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Role of Big Data In Modern Smart Arena

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ABSTRACT: Accumulation and analysis of data is the upcoming trend, which is being supported by the internet. The internet has hugely spread its arena and the devices, as well as objects, are connected through it. The purpose of controlling the data is to know about the patterns and vogue to benefit the various sectors like energy conservation, lifestyle, health, and transportation. Data can only be nurtured fruitfully if it is conjugated with IoT or the Internet of Things, as one is incomplete without the other. The main challenge is to gather information from the devices when it is still under a particular process. However, to understand the connection between them, it is important to understand the importance of Big Data as well as IoT.

KEYWORDS: modern, data, arena, big, smart, IoT, devices, analysis, lifestyle, conservation

I. INTRODUCTION

IoT is a simple concept, where common objects are converted into smarter ones with the help of sensors and chips. The insertion of the digitized objects in the objects will be able to accumulate data from them even if it is not connected to the internet. This process will help in establishing a connection between the digital world and also among each other. IoT has been implemented to track and gather information from those objects to know the usage pattern and also the performance of the product. It is anticipated that by the end of this decade, IoT will be reaching most of the objects that will help in improvising the trend and various aspects of the lives.[1]
Starting from watches to traffic signals and Smartphones to smart homes, IoT will make data processing seamless. Hence, people will enjoy exceptional products and can live in an ambiance that is safer and smarter. With this exponential growth, IoT devices are projected to reach more than 20.8 billion things.[2]

Features of IoT

- High-quality and sensitive data can be gathered.
- The process of collection and storage of data can be pre-determined.
- Privacy is maintained if the situation calls for it.
- Laws are designed to activate when security is breached.[3]

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Big Data

When information is described with the help of veracity, variety, volume, and velocity, then it is termed as Big Data. Veracity is the uncertainty whereas velocity is the speed with which data is captured. Big Data is the composition of a huge amount of data that is an amalgamation of structured same as unstructured data.[4]

Features of Big Data

The features of the Big Data are as follows:

- The amount of data gathered can be controlled.
- The type and nature of data can be selected to get an effective result.
- Analytics and algorithms are used for processing the data.
- Uses inductive statistics to understand the dependencies and relationships of the data.[5]

Relationship between IoT & Big Data

The latest technology demands new hardware and software applications along with a new infrastructure. The firms need to take care of the flowing data to analyze it in real-time. This activity can be proficiently taken care of by the tools of Big Data analytics. It will help analyze the mass of huge flowing data from the IoT devices. IoT and Big Data are the most important part of an industry, in which IoT is utilized to capture data from various sources, which is taken care of by the Big Data analytics to get an insight into the information.[6]

IoT concerns the devices, connectivity, and data. The main purpose of IoT is to create smarter devices that will successfully deliver intellectual insights into those products. It helps in opening a new business prospect. With the onset of numerous smart devices, the intervention of Big Data has become mandatory. It will not only gather proper information but will also capture the data in a particular style. It enables the Big Data analytics solutions to get a prompt result that leads to an accurate extraction.

When data is being extracted, the prime concern is to distinguish between the type of data, that is structured, unstructured, contextual, real-time, dark, images, etc. It is done efficiently with the help of Artificial Intelligence that helps establish a proper connection between smart devices and the digital world.[7]

The motto of the entire process is to extract valuable data from the smart devices to understand the operation, which will help nurture the business in a positive direction. The Big Data technologies need to be augmented to store, capture and manage data from the continuous flowing data from the devices impregnated with IoT chips and sensors.

From the above points, it is clear that IoT and Big Data are interlinked to bring more results. Big data activity will not be complete without IoT and beyond. In simple words, IoT is the impression that is run with the help of Big Data. The fusion of these two aspects will help create a modern world that is smartly connected. The intervention of IoT will accentuate the smarter decision-making process, making the digital world smarter and safer.[8]

II.DISCUSSION

Big data and the Internet of Things (IoT) are two hot topics top of mind for business leaders. Together they have been making a significant impact on companies' ability to capture and analyze data to drive business decisions. In today's environment there are many situations where the Internet of Things and big data work hand in hand with each other. However, they evolved as separate technologies and have some differences as well. Big data has been an evolving concept since the start of the digital age. Used to describe a huge data set that is defined by three characteristics, known as the three Vs— volume, velocity, and variety—big data differs from other data sets by the size (volume), rate of growth/change (velocity) and the variety of structured, unstructured, and semi structured data within the set. 9

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The benefit to having an expansive data set is its potential to hold hidden patterns or trends that are only visible in a set that large. Additionally, it enables a full-picture view.

