ISSN (Online): 3007-1038
Pages: 24–36
DOI: 10.62997/rl.2025.41022

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Big Data Analytics Impact on the Growth & Development of Entrepreneurship in Pakistan

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Abstract: This study explores big data's impact on the growth and development of entrepreneurship in Pakistan. The study aims to determine how entrepreneurs in emerging economies like Pakistan benefit from using Big Data analytics in their quest for sustainable economic growth and development, identify challenges, and proffer solutions. An explorative approach is adopted in this study because much of the knowledge about Big Data is still in its early stages. Empirical information was collected from government publications, journal articles, conference proceedings, and books. The study concluded that Bid Data analytics has a significant positive impact on the growth performance of entrepreneurs. Equally, the study found that adapting and using Big Data analytics leads to entrepreneurial opportunity recognition and exploitation. Finally, it is recommended that entrepreneurs evolve, adopt, and use Big Data in their enterprises to achieve rapid growth and sustained development in their businesses, resulting in sustainable economic development in Pakistan.

Key Words: Big Data, Analytics, AI, Entrepreneurship, Uber, Khadi, Netflix, Pakistan

Introduction

Big Data technology has become a hot subject matter in recent years. Businesses in every industry collect, store, and process ever-increasing amounts of data. With the widespread availability of data tools spanning both macroeconomic and behavioral dimensions and the vital role of information as a critical factor of production, a continuous flow of innovative business ideas will persistently emerge and undergo rigorous testing. Big Data is a cutting-edge technology that can digitally store vast amounts of data and aid in computer analysis to uncover patterns, trends, correlations, and discrepancies, according to Haleem et al. (2020). A massive surge of new businesses will be ushered in by this continuous cycle, which has the profound ability to fundamentally alter the reality of production and the structure of different industries and activities in the marketplace.

Researchers, Business leaders, policymakers, and government agents have observed that the world is currently data-driven. According to Kobayashi et al. (2018), businesses must leverage big data to compete consistently. Hence, having the highest quality information is a condition that may allow the birth of entrepreneurs and the growth of activity or profits. More than ever, one should consider these points in the context of the availability of tools and databases that allow the development of Big Data and the absence of a theoretical model on relations between entrepreneurship, information, and productivity. There are many definitions of Big Data, but interestingly enough, most definitions refer to it in terms of volume, variety, and velocity, with the so-called three "Vs.". As barriers to entry continue to diminish, entrepreneurs from all corners of the globe can now access the resources and information necessary to transform their innovative ideas into successful ventures (Seseni & Mbohwa, 2021).

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Citation: Shahzad, K., Siddique, F. U. H., & Tariq, I. (2025). Big Data Analytics Impact on the Growth & Development of Entrepreneurship in Pakistan. *Regional Lens, 4*(1), 24-36. https://doi.org/10.62997/rl.2025.41022

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According to the Entrepreneurship and Big Data report (2019), the term "entrepreneurship" was first used in the Middle Ages to mean "someone who performs tasks in projects like buildings, construction, and the likes by using all the resources he had. " However, the word entrepreneur was Initially used in the Middle Ages; the term "entrepreneurship" referred to "someone who performs tasks in projects like buildings, construction, and the like by using all the resources he had." However, Cantillon defined the term "entrepreneur" as "a person responsible for undertaking a business venture" in the 17th century, giving it its current definition. It gained its present form in the 17th century, as Cantillon described it "as a person responsible for undertaking a business venture" (Thorton, 2019). The increasingly interconnected nature of the global economy, enabled by advancements in technology and communication infrastructure, further fuels the expansion of this entrepreneurial phenomenon. The expansion of the entrepreneurial phenomenon is a global force that shows no signs of slowing down. Enabled by technological advancements, driven by a desire for innovation, and fueled by a diverse range of individuals, entrepreneurship can reshape industries, drive economic growth, and address societal challenges. As the world continues to evolve, so will the entrepreneurial landscape, paving the way for a future defined by creativity, resilience, and endless possibilities (Kashyap & Kashyap, 2022). With that context comes a need to help entrepreneurs understand what big data is, how it is relevant to their business, and what kinds of technology they may want to consider in their support.

Artificial Intelligence (AI), which Prüfer & Prüfer (2020) define as "a concept in which machines mimic cognitive functions of learning and problem-solving," is another ground-breaking innovation. The current "second machine age" is propelled by data and artificial intelligence, in contrast to the industrial revolution primarily propelled by coal and steam (Obschonka & Audretsch, 2019; Di Vaio et al., 2020). Azam and Ahmed (2023) highlighted the adoption of big data analytics to achieve sustainable growth of libraries in higher institutions in Pakistan. The study concluded a strong relationship between social influence, expected performance, and effort expectancy on the behavioral intention to adopt big data analytics. Latif et al. (2018) talked about the new tool of big data in Pakistan; the study suggested that for an innovative ecosystem, the promotion of big data analytics is essential for which investment and development are required. The government of Pakistan has accepted the policies of big data analytics and recommended developing this eco-friendly system. Qaiser and Fatima (2024) identified the relationship between alertness, exhaustion, and significant data intervention in healthcare enterprises. The study concluded that awareness and usage of big data have a substantial positive relationship with an enterprise's performance.

