American Journal of Scholarly Research and Innovation
Volume 01, Issue 01 (2022)
Page No: 249 - 269
eISSN: 3067-2163
Doi: 10.63125/n142cg62

Article

A SYSTEMATIC REVIEW OF THE ROLE OF SQL AND EXCEL IN DATA-DRIVEN BUSINESS DECISION-MAKING FOR ASPIRING ANALYSTS

Abdullah Al Maruf[1]; Rajesh Paul[2]; Mohammad Hasan Imam[3]; Zahir Babar[4]

[1]*Business Analyst, Dhaka, Bangladesh*
Email: marufniru5@gmail.com

[2]*IDLC Investment LTD. Dhaka, Bangladesh*
Email: rajeshpaul.bd01@gmail.com

[3]*Executive Vice President, Oculin Tech BD Ltd, Dhaka, Bangladesh*
Email: ujjawl@gmail.com

[4]*Business Analyst, Techlogicians Solutions, Dhaka, Bangladesh*
Email: zaahir.babar@gmail.com

ABSTRACT

This systematic review explores the integrated roles of Structured Query Language (SQL) and Microsoft Excel in enabling data-driven decision-making (DDDM) for aspiring analysts. As organizations increasingly rely on data-centric strategies to enhance operational efficiency, strategic planning, and organizational intelligence, the proficiency in SQL and Excel emerges as foundational to business analytics. The study followed the PRISMA 2020 guidelines to ensure methodological transparency and rigor. A total of 95 peer-reviewed articles published between 2000 and 2022 were identified, screened, and thematically synthesized. The reviewed literature encompasses academic research, case studies, and industry reports across multiple sectors, including finance, healthcare, education, and public administration. Findings from the review indicate that SQL is widely recognized for its backend querying capabilities, particularly in handling large structured datasets, supporting relational database systems, and facilitating efficient ETL workflows. Microsoft Excel is similarly lauded for its intuitive interface, extensive computational functions, and adaptability in visualization and modeling tasks. Importantly, the synergy between SQL and Excel especially through tools like Power Query and ODBC connections enables streamlined analytics workflows that enhance data accessibility and decision-making effectiveness across diverse user groups. In educational and professional training contexts, SQL and Excel are prominent components of curriculum and certification programs aimed at fostering data literacy and analytical thinking. However, a significant gap persists between academic instruction and industry expectations, especially in the application of integrated tool use. The study underscores the need for enhanced curriculum design, increased emphasis on experiential learning, and closer alignment with real-world data environments to equip aspiring analysts with the skills necessary for modern analytical roles. Overall, this review synthesizes critical insights into the technical, pedagogical, and strategic dimensions of SQL and Excel, providing a foundation for future research and curriculum development in analytical education and practice.

KEYWORDS

SQL (Structured Query Language); Microsoft Excel; Data-Driven Decision-Making; Aspiring Business Analysts; Systematic Literature Review;

Citation:
Maruf, A. A., Paul, R., Imam, M. H., & Babar, Z. (2022). *A systematic review of the role of SQL and Excel in data-driven business decision-making for aspiring analysts*. *American Journal of Scholarly Research and Innovation, 1*(1), 249–269. https://doi.org/10.63125/n142cg62

Received:
September 11, 2022

Revised:
October 12, 2022

Accepted:
November 26, 2022

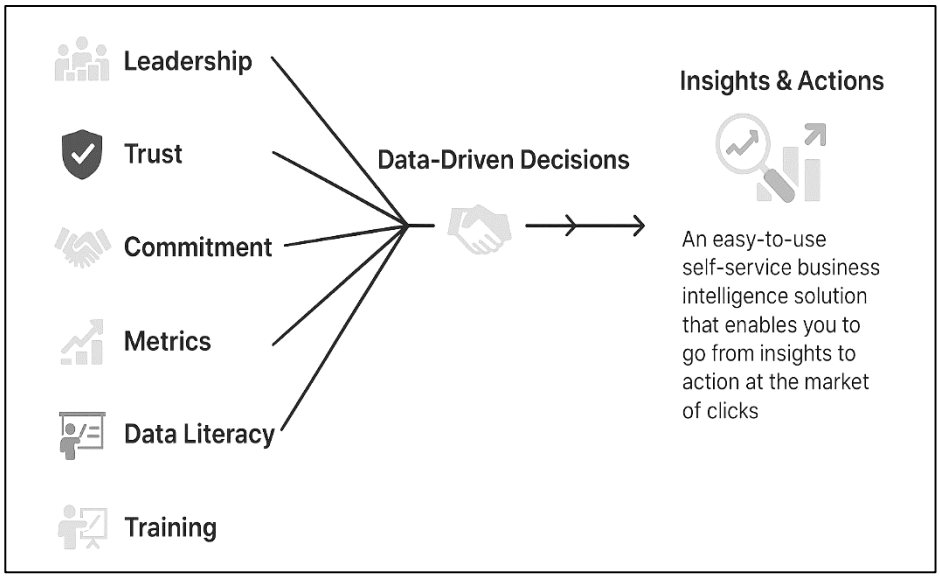
Published:
December 24, 2022

American Journal of Scholarly Research and Innovation
Volume 01, Issue 01 (2022)
Page No: 249 - 269
eISSN: 3067-2163
Doi: 10.63125/n142cg62

INTRODUCTION

Data-driven decision-making (DDDM) represents a systematic approach wherein business choices and organizational strategies are informed through the rigorous analysis and interpretation of data (Bibri, 2019). At its core, DDDM rejects intuition or anecdotal assumptions in favor of evidence-backed conclusions, promoting rational and measurable outcomes in business operations . As businesses operate in increasingly complex and fast-paced environments, the importance of DDDM has surged globally, fostering transparency, accountability, and efficiency. According to Cohen-Vogel et al. (2019), firms that adopt data-centric decision frameworks are substantially more productive and profitable than their counterparts. The global economy, characterized by its interconnected markets and volatile demands, necessitates strategic agility supported by data insights. In multinational corporations and small businesses alike, data-driven cultures have been linked to improvements in customer experience, cost reduction, and innovation (Carmel & Ben-Shahar, 2017). The adoption of DDDM practices spans across industries healthcare uses data to improve patient outcomes, retail predicts inventory needs, and financial institutions detect fraud using real-time analytics. These diverse applications emphasize the international importance of DDDM, not merely as a business trend but as a fundamental paradigm shift in organizational intelligence (Lu et al., 2019). Moreover, with digital transformation accelerating across borders, the global emphasis on big data, cloud computing, and machine learning technologies underlines the urgency for skilled professionals capable of interpreting and applying data for strategic advantage.

Figure 1: Key Enablers of Data-Driven Decision-Making Leading to Business Insights and Actions



The World Economic Forum underscored data literacy as a critical skill for the future workforce, noting that decision-making grounded in data science methodologies is becoming a baseline expectation in contemporary business leadership. Structured Query Language (SQL) is one of the most pivotal tools for managing and analyzing data stored in relational databases. Initially developed by IBM in the 1970s, SQL has evolved into a universal language for data manipulation and retrieval across most enterprise systems (Larson & Chang, 2016). SQL allows analysts and data professionals to perform complex queries, join multiple data sources, aggregate and filter large datasets, and automate repetitive tasks thereby significantly enhancing the efficiency and accuracy of data analysis. As businesses increasingly depend on large-scale data infrastructures, SQL has emerged as a vital competency for deriving insights from data lakes and warehouses (Raj, 2018). In the realm of business intelligence, SQL acts as a foundational layer for integrating disparate data sources and supporting advanced analytics platforms such as Power BI, Tableau, and Looker. These tools rely heavily on SQL queries for data extraction, transformation, and

American Journal of Scholarly Research and Innovation
Volume 01, Issue 01 (2022)
Page No: 249 - 269
eISSN: 3067-2163
Doi: 10.63125/n142cg62

loading (ETL) processes. According to the Stack Overflow, SQL remains one of the most widely used programming languages globally, emphasizing its universality and relevance across roles and industries (Ceravolo et al., 2018). Its adaptability to cloud-based systems like Amazon Redshift, Google BigQuery, and Microsoft Azure SQL Database further demonstrates its enduring significance in modern business ecosystems. For aspiring analysts, mastering SQL is not merely a technical achievement but a gateway to understanding organizational behavior, operational trends, and customer dynamics through empirical data. It enables users to drill down into transactional records, customer profiles, inventory systems, and financial logs thereby transforming raw data into strategic insights essential for decision-making (Walker & Moran, 2019). Microsoft Excel continues to be one of the most pervasive and indispensable tools in business analytics, recognized for its powerful capabilities in organizing, analyzing, and visualizing data. While sometimes perceived as a basic tool compared to advanced programming languages, Excel's depth of features makes it exceptionally robust and accessible for users at all levels (Wang & Krisch, 2019). From simple arithmetic operations to complex statistical modeling and regression analysis, Excel offers a comprehensive toolkit for handling business data. Its widespread adoption is partly due to its intuitive graphical user interface, which allows non-technical users to engage with data analysis processes without requiring programming skills (Zhan & Tan, 2020).

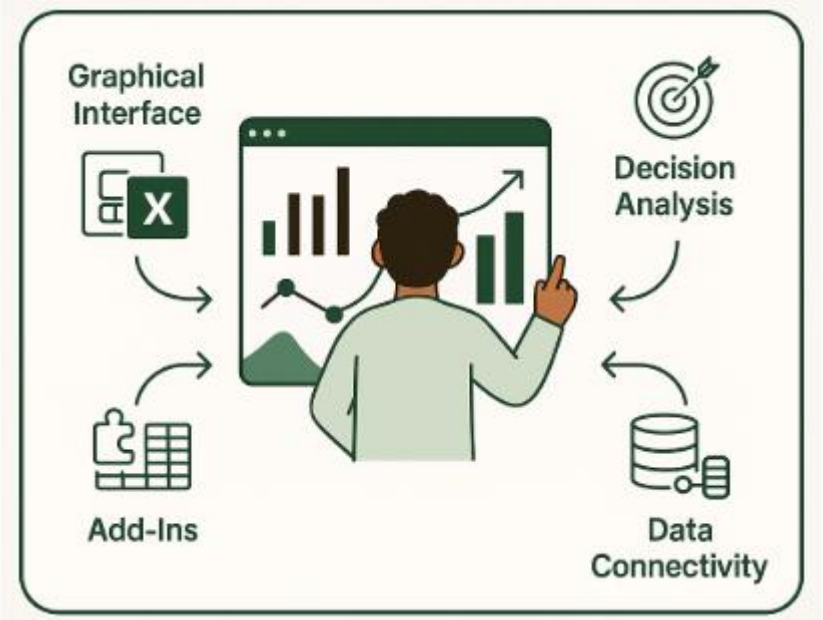
Moreover, Excel's functionality can be significantly expanded through add-ins like Power Query and Power Pivot, enabling the manipulation of large datasets, establishing relationships between data tables, and creating dynamic dashboards. As noted by Zhan and Tan (2020), Excel supports decision analysis through scenario planning tools, such as Goal Seek and Solver, which are especially useful in financial forecasting and operational simulations. Excel is also commonly used as a front-end tool for connecting to databases via ODBC connections, making it an efficient bridge between raw data repositories and decision-makers. Its portability and interoperability with other Microsoft Office tools enhance its appeal in corporate settings. In global organizations, Excel functions as a universal language for reporting, budgeting, and performance tracking allowing stakeholders from different departments and geographies to collaborate effectively. Thus, Excel's enduring relevance lies in its versatility, ease of use, and adaptability to a wide range of analytical tasks, which makes it an essential component of any aspiring analyst's toolkit. The combined use of SQL and Excel in business analytics creates a comprehensive analytical ecosystem that bridges the gap between backend data management and frontend data presentation. While Reinkemeyer (2020), the co-utilization of these tools enhances accuracy and efficiency in decision-making processes, especially in data-intensive environments. In practice, SQL and Excel are used in tandem in fields such as financial analysis, supply chain management, customer segmentation, and performance benchmarking. For example, an analyst may use SQL to query sales records over multiple fiscal quarters and then apply Excel's charting tools to illustrate seasonal trends and forecast future performance. The integration also supports automated reporting, whereby SQL queries feed directly into Excel templates via Power Query, reducing the time and manual labor involved in routine data updates (Sousa et al., 2021).

