A Process Reengineering Framework for Automating Contact Center Operations Using Lean and Agile Principles

ADAOBI BEVERLY AKONOBI[1], CHRISTIANA ONYINYECHI OKPOKWU[2]
[1]*Access Pensions, Nigeria*
[2]*Zenith Bank PLC, University of Nigeria Nsukka, Nigeria*

Abstract- ***The increasing demand for rapid, personalized, and efficient customer service has driven organizations to reimagine contact center operations. Traditional contact center workflows are often plagued by inefficiencies, high operational costs, and slow response times, which limit the ability to deliver agile, customer-centric experiences. This presents a process reengineering framework for automating contact center operations by integrating Lean and Agile principles. The framework aims to streamline workflows, eliminate non-value-adding activities, and enable continuous improvement through iterative development cycles and stakeholder collaboration. The proposed model comprises five core phases: (1) assessment of existing processes and stakeholder needs; (2) value stream mapping to identify waste and operational bottlenecks; (3) Agile process redesign using sprint-based modules and cross-functional teams; (4) automation deployment leveraging robotic process automation (RPA), artificial intelligence (AI), and chatbot technologies; and (5) continuous feedback integration to drive iterative enhancement and service resilience. Key enablers such as a robust technology stack, change management strategies, and data governance protocols are emphasized to ensure successful implementation. Case application scenarios—including automated inbound call handling, customer complaint resolution, and outbound campaign management—demonstrate the framework's ability to reduce turnaround time, enhance customer satisfaction, and optimize resource utilization. By aligning Lean's focus on value creation and waste reduction with Agile's emphasis on adaptability and user-centricity, the framework fosters an operational culture of responsiveness and continuous innovation. This also highlights practical challenges, including resistance to organizational change, integration with legacy systems, and complexities in performance measurement. Nonetheless, the proposed framework offers a scalable and adaptable pathway for digital transformation in customer service. Future research directions include autonomous service orchestration, sentiment-driven decision-making, and the development of predictive analytics for proactive customer engagement.***

Indexed Terms- ***Process Reengineering, Framework, Automating Contact Center, Operations, Lean and Agile Principles***

I. INTRODUCTION

In the era of digital transformation, the role of contact centers has evolved dramatically from being traditional service hubs to becoming integral touchpoints for delivering customer-centric experiences (Akinbola, O.A. and Otoki, 2012; Lawal *et al*., 2014). With the proliferation of automation technologies, artificial intelligence (AI), and machine learning, the customer service industry is undergoing a paradigm shift (Lawal *et al*., 2014; Otokiti and Akorede, 2018). Companies are increasingly leveraging digital tools to enhance service speed, personalization, and responsiveness. At the forefront of this shift are contact centers, where the pressure to deliver seamless, multichannel interactions has intensified (Ajonbadi*et al*., 2015; Otokiti, 2017). As customer expectations rise and operational demands become more complex, contact centers are compelled to adopt more agile and intelligent systems that go beyond static workflows and scripted interactions (SHARMA *et al*., 2019; Otokiti, 2012).

The rapid growth of automation and AI in customer service presents both opportunities and challenges. On one hand, technologies such as robotic process automation (RPA), natural language processing (NLP), intelligent virtual assistants, and predictive analytics have enabled contact centers to reduce wait times, handle high volumes of requests, and deliver more consistent responses (Ajonbadi *et al*., 2016). On the other hand, these advancements necessitate a rethinking of how contact center operations are structured, managed, and optimized. Automation alone cannot resolve the deeply embedded inefficiencies that arise from outdated processes, fragmented systems, and rigid service protocols (Otokiti, 2018; Adenuga *et al*., 2019). Moreover, implementing automation without a clear strategic framework can result in poor integration, underutilized tools, and user dissatisfaction.

Traditional contact center workflows often suffer from several shortcomings. These include long handling times due to manual data entry, repetitive task cycles, lack of real-time visibility into service performance, and siloed communication between departments (Otokiti and Akinbola, 2013; Ajonbadi *et al*., 2014). Such inefficiencies are not only cost-intensive but also detrimental to customer satisfaction and agent productivity. Static workflows fail to accommodate evolving customer needs, channel preferences, and service expectations, making the system inherently reactive rather than proactive. In this context, there is an urgent need for a comprehensive transformation of contact center operations—one that is agile, scalable, and fundamentally centered around value creation for the end user (Akinbola *et al*., 2020; FAGBORE *et al*., 2020).

This addresses the pressing issue of operational inefficiency in contact centers by proposing a process reengineering framework that combines the strengths of Lean and Agile methodologies. Lean principles emphasize the elimination of waste, continuous improvement, and a relentless focus on customer value. Agile principles, originally developed for software development, stress adaptability, iterative development, cross-functional collaboration, and rapid response to change. When integrated, these paradigms offer a powerful approach to reengineering service processes that are both efficient and resilient.

The objective of this review is to design a framework that guides the automation of contact center operations through systematic process reengineering. This framework will serve as a strategic tool for organizations seeking to move beyond piecemeal automation and achieve meaningful digital transformation. It introduces a structured methodology for assessing current workflows, identifying waste and pain points, and redesigning service processes using Agile sprints and Lean value stream mapping. The framework also incorporates technology integration strategies involving AI, RPA, and data analytics to automate redesigned workflows effectively. Furthermore, it highlights the importance of feedback loops, continuous improvement mechanisms, and change management as critical enablers of sustainable transformation.

By aligning automation initiatives with Lean and Agile principles, the proposed framework not only enhances operational efficiency but also strengthens customer engagement, service quality, and employee empowerment. It provides a roadmap for transforming contact centers into intelligent, adaptive, and customer-focused ecosystems capable of thriving in an increasingly dynamic service environment (Omisola *et al*., 2020; Osho *et al*., 2020).

This introductory sets the foundation for the subsequent parts of the study, which detail the theoretical underpinnings of the framework, its architectural components, implementation strategies, case application scenarios, and the strategic implications for service organizations. In doing so, this aims to contribute to the broader discourse on intelligent process automation, organizational agility, and the future of customer service operations.

II. METHODOLOGY

The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) methodology was applied to guide a systematic review of existing literature and frameworks relevant to process reengineering, automation, and the application of Lean and Agile principles in service operations, particularly contact centers. A comprehensive literature search was conducted across several academic databases, including Scopus, Web of Science, IEEE Xplore, ScienceDirect, and Google

Scholar. The search focused on peer-reviewed journal articles, conference proceedings, and white papers published between 2010 and 2024. Keywords used included combinations of terms such as "process reengineering," "contact center automation," "Lean service design," "Agile transformation," "RPA in customer service," "AI in contact centers," and "digital transformation in service operations."

Inclusion criteria required that articles (i) discuss methodologies for business process improvement or automation in service environments, (ii) incorporate Lean or Agile principles in operational redesign, and (iii) be directly or indirectly applicable to contact center settings. Studies that focused solely on manufacturing processes, lacked methodological rigor, or provided no empirical or conceptual basis relevant to service automation were excluded. Grey literature and non-English publications were also omitted to maintain quality and consistency.

The initial search yielded 536 articles. After removing duplicates and screening titles and abstracts for relevance, 122 articles were selected for full-text review. A further evaluation based on methodological quality and thematic alignment resulted in the inclusion of 47 articles in the final synthesis. Data extraction was performed using a standardized coding framework that categorized studies by objectives, methods, technologies applied (e.g., RPA, AI, chatbots), and outcomes related to operational efficiency, customer satisfaction, and system adaptability.

Findings from the systematic review were then synthesized to inform the development of a process reengineering framework that integrates Lean and Agile principles for automating contact center operations. The PRISMA flow diagram was used to document the review process, ensuring transparency, reproducibility, and alignment with best practices in evidence-based model design.