Statement of Problem

In today's digital era, sophisticated tools and expansive databases have revolutionized how entrepreneurs gather, analyze, and utilize Big Data to drive their ventures forward. However, despite these vast resources, there remains a significant gap in our understanding of the complex interplay between entrepreneurship, information acquisition, and productivity. Researchers, policymakers, and business leaders must collaborate to establish a theoretical framework that elucidates the multifaceted relationships between these pivotal factors. Doing so can foster an environment conducive to entrepreneurial success, economic growth, and societal progress.

In the global arena, according to Columbus (2018), the big data market is expected to grow at a Compound Annual Growth Rate (CAGR) of 10.48%, from $42 billion in 2018 to $103 billion in 2027. Similarly, according to New Vantage Venture Partners, Big Data offers businesses the greatest value by lowering costs (49.2%) and opening up new opportunities for innovation and disruption. Algorithms allow for hundreds of dimensions of information, but the human brain can only handle two or three. As a result, data science could use association, categorization, and data clusters to extract valuable information (Prüfer & Prüfer, 2020). In 2018, 2.5 quintillion bytes of data were generated daily, with an average of over 40,000 Google searches occurring per second, or 3.5 billion searches daily. With the growth of the Internet of Things (IoT), this pace will only accelerate (Marr, 2018).

Although a new research endeavor, Big Data adaptation and usage has been identified by Pakistan entrepreneurs as the new prosperity path. However, despite efforts made in that regard, not much has been obtained from its enormous potential and benefits. On the above premise, a study of this nature is profound.

Purpose of the Study

The study aims to examine how businesses in emerging economies might profit from the use of big data and identify obstacles they face when utilizing big data tools and technology. Specifically, an attempt is made to design a theoretical framework that will help foster an environment conducive to entrepreneur success through the use of Big Data.

Objectives of the Study

The objectives of this study are,

- To determine the impact of Big Data on entrepreneurship growth performance in Pakistan.
- To identify the benefits, limitations, and challenges confronting entrepreneurs in Big Data usage
- To proffer solutions on effective ways of harnessing the benefits of Big Data by entrepreneurs.

Literature Review

The literature reviewed in this study cuts across the concept of Big Data in entrepreneurship growth and development, the role of entrepreneurs in utilizing Big Data, and the challenges and suggested solutions to the use of Big Data by entrepreneurs in Pakistan.

Concept of Big Data in relations to entrepreneurship growth and development

Ahmadi et al. (2016) assert that "Big Data" lacks a consensus definition. Volume (high volume – number of data), velocity (high velocity – speed of data), and variety (variety – diverse data generated) are the three keywords that emerge from the several definitions that are accessible. Accordingly, Big Data can be summed up as numerical data produced in large quantities, quickly, and in various ways. Big Data refers to extensive and complicated data sets inefficiently handled by conventional data processing tools and techniques. These data sets can be semi-structured (like XML files), unstructured (like social media posts or videos), or structured (like databases). The term encompasses not just the volume of data but also the data's variety, velocity, veracity, and value.

The equation representing big data is simple to remember: Big Data equals data as raw material, multi-structured data, and new and innovative technology. i.e.

$$BD = RD + MSD + NIT$$
$$\pi = \emptyset + \beta + \delta$$

In its inception, Some businesses and entrepreneurs saw big data as a threat, but when new technology emerged, it started to work in their favor. Its reach could be found in every part of the commercial world, either directly or indirectly. Any type of data, including text messages, images, videos, blogs, reports, multimedia content, digital traces, swipes across websites, mobile reading preferences, time spent on each page, omitted sections, likes on social media, or anything else related, is scanned by data analysts to produce insightful information (Batistič & van der Laken, 2019).

Recent advancements in digitalization and the Internet of Things (IoT) have fuelled the exponential growth of data in various industries. The availability of Big Data has become paramount for companies, pushing them to explore and comprehend its immense potential. It has been observed that entrepreneurs who effectively harness the power of Big Data not only outshine their competitors but also experience a multitude of advantages. These advantages range from increased profitability and enhanced operational efficiency to improved customer satisfaction, amplified retail value, refined decision-making processes, heightened productivity, accelerated revenue growth, and optimized asset utilization (Bormida, 2021).

One of the benefits delivered by Big Data to entrepreneurs is that it enables them to make better data-driven decisions, thereby revolutionizing their operations and strategies to stay ahead in the competitive market. However, questions about privacy regarding Big Data and the Big Data operating model leave some people concerned about whether Big Data is everything it is thought to be. Entrepreneurs should be clear regarding the critical questions they need to address, the extensive benefits they deliver, and the state of their readiness to confront the ever-growing Big Data wave (Bormida, 2021). Entrepreneurs should also be crystal clear about the robust and well-defined methodology

for their Big Data projects, ensuring maximum efficiency, accuracy, and success in leveraging the power of Big Data to drive growth and innovation. With the exponential growth of data, Big Data has become an indispensable asset for organizations aiming to remain at the forefront of their respective industries. As technology advances, Big Data will continue to evolve, presenting new opportunities and challenges for organizations worldwide.

The Role of Entrepreneurs in Utilizing Big Data

Entrepreneurs, pioneers of innovation, play a pivotal role in unlocking the actual value of this data resource. With their unique ability to uncover hidden patterns and untapped potential, entrepreneurs possess an uncanny knack for transforming raw data into unprecedented business opportunities. Through their unwavering commitment, entrepreneurs tirelessly evaluate the viability of new business ideas, consistently spotting remarkable prospects within the vast expanse of data. While large companies have made substantial investments in data analysis, the entrepreneurial spirit enables individuals to perceive invaluable insights and seize upon them, even in the face of fierce competition.