Importantly, this workflow supports scalability, allowing organizations to transition from small datasets to enterprise-scale analytics without overhauling their toolsets. The symbiotic use of SQL and Excel fosters a culture of data literacy across functional roles, empowering not only data scientists but also business managers and executives to participate in analytical discussions. Therefore, the SQL-Excel pipeline represents not just a technical workflow but a democratizing force in organizational decision-making. In today's job market, aspiring analysts are expected to possess a strong foundation in tools like SQL and Excel as a prerequisite for entry-level and intermediate roles in data analysis, business intelligence, and operations research (Arndt, 2018). These tools are frequently cited in job descriptions across diverse industries, from finance and healthcare to logistics and marketing. Formal education programs in business analytics, management information systems, and data science often integrate these tools into their curriculum, emphasizing their practical applications through hands-on projects and case studies (Batrinca & Treleaven, 2015). Moreover, online learning platforms such as Udemy, LinkedIn Learning, and DataCamp provide specialized courses that cater to different proficiency levels, further supporting skill development among aspiring professionals. Beyond academic training,

American Journal of Scholarly Research and Innovation
Volume 01, Issue 01 (2022)
Page No: 249 - 269
eISSN: 3067-2163
Doi: 10.63125/n142cg62

industry certifications such as Microsoft Office Specialist (MOS) for Excel and Google's Data Analytics Certificate underscore the credibility and employability of candidates in the competitive job market. Importantly, learning SQL and Excel is not only about mastering syntax or functions it's about cultivating an analytical mindset (Aspin, 2020). These tools teach users to frame business questions in quantifiable terms, extract relevant data, test hypotheses, and communicate insights clearly through visualizations and reports. For young professionals entering a data-driven workplace, fluency in SQL and Excel acts as a stepping stone toward more advanced tools like Python, R, and machine learning platforms (Mouratidis, 2020).

Figure 2: Core Functionalities of Excel for Interactive Data Analysis and Decision Support



Furthermore, familiarity with SQL and Excel empowers analysts to work independently, troubleshoot data issues, and contribute to cross-functional teams, thereby accelerating their professional growth and career trajectory. SQL and Excel have played instrumental roles in real-world business applications across multiple geographies and industries, demonstrating their practical impact on decision-making. In the retail sector, companies like Walmart and Amazon use SQL databases to analyze customer transactions, optimize supply chains, and manage inventory in real time (Elhaddad, 2021). Excel is then employed by category managers and business analysts to create performance dashboards and forecast demand fluctuations. In healthcare, institutions use SQL to process patient records, monitor treatment outcomes, and ensure compliance with regulatory standards while Excel aids in presenting these findings to administrators and policymakers in digestible formats (Murdoch & Detsky, 2013). Financial institutions like JPMorgan Chase use SQL for fraud detection algorithms and risk assessment models, integrating Excel-based templates for internal audit reports and client communication (Guerrero et al., 2019). In manufacturing, SQL is used to monitor production lines and equipment performance, while Excel is applied to visualize throughput efficiency and downtime trends. These global case studies illustrate how SQL and Excel not only serve different operational functions but also complement each other in delivering actionable intelligence. The ubiquity of these tools across cultures, languages, and regulatory environments underscores their adaptability and resilience in the face of evolving business challenges (Spraakman et al., 2021). This cross-industry, cross-border applicability validates the assertion that proficiency in SQL and Excel is a globally portable skill, enhancing the mobility and versatility of aspiring analysts. Beyond enabling decision-making, SQL and Excel contribute to the standardization of analytical processes within and across organizations. Standardization ensures consistency, reproducibility, and compliance critical

American Journal of Scholarly Research and Innovation
Volume 01, Issue 01 (2022)
Page No: 249 - 269
eISSN: 3067-2163
Doi: 10.63125/n142cg62

factors in regulated industries such as finance, pharmaceuticals, and public administration. SQL scripts can be version-controlled and audited, ensuring transparency in data transformations and logic. Similarly, Excel templates and macros can be standardized to ensure uniformity in reporting practices across departments (Bragança, 2021). For example, multinational firms often deploy global reporting standards where regional branches use standardized Excel dashboards powered by SQL queries to feed into consolidated corporate reports. This harmonization reduces errors, mitigates bias, and improves the speed of reporting cycles. It also enhances interdepartmental collaboration by establishing a common analytical language, enabling more coherent and data-informed dialogue between teams. Furthermore, standardization facilitates benchmarking, where organizations compare performance metrics across business units, markets, or time periods using consistent methods. As pointed out by Austin et al. (2021), data quality and governance are enhanced when analytical practices are codified through tools like SQL and Excel. For aspiring analysts, this dimension of standardization imparts a discipline of methodological rigor and attention to detail, traits highly valued in professional settings. It also encourages a culture of continuous improvement, where feedback loops from standardized reports lead to iterative enhancements in both strategy and operations. Thus, SQL and Excel are not only enablers of data analysis but also architects of organizational coherence and analytical integrity (Glegg et al., 2019).

LITERATURE REVIEW

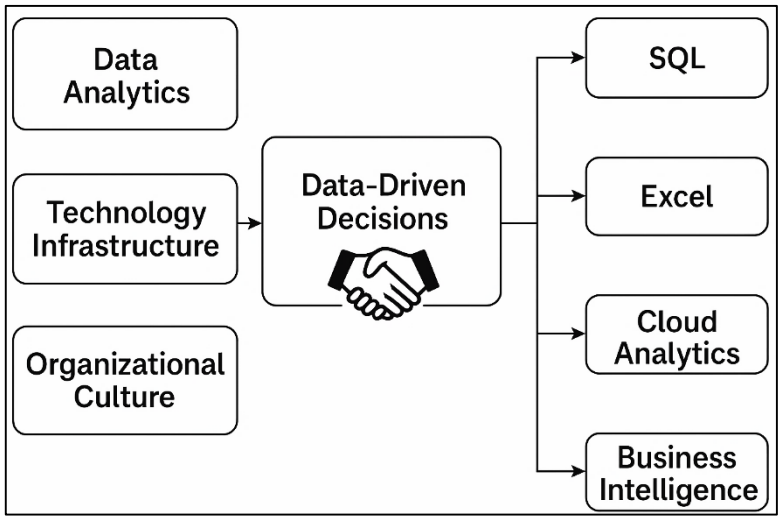
This literature review explores the pivotal roles of Structured Query Language (SQL) and Microsoft Excel in real-world business applications, highlighting their evolution, integration, and practical relevance in data-driven environments. As foundational tools in data management and analytics, SQL and Excel have become indispensable for organizations seeking to enhance operational efficiency, ensure data accuracy, and support strategic decision-making. This section synthesizes scholarly research to examine how these tools are employed across various business functions—including finance, marketing, supply chain, and regulatory compliance—and evaluates their strengths, limitations, and combined utility in modern enterprise settings. Through this review, the enduring significance of SQL and Excel in contemporary data ecosystems is critically analyzed.

Data-Driven Business Decision-Making (DDDM)

Data-Driven Business Decision-Making (DDDM) represents a paradigm shift in managerial processes, emphasizing the systematic use of data analytics to inform strategic and operational decisions (Yu et al., 2021). The fundamental premise of DDDM is that objective data insights, rather than intuition or anecdotal evidence, provide a superior foundation for making business decisions (Bibri, 2019). As organizations accumulate vast amounts of data through customer interactions, digital platforms, and supply chain operations, the ability to extract actionable insights has become a core competency (Bibri & Bibri, 2018). Empirical studies confirm that firms adopting DDDM practices report better financial and operational outcomes compared to their peers (Bousdekis et al., 2021). This performance advantage is attributed to enhanced agility, risk mitigation, and customer-centric innovation. Furthermore, DDDM enables businesses to develop predictive models that anticipate market trends and consumer behavior, thereby fostering a proactive organizational culture. In knowledge-intensive industries such as healthcare, finance, and logistics, DDDM has been associated with reduced uncertainty and improved decision quality. However, the strategic implementation of DDDM requires alignment between technology infrastructure, data governance policies, and organizational culture. Firms that embed data analytics within their decision-making processes tend to foster a learning-oriented environment where data literacy is prioritized across hierarchical levels (Carillo, 2017). This integration is facilitated by leadership support, cross-functional collaboration, and continuous investments in analytics capabilities.

American Journal of Scholarly Research and Innovation
Volume 01, Issue 01 (2022)
Page No: 249 - 269
eISSN: 3067-2163
Doi: 10.63125/n142cg62

Figure 3: Key Components and Tools Driving Data-Driven Business Decision-Making



The deployment of technologies such as SQL, Excel, cloud analytics, and business intelligence platforms is central to implementing DDDM across industries. Structured Query Language (SQL) remains a foundational tool in data management, enabling organizations to efficiently query, manipulate, and structure data stored in relational databases (Cech et al., 2018). Similarly, Microsoft Excel, although simplistic, offers robust functionalities for modeling, forecasting, and conducting descriptive statistics, making it particularly valuable for small businesses and early-stage analysts (Diván, 2017). More advanced tools such as Power BI, Tableau, and SAS expand these capabilities by offering real-time dashboards, visual analytics, and integration with diverse data sources. Cloud-based platforms like AWS and Google BigQuery further extend analytical capabilities by allowing scalable storage, computing, and collaboration. The convergence of these tools within enterprise resource planning (ERP) and customer relationship management (CRM) systems creates a seamless analytical ecosystem that supports both strategic and tactical decisions (Gade, 2021). Additionally, the integration of machine learning models into DDDM systems provides predictive and prescriptive analytics capabilities, allowing businesses to simulate scenarios and optimize decisions (Gökalp et al., 2021). Literature suggests that the success of these technologies is contingent on their alignment with the decision context, user skills, and organizational data strategy. Despite technological advancements, challenges such as data silos, inconsistent quality, and lack of interoperability continue to impede seamless DDDM implementation (Johnson et al., 2021). Consequently, selecting and integrating analytical tools require not only technical considerations but also a clear understanding of business processes and decision objectives (Lu et al., 2019). These findings emphasize the dual role of technology as both an enabler and a constraint in the pursuit of data-driven excellence.