2.1 Theoretical Foundations

The integration of Lean and Agile principles forms a robust theoretical foundation for the reengineering of contact center operations in the digital age. These principles, though originally conceptualized in manufacturing and software development respectively, have evolved into powerful tools for managing complexity, enhancing responsiveness, and driving continuous improvement across service-oriented environments (Osho *et al*., 2020; Omisola *et al*., 2020). In the context of contact center automation, the combined application of Lean and Agile methodologies provides a strategic pathway for eliminating inefficiencies, aligning processes with customer value, and fostering adaptive, high-performance operations. This explores the theoretical underpinnings of Lean and Agile principles and the synergies they offer when applied to service automation.

Lean thinking, derived from the Toyota Production System, is fundamentally concerned with maximizing customer value while minimizing waste. In service operations such as contact centers, waste (muda) is often manifested in the form of redundant processes, rework, waiting times, underutilized talent, and overprocessing (Akpe *et al*., 2020; Omisola *et al*., 2020). The Lean framework identifies seven classical types of waste—transportation, inventory, motion, waiting, overproduction, overprocessing, and defects—all of which can be mapped analogously to contact center operations.

The elimination of waste is achieved by systematically identifying non-value-adding activities and redesigning workflows to streamline service delivery. For instance, excessive call transfers, repeated data entry, or prolonged customer wait times during service escalation are typical forms of waste that degrade service quality and increase costs (Omisola *et al*., 2020; Akpe *et al*., 2020). Lean tools such as root cause analysis, 5 Whys, and the Fishbone diagram are instrumental in diagnosing inefficiencies within service systems.

Value stream mapping (VSM) is another foundational Lean tool that offers a holistic view of the end-to-end service process, highlighting the flow of information and tasks involved in delivering customer service. In contact centers, VSM can be used to trace the journey of a customer request from initiation to resolution, pinpointing delays, handoff errors, and system bottlenecks. This visual representation is crucial for understanding how value is created—or lost—at each touchpoint, and it guides the prioritization of

improvement initiatives (Maechler *et al*., 2016; Palovuori, 2017).

Continuous improvement (Kaizen), a central tenet of Lean philosophy, fosters a culture of incremental change driven by employee involvement and data-informed experimentation. Contact center teams are encouraged to routinely evaluate and refine processes, drawing from feedback, performance metrics, and user experiences (Adelusi *et al*., 2020; Akinrinoye *et al*., 2020). Kaizen events and daily huddles can be implemented to support frontline agents and supervisors in suggesting improvements, testing solutions, and measuring results in short feedback cycles.

Agile methodology, originating in the field of software engineering, emphasizes flexibility, responsiveness, and rapid iteration in the face of evolving requirements. The Agile Manifesto outlines core values such as customer collaboration over contract negotiation, responding to change over following a plan, and working solutions over comprehensive documentation. These values are particularly relevant to contact center operations, where service demands fluctuate dynamically, and user needs are diverse and time-sensitive.

One of the key tenets of Agile is iterative development, which involves breaking down process reengineering into manageable increments (sprints) that can be designed, tested, and refined in short timeframes. This approach contrasts with traditional waterfall models, which attempt to redesign entire systems upfront without sufficient flexibility for mid-course correction. In a contact center setting, iterative redesign allows teams to pilot new automation scripts, chatbot flows, or escalation protocols in a controlled environment before scaling them more broadly.

Customer collaboration is another pillar of Agile that aligns well with the goals of customer-centric automation. Agile encourages continuous engagement with stakeholders, including end users and frontline staff, to ensure that process improvements are grounded in real-world needs and experiences (Doherty *et al*., 2017; Corbett and Mellouli, 2017). Techniques such as user stories, customer journey mapping, and service design thinking help incorporate the voice of the customer into the development process, thereby enhancing usability and satisfaction.

Agile's emphasis on responsiveness to change is vital in fast-paced service environments. Market conditions, customer behavior, and regulatory requirements are constantly shifting, and contact centers must be able to adapt without disrupting operations. Agile ceremonies such as sprint reviews, retrospectives, and daily stand-ups promote visibility, alignment, and adaptability across cross-functional teams, enabling continuous learning and rapid course correction (Adewoyin *et al*., 2020; Ogunnowo *et al*., 2020).

While Lean and Agile have distinct origins and emphases, their integration offers a synergistic approach particularly suited to the complexities of automating service operations. Lean provides the structural rigor needed to identify and eliminate waste, while Agile delivers the flexibility and speed to design, test, and implement improvements in real time. Together, they create a feedback-rich environment where customer value drives every aspect of operational redesign.

In service automation, this synergy manifests in several ways. Lean's focus on value stream efficiency ensures that automation targets genuinely problematic areas, avoiding the common pitfall of automating inefficiencies rather than eliminating them. Agile's focus on user-centered design and iterative prototyping ensures that automation tools—such as chatbots, RPA scripts, and AI-driven decision engines—are aligned with user needs and tested in real scenarios before deployment.

Furthermore, Lean-Agile integration enhances organizational learning and responsiveness. By embedding continuous improvement (Kaizen) within Agile sprints, teams can build a culture of experimentation where feedback loops are short, errors are seen as opportunities, and innovation is continuous (Sobowale *et al*., 2020; Adewoyin *et al*., 2020). This is especially important in contact centers, where automation must adapt to changing service trends, seasonal demand fluctuations, and emerging communication channels.

Finally, combining Lean and Agile enables scalable transformation. Lean's structured diagnostics (e.g., VSM) help in selecting and sequencing automation projects based on strategic value, while Agile's modular delivery allows for phased implementation without disrupting ongoing operations (Clark, 2016; Sousa *et al*., 2018). The result is a robust and adaptive system that evolves with the organization's needs while maintaining a strong focus on customer experience.

2.2 Framework Architecture

The proposed framework for reengineering contact center operations using Lean and Agile principles is structured into five interconnected phases as shown in figure 1. Each phase plays a critical role in diagnosing operational inefficiencies, designing user-centered solutions, and deploying automation tools effectively (Ikponmwoba *et al*., 2020; Ajuwon *et al*., 2020). The architecture is iterative and scalable, designed to adapt to the complexity of modern contact centers while ensuring alignment with customer value, business goals, and technological feasibility.

The reengineering process begins with a comprehensive assessment phase aimed at understanding the current state of operations and identifying opportunities for transformation. This starts with stakeholder mapping, which involves identifying all internal and external actors who influence or are influenced by contact center performance. These typically include customer service representatives, IT teams, quality assurance personnel, management, end users, and external partners (e.g., chatbot vendors or CRM providers). Engaging stakeholders early fosters shared ownership, ensures diverse perspectives are considered, and aligns project goals with organizational priorities.

Concurrently, a detailed process audit is conducted to document current workflows, technologies, and performance metrics. This includes tracking customer touchpoints, agent workflows, ticket lifecycles, escalation paths, and system handoffs. Tools such as process mining software and direct observation help reveal the actual process behavior, which often differs from the documented standard operating procedures.

The core objective of this phase is the identification of pain points and bottlenecks. These may include long response times, redundant task flows, excessive call transfers, frequent escalation loops, or poor data accessibility. Understanding these inefficiencies provides the foundation for targeted improvements and sets measurable benchmarks for process redesign and automation efforts.