Entrepreneurs increasingly want to know as much as possible about potential business opportunities for an informed decision. This goes from knowing almost everything about the people making suggestions as new employees to knowing everything about those making purchase decisions. To that effect, various databases are bought from which the information can be monitored (Guo et al., 2016). However, the possibilities of using data do not stop here. The data can also be seen as opportunities for new business ideas, typically the entrepreneur's role, i.e., people who actively seek opportunities for new business ideas.

Data is rarely viewed as an opportunity in itself on a firm level. A data-based marketplace emerged, enabling new entrepreneurial business possibilities independent of all these databases. In short, big data-based entrepreneurs see databases as opportunities in them, i.e., something more than cheap information. Typically, the acquisition of data in, for example, the stock market is time-critical, thus implying a strong emphasis on the time dimension of the risks in acting on opportunity information. Big data-based opportunities can enable new business possibilities that no one else can see. From an operational point of view, such opportunities can enable new business possibilities that can only be seen by someone persistent in exploring by chance.

Imperatives of Big Data for entrepreneurs in developing countries.

Enhanced Decision-Making: In today's rapidly evolving business landscape, making informed decisions is crucial for entrepreneurial success. Big Data offers a plethora of benefits in terms of enhanced decision-making. By leveraging advanced analytics and data visualization tools, entrepreneurs can gain valuable insights from large and diverse data sets. These insights enable them to identify patterns, trends, and correlations that might have gone unnoticed. Armed with this information, entrepreneurs can make data-driven decisions that are more accurate, timely, and aligned with their business goals. Whether it's optimizing operational processes, identifying potential customer segments, or exploring new market opportunities, big data is pivotal in empowering entrepreneurs to make informed and strategic decisions.

Improved Customer Understanding: Understanding customers is at the heart of any successful business. Big Data gives entrepreneurs a treasure trove of information about their customer's preferences, behaviors, and needs. Entrepreneurs can gain deep insights into their target audience by analyzing vast amounts of customer data, such as purchase history, browsing patterns, social media interactions, and demographic information. These insights enable entrepreneurs to personalize their marketing strategies, tailor their products or services to meet specific customer demands, and offer a seamless customer experience. By leveraging Big Data, entrepreneurs can build stronger customer relationships, enhance customer satisfaction, and ultimately drive business growth.

Efficient Operations and Resource Management: Efficiency is a critical factor in ensuring the long-term success of any business. Big Data offers entrepreneurs valuable tools to optimize their operations and resource management. Entrepreneurs can identify bottlenecks, streamline processes, and improve efficiency by analyzing operational data. For example, in industries like manufacturing or logistics, Big Data analytics can optimize supply chain management, reduce

inventory costs, and minimize delivery times. Furthermore, predictive analytics can help entrepreneurs anticipate maintenance needs, avoid costly downtime, and ensure the seamless functioning of machinery and equipment. By harnessing the power of Big Data, entrepreneurs can enhance operational efficiency, reduce costs, and maximize their resource utilization, thereby gaining a competitive edge in the market.

Competitive Advantage through Data-Driven Innovation: Innovation is key to staying ahead in today's competitive business landscape. Big Data opens up new avenues for entrepreneurial innovation by providing insights and opportunities. Leveraging advanced analytics allows entrepreneurs to uncover hidden patterns, emerging trends, and untapped market segments. This knowledge allows them to identify gaps in the market and develop innovative products, services, or business models to cater to evolving customer demands. Furthermore, Big Data enables entrepreneurs to test and validate their ideas through rapid prototyping and iterative feedback loops. By embracing data-driven innovation, entrepreneurs can differentiate themselves from competitors, capture new market spaces, and drive disruptive growth.

Challenges and Limitations of Big Data Usage by Entrepreneurs and Suggested Solutions.

Big data must be handled carefully, with an awareness of the different sources of its complexity and the limitations it entails, which include the price and quality of Big Data, revenue and value extraction, social norms, and the need to address economic, social, and ethical concerns, as well as the formulation of suitable policies to encourage innovation and adoption of Big Data. Big Data works cooperatively with data mining to handle large data sets by allowing new types of data to be explored.

According to Seseni & Mbohwa (2021), in today's digital economy, data is considered the "new oil," and entrepreneurs are keen to tap into this resource. However, the challenges of working with Big Data can be significant. For most entrepreneurs, overcoming these obstacles is crucial for effective decision-making and competitiveness. Below are some key challenges entrepreneurs face when dealing with Big Data and suggested solutions.

Data Volume and Storage: One of the most prominent challenges entrepreneurs face is managing the volume of data. They often have limited infrastructure or resources, which makes storing and maintaining data difficult. The amount of data generated from social media, customer interactions, website traffic, and IoT devices can be overwhelming, requiring expensive storage solutions and robust management systems. A significant solution to problems of this nature is Cloud storage options like AWS, Google Cloud, or Microsoft Azure, which offer scalable solutions but come at a cost.