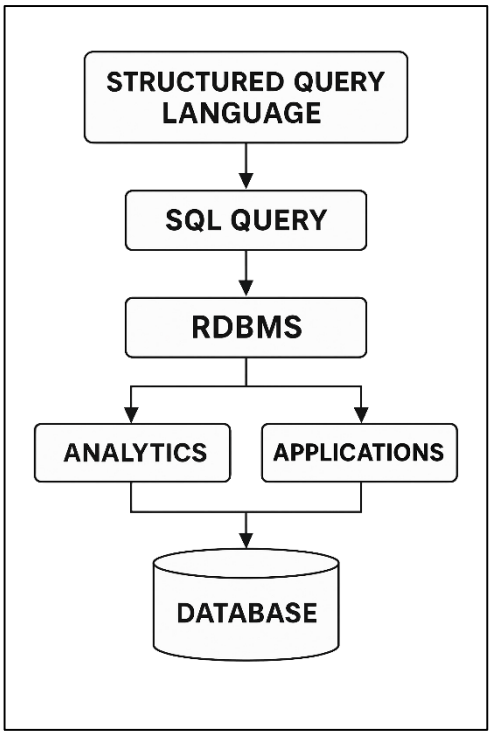
Structured Query Language (SQL)

Structured Query Language (SQL) has been a cornerstone of relational database management systems (RDBMS) since its standardization in the 1980s by the American National Standards Institute (ANSI) and the International Organization for Standardization (ISO) (Čerešňák & Kvet, 2019). SQL originated from the SEQUEL project at IBM, developed by Chamberlin and Boyce to facilitate querying and manipulating data stored in the System R database (Aspin, 2020). Its syntax, rooted in English-based declarative commands, allowed non-programmers to perform complex data operations, democratizing access to structured data. Over the decades, SQL has evolved through various versions (e.g., SQL-92, SQL:1999, SQL:2011), introducing advanced functionalities such as triggers, procedural extensions (e.g., PL/SQL, T-SQL), XML/JSON support, and recursive queries.

American Journal of Scholarly Research and Innovation
Volume 01, Issue 01 (2022)
Page No: 249 - 269
eISSN: 3067-2163
Doi: 10.63125/n142cg62

SQL's consistency and backward compatibility have reinforced its dominance, particularly in enterprise settings where data reliability and ACID (Atomicity, Consistency, Isolation, Durability) properties are essential (Cai et al., 2018). Despite the emergence of NoSQL alternatives, SQL has remained resilient, especially in hybrid environments where structured and semi-structured data coexist (Soru et al., 2018). Studies underscore SQL's enduring utility due to its widespread standardization, robust transaction handling, and extensive integration with business intelligence tools and analytics platforms (Trivedi et al., 2017). As organizations increasingly rely on data for decision-making, SQL's centrality to data governance, warehousing, and reporting processes positions it as a critical enabler of information systems (Zhong et al., 2017). These findings collectively highlight SQL's role not just as a querying tool but as a foundational component of modern data infrastructure. Beyond its foundational role in data storage and manipulation, SQL has become instrumental in supporting analytical tasks and data-driven decision-making within organizations. SQL is frequently used to perform descriptive analytics, generate key performance indicators (KPIs), and facilitate real-time business monitoring through queries and views. The literature reveals that SQL's JOIN operations, window functions, subqueries, and aggregation capabilities enable analysts to derive insights from complex relational schemas (Trivedi et al., 2017). In particular, SQL enables data transformation and extraction in ETL (Extract, Transform, Load) processes, a critical step in data warehousing and business intelligence workflows. According to (Dubey et al., 2016), proficiency in SQL correlates with higher analyst productivity, especially in domains like retail analytics, healthcare informatics, and financial forecasting. Luz and Finger (2018) showed SQL ranking among the top three most-used languages by data professionals, demonstrating its ubiquity and relevance. Several case studies validate SQL's effectiveness in processing large datasets and supporting dashboarding applications like Power BI, Tableau, and Looker, where SQL-based queries generate real-time metrics and trend analyses. Moreover, SQL supports operational decisions through the creation of automated triggers and stored procedures, allowing businesses to respond to events such as inventory thresholds or financial anomalies. Although newer programming languages like Python and R dominate advanced analytics, SQL remains indispensable in data preparation and integration (Soru et al., 2018). Its integration with cloud-based systems like Google BigQuery, Amazon Redshift, and Snowflake further enhances scalability and performance for enterprise-grade analytics (Trivedi et al., 2017). Hence, SQL's analytical versatility and alignment with decision support systems reinforce its strategic importance in data-informed environments.

Figure 4: Architecture of SQL-Based Data Flow in Relational Database Management Systems (RDBMS)



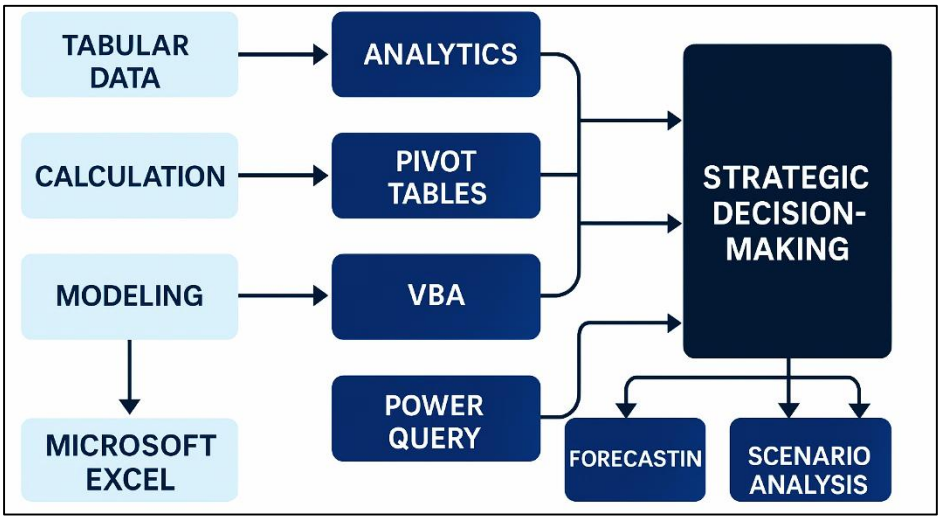
Microsoft Excel: From Spreadsheet to Strategic Decision Platform

Microsoft Excel has evolved significantly since its initial release in 1985, transitioning from a basic spreadsheet application to a powerful platform supporting business modeling, statistical analysis, and strategic decision-making. Initially designed for tabular data management and arithmetic computation, Excel quickly gained prominence due to its user-friendly interface, extensive formula library, and customizable functionalities (Jahan et al., 2022; Briones & Escola, 2019). Over time, Microsoft integrated advanced features such as pivot tables, conditional formatting, Visual Basic for Applications (VBA), and Power Query, transforming Excel into a multifunctional analytics tool (Ferreira & Salcedo, 2001; Masud, 2022). These capabilities enabled users to conduct trend analysis, sensitivity testing, and dynamic scenario planning without relying on dedicated statistical

American Journal of Scholarly Research and Innovation
Volume 01, Issue 01 (2022)
Page No: 249 - 269
eISSN: 3067-2163
Doi: 10.63125/n142cg62

software (Martn, 2014; Hossen & Atiqur, 2022). The flexibility of Excel supports applications across domains including finance, marketing, supply chain, and academic research (Ferreira & Salcedo, 2001; Akter & Razzak, 2022). Literature highlights that small and medium-sized enterprises (SMEs) particularly benefit from Excel's accessibility and cost-effectiveness, using it to simulate cash flows, optimize resource allocation, and track key performance indicators (Briones & Escola, 2019). In a study by Martn (2014), over 80% of surveyed firms indicated Excel as their primary tool for financial analysis and reporting. The proliferation of Excel-based models has also influenced decision support system design, where analysts can develop and test models in-house with minimal technical barriers (Briones et al., 2019). As a ubiquitous application embedded in Microsoft Office, Excel remains foundational for knowledge workers, serving as both a standalone tool and a component of broader enterprise resource planning (ERP) ecosystems (Bragança, 2021). Thus, Excel's functional evolution illustrates its transition from a numeric ledger to a strategic digital platform integral to contemporary decision processes.

Figure 5: Transforming Microsoft Excel into a Strategic Decision-Making Platform



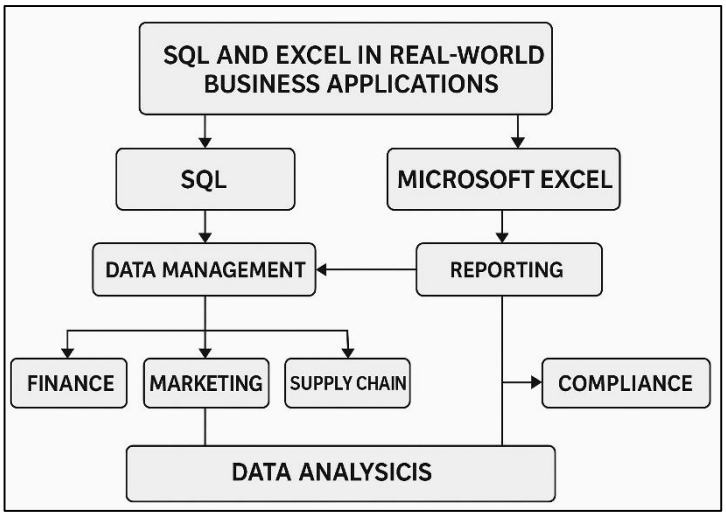
Microsoft Excel's integration into business intelligence (BI) workflows has reinforced its role as a strategic enabler of data-driven decision-making. Excel supports a wide array of analytical functions, ranging from descriptive statistics to regression modeling, and serves as a front-end tool for exploring large datasets extracted from relational databases and cloud systems (Ferreira & Salcedo, 2001). Its compatibility with SQL databases, Power BI, and external data connectors allows seamless data import, transformation, and visualization, which has made it an accessible bridge between raw data and executive dashboards. According to a study by Guerrero et al., (2019), Excel's ease of use and integration capabilities significantly contribute to operational efficiency and performance monitoring in SMEs and large enterprises alike. Pivot tables and slicers, in particular, facilitate interactive reporting and drill-down analytics that enhance organizational insight generation. The inclusion of Power Pivot and DAX (Data Analysis Expressions) has further elevated Excel's analytical capacity by enabling columnar data models and in-memory processing for large datasets. Ferreira and Salcedo (2001) assert that Excel serves not only as a tactical decision support tool but also as a strategic BI component when integrated with data warehouses and automated ETL processes. Furthermore, Excel allows decision-makers to simulate outcomes using "what-if" analyses, scenario managers, and solver-based optimization models. Bragança (2021) confirms Excel's utility in project management and supply chain coordination, citing its application in lead-time simulation and inventory control. These insights reinforce that Excel's influence extends beyond static spreadsheets to dynamic, interactive platforms that support complex managerial decision-making in real time.