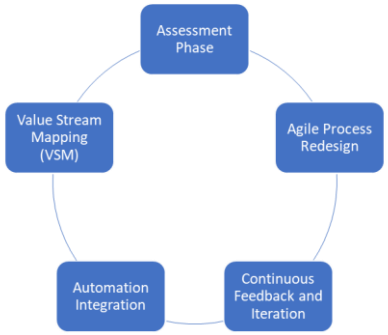

Figure 2: Framework Architecture

Building on the assessment phase, Value Stream Mapping (VSM) is used to visualize the end-to-end flow of customer interactions. VSM is a Lean tool that depicts each step involved in delivering a service, distinguishing between value-added activities (those directly contributing to customer satisfaction) and non-value-added activities (waste) (Ikponmwoba *et al*., 2020; Adewuyi *et al*., 2020).

In a contact center context, a value stream might start with a customer initiating a service request via phone, chatbot, or email and end with issue resolution and follow-up. Mapping this journey helps identify delays, inefficiencies, and handoff errors, such as time lost in queue, redundant data entry, multiple verification steps, or disconnected communication systems.

Importantly, VSM supports cross-functional collaboration by offering a shared view of the process across teams. It becomes a diagnostic and strategic planning tool for prioritizing automation and streamlining efforts. Insights gained from VSM directly inform the selection of process segments to be reengineered in the next phase.

With a clear understanding of current-state operations and pain points, the next phase involves Agile process redesign. This phase embraces the principles of iteration, flexibility, and user co-creation. It begins

with the creation of a process backlog, a prioritized list of process elements to be redesigned or automated. Each item in the backlog is decomposed into user stories—concise descriptions of user needs and the functionality required to meet them. For example, a user story might be: "As a customer service agent, I want to auto-populate customer details so that I can reduce call handling time."

Sprint planning is then conducted to organize the work into time-boxed intervals (sprints), typically lasting 2–4 weeks. During each sprint, a cross-functional team—comprising process analysts, developers, customer service representatives, and automation specialists—collaborates to redesign workflows, prototype solutions, and test improvements (Adenuga *et al*., 2020; Oyedele *et al*., 2020). Emphasis is placed on usability, service continuity, and responsiveness to feedback.

The Agile approach ensures that redesign efforts are user-centric, incremental, and adaptable. It avoids the pitfalls of "big-bang" process overhauls by enabling continuous learning and rapid adjustments.

Following redesign, the next phase focuses on automation integration, where reengineered workflows are implemented using intelligent technologies. Each redesigned module is mapped to appropriate tools, such as Robotic Process Automation (RPA) for repetitive tasks, chatbots for handling tier-1 queries, and AI-based systems for predictive analytics and intelligent routing.

To support robust and scalable automation, decision trees are developed to define logic pathways for automated systems. These trees outline conditions under which specific actions should be taken, such as escalating a complaint to a human agent, requesting additional information, or providing a solution from a knowledge base. Exception handling protocols are designed to manage scenarios where automation fails, ensuring that issues are flagged and addressed without disrupting customer experience (Keller, 2017; Skadsheim, 2018).

This phase also involves integration with existing systems, such as CRMs, ticketing platforms, and communication tools, through APIs and middleware. Security, compliance, and data privacy considerations are embedded throughout the automation layer.

To sustain the benefits of automation and process reengineering, the final phase focuses on continuous feedback and iteration. Each sprint concludes with a sprint review and retrospective, during which teams assess what worked, what didn't, and how future cycles can improve. Key performance indicators (KPIs) such as average handling time, first-call resolution rate, customer satisfaction (CSAT), and automation success rate are tracked to measure the impact of changes.

Feedback is also gathered from agents and customers to identify usability issues, gaps in automation logic, or emerging service needs. This feedback loop ensures that the automation system evolves alongside customer expectations and operational realities.

To support real-time monitoring and performance management, Lean visual management tools such as Kanban boards or Andon dashboards are deployed. These tools offer visibility into work progress, bottlenecks, and process anomalies, enabling teams to intervene promptly and maintain flow efficiency.

2.3 Key Enablers

The successful implementation of a process reengineering framework for automating contact center operations using Lean and Agile principles hinges on the presence of several foundational enablers (Nabelsi and Gagnon, 2017; Petrillo *et al*., 2018). These enablers are not merely supportive mechanisms but essential pillars that facilitate technological integration, organizational adaptability, and regulatory alignment. Among the most critical are the availability and deployment of a robust technology stack, a well-orchestrated change management strategy, and a comprehensive data governance framework. Each of these elements plays a distinct role in ensuring that automation initiatives are sustainable, secure, and aligned with the strategic objectives of customer-centric transformation.

At the core of contact center automation lies a sophisticated technology stack that enables the redesign and implementation of intelligent workflows. The stack typically comprises Robotic Process

Automation (RPA) tools, artificial intelligence (AI) and machine learning (ML) services, and Customer Relationship Management (CRM) system integrations. These technologies work synergistically to support both the operational and analytical aspects of reengineered processes.

RPA tools such as UiPath, Automation Anywhere, and Blue Prism are instrumental in automating repetitive, rule-based tasks. In contact centers, RPA can be applied to functions like data extraction from multiple systems, auto-filling forms, generating routine reports, or managing after-call work (ACW). RPA reduces manual errors, improves speed, and allows agents to focus on higher-value, customer-facing activities.

AI/ML services further enhance automation by enabling the intelligent processing of unstructured data, natural language understanding, and predictive decision-making. Natural Language Processing (NLP) models are particularly valuable in managing chatbots, email triage, sentiment analysis, and voice-to-text conversion. Machine learning algorithms can be trained to optimize routing strategies, forecast call volumes, or detect patterns in customer complaints. AI tools integrate with reengineered workflows to introduce adaptability and personalization, key attributes of customer-centric service models.

CRM integration is another essential component. Automation must be embedded within the contact center's core systems of record to ensure seamless information flow across touchpoints. Whether using Salesforce, Zendesk, Microsoft Dynamics, or industry-specific platforms, CRM systems store critical customer data, service history, and interaction logs (Parenteau *et al*., 2016; Oestreich, 2016). Integrating automation tools with CRMs allows real-time data access and updates, enabling personalized responses and continuity of service.

Moreover, the modular design of modern technology stacks, supported by APIs and cloud-native platforms, allows for scalability and flexibility in deploying automated services across multiple channels—voice, email, chat, and social media. The interoperability of these tools is crucial for continuous improvement and rapid response to evolving customer expectations.

While technology serves as the backbone of automation, its success depends heavily on change management—the human and organizational side of transformation. Contact center automation often disrupts traditional roles, workflows, and performance metrics, necessitating a structured approach to managing this transition.

A key element of change management is employee training and upskilling. Automation changes the nature of agent work, shifting focus from routine task execution to exception handling, empathy-driven service, and technology supervision. Therefore, staff must be equipped with the skills to interact with AI tools, interpret automated outputs, and deliver human value in complex or emotionally charged interactions. Training programs should be continuous, role-specific, and hands-on, incorporating simulations and scenario-based learning.

Communication strategies are equally important. Transparent, two-way communication reduces resistance, builds trust, and fosters a shared vision for the transformation initiative. Leaders must articulate the strategic rationale for automation, outline its expected benefits for both customers and employees, and provide platforms for feedback. Communication should also address concerns about job displacement, emphasizing opportunities for role evolution and professional development.

Another critical component is role realignment. As automation takes over transactional tasks, organizational structures must adapt to support new responsibilities and workflows. New roles such as automation analysts, bot supervisors, and digital process coordinators may emerge. Cross-functional teams must be empowered to collaborate effectively, breaking down silos between IT, operations, and customer service (Boroș *et al*., 2017; Ali and Hussain, 2017). Agile frameworks, including Scrum and Kanban, can be adopted to manage evolving responsibilities and maintain alignment.

