

Review Article

Optimizing Worker's Compensation Outcomes Through Technology: A Review and Framework for Implementations

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Received: 28 January 2024

Revised: 02 March 2024

Accepted: 18 March 2024

Published: 31 March 2024

Abstract - This research investigates the potential of harnessing technology to optimize Worker's Compensation (WC) outcomes. By integrating Artificial Intelligence (AI), Machine Learning (ML), and other cutting-edge technologies, the efficiency, transparency, and cost-effectiveness of the WC system can be significantly improved. The traditional WC system grapples with issues such as inefficient processes, limited transparency, and rising costs. This study proposes a framework to address these shortcomings and enhance WC outcomes for various businesses. Key technologies explored include AI, ML, communication tools, data analytics, Internet of Things (IoT), and automation. Implementing these technologies is crucial for streamlining workflows, fostering improved communication, and mitigating potential risks. The paper delves into established solutions, potential benefits and drawbacks, and crucial considerations for deploying advanced technological solutions within WC systems. Finally, a comprehensive framework for WC system technology implementation is presented. This framework emphasizes stakeholder needs assessment, technology selection processes, addressing challenges, and execution strategies. This framework aims to facilitate the adoption of advanced technological solutions within the WC domain, ultimately benefiting all stakeholders involved in the insurance industry.

Keywords - Artificial intelligence (AI), Data analytics, Internet of Things (IoT), Risk management, Worker's Compensation.

1. Introduction

Established in 1923, the Worker's Compensation or WC system is the primary way to protect workers and prevent injuries, disabilities and deaths resulting from workplace accidents. According to the provisions of the law, the employer is obliged to provide financial assistance for medical expenses or support to dependents in the event of the employee's death. Despite its importance, the WC system still faces problems such as inefficient procedures, lack of visibility, and increased costs.

The purpose of this article is to explore how technology can be used to replace the worker's compensation system, solving the worker's compensation problems and improving its outcomes concerning all businesses. Sprains and strains are the most common workplace injuries, often occurring when handling hard traditional machines in workplaces.

The traditional compensation process is time-consuming and error-prone, causing delays for all employees as well as

for enterprises [1]. Additionally, old system limitations can make it more difficult to track data requests and get relevant information quickly to handle any emergency problem in emergencies.

Lack of visibility (for example, having no WIFI access or internet network failure) can lead to conflict and distrust among clients [2]. Additionally, manual work and a lack of data-driven technology use in the workplace can make management ineffective and ultimately increase costs for all businesses [3].

Not reading the user manual of any application website or software can lead to errors, as cited by [4]. Following up on information requests and timely access to relevant information can lead to distrust and confusion among business clients and service providers [5]. Manual work and poor communication may lead to poor management and increase costs for all clients and business providers [6], including health insurance providers.



2. Technology and its Potential in Worker’s Compensation Systems

The report study by Shahin Hatamian also shows a 35 % impact on business using telemedicine, 13 % impact on business using mobile devices, 8 % impact on business using predictive analysis, 7 % impact on business using electronic bills, 4 impact on business using cloud technology, and 1 % impact on business using chatbots and wearable watches like advance technological implementation on WC system shown in Figure 1.