American Journal of Scholarly Research and Innovation
Volume 01, Issue 01 (2022)
Page No: 249 - 269
eISSN: 3067-2163
Doi: 10.63125/n142cg62

SQL and Excel in Real-World Business Applications

Structured Query Language (SQL) and Microsoft Excel serve as foundational tools for managing, analyzing, and visualizing data in real-world business contexts. SQL is primarily used for querying and manipulating structured data within relational databases, while Excel functions as a versatile interface for data organization, basic analytics, and reporting (Cai et al., 2018). The complementary use of these tools allows organizations to manage complex back-end data operations with SQL and conduct front-end data visualization and decision support with Excel (Mills et al., 2017). SQL enables efficient extraction and transformation of large datasets from enterprise systems like Oracle, MySQL, and Microsoft SQL Server, after which the data is often exported into Excel for ad hoc analysis, pivot table generation, or dashboard construction. This hybrid approach has become especially prevalent in small to medium-sized enterprises (SMEs) lacking access to advanced business intelligence platforms. Research indicates that the integration of SQL and Excel enhances data accessibility, reduces analytical bottlenecks, and facilitates evidence-based decision-making (Raj, 2018). SQL ensures data accuracy and governance through relational integrity, while Excel provides a user-friendly interface for exploring trends and generating actionable insights. The interoperability of these tools is further enhanced by features such as Excel's Power Query and external data connectors that allow direct SQL querying within workbooks (Alzraiee, 2020). Consequently, the literature underscores that the joint deployment of SQL and Excel enables a cost-effective yet robust analytical ecosystem suitable for a wide range of business operations.

Figure 6: Integration of SQL and Microsoft Excel in Real-World Business Applications



In finance, SQL and Excel are widely employed for budgeting, forecasting, and auditing processes. SQL queries are used to extract data from general ledgers, transaction records, and financial databases, while Excel provides the platform for ratio analysis, cash flow modeling, and budget variance reporting(Aspin, 2020). Financial professionals rely on SQL to perform complex joins and aggregate functions across multi-period data, and then use Excel's pivot tables and conditional formatting to visualize discrepancies and anomalies. In marketing, SQL is applied for customer segmentation, campaign performance analysis, and behavior tracking, especially in CRM-integrated databases (Borrmann et al., 2009). These SQL outputs are often imported into Excel to evaluate ROI, calculate customer lifetime value (CLV), and design A/B testing summaries (Cai et al., 2018). Supply chain management also benefits from this dual-tool approach, particularly in areas such as inventory optimization, vendor performance evaluation, and logistics tracking. SQL-based systems allow the extraction of real-time inventory levels and supplier lead times, which are then analyzed in Excel to calculate reorder points and safety stock levels. A case study by Čerešňák and Kvet (2019) demonstrated how retailers improved decision accuracy and agility by integrating SQL-based automation with Excel-based forecasting models. In all these domains, SQL provides the structural backbone for data curation and integrity, while Excel enables iterative analysis, simulation, and executive reporting. The tools' joint utility across financial, marketing, and logistical applications exemplifies their strategic significance in supporting real-world business operations.

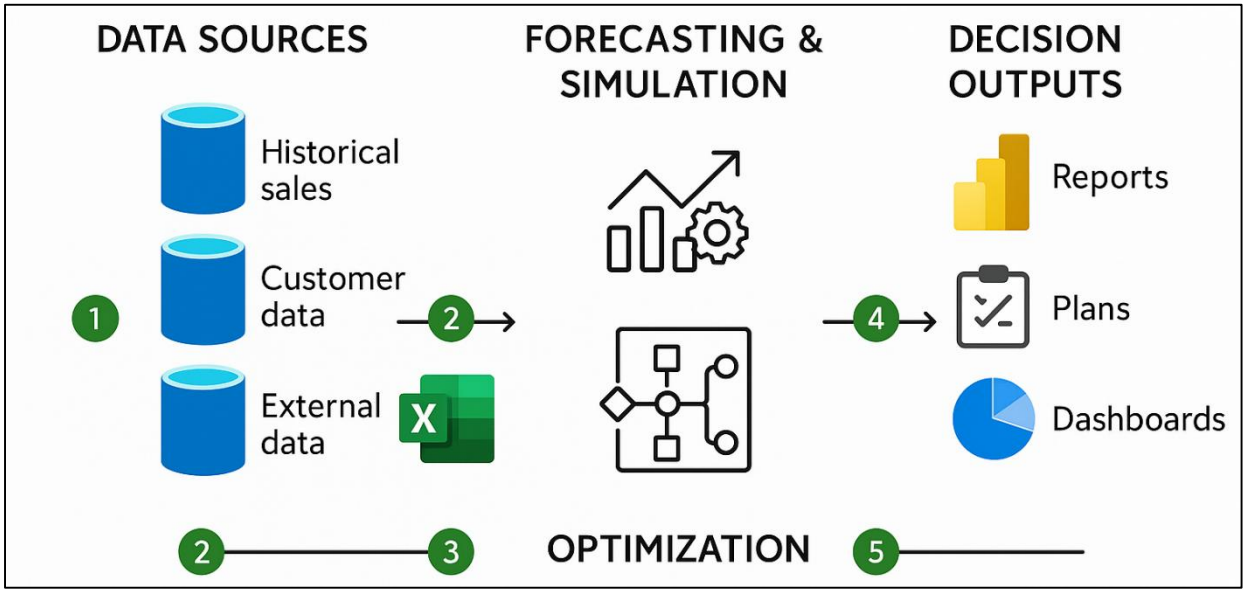
Excel for demand forecasting, simulation, and optimization

Microsoft Excel has emerged as a widely adopted tool for demand forecasting and business simulation due to its accessibility, flexibility, and powerful built-in functionalities. Organizations across sectors utilize Excel for time series analysis, moving averages, exponential smoothing, and

American Journal of Scholarly Research and Innovation
Volume 01, Issue 01 (2022)
Page No: 249 - 269
eISSN: 3067-2163
Doi: 10.63125/n142cg62

regression modeling to predict demand patterns (Aspin, 2020). Excel's native functions such as FORECAST.LINEAR, TREND, and GROWTH, combined with charting and pivot capabilities, allow analysts to visualize historical data and project future trends with a relatively low learning curve (Briones & Escola, 2019). In small and medium-sized enterprises (SMEs), where access to high-end analytics platforms may be limited, Excel offers a cost-effective alternative for conducting sales forecasts, seasonal analysis, and scenario-based projections (Bragança, 2021). According to Ferreira and Salcedo (2001), over 80% of supply chain professionals in mid-tier firms rely on Excel for short-term demand planning and production scheduling. Furthermore, Excel's ability to incorporate real-time data via Power Query and data connectors enhances the accuracy and timeliness of forecasting models (Guerrero et al., 2019). Researchers such as Martn (2014) have demonstrated that Excel, when augmented with VBA (Visual Basic for Applications), can simulate complex business environments including inventory turnover, order fulfillment cycles, and market volatility scenarios. Academic integration of Excel into forecasting curricula has also been shown to improve student competency in real-world planning and logistics problems (Sutskever et al., 2014). Although Excel may lack the statistical depth of specialized software like R or SPSS, its transparency, traceability, and user control make it an ideal tool for iterative forecasting, particularly in dynamic, resource-constrained business contexts (Martn, 2014).

Figure 7: Excel-Powered Workflow for Demand Forecasting, Simulation, and Optimization



Excel's optimization capabilities have positioned it as a practical tool for decision-makers seeking to balance cost, resource allocation, and operational efficiency. One of its most prominent features for optimization is the Solver add-in, which supports linear programming, integer constraints, and non-linear optimization models (Guerrero et al., 2019). Solver is routinely used in logistics, finance, and manufacturing to determine optimal inventory levels, transportation routing, workforce scheduling, and pricing strategies. The flexibility of Excel allows managers to build optimization models that integrate financial constraints, demand forecasts, and supply-side parameters into one cohesive system, which can be updated dynamically based on changing inputs. Case studies by Ferreira and Salcedo (2001) and Bragança (2021) illustrate successful implementations of Excel-based optimization in retail supply chains and production planning environments. Additionally, Excel enables risk-informed decision-making through Monte Carlo simulation, using tools like @RISK or custom VBA scripts, which provide probabilistic forecasting under uncertainty (Briones et al., 2019). This has been particularly valuable in financial modeling and project risk assessment, where deterministic approaches may fall short (Bragança, 2021). Although Excel may not match the computational power of Python-based optimization libraries

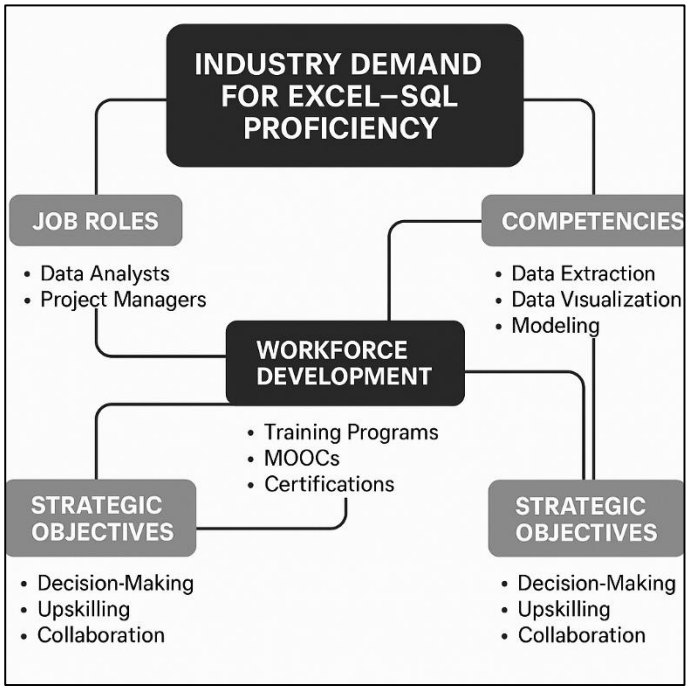
American Journal of Scholarly Research and Innovation
Volume 01, Issue 01 (2022)
Page No: 249 - 269
eISSN: 3067-2163
Doi: 10.63125/n142cg62

or specialized platforms like IBM CPLEX, its simplicity and transparency make it ideal for managerial experimentation and sensitivity analysis (Ferreira & Salcedo, 2001). Studies have emphasized that Excel-based optimization fosters cross-functional collaboration, as the intuitive interface allows both technical and non-technical stakeholders to contribute to model development and refinement. As such, Excel not only supports operational improvements but also cultivates a data-driven culture where optimization is embedded into everyday managerial decision-making processes.

