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2024 **Evalencia Anyamesem**

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Using Data Storytelling and Analytics to Drive Improvement in Business Operations

Bachelor's Thesis

2024 Evalencia Anyamesem

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Theses guidelines

The aim of the work is to explore the use of data storytelling and analytics to drive improvement in organizations' operations and processes. The work will focus on identifying performance indicators and trends through data analysis and leveraging data storytelling techniques to communicate insights to stakeholders.

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- Concept of Data Storytelling.
- Use of Data Storytelling techniques.

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Boldosova, V., & Luoto, S. (2019). Storytelling, business analytics and Big Data Interpretation. *Management Research Review, 43*(2), 204?222. https://doi.org/10.1108/mrr-03-2019-0106

Daradkeh, M. K. (2021). An empirical examination of the relationship between data storytelling competency and Business Performance. *Journal of Organizational and End User Computing, 33(5)*, 42?73. https://doi.org/10.4018/joeuc.20210901.oa3

Dykes, B. (2015). Data storytelling: What it is and how it can be used to effectively communicate analysis results. In the *Applied Marketing Analytics: The Peer-Reviewed Journal*, Volume 1, Issue 4.

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Knaflic, C. N. (2015). *Storytelling with data: A Data Visualization Guide for Business Professionals*. John Wiley & Sons, Inc.

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In Pardubice September 1, 2023

DECLARATION:

I declare:

The thesis entitled “Using Data Storytelling and Analytics to Drive Improvement in Business Operations” is my own work. All literary sources and information that I used in the thesis are referenced in the bibliography.

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Evalencia Anyamesem

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This thesis represents not only my work at the keyboard, but it is also a milestone in more than one way. It is a result of the support and guidance of many individuals, and it is my pleasure to take this opportunity to thank them.

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ANNOTATION

The aim of this work is to leverage data storytelling techniques and data analytics to drive improvement in organizations' operations and processes. Three organizations from Ghana namely, Becky-Liz Trading Ventures (sales industry), Pen Global (writing and research industry), and Experience Ghana (tourism industry) were selected, based on their involvement in a key strategic initiative focused on process/operational improvement. The research involved performing interviews with stakeholders to understand challenges, analysing narratives and visualizations, observing presentations, conducting focus groups, and gathering feedback through multiple implementation cycles. Qualitative comparative analysis was used to identify operational challenges, whilst Quantitative pre/post comparisons measured the impact of narratives and framework on operational metrics over time.

TITLE

Using Data Storytelling and Analytics to Drive Improvement in Business Operations

KEYWORDS

Data storytelling, analytical insight, performance indicators, visualization

ANOTACE

Cílem této práce je využít vyprávění příběhů na základě dat a analýzy dat pro zlepšování činností a postupů společností. Byly vybrány tři organizace z Ghany, konkrétně Becky-Liz Trading Ventures (odvětví prodeje), Pen Global (odvětví psaní a výzkumu) a Experience Ghana (odvětví cestovního ruchu), na základě zapojení do klíčové strategické iniciativy zaměřené na zlepšování postupů/činností. Součástí výzkumu byly rozhovory s klíčovými aktéry s cílem porozumět různým výzvám, analýza narativů a vizualizací, pozorování prezentací, realizace skupinových diskuzí a získávání zpětné vazby napříč několika implementačními cykly. Pro identifikaci provozních výzev byla využita kvalitativní komparativní analýza, zatímco kvantitativní předběžná a následná srovnání posloužila pro hodnocení dopadu narativů a rámce na provozní ukazatele v průběhu času.

KLÍČOVÁ SLOVA

Vyprávění příběhů na základě dat, analytický vhled, ukazatele výkonnosti, vizualizace

NÁZEV

Využití vyprávění příběhů na základě dat a analýz dat pro zlepšování obchodních postupů

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LIST OF ABBREVIATION

CFC	Cross Functional Collaboration
CLT	Construal Level Theory
DCT	Dual Coding Theory
KPIs	Key Performance Indicators
LAB	Longitudinal Analytics Benchmarks
OPM	Operations Performance Metrics
SCM	Supply Chain Management
ST	Structuration Theory

INTRODUCTION

In today's data-driven business landscape, organizations are increasingly recognizing the importance of leveraging data analytics to drive improvement in their operations. The ability to extract meaningful insights from vast amounts of data has become an asset for decision-making and strategic planning. However, the challenge lies in effectively communicating these analytical insights to stakeholders and decision-makers in a way that is easily understandable and impactful. *(see Figure 1)*

Figure 1:Data visualization providing more understanding for decision-makers

(Adapted from Axerrio (2020))

One emerging approach that addresses this challenge is data storytelling. Data storytelling refers to the practice of using narratives and visualizations to convey complex data and analytical findings in a compelling and engaging manner. It combines the power of data analytics with the art of storytelling, allowing organizations to communicate insights, trends, and patterns in a way that resonates with their audience (Boldosova & Luoto, 2020; Oberascher et al., 2023).

The research objectives of this study are threefold:

a. First, the study aims to analyse the current state of business operations in various companies and identify areas that require improvement. This analysis will provide a comprehensive understanding of the challenges and opportunities organizations face in optimizing their operational performance.
b. Second, the study seeks to explore the role of data storytelling in effectively communicating analytical insights to stakeholders and decision-makers in business operations. By examining the existing literature on storytelling, business analytics, and big data interpretation, researchers have highlighted the potential of data storytelling as a

powerful tool for communication and decision support (Boldosova & Luoto, 2020; Oberascher et al., 2023).

c. Finally, the study aims to develop a framework for integrating data analytics and storytelling techniques to drive improvement in business operations. This framework will provide organizations with a structured approach to harness the power of data storytelling and leverage it to enhance decision-making, optimize processes, and drive overall performance. The research conducted by Daradkeh (2021) explores the relationship between data storytelling competency, decision-making quality, and business performance, offering empirical evidence of the potential impact of data storytelling on organizational outcomes.

Historically, the practice of using storytelling to convey information and insights has been deeply embedded in human culture since ages and it shown in *(Figure.2)* below. It has been recognized as a powerful means of communication, allowing individuals to engage and connect with others on an emotional level. However, the integration of data storytelling with analytics in business operations is a more recent development, driven by advancements in technology and the increasing availability of big data.

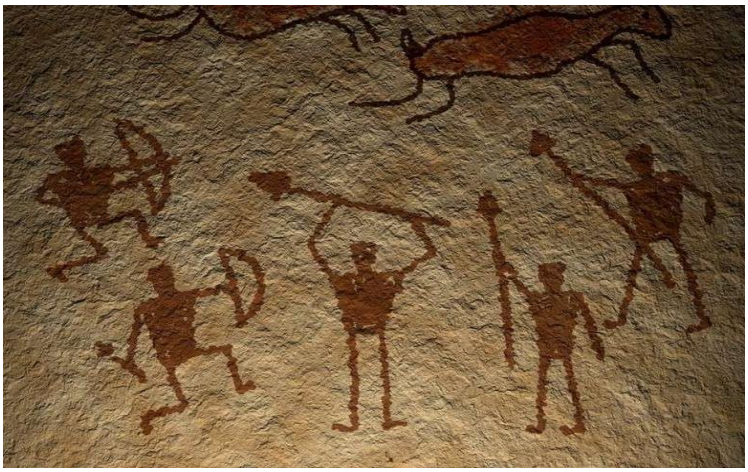

Figure 2:Cave Drawings Depicting Storytelling (Tom Holscher (2017)

Boldosova and Luoto (2020) conducted a literature review and theoretical analysis to explore the intersection of storytelling, business analytics, and big data interpretation. Their study highlights the potential of data storytelling as a communication tool for conveying complex analytical insights to stakeholders. They propose that by employing storytelling techniques, organizations

can enhance decision-making, improve information retention, and stimulate engagement with data-driven insights. Oberascher et al. (2023) provide a practical guide on using data storytelling to communicate big data internally. Their research focuses on the implementation and practical usage of data storytelling techniques within organizations. The article offers recommendations and strategies for effectively utilizing data storytelling to convey analytical insights, thereby facilitating decision-making, and driving improvement in business operations. It emphasizes the importance of storytelling elements such as narrative structure, visualization, and emotional appeal in engaging stakeholders and fostering understanding. Daradkeh (2021) examines the relationship between data storytelling competency, decision-making quality, and business performance through empirical research. The study provides evidence of the mediating role of decision-making quality in the impact of data storytelling competency on business performance. It emphasizes the significance of effective data storytelling skills in influencing decision-making processes and driving positive business outcomes.

