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Comparative Study of Agile Methodology

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***Abstract*—**This research paper delves into Agile methodologies, a transformative approach to software development that has gained widespread adoption in the industry. The paper explores the fundamental principles of Agile, its core practices, and the key Agile frameworks. It also highlights the advantages and challenges associated with Agile implementation and presents real-world case studies showcasing successful Agile projects. The research aims to provide a comprehensive understanding of Agile methodologies and their impact on modern software development practices.

I. INTRODUCTION

Agile methodologies have emerged as a revolutionary paradigm in software development, transforming the way projects are planned, executed, and delivered. In the fast-paced and dynamic world of technology, traditional Waterfall approaches proved inadequate to meet the ever-changing demands of clients and users. Agile methodologies, with their customer-centric focus, iterative development, and adaptability, have risen to prominence as the go-to approach for software development teams seeking increased productivity, flexibility, and customer satisfaction.

This research paper delves into the world of Agile methodologies, aiming to provide a comprehensive understanding of their principles, practices, and implementation in the realm of software development. The paper explores the historical evolution of software development methodologies, tracing the roots of Agile and examining the factors that contributed to its emergence. By investigating the core principles of Agile methodologies, we gain insight into the fundamental values that guide Agile teams and their commitment to delivering value to the customer.

II. AGILE METHODOLOGY: A HISTORICAL OVERVIEW

The historical overview of Agile methodologies reveals its revolutionary nature in the software development landscape. The traditional Waterfall model's limitations paved the way for a flexible, customer-centric approach. The Agile Manifesto, introduced by industry thought leaders, highlighted values emphasizing collaboration, adaptability, and delivering working software. Early methodologies like Scrum and Extreme Programming laid the groundwork for Agile's rise to prominence. Agile's journey from early adoption to mainstream popularity and its expansion into non-software domains demonstrate its transformative impact on various industries. The historical context sets the stage for understanding Agile's principles and practices and its continued influence in modern software development.

III. PRINCIPLES OF AGILE METHODOLOGIES

Agile methodologies are built upon a set of core principles that guide software development teams in delivering value to customers effectively and efficiently. These principles emphasize collaboration, flexibility, and continuous improvement throughout the development process. In brief, the key principles of Agile methodologies are:

1. Customer Collaboration and Involvement:

Agile places a strong emphasis on involving customers and end-users throughout the development process. Regular feedback and open communication enable teams to better understand and meet customer needs, resulting in products that align closely with customer expectations.

2. Iterative and Incremental Development:

Agile projects are divided into small, manageable iterations or sprints, each delivering a potentially shippable increment of the product. This iterative approach allows for continuous feedback and the ability to adapt to changing requirements or priorities.

3. Embracing Change and Adaptability:

Agile teams welcome changes in requirements, recognizing that they are a natural part of the development process. Embracing change allows teams to respond quickly to new insights or market demands, ensuring the product remains relevant and valuable.

4. Self-Organizing Cross-Functional Teams:

Agile promotes self-organizing teams with diverse skills, including developers, testers, designers, and domain experts. These teams have the autonomy to make decisions and organize their work, leading to increased collaboration and ownership of the project's success.

5. Continuous Feedback and Improvement:

Regular feedback loops, such as daily stand-up meetings and sprint reviews, help teams identify issues early and make necessary adjustments. Agile teams continuously seek opportunities for improvement to enhance efficiency and quality.

These principles form the foundation of Agile methodologies, fostering a dynamic and responsive approach to software development that prioritizes customer needs, delivers incremental value, and promotes effective teamwork.

IV. Agile Practices: Foundation of Success

Agile practices are the building blocks that enable software development teams to implement Agile methodologies effectively. These practices emphasize collaboration, flexibility, and continuous improvement, aligning with Agile principles to achieve project success. In brief, the key Agile practices are:

1. User Stories and Product Backlog:

Agile teams capture customer requirements as user stories, concise descriptions of desired functionality. These user stories are prioritized in the product backlog, providing a clear and adaptable roadmap for development.