Change management also involves updating performance metrics and incentives. Traditional KPIs focused on call volume or handle time may no longer be appropriate. Instead, metrics such as resolution quality, customer satisfaction (CSAT), and successful automation rate should be emphasized. Aligning

incentives with these metrics ensures that employees are motivated to support and sustain the new system.

The increasing reliance on automation and AI in contact center operations elevates the importance of data governance, especially in environments handling sensitive customer information. Effective data governance encompasses data quality, access control, compliance, privacy, and cybersecurity—all of which are vital for ensuring the integrity and accountability of automated processes.

First and foremost, compliance with data protection regulations is non-negotiable. Frameworks such as the General Data Protection Regulation (GDPR), the California Consumer Privacy Act (CCPA), and local data sovereignty laws in emerging markets must guide data handling practices. Contact centers must ensure that data collection, storage, and processing practices are transparent, consent-based, and subject to user rights such as data portability and erasure.

Data privacy must be embedded into the design of automated workflows. This includes anonymizing personally identifiable information (PII), implementing role-based access controls, and conducting privacy impact assessments for new automation deployments. Automation scripts and AI tools must be auditable and designed to minimize the risk of bias or misuse.

Secure integration across platforms is also critical. Contact center automation typically involves the interconnection of CRMs, telephony systems, databases, and external APIs. These integrations must be protected through encryption, secure APIs, and robust authentication protocols. Network segmentation, intrusion detection systems, and regular security audits are essential to prevent data breaches and maintain customer trust (Iqbal *et al*., 2016; Subramanian and Jeyaraj, 2018).

Finally, data quality must be continuously monitored. Automation systems depend on accurate, timely, and complete data to function effectively. Poor data can lead to faulty automation, misrouted requests, or erroneous decisions. Data governance policies should mandate regular validation, cleansing, and enrichment of datasets used in automation workflows.

2.4 Case Application Scenarios

The practical application of a Lean-Agile process reengineering framework for automating contact center operations can be effectively demonstrated through real-world use cases (Garza-Reyes *et al*., 2016; Datta, 2017). These application scenarios showcase how redesigned workflows, intelligent automation, and agile iterations can transform routine customer interactions into efficient, responsive, and customer-centric services. This examines three high-impact cases: inbound call handling automation, customer complaint resolution workflows, and outbound campaign and follow-up automation.

Inbound call handling is one of the most resource-intensive functions of a contact center. Traditional models often involve long hold times, repetitive identity verification steps, manual data retrieval, and multiple handovers between agents. These inefficiencies not only reduce customer satisfaction but also increase operational costs. By applying Lean principles, the process is mapped to identify non-value-adding activities such as redundant customer queries, unnecessary transfers, and prolonged after-call work (ACW).

Agile redesign enables this workflow to be modularized into components such as identity verification, intent recognition, self-service response, and human escalation. Automation is then introduced using a combination of interactive voice response (IVR) systems enhanced with natural language processing (NLP), AI-powered virtual assistants, and Robotic Process Automation (RPA) for backend data access.

For example, upon receiving a call, an AI-driven IVR can identify the caller using voice biometrics or token-based authentication, analyze the intent of the call through speech recognition, and provide instant responses or escalate to a live agent if the query is complex. Routine inquiries like account balance checks, payment confirmations, or password resets are resolved without human intervention. This significantly reduces average handle time, improves first-contact resolution rates, and allows agents to focus on high-value interactions.

Customer complaints are sensitive and often require rapid, accurate, and empathetic resolution to maintain brand loyalty. However, conventional complaint management systems are fragmented, slow, and reliant on human tracking of resolution status (Bilal *et al*., 2016; Wei *et al*., 2016). Complaints may be lost in handovers, poorly categorized, or inadequately documented, leading to repeat calls and customer frustration.

Using Lean techniques, a value stream map of the complaint lifecycle reveals delays in case triaging, information silos, and inconsistent escalation protocols. Agile methodology enables the development of a flexible, iterative complaint-handling process that adapts based on feedback and evolving service requirements. Teams can develop user stories such as "As a customer, I want to receive real-time updates on my complaint so I feel heard and valued."

Automation is integrated at multiple stages. For instance, AI-powered sentiment analysis can be applied to voice or text inputs to prioritize complaints based on emotional tone and urgency. Chatbots integrated into messaging platforms or mobile apps can assist in complaint logging, categorize issues based on predefined taxonomies, and provide immediate acknowledgment. Workflow automation can then assign the case to the appropriate department using RPA and auto-generate service-level agreements (SLAs) for resolution timeframes.

A centralized complaint dashboard allows agents and supervisors to monitor progress, trigger escalations, and communicate updates to customers automatically. These improvements not only reduce resolution time but also enhance transparency, accountability, and customer trust.

Outbound contact center operations, including marketing campaigns, service reminders, payment notifications, and customer satisfaction surveys, often suffer from low engagement rates and high resource consumption. Traditional campaigns rely on batch processes and generic messaging, which fail to capture user attention or match preferred communication channels.

Applying Lean principles helps eliminate waste in campaign execution, such as contacting ineligible customers or duplicating outreach efforts. Agile methods allow rapid prototyping and testing of campaign scripts, timing strategies, and channel combinations (Brinker, 2016; Saha *et al*., 2017). Customer segments are defined and refined based on iterative feedback from previous campaigns.

Automation plays a pivotal role through automated dialers, SMS/email bots, and personalized content delivery engines. For instance, AI tools can determine the optimal time to reach a customer based on previous interactions, while machine learning algorithms can personalize the message content based on user behavior or service history.

Follow-up processes are also automated. If a customer interacts with a campaign—for instance, by clicking a link in an email or confirming an appointment via SMS—the system updates the CRM in real-time, schedules follow-ups, and assigns tasks to the appropriate agent if necessary. This end-to-end automation ensures continuity, increases engagement rates, and minimizes the need for manual tracking.

2.5 Benefits and Impact

The implementation of a Lean-Agile process reengineering framework for contact center automation brings transformative benefits across customer experience, operational efficiency, and strategic adaptability. Contact centers are increasingly under pressure to deliver personalized, real-time service across multiple channels while maintaining cost efficiency and compliance. Traditional methods are ill-equipped to meet these demands, often relying on static workflows, siloed systems, and manual decision-making (Haney, 2016; Turner *et al*., 2018). The adoption of a Lean-Agile automation framework addresses these limitations by fostering streamlined operations, continuous feedback loops, and scalable digital capabilities as shown in figure 2. This explores the key benefits and impacts in terms of improved customer response time and satisfaction, reduced operational costs and error rates, and enhanced scalability and agility in service delivery.

One of the most critical measures of contact center performance is customer responsiveness. Traditional

contact centers, encumbered by legacy systems and fragmented processes, often struggle to respond promptly and effectively to customer inquiries. Delays due to long hold times, repetitive authentication steps, and inefficient handoffs contribute to customer frustration and attrition.

The application of Lean principles enables the identification and elimination of process inefficiencies that lead to delayed responses. For instance, value stream mapping highlights non-value-adding activities, allowing organizations to streamline the customer journey and eliminate redundant steps. Agile methodologies further enhance this by promoting rapid iteration and user-centric design, ensuring that solutions are responsive to real customer needs and expectations.

Automation plays a pivotal role in accelerating response times. Tools such as AI-powered chatbots, intelligent IVR systems, and robotic process automation (RPA) can handle common customer queries instantly, reducing the need for human intervention. For more complex issues, intelligent triaging and routing systems ensure that customers are directed to the right agent with minimal delay. As a result, average handling time (AHT) and first contact resolution (FCR) rates improve significantly.

Moreover, the integration of machine learning models enables real-time sentiment analysis, allowing the system to adapt dynamically to customer emotions and urgency (Torres *et al*., 2018; Attaran and Deb, 2018). Customers experience more empathetic, context-aware service, which leads to higher satisfaction scores (CSAT) and stronger brand loyalty.