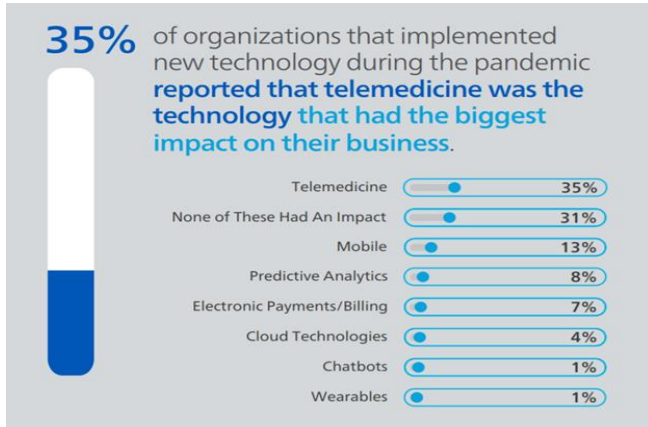


Fig. 1 <https://mitchell.com>

3. Established Solutions for Worker’s Compensation System

3.1. Cloud-based Platforms

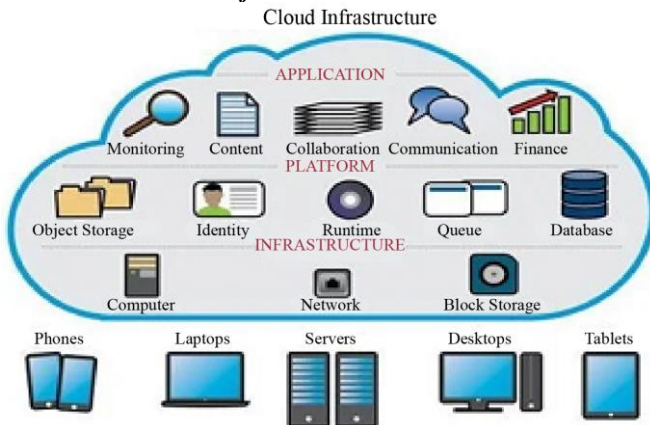


Fig. 2 Credit: Proterra Technologies

Cloud technology provides central access to information, making it transparent and easy to access among the whole system of work, employees, and clients shown in Figure 2. Advanced technology incorporation not only facilitates communication between stakeholders but also allows quick access to important information and faster processing of services by employees [7]. The report study by Shahin Hatamian confirmed a 5 % impact on the WC system in the next 5-10 years, as shown below in Figure 3.