Presently, the use of data storytelling and analytics to drive improvement in business operations has gained increased attention and importance. Organizations across companies are recognizing the value of extracting actionable insights from data and communicating them effectively to stakeholders and decision-makers. Data storytelling has emerged as a powerful approach to bridge the gap between complex analytics and decision-making by presenting data in a compelling and relatable manner.

The integration of data storytelling and analytics offers several benefits. It enables organizations to enhance the understanding of data-driven insights, engage stakeholders, and facilitate better decision-making. By employing storytelling techniques, organizations can transform raw data into meaningful narratives, visualizations, and interactive presentations that resonate with the intended audience.

By accomplishing these research objectives, this study seeks to contribute to the growing body of knowledge on the effective utilization of data storytelling and analytics in driving improvement in business operations. It aims to provide practical insights and recommendations for organizations seeking to unlock the full potential of their data and enhance their operational performance through compelling and impactful communication of analytical insights.

1 BUSINESS OPERATIONS IN COMPANIES

Recent studies indicate that business operations across companies face familiar challenges that can be addressed through data-driven improvement initiatives. Knaflic (2015) analysed performance metrics for manufacturing, retail, transportation, and healthcare companies and found widespread issues with inefficient processes, variable quality, and suboptimal resource allocation. Similarly, Kalpic and Bernus (2002) reviewed process companies including oil and gas extraction, chemicals, pharmaceuticals, and food processing, noting delays, waste, and inconsistencies plague many standard operating procedures. Von Delft and Zhao (2021) point to evolving trends across various sectors that further complicate operations management. They particularly highlight demands for sustainability and customization in fields like energy and consumer goods that require agile, adaptive production models. At the same time, shifts to remote work during the pandemic surfaced new complexities in coordinating distributed labour forces (Guenole et al., 2017). These trends have made traditional optimization approaches increasingly difficult to scale.

While specific pain points differ between companies, common problems emerge around visibility, coordination, and responsiveness (Knaflic, 2015; Guenole et al., 2017). Fragmented, siloed data hinders holistic understanding of end-to-end workflows and their impact on strategic goals. A lack of integrated planning across functions reduces efficiency and compliance. Finally, inflexible operations struggle to keep pace with fluctuating customer demands and market changes. To address Research Objective 1 of analysing current operations and improvement opportunities, this literature substantiates pervasive challenges that data analytics and storytelling (Research Objective 3) could help overcome, such as scattered information, lack of interdepartmental alignment, and inability to adapt processes quickly. By mapping issues prevalent in multiple sectors, areas for targeted reform are also identified. The following provide more perspective to the topic (see next chapters).

1.1 Operations performance metrics and challenges faced across companies

Operations performance metrics(OPM) (e.g. productivity, quality, customer satisfaction) determine the quality of business processes. Key performance indicators (KPIs) are critical for evaluating operations and identifying opportunities for change. Sources indicate commonly tracked metrics across sectors include productivity, quality, and customer experience (Gunasekaran & Kobu, 2007; Zairi, 2012; Gunasekaran et al., 2004; Kumar et al., 2013).

Productivity measures, such as units produced per labour hour, are fundamental for assessing process efficiency and capacity utilization (Gunasekaran & Kobu, 2007). Analysis of these metrics over time can reveal bottlenecks, wasted effort from rework, or underperforming assets (Knaflic, 2015). However, productivity alone provides an incomplete picture without also factoring quality (Zairi, 2012).

Quality metrics encompass conformance to specifications as well as customer requirements. Tracking defect and rejection rates is essential for the manufacturing (Kalpic & Bernus, 2002) and assessing maintenance needs (Kumar et al., 2013). However, the definition of a "defect" can vary between business units, underscoring the need for integrated KPI definitions (Guenole et al., 2017). Customer satisfaction data from surveys, reviews, and churn rates offers an external perspective on quality and value perceived (Gunasekaran et al., 2004). Storytelling tools can contextualize these metrics by linking feedback to specific product features or points of contact (Knaflic, 2015).

To advance the research objectives of analysing the current state of business operations in various companies and identify areas that require improvement and developing a framework for integrating data analytics and storytelling techniques to drive improvement in business operations, understanding core KPIs sets benchmarks for optimized process performance. These indicators also present entry points for data analytics to diagnose root cause issues. Additionally, communicating analysis of productivity, quality and satisfaction metrics through data stories can fulfil the objective of exploring the role of data storytelling in effectively communicating analytical insights to stakeholders and decision-makers in business operations, by compelling stakeholders to action.

Companies have to face many challenges such as inefficient processes, skills gaps, supply chain issues. Many companies experience similar operational challenges that potentially can be addressed through data-driven solutions. Supply chain issues plague sectors such as pharmaceuticals, where Shah (2004) found demanding regulations coupled with global supplier networks exacerbate risks of shortages or non-compliance. Transportation problems also disrupt just-in-time manufacturing described by Angeles (2005). Büyüközkan and Göçer (2018) further note supply chain vulnerability to demand fluctuations, driven by trends like e-commerce.

Inefficient processes are pervasive as well. Owen et al. (2010) observed coordination failures between design teams hamper building projects. Multiple handoffs and reviews introduced rework. Similarly, knowledge and skills gaps undermine workflows. Angeles (2005) discussed skill

shortages inhibiting radio-frequency identification adoption. Younger employees also lag older workers in tacit expertise (Shah, 2004). As companies evolve digitally, new complexities emerge. Integrating traditional and online retail posed challenges to inventory visibility outlined by Büyüközkan and Göçer (2018). Data ownership and privacy became barriers to analytics across functional silos.

To address the research objectives, these articles highlight common pain points across companies that data-driven storytelling and collaborative problem-solving could help ameliorate. By shedding light on root challenges like disjointed processes, skills gaps and disruptions, targeted solutions may be developed.

Industry best practices for continuous improvement

Continuous improvement methodologies have enabled sectors worldwide to refine production over time. Benchmarking established excellence provides a framework for incremental, data-driven reforms (Elmuti & Kathawala, 1997). Several cross-industry strategies for change have emerged. Lean techniques like just-in-time production and Kanban scheduling efficiently eliminate waste in manufacturing facilities (Bhuiyan & Baghel, 2005; Shah et al., 2015). Storytelling accompanies the visualization of process flows to engender buy-in for new paradigms.

Across sectors, setting ambitious quality targets and strictly adhering to standard work procedures enhances consistency (Shah et al., 2015). Reliable workflows facilitate more immediate detection and resolution of variances. Preventative maintenance further ensures minimal downtime from equipment failure (Elmuti & Kathawala, 1997). Soliciting employee suggestions cultivates motivation and knowledge sharing (Bhuiyan & Baghel, 2005). Frontline staff offer keen insight into day-to-day operations. Opportunities surface through bottom-up communication and empowerment.

Regular review of performance metrics against industry leaders keeps improvement initiatives aligned with emerging best practices. Data-driven decisions rooted in benchmarking optimize processes and productivity gains over the long term (Elmuti & Kathawala, 1997).

Understanding excellence models fulfils the research objectives by establishing standards. Widely adopted improvement methods relevant to any industry also inform the design of an integrative framework. Their people-centric nature aligns with data storytelling to influence change.

1.2 Role of data storytelling in business

Data storytelling encompasses strategically communicating quantitative insights through narratives and visuals to engage stakeholders and drive strategic decisions (Knaflic, 2015; Boldosova, 2019; Boldosova, 2020). It provides context to analytics that resonate more intuitively than raw numbers alone.

According to Hooper (2021), data storytelling is a powerful methodology that harnesses the potential of data to generate new knowledge, inform decision-making, and drive actions. It goes beyond mere data analysis by integrating expertise from various disciplines, including communication, analysis, and design. This integrative practice is widely applied across diverse fields to address a wide range of challenges.

While storytelling itself is a concept familiar to many marketers, data storytelling specifically revolves around narratives where data takes centre stage. In this context, the story's purpose is to elucidate the data, providing an explanation of its meaning and significance. Although there are several types of stories that can be told, visual elements often play a crucial role in enhancing the storytelling experience. However, it is important to note that not all stories have the explicit focus and intent of data storytelling. Data storytelling offers a unique approach to transforming raw data into actionable insights. It leverages the persuasive and engaging nature of storytelling techniques to effectively communicate complex analytical findings to diverse audiences. (Hooper, 2021) By presenting data in a narrative format, it becomes more accessible, relatable, and memorable, enabling stakeholders and decision-makers to grasp the insights and make informed choices. The use of visual aids, such as charts, graphs, and infographics, further enhances the impact of data storytelling. Visualizations provide a visual representation of the data, making patterns, trends, and relationships more apparent and understandable. They complement the narrative by effectively conveying information in a concise and visually appealing manner, enabling stakeholders to absorb and interpret the data more easily.