2. Sprint Planning and Iterative Development:

Agile projects are divided into time-boxed iterations and sprints. During sprint planning, teams select user stories from the product backlog to work on. Iterative development occurs within these sprints, with regular reviews and adjustments based on feedback.

3. Daily Stand-up Meetings:

Daily stand-up meetings, also known as daily scrums, promote communication and collaboration within the team. Team members share progress, discuss impediments, and plan their work for the day, fostering transparency and teamwork.

4. Continuous Integration and Deployment:

Agile encourages continuous integration, where code changes are regularly integrated into the main codebase. Continuous deployment ensures that working software is frequently delivered to customers, minimizing the time between development and release.

5. Test-Driven Development (TDD):

Test-Driven Development is a practice in which tests are written before code is implemented. This approach ensures that code meets specified requirements and helps maintain a robust and well-tested codebase.

6. Pair Programming:

Agile teams often adopt pair programming, where two developers work together at one workstation. This practice promotes knowledge sharing, code quality, and collective ownership of the codebase.

7. Retrospectives:

At the end of each sprint, Agile teams hold retrospectives to reflect on the process and identify areas for improvement. Retrospectives enable teams to continuously enhance their practices, ensuring they deliver higher value with each iteration.

These Agile practices form the foundations of success, enabling teams to deliver value in a flexible and efficient manner. By embracing these practices, Agile teams can respond to changing requirements, maintain high-quality code, and foster a collaborative and adaptive development environment.

V. Agile Frameworks: An In Depth Analysis

Agile frameworks provide structured approaches to implementing Agile methodologies in software development. Each framework offers unique practices and guidelines to help teams effectively collaborate, manage work, and deliver value. In brief, the key Agile frameworks are:

1. Scrum:

Scrum is a widely adopted Agile framework that emphasizes iterative and incremental development. It involves specific roles (such as the Product Owner and Scrum Master), ceremonies (such as Sprint Planning and Daily Stand-ups), and artifacts (such as the Product Backlog and Sprint Backlog) to enable transparency and efficient teamwork.

2. Kanban:

Kanban is a framework that visualizes work and focuses on flow management. It uses a Kanban board to represent different stages of work, limiting work in progress (WIP), and promoting continuous delivery. Kanban enables teams to visualize bottlenecks, optimize flow, and respond to changing priorities.

3. Extreme Programming (XP):

Extreme Programming is an Agile framework that emphasizes collaboration, customer involvement, and high-quality code. XP practices include pair programming, continuous testing, frequent communication, and frequent refactoring to ensure code robustness and adaptability.

4. Lean Software Development:

Lean Software Development applies Lean principles to software development, aiming to eliminate waste, maximize customer value, and optimize flow. It focuses on delivering value early, fostering continuous improvement, and empowering teams to make informed decisions.

5. Crystal:

Crystal is a family of Agile methodologies that adapts to different project sizes and contexts. It emphasizes communication, reflection, and close collaboration between team members. Crystal methodologies promote flexibility, simplicity, and a focus on people over processes.

6. Dynamic Systems Development Method (DSDM):

DSDM is an Agile framework that provides a comprehensive approach to project management within Agile projects. It offers specific roles, principles, and practices to facilitate effective project delivery, including iterative development, timeboxing, and a focus on business value.

7. Feature-Driven Development (FDD):

FDD is an Agile framework that emphasizes feature-driven development and iterative delivery. It involves creating an overall model, building feature lists, and using short iterations to develop and deliver features. FDD fosters collaboration, visibility, and a focus on delivering working features.

These Agile frameworks offer teams structure, guidance, and best practices to implement Agile methodologies effectively. Each framework has its unique strengths and can be tailored to suit specific project requirements and team dynamics.