Figure 2: Benefits and Impact

Automation powered by Lean-Agile principles dramatically reduces the operational burden on contact centers. Traditional service delivery models are resource-intensive, requiring large teams to handle high volumes of repetitive, low-complexity tasks. This not only drives up labor costs but also increases the likelihood of human error—particularly in data entry, information retrieval, and case management.

Lean methodology identifies and targets waste in operational processes—whether it be excessive motion (switching between systems), waiting times (idle queues), or overprocessing (manual data duplication). Agile redesign then breaks down complex workflows into smaller, manageable sprints that are continuously optimized. When these redesigned workflows are automated using RPA and AI tools, organizations achieve significant reductions in task completion time, labor effort, and overhead.

For example, automating after-call work (ACW), such as case documentation and follow-up scheduling, can reduce task times by over 50%. Similarly, chatbots can handle thousands of simultaneous interactions at a fraction of the cost of live agents. These efficiencies translate into tangible cost savings through reduced headcount requirements, lower training expenses, and improved resource allocation.

Automation also reduces error rates by standardizing task execution. Manual processes are prone to inconsistencies and fatigue-related mistakes, particularly in high-volume environments. Automated systems, by contrast, follow predefined rules and logic with high accuracy. This minimizes errors in data entry, billing, order processing, and compliance reporting. In regulated industries such as finance and healthcare, the reduction of compliance errors has significant financial and reputational benefits.

One of the most powerful impacts of the Lean-Agile automation framework is the enhancement of scalability and organizational agility. Traditional contact center infrastructures are often rigid, with limited ability to scale operations in response to fluctuating customer demands (Horlach *et al*., 2016; Saberi *et al*., 2017). Scaling typically requires proportional increases in staff, training, and support infrastructure, which is both costly and time-consuming.

The modular nature of Agile process design enables rapid adaptation and scaling. Redesigned workflows can be deployed incrementally, tested in controlled environments, and rolled out across the enterprise with minimal disruption. This approach supports experimentation, learning, and continuous improvement—key drivers of agility.

Automation technologies, especially cloud-native AI services and RPA platforms, provide inherent scalability. They can handle spikes in interaction volumes—such as during promotional campaigns, outages, or seasonal surges—without compromising service quality. For example, chatbots and automated email responses can handle unlimited interactions simultaneously, providing instant service regardless of volume.

Additionally, Agile practices promote frequent iteration and responsiveness to change. Customer feedback is integrated into each sprint cycle, allowing teams to refine service processes and automation scripts in real time. This agility is particularly valuable in dynamic environments where customer preferences, technologies, and regulations evolve rapidly. It allows contact centers to remain competitive by continuously aligning service delivery with market expectations.

Furthermore, the framework facilitates global scalability. Automated systems, once designed, can be adapted across regions and languages with minimal additional investment. Cloud-based infrastructure supports rapid deployment across geographic locations, enabling multinational organizations to standardize and scale best practices across diverse operational contexts (Demchenko *et al*., 2016; Mitra *et al*., 2019).

2.6 Challenges and Limitations

While the integration of Lean and Agile principles into contact center automation presents numerous benefits—ranging from efficiency gains to enhanced customer satisfaction—it is not without significant challenges and limitations as shown in figure 3. The reengineering of complex service operations involves not only technical transformations but also cultural, managerial, and organizational shifts (Ismail *et al*., 2017; Bhasin *et al*., 2018). Successful implementation depends on how well these challenges are anticipated and mitigated. This explores three critical areas of concern: resistance to change among staff, integration complexity with legacy systems, and difficulty in measuring return on investment (ROI) and the long-term impact of automation.

One of the most pervasive challenges in the reengineering of contact center operations is resistance to change. Employees, particularly frontline agents and mid-level supervisors, often express apprehension regarding automation initiatives. These concerns are typically rooted in fears of job displacement, loss of autonomy, or being replaced by AI systems. Additionally, automation alters traditional workflows, requiring employees to adapt to new roles that may involve oversight of digital agents or increased focus on soft skills and exception handling.

The Lean-Agile framework, while promoting continuous improvement and flexibility, demands high levels of collaboration and transparency. This can be disorienting for teams accustomed to hierarchical structures and linear workflows. Agile ceremonies such as daily stand-ups, retrospectives, and iterative feedback cycles require cultural buy-in, which may be lacking in organizations with rigid or siloed cultures.

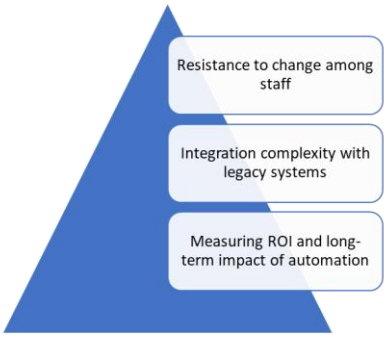

Figure 3: Challenges and Limitations

Furthermore, reskilling and upskilling programs are essential but often underfunded or poorly executed. Without effective training, staff may feel overwhelmed by new systems, leading to reduced morale and productivity during the transition (Vijayan, 2017; Massingham, 2018). The psychological aspect of change—especially the fear of the unknown—can inhibit engagement and slow down transformation efforts.

Overcoming resistance requires a well-articulated change management strategy, encompassing inclusive communication, leadership support, employee involvement, and recognition of contributions throughout the transformation process. However, implementing such strategies at scale remains a considerable challenge, particularly in organizations with high turnover or limited organizational learning capacity.

Another significant limitation lies in the technical complexity of integrating new automation tools with existing legacy systems. Many contact centers, especially those in large or regulated industries, rely on aging infrastructure that was not designed for interoperability or real-time data exchange. These legacy systems often include on-premise telephony, customer databases, ticketing software, and proprietary CRM platforms that are rigid, monolithic, and poorly documented.

Integrating modern technologies—such as Robotic Process Automation (RPA), AI-powered chatbots, and cloud-based CRM solutions—into these environments requires custom middleware, data normalization, and extensive API development. This not only increases the implementation timeline and cost but also introduces points of fragility. Errors in integration can lead to data loss, service outages, or duplication of customer interactions, all of which degrade user experience and erode trust (Mik, 2017; Reaves *et al*., 2017).

Moreover, data silos within legacy systems limit the effectiveness of automation. For instance, a chatbot may be capable of processing a customer's inquiry, but if it lacks access to historical service records stored in an isolated database, it cannot provide a personalized or informed response. Similarly, automated workflows may be hindered if real-time data synchronization is unavailable between systems.

Organizations may also face vendor lock-in and licensing constraints that complicate migration or integration. In many cases, a complete system overhaul may be technically desirable but financially or operationally unfeasible. As a result, contact centers must often settle for partial or workaround-based integrations, which limit the scope and scalability of automation benefits.

To address this, enterprise architects must adopt modular, standards-based design principles and prioritize API-first and cloud-native approaches where possible. However, the journey to full system interoperability remains long and resource-intensive, especially for legacy-dependent environments.

A third core limitation is the difficulty in quantifying the return on investment (ROI) and long-term impact of contact center automation. Unlike capital investments with clearly defined depreciation schedules, process automation yields both tangible and intangible benefits that may be difficult to measure directly (Saunders and Brynjolfsson, 2016; Zambon, 2017). For instance, improvements in customer satisfaction, employee engagement, or service quality are often not immediately reflected in financial statements.

Additionally, Lean and Agile transformations are inherently iterative and require time to mature. Early phases may result in sunk costs due to pilot failures, tool misconfigurations, or learning curve delays. This can make it challenging to demonstrate value to executive stakeholders or justify continued investment, especially in budget-constrained environments.

