Trends in Data Science and Business Intelligence: Global, National, and Local Perspectives

Laura Margarita Rodríguez Peralta[*]

Resumen

Los campos de la ciencia de datos y la inteligencia empresarial (BI) han experimentado un rápido crecimiento y evolución a nivel mundial. Este artículo explora las tendencias actuales y las direcciones futuras de estos campos a nivel internacional, nacional (México) y local (Puebla). Discutimos los avances tecnológicos, las tasas de adopción y las necesidades sociales, culturales y económicas que impulsan estos campos. Esta revisión integral proporciona información sobre cómo las diferentes regiones se están adaptando al panorama cambiante de la toma de decisiones basada en datos y las implicaciones para las empresas y la sociedad.

Este estudio fue elaborado para la evaluación del contexto, el cual sirve para tomar decisiones que en la planificación del proyecto curricular de la Maestría en Ciencia de Datos e Inteligencia de Negocios (UPAEP), conduzcan a determinar los propósitos del proyecto. A partir de él se fundamentan o justifican los propósitos, el entorno relevante, se definen las condiciones actuales y deseables, se identifican y diagnostican las necesidades.

Palabras Clave: Tendencias, Ciencia de Datos, Inteligencia de Negocios.

Abstract

The fields of Data Science and Business Intelligence (BI) have seen rapid growth and evolution globally. This paper explores the current trends and future directions of these fields at international, national (Mexico), and local (Puebla) levels. We discuss the technological advancements, adoption rates, and the social, cultural, and economic needs driving these fields. This comprehensive review provides insights into how different regions are adapting to the evolving landscape of data-driven decision-making and the implications for businesses and society.

This study was prepared for the context evaluation, which serves to make decisions that in the planning of the curricular project of the Master of Data Science and Business Intelligence (UPAEP), lead to determining the purposes of the project. From it, the purposes are founded or justified, the relevant environment, the current and desirable conditions are defined, the needs are identified and diagnosed.

Keywords: Trends, Data Science, Business Intelligence.

---

[*] Facultad de Tecnologías de Información y Ciencia de Datos, Universidad Popular Autónoma del Estado de Puebla (UPAEP), E-mail: lauramargarita.rodriguez01@upaep.mx

1 Introduction

Data Science and Business Intelligence (BI) are crucial in today's data-driven world. They enable organizations to make informed decisions, optimize operations, and gain competitive advantages. This paper examines the trends in Data Science and BI from a global perspective, delving into the specific contexts of Mexico and Puebla. We aim to highlight the key developments, challenges, and opportunities in these fields, considering the diverse needs of different regions.

1.1 Global Trends in Data Science and Business Intelligence

The global landscape of Data Science and BI is characterized by rapid technological advancements and increasing adoption across various industries. Key trends include:

- Artificial Intelligence (AI) and Machine Learning (ML) Integration: AI and ML are at the forefront of Data Science, enabling more accurate predictive analytics and automation of complex tasks (Davenport & Ronanki, 2018).

- Big Data Analytics: The ability to process and analyze large datasets is essential for extracting meaningful insights. This trend is driven by advancements in cloud computing and distributed computing systems (Chen, Mao, & Liu, 2014).

- Data Privacy and Security: With the rise of data breaches, there is a growing emphasis on data privacy and security measures. Regulations like GDPR in Europe have set standards for data protection (Voigt & von dem Bussche, 2017).

- Real-time Analytics: Organizations are increasingly adopting real-time analytics to make timely decisions and respond to market changes swiftly (Beyer & Laney, 2012).

- Augmented Analytics: The use of AI to enhance human analysis through natural language processing and automated insights is becoming more prevalent (Davenport, 2020).

- Edge Computing: Processing data at the edge of the network, close to the source of data generation, is gaining traction to reduce latency and bandwidth usage (Shi, Cao, Zhang, Li, & Xu, 2016).

Globally, DS and BI are experiencing rapid advancements due to the proliferation of big data, artificial intelligence (AI), and machine learning (ML). According to a report by Grand View Research (2022), the global BI market size was valued at USD 24.90 billion in 2021 and is expected to expand at a compound annual growth rate (CAGR) of 8.6% from 2022 to 2030. This growth is driven by the increasing demand for data-driven decision-making and the integration of advanced analytics in various industries.

The adoption of cloud-based BI solutions is another significant trend, facilitating real-time data analysis and accessibility. Gartner (2021) notes that by 2025, over 85% of large organizations will have deployed some form of BI and DS in the cloud, enhancing scalability and collaboration. Moreover, there is a growing emphasis on the democratization of data, making advanced analytics accessible to non-technical users through user-friendly interfaces and self-service BI tools (Davenport & Dyché, 2013).

