also searched the following databases: EBSCO. Web of Science, Jstor, and Scopus. No additional publications were identified. When I came upon multiple reports on the GDPR and implications, I drew on data from the source with more detailed information. I excluded papers in languages other than English or dealt with laboratory or environmental issues and focused on implications of GDPR on emerging technologies [7].

2.2. Literature review

In the present technology-driven economic environment, reliance on data has become an important element of the operational activities, varying from organizations in the global environment. Real-time data gathered through various artificial intelligence applications and devices have built a linking bridge between various businesses that operate on large-scale production and consumer interaction. Gathering relevant data has become the ultimate requirement among various business activities. It influences the organization to interpret the changing behavioral patterns of consumers at large in the economic world [8].

As businesses grow from a domestic domain to an international platform, exposure to various competi-

tors and consumers is prone to occur. Hence, it has become the prime requirement for business enterprises to understand the changing behavior of consumers, as it will help create customer value and gain a competitive advantage. The added benefits of understanding consumer behavior enable manufacturing industries to tailor products and services that the company uses as per their consumers' recommendations through digital devices and technology [9].

Although consumers understand the requirements of gathering relevant data that could benefit organizations, there are strict concerns about giving away personal data. It could be used negatively and can be exploited. The general data protection regulation was adopted in April 2016 by the European Union, which was further forced after two years in May 2018, mainly targeted to safeguard the data accumulated from consumers. The main framework of the general data protection regulation emphasized protecting and providing relevant management data collection, data analyzing, data privacy, initiating precautionary measures and penalties on each using data processing. The GDPR, at times, is considered to be hard to follow due to the complexity of its framework and legislation [10].

The general data protection regulation regulatory framework also enables consumers and users to have access to their data, allowing making necessary changes whenever required (Regulation 2016/679, General Data Protection Regulation, 2017). Without the consumer's consent, personal data cannot be collected by organizations, and any act of violation would lead to a huge penalty or fine. Since technology has taken over the business operational activities, implementation of general data protection regulation has become a core element in the functioning of organizational activities globally [11].

2.3. General Data Protection Regulations

The introduction of the European Union's general data protection regulation, which came into effect in May 2018, dealt with applications that processed data collected from individuals to be used by various organizations for enhancing operational activities and finalizing managerial decisions within their organizational environment. The general data protection regulation enables the users or individuals to access data, control, and have rights over personal, relevant data processing. The general data protection regulation and policies have enabled several responsibilities on organizations

that gather and analyze personal data of individuals, transform the raw data into refined technical analysis enabled by artificial intelligence devices and big data analytics giving access to optimize efficiency in the workflow segment of industrial activities [12].

Several authorities are appointed by the regulatory board of the general data protection regulation responsible for taking measures and supervising the usage of personal data accumulated. Suppose organizations fail to comply with the principles and framework of the general data protection regulation. In that case, the penalty may occur, which could affect both the physical environment and the economic environment of the organization [13].

3. Discussion

The research conducted has given a platform to observe several papers related to the topic implication of GDPR on emerging technologies [14]. The secondary data from various research works has helped us to answer and address the research question.

3.1. What Are the Implications of GDPR on Emerging Technologies Specifically Related to Artificial Intelligence Applications?

The digital economy is expanding to a greater extent, as emerging technologies in the digital era create huge volumes of data, useful for developing organizational approaches. To gain a competitive advantage of achieving desired goals and objectives [15]. Various technological advancements such as Big Data Analytics, artificial intelligence, cybersecurity, cloud computing, the internet of things (IoT), VR/AR applications, and blockchain are helping the organization to improve in their supply chain management processing that reflects on the overall development of an organization [16].

Information technologies and their applications are helping the organization to improve and implement management strategies and decisions successfully. As economic activity has taken a huge shift in their operating performances from the traditional approach into a fast-paced globalized platform, the tools and devices used in the applications of the emerging technologies only rely upon collective data and analysis based on digital programming and algorithms, which has encouraged organizations to accumulate, analyze, record, and store huge volumes of real-time data col-

lected from various devices operating throughout the organizational environment [17]. The proper use of these data has proven to be of greater advantage to organizations in making efficient managerial decisions; however, due to the advancement in digital technology, safeguarding and protecting relevant data has become a huge challenge among various organizations, enabling consumers to reveal and disclose personal information [18].

Hence, the GDPR framework focuses on protecting personal data accumulated by Digital technology applications and initiating specific rights to individuals and consumers from a broader perspective. Given below are certain main areas in which the General Data Protection Regulation has a major impact on emerging technologies in the coming future years.

Figure 2 displays a graphical representation of the Implications of GDPR on emerging technologies. The following areas may be discussed below as follows.

Figure 2: A Graphical representation on implications of GDPR on emerging technologies

3.2. Artificial Intelligence

Various organizations use artificial intelligence applications to improve and surpass human functioning, such as understanding, learn, interact with people and machines (Daniel Castro and Joshua New, 2016). Artificial intelligence has proven to be more capable of performing human functions that involve accurate decision-making and quick analyzing of data accumulated and making crucial decisions and future predictions, enabling humans to interact with machines in a new fashion [19].