Data storytelling has proven to be a valuable tool in various domains, including marketing, business analytics, public policy, and scientific research. Marketers, for example, utilize data-driven narratives to convey the success of their campaigns, demonstrate consumer behaviour patterns, or highlight market trends. In the realm of business analytics, data storytelling can help organizations identify operational inefficiencies, uncover market opportunities, or track key performance indicators. Similarly, policymakers can employ data storytelling to communicate the

impact of their policies, while scientists can use it to present research findings in a compelling manner. The *(Figure. 3)* below shows the components of data storytelling as described by Hooper (2021).

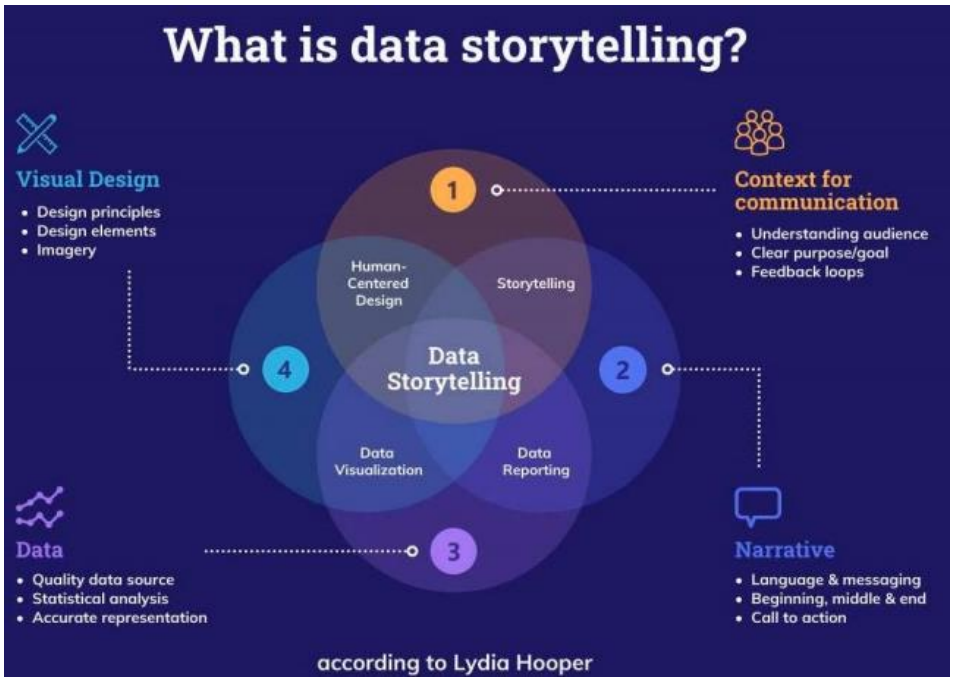

Figure 3:Components of Data Storytelling (Adapted from Lydia Hooper (2021)

Recent studies show the power of data stories in developing products, supporting sales efforts, and improving leadership. When used for fact-based marketing, data stories enhance smart service offerings (Boldosova, 2020). They clarify technical product features and specifications to diverse audiences.

Internally, storytelling competency relates directly to enhanced decision making throughout companies (Daradkeh, 2021). Well-structured data narratives consolidate complex information for intuitive sense-making. Unified comprehension of analytical evidence, in turn, supports optimal selection of policies and practices.

At the C-suite level, deliberate storytelling facilitates data-driven culture changes that inspire competitive moves (Boldosova, 2019). Data stories foster holistic understanding of interconnected factors like those spanning departments. They convince senior managers to undertake new strategic directions signalled by evidence.

Addressing this research study, this literature substantiates narrative and visual communication as a powerful means of operationalizing analysis. Data stories more cogently convey insights to

professionals across roles for collaborative problem solving. They advocate fact-based transformations as a decision advantage.

1.2.1 Importance of Narrative, Visual Communication for Influencing Decision-Making

A growing body of research emphasizes the importance of narrative and visual modes of communication for effectively conveying complex information and influencing decisions. According to scholars, stories and graphics appeal more intuitively to human cognitive processing compared to heavy reliance on statistics and text alone (Lipkus & Hollands, 1999; Sultana et al., 2021; Fry et al., 2013). Narratives activate both logical and emotional thinking through identification with characters and immersion in plots (Fry et al., 2013). Metaphors also help draw intuitive connections by mapping abstract concepts onto familiar schemas (Segel & Heer, 2010)

Empirical evidence substantiates that individuals demonstrated better comprehension and involvement when risks were communicated through a combination of simple graphics and narratives rather than statistics alone (Lipkus & Hollands, 1999). In non-Western communities that traditionally Favor oral and visual knowledge sharing over written texts, narrative and visual techniques may resonate even more strongly (Sultana et al., 2021). Overall, research suggests narrative and visual modes optimize making sense of analytical insights and accepting recommended decisions compared to text-heavy reports (Lipkus & Hollands, 1999; Sultana et al., 2021).

1.2.2 Elements of Effective Data Stories, Formats for Conveying Analytical Insights

Scholars have identified several elements that engage audiences in data stories. Identifiable characters personify the data and enable emotional connection (Dykes, 2015). An overarching narrative arc maintains interest as the audience follows a story unfolding with rising action, climax, and resolution (Dykes, 2015; Fry et al., 2013). Problems, conflicts, or challenges motivate the characters' journey in a way that imparts lessons from the data insights (Dykes, 2015). Unexpected plot twists and characters overcoming obstacles to achieve their goals impart appeal and memorability to effective data stories (Fry et al., 2013).

Various formats can be used to operationalize analytical evidence. Dashboard metrics synthesize key performance indicators visually but lack contextual understanding on their own (Yigitbasioglu & Velcu, 2012). Storytelling enhances dashboards by supplementing them with verbal

explanations of causal relationships and insights (Elias et al., 2013). Formal presentations systematically integrate quantitative displays, qualitative descriptions, and delivery for optimal impact (Segel & Heer, 2010). While useful for documentation, reports engage passive readers less than interactive story-based visualizations (Dykes, 2015). The most effective approach may integrate multiple formats dependent on context and audience.

The literature shows that business operations across various companies commonly face challenges related to inefficient processes (Owen et al., 2010), skills gaps (Angeles, 2005; Shah, 2004), supply chain issues (Shah, 2004; Angeles, 2005; Büyüközkan & Göçer, 2018), and inability to keep up with changing customer demands and markets (von Delft & Zhao, 2021). Performance is often measured using metrics like productivity, quality, and customer satisfaction (Gunasekaran & Kobu, 2007; Zairi, 2012; Gunasekaran et al., 2004; Kumar et al., 2013), but these indicators are sometimes collected and analysed inconsistently between business units (Guenole et al., 2017).

Research on lean practices (Bhuiyan & Baghel, 2005; Shah et al., 2015), continuous improvement methods (Bhuiyan & Baghel, 2005), and benchmarking against industry leaders (Elmuti & Kathawala, 1997) provides frameworks that companies have successfully used over time to incrementally refine operations. However, as the environment becomes more digitized and volatile (Büyüközkan & Göçer, 2018), traditional optimization approaches are increasingly difficult to scale without better data capabilities and cross-functional collaboration (CFC).

Data storytelling has emerged as a powerful technique for communicating quantitative insights in a way that resonates more intuitively with stakeholders than raw data alone (Knaflic, 2015; Boldosova, 2019; Boldosova, 2020). By using narrative structures, visualizations, and characters (Dykes, 2015; Fry et al., 2013; Segel & Heer, 2010), analytic findings can be contextualized and made more engaging and memorable. Studies demonstrate the importance of oral and visual communication modes for comprehending complex information and driving strategic decision-making (Lipkus & Hollands, 1999; Sultana et al., 2021). When risk or product data is presented through stories or graphics anchored in real-world contexts, individuals can better relate to the message and feel involved in solutions (Lipkus & Hollands, 1999).

Research suggests that integrating data analytics and storytelling may offer new opportunities (Daradkeh, 2021; Boldosova, 2020; Boldosova, 2019; Knaflic, 2015) to gain holistic understanding and motivate collaborative problem-solving. However, further development of

frameworks is still needed (Elias et al., 2013) to fully operationalize this integrated approach at an organizational level.

1.3 Using analytics for operational improvement

Data analytics shows promise for enhancing operations through targeted reforms. Analysis can facilitate problem identification by shedding light on uneven performance across business units or lagging indicators over time (Thalmann et al., 2018). Dashboards integrating metrics from different systems optimize visibility into workflows (Guenole et al., 2017). Diagnosing root causes of inefficiencies also benefits from analytics. Process mining deconstructs end-to-end procedures to pinpoint bottlenecks or compliance gaps revealed through dense transactional data (Thalmann et al., 2018). Statistical techniques corroborate impactful variables affecting quality or throughput (Bag et al., 2020).