Furthermore, the metrics used to assess ROI can be misleading if they focus only on cost savings or task completion speed. These measures may ignore broader organizational impacts such as innovation capacity, customer loyalty, or reputational benefits. Rigid performance indicators may also fail to capture the adaptive advantages of Agile practices—such as responsiveness to change, continuous improvement, and rapid experimentation.

Evaluating long-term impact requires a balanced scorecard approach that combines financial, operational, customer, and innovation perspectives. This includes tracking metrics such as net promoter score (NPS), first contact resolution (FCR), employee net engagement, and cycle time reduction. However, developing and maintaining such a dashboard involves a high level of analytical capability, data integration, and executive commitment—resources that are often limited in organizations pursuing automation for the first time (Kumar and Belwal, 2017; Torres *et al*., 2018).

Longitudinal studies and benchmarking initiatives are also essential to understand the full value of automation over time. Yet, few organizations have the discipline or infrastructure to conduct such analyses, limiting the evidence base needed to guide strategic decisions.

CONCLUSION AND FUTURE RESEARCH

The proposed Lean-Agile process reengineering framework for automating contact center operations offers a structured, strategic approach to achieving operational efficiency, enhanced customer satisfaction, and scalable service delivery. By integrating Lean principles—focused on waste elimination, value stream optimization, and continuous improvement—with Agile methodologies—centered on iterative design, cross-functional collaboration, and responsiveness to change—the framework aligns technical capabilities with human-centric values. Its strategic value lies not only in cost reduction and speed gains but also in fostering resilient, customer-responsive service environments.

This framework begins with an in-depth assessment phase, using stakeholder mapping and process audits to diagnose inefficiencies and pain points. It progresses through value stream mapping (VSM) to visualize customer journeys and identify non-value-adding steps. Agile process redesign then modularizes workflows into user stories and sprints, facilitating iterative testing and improvement. Automation integration leverages AI, RPA, and CRM platforms to operationalize redesigned workflows. Finally, continuous feedback loops, KPI monitoring, and Lean visualization tools sustain improvements and ensure adaptability. Together, these components provide a comprehensive blueprint for transforming legacy contact centers into intelligent, flexible, and human-centric service hubs.

To ensure practical success, phased implementation is strongly recommended. Organizations should begin with low-risk, high-volume processes—such as inbound call triaging or FAQ resolution—that offer quick wins and measurable ROI. These early pilots build technical confidence, generate user buy-in, and establish foundational infrastructure (e.g., integration layers, automation governance protocols). Subsequently, more complex workflows—such as complaints resolution or outbound campaigns—can be tackled in iterative waves, informed by feedback and performance metrics from earlier phases. Phased scaling should also include incremental upgrades to training, change management, and data governance capabilities to match the growing complexity of automation deployments.

Looking ahead, future research should address several emerging frontiers in contact center transformation. One promising area is autonomous decision-making systems, in which AI agents are endowed with contextual reasoning capabilities to make real-time service decisions without human intervention. These systems will require new frameworks for explainability, compliance monitoring, and ethical alignment, especially in sensitive sectors such as healthcare or financial services.

Another area of inquiry involves sentiment-driven service models, which use real-time emotional analytics to dynamically shape service interactions. Combining biometric inputs, speech tone analysis, and behavioral signals, these models could enable proactive and empathetic service experiences, where automation adapts not only to customer intent but also to emotional state. Research is needed to improve the precision, privacy, and cross-cultural validity of sentiment analysis technologies and to integrate them responsibly into service automation protocols.

The Lean-Agile reengineering framework provides a strategic pathway for modernizing contact center operations in a customer-centric, cost-effective, and adaptable manner. As organizations increasingly embrace digital transformation, the ability to iteratively refine service processes and embed intelligence at every layer will be key to maintaining competitiveness. Ongoing research and innovation in autonomous systems, emotional intelligence, and adaptive automation will further expand the potential of this framework, positioning contact centers as dynamic enablers of enterprise value and customer trust.

REFERENCES

[1] Adelusi, B.S., Uzoka, A.C., Hassan, Y.G. & Ojika, F.U., 2020. Leveraging Transformer-Based Large Language Models for Parametric Estimation of Cost and Schedule in Agile Software Development Projects. IRE Journals, 4(4), pp.267-273. DOI: 10.36713/epra1010

[2] Adenuga, T., Ayobami, A.T. & Okolo, F.C., 2019. Laying the Groundwork for Predictive Workforce Planning Through Strategic Data Analytics and Talent Modeling. IRE Journals, 3(3), pp.159–161. ISSN: 2456-8880.

[3] Adenuga, T., Ayobami, A.T. & Okolo, F.C., 2020. AI-Driven Workforce Forecasting for Peak Planning and Disruption Resilience in Global Logistics and Supply Networks. International Journal of Multidisciplinary Research and Growth Evaluation, 2(2), pp.71–87. Available at: https://doi.org/10.54660/.IJMRGE.2020.1.2.71-87.

[4] Adewoyin, M.A., Ogunnowo, E.O., Fiemotongha, J.E., Igunma, T.O. & Adeleke, A.K., 2020. A Conceptual Framework for Dynamic Mechanical Analysis in High-Performance Material Selection. IRE Journals, 4(5), pp.137–144.

[5] Adewoyin, M.A., Ogunnowo, E.O., Fiemotongha, J.E., Igunma, T.O. & Adeleke, A.K., 2020. Advances in Thermofluid Simulation for Heat Transfer Optimization in Compact Mechanical Devices. IRE Journals, 4(6), pp.116–124.

[6] Adewuyi, A., Oladuji, T.J., Ajuwon, A. & Nwangele, C.R. (2020), A Conceptual Framework for Financial Inclusion in Emerging Economies: Leveraging AI to Expand Access to Credit, IRE Journals, 4(1), pp. 222–236. ISSN: 2456-8880.

[7] Ajonbadi, H.A., Lawal, A.A., Badmus, D.A. and Otokiti, B.O., 2014. Financial Control and Organisational Performance of the Nigerian Small and Medium Enterprises (SMEs): A Catalyst for Economic Growth. *American Journal of Business, Economics and Management. 2 (2), 135*, *143*.

[8] Ajonbadi, H.A., Otokiti, B.O. and Adebayo, P., 2016. The efficacy of planning on organisational performance in the Nigeria SMEs. *European Journal of Business and Management*, *24*(3), pp.25-47.

[9] AjonbadiAdeniyi, H., AboabaMojeed-Sanni, B. and Otokiti, B.O., 2015. Sustaining Competitive Advantage in Medium-sized Enterprises (MEs) through Employee Social Interaction and Helping Behaviours. *Journal of Small Business and Entrepreneurship*, *3*(2), pp.1-16.

[10] Ajuwon, A., Onifade, O., Oladuji, T.J. & Akintobi, A.O. (2020), Blockchain-Based Models for Credit and Loan System Automation in Financial Institutions, IRE Journals, 3(10), pp. 364–381. ISSN: 2456-8880.

[11] Akinbola, O.A. and Otoki, B.O., 2012. Effects of lease options as a source of finance on profitability performance of small and medium enterprises (SMEs) in Lagos State, Nigeria. *International Journal of Economic Development Research and Investment Vol. 3 No3, Dec 2012*.

[12] Akinbola, O.A., Otokiti, B.O., Akinbola, O.S. and Sanni, S.A., 2020. Nexus of Born Global Entrepreneurship Firms and Economic Development in Nigeria. *Ekonomicko-manazerske spektrum*, *14*(1), pp.52-64.