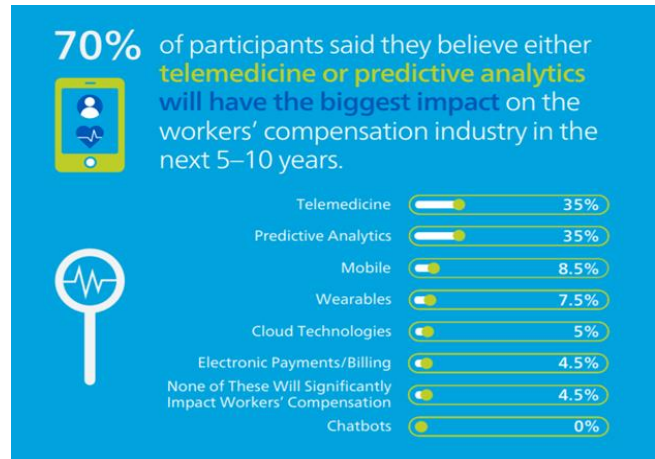


Fig. 3 www.mitchell.com

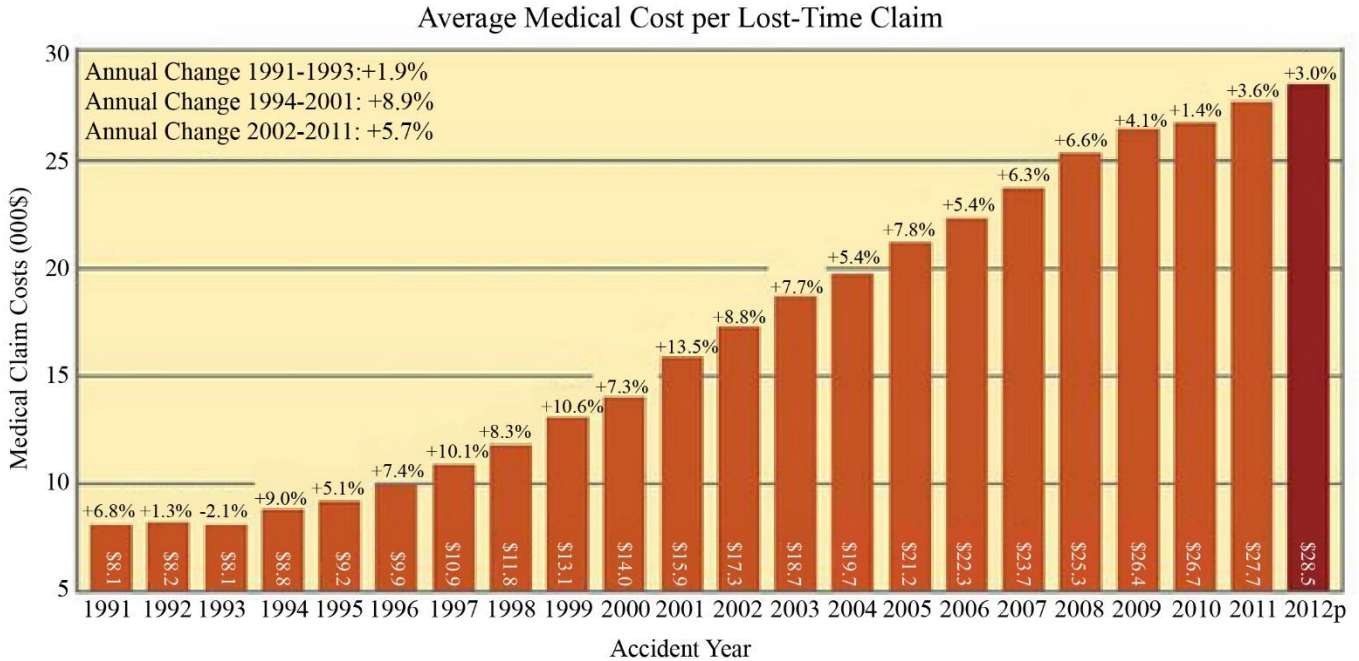


Fig. 4 Credit: Supersuper357 / Dreamstime

3.2. Communication Tools

Various communication tools such as mobile, Wi-Fi, e-mail, social media, etc. (shown below in Figure 4) play an important role in improving accountability and collaboration among participants. These tools, like social media applications or using digital platforms to communicate, facilitate the rapid exchange of information, help make decisions faster and solve problems faster for any case study [8].

Various communication tools such as mobile, Wi-Fi, e-mail, social media, etc. (shown above in Figure 4) play an important role in improving accountability and collaboration among participants. These tools, like social media applications or using digital platforms to communicate, facilitate the rapid exchange of information, help make decisions faster and solve problems faster for any case study [8]. The report study by AmeriTrust Group, Inc. confirmed the importance of various communication tools. It stated that “By communicating with employees daily and providing feedback on how job tasks can be safely completed, supervisors can limit the risk of illnesses and injuries occurring—thereby reducing workers’ compensation claims.”



2012p: Preliminary based on data valued as of December 31, 2012.

1991-2011: Based on data through December 31, 2011, developed to ultimate; excludes high-deductible policies.

Average severity for the states where NCCI provides ratemaking services, including state funds (excluding West Virginia).

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Fig. 5 (<https://www.insurancejournal.com/news/national/2015/02/12/371691.htm>)

3.3. Data Analytics and Reporting

Advanced technology like data analytics software (for example, Tableau) to provide insights for operational efficiency and effective communication. By analyzing with advanced software employees can identify situations, predict problems, and improve decision-making capabilities to achieve effective demand management [9].

Figure 5 was collected from NCCI, which reported that the health insurance claim cost is rising with time but can be mitigated by using predictive data analytics, which can be designed to decrease claim adjuster’s workload as a safety process within the insurance industry.

3.4. Workflow Automation

Workflow automation reduces errors and frees up resources to focus on what’s important for the health insurance business. The efficiency of this advanced technology using AI and ML not only speeds up the application process but also allows candidates to spend more time focusing on difficult issues [10].

Workflow automation, like processing claims through Triage, insurance claim automation, automatic claim referral systems, automation of decisions and adjuster guidance, etc., are the impactful processes which can be automated and will have a positive impact on the WC system, as shown in the below Figure 6.

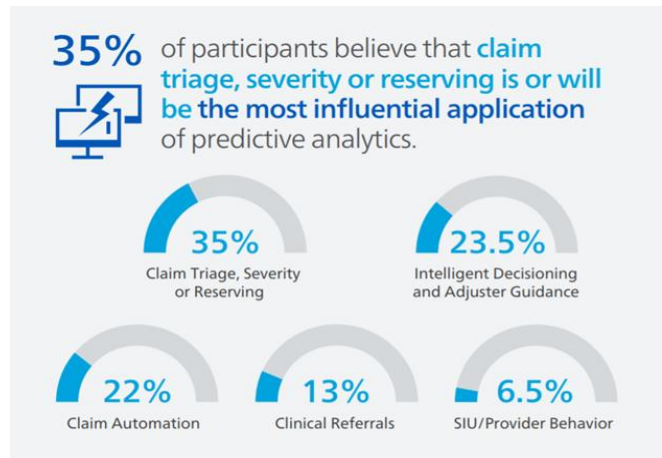


Fig. 6 (<https://www.mitchell.com/insights/workers-comp/article/workers-comp-2021-technology-trends-report>)

4. Benefits and Considerations for Advanced Technology Solutions

Advanced technology solutions for worker’s compensation can provide significant benefits by transforming the traditional claims process to increase the efficiency and timeliness of claims processing. Digital platforms and automation tools play an important role in manual and operational processes such as data access, data storage, and data structuring interaction. Advanced technologies such as robotic process automation or RPA and

artificial intelligence are most popular nowadays. People use them at work to reduce manual work and increase business processes in every aspect [11].