Data Complexity and Integration: Big Data is not just large; it is complex. Hence, entrepreneurs often have to deal with various data formats (structured, unstructured, semi-structured), making integration challenging. Data from different sources, such as customer databases, market analytics, and internal operations, can complicate analysis. A likely solution in this regard is that data integration platforms and middleware can help combine different datasets, but they often require specialized knowledge to implement effectively.

Data Quality and Accuracy: Another major hurdle is ensuring data quality. This is because poor data (whether it is incomplete, outdated, or incorrect) can lead to faulty analytics and misguided business decisions. For entrepreneurs, maintaining data accuracy is critical but resource-intensive. The way out of such problems is for entrepreneurs to invest in data cleaning and validation processes, possibly using automation tools to reduce errors.

Lack of Expertise. Big Data analytics requires a unique skill set, including proficiency in data science, machine learning, and analytics software. Entrepreneurs may not have access to this expertise, making extracting valuable insights from the data difficult. Entrepreneurs should consider hiring data scientists or outsourcing to third-party analytics providers as a way out.

Privacy and Regulatory Compliance. Handling Big Data also comes with legal and ethical responsibilities. Entrepreneurs must navigate complex data privacy regulations like the Pakistan Data Protection Act (DPA). Failing to comply can result in severe penalties. The answer to regulation issues is that entrepreneurs must be vigilant in setting up systems that ensure compliance with data protection regulations. This often requires legal consultation and investment in secure data-handling practices.

Real-Time Processing and Decision Making. For entrepreneurs, especially in competitive markets, real-time data processing is essential for quick decision-making. However, traditional data processing methods often cannot efficiently handle real-time data analysis, leaving some entrepreneurs disadvantaged. As a way out, real-time analytics platforms like Apache Kafka or Spark Streaming can help.

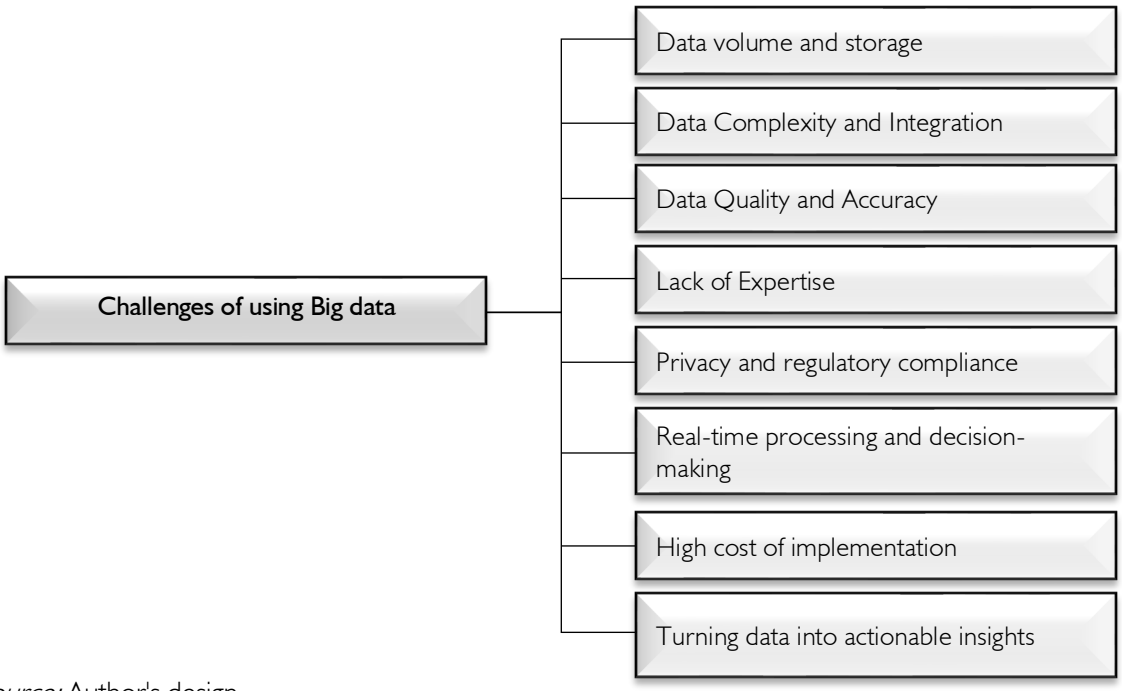
High Costs of Implementation. Big Data requires investment in software, hardware, and skilled personnel. These costs can be prohibitive for entrepreneurs, who often work with limited budgets. In this regard, entrepreneurs should balance the potential value of Big Data and the financial resources available. Open-source tools and gradual scaling may offer a more cost-effective approach.

Turning Data into Actionable Insights. Collecting and analyzing data is just the first step. The real challenge is turning that data into actionable insights to drive entrepreneurship growth. Many entrepreneurs struggle to derive meaningful insights from large data sets, leading to analysis problems. A cardinal solution uses business intelligence tools (like Power BI or Tableau), which can help visualize data and make it more digestible.

Understanding which data points are relevant and actionable requires strategic thinking and domain expertise. The diagram below sums up the challenges entrepreneurs face when using big data.

Figure 1

Challenges of Big Data usage by entrepreneurs



Source: Author's design

Methodology

An exploratory methodology is used to achieve the objectives of the study. It is better to apply an exploratory research design when many phenomena are unknown about the subject; an exploratory study is appropriate. This kind of research can be qualitative and involve a desk review. While qualitative data can be found in government publications,

journal articles, conference proceedings, online articles, and other sources, exploratory research typically relies on secondary data from literature, informal discussions, interviews, case studies, focus groups, and projective methods.