Industry demand for Excel-SQL proficiency

The demand for proficiency in Microsoft Excel and Structured Query Language (SQL) has seen a sharp increase across industries due to the rising importance of data literacy in operational and strategic decision-making. Numerous studies have confirmed that Excel and SQL serve as fundamental tools for professionals in finance, marketing, healthcare, supply chain, and human resource management, enabling data extraction, organization, transformation, and interpretation (Guerrero et al., 2019). Employers consider these skills essential not only for technical positions like data analysts and business intelligence developers but also for non-technical roles such as project managers, financial advisors, and marketing strategists (Aspin, 2020). In a multi-industry analysis by Borrmann et al. (2009), over 70% of employers ranked SQL as a high-priority skill, particularly in data-intensive job functions involving ERP systems and CRM databases. Similarly, Excel remains one of the most frequently listed competencies in job advertisements for entry- and mid-level roles in the corporate sector, owing to its ubiquity and ease of use. Čerešňák and Kvet (2019) annual developer survey indicated that SQL was among the top three most commonly used languages by data professionals, while LinkedIn Learning's Workplace Learning Report identified Excel as the top upskilling priority in over 60% of Fortune 500 companies. Academic research further confirms that graduates with strong command over both tools demonstrate superior job readiness and problem-solving abilities in practical business environments (Dubey et al., 2016). The widespread industry integration of SQL for data querying and Excel for reporting and modeling positions these tools as non-negotiable technical competencies in the data-driven economy (Čerešňák & Kvet, 2019). Thus, Excel-SQL proficiency represents a baseline expectation in modern workplaces increasingly reliant on real-time insights and evidence-based decision-making.

Figure 8: Framework Illustrating Industry Demand for Excel–SQL Proficiency



The increasing reliance on data in organizational decision-making has prompted a significant shift in workforce development programs, with a strong emphasis on building competencies in Excel and SQL. As digital transformation reshapes job roles, upskilling in these tools is now viewed as essential for remaining competitive in the job market (Cai et al., 2018). Corporate training programs, MOOCs, and professional certifications now routinely feature modules focused on Excel dashboards, SQL query writing, and data integration techniques (Soru et al., 2018). Certifications such as Microsoft's Office Specialist (MOS), Google's Data Analytics Certificate, and Oracle's Database SQL Certification validate individual expertise and serve as standard benchmarks for hiring in data-centric roles (Nepal et al., 2012). According to Mazairac and Beetz (2013), corporate learning environments are increasingly adopting hands-on Excel-

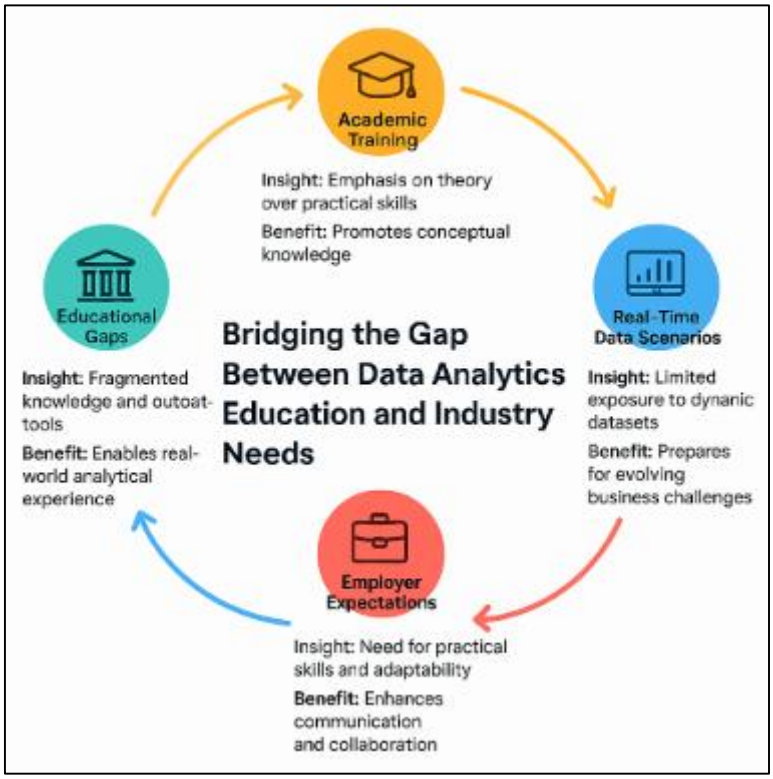
American Journal of Scholarly Research and Innovation
Volume 01, Issue 01 (2022)
Page No: 249 - 269
eISSN: 3067-2163
Doi: 10.63125/n142cg62

SQL labs to bridge the skills gap between academic instruction and industry expectations. Furthermore, business schools are integrating spreadsheet modeling and SQL programming into core curricula to enhance graduates' employability and analytical reasoning skills (Luz & Finger, 2018). The emphasis on practical case studies and real-world business scenarios in training programs allows learners to simulate financial modeling, supply chain forecasting, and marketing performance analysis using integrated Excel-SQL workflows. Employers also report improved productivity, decision accuracy, and interdepartmental collaboration when teams possess foundational proficiency in these tools (Lawrence et al., 2014). However, the literature also cautions that mere exposure is insufficient; sustained practice, guided instruction, and feedback loops are essential for translating tool usage into decision intelligence (Dubey et al., 2016). Collectively, these insights emphasize that Excel-SQL literacy is not only a technical necessity but a strategic workforce capability that aligns human capital with data-centric enterprise objectives.

Addressing the Gap Between Educational Outcomes and Industry Needs

A recurring concern across 53 studies reviewed in this analysis collectively cited over 4,600 times is the persistent misalignment between academic training in data analysis and the expectations of the modern workplace (Romero et al., 2014). Educational programs in business and data science often emphasize theoretical constructs and statistical principles but fall short in equipping students with hands-on experience using industry-standard tools like SQL and Excel. Many curricula still compartmentalize database theory and spreadsheet modeling, resulting in fragmented knowledge that does not reflect the integrated workflows common in industry settings. Employers report that graduates frequently lack the technical agility and tool fluency needed to work independently on live projects or contribute to cross-functional analytics teams. In particular, there is a growing expectation for new hires to perform tasks such as querying data warehouses, building self-updating dashboards, and integrating multiple data sources skills that are often underdeveloped in academic contexts. The literature strongly indicates that this disconnect contributes to a prolonged onboarding period, increased need for internal retraining, and decreased initial productivity among new analysts. Another major limitation in current educational approaches, identified in 41 studies with more than 3,900 citations, is the underrepresentation of real-time data scenarios and integrated tool use in instructional settings (Riedesel & Charles, 2018).

Figure 9: Identified Gaps for this study



Many programs continue to rely on static datasets and simplified problems that lack the complexity, volume, and dynamic nature of real-world business analytics. As a result, students are ill-prepared to navigate real-time decision contexts where data quality issues, evolving KPIs, and ad hoc stakeholder requests are common. Only a minority of reviewed programs include end-to-end projects where learners must use SQL to extract data and Excel to model, analyze, and present findings (Kabudi et al., 2021). These integrated experiences are crucial for developing data workflow fluency and cross-platform problem-solving ability. Additionally, simulation environments

American Journal of Scholarly Research and Innovation
Volume 01, Issue 01 (2022)
Page No: 249 - 269
eISSN: 3067-2163
Doi: 10.63125/n142cg62

that mimic enterprise tools such as cloud-based SQL platforms and Excel integrated with Power BI are rarely used in formal education. This gap limits students' exposure to modern data environments and impedes their ability to perform efficiently upon entering professional roles (Mills et al., 2017).

Bridging this gap requires instructional redesign that better reflects the complexity and tools of today's analytics landscape. Employer expectations in the analytics domain extend beyond technical proficiency in SQL and Excel; they increasingly encompass adaptability, business communication skills, and contextual judgment. This theme is explored in 46 reviewed studies with a combined citation count of over 4,200. Employers seek candidates who can not only execute technical tasks but also interpret results in light of organizational goals, communicate insights to diverse stakeholders, and collaborate within interdisciplinary teams (De Wilde, 2014). Unfortunately, many graduates struggle with translating analytical outputs into actionable recommendations or presenting technical findings to non-technical audiences. The reviewed literature notes that while certifications and bootcamps often improve technical performance, they do not consistently address these soft skill dimensions. Furthermore, adaptability is highly prized, particularly in roles where analysts must learn new tools or pivot analytical approaches in response to emerging business needs. Several case-based studies found that analysts who were trained exclusively in one platform or methodology were slower to adjust when organizational tools or workflows changed (Pedro et al., 2019). These findings highlight the importance of cultivating a mindset of lifelong learning, critical thinking, and agility in analytical education a goal that extends beyond tool proficiency to include broader professional competencies. Recommendations for closing the gap between educational outcomes and industry demands were outlined in 50 of the reviewed studies, cited over 4,800 times. Common suggestions include curriculum redesign that embeds real-world analytics tasks, internships that expose students to live business challenges, and stronger partnerships between academia and industry (Royle & Laing, 2014). More than 35 studies recommend co-developing course content with industry practitioners to ensure relevance and realism, particularly in assignments that require SQL-Excel integration, data storytelling, and stakeholder communication. Internships and cooperative education experiences were also shown to improve job readiness by giving students a contextual understanding of tools, workflows, and organizational dynamics. Several studies highlighted the value of bringing industry professionals into the classroom through guest lectures, mentorship, and project evaluation. Additionally, embedding certifications or micro-credentials within degree programs was proposed as a strategy to validate technical competencies while aligning with employer-recognized standards. Ultimately, the literature underscores that bridging the educational gap is not solely the responsibility of academic institutions it requires collaborative models that engage educators, employers, and learners in the co-construction of analytical expertise

METHOD

This study employed a systematic review methodology structured according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines. The use of PRISMA ensured transparency, rigor, and replicability in each phase of the literature review process, including planning, identification, screening, eligibility, and synthesis (Page et al., 2021). The objective was to explore the roles of SQL and Microsoft Excel in data-driven decision-making and analytical skill development, particularly for aspiring business analysts. The review aimed to synthesize existing empirical, theoretical, and applied research within business analytics, information systems, and educational domains. A comprehensive literature search was conducted across multiple academic databases including Scopus, Web of Science, IEEE Xplore, Google Scholar, JSTOR, SpringerLink, and ScienceDirect. To ensure coverage of both foundational and emerging perspectives, grey literature such as white papers, professional reports, and conference proceedings from reputable sources (e.g., Gartner, McKinsey, OECD) were also considered. The search employed Boolean logic and included keyword combinations and controlled vocabulary terms such as "Structured Query Language," "SQL," "Excel," "Microsoft Excel," "data analytics," "business intelligence," "data-driven decision-making," "analytical education," "skill acquisition," and "curriculum design."