Using data analytics to manage workplace safety can help identify situations and predict risks based on data that is not available. This approach will help identify trends, define business models and create a foundation for creating a culture of continuous improvement. There are many benefits to using a data-driven approach to monitor and improve security [12]. The report study by Illia Pinchuk highlighted 8 types of benefits such as cost reduction, human error mitigation, sales growth, accuracy in prediction, fraud detection, customer experience, claim processing efficiency, and achieving better business profit than competitors, etc. shown in Figure 7. can be achieved by using advance and new technology implications as shown in the following figure. A study report by Viaante discussed the benefits of using RPA in the health insurance domain. It confirmed that RPA can be implemented to reduce operational costs, increase cycle times, reduce human error, improve productivity, and improve customer satisfaction.

By using data and analytics to identify risks and implement preventive measures, companies can reduce risks, prevent incidents, reduce the impact on productivity, and prevent financial and reputational damage. To ensure risks are managed effectively, organizations can follow a “management hierarchy” that identifies and evaluates risk management options. Compliance with hazard management means selecting and implementing controls, including measures to protect workers during emergencies and non-routine activities [13].

However, to take full advantage of a data-driven approach, it is important to avoid data silos, as cited by [14]. Information silos separate groups of information accessible only by specific departments and impede organizational transparency, efficiency, and trust. Encouraging collaboration across teams and workplaces, creating collaborative teams or data-driven teams, and creating a data-driven culture are good ideas for breaking down information silos shown in Figure 8.



Fig. 7 (<https://diceus.com/how-to-automate-insurance-operations-with-technology/>)

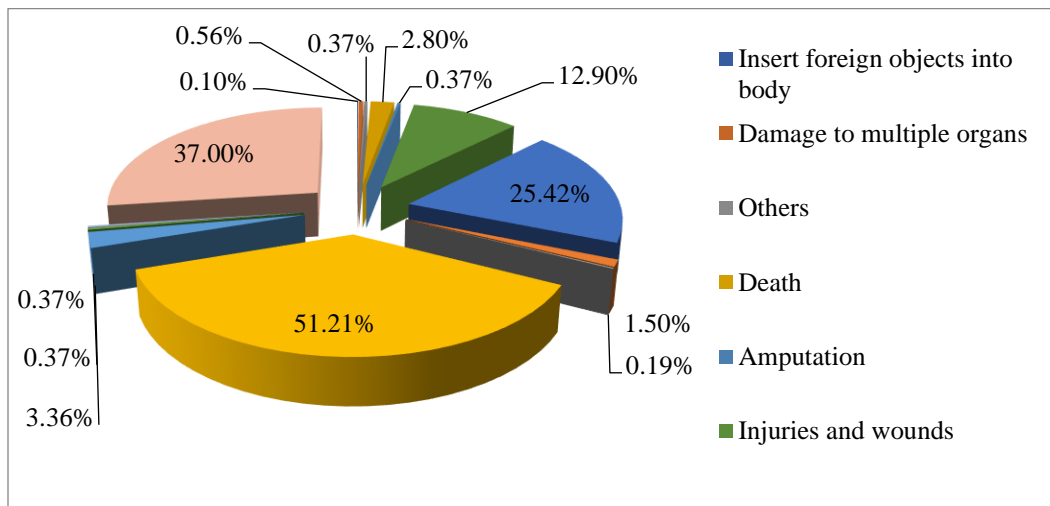


Fig. 8 Source: [27]

A study [15] shows the distribution of claims concerning different injury types as shown above, and it also confirmed that the major injury of workers’ perspective is sprains and confusion with 51.21 %.

Investing in data management solutions such as data warehouses, data lakes, data grids, and data models that can connect disparate data and eliminate silos to create shared information [16]. Strong security measures, including access,

firewalls, and access control, are required to prevent unauthorized access and protect sensitive data. Adherence to business practices ensures that sensitive information is protected.