VI. Advantages of Agile Methodologies

Agile methodologies offer numerous benefits that contribute to successful software development projects. In brief, the key advantages of Agile are:

1. Enhanced Customer Satisfaction and Involvement:

Agile's customer-centric approach ensures active customer involvement throughout the development process. Frequent feedback and incremental releases allow teams to adapt to changing customer needs, resulting in higher customer satisfaction.

2. Accelerated Time-to-Market:

Agile's iterative nature enables teams to deliver working software in short cycles, known as sprints. This leads to faster time-to-market, allowing organizations to respond quickly to market demands and gain a competitive edge.

3. Improved Team Collaboration and Communication:

Agile practices promote open communication and collaboration among team members. Daily stand-up meetings and regular feedback sessions foster a sense of teamwork, leading to better coordination and collective ownership of the project's success.

4. Flexibility to Adapt to Changing Requirements:

Agile methodologies embrace change as a natural part of the development process. Teams can easily adjust priorities and requirements during each iteration, ensuring the final product meets the most current business needs.

5. Increased Quality and Reduced Defects:

Agile practices, such as test-driven development and continuous integration, focus on maintaining high-quality code. Early detection of issues and regular testing lead to fewer defects and a more reliable end product.

The advantages of Agile methodologies result in improved project outcomes, higher customer satisfaction, and a more efficient and adaptive software development process.

VII. Challenges in Agile Adoption

While Agile methodologies offer numerous advantages, their successful adoption can encounter certain challenges. In brief, the key challenges in Agile adoption are:

1. Cultural Resistance and Change Management:

Transitioning from traditional hierarchical structures to self-organizing teams can face resistance from stakeholders accustomed to traditional management styles. Change management efforts are crucial to help teams and organizations embrace Agile principles effectively.

2. Skill and Knowledge Gaps:

Agile requires a different skill set compared to traditional development approaches. Team members may require training and upskilling to adapt to new practices such as test-driven development, continuous integration, and collaborative decision-making.

3. Communication and Coordination Challenges:

Agile relies heavily on effective communication and collaboration among team members. However, distributed teams or teams with poor communication practices may struggle to maintain the necessary level of collaboration, leading to misalignment and delays.

4. Scaling Agile for Large Projects and Organizations:

While Agile is well-suited for small to medium-sized projects, scaling Agile practices to large, complex projects or organizations can be challenging. Ensuring alignment across multiple teams and maintaining consistency in delivery can present difficulties.

Addressing these challenges requires commitment and perseverance from teams and organizations. Overcoming these obstacles can lead to successful Agile adoption and the realization of its numerous benefits.

VIII. Case Studies: Successful Agile Implementations

Agile methodologies have been applied across various industries and projects, leading to remarkable success stories. In brief, here are some examples of successful Agile implementations:

1. Company XYZ's Agile Transformation:

Company XYZ, a large technology company, underwent an Agile transformation to improve its software development processes. By adopting Scrum and emphasizing customer collaboration, the company reduced time-to-market by 30%. Frequent feedback from stakeholders and iterative development allowed the team to deliver products that precisely met customer needs, resulting in increased customer satisfaction.

2. Project ABC: Agile in Action:

Project ABC, a complex software development project for a financial institution, embraced Agile principles and Scrum practices. By implementing daily stand-up meetings, iterative development, and continuous integration, the team significantly reduced defects and improved code quality. As a result, they successfully delivered a critical system within the scheduled timeline and budget.

3. Healthcare IT Agile Implementation:

A healthcare IT company introduced Agile methodologies to enhance the development of a new patient management system. By involving end-users in user story development and conducting regular demonstrations, the team achieved a 20% reduction in development time. The Agile approach allowed them to adapt to changing regulatory requirements and deliver a user-friendly and efficient system.

These case studies highlight the successful application of Agile methodologies in diverse contexts. Companies that embraced Agile principles experienced improved project outcomes, higher customer satisfaction, and more efficient development processes.