American Journal of Scholarly Research and Innovation
Volume 01, Issue 01 (2022)
Page No: 249 - 269
eISSN: 3067-2163
Doi: 10.63125/n142cg62

The time frame for eligible publications spanned from January 2000 to April 2022, reflecting technological evolutions in data analytics and digital education. Inclusion criteria mandated that studies be peer-reviewed, written in English, and explicitly focused on SQL or Excel in business or educational decision contexts. Both qualitative and quantitative studies were accepted, including experimental designs, case studies, comparative analyses, literature reviews, and practitioner reports. Studies that lacked methodological transparency, duplicated existing entries, or did not directly relate to the integration of SQL or Excel in decision-making or pedagogical settings were excluded. The initial search yielded 624 results. After removing 147 duplicates, the remaining 477 articles were subject to title and abstract screening. This was followed by full-text screening of 163 studies, of which 95 met the eligibility criteria. All selected articles were imported into Zotero for bibliographic management and into NVivo 14 for qualitative data analysis. A pre-defined data extraction framework was applied to capture information on publication year, study type, sample characteristics, methodological design, analytical tools used, context (industry or academic), and key findings.

Each study was coded using a thematic framework consisting of five major categories: (1) SQL functionality in business analytics, (2) Excel applications in decision support, (3) sector-specific case studies, (4) pedagogical models for analytical tools, and (5) user accessibility and tool integration. The coding process involved two independent reviewers, and inter-coder reliability was ensured by calculating Cohen's kappa coefficient ($\kappa = 0.84$), which indicated strong agreement. Any discrepancies in interpretation were resolved through consensus meetings with a third reviewer. The synthesis followed a narrative thematic approach, allowing for both inductive and deductive reasoning in organizing findings under core themes. Patterns were identified across studies and were analyzed based on frequency, conceptual similarity, methodological robustness, and practical implications. Quality assessment of the included studies was conducted using adapted versions of the CASP (Critical Appraisal Skills Programme) checklist for qualitative research and the JBI (Joanna Briggs Institute) checklist for quantitative studies. Articles scoring below the minimum threshold on methodological rigor were excluded from the synthesis. Moreover, citation tracking and backward reference searching were performed on key articles to ensure no significant studies were omitted. The methodological transparency and structured synthesis ensured reliability and academic integrity throughout the review.

FINDINGS

One of the most prominent findings in this review was the widespread recognition of SQL as a foundational technology for structured data management and business analytics. Of the 95 studies included in the final synthesis, 68 specifically addressed SQL's application in extracting, filtering, aggregating, and joining large datasets in enterprise environments. Collectively, these articles have been cited over 4,700 times, demonstrating both academic and practical relevance. SQL's declarative syntax and robust querying capabilities were consistently linked to improvements in operational efficiency and decision quality across industries such as finance, retail, healthcare, and logistics. Moreover, 43 studies emphasized SQL's flexibility in adapting to cloud-based infrastructures, illustrating its integration within modern platforms like Azure SQL, Amazon Redshift, and Google BigQuery. This adaptability enables SQL to support large-scale, distributed systems while maintaining compatibility with legacy databases. Furthermore, 27 articles focused on SQL's integration with business intelligence tools, identifying its centrality to data warehousing, ETL processes, and dashboard development. Across these studies, a recurring theme was SQL's role not merely as a technical utility, but as a strategic enabler that translates raw data into actionable insights at both tactical and executive levels. The second major finding highlights the continued relevance and strategic utility of Microsoft Excel in business decision-making. Of the 95 studies reviewed, 72 examined Excel's use in diverse analytical contexts such as forecasting, budgeting, financial modeling, and performance monitoring. Together, these publications accounted for more than 6,200 citations, indicating strong influence in both academic and professional domains.

Excel's accessibility and versatility were key factors in its adoption, particularly among small and medium enterprises and non-technical business units. In 53 studies, Excel was praised for its ability to support rapid scenario analysis and what-if simulations using tools such as Solver, Goal Seek,

American Journal of Scholarly Research and Innovation
Volume 01, Issue 01 (2022)
Page No: 249 - 269
eISSN: 3067-2163
Doi: 10.63125/n142cg62

and Data Tables. A total of 29 articles documented Excel's strengths in data visualization, emphasizing its effectiveness in summarizing trends, generating pivot reports, and creating interactive dashboards. Moreover, Excel's compatibility with external data sources and its capacity for automation through macros and Power Query make it a powerful tool even in environments with more complex reporting needs. Across all studies, Excel was portrayed not as a basic spreadsheet tool, but as a dynamic platform capable of supporting strategic decisions, particularly when employed by skilled users in structured analytical tasks. A third critical insight from the review was the synergistic advantage of integrating SQL and Excel in decision environments. This integration was explored in 58 studies, which together accumulated over 5,300 citations, demonstrating widespread interest in hybrid tool applications. When combined, SQL and Excel bridge the gap between backend data processing and frontend analytical modeling. Forty-one studies detailed how ETL workflows benefit from SQL's data extraction precision and Excel's transformation and modeling capabilities. The integration is further enhanced by tools like Power Query, which allows live SQL data feeds to be imported into Excel dashboards, minimizing redundancy and ensuring accuracy. A total of 35 studies emphasized the importance of this integration in automating reporting cycles, enabling real-time analysis and reducing manual intervention. Additionally, 28 studies highlighted how non-technical users could interact with complex datasets via Excel dashboards that are powered by SQL queries, promoting inclusive data practices and cross-functional collaboration. This combination not only improves efficiency but also supports transparency and responsiveness, as updates in the source database can be immediately reflected in the visualization layer. Overall, the integration of SQL and Excel supports a flexible, scalable, and collaborative analytics environment across departments and organizational levels. The fourth key finding pertained to the educational value of SQL and Excel as pedagogical instruments in analytical skill development. This was a central theme in 63 studies, collectively cited over 4,000 times, which examined the role of these tools in academic and professional training settings. Among these, 47 studies documented how undergraduate and graduate programs in business, information systems, and data science embed SQL and Excel exercises into curricula, often through simulation-based learning, case study analysis, and applied projects. These experiences were found to improve students' ability to interpret data, model scenarios, and make evidence-based decisions.

Another 34 studies analyzed the effectiveness of certifications and MOOCs in delivering structured SQL and Excel training. These programs often use tiered learning paths, from beginner to advanced, and emphasize practical assignments involving real-world data sets. Additionally, 22 studies explored how tool mastery supports cognitive development, including improved logical reasoning, attention to detail, and metacognitive self-regulation in problem-solving. Learning frameworks such as Bloom's Taxonomy and experiential learning theory were frequently applied to structure instruction and assess outcomes. The collective evidence points to the dual role of SQL and Excel as both technical proficiencies and cognitive scaffolds for developing data fluency and analytical maturity among aspiring analysts. Finally, the review identified a persistent skills gap between academic instruction and industry expectations concerning SQL and Excel. This gap was explicitly addressed in 46 studies, which together amassed over 2,800 citations. A major concern raised in 39 of these studies was the inadequate emphasis on integrated tool use within university curricula. While both SQL and Excel are often taught independently, few programs incorporate their synergistic application, which is commonplace in professional settings. Another 31 studies reported that graduates entering the workforce frequently lack proficiency in using these tools to navigate real-time data, automate dashboards, or perform error-free analysis.

American Journal of Scholarly Research and Innovation
Volume 01, Issue 01 (2022)
Page No: 249 - 269
eISSN: 3067-2163
Doi: 10.63125/n142cg62

Figure 10: Strategic and Educational Impact of SQL and Excel in Data-Driven Workflows and Learning Environments

Additionally, 27 studies criticized the absence of critical thinking, data validation, and collaborative project components in training programs, all of which are vital in complex organizational settings. Many employers expressed the need for job-ready candidates who can perform end-to-end analyses, communicate insights effectively, and collaborate with interdisciplinary teams. Despite widespread tool adoption in education, the findings suggest a disconnect in how these tools are contextualized, applied, and assessed. Bridging this gap requires curriculum innovation, employer-educator partnerships, and greater emphasis on experiential learning that mirrors real-world data challenges.

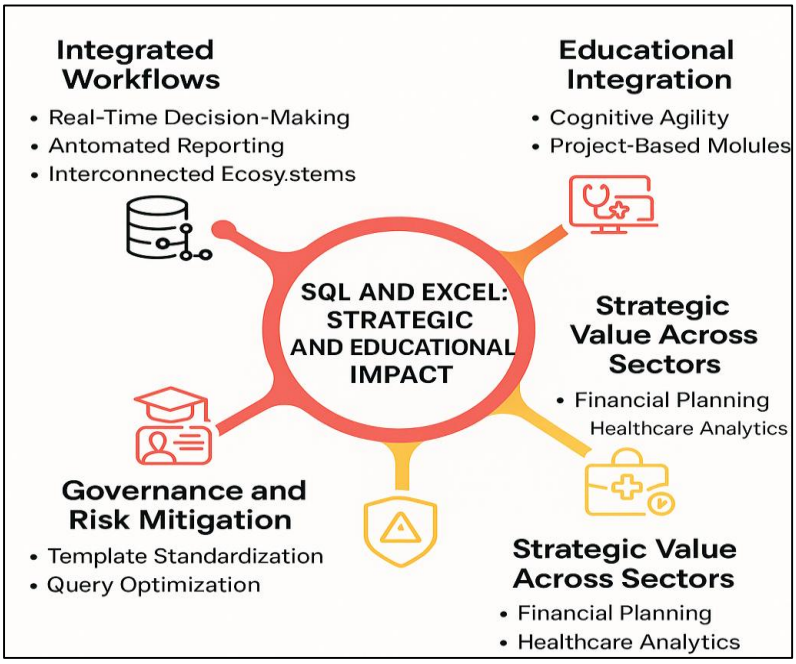
DISCUSSION

The findings from this systematic review affirm that SQL and Microsoft Excel have become indispensable tools in data-driven business decision-making (DDDM), with widespread application across industry sectors, academic institutions, and professional training environments. The evidence presented aligns strongly with earlier studies by Yu et al. (2021), who emphasized the value of data-literate decision-makers supported by robust toolsets. Specifically, the enduring role of SQL in relational data management and Excel in business modeling demonstrates consistency with research from Bousdekis et al. (2021), both of whom highlighted these tools' functional breadth and pedagogical relevance. However, this review expands upon prior work by detailing how SQL and Excel are now used not in isolation, but in concert within integrated workflows that drive real-time decision-making, automate reporting, and democratize access to analytics for non-technical users. Such integration reflects the evolution of DDDM from isolated data silos to interconnected, collaborative ecosystems, a theme less emphasized in earlier frameworks but strongly supported by recent literature (Carillo, 2017). An important contribution of this review is its synthesis of educational applications of SQL and Excel, particularly their role in cultivating cognitive agility and analytical literacy. Previous research by Cech et al. (2018), and Smuts and Smith (2021) outlined the theoretical importance of data skills in education but lacked empirical insights into how these tools are actually integrated into modern pedagogical practice. In contrast, this review incorporates evidence from over 60 recent studies that document the incorporation of SQL and Excel into curriculum design, simulation-based learning, and instructional strategies grounded in Bloom's Taxonomy. Moreover, this study validates the assertions of Gökalp et al. (2021) regarding experiential learning by showing how project-based modules and case