Continuous support and evaluation are needed when new solutions are implemented in the workers' compensation system [17]. Stakeholders-suppliers, customers, and internal teams play an important role in the development and change of technology. Support can provide effective and efficient use of new technology through workshops, training, peer learning, online discussions, quizzes, support groups, and newsletters [18] shown in Figure 9.



Fig. 9 (<https://www.linkedin.com/>)

Eric Schmitz, Senior Vice President of Business Development at KPA, reported that using advanced technology in claim processing can benefit the overall safety culture of the system by improving communication, leadership, and event analysis and reducing insurance premiums, which can mitigate time loss and increase higher degree of trust among employee, insurance company, and customer.

Technological innovation is important for companies to have a competitive advantage. Business leaders who embrace and use the latest technology will reap significant personal and professional benefits [19]. This change not only benefits people but also allows companies to continue to thrive in a better environment for employee compensation and safety management.

5. Framework for Implementation in Worker's Compensation System

5.1. Analysing Stakeholder Needs and Challenges

A good needs assessment is important before implementing technological solutions. Identifying stakeholders and understanding their power, influence, and

interests is the first step. This involves working with the most important stakeholders and fully understanding their reactions to change. In the context of WC, stakeholders include healthcare professionals, legal entities, regulatory bodies, and employees [20].

6. Key Challenges of Implementing Technology System

6.1. Limited Healthcare Workforce

6.1.1. Challenge

- **Increased Wait Times:** A shortage of healthcare providers can lead to longer wait times for appointments, diagnoses, and treatment. This can significantly impact patients seeking urgent care, preventative check-ups, or management of chronic conditions.
- **Strained Resources:** Limited staff can lead to overworked healthcare professionals, potentially affecting the quality of care provided and increasing the risk of burnout.
- **Delayed Recoveries and Return to Work:** Patients might experience delays in receiving necessary procedures or specialist consultations, hindering their recovery timelines and impacting their ability to return to work promptly.
- **Statistic:** A 2023 study by the Association of American Medical Colleges (AAMC) projects a shortage of up to 139,000 physicians by 2033 in the United States alone. (<https://www.aamc.org/news/press-releases/aamc-report-reinforces-mounting-physician-shortage>)

6.1.2. Solution:

- **Telehealth and Mobile Health Solutions:**
 - Virtual consultations and remote patient monitoring can expand access to care, especially in geographically isolated areas or for patients with limited mobility.
 - Online appointment scheduling and prescription refills can streamline processes and reduce in-person wait times.
- **Digital Health Records (EHRs):**
 - Electronic patient records improve information sharing and care coordination between healthcare providers, potentially reducing the need for repeat tests and expediting treatment plans.
 - Secure access to patient data allows for improved care continuity and informed decision-making by medical professionals.

6.2. Workplace Safety Challenges

6.2.1. Challenge

- **Increased Remote Work:** Traditional safety protocols designed for physical workspaces might not adequately address the risks associated with remote work environments.
- **Rise in Marijuana Use (where legal):** Potential impairment due to marijuana use can pose safety hazards

in certain work environments, particularly those involving machinery or requiring focused attention.

- **Growing Contamination Concerns:** Heightened awareness of pandemics and infectious diseases necessitates stricter hygiene protocols and appropriate response mechanisms to prevent outbreaks within the workplace.
- **Workplace Violence Incidents:** Effective measures are crucial to address this ongoing threat, including:
 - Improved security protocols and access control systems.
 - Employee training programs on conflict resolution and de-escalation techniques.

6.2.2. Solution

- **Security-focused Technologies:**
 - Implementing access control systems like keycard entry or biometrics can restrict unauthorized access to sensitive areas.
 - Video surveillance systems can deter criminal activity and provide valuable footage for investigations.
 - Data security measures like encryption and firewalls can safeguard sensitive information from cyberattacks.
- **IoT (Internet of Things) Tools and Analytics:**
 - Sensor-based systems can monitor environmental conditions like air quality, temperature, and noise levels, alerting personnel to potential hazards.
 - Wearable devices can track the vital signs of employees working in hazardous environments, providing real-time data for proactive intervention in case of emergencies.
 - Data analytics platforms can identify trends and patterns in workplace incidents, enabling targeted interventions to prevent future occurrences [21].

6.3. Managing Comorbidities and Mental Health Conditions

6.3.1. Challenge

- The increasing prevalence of individuals with multiple chronic conditions (comorbidities) like diabetes, heart disease, and respiratory illnesses often coincides with mental health issues like anxiety and depression.
- Fragmented healthcare systems often lack coordinated care models, leading to difficulties in addressing the complex needs of these patients.
- Traditional healthcare delivery models might not be equipped to effectively manage the interplay between physical and mental health conditions.