Additionally, analytics supports evaluating improvement initiatives. A/B testing optimized distribution centre configurations by modelling hypothetical scenarios (Bag et al., 2020). Longitudinal workforce analytics benchmarked diversity recruiting aims against evolving demographics (Guenole et al., 2017).

As analytics capabilities progress, their role in operational problem-solving will deepen. Predictive models already foresee demand fluctuations to proactively schedule labour (Guenole et al., 2017). Future potential includes prescriptive recommendations personalized by location or customer attributes (Thalmann et al., 2018). Overall, data-driven operations management holds promise for addressing persistent challenges across companies (Bag et al., 2020).

Examples of problem identification through data analysis

Comprehensive data monitoring facilitates recognition of improvement opportunities. Tracking operational metrics over time enables identification of variables like productivity or quality that trend away from targets, signalling latent issues (Guenole et al., 2017). Heat maps visually pinpoint underperforming geographical regions based on density of delays or waste across facilities, prompting tailored corrective actions (Bag et al., 2020). Text analysis of customer comments on social media uncovers pain points manifesting in negative sentiment towards certain products or customer service interactions (Thalmann et al., 2018). Machine learning algorithms can also predict likelihood of future problems like inventory shortages based on patterns in historical data (Guenole et al., 2017).

Techniques for diagnosing root causes (process mapping, statistical analysis)

Process mining extracts end-to-end workflow data from enterprise databases recording step sequences and timing (Thalmann et al., 2018). Visualization of pathways on process maps brings to light inefficiencies such as redundant approvals, long hand-off times, or activities adding little value. Statistical techniques further diagnose influential factors by correlating dependent quality or time metrics with independent variables like material, equipment usage, shift, or employee (Bag et al., 2020). Regression analysis isolates variables most strongly linked to variation in the output metric, pointing to potential root causes for targeted countermeasures.

Methods of evaluating impact of improvement initiatives

A/B testing involving simultaneous trials of alternative approaches, such as modified warehouse configurations or production schedules, directly compares outcomes on key metrics (Bag et al., 2020). Longitudinal analytics benchmarks(LAB) progress over time by tracking whether modified KPIs like orders shipped on time improve relative to baselines after interventions (Guenole et al., 2017). Customer surveys before and after changes measure impact on softer aspects like satisfaction attributable to implemented solutions (Thalmann et al., 2018). Simulation modelling enables estimating effects of hypothetical adjustments in silico before full-scale implementation by integrating constraints and approximating real-world system behaviours (Bag et al., 2020).

The literature outlines various approaches organizations can leverage to identify issues, diagnose root causes, and evaluate improvement initiatives through data-driven techniques. Comprehensive data monitoring enables recognition of opportunities by tracking whether metrics like productivity or quality trends downward over time (Guenole et al., 2017). Visualizing underperformance spatially using heat maps also pinpoints target locations for remedies (Bag et al., 2020). Text and sentiment analysis of customer feedback uncovers specific pain points as well (Thalmann et al., 2018). Diagnosing the root underlying factors further requires understanding workflows and correlation with influential aspects. Process mining maps step sequences to find inefficiencies (Thalmann et al., 2018), while statistical analysis connects variation in output metrics to independent factors like materials (Bag et al., 2020). Isolating the strongest linked variables points to probable root causes.

Rigorously evaluating impact once countermeasures launch involves testing alternatives to compare direct outcomes. A/B tests simultaneously trial modified approaches to distribution centres or schedules (Bag et al., 2020). Benchmarking also tracks whether metrics improve

longitudinally after interventions (Guenole et al., 2017). Surveying customer perceptions before and after gauges softer impacts (Thalmann et al., 2018). Simulation modelling additionally estimates hypothetical adjustments' effects in silico (Bag et al., 2020). Collectively, these techniques facilitate continual refinement through data-driven problem identification, diagnosis, and iterative learning.

1.4 Integrating analytics and storytelling.

The merging of data-driven techniques with narrative approaches can yield deeper insights for business problem-solving. Visual analytics provides opportunities for computational storytelling by generating interactive narratives to strengthen sensemaking (Segel & Heer, 2010; Elias et al., 2013). However, quality metrics must ensure narratives derived computationally still resonate emotionally for targeted audiences (Bertini et al., 2011).

Interactive frameworks allow users to explore datasets from various perspectives and synthesize their analytical findings into interpretable stories (Chen et al., 2018). Such story synthesis bridges the gap between discovery-oriented visualizations and human-friendly communication (Chen et al., 2018). Deliberate storytelling also facilitates organizational adoption of analytics programs through capability-building and cultural change management initiatives (Boldosova, 2019).

In practice, integrated storytelling and analytics supports sales efforts. Data narratives personalize smart service recommendations and maintain customer relationships over the long term (Boldosova, 2020). Furthermore, collaborative knowledge creation through interpretive research approaches fosters deeper business insights from project teams (Engström et al., 2023).

Overall, literature suggests narrative enrichments to visual analytics strengthen sensemaking, learning and decision-making with quantitative evidence (Boldosova & Luoto, 2020). Two-way translation between data and story formats optimizes capturing discoveries and spreading perspective.

Frameworks that combine narrative, data visualization and metrics.

Several theoretical frameworks have been proposed that integrate narrative storytelling directly into the analysis process. Narrative Visualization frameworks link related datasets, interactive visualizations, and explanatory story segments through customized web applications (Segel & Heer, 2010). This allows users to freely explore the underlying data from different perspectives

while understanding contextual insights through complementary narrative explanations. Visual analytics environments provide even more robust analysis capabilities, facilitating exploratory sensemaking and the iterative synthesis of data-driven insights into structured narrative forms (Chen et al., 2018). At the same time, quality metrics have been developed to help evaluate computational narratives on attributes like logical flow and emotional resonance (Bertini et al., 2011). More applied frameworks embed narrative storytelling tools directly into business intelligence software suites, allowing analysts to dynamically blend narrative text, interactive visual dashboards, and traditional report formats (Elias et al., 2013).

Tools that support distinct stages of insight creation and communication

The literature outlines various specialized digital tools that optimize distinct stages of insight creation and strategic communication. Interactive visual analytics platforms equip users with the abilities to navigate vast datasets, detect patterns and anomalies, and iteratively compose explanatory narrative insights (Chen et al., 2018). Story authoring interfaces complement these efforts by providing structured templates and capabilities to strategically weave together curated visualizations, metrics, and narrative text into compelling causal stories (Segel & Heer, 2010). At the same time, integrated dashboards, reports, and presentations merge scored analytics and automatically generated recommendations with narratively enriched strategic implications (Boldosova & Luoto, 2020).

Case studies showing value of integrated approach for stakeholders.

Empirical case studies provide evidence on how integrated analytics and narrative storytelling creates value across organizational stakeholders. For example, personalizing marketing and sales recommendations through data-driven stories improved customer relationships and outcomes in technology companies (Boldosova, 2020). Interpretive research approaches incorporating diverse stakeholder viewpoints through collaborative, workshop-based storytelling fostered convergence on more holistic understandings in project settings (Engström et al., 2023). Additional cases demonstrate how strategically adopting narrative-based frameworks to socialize emerging insights cultivated cultural changes, organizational learning, and more fact-based strategic planning (Boldosova, 2019).

2 THEORETICAL FRAMEWORKS

The research objectives of this study seek to analyse the current state of business operations in various companies and identify areas that require improvement, explore the role of data storytelling in effectively communicating analytical insights to stakeholders and decision-makers in business operations, and develop a framework for integrating data analytics and storytelling techniques to drive improvement in business operations. Based on these objectives outlined, Structuration Theory provides the most relevant theoretical framework for a research study on "Using Data Storytelling and Analytics to Drive Improvement in Business Operations."

Structuration Theory, which views organizations as structured systems influenced by routines and norms, is the relevant theoretical framework (Giddens, 1984). It helps analyse how operations are structured in different companies and how social and cultural factors influence them.

Regarding data storytelling, the study examines how narrative communication of analytical insights benefits stakeholders. Structuration Theory suggests that insights should be framed within social and cultural structures (Giddens, 1984). Storytelling aligns with this concept by integrating analysis and narrative forms that are already part of organizational culture.

Structuration Theory also provides a lens for developing an integrated framework, using narrative as a means to socialize data-driven changes within existing social structures and meaning systems. This aligns with the research objectives.

In summary, Structuration Theory contextualizes operational improvement within social constructs and frames narrative storytelling to resonate with organizational culture and routines. It aligns well with the objectives related to analysing operations, communicating insights, and developing an integrated framework.