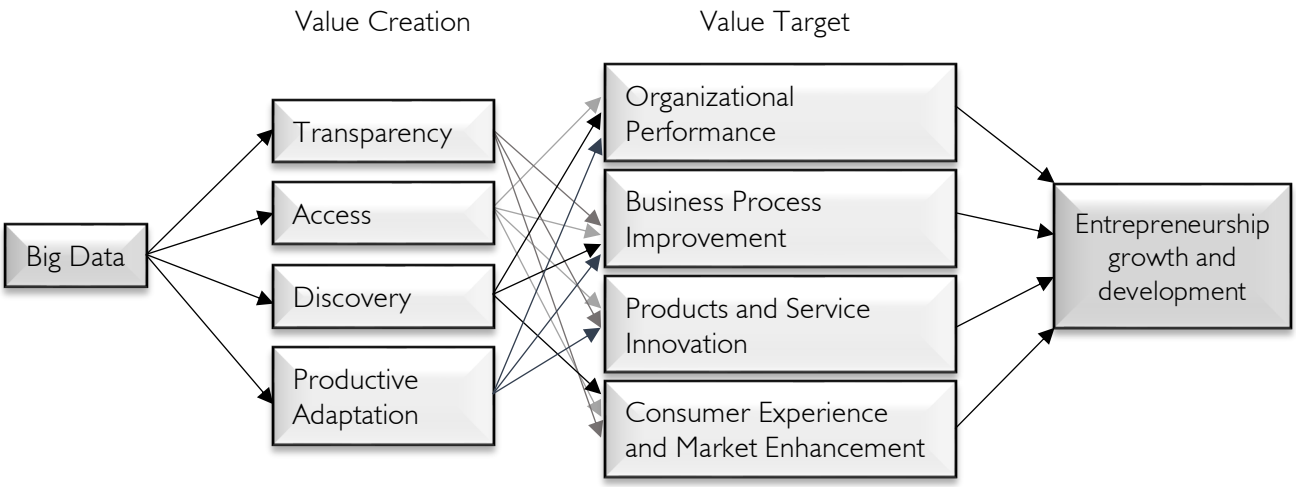
Data for this study came from government documents, conference papers, and journal articles. The author studied journal and conference publications for the newest peer-reviewed work. The author restricted the search to articles no more than five years old. Data collection was limited to articles published between 2020 and the present. The goal was to find contemporary answers to an existing issue. The Emerald, EBSCOhost, and Elsevier databases were consulted to locate high-quality articles. Table 1 lists the factors (variables) that were examined, the titles of the publications that reported the findings, the author or authors, and the year the studies were published.

Table1

SN	Variables	The Authors	Books/Journal Title
1.	Big Data and Entrepreneurship Innovation	Shahid, & Sheikh (2021)	Impact of Big Data on innovation, competitive Advantage productivity, and decision making. Literature review.
2.	Big Data and Entrepreneurship Productivity	Shahid, & Sheikh (2021)	Big Data's effects on competitive advantage and innovation Decision-making and productivity. Review of the literature.
3.	Big Data and Entrepreneurship Efficiency	Doaa et al (2023)	The impact of Big Data analytics on investment efficiency and financial performances: Evidence from Saudi Stocks market.
4.	Big Data and Entrepreneurship Financial Performance	Doaa et al (2023)	The impact of B. D analytics on investment efficiency and financial performances: Evidence from Saudi Stocks market.
5.	Big Data and entrepreneurship decision making	Shahid, & Sheikh (2021) Shesadri et al. 2023	Big Data's effects on competitive advantage and innovation Decision-making and productivity. Review of the literature. Evaluating how big data analytics affects firm performance, forecasting, and decision-making. Social transformation and technological predictions Assessing the impact of big data analytics on decision-making, forecasting, and firm performance. Technological forecasting and social change 196(122824)
6.	Big Data and Entrepreneurship Dynamic pricing	Guizzardi et al. 2021 Steinberg (2020)	Big Data from dynamic pricing: A Smart approach to tourism demand forecasting 37(3) 1049-1060 a and Personalized Pricing
7.	Big Data and Entrepreneurship Management	Taung & Xie (2024)	Big Data on Inventory Management: Procedure of the 9th Int'l Conference on Engineering Management & the second forum on modern logistics and supply chain management (1-ICEM – MLSCM) pp 141-148 Atlantic press
8.	Big Data and Security	Koo, et at (2020)	Security and Privacy in B.D life cycle. A survey and open challenge. Sustainability 12.10571 DOI:16.3390/Sui12241057l
9.	Big Data and Entrepreneurship Growth	Nupur & Ankur (2022)	Ecosystem for Entrepreneurship in a Big Data-Driven Universe.

Source: *Author compilation*

Theoretical Approach to the Impact of Big Data on Entrepreneurship Growth



Source: Adapted from Guangming et al. 2021

Some successful entrepreneurship ventures that have effectively utilized Big Data:

Uber: Revolutionizing Transportation with Data

This transportation outfit was founded in 2009, and it has disrupted the traditional taxi industry by leveraging Big Data and mobile technology. It connects drivers and passengers through its mobile app, using real-time data for dynamic pricing, route optimization, and service efficiency. Pakistan entrepreneurs have also evolved similar taxi apps such as Uber, Careem, Bykea, and inDrive.