6.3.2. Solution

- Implement integrated care models that involve collaboration between primary care physicians, mental health professionals, and specialists. This can facilitate the development of comprehensive treatment plans addressing both physical and mental health aspects.

- Leverage telehealth technologies like video conferencing and remote patient monitoring to improve access to care, particularly in geographically isolated rural areas (as evidenced by [24]).
- Utilize patient engagement tools like mobile apps and online portals to empower patients to actively participate in their care journey.

6.4. Legal and Regulatory Concerns

6.4.1. Challenge

- The worker's compensation landscape is intricate, with complex legal frameworks governing eligibility, benefits, and dispute resolution.
- Mental health care is subject to evolving regulations regarding privacy, confidentiality, and parity with physical healthcare.
- Keeping pace with these changes can be a significant challenge for healthcare providers and administrators.

6.4.2. Solution

- Utilize compliance management software that automates tasks like claims processing, regulatory updates, and reporting.
- Implement data analytics platforms to identify and address potential compliance gaps.
- Invest in ongoing training programs for staff to ensure they possess the necessary knowledge and skills to navigate the legal and regulatory environment (as suggested by [25]).

6.5. Talent Shortages

6.5.1. Challenge

- There's a growing shortage of qualified healthcare professionals, especially in rural areas. This lack of manpower can lead to longer wait times, limited access to specialists, and potentially inadequate care.
- Worker's compensation systems and medical facilities may not be adequately equipped to handle the increasing demand for services due to limited resources and staffing.

6.5.2. Solution

- Implement technological solutions for:
 - Recruitment: Utilize online job boards and social media platforms for wider reach.
 - Training: Leverage online learning modules and virtual reality simulations for efficient skill development.
 - Performance management: Implement performance tracking software to identify areas for improvement and provide targeted feedback.
- Explore telemedicine options to expand access to specialist care in underserved areas. This can help bridge the gap in geographically dispersed healthcare systems.

6.6. Existing Infrastructure

6.6.1. Challenge

- Outdated healthcare infrastructure often relies on manual processes and paper-based records, leading to inefficiencies, delays, and potential errors.
- Fragmented data across different systems makes it difficult to obtain a holistic view of a patient's health and hinders coordinated care.

6.6.2. Solution

- Integrate modern technologies like:
 - Cloud computing: Enables secure storage and access to patient data from any location.
 - Electronic health records (EHR): Facilitates the creation, storage, and sharing of electronic patient information across healthcare providers.
- Conduct regular assessments of existing infrastructure to identify areas for improvement. This can involve analyzing workflow bottlenecks, data silos, and outdated technology.

7. Identifying Suitable Solutions

7.1. Features and Alignment with Requirements

Evaluate whether the equipment meets technical, analytical and mobility needs [26]. Categorize requirements as "must-have," "should-have," or "could-have." Technologies are scored based on their compliance with these requirements.

7.2. User-Friendliness

Consider the understanding of the technology and the ease of use of the technology's user interface [27].

Evaluate the overall user experience for stakeholder satisfaction.

7.3. Alignment with Long-Term Goals

Check the possibilities to ensure the use of technology in the organization with existing systems [28]. Examine vendor support and performance. Investigate vendor support and responsiveness.

7.4. Total Cost of Ownership (TCO)

Determine licensing and maintenance costs in advance. Evaluate implementation costs, including training and data migration. Understand hidden costs throughout the technology lifecycle [29].

Figure 10 was produced by a study [30], and it confirmed that using a cloud-like technology-driven process can reduce the cost compared to the traditional claim process. A recent study report shows customer expectations have been increased by using technology-driven claim processing in recent times. In addition, a study by FasterCapital confirmed technology like IoT, data analytics, cloud, and automation make claim settlement simplified and better.