[13] Akinrinoye, O.V., Kufile, O.T., Otokiti, B.O., Ejike, O.G., Umezurike, S.A. & Onifade, A.Y., 2020. Customer Segmentation Strategies in Emerging Markets: A Review of Tools, Models, and Applications. International Journal of Scientific Research in Computer Science, Engineering and Information Technology, 6(1), pp.194-217. DOI: 10.32628/IJSRCSEIT

[14] Akpe, O.E., Mgbame, A.C., Ogbuefi, E., Abayomi, A.A. & Adeyelu, O.O., 2020. Barriers and Enablers of BI Tool Implementation in Underserved SME Communities. IRE Journals, 3(7), pp.211-220. DOI: 10.6084/m9.figshare.26914420.

[15] Akpe, O.E., Mgbame, A.C., Ogbuefi, E., Abayomi, A.A. & Adeyelu, O.O., 2020. Bridging the Business Intelligence Gap in Small Enterprises: A Conceptual Framework for Scalable Adoption. IRE Journals, 4(2), pp.159-168. DOI: 10.6084/m9.figshare.26914438.

[16] Ali, F. and Hussain, N., 2017. Collaborative Commons in Tech: Enhancing Cross-Functional Development with Cloud Solutions.

[17] Attaran, M. and Deb, P., 2018. Machine learning: the new'big thing'for competitive advantage. *International Journal of Knowledge Engineering and Data Mining*, *5*(4), pp.277-305.

[18] Bhasin, S., Dhami, S. and SB, S., 2018. Business Process Reengineering–The Role of Human Resource Function: A Comprehensive Review of Literature. *International Journal of Business Management & Research*, *8*(2), pp.1-17.

[19] Bilal, M., Oyedele, L.O., Qadir, J., Munir, K., Ajayi, S.O., Akinade, O.O., Owolabi, H.A., Alaka, H.A. and Pasha, M., 2016. Big Data in the construction industry: A review of present status, opportunities, and future trends. *Advanced engineering informatics*, *30*(3), pp.500-521.

[20] Boroş, S., Van Gorp, L., Cardoen, B. and Boute, R., 2017. Breaking silos: a field experiment on relational conflict management in cross-functional teams. *Group Decision and Negotiation*, *26*, pp.327-356.

[21] Brinker, S., 2016. *Hacking marketing: Agile practices to make marketing smarter, faster, and more innovative*. John Wiley & Sons.

[22] Clark, D., 2016. Quality improvement in basic histotechnology: the lean approach. *Virchows Archiv*, *468*, pp.5-17.

[23] Corbett, J. and Mellouli, S., 2017. Winning the SDG battle in cities: how an integrated information ecosystem can contribute to the achievement of the 2030 sustainable development goals. *Information Systems Journal*, *27*(4), pp.427-461.

[24] Datta, P.P., 2017. Enhancing competitive advantage by constructing supply chains to achieve superior performance. *Production Planning & Control*, *28*(1), pp.57-74.

[25] Demchenko, Y., Turkmen, F., De Laat, C., Blanchet, C. and Loomis, C., 2016, July. Cloud based big data infrastructure: Architectural components and automated provisioning. In *2016 International Conference on High Performance Computing & Simulation (HPCS)* (pp. 628-636). IEEE.

[26] Doherty, E., Carcary, M., Conway, G. and Crowley, C., 2017, September. Customer experience management (CXM) Development of a conceptual model for the digital organization. In *ECISM 2017 11th European Conference on Information Systems Management* (p. 103). Academic Conferences and publishing limited.

[27] FAGBORE, O.O., OGEAWUCHI, J.C., ILORI, O., ISIBOR, N.J., ODETUNDE, A. and ADEKUNLE, B.I., 2020. Developing a Conceptual Framework for Financial Data Validation in Private Equity Fund Operations.

[28] Garza-Reyes, J.A., Villarreal, B., Kumar, V. and Molina Ruiz, P., 2016. Lean and green in the transport and logistics sector–a case study of simultaneous deployment. *Production Planning & Control*, *27*(15), pp.1221-1232.

[29] Haney, E., 2016. Data Engineering in Aerospace Systems Design & Forecasting.

[30] Horlach, B., Drews, P. and Schirmer, I., 2016, March. Bimodal IT: Business-IT Alignment in the Age of Digital Transformation. In *MKWI* (pp. 1417-1428).

[31] Ikponmwoba, S.O., Chima, O.K., Ezeilo, O.J., Ojonugwa, B.M., Ochefu, A., & Adesuyi, M.O., 2020. A Compliance-Driven Model for Enhancing Financial Transparency in Local Government Accounting Systems. International Journal of Multidisciplinary Research and Growth Evaluation, 1(2), pp.99-108. DOI: 10.54660/.IJMRGE.2020.1.2.99-108.

[32] Ikponmwoba, S.O., Chima, O.K., Ezeilo, O.J., Ojonugwa, B.M., Ochefu, A., & Adesuyi, M.O., 2020. Conceptual Framework for Improving Bank Reconciliation Accuracy Using Intelligent Audit Controls. Journal of Frontiers in Multidisciplinary Research, 1(1), pp.57-70. DOI: 10.54660/.IJFMR.2020.1.1.57-70.

[33] Iqbal, S., Kiah, M.L.M., Dhaghighi, B., Hussain, M., Khan, S., Khan, M.K. and Choo, K.K.R., 2016. On cloud security attacks: A taxonomy and intrusion detection and prevention as a service. *Journal of Network and Computer Applications*, *74*, pp.98-120.

[34] Ismail, M.H., Khater, M. and Zaki, M., 2017. Digital business transformation and strategy: What do we know so far. *Cambridge Service Alliance*, *10*(1), pp.1-35.

[35] Keller, A., 2017. Challenges and directions in service management automation. *Journal of Network and Systems Management*, *25*(4), pp.884-901.

[36] Kumar, S.M. and Belwal, M., 2017, August. Performance dashboard: Cutting-edge business

intelligence and data visualization. In *2017 International Conference On Smart Technologies For Smart Nation (SmartTechCon)* (pp. 1201-1207). IEEE.

[37] Lawal, A.A., Ajonbadi, H.A. and Otokiti, B.O., 2014. Leadership and organisational performance in the Nigeria small and medium enterprises (SMEs). *American Journal of Business, Economics and Management*, *2*(5), p.121.

[38] Lawal, A.A., Ajonbadi, H.A. and Otokiti, B.O., 2014. Strategic importance of the Nigerian small and medium enterprises (SMES): Myth or reality. *American Journal of Business, Economics and Management*, *2*(4), pp.94-104.

[39] Maechler, N., Neher, K. and Park, R., 2016. From touchpoints to journeys.

[40] Massingham, P.R., 2018. Measuring the impact of knowledge loss: a longitudinal study. *Journal of Knowledge Management*, *22*(4), pp.721-758.

[41] Mik, E., 2016. The erosion of autonomy in online consumer transactions. *Law, Innovation and Technology*, *8*(1), pp.1-38.

[42] Mitra, A., O'Regan, N. and Sarpong, D., 2018. Cloud resource adaptation: A resource based perspective on value creation for corporate growth. *Technological Forecasting and Social Change*, *130*, pp.28-38.

[43] Nabelsi, V. and Gagnon, S., 2017. Information technology strategy for a patient-oriented, lean, and agile integration of hospital pharmacy and medical equipment supply chains. *International Journal of Production Research*, *55*(14), pp.3929-3945.

[44] Oestreich, T.W., 2016. Magic quadrant for business intelligence and analytics platforms. *Analyst (s)*, *501*, p.G00275847.