1.2 National Trends in Data Science and Business Intelligence (Mexico)

In Mexico, the adoption of Data Science and BI is growing, driven by the need for digital transformation across various sectors. Notable trends include:

- Government Initiatives: The Mexican government has launched several initiatives to promote digital transformation and data usage in public administration (Aguilar, 2019).
- Emerging Startups: A vibrant startup ecosystem focusing on Data Science and BI solutions is emerging, particularly in tech hubs like Mexico City and Guadalajara (Kshetri, 2018).

- Education and Training: Mexican universities and institutions are increasingly offering specialized programs in Data Science and BI to address the skills gap (CONACYT, 2020).

- Industry Adoption: Key industries such as finance, retail, and telecommunications are leveraging Data Science and BI to improve customer experiences and operational efficiencies (García, 2019).

In Mexico, the adoption of DS and BI is gaining momentum as businesses seek to remain competitive in the digital economy. The Mexican government has initiated several programs to promote digital transformation and the use of advanced analytics. For instance, the National Digital Strategy aims to enhance the use of digital technologies in public administration and services (Gobierno de México, 2020).

A study by Statista (2021) indicates that the BI market in Mexico is expected to grow significantly, driven by sectors such as retail, finance, and healthcare. Mexican companies are increasingly investing in BI tools to improve customer insights, optimize supply chains, and enhance risk management.

1.3 Local Trends in Data Science and Business Intelligence (Puebla)

Puebla, as an emerging technological hub, reflects unique trends in the adoption of Data Science and BI such as:

- Academic Collaboration: Local universities are collaborating with businesses to provide tailored Data Science and BI training programs (López, 2020).

- SME Adoption: Small and Medium Enterprises (SMEs) in Puebla are increasingly adopting BI tools to gain competitive advantages in local markets (Martínez, 2020).

- Government Support: The local government is supporting tech innovation through grants and incentives aimed at fostering the growth of Data Science and BI (INEGI, 2020).

- Community Initiatives: Local tech communities are organizing events and meetups to share knowledge and best practices in Data Science and BI (Puebla Tech, 2021).

Puebla, a key industrial and academic hub in Mexico, is witnessing a growing interest in DS and BI. Local universities, such as the Universidad Popular Autónoma del Estado de Puebla (UPAEP), Benemérita Universidad Autónoma de Puebla (BUAP), Universidad de las Américas Puebla (UDLAP), Instituto Politécnico Nacional (IPN) campus Puebla, Universidad del Valle de México (UVM), are offering specialized programs in these fields, producing a skilled workforce to meet industry demands.

A recent survey conducted by the Puebla Chamber of Commerce (2022) revealed that 65% of local businesses are planning to implement BI solutions within the next two years. The automotive and manufacturing sectors, in particular, are leading the adoption of advanced analytics to improve production processes and reduce costs.

2   Social, Cultural and Economic Needs

2.1 Social Needs

DS and BI can address various social challenges, including healthcare, education, and public safety. For example, predictive analytics can improve patient outcomes by identifying at-risk individuals and optimizing treatment plans. In education, data analytics can enhance learning

experiences by personalizing curriculum and identifying areas where students need additional support (Siemens, 2022).

2.2 Cultural Needs

Culturally, there is a growing emphasis on data literacy and the ethical use of data. Ensuring that data practices respect cultural norms and privacy is crucial. Organizations are increasingly aware of the need to foster a culture of data-driven decision-making while maintaining transparency and accountability (Boyd & Crawford, 2012).

2.3 Economic Needs

Economically, DS and BI drive innovation and competitiveness. Businesses leveraging these technologies can optimize operations, reduce costs, and identify new market opportunities. In Mexico, supporting the growth of DS and BI can stimulate economic development and create high-skilled job opportunities (OECD, 2020).

3 Challenges and Opportunities

3.1 Data Privacy and Security

One of the primary challenges in implementing DS and BI is ensuring data privacy and security. Organizations must comply with regulations such as the General Data Protection Regulation (GDPR) and the Mexican Federal Law on the Protection of Personal Data (LFPDPPP). Implementing robust security measures and fostering a culture of data ethics are essential to mitigate risks (Kitchin, 2014).

3.2 Skill Gaps

The demand for skilled data scientists and BI professionals often exceeds supply. Addressing this skill gap requires investments in education and training programs. Collaborations between academia and industry can help bridge this gap by providing students with practical experience and aligning curricula with industry needs (Davenport & Patil, 2012).

3.3 Integration with Legacy Systems

Integrating DS and BI solutions with existing legacy systems can be challenging. Organizations must invest in modernizing their IT infrastructure and ensuring compatibility between new and old systems. Cloud-based solutions and modular architectures can facilitate smoother integration and scalability (Chen et al., 2012).

3.4 Future Directions

The future of DS and BI lies in the continued integration of AI and ML, the expansion of IoT, and the adoption of blockchain technologies. As these technologies evolve, they will enable more sophisticated analytics and unlock new opportunities for innovation. Additionally, the focus on data ethics and privacy will become increasingly important as organizations navigate the complexities of data governance (Russell & Norvig, 2020).