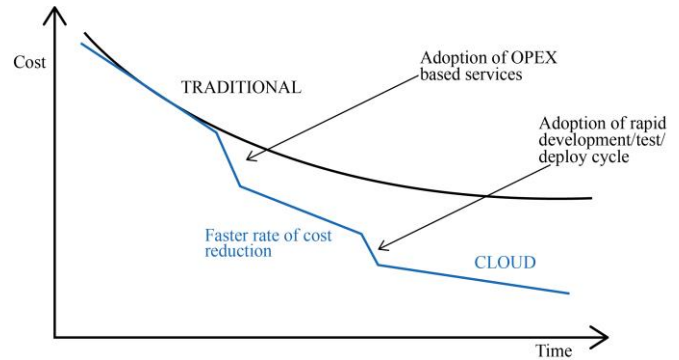


Fig. 10 (https://www.researchgate.net/figure/Traditional-and-Cloud-technology-cost-and-time-analysis_fig2_363525403)

8. Executing the Workers' Compensation Plan: A Focus on Technology and Collaboration

This section outlines the crucial stages involved in implementing and optimizing a workers' compensation program with a focus on technological advancements and collaborative efforts:

8.1. Implementation: Streamlining Processes

- Description: This stage involves translating established procedures and regulations into practical actions.
- Focus: The primary objective is to leverage technology to enhance efficiency and accuracy in claims processing, communication, and data management.
- Activities: This may involve:
 - Software implementation: Adopting dedicated workers' compensation management software to automate tasks like claims filing, adjudication, and reporting.
 - Medical bill review and coding systems: Integrating technology to streamline medical bill processing and ensure proper coding for accurate reimbursement.
 - Development of online portals: Creating secure online platforms for employees to easily report injuries, access claim information, and receive updates.
- Goal: To establish a smooth workflow, minimize manual processes, and ensure timely and accurate claim resolution.

8.2. Integration: Fostering collaboration

- Definition: Integration refers to connecting various entities involved in the workers' compensation process, including employers, insurers, healthcare providers, and legal representatives.
- Focus: The emphasis lies on establishing seamless communication and data exchange between all stakeholders.
- Activities:
 - Data integration: Ensuring consistent data format and secure exchange between the workers' compensation management software, medical providers' systems, and other relevant platforms.

- Real-time communication tools: Implementing secure communication channels like online portals or secure messaging platforms to facilitate efficient information sharing and collaboration.
- Developing collaborative workflows: Make clear communication protocols and streamlined processes for claim handling, return-to-work initiatives, and dispute resolution.
- Goal: To achieve transparency, improve communication efficiency, and facilitate faster claim resolution through coordinated efforts.

8.3. Importance of a Holistic Approach

- Implementation: Effective technology implementation can significantly reduce administrative burdens, minimize errors, and expedite the claims process.
- Integration: Seamless integration between various systems fosters collaboration among stakeholders, leading to faster communication, improved data accuracy, and efficient claim resolution.

9. Specific Example in Workers' Compensation

- Scenario: An employee suffers a work-related injury and files a claim through the company's online portal.
- Technology Integration: The claim is automatically routed to the workers' compensation management software, triggering notifications for the employer, insurer, and healthcare provider.
- Collaborative Workflow: The healthcare provider electronically submits medical records through a secure portal accessible by authorized personnel.
- Streamlined Communication: All stakeholders can communicate and share updates through the online platform, facilitating a transparent and efficient claims process.

10. Key Takeaways

- Integrating technology into the workers' compensation program can significantly improve efficiency, accuracy, and communication.
- Fostering collaboration among all stakeholders through effective data exchange and communication channels

streamlines the claims process and ensures timely resolution.

11. Additional Considerations

- Data security: Implementing robust cybersecurity measures is crucial to protect sensitive employee information and ensure compliance with data privacy regulations.
- Training and support: Providing adequate training for employees, employers, and other stakeholders on using the new technology and communication platforms is essential for successful implementation.

By effectively implementing and integrating technology while promoting collaboration, organizations can establish a robust workers' compensation system that benefits both employers and employees.

12. Conclusion

This framework provides an effective way to implement solutions in employee compensation. Meeting stakeholder needs, understanding problems, and aligning with long-term goals are important steps. The research work highlighted that implementation of advanced technology is needed there, as well as several challenges which exist. However, for successful implementation of technology, there are many factors which need to be considered, such as user-friendliness of applicable technology and time-cost which have been thoroughly discussed in the paper.

Using the proposed framework of integrating technology, insurance organizations can mitigate the challenges of the implementation of technology to the WC system, improve the claim process cycle, and benefit all stakeholders related to the Insurance domain.

Acknowledgments

An Acknowledgements section is optional and may recognise those individuals who provided help during the research and preparation of the manuscript. Other references to the title/authors can also appear here, such as "Author 1 and Author 2 contributed equally to this work."

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