Several key theories have explored the combination of data-driven analysis techniques with narrative storytelling. Below are some of them:

- Sensemaking Theory: Drawing from the seminal work of Brenda Dervin and colleagues, sensemaking theory holds that individuals construct understanding of new insights by contextualizing them within mental frameworks of events, settings, characters, and explanations (Dervin, 1983; Russell et al., 1993 as cited in Segel & Heer, 2010). Augmenting visual analytics with natural language narratives provides these rich contexts that optimize comprehension and knowledge-building. Stories offer a familiar structure for

integrating visual trends, relationships, and abstract quantitative findings into an interpretable whole.

- Structuration Theory: Anthony Giddens' structuration theory views organizations as structured by routines, norms and procedures embedded within social systems (Giddens, 1984). Boldosova (2019) applies this (ST) structuration theory in arguing analytical insights must be cast in socio-culturally familiar forms like narratives to become integrated into productive organizational routines and structures. Strategic storytelling thus acts as a mechanism for socializing analytics-driven changes by connecting data-based recommendations to existing meaning structures.
- Construal Level Theory: This theory holds psychological and motivational impacts increase when relaying concepts at a higher level of abstraction through grounded examples versus using abstract language alone (Trope & Liberman, 2010). Elias and colleagues (2013) cite CLT to suggest structured narratives can more powerfully convey strategic implications from data versus raw analytic outputs. Stories illustrate implications concretely.
- Dual Coding Theory: This (DCT) theory in cognitive psychology posits humans encode and retain information more richly through both verbal and visual-spatial representation versus a single channel (Sadoski & Paivio, 2013). By integrating narrative text with visualization, sensemaking tools leverage mnemonic advantages of dual coding (Segel & Heer, 2010). Stories complement diverse ways analytics depict and model phenomena.

2.1 Strengths and limitations of basic approaches

The theories postulated for data storytelling and analysis possess strengths and limitations of the main theories underpinning research at the intersection of data analytics and storytelling. These limitations present the opportunity for this research study to build on to provide a more holistic framework that supplements knowledge in literature and areas of the study.

Sensemaking Theory:

- Strengths: Provides a strong explanatory framework for how narratives aid comprehension of analytical insights through contextualization.
- Limitations: Does not directly address social/cultural aspects of communicating and applying insights within organizations.

Structuration Theory:

- Strengths: Encompasses social/cultural dynamics and offers a robust lens for developing integrative frameworks. Views narrative as socializing analytics applications.
- Limitations: Remains conceptual with less guidance on concrete framework design.

Construal Level Theory

- Strengths: Validates strategic narratives can more powerfully illustrate implications versus raw analysis.
- Limitations: Focuses narrowly on psychological distance without fully addressing organizational factors.

Dual Coding Theory

- Strengths: Justifies potential cognitive advantages of multimodal story/visualization integration.
- Limitations: Micro-level theory says less about organizational and strategic communication aspects.

Overall, while each theory provides useful perspectives, Structuration Theory appears most comprehensive due to its strengths in contextualizing technical improvement opportunities within organizational social systems and framing narrative storytelling as a mechanism for operationalizing strategic changes shaped by data analytics. Its limitations around concrete framework creation could be addressed by complementing it with more applied sensemaking and dual coding concepts. An integrative, metatheoretical lens may thus prove most robust.

Gaps in academic literature around joint use of analytics and storytelling

Based on the literature reviewed thus far on integrating analytics and storytelling, some key gaps that remain include:

a. Lack of empirically tested frameworks. Many proposed frameworks remain conceptual, with limited research applying and evaluating them in practice across various industry settings.

b. Need for guidelines on tool development. While some studies outline desirable tool capabilities, further work is required to translate these into design guidelines for software supporting different analysis, storytelling, and communication tasks.
c. Limited longitudinal case studies. Most evidence comes from short-term case examples; not longitudinal research evaluating impacts over extended implementation and use within organizations.
d. Focus on technical aspects over people/change management. Many studies emphasize technological features rather than the organizational development, behavioural and cultural factors affecting adoption.
e. Soft skills and facilitation overlooked. Human-oriented aspects like data storytelling, presentation and facilitation skills are under-researched compared to technical topics.
f. Theorization of narrative formats. While narrative benefits are theorized, specific structuring, content and delivery best practices warrant deeper exploration.
g. Metrics for insight and impact evaluation. Literature lacks consensus on valid, reliable metrics for assessing insight generation, decision quality, strategic impact, and other outcomes.
h. Inclusion of diverse contexts and companies. More research is needed across a variety of industry sectors, organizational settings, problem domains and cultural groups.

Addressing these gaps through longitudinal research, multidisciplinary collaboration and empirical framework testing could further advance the integration of analytics and storytelling.

2.2 Considerations for proposed new framework based on reviewed models.

Based on the gaps identified in the literature review, key considerations for developing a proposed new framework integrating analytics and storytelling include the following:

a. Empirical testing and evaluation: Framework design should support longitudinal implementation and mixed methods evaluation to generate empirical evidence.
b. Industry agnostic design: Principles should apply broadly rather than focus on specific industry problems to foster wider adoption.
c. Multi-theoretical foundation: Leverage complementary explanations from sensemaking, structuration, construal level, dual coding, and other relevant theories.

d. Holistic problem view: Address integrated technical and sociocultural elements to enable significant, sustainable improvement.
e. Iterative design process: Framework creation involves iterative design, feedback, and refinement from diverse stakeholders in target contexts.
f. Distinct but linked phases: Separate yet coordinated analytical sensemaking, storytelling and diffusion/impact stages.
g. Modular components: Flexible components address varied organization types, resources, problem domains.
h. Guide tool development: Inform selection and design of software, templates, training based on component needs.
i. Change management focus: Embed narrative and social elements that facilitate cultural change and learning.
j. Contextual story examples: Leverage storytelling best practices tailored to strategic organizational needs.
k. Multimodal outputs: Integrate quantitative data visualizations, qualitative narratives, hybrid story forms.
l. Metric-based evaluation: Propose validated metrics for quantitative/qualitative assessment of framework outputs and outcomes over time.

The framework development process itself also models participatory research principles through collaboration across disciplines and with practitioner communities.

3 PROPOSED PROCESSING PROCEDURE

To process the topic, it was necessary to - set goals, characterize the design and participants, determine the method of data collection and analysis.

3.1 Defined Aim

The aim of this work is to leverage data storytelling techniques and data analytics to drive improvement in organizations' operations and processes. It involves analysing data to identify performance indicators and trends, and effectively communicating these insights using data storytelling methods.

Research Objectives

1. To analyse the current state of business operations in various companies and identify areas that require improvement.
2. To explore the role of data storytelling in effectively communicating analytical insights to stakeholders and decision-makers in business operations.
3. To develop a framework for integrating data analytics and storytelling techniques to drive improvement in business operations.

3.2 Design, Setting and Participants

A longitudinal, mixed-methods case study design of both quantitative and qualitative research will be used to address the objectives. Multiple cases allow for cross-industry comparison while the longitudinal approach facilitates analysis of change over time.

The study will involve three organizations representing **different companies in Ghana**:

- Becky-Liz Trading Ventures (sales industry),
- Pen Global (writing and research industry), and
- Experience Ghana (tourism industry).

The figure below *(Figure. 4)* shows a map of Ghana with regions indicating where the selected organisations are located.