Advantages of using Big Data by Uber & Careem

- Dynamic Pricing (Surge Pricing): Uber and Careem use real-time demand and supply data to adjust ride prices dynamically. This helps manage demand during peak hours and ensures that riders can access drivers.
- Route Optimization: Uber and Careem collect data on traffic patterns, rider and driver locations, and weather conditions to suggest optimal routes for drivers, reducing both travel time and fuel costs.
- Customer Insights: Uber and Careem leverage customer data to analyze preferences, improve user experience, and suggest new services, such as UberPool and Uber Eats, based on demand patterns.

Result/effect: Careem's ability to collect and analyze vast amounts of data allowed it to scale rapidly, disrupting the taxi industry globally and growing into a multi-billion-dollar company.

Netflix: Personalizing Entertainment with Big Data

This entertainment outfit was originally a DVD rental service, but it has been transformed into a leading streaming service by using Big Data to deliver personalized content recommendations to its users.

Advantages of using Big Data by Netflix

- Personalized Recommendations: Netflix's recommendation engine collects and analyzes user data, including viewing history, ratings, and search queries. This data helps create personalized suggestions, increasing viewer engagement and retention.
- Content Creation: Big data also informs Netflix's original content decisions. By analyzing user behavior and preferences, Netflix decides which types of shows and movies to invest in. For example, data insights played a significant role in creating hits like *House of Cards*.
- User Experience Optimization: Data helps Netflix optimize user interfaces, reduce buffer time, and provide a seamless experience across devices.

Result: Netflix's ability to harness Big Data for recommendations and content decisions has driven its exponential growth, with over 277.68 million subscribers globally as of 2024.

Gul Ahmed & Khadi: Optimizing Fashion Retail with Data

Gul Ahmed & Khadi, a global fashion retailer, has successfully integrated Big Data into its supply chain, allowing it to stay ahead of fashion trends and swiftly meet customer demand. Similar fashion houses in Pakistan are Daraz, Alkaram, Limelight, and Sapphire.

Advantages of using Big Data by Gul Ahmed Khadi

- Inventory Management: Gul Ahmed & Khadi Brands uses real-time sales data to optimize inventory management. It tracks what customers buy in each store, adjusting stock and production accordingly to prevent over-stocking or under-stocking.
- Trend Prediction: Data from online and in-store transactions, social media, and customer feedback help Gul Ahmed and Khadi identify emerging fashion trends. This data-driven approach enables Zara to design, produce, and ship new collections in as little as '15' days.
- Pricing and Promotions: Gul Ahmed and Khadi use Big Data to analyze market trends and customer behavior, allowing it to optimize pricing strategies and offer targeted promotions that drive sales.

Result: As a result, with data-driven decision-making, Khadi has become a leader in the fashion industry, allowing it to respond to market trends faster than its competitors and maintain profitability.

The above case studies highlight how entrepreneurs across industries have utilized Big Data to innovate, optimize operations, and scale their businesses. Each company leveraged data to understand its customers better, enhance operational efficiency, and drive business growth.

Future Trends and Opportunities in Big Data for Entrepreneurs to Explore

Great opportunities abound in Big Data, especially for developing countries such as Pakistan. According to McRae et al. (2024), such future trends and opportunities include;

1. **Edge Computing and Real-Time Analytics:** This new trend means that as IoT devices and innovative applications proliferate, data needs to be processed closer to where it is generated (e.g., sensors and autonomous vehicles). This reduces latency and bandwidth issues. The identified opportunity for entrepreneurs is to develop platforms and services specializing in edge data processing and real-time analytics for industries like healthcare, logistics, and smart cities.

2. **AI-Driven Data Automation:** Entrepreneurs need AI tools to automate data collection, cleaning, and analysis as data sets grow in volume and complexity. Opportunities abound in this area because entrepreneurs need to build AI-based solutions that can automatically prepare, analyze, and generate actionable insights from Big Data, which can help them reduce costs and improve decision-making. This is particularly promising in fields like retail, finance, and marketing.

3. **Data Privacy and Governance Solutions:** With increasing regulatory scrutiny on data usage, companies face challenges in managing data ethically and complying with laws. As a way out, entrepreneurs can offer tools for data governance, privacy compliance, and secure data sharing, making navigating complex regulatory landscapes easier while ensuring customer trust.

4. **Industry-Specific Data Solutions:** The new trend here is that different industries (such as healthcare, agriculture, energy, and education) have unique Big Data needs. There is a growing demand for niche solutions that cater to these specific sectors. The opportunity that presents itself is the development of vertical-specific analytics platforms that integrate domain knowledge with advanced analytics tools that can help industries unlock the full potential of their data, such as predictive maintenance for manufacturing or personalized learning platforms for education.

5. **Blockchain for Data Integrity:** It is noted that entrepreneurs increasingly rely on vast amounts of data for decision-making; hence, ensuring data integrity and transparency is crucial. Blockchain can help create immutable records of data transactions. Opportunities in this area are that start-ups can explore combining blockchain with Big Data to provide solutions that ensure secure, tamper-proof data management for sensitive industries like finance, healthcare, and supply chain management.