However, due to the magnitude and complexity of big data, the value comes from being able to analyze this data -- not the data itself -- which can prove to be a challenge. Big data is so large and complex that identifying business value from so much information can't be done through traditional methods for processing and analyzing information. 10

Historically, organizations would have had to dedicate enormous amounts of time, money, and resources to analyzing the data if they wanted to gain any valuable insights from it. Fortunately, due to advancements in computing, big data analytics now makes it possible to combine big data sets with high- powered analytics. The result? Previously unwieldy data sets can now reveal actionable insights. Big data analytics packages huge data sets into a comprehensible format that allows organizations to use them. Additionally, by incorporating technologies like artificial intelligence (AI) and machine learning, more applicable insights can come to light. There are many sources of big data, one of those being data from the Internet of Things (IoT). The Internet of Things (IoT) refers to physical objects connected through shared networks. A variety of sensors gather information and share it across systems that can store, manage, filter, and analyze the data. An IoT device can refer to everything from wearables to medical devices to industrial equipment. 11

The IoT enables companies unprecedented visibility into what is happening across their connected devices in real time. A vast amount of real-time data points are collected from connected IoT devices and transferred across the internet for storage and analysis. IoT and big data have many overlapping components, and IoT is considered a major source of big data.
However, they were developed independently of one another. As the volume of IoT-generated data increased to the point that conventional storage and analysis methods became inefficient, big data and IoT become more and more interrelated. 12
In the current environment, the complex data and information gathered by IoT devices can be considered a big data set being gathered in real time. Big data storage and analytics currently help to make sense of the plethora of those real-time data points and provide helpful insights.

To sum up the relationship at a high level: A network of devices equipped with electronics and sensors (connected devices) send real-time information to the internet (IoT), where it is compiled and stored into vast data sets (big data) and analyzed to find useful patterns (big data analytics). Big data analytics help to make sense of the data and information that is gathered by IoT devices. These solutions take the vast, unstructured data that's been collected, and identify ways to organize it into smaller data sets that can give companies insights into how their processes are working, as well as improve decision-making.
Big data analytics can provide different types of insights when used with the IoT; namely, descriptive analytics, diagnostic analytics, predictive analytics, and prescriptive analytics. Descriptive analytics gives insights into how a connected device is performing in real time. It can be used for anything from locating a connected device, to understanding how that device is used by costumers, to identifying anomalies. 13
Diagnostic analytics gives insights into the "why" behind descriptive analytics. For a particular connected device, it can help organization understand why it is running in a certain way or why it is producing certain outputs.
A very applicable use of big data in IoT is in predictive analytics. This type of analytics utilizes machine learning by analyzing past data and producing probabilities for how the device will function in the future. This is especially beneficial when it comes to the servicing of IoT devices. Using this technology, organizations can anticipate failures or servicing needs before the device stops working.
Lastly, big data is used in IoT for prescriptive analytics. This type of analysis gives insights into how to impact things that have been observed or predicted. Challenges in IoT with big data analytics14

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Data visualization
Data visualization is an important aspect of IoT analysis, aiding in the ability to identify key trends. Data visualization is needed to properly identify and convey the best data insights that can be used to drive business decisions. The data generated by IoT devices is heterogeneous, meaning it comes in a variety of formats: structured, unstructured, and semi structured. While in theory visualizations of data should make it easier to understand trends, when the data comes in so many different formats, a method of visualization becomes more difficult. 15