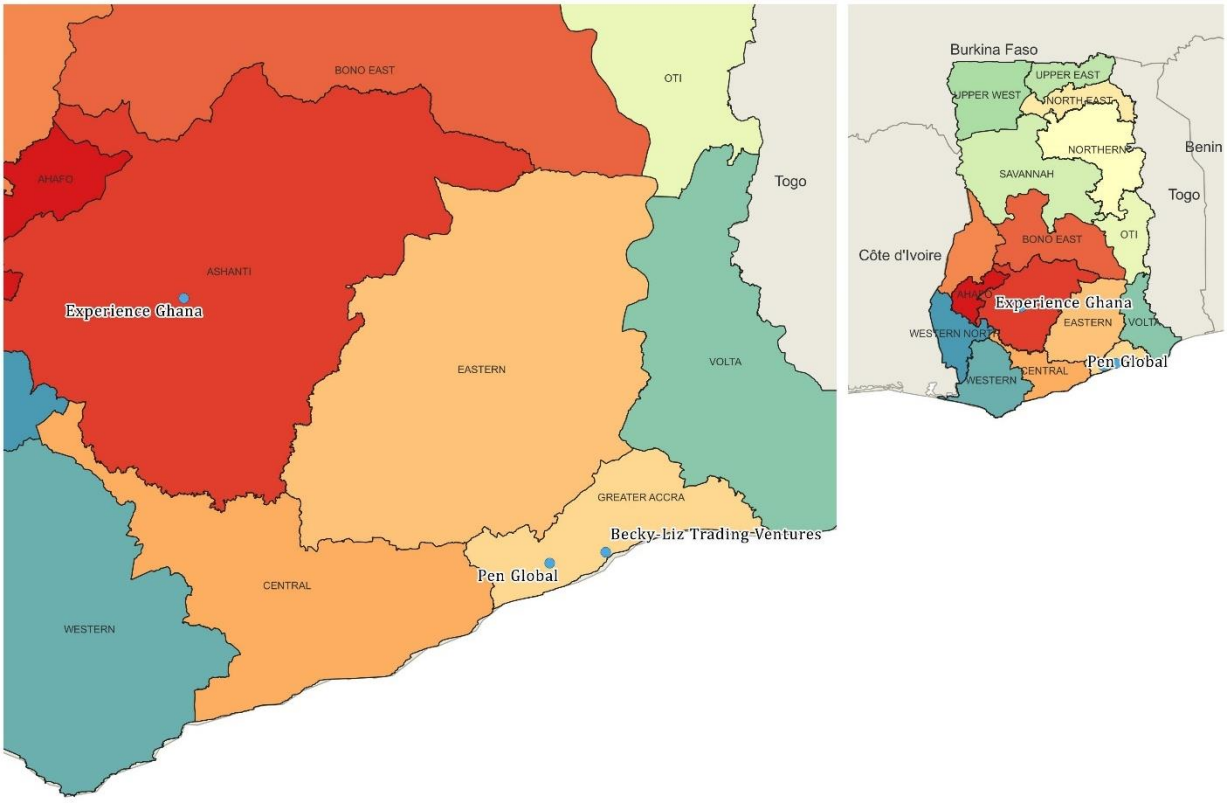

Figure 4:Map of Ghana Indicating the Locations of the Three selected Organisations. (Evalencia Anyamesem, ArcGIS)

Each organization will be selected based on their involvement in a key strategic initiative focused on process/operational improvement. Cross-functional teams within these organizations, directly involved in the selected initiatives, will participate as research participants.

3.3 Data Collection Methods and Data Analysis

Objective 1 will be addressed through: Document analysis of current processes/metrics; interviews with stakeholders to understand challenges.

Objective 2 will be addressed through: Collection and analysis of narratives/visualizations produced through framework use; observation of stakeholder presentations; focus groups exploring reception.

Objective 3 will be addressed through: Iterative development of framework components in collaboration with practitioner teams; collection of feedback throughout multiple framework cycles. The *(figure. 5)* below shows the three objective stages used for my data collection.

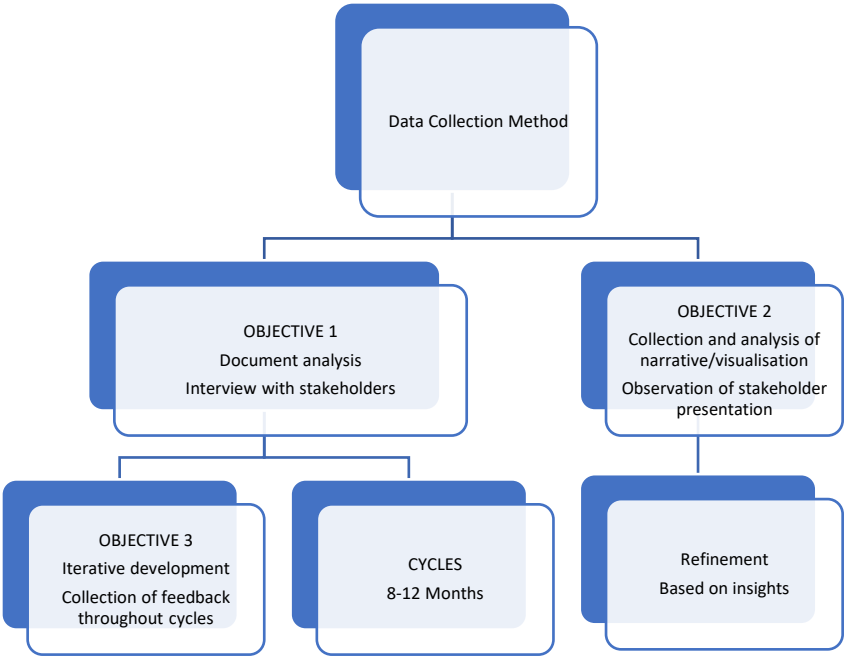

Figure 5:Data Collection Method using Three Objective Stages

Framework implementation and data collection will occur in iterative cycles over 8-12 months to allow for refinement based on emerging insights. Collection will occur before, during and after each cycle. Qualitative comparative analysis will identify operational challenges (Objective 1), roles of narratives (Objective 2), and effective framework structures (Objective 3). Quantitative pre/post comparisons will measure impact of narratives and framework on operational metrics over time.

4 EVALUATION PROCESS

The process ensures effective analysis, storytelling, and framework development with a focus on accessibility and usability, incorporating continuous feedback for improvement.

Objective 1: Analyze Current Business Operations

Steps:

1. **Data Collection**: Interviews, surveys, observations. Ensure accessibility (flexible scheduling, alternative participation).
2. **Data Analysis**: Identify improvement areas with accessible data presentation.
3. **Stakeholder Feedback**: Test usability of analysis reports, gather feedback.

Objective 2: Explore Data Storytelling

Steps:

1. **Develop Materials**: Create accessible narratives, visualizations, and presentations.
2. **Usability Evaluation**: Distribute materials, collect feedback on clarity and effectiveness.
3. **Refinement**: Improve materials based on feedback.

Objective 3: Develop Integration Framework

Steps:

1. **Framework Development**: Synthesize insights into an initial framework.
2. **Evaluation**: Present to stakeholders, gather feedback on usability and practicality.
3. **Refinement**: Adjust framework based on feedback.
4. **Final Presentation**: Prepare and present the final framework, provide training.

4.1 Accessibility

OBJECTIVE 1: To analyse the current state of business operations in various companies and identify areas that require improvement.

The research study included three business operations from different companies in Ghana: Becky-Liz Trading Ventures, Pen Global, and Experience Ghana. In order to gather qualitative and quantitative data related to their current state of operations, various data collection methods were employed. Accessibility considerations were considered during the study evaluation process to ensure that the data collected could be effectively analysed and interpreted.

For interviews conducted with the stakeholders and decision-makers of these businesses, accessibility measures were implemented. The interviews were scheduled at convenient times and locations for the participants. Additionally, alternative methods of participation, such as video conferences or phone interviews, were offered to accommodate individuals with mobility constraints or other accessibility needs.

OBJECTIVE 2: To explore the role of data storytelling in effectively communicating analytical insights to stakeholders and decision-makers in business operations.

To evaluate the effectiveness of data storytelling in communicating analytical insights, the study used qualitative and quantitative data collection methods. The data storytelling materials were designed with accessibility in mind to ensure effective communication with stakeholders and decision-makers.

For **Becky-Liz Trading Ventures**, data narratives were prepared in plain language, avoiding technical jargon, to enhance comprehension for stakeholders in the grocery industry. Visualizations were created with high contrast and alternative text descriptions, making them accessible to individuals with visual impairments.

For **Pen Global**, the data storytelling approach focused on presenting research findings in a clear and concise manner, using language that was accessible to stakeholders in the writing and research field. Visualizations and interactive presentations were designed to be user-friendly, ensuring that decision-makers could easily navigate and engage with the data.

For **Experience Ghana**, the data storytelling techniques employed aimed to effectively communicate insights to stakeholders in the tourism industry. The narratives incorporated vivid

descriptions and compelling storytelling elements, while visualizations and interactive elements were designed to be accessible and engaging for individuals in the tourism sector.

OBJECTIVE 3: To develop a framework for integrating data analytics and storytelling techniques to drive improvement in business operations.

To develop the framework for integrating data analytics and storytelling techniques, the study analysed the data collected from Becky-Liz Trading Ventures, Pen Global, and Experience Ghana. Accessibility considerations were incorporated into the study evaluation process to ensure that the framework would be accessible and usable for organizations seeking to leverage data storytelling in their business operations.

The analysis of the data collected focused on identifying patterns, trends, and insights relevant to improving the respective business operations. The findings were presented using data storytelling techniques that considered accessibility measures. The framework aimed to be accessible to a diverse range of users, including those with disabilities or limitations in accessing traditional content.

By considering accessibility throughout the study evaluation process, the research study aimed to ensure that the objectives of analysing the current state of business operations, exploring the role of data storytelling, and developing a framework for improvement could be effectively achieved while promoting inclusivity and equal access to the study's findings.