Conclusion

Data Science and Business Intelligence are reshaping the way organizations operate and make decisions. The trends observed at global, national, and local levels underscore the growing importance of these fields. By addressing social, cultural, and economic needs, DS and BI can

drive innovation and improve quality of life. Future research should focus on exploring new applications and addressing challenges related to data privacy and ethical use.

References

AGUILAR, A. (2019). *Digital Government in Mexico: Moving Towards Digital Transformation*. Journal of Digital Government, 1(1), 22-30.

BBVA. (2021). *BBVA México y la transformación digital*. Retrieved from https://www.bbva.com

BEYER, M. A., & LANEY, D. (2012). *The Importance of "Big Data2: A Definition*. Gartner.

BOYD, D., & CRAWFORD, K. (2012). *Critical questions for big data: Provocations for a cultural, technological, and scholarly phenomenon*. Information, Communication & Society, 15(5), 662-679. doi:10.1080/1369118X.2012.678878

CHEN, H., CHIANG, R. H., & STOREY, V. C. (2012). *Business intelligence and analytics: From big data to big impact.* MIS Quarterly, 36(4), 1165-1188. doi:10.2307/41703503

CHEN, M., MAO, S., & LIU, Y. (2014). *Big Data: A Survey*. Mobile Networks and Applications, 19(2), 171-209.

CONACYT. (2020). *National Council for Science and Technology*. Annual Report.

DAVENPORT, T. H. (2020). *The AI Advantage: How to Put the Artificial Intelligence Revolution to Work*. MIT Press.

Davenport, T. H., & Dyché, J. (2013). Big data in big companies. International Institute for Analytics. Retrieved from https://www.iianalytics.com

DAVENPORT, T. H., & RONANKI, R. (2018). *Artificial Intelligence for the Real World*. Harvard Business Review, 96(1), 108-116.

GARCÍA, R. (2019). *Data-Driven Decision Making in Mexican Corporations: Trends and Challenges*. Business Journal of Mexico, 15(3), 50-62.

GOBIERNO DE MÉXICO. (2020). *Estrategia Digital Nacional*. Retrieved from https://www.gob.mx/estrategiadigital

GRAND VIEW RESEARCH. (2022). *Business Intelligence Market Size, Share & Trends Analysis Report By Component (Platform, Software, Service), By Deployment (On-premise, Cloud), By Enterprise Size, By End Use, By Region, And Segment Forecasts*, 2022 - 2030. Retrieved from https://www.grandviewresearch.com

GARTNER. (2021). *Gartner Forecasts Worldwide Public Cloud End-User Spending to Grow 23% in 2021*. Retrieved from https://www.gartner.com

HARRIS, J. (2020). *How Walmart Uses Business Intelligence to Boost Supply Chain Efficiency. Harvard Business Review*. Retrieved from https://hbr.org

INEGI. (2020). *Economic Census*. National Institute of Statistics and Geography.

KSHETRI, N. (2018). *Big Data's Role in Expanding the Market for Data Science and BI in Mexico*. Journal of International Technology and Information Management, 27(1), 1-15.

KITCHIN, R. (2014). *The data revolution: Big data, open data, data infrastructures and their consequences*. Sage Publications. doi:10.4135/9781473909472

LÓPEZ, M. (2020). *Academic-Business Partnerships in Puebla: Fostering Innovation in Data Science and BI*. Journal of Innovation in Puebla, 5(2), 33-47.

MARTÍNEZ, J. (2020). *BI Adoption Among SMEs in Puebla: Opportunities and Challenges.* Business Insights Puebla, 8(4), 12-23.

OECD. (2020). *Digital Economy Outlook 2020*. Organisation for Economic Co-operation and Development. Retrieved from https://www.oecd.org

PUEBLA CHAMBER OF COMMERCE. (2022). *Encuesta de adopción de BI en empresas locales*. Retrieved from https://www.ccepuebla.org

PUEBLA TECH. (2021). *Annual Report on Tech Community Activities*.

RUSSELL, S., & NORVIG, P. (2020). *Artificial Intelligence: A Modern Approach (4th ed.)*. Pearson. Retrieved from https://www.pearson.com

SIEMENS, G. (2022). *Learning Analytics: The Emergence of a Discipline. American Behavioral Scientist, 57*(10), 1380-1400. DOI:10.1177/0002764213498851

STATISTA. (2021). *Business Intelligence Market Size in Mexico*. Retrieved from https://www.statista.com

SHI, W., CAO, J., ZHANG, Q., LI, Y., & XU, L. (2016). *Edge Computing: Vision and Challenges*. IEEE Internet of Things Journal, 3(5), 637-646.

VOIGT, P., & VON DEM BUSSCHE, A. (2017). *The EU General Data Protection Regulation (GDPR). A Practical Guide*. Springer International Publishing.

VOLKSWAGEN GROUP. (2022). *Innovaciones en la planta de Volkswagen Puebla*. Retrieved from https://www.volkswagenag.com