6. Data as a Service (DaaS): This is a new area where companies increasingly seek to outsource their data storage, management, and processing needs to third-party providers. A new outlook in this arena is that entrepreneurs can build platforms offering DaaS solutions, where businesses can access real-time, quality data streams without needing to manage their infrastructure. This could apply to sectors like real estate, financial markets, or public utilities.

7. Augmented Analytics and Data Democratization: Entrepreneurs want to empower non-technical employees to work with Big Data without requiring extensive data science skills. Augmented analytics leverages AI to help users understand data and generate insights through intuitive tools. There is the opportunity to create platforms that offer easy-to-use data visualization, self-service BI, or AI-driven reporting tools that enable smaller entrepreneurs and non-experts to harness the power of Big Data.

8. Predictive and Prescriptive Analytics: The new trend in this aspect is beyond analyzing past data. Entrepreneurs want to predict future trends and optimize decision-making through prescriptive analytics. Entrepreneurs have a big opportunity in this area as they can create advanced analytics platforms that forecast outcomes and suggest the best course of action based on historical data. This is particularly valuable in supply chain, finance, and customer relationship management.

9. Big Data for Sustainability: This is an exciting trend in Big Data because **s**ustainability is a key focus for businesses worldwide. Big Data is crucial in monitoring environmental impact, optimizing resource use, and tracking carbon footprints**.** Again, opportunities abound for entrepreneurs to develop solutions that help organizations track sustainability metrics, improve energy efficiency, and reduce waste, leveraging Big Data for environmental and social impact.

10. Synthetic Data Generation: As data privacy becomes a concern, companies explore synthetic data (artificially generated data sets) that mimic actual data for use in model training and testing. This has created opportunities where entrepreneurs can create platforms that generate high-quality synthetic data for AI and machine learning applications, enabling them to develop solutions without exposing accurate, sensitive data**.** By staying ahead of these trends and capitalizing on emerging technologies, entrepreneurs can find numerous opportunities in the evolving Big Data landscape.

Conclusion

With data collections in terabytes, petabytes, exabytes, and beyond, computer systems cannot process pieces fast enough, and data cannot be efficiently stored and accessed. In many cases, exponentially more data is being created than the best storage technologies available can handle. The lack of standardization, the sheer number of different data formats, and the unpredictability of incoming formats make programming against these data streams difficult and brittle. (Khan, 2020). This study draws the following conclusions.

Big Data has a significant positive impact on entrepreneurship growth performance in Pakistan. This is because it gives them valuable insights into customer interactions, market trends, and competitor solutions. The study also concluded that Big Data analytics adaption and usage leads to entrepreneurial opportunity recognition and opportunity exploitation. This is because it helps to provide insights into customer behavior, market trends, and operational inefficiencies. While Big Data offers significant opportunities for entrepreneurs, it is necessary to carefully navigate its limitations, such as high costs, specialized skills, compliance challenges, and data quality issues. Entrepreneurs must weigh these challenges against the potential benefits and adopt a strategic, incremental approach to leveraging big data, ensuring that it aligns with their business goals and resources.

Recommendations

Since Big Data positively impacts entrepreneur growth and development, entrepreneurs need to adopt and use Big Data to take advantage of Big Data capabilities and compatibilities, which will lead to their business increasing competitiveness, growth, and development. Big Data may be a source of competitive advantage and part of the business model. Universities and business schools should leverage big data to effectively analyze the most sought-after

entrepreneurial characteristics and shape their curriculum, ensuring that the education of entrepreneurs is effective. This is particularly crucial for educational institutions that are slow to adapt their teaching content, as proficiency in Big Data might soon become necessary, potentially posing a threat to these institutions.

Pakistan's government should increase its investment in building data warehouses and lakes, invest in high-performance computing (HPC), increase the use of cloud computing, and build high-speed networks. Academicians should boost their adoption of a Big Data mindset, increase Big Data technology and policy sharing, integrate Big Data with traditional data, and align Big Data with business goal-set criteria.

References

Ahmadi, M., Dileepan, P., & Wheatley, K. K. (2016). A SWOT analysis of big data. *Journal of Education for Business*, *91*(5), 289-294. https://doi.org/10.1080/08832323.2016.1181045

Azam, M., & Ahmad, K. (2024). Adoption of big data analytics for the sustainability of library services in academic libraries of Pakistan. *Library Hi Tech*, *42*(5), 1457–1476. https://doi.org/10.1108/lht-12-2022-0584

Batistič, S., & van der Laken, P. (2019). History, evolution and future of big data and analytics: A bibliometric analysis of its relationship to performance in organizations. *British Journal of Management*, *30*(2), 229–251. https://doi.org/10.1111/1467-8551.12340

Bormida, M. D. (2021). The big data world: Benefits, threats and ethical challenges. In *Ethical issues in covert, security and surveillance research* (pp. 71-91). Emerald Publishing Limited.