The GDPR guidelines also emphasize allowing individuals to access personal data and gain ownership and control to make necessary changes in adding or removing data as per their convenience. Many organizations gather data that are very personal as it includes sensitive contents, such as information related to an individual's name, age, gender, address, income, health status, cultural and religious background, shopping pattern, political beliefs, household income, and occupation. Several studies have shown tracking of personal information through apps installed on digital devices used by individuals [20].

Hence, many individuals not comfortable giving out their personal information as the accumulated data, if misused, could affect both the society and the organization resulting in a negative outcome. The regulations of GDPR ensure necessary precautionary measures to be taken to prevent negative outcomes and successful continuation of artificial intelligence applications and their activities involving gathering personal data and enhancing overall organizational activity to improve consumer experience and provide satisfactory results [21].

3.3. Big Data Analytics

Big Data Analytics has proven to be one of the most efficient methods of gathering and analyzing real-time data using various artificial intelligence applications and devices. Organizations are investing many resources to enable big data analytics to be part of the organization's operational activities [22]. Several specialist teams are recruited to study use volumes of data gathered and interpret futuristic scenarios that could influence and affect the organization from its competitors. Data collected through automation applications and processes could create negative results by computing results based on specific patterns; however, it could produce decision-making results more efficiently than a human if carefully monitored. Since big data analytics consists of gathering huge volumes of personal data, the GDPR has laid regulate the framework that ensures organizations safeguard and protect the relevant data gathered. It is home and eradicates process information once it is being used. Several organizations that rely on big data analytics are looking for ways to accumulate data and keep a record for statistical analysis, which can be further used as references for data analysis [23].

3.4. Blockchain Analysis

Blockchain activities affect the overall operational activities, and it is interconnected with each depart-

ment, and providing relevant data is a topmost priority. The data gathered should be consistent over a longer time to perform effectively. The GDPR faces a big challenge in implementing a rigid framework that would enable visibility in personal data accumulation and controlling in every performing activity [24]. Suppose the blockchain users alter the personal data. In that case, it could have a very poor impact on delivering relevant output. The data gathered to analyze would be inconsistent, which will bring difficulty in continuing with the operational activity, as the managerial decision would be incomplete. It could bring about increased costs to operate and continue with the organization's activities.

3.5. Cybersecurity

Cybersecurity frameworks and guidelines have specific requirements as companies can access reliable personal data gathered to understand consumer interests and requirements. Personal data regarding the taste and preference of consumers has greatly influenced organizations in making managerial decisions that turn out to favor the specifications of consumers [25]. Since organizations accumulate personal data on a large scale, the GDPR has said certain guidelines to the cybersecurity of organizations that enable individuals to have control over their data, which are collected by various artificial intelligence applications and processed individuals have access to their data and can also alter and remove information as per their convenience.

GDPR also has given more stress to a specialist that deals with cybersecurity and safeguarding data. Organizations have also invested resources to train and upgrade specific skills required for cybersecurity operational activities that would govern the data gathered to ensure both the company and the public benefit from the data accumulated [26]. However, many individuals are not convinced, as most of the information gathered on a personal level could reflect negatively if not used in the proper channel and reduce customer retention and loyalty towards the organization.

3.6. Cloud Computing

Cloud computing has proven to be an important element in providing a platform for various organizations to accumulate huge volumes of data gathered by artificial intelligence applications and devices and store relevant real-time data that can be accessed at any given time [27]. Cloud computing has enabled

several professionals and data specialists to forecast and predict future changes that could occur by relying on data gathered over time. General Data Protection Regulation guidelines have defined several roles and requirements for data specialists involved in gathering and analyzing personal data. These responsibilities enable certain control over the processing of personal data used by various computing devices to extract information that could help in managerial decision-making. The GDPR guidelines on cloud computing operational activities have set aside specifications dealing with process information, which must be removed or erased after processing the data extracting activity [28]. For organizations operating on a large scale, it will be easy to comply with the GDPR policies. They can invest resources to change and upgrade the technology requirements and be a bigger challenge for smaller organizations.

3.7. VR/AR Applications

One of the fascinating outcomes of digital technologies in the present era is the implementation and use of virtual reality and augmented reality applications and devices that are already used in various service sector domains to enable better efficiency and productivity to help achieve desired results ultimately [29]. Many organizations have implemented the use of the devices, as it is proven to be more effective in comparison with the traditional approaches of delivering content or information.

Since virtual reality and augmented reality technologies rely on relevant data, safeguarding and protecting personal data has become a huge concern, as much of the information collected on a personal level such as age, gender, nationality, marital status, medical records, social records, and job profile, are used to ensure the individual database is creative to understand their needs and requirements better. The GDPR has considered providing users with control of personal data to create a safe environment for accessing personal data and has implemented certain precautions that organizations have to comply with as they continue together personal information that could enhance better organizational interactions among various consumers [30].