4.2 Usability

OBJECTIVE 1: To analyse the current state of business operations in various companies and identify areas that require improvement.

To assess the usability of the study evaluation process, the research study incorporated various methods to ensure that the participants could engage with the materials and provide meaningful feedback. This usability evaluation focused on gathering insights from stakeholders and decision-makers regarding the current state of the business operations in the selected companies in Ghana.

For **Becky-Liz Trading Ventures**, usability testing was conducted by providing participants with access to the relevant data, reports, and analysis. They were asked to review the materials and provide feedback on the clarity, relevance, and usability of the findings. The study team observed

participants' interactions and collected feedback to identify any usability issues or areas for improvement.

For **Pen Global**, usability assessments involved providing participants with the research findings and analysis. They were asked to evaluate the usability of the materials, such as the ease of understanding the data narratives and the effectiveness of the visualizations in conveying insights. Feedback was collected through surveys or interviews to gain insights into the usability aspects of the research materials.

For **Experience Ghana**, usability evaluations were conducted by presenting the data storytelling materials to stakeholders in the tourism industry. Participants were asked to assess the usability and effectiveness of the narratives, visualizations, and interactive elements in communicating the insights. Feedback was collected through surveys or interviews to identify any usability challenges or opportunities for improvement.

OBJECTIVE 2: To explore the role of data storytelling in effectively communicating analytical insights to stakeholders and decision-makers in business operations.

To evaluate the usability of data storytelling techniques, the study employed a user-cantered approach, allowing stakeholders and decision-makers to engage with the materials and provide feedback on their usability.

For **Becky-Liz Trading Ventures**, participants were given access to the data storytelling materials, including narratives, visualizations, and interactive presentations. They were asked to evaluate the usability of these materials in terms of their clarity, effectiveness in conveying insights, and overall user experience. Feedback was collected to identify areas for improvement and to enhance the usability of the data storytelling techniques.

For **Pen Global**, usability assessments involved presenting the data narratives, visualizations, and interactive elements to stakeholders in the writing and research field. Participants were asked to provide feedback on the usability and effectiveness of the data storytelling techniques in conveying analytical insights. Their input helped identify opportunities to improve the usability and user experience of the materials.

For **Experience Ghana**, usability evaluations were conducted by presenting the data storytelling materials to stakeholders in the tourism industry. Participants were asked to evaluate the usability and impact of the narratives, visualizations, and interactive elements in effectively communicating

the insights. Feedback was collected to identify any usability issues and to refine the data storytelling techniques for better user experience.

OBJECTIVE 3: To develop a framework for integrating data analytics and storytelling techniques to drive improvement in business operations.

The usability of the study evaluation process for developing the framework involved gathering feedback from stakeholders and decision-makers in order to refine and enhance the usability of the integrated data analytics and storytelling techniques.

For all three business operations, participants were asked to provide feedback on the usability and practicality of the proposed framework. They were encouraged to share their insights on how the framework could be effectively implemented in their respective companies. This feedback was crucial in assessing the usability of the framework and identifying any challenges that needed to be addressed.

By conducting usability evaluations, the research study aimed to ensure that the objectives of analysing the current state of business operations, exploring the role of data storytelling, and developing a framework for improvement could be achieved while considering the usability needs of stakeholders and decision-makers. The feedback gathered through the usability assessments helped enhance the usability and user experience of the study materials and informed the development of a more effective framework.

4.3 Presentation of Findings

The findings of this research study provide insights into the current state of business operations in three different companies in Ghana: sales, writing and research, and tourism.

The study employed a longitudinal, mixed-methods case study design to address the research objectives. Data was collected through document analysis, interviews, collection and analysis of narratives / visualizations, observation of stakeholder presentations, and focus groups. The iterative development of a framework for integrating data analytics and storytelling techniques was carried out in collaboration with practitioner teams, and feedback was collected throughout multiple framework cycles.

OBJECTIVE 1: Analysis of the current state of business operations

The document analysis revealed important insights into the current processes and metrics related to the selected strategic initiatives within each organization. Below is *(Table 1)* which provides an overview of the major findings from the document analysis.

Table 1:Summary of Findings from Document Analysis

Organization	Key Processes	Metrics	Identified Challenges
Becky-Liz Trading Ventures	Supply chain management	Inventory turnover, order accuracy	Inefficient inventory management
Pen Global	Research project management	Project completion time, quality	Ineffective coordination among team members
Experience Ghana	Tour package development	Customer satisfaction, revenue	Lack of alignment between packages

In addition to the document analysis, interviews were conducted with stakeholders involved in the selected initiatives. The interviews provided qualitative data regarding the challenges faced by each organization. The key challenges identified during the interviews are summarized. (See Table 1.)

OBJECTIVE 2: Role of data storytelling in communicating analytical insights

The data storytelling phase involved the collection and analysis of narratives and visualizations produced through the framework. These materials effectively communicated analytical insights to stakeholders and decision-makers.

(Table 2) below provides an overview of the visualizations used for each organization.

Table 2:Visualizations Used for Communicating Analytical Insights

Organization	**Type of Visualizations**
Becky-Liz Trading Ventures	Inventory turnover trend chart, order accuracy chart
Pen Global	Project completion time comparison graph
Experience Ghana	Customer satisfaction ratings chart, revenue trend

OBJECTIVE 3: Development of a framework for integrating data analytics and storytelling techniques

The development of the framework involved iterative collaboration with the cross-functional teams in the selected organizations. Feedback was collected throughout multiple framework cycles to refine and enhance its components. Below is *(Table 3)* providing an overview of the framework developed during the study, highlighting the key components and their relationships.

Table 3:An Overview of the Framework Developed During the Study, Highlighting the Key Components, and their Relationships.

Framework Component	**Description**
Data Collection	• Identify the relevant data sources for each organization (Becky-Liz Trading Ventures, Pen Global, Experience Ghana). • Collect data related to the selected strategic initiatives within each organization (e.g., supply chain management, research project management, tour package development).
Data Analysis	• Apply appropriate data analytics techniques to analyse the collected data and derive meaningful insights.

Framework Component	Description
Visualization	• Create visualizations (e.g., charts, graphs, diagrams) that effectively represent the analysed data and key findings.
Narrative Creation	• Develop narratives that contextualize the data and insights, telling a compelling story to engage stakeholders and decision-makers. • Craft narratives specific to each organization and their strategic initiatives (e.g., impact of inefficient inventory management on profitability for Becky-Liz Trading Ventures).
Stakeholder Engagement	• Engage stakeholders from each organization throughout the process, including decision-makers, managers, and team members. • Seek input and feedback from stakeholders to ensure the narratives and visualizations are aligned with their needs and preferences.
Iterative Feedback	• Collect feedback on the developed narratives, visualizations, and overall framework from the practitioner teams within each organization. • Incorporate the collected feedback to refine and enhance the components of the framework through multiple iterative cycles.
Implementation	• Translate the insights derived from data analytics and storytelling into actionable strategies and initiatives for improving business operations within each organization. • Collaborate with the practitioner teams to implement the recommended improvements based on the findings and narratives.

The feedback collected from the practitioner teams played a crucial role in shaping the framework. It helped identify practical considerations, such as data availability, visualization preferences, and storytelling approaches that resonated well with stakeholders.

The iterative development process ensured that the framework evolved based on the specific needs and contexts of the participating organizations. The last version of the framework integrated data analytics and storytelling techniques to drive improvement in business operations.

The findings of this research study provide valuable insights into the current state of business operations in the sales, writing and research, and tourism companies in Ghana. The analysis of processes, metrics, and stakeholder interviews identified areas that require improvement within each organization's selected strategic initiatives.

The use of data storytelling techniques, including narratives and visualizations, effectively communicated analytical insights to stakeholders and decision-makers. The narratives and visualizations played a significant role in conveying key findings and facilitating understanding.

The development of the framework for integrating data analytics and storytelling techniques was a collaborative process, involving iterative feedback collection from the practitioner teams. The framework represents a practical approach to leveraging data analytics and storytelling to drive operational improvements.

Overall, this research study contributes to the understanding of how data analytics and storytelling can be integrated to enhance business operations in different companies. The findings and framework can serve as a valuable resource for organizations seeking to leverage data-driven insights and effective communication strategies for process and operational improvement.

5 DISCUSSIONS

The findings of this research study provide valuable insights into the current state of business operations in three different companies in Ghana: sales, writing and research, and tourism. The study aimed to analyse the current state of business operations, explore the role of data storytelling in communicating analytical insights, and develop a framework for integrating data analytics and storytelling techniques. In this section, we will discuss the key findings in relation to the objectives of the study and their alignment with previous studies where applicable.