Chatterjee, S., Chaudhuri, R., Gupta, S., Sivarajah, U., & Bag, S. (2023). Assessing the impact of big data analytics on decision-making processes, forecasting, and performance of a firm. *Technological Forecasting and Social Change*, *196*(122824), 122824. https://doi.org/10.1016/j.techfore.2023.122824

Columbus, L. (2018, May 23). 10 Charts That Will Change Your Perspective Of Big Data's Growth. *Forbes*. https://www.forbes.com/sites/louiscolumbus/2018/05/23/10-charts-that-will-change-your-perspective-of-big-datas-growth/

Di Vaio, A., Palladino, R., Hassan, R., & Escobar, O. (2020). Artificial intelligence and business models in the sustainable development goals perspective: A systematic literature review. *Journal of Business Research*, *121*, 283-314. https://doi.org/10.1016/j.jbusres.2020.08.019

Doaa, A. S. B., Magdy, M. A. M., & Maged, M. A. A. (2023). The impact of B. D analytics on Investment efficiency and financial performances: Evidence from Saudi Stocks market. *Information Science Letter*, *12*(6), 2461–2473. https://digitalcommons.aaru.edu.jo/isl/vol12/iss6/45

Entrepreneurship and Big Data. (2019). In *Advances in Business Information Systems and Analytics* (pp. 196–233). IGI Global. https://doi.org/10.4018/978-1-5225-7609-9.ch007.

Guangming, C., Na, t. & Blankson, C. (2021). Big data, marketing analytics, and firm marketing capabilities. Journal of Computer Information Systems, 62(3), 442–451. https://doi.org/10.1080/08874417.2020.1842270

Guizzardi, A., Pons, F. M. E., Angelini, G., & Ranieri, E. (2021). Big data from dynamic pricing: A smart approach to tourism demand forecasting. *International Journal of Forecasting*, *37*(3), 1049–1060. https://doi.org/10.1016/j.ijforecast.2020.11.006

Guo, H., Liu, Z., Jiang, H., Wang, C., Liu, J., & Liang, D. (2016). Big Earth Data: a new challenge and opportunity for Digital Earth's development. *International Journal of Digital Earth*, 10(1), 1–12. https://doi.org/10.1080/17538947.2016.1264490.

Haleem, A., Javaid, M., Khan, I. H., & Vaishya, R. (2020). Significant applications of big data in COVID-19 pandemic. *Indian Journal of Orthopaedics*, *54*(4), 526–528. https://doi.org/10.1007/s43465-020-00129-z

Kashyap, N., & Kashyap, A. (2021). Ecosystem for Entrepreneurship in a Big Data-Driven Universe. In *Entrepreneurship and Big Data* (pp. 1-11). CRC Press.

Khan, M. L. (2020). *Big Data and Entrepreneurship. Handbook of Media Management and business* (Vol. 2). Rowman & Littlefield.

Kobayashi, V. B., Mol, S. T., Berkers, H. A., Kismihók, G., & Den Hartog, D. N. (2018). Text mining in organizational research. *Organizational Research Methods*, *21*(3), 733–765. https://doi.org/10.1177/1094428117722619

Latif, Z., Tunio, M. Z., Pathan, Z. H., Jianqiu, Z., Ximei, L., & Sadozai, S. K. (2018). A review of policies concerning development of big data industry in Pakistan: Subtitle: Development of big data industry in Pakistan. *2018 International Conference on Computing, Mathematics and Engineering Technologies (iCoMET)*, 1–5. https://doi.org/10.1109/ICOMET.2018.8346315.

Marr, B. (2018). How much data do we create every day? The mind-blowing stats everyone should read. *Forbes*, *21*, 1-5. https://www.forbes.com/sites/bernardmarr/2018/05/21.

McRae, E. R., Aykens, P., Lowmaster, K., & Shepp, J. (2023). 9 Trends that will shape work in 2023 and beyond. *Harvard Business Review January*.

Obschonka, M., & Audretsch, D. B. (2020). Artificial intelligence and big data in entrepreneurship: a new era has begun. *Small Business Economics*, *55*(3), 529–539. https://doi.org/10.1007/s11187-019-00202-4

Prüfer, J., & Prüfer, P. (2020). Data science for entrepreneurship research: studying demand dynamics for entrepreneurial skills in the Netherlands. *Small Business Economics*, *55*(3), 651–672. https://doi.org/10.1007/s11187-019-00208-y

Qaiser T, & Fatima I. (2024). Big Data awareness and health care industry: An insight from Pakistan. Proceedings S.Z.M.C, 38(4):256-562. https://proceedings-szmc.org.pk/index.php/szmc/article/view/411

Seseni, L., & Mbohwa, C. (2011). The significance of Big Bata in the success of SMEs in emerging markets; a case of South Africa. In *Proceedings of the 11th Annual International Conference on Industrial Engineering and Operations Management*.

Shalid, N., & Sheikh, N. (2021). Impact of Bid Dada on innovation, competitive an advantage Productivity and decision making. Literature review. *Open Journal of Business & Management*, *9*(02), 586–617. http://doi.org/10.4236/ojbm.2021.92032

Steinberg, E. (2020). Big data and personalized pricing. *Business ethics quarterly*, *30*(1), 97-117. https://doi.org/10.1017/beq.2019.19

Tang, G., & Xie, Y. (2024, October). Big Data and Inventory Management. In *9th International Conference on Engineering Management and the 2nd Forum on Modern Logistics and Supply Chain Management (ICEM-MLSCM 2024)* (pp. 141-148). Atlantis Press.

Thornton, M. (2019). Why did cantillon change the meaning of entrepreneurship? *MISES Interdisciplinary Journal of Philosophy Law and Economics*, *7*(3). https://doi.org/10.30800/mises.2019.v7.1241