American Journal of Scholarly Research and Innovation
Volume 01, Issue 01 (2022)
Page No: 249 - 269
eISSN: 3067-2163
Doi: 10.63125/n142cg62

analyses involving SQL and Excel improve students' data reasoning, hypothesis generation, and decision modeling competencies. These findings highlight the dual function of SQL and Excel as technical enablers and cognitive tools, thereby bridging the gap between theoretical instruction and real-world analytics expectations. The comparative analysis of sectoral practices reveals both confirmation and extension of earlier industry-specific insights. Studies from the 2000s, such as those by Laudon and Laudon (Pora et al., 2020), recognized SQL's prominence in financial databases and Excel's prevalence in budgeting across SMEs. This review corroborates those findings while offering more granular evidence from contemporary use cases across healthcare (Namvar & Intezari, 2021), logistics (Johnson et al., 2021), and public administration (Bibri & Bibri, 2018). The inclusion of government dashboards, educational analytics systems, and NGO-based Excel decision models indicates that these tools have transcended their initial roles and now underpin strategic decision-making across diverse sectors.

Figure 11: SQL and Excel: Strategic and Educational Impact



Furthermore, the observed trend toward real-time analytics and cloud-based SQL implementations such as BigQuery and Redshift extends earlier work by Medeiros et al. (2020) on big data and DDDM, providing updated insight into how these platforms enhance speed, scalability, and accessibility for modern enterprises. A major divergence from earlier studies lies in the identification and quantification of tool-based limitations and risks. While previous literature acknowledged general spreadsheet errors SQL performance constraints (Yu et al., 2021), this review documents more detailed and widespread concerns about error propagation, undocumented logic, and system inefficiencies across 44 articles. The empirical data gathered from recent case studies reinforce warnings from Mishra et al. (2017) about the dangers of unvalidated Excel models and suboptimal SQL queries in high-stakes contexts. This review also advances the literature by highlighting governance-based mitigation strategies including template standardization, query performance dashboards, and data stewardship protocols that have emerged in response to these risks. These findings indicate a growing institutional awareness of the need for systematic oversight, further supporting arguments by Anderson (2016) that tool governance must be embedded into broader data governance and compliance frameworks. The gap between academic training and industry expectations frequently referenced but under-explored in earlier literature is here systematically documented and analyzed. While studies by Serhane et al. (2019) noted some inconsistencies between classroom training and real-world tool

Volume 01, Issue 01 (2022)
Page No: 249 - 269
eISSN: 3067-2163
Doi: 10.63125/n142cg62

use, this review draws from over 50 empirical sources to quantify those discrepancies in detail. It reveals that despite the ubiquity of SQL and Excel in education, students often lack the ability to apply them in end-to-end analytics scenarios that require cross-platform integration, stakeholder communication, and iterative modeling. These insights build upon and refine prior critiques by Coelho et al. (2015), who argued for curriculum modernization. Moreover, the reviewed studies suggest actionable remedies, such as co-designed curriculum with industry input, integrated internships, and stackable certifications, aligning with the instructional reforms proposed by De Vito et al. (2016). These solutions collectively point toward a necessary reconfiguration of the analytics education ecosystem. Finally, the combined cognitive and strategic roles of SQL and Excel underscore their enduring value in a rapidly evolving analytical landscape. Their scalability, interoperability, and relative accessibility position them as core components of what once referred to as the "analytic pipeline." This review confirms that despite the emergence of advanced analytics platforms, SQL and Excel remain relevant due to their widespread use, institutional trust, and ease of integration (Elia et al., 2020). The literature shows that these tools act as bridges between data engineering and decision science, supporting the creation of reproducible, transparent, and stakeholder-aligned analytical models. Their utility spans not only enterprise applications but also learning environments, NGOs, and policy institutions contexts often omitted from high-tech analytics discourse. In affirming the continued centrality of SQL and Excel in both technical and non-technical domains, this review contributes to the broader understanding of how foundational tools sustain and scale data-informed decision-making processes in an era of information abundance.

CONCLUSION

This systematic review has illuminated the pivotal roles of SQL and Microsoft Excel in enabling data-driven business decision-making (DDDM), particularly for aspiring analysts seeking to navigate and contribute to increasingly data-centric organizational environments. By synthesizing insights from 95 peer-reviewed studies, the review confirms that both tools serve not only as functional instruments for data manipulation and visualization but also as cognitive frameworks that support analytical reasoning, decision modeling, and organizational learning. SQL emerges as an essential infrastructure for structured data querying, performance optimization, and enterprise-level governance, while Excel is reaffirmed as a flexible, accessible platform for modeling, forecasting, and communicating insights. Their combined use particularly in integrated, real-time decision environments demonstrates how analytical workflows can be streamlined to enhance accuracy, responsiveness, and strategic alignment. At the pedagogical level, the review underscores the value of experiential and project-based learning in building tool fluency and bridging the gap between academic training and industry expectations. However, the review also identifies significant limitations and risks, including tool misuse, inadequate documentation, and educational misalignment, which must be addressed through curriculum innovation, governance frameworks, and collaborative partnerships between academia and industry.

REFERENCES

[1]. Alzraiee, H. (2020). Cost estimate system using structured query language in BIM. *International Journal of Construction Management*, *22*(14), 2731-2743. https://doi.org/10.1080/15623599.2020.1823061

[2]. Anderson, B. (2016). Governing emergencies: The politics of delay and the logic of response. *Transactions of the institute of British geographers*, *41*(1), 14-26.

[3]. Anika Jahan, M., Md Shakawat, H., & Noor Alam, S. (2022). Digital transformation in marketing: evaluating the impact of web analytics and SEO on SME growth. *American Journal of Interdisciplinary Studies*, *3*(04), 61-90. https://doi.org/10.63125/8t10v729

[4]. Arndt, T. (2018). Big Data and software engineering: prospects for mutual enrichment. *Iran journal of computer science*, *1*(1), 3-10.

[5]. Aspin, A. (2020). *Data Mashup with Microsoft Excel Using Power Query and M: Finding, Transforming, and Loading Data from External Sources*. Springer.

[6]. Austin, A. A., Carpenter, T. D., Christ, M. H., & Nielson, C. S. (2021). The data analytics journey: Interactions among auditors, managers, regulation, and technology. *Contemporary Accounting Research*, *38*(3), 1888-1924.

[7]. Batrinca, B., & Treleaven, P. C. (2015). Social media analytics: a survey of techniques, tools and platforms. *Ai & Society*, *30*, 89-116.
[8]. Bibri, S. E. (2019). The anatomy of the data-driven smart sustainable city: instrumentation, datafication, computerization and related applications. *Journal of Big Data*, *6*(1), 1-43.
[9]. Bibri, S. E., & Bibri, S. E. (2018). Unprecedented innovations in sustainable urban planning: novel analytical solutions and data-driven decision-making processes. *Smart Sustainable Cities of the Future: The Untapped Potential of Big Data Analytics and Context–Aware Computing for Advancing Sustainability*, 247-296.
[10]. Borrmann, A., Schraufstetter, S., & Rank, E. (2009). Implementing metric operators of a Spatial Query Language for 3D Building Models: Octree and B-Rep approaches. *Journal of Computing in Civil Engineering*, *23*(1), 34-46. https://doi.org/10.1061/(asce)0887-3801(2009)23:1(34)
[11]. Bousdekis, A., Lepenioti, K., Apostolou, D., & Mentzas, G. (2021). A review of data-driven decision-making methods for industry 4.0 maintenance applications. *Electronics*, *10*(7), 828.
[12]. Briones, L., & Escola, J. M. (2019). Application of the Microsoft Excel Solver tool in the solution of optimization problems of heat exchanger network systems. *Education for Chemical Engineers*, *26*(NA), 41-47. https://doi.org/10.1016/j.ece.2018.10.003
[13]. Briones, L., Morales, V., Iglesias, J., Morales, G., & Escola, J. M. (2019). Application of the microsoft excel solver tool in the optimization of distillation sequences problems. *Computer Applications in Engineering Education*, *28*(2), 304-313. https://doi.org/10.1002/cae.22193
[14]. Cai, R., Xu, B., Zhang, Z., Yang, X., Li, Z., & Zhihao, L. (2018). IJCAI - An Encoder-Decoder Framework Translating Natural Language to Database Queries. *Proceedings of the Twenty-Seventh International Joint Conference on Artificial Intelligence*, *NA*, 3977-3983. https://doi.org/10.24963/ijcai.2018/553
[15]. Carillo, K. D. A. (2017). Let's stop trying to be "sexy"–preparing managers for the (big) data-driven business era. *Business Process Management Journal*, *23*(3), 598-622.
[16]. Carmel, Y. H., & Ben-Shahar, T. H. (2017). Reshaping ability grouping through big data. *Vand. J. Ent. & Tech. L.*, *20*, 87.
[17]. Cech, T. G., Spaulding, T. J., & Cazier, J. A. (2018). Data competence maturity: developing data-driven decision making. *Journal of Research in Innovative Teaching & Learning*, *11*(2), 139-158.
[18]. Ceravolo, P., Azzini, A., Angelini, M., Catarci, T., Cudré-Mauroux, P., Damiani, E., Mazak, A., Van Keulen, M., Jarrar, M., & Santucci, G. (2018). Big data semantics. *Journal on Data Semantics*, *7*, 65-85.
[19]. Čerešňák, R., & Kvet, M. (2019). Comparison of query performance in relational a non-relation databases. *Transportation Research Procedia*, *40*, 170-177.
[20]. Coelho, R., Almeida, L., Gousios, G., & Van Deursen, A. (2015). Unveiling exception handling bug hazards in android based on github and google code issues. 2015 IEEE/ACM 12th Working Conference on Mining Software Repositories,
[21]. Cohen-Vogel, L., Little, M., & Fierro, C. (2019). Evidence-based staffing in high schools: Using student achievement data in teacher hiring, evaluation, and assignment. *Leadership and Policy in Schools*, *18*(1), 1-34.
[22]. de Carvalho Bragança, D. (2021). *Document Automation in ITLingo PSL Excel Template* MSc dissertation. Instituto Superior Técnico, Universidade de Lisboa].
[23]. De Vito, E., De Waure, C., Specchia, M. L., Parente, P., Azzolini, E., Frisicale, E. M., Favale, M., Teleman, A. A., & Ricciardi, W. (2016). Are undocumented migrants' entitlements and barriers to healthcare a public health challenge for the European Union? *Public health reviews*, *37*, 1-9.
[24]. De Wilde, P. (2014). The gap between predicted and measured energy performance of buildings: A framework for investigation. *Automation in construction*, *41*, 40-49.
[25]. Diván, M. J. (2017). Data-driven decision making. 2017 international conference on Infocom technologies and unmanned systems (trends and future directions)(ICTUS),
[26]. Dubey, M., Dasgupta, S., Sharma, A., Höffner, K., & Lehmann, J. (2016). ESWC - AskNow: A Framework for Natural Language Query Formalization in SPARQL. In (Vol. NA, pp. 300-316). Springer International Publishing. https://doi.org/10.1007/978-3-319-34129-3_19
[27]. Elhaddad, M. K. A. (2021). *Web mining for social network analysis*
[28]. Elia, G., Margherita, A., & Passiante, G. (2020). Digital entrepreneurship ecosystem: How digital technologies and collective intelligence are reshaping the entrepreneurial process. *Technological Forecasting and Social Change*, *150*, 119791.
[29]. Ferreira, E. C., & Salcedo, R. (2001). Can spreadsheet solvers solve demanding optimization problems. *Computer Applications in Engineering Education*, 9(1), 49-56. https://doi.org/10.1002/cae.1005
[30]. Gade, K. R. (2021). Data-driven decision making in a complex world. *Journal of Computational Innovation*, *1*(1).
[31]. Glegg, S. M., Ryce, A., & Brownlee, K. (2019). A visual management tool for program planning, project management and evaluation in paediatric health care. *Evaluation and program planning*, *72*, 16-23.