[45] Ogunnowo, E.O., Adewoyin, M.A., Fiemotongha, J.E., Igunma, T.O. & Adeleke, A.K., 2020. Systematic Review of Non-Destructive Testing Methods for Predictive Failure Analysis in Mechanical Systems. IRE Journals, 4(4), pp.207–215.

[46] Omisola, J.O., Chima, P.E., Okenwa, O.K. and Tokunbo, G.I., 2020. Green Financing and Investment Trends in Sustainable LNG Projects A Comprehensive Review. *Unknown Journal*.

[47] Omisola, J.O., Etukudoh, E.A., Okenwa, O.K. and Tokunbo, G.I., 2020. Innovating project delivery and piping design for sustainability in the oil and gas industry: A conceptual framework. *perception*, *24*, pp.28-35.

[48] Omisola, J.O., Etukudoh, E.A., Okenwa, O.K. and Tokunbo, G.I., 2020. Geosteering Real-Time Geosteering Optimization Using Deep Learning Algorithms Integration of Deep Reinforcement Learning in Real-time Well Trajectory Adjustment to Maximize. *Unknown Journal*.

[49] Omisola, J.O., Etukudoh, E.A., Okenwa, O.K. and Tokunbo, G.I., 2020. Innovating project delivery and piping design for sustainability in the oil and gas industry: A conceptual framework. *perception*, *24*, pp.28-35.

[50] Osho, G.O., Omisola, J.O. and Shiyanbola, J.O., 2020. A Conceptual Framework for AI-Driven Predictive Optimization in Industrial Engineering: Leveraging Machine Learning for Smart Manufacturing Decisions. *Unknown Journal*.

[51] Osho, G.O., Omisola, J.O. and Shiyanbola, J.O., 2020. An Integrated AI-Power BI Model for Real-Time Supply Chain Visibility and Forecasting: A Data-Intelligence Approach to Operational Excellence. *Unknown Journal*.

[52] Otokiti, B.O. and Akinbola, O.A., 2013. Effects of Lease Options on the Organizational Growth of Small and Medium Enterprise (SME's) in Lagos State, Nigeria. *Asian Journal of Business and Management Sciences*, *3*(4), pp.1-12.

[53] Otokiti, B.O. and Akorede, A.F., 2018. Advancing sustainability through change and innovation: A co-evolutionary perspective. *Innovation: Taking creativity to the market. Book of Readings in Honour of Professor SO Otokiti*, *1*(1), pp.161-167.

[54] Otokiti, B.O., 2012. *Mode of Entry of Multinational Corporation and their Performance in the Nigeria Market* (Doctoral dissertation, Covenant University).

[55] Otokiti, B.O., 2017. Social media and business growth of women entrepreneurs in Ilorin metropolis. *International Journal of Entrepreneurship, Business and Management*, *1*(2), pp.50-65.

[56] Otokiti, B.O., 2018. Business regulation and control in Nigeria. *Book of readings in honour of Professor SO Otokiti*, *1*(2), pp.201-215.

[57] Oyedele, M. *et al*., 2020. Leveraging Multimodal Learning: The Role of Visual and Digital Tools in Enhancing French Language Acquisition. IRE Journals, 4(1), pp.197–199. ISSN: 2456-8880. https://www.irejournals.com/paper-details/1708636

[58] Palovuori, J., 2017. Towards harmonious experiences–A service design approach to evaluating and optimizing multi-touchpoint user experience.

[59] Parenteau, J., Sallam, R.L., Howson, C., Tapadinhas, J., Schlegel, K. and Oestreich, T.W., 2016. Magic quadrant for business intelligence and analytics platforms. *Recuperado de https://www. gartner. com/doc/reprints*.

[60] Petrillo, A., Di Bona, G., Forcina, A. and Silvestri, A., 2018. Building excellence through the Agile Reengineering Performance Model (ARPM) A strategic business model for organizations. *Business Process Management Journal*, *24*(1), pp.128-157.

[61] Reaves, B., Bowers, J., Scaife, N., Bates, A., Bhartiya, A., Traynor, P. and Butler, K.R., 2017. Mo (bile) money, mo (bile) problems: Analysis of branchless banking applications. *ACM Transactions on Privacy and Security (TOPS)*, *20*(3), pp.1-31.

[62] Saberi, M., Khadeer Hussain, O. and Chang, E., 2017. Past, present and future of contact centers: a literature review. *Business Process Management Journal*, *23*(3), pp.574-597.

[63] Saha, S.K., Ghasempour, Y., Haider, M.K., Siddiqui, T., De Melo, P., Somanchi, N., Zakrajsek, L., Singh, A., Torres, O., Uvaydov, D. and Jornet, J.M., 2017, October. X60: A programmable testbed for wideband 60 GHz WLANs with phased arrays. In *Proceedings of the 11th Workshop on Wireless Network Testbeds, Experimental evaluation & CHaracterization* (pp. 75-82).

[64] Saunders, A. and Brynjolfsson, E., 2016. Valuing information technology related intangible assets. *Mis Quarterly*, *40*(1), pp.83-110.

[65] SHARMA, A., ADEKUNLE, B.I., OGEAWUCHI, J.C., ABAYOMI, A.A. and ONIFADE, O., 2019. IoT-enabled Predictive Maintenance for Mechanical Systems: Innovations in Real-time Monitoring and Operational Excellence.

[66] Skadsheim, A., 2018. Management, procedures, risks and exception handling. In *Operation and Maintenance of Large Infrastructure Projects* (pp. 103-109). Routledge.

[67] Sobowale, A., Ikponmwoba, S.O., Chima, O.K., Ezeilo, O.J., Ojonugwa, B.M., & Adesuyi, M.O., 2020. A Conceptual Framework for Integrating SOX-Compliant Financial Systems in Multinational Corporate Governance. International Journal of Multidisciplinary Research and Growth Evaluation, 1(2), pp.88-98. DOI: 10.54660/.IJMRGE.2020.1.2.88-98.

[68] Sousa, P., Tereso, A., Alves, A. and Gomes, L., 2018. Implementation of project management and lean production practices in a SME Portuguese innovation company. *Procedia computer science*, *138*, pp.867-874.

[69] Subramanian, N. and Jeyaraj, A., 2018. Recent security challenges in cloud computing. *Computers & Electrical Engineering*, *71*, pp.28-42.

[70] Torres, A.D., Yan, H., Aboutalebi, A.H., Das, A., Duan, L. and Rad, P., 2018. Patient facial emotion recognition and sentiment analysis using secure cloud with hardware acceleration. In *Computational Intelligence for Multimedia Big Data on the Cloud with Engineering Applications* (pp. 61-89). Academic Press.

[71] Torres, R., Sidorova, A. and Jones, M.C., 2018. Enabling firm performance through business intelligence and analytics: A dynamic capabilities perspective. *Information & Management*, *55*(7), pp.822-839.

[72] Turner, A., Mulla, A., Booth, A., Aldridge, S., Stevens, S., Begum, M. and Malik, A., 2018. The international knowledge base for new care models relevant to primary care-led integrated models: a realist synthesis. *Health and Social Care Delivery Research*, *6*(25), pp.1-176.

[73] Vijayan, M., 2017. IMPACT OF JOB STRESS ON EMPLOYEES'JOB PERFORMANCE IN AAVIN, COIMBATORE. *Journal of Organisation & Human Behaviour*, *6*(3).

[74] Wei, L., Liu, Y. and Cheung, S.C., 2016, August. Taming android fragmentation: Characterizing and detecting compatibility issues for android apps. In *Proceedings of the 31st IEEE/ACM international conference on automated software engineering* (pp. 226-237).

[75] Zambon, S., 2017. Intangibles and intellectual capital: an overview of the reporting issues and some measurement models. *The economic importance of intangible assets*, pp.153-183.