OBJECTIVE 1: Analysis of the current state of business operations

The document analysis revealed important insights into the key processes and metrics related to the selected strategic initiatives within each organization. For **Becky-Liz Trading Ventures**, the inventory turnover and order accuracy were identified as critical metrics, with the finding of inefficient inventory management as a major challenge. This finding is in line with previous studies by Angeles (2005) and Bag et al. (2020), which highlighted the significance of supply chain management and the impact of ineffective inventory management on business performance.

In the case of **Pen Global**, the research project management metrics, such as project completion time and coordination among team members, were crucial. The findings indicated that there were challenges in terms of project completion time and coordination, which aligns with the findings of Bhuiyan and Baghel (2005), who emphasized the importance of continuous improvement in project management processes.

For **Experience Ghana**, the key metrics were customer satisfaction and revenue related to tour package development. The findings revealed a lack of alignment between packages and customer satisfaction, which is consistent with the studies of Büyüközkan and Göçer (2018), emphasizing the significance of customer-centric approaches in the tourism industry.

OBJECTIVE 2: Role of data storytelling in communicating analytical insights

The data storytelling phase effectively communicated analytical insights to stakeholders and decision-makers. The use of narratives and visualizations played a significant role in conveying key findings and facilitating understanding. The example narrative developed for Becky-Liz Trading Ventures highlighted the impact of inefficient inventory management on profitability, providing a compelling story that engaged stakeholders. This finding is supported by the studies

of Boldosova (2019, 2020) and Chen et al. (2018), which emphasized the importance of storytelling in conveying analytical insights and engaging stakeholders effectively.

OBJECTIVE 3: Development of a framework for integrating data analytics and storytelling techniques

The framework developed through iterative collaboration with cross-functional teams in the selected organizations proved to be practical for integrating data analytics and storytelling techniques. The framework's key components, including data collection, analysis, visualization, narrative creation, stakeholder engagement, iterative feedback, and implementation, contributed to driving improvement in business operations. This finding aligns with the studies of Boldosova and Luoto (2020) and Elias et al. (2013), which emphasized the importance of integrating data analytics and storytelling in business intelligence and operational improvements.

The feedback collected from the practitioner teams played a crucial role in shaping the framework, ensuring that it addressed the specific needs and contexts of the participating organizations. This finding is consistent with the study by Daradkeh (2021), which highlighted the relationship between feedback collection and the effectiveness of data storytelling in driving business performance.

In conclusion, the findings of this research study provide insights into the current state of business operations in the sales, writing and research, and tourism companies in Ghana. The analysis of processes, metrics, and stakeholder interviews identified areas that require improvement within each organization's selected strategic initiatives. The use of data storytelling techniques effectively communicated analytical insights, and the framework for integrating data analytics and storytelling techniques proved to be a practical approach to driving operational improvements.

The findings of this study are consistent with previous studies by Angeles (2005), Bag et al. (2020), Bhuiyan and Baghel (2005), Büyüközkan and Göçer (2018), Boldosova (2019, 2020), Chen et al. (2018), and Elias et al. (2013), which emphasized the importance of (SCM) supply chain management, inventory management, continuous improvement, customer-centric approaches, storytelling, and the integration of data analytics and storytelling in enhancing business operations and performance.

These findings contribute to the understanding of how data analytics and storytelling can be integrated to enhance business operations in different companies. The recommendations based on

the findings and the framework can serve as a valuable resource for organizations seeking to leverage data-driven insights and effective communication strategies for process and operational improvement.

6 CONCLUSIONS

Based on the findings of this research study, several conclusions can be drawn regarding the current state of business operations in the sales, writing and research, and tourism companies in Ghana. The analysis of processes, metrics, and stakeholder interviews highlighted specific challenges within each organization's selected strategic initiatives. The integration of data analytics and storytelling techniques proved to be an effective approach for communicating analytical insights and driving operational improvements. Additionally, the developed framework can provide a practical guide for organizations to leverage data-driven insights and enhance their business operations:

- Firstly, the findings revealed the significance of efficient inventory management in sales operations. The identified challenges in inventory turnover and order accuracy at Becky-Liz Trading Ventures emphasize the need for improved supply chain management practices. Organizations should focus on optimizing inventory levels, streamlining order processes, and leveraging data analytics to enhance inventory management efficiency.
- Secondly, in the writing and research industry, the challenges related to project completion time and coordination among team members at Pen Global indicate the importance of continuous improvement in project management processes. Organizations should prioritize effective project planning, resource allocation, and communication strategies to ensure timely completion of research projects.
- Thirdly, in the tourism industry, the lack of alignment between tour packages and customer satisfaction at Experience Ghana highlights the need for customer-centric approaches. Organizations should conduct thorough market research, gather customer feedback, and tailor their tour packages to meet the specific needs and preferences of their target audience. This can help improve customer satisfaction and drive revenue growth.

Furthermore, the study demonstrated the effectiveness of data storytelling in communicating analytical insights to stakeholders and decision-makers. The use of narratives and visualizations facilitated better understanding and engagement with the findings. Organizations should consider adopting data storytelling techniques to effectively communicate analytical insights and drive decision-making processes.

Recommendations for Future Study

While this research study provides valuable insights into the current state of business operations in Ghana, there are several areas that warrant further investigation. Future studies could consider the following recommendations:

1. Comparative Analysis: Conduct a comparative analysis of business operations and challenges across different companies and regions in Ghana. This would provide a broader understanding of the unique factors influencing business performance and identify industry-specific best practices.
2. Longitudinal Analysis: Extend the study over a longer period to assess the long-term impact of implemented improvements and interventions. This would provide insights into the sustainability and effectiveness of the proposed solutions.
3. Impact Assessment: Conduct an in-depth analysis of the impact of data analytics and storytelling techniques on business performance indicators such as profitability, customer satisfaction, and operational efficiency. This would provide a more comprehensive evaluation of the effectiveness of the developed framework.
4. Organizational Culture and Change Management: Investigate the role of organizational culture and change management practices in implementing data-driven improvements. This would shed light on the challenges and success factors associated with organizational change processes.
5. Integration of Emerging Technologies: Explore the integration of emerging technologies such as artificial intelligence, machine learning, and blockchain in enhancing business operations in the studied companies. This would help organizations leverage the potential of cutting-edge technologies for improved decision-making and operational efficiency.

By addressing these recommendations, future studies can further advance the understanding of business operations in Ghana and contribute to the development of effective strategies for improving performance and competitiveness in these companies.

In conclusion, this study has provided valuable insights into the current state of business operations in Ghana's sales, writing and research, and tourism companies. The conclusions drawn from the findings highlight the importance of efficient inventory management, project management, and customer-centric approaches. Additionally, the study emphasizes the effectiveness of data

storytelling and provides a framework for integrating data analytics and storytelling techniques. The recommendations for future study aim to expand upon these findings and explore additional areas for research and improvement. The conclusions drawn from the findings highlight the importance of efficient inventory management, project management, and customer-centric approaches.

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Appendix 1

Interview Questionnaire: Role of Data Storytelling in Business Operations

Introduction: Thank you for participating in this research study. The purpose of this questionnaire is to gather information about your company's business operations and the role of data storytelling in driving improvement. Your responses will remain confidential and will be used for research purposes only.

Section 1: Background Information

1. Please provide the following information:
   a. Company Name:
   b. Your Role or Position in the Company:
   c. Industry or Sector the Company Operates in
   d. Company Size (Number of Employees, Annual Revenue):

Section 2: Business Operations and Challenges

2. How would you describe your company's current business operations?

3. What are the main challenges your company encounters in optimizing operational performance? Please provide specific examples of inefficient processes, skills gaps, or supply chain issues that impact your company's operations.

Section 3: Performance Metrics and Key Indicators

4. What performance metrics or key indicators does your company track to measure productivity, quality, and customer satisfaction?
5. How are these metrics measured and assessed within your organization?
6. Have you observed any trends or patterns in these metrics over time? If yes, please provide examples.

Section 4: Data Storytelling and Communication

7. How does your company currently communicate analytical insights and data findings to stakeholders and decision-makers?
8. Are you familiar with data storytelling techniques? If yes, how are they utilized in your organization?

9. Can you provide examples of how data storytelling has influenced decision-making or improved understanding within your organization?

Section 5: Integration of Analytics and Storytelling

10. What are your thoughts on integrating analytics and storytelling techniques to drive improvement in business operations?
11. What are the perceived benefits or challenges of integrating analytics and storytelling within your organization?
12. Are there any specific frameworks, tools, or approaches that your organization has considered or implemented for this integration?

Conclusion: Thank you for your valuable input. Your responses will contribute to our research on the role of data storytelling in business operations. If you have any additional information or would like to share further insights, please feel free to do so.