Data storage and management
Big data continues to grow at an exponentially high rate. As they are today, big data storage systems have a limited amount of space, so it is becoming a significant challenge to manage and store such a large amount of data.
Solutions for IoT and big data analytics
Big data and the Internet of Things will continue to evolve and play a significant role in an organization's ability to make decisions. Explore PTC's analytics solutions that are making it easy to turn raw data into valuable insights.16

III.RESULTS

The emergence of Big Data has added a new aspect to conceptualizing the use of digital technologies in the delivery of public services and for realizing digital governance. This article explores, via the 'value-chain' approach, the evolution of digital governance research, and aligns it with current developments associated with data analytics, often referred to as 'Big Data'. In many ways, the current discourse around Big Data reiterates and repeats established commentaries within the eGovernment research community. This body of knowledge provides an opportunity to reflect on the 'promise' of Big Data, both in relation to service delivery and policy formulation.[17] This includes, issues associated with the quality and reliability of data, from mixing public and private sector data, issues associated with the ownership of raw and manipulated data, and ethical issues concerning surveillance and privacy. These insights and the issues raised help assess the value of Big Data in government and smart city environments. The deployment of Big Data technologies and practices is assessed through the lens of the 'value chain' and the value chain conceptual model is utilized as a vehicle to aid understanding and to highlight critical issues and points of interest.[18] It is argued that many of the Big Data challenges in modern urban environments are the result of a technocratic understanding of governance, the emergence of technologically mediated surveillance practices and conflicting practices and norms embedded in the distinction between the public and private sectors. Furthermore, the value chain approach used here highlights the different challenges that appear at different points of the chain, the differentiated role of actors in the process and how in the smart city digital sphere the public and private sectors are intimately meshed together.[19]

Following this introduction, the next section sets out contemporary definitions of the 'Big Data' and 'smart city' concepts and seeks to align them to the research direction of the article. The subsequent section presents the value chain model and establishes its usefulness as an analytical tool for distinguishing between different stages of Big Data use. The penultimate section explores systematically each link of the value chain, as applied to Big Data in a smart city context, thereby allowing pertinent issues and challenges to be identified. In doing so, the value chain operates as a 'road-map' for reviewing the extant literature. Finally, the last section offers up some concluding comments and considers the future governance of Big Data, especially in relation to smart cities where new hybrid public–private spheres of activity are emerging.[20]

In the commercial arena the value chain analysis enables the analyst to identify the sequence of organizational activities which contribute to the achievement of objectives. These value generating activities occur at different points in a production process. They are seen to 'add value' in that they generate financial assets, knowledge assets, information assets, expertise and skills which help the organization to achieve its ultimate goals.[21] For Porter, this 'goal' is the endpoint of the value chain,

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where value is experienced, with value defined in terms of the benefits accrued from consumption of the good or service. In a public service context, the value chain analysis can also be used to identify chains of related activities that interconnect in the delivery of policy and services.[22] This chain could involve government agencies, public service providers, private contractors and service users. Here value is multidimensional in that it is perceived to be both the value realized by the service user, the immediate consumer, and also society more broadly. In the smart city context, the beneficiary of value is further complicated by new delivery mechanisms involving public service providers and commercial partners. This raises issues about the control, ownership and access to data, and whether value is privatized by commercial interests or retained by society via public agencies. Furthermore, the complexity of the public policy and service environment also points to another way in which the value chain analysis can be seen to be assisting with value creation. This is because many public service agencies are looking to tackle challenging 'wicked issues' which cut across service domains. Examples include deprivation, crime drugs and employment, all of which require multi-agency responses.[23] Here, it is argued that there is a procedural value, which may be unquantifiable, in bringing these agencies together in a partnership scenario to collaborate in finding policy and service solutions, with the ultimate goal of realizing better services which benefit the consumer and society . In a public service context value is therefore multidimensional, not necessarily easy to quantify, and realized by both service providers and users.[24]

The value chain analysis can also be used to diagnose problems, blockages or failures, those organizational activities which are impeding the creation of value, in both the public and private sectors. By breaking down the production process into a series of linked activities it becomes easier to identify when one of the links in the chain is not erforming adequately, creating problems or is hindering the creation of value. In essence this is how the value chain analysis is being used in this article, as a vehicle to identify the actors, organizations and activities that form the links in value creation in order to highlight specific problems that are evident in individual links, but which are less easy to identify in the broader process. [25]