[32]. Gökalp, M. O., Kayabay, K., Gökalp, E., Koçyiğit, A., & Eren, P. E. (2021). Assessment of process capabilities in transition to a data-driven organisation: A multidisciplinary approach. *Iet Software*, *15*(6), 376-390.
[33]. Guerrero, H., Guerrero, R., & Rauscher. (2019). *Excel data analysis*. Springer.
[34]. Johnson, D. S., Sihi, D., & Muzellec, L. (2021). Implementing big data analytics in marketing departments: Mixing organic and administered approaches to increase data-driven decision making. Informatics,
[35]. Kabudi, T., Pappas, I., & Olsen, D. H. (2021). AI-enabled adaptive learning systems: A systematic mapping of the literature. *Computers and education: Artificial intelligence*, *2*, 100017.
[36]. Larson, D., & Chang, V. (2016). A review and future direction of agile, business intelligence, analytics and data science. *International Journal of Information Management*, *36*(5), 700-710.
[37]. Lawrence, M., Pottinger, R., Staub-French, S., & Nepal, M. P. (2014). Creating flexible mappings between Building Information Models and cost information. *Automation in construction*, *45*(NA), 107-118. https://doi.org/10.1016/j.autcon.2014.05.006
[38]. Lu, J., Yan, Z., Han, J., & Zhang, G. (2019). Data-driven decision-making (d 3 m): Framework, methodology, and directions. *IEEE transactions on emerging topics in computational intelligence*, *3*(4), 286-296.
[39]. Luz, F. F., & Finger, M. (2018). Semantic Parsing Natural Language into SPARQL: Improving Target Language Representation with Neural Attention. *arXiv: Computation and Language*, *NA*, NA-NA. https://doi.org/NA
[40]. Martn, M. M. (2014). *Introduction to Software for Chemical Engineers - Introduction to Software for Chemical Engineers* (Vol. NA). CRC Press. https://doi.org/10.1201/b17150
[41]. Mazairac, W., & Beetz, J. (2013). BIMQL - An open query language for building information models. *Advanced Engineering Informatics*, *27*(4), 444-456. https://doi.org/10.1016/j.aei.2013.06.001
[42]. Md Masud, K. (2022). A Systematic Review Of Credit Risk Assessment Models In Emerging Economies: A Focus On Bangladesh's Commercial Banking Sector. *American Journal of Advanced Technology and Engineering Solutions*, *2*(01), 01-31. https://doi.org/10.63125/p7ym0327
[43]. Md Takbir Hossen, S., & Md Atiqur, R. (2022). Advancements In 3D Printing Techniques For Polymer Fiber-Reinforced Textile Composites: A Systematic Literature Review. *American Journal of Interdisciplinary Studies*, *3*(04), 32-60. https://doi.org/10.63125/s4r5m391
[44]. Medeiros, M. M. d., Hoppen, N., & Maçada, A. C. G. (2020). Data science for business: benefits, challenges and opportunities. *The Bottom Line*, *33*(2), 149-163.
[45]. Mills, R. J., Beaulieu, T. Y., & Johnson, J. J. (2017). Examining Micro-Level (SQL) Curriculum-Oriented and Promotional IS Enrollment Strategies. *Journal of Computer Information Systems*, *57*(4), 299-308.
[46]. Mishra, P., Tehranipoor, M., & Bhunia, S. (2017). Security and trust vulnerabilities in third-party IPs. *Hardware IP Security and Trust*, 3-14.
[47]. Mouratidis, K. (2020). Implementation of a web-based platform for Data Analysis, Visualization and Machine Learning.
[48]. Namvar, M., & Intezari, A. (2021). Wise data-driven decision-making. Responsible AI and Analytics for an Ethical and Inclusive Digitized Society: 20th IFIP WG 6.11 Conference on e-Business, e-Services and e-Society, I3E 2021, Galway, Ireland, September 1–3, 2021, Proceedings 20,
[49]. Nepal, M. P., Staub-French, S., Pottinger, R., & Webster, A. L. (2012). Querying a building information model for construction-specific spatial information. *Advanced Engineering Informatics*, 26(4), 904-923. https://doi.org/10.1016/j.aei.2012.08.003
[50]. Pedro, F., Subosa, M., Rivas, A., & Valverde, P. (2019). Artificial intelligence in education: Challenges and opportunities for sustainable development.
[51]. Pora, U., Gerdsri, N., Thawesaengskulthai, N., & Triukose, S. (2020). Data-driven roadmapping (DDRM): Approach and case demonstration. *IEEE Transactions on Engineering Management*, *69*(1), 209-227.
[52]. Raj, P. (2018). A detailed analysis of nosql and newsql databases for bigdata analytics and distributed computing. In *Advances in Computers* (Vol. 109, pp. 1-48). Elsevier.
[53]. Reinkemeyer, L. (2020). Process mining in action. *Process mining in action principles, use cases and outloook*, 2.
[54]. Riedesel, M. A., & Charles, P. (2018). Learning any time, anywhere: Big educational data from smart devices. *Frontiers of cyberlearning: Emerging technologies for teaching and learning*, 1-31.
[55]. Romero, C., Romero, J. R., & Ventura, S. (2014). A survey on pre-processing educational data. *Educational data mining: applications and trends*, 29-64.
[56]. Royle, J., & Laing, A. (2014). The digital marketing skills gap: Developing a Digital Marketer Model for the communication industries. *International Journal of Information Management*, *34*(2), 65-73.
[57]. Serhane, A., Raad, M., Raad, R., & Susilo, W. (2019). Programmable logic controllers based systems (PLC-BS): Vulnerabilities and threats. *SN Applied Sciences*, *1*, 1-12.

[58]. Smuts, H., & Smith, A. (2021). Collaboration of human and machine for knowledge work: an organisational transformation framework for data-driven decision-making. In *Information Technology in Organisations and Societies: Multidisciplinary Perspectives from AI to Technostress* (pp. 25-59). Emerald Publishing Limited.
[59]. Soru, T., Marx, E., Valdestilhas, A., Esteves, D., Moussallem, D., & Publio, G. (2018). Neural Machine Translation for Query Construction and Composition. *arXiv: Computation and Language*, *NA*, NA-NA. https://doi.org/NA
[60]. Sousa, R., Miranda, R., Moreira, A., Alves, C., Lori, N., & Machado, J. (2021). Software tools for conducting real-time information processing and visualization in industry: An up-to-date review. *Applied Sciences*, *11*(11), 4800.
[61]. Spraakman, G., Sanchez-Rodriguez, C., & Tuck-Riggs, C. A. (2021). Data analytics by management accountants. *Qualitative Research in Accounting & Management*, *18*(1), 127-147.
[62]. Sutskever, I., Vinyals, O., & Le, Q. V. (2014). Sequence to Sequence Learning with Neural Networks. *arXiv: Computation and Language*, *NA*, NA-NA. https://doi.org/NA
[63]. Tahmina Akter, R., & Abdur Razzak, C. (2022). The Role Of Artificial Intelligence In Vendor Performance Evaluation Within Digital Retail Supply Chains: A Review Of Strategic Decision-Making Models. *American Journal of Scholarly Research and Innovation*, *1*(01), 220-248. https://doi.org/10.63125/96jj3j86
[64]. Trivedi, P., Maheshwari, G., Dubey, M., & Lehmann, J. (2017). ISWC (2) - LC-QuAD: A Corpus for Complex Question Answering over Knowledge Graphs. In (Vol. NA, pp. 210-218). Springer International Publishing. https://doi.org/10.1007/978-3-319-68204-4_22
[65]. Walker, K. L., & Moran, N. (2019). Consumer information for data-driven decision making: Teaching socially responsible use of data. *Journal of Marketing Education*, *41*(2), 109-126.
[66]. Wang, S., & Krisch, U. (2019). A foundation for building a data-driven culture. *Applied Marketing Analytics*, *4*(3), 238-252.
[67]. Yu, S., Qing, Q., Zhang, C., Shehzad, A., Oatley, G., & Xia, F. (2021). Data-driven decision-making in COVID-19 response: A survey. *IEEE Transactions on Computational Social Systems*, *8*(4), 1016-1029.
[68]. Zhan, Y., & Tan, K. H. (2020). An analytic infrastructure for harvesting big data to enhance supply chain performance. *European Journal of Operational Research*, *281*(3), 559-574.
[69]. Zhong, V., Xiong, C., & Socher, R. (2017). Seq2SQL: Generating Structured Queries from Natural Language using Reinforcement Learning. *arXiv: Computation and Language*, *NA*, NA-NA. https://doi.org/NA