3.8. The IoT

The internet of things (IoT) refers to devices that interact with each other through an internet connection using either automated physical inputs that are mostly

used in the information technology industries. the internet of things devices functions by accessing personal information and data such as the name of the individual user, age, gender, physical location, IP addresses, online data, and so forth. The GDPR cannot seek permission for every operation activity done by the devices. It would be impossible to keep an account of every operation in a huge networking activity. GDPR has made it a mandatory function for every organization to keep an account of personal data collected at all times, and should also keep a tab on access to data and permissions granted for its usage to ensure complete control over using of personal data, as information could be missed handled when accessing huge volumes of data. There has been added stress on protecting and maintaining a privacy channel to ensure personal data is secure and risk-free. The GDPR requirements on safeguarding personal data are rapidly increasing as the internet of things devices and technology are advancing from various appliances used by individuals. However, there are several challenges in safeguarding and getting permission for individuals to gather personal information. In consideration of the present digital era, access to personal information can occur within a fraction of a second; hence safeguarding personal data has become an important priority by the GDPR framework interfering with the internet of things and their applications [31].

3.9. Does GDPR Parameters Help Reduce the Misuse of Accumulated Data?

The general data protection regulation is based on certain principles that organizations should follow and carry on with their business operational activity. These principles are different from the organization's basic regulations and rules, which generally become idle and inconsistent over time. These principles that are initiated by the general data protection regulation provide individual consumers with certain rights over their data such as accessing, modifying, and removing relevant information that is monitored and gathered by machines, and if found violated, a impose of up to 4% of the entire accumulated revenue will be charged. On the other hand, organizations also have a greater role in safeguarding the personal data collected through individuals to comply with the rules and regulations of general data protection regulation policies and framework.

Several cases have to identify misuse of personal data gathering to implement preventive measures to avoid huge losses incurred by the organization, which has forced the regulatory body to implement a law specifically dealing with protecting personal data and taking responsibility in identifying and investigating in two organizations that forbid complying with the law. As many organizations are wholly dependent upon digital technologies and personal and relevant data from consumers at large, there is a high risk of misusing data that could be a disadvantage to many organizations if the information is leaked into the hands of their competitors. It has also become a growing concern for too many individuals and public groups as personal information is extracted to benefit manufacturing industries and large-scale organizations that function on a global platform.

In comparison with large-scale organizations, very little acknowledgment is given to small-scale enterprises that function on data accumulated through applications of artificial intelligence technologies and devices. Organizations that function based on technology and Big Data Analytics have to take several measures to protect the privacy of personal data accumulated from individuals. Organizations also must be proactive in following the guidelines and framework of getting personal data. Data protection must be of utmost importance, as the source of data collection from individuals has all the rights of ownership and control over personal information. It is a requirement that every organization takes accountability for the use of data in digital technology and artificial intelligence methodologies.

4. Limitation of the study

The research paper relied on the information collected through secondary data resources.

The broad use of GDPR, in general, was narrowed down to its uses on emerging technologies.

5. Recommendations

Although there are a lot of opportunities to implement GDPR, there are also challenges faced by many organizations in terms of protecting and safeguarding the personal information acquired through various technological applications. Hence organizations should be more proactive in taking certain preventive measures that could benefit the general public and organization decision-making process in providing relevant products and services that could satisfy the needs and requirements of consumers in the economic envi-

ronment. Mentioned below are certain recommendations that could help organizations implement GDPR and comply most effectively [32].

5.1. Safeguarding data

Organizations should focus on adapting to methods and practices that could involve using technology in gathering relevant data and processing real-time information in a secure environment that could enhance companies' decision-making process through the use of personal data accumulation. Organizations also should find out methods that would allow individuals to understand the motive behind gathering personal information by being very transparent with the public. Several Investments should be the channel to ensure the latest technology is being implemented and used to collect relevant data that protect and safeguard accumulated data; however, the effects are visible more on small-scale organizations.

5.2. Gaining Trust

Organizations that deal with customers and commercial activities need to maintain a good relationship with the general public. Most of the decision-making process depends on customers' preferences and requirements. To produce products and services that the consumers expect, it is very important together relevant data on a personal basis to understand and forecast the behavioral patterns of consumers. Several factors influence organizations to gain the consumer's trust by being transparent and honest in performing duties and practices that ultimately help increase the brand image and reputation. When customers gain the organization's trust, they are more than happy to give out personal information and relevant data that could enhance the functionality of the organization's activities.

6. Conclusion

In the future, GDPR will have a major impact on developing future technology used by various organizations to succeed and venture into a sustainable journey. Organizations should comply with GDPR and consider it an opportunity to help achieve favorable results with the use of data derivatives. Organizations that function on a global scale should allocate resources and enable a workforce that analyses personal data and formulate strategies to overcome issues related to GDPR compliance. To gain the trust of consumers and employees, the organization should comply with safeguarding measures to protect personal data used by technology applications in recent years; various organizations have understood the significant relationship between data and technology compilation that have produced desirable results. The role of GDPR and emerging technologies will enhance the overall performance of organizational activities to a greater extent by carefully gathering and analyzing personal data and using relevant data that would be necessary for organizations to improve efficiency that would gain a competitive advantage in the present market environment and the future global economic environment.

Ethical approval

Not applicable

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