IV.CONCLUSIONS

The value chain approach applied in this article illustrates that the challenges of Big Data practices in smart city contexts differ depending on the stage of the value chain. In this respect, it is a useful analytical tool which can be used to unpick data analytics in urban contexts. Importantly, issues around privacy are prominent throughout the whole process and should be central to all discussions about extending Big Data processes. Moreover, what this review also demonstrates is that the different concerns have little to do with technological maturity or technological capability. It is not just the technology that causes concern, it is the naïve belief that the technological advances are neutral and disregard political, social and economic institutions and norms.[26]

The application of the value chain to the use of Big Data in smart city contexts highlights the intimate intertwined relationship between commercial and public sector entities. The new digital sphere includes both hybrid data processes and the merging of values, processes and institutions. The binary public–private divide no longer exists and public service and policy outcomes are the result of the interaction of multiple organizations with competing motivations and values. The extent to which 'value' can be created for all parties without detriment to the other seems unlikely, given the challenges raised in this article.[27]

Interestingly, the value chain approach highlights a range of issues and challenges at every stage or link in the process, especially where the value chain relates to a governmental or smart city context. The challenges described in this article are not meant as an argument to reject the potential of data analytics in smart cities. Rather, they point to the need for recommendations and strategies for managing the Big Data revolution in the public interest. The application of Big Data processes in smart city contexts take place in a highly fragmented space where public and private actors are assumed to collaborate and harvest value from the data, in order to deliver better public services and policy. To some extent this space is

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already well regulated, by data protection laws, intellectual property rights and data sharing protocols – but there are some significant gaps in relation to responsibility and accountability. Rather than advocating more formal regulation of this new sphere, where the public and private sectors are intimately meshed together, which may or may not be effective, attention could be focused on areas and practices which could be improved, which in turn could lead to more 'value' being extracted from Big Data whilst at the same time protecting and enhancing core public values.[28]

First, one of the underlying themes of this review is how in a smart city context both public and private sector actors interact to constitute the foundation and infrastructure of the smart city. While many smart city applications have proven that the technical challenges can be overcome, the real issues are how to deal with organizational differences, governance and legal issues. This is not just a matter for the local actors in the smart city, but also for regional/provincial, national, and in some cases transnational, bodies of governance. Formal national and transnational regulation is likely to emerge in the longer term, but would take many years to be formed and constituted. What is needed are some basic minimum agreed self-regulatory principles concerning: (a) the quality standards of data to be used in the smart city; (b) the ethical standards regarding privacy and data protection; (c) a clearer policy regarding the ownership of unstructured and structured data; and (d) agreed standards regarding safety and protection of storing of data. These should be based on voluntary agreements between local/city governments and main commercial actors, preferably under the auspices of some privacy 'watchdogs' such as information/privacy commissioners.[29]

Second, the discourse around Big Data analytics and smart cities needs to move beyond the speculative and technological determinist space of science fiction and into a discussion about the future of urban spaces and how data analytics can be used effectively in complex urban environments. To date, most of the hyperbole around Big Data and smart cities has distorted political decisions rather than being supportive of the policy process. This is more an issue of the maturity of the discourse as opposed to the maturity of the technology itself. It took eGovernment roughly 10 years to abandon the utopian space in favor of a more 'sober', and perhaps more mundane, discussion about modern forms of public sector online service delivery. Here, the aspiration is that it will not take as long for discourses about Big Data and smart cities to become more critically realistic. The argument here is not that Big Data is fatally flawed, rather that it needs to be understood in its institutional environment, alongside its impacts and consequences, if individual and societal value is to be realized. Such critical realism highlights the socio-technical integration of Big Data practices and how these are operationalized in a smart city context. In other words, the true value of Big Data cannot be solely understood in technical or commercial terms and is closely aligned to other organizational and institutional practices.[30]

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