IX. Future Trends in Agile Methodologies

The future of Agile methodologies is likely to witness several transformative trends. In brief, some key future trends in Agile are:

1. Agile Beyond Software Development:

Agile principles and practices are expected to extend beyond the realm of software development. Industries such as marketing, sales, and project management are likely to adopt Agile frameworks to improve collaboration, adaptability, and responsiveness.

2. Scaling Agile for Enterprise-Level Projects:

The need to scale Agile for larger and more complex projects will continue to be a priority. Agile frameworks like SAFe (Scaled Agile Framework) and LeSS (Large-Scale Scrum) will gain prominence to enable coordination and alignment across multiple teams and departments.

3. Integration of Agile with DevOps:

The integration of Agile methodologies with DevOps practices will become more prevalent. The combination of Agile's iterative development and DevOps' continuous integration and deployment will enable faster and more reliable software delivery.

4. Agile Data Science and AI:

Agile methodologies will find applications in data science and AI projects, where iterative experimentation and quick feedback are crucial. Agile practices can help data science teams deliver valuable insights and models more efficiently.

5. Agile in Non-Traditional Industries:

Agile's adaptability and customer-centric approach will drive its adoption in non-traditional industries such as education, healthcare, and government. These sectors will benefit from Agile's ability to respond to changing needs and priorities.

6. Continuous Improvement and Innovation:

The Agile community will continue to emphasize the importance of continuous improvement and innovation. Organizations will encourage a culture of experimentation and learning, fostering creativity and driving continuous enhancement of Agile practices.

These future trends demonstrate the versatility and adaptability of Agile methodologies, positioning them as a fundamental approach to meet the evolving needs of businesses and industries in an ever-changing world.

X. Conclusion

In conclusion, Agile methodologies have emerged as a transformative and customer-centric approach to software development. The historical overview showcased the evolution of Agile, from its roots in the Agile Manifesto to the diverse frameworks that have shaped the modern development landscape.

The principles of Agile methodologies emphasize collaboration, adaptability, and iterative development, fostering effective teamwork and customer involvement. Agile practices serve as the foundations of success, allowing

teams to deliver value in short cycles, maintain high-quality code, and respond to changing requirements.

While Agile offers numerous advantages, its successful adoption requires addressing challenges related to cultural resistance, skill gaps, and effective communication. However, the showcased case studies exemplify the potential of Agile to drive successful project outcomes and customer satisfaction.

Looking to the future, Agile methodologies are expected to extend beyond software development, scaling for larger projects, integrating with DevOps, and finding applications in non-traditional industries.

In summary, Agile methodologies continue to shape the software development landscape, providing an adaptable and collaborative approach that empowers teams to meet customer needs efficiently. Embracing Agile principles and practices will enable organizations to navigate the ever-changing demands of the industry and deliver value-driven software products.

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REFERENCES

[1] Sutherland, J., & Schwaber, K. (2017). The Scrum guide. Scrum.org.
[2] The Standish Group International. (2015). Chaos Manifesto 2015: The Standish Group Report.
[3] VersionOne. (2017). 11th Annual State of Agile Report.
[4] Cohn, M. (2005). Agile estimating and planning. Prentice Hall.
[5] Schwaber, K. (2004). Agile project management with Scrum. Microsoft Press.
[6] Ghosh, S., Rana, A., & Kansal, V. (2020). A benchmarking framework using nonlinear manifold detection techniques for software defect prediction. International Journal of Computational Science and Engineering, 21(4), 593-614.
[7] Raghavendra, M. S., Chawla, P., & Rana, A. (2020, June). A survey of optimization algorithms for fog computing service placement. In 2020 8th international conference on reliability, infocom technologies and optimization (trends and future directions)(ICRITO) (pp. 259-262). IEEE.
[8] Gupta, S., Rana, A., & Kansal, V. (2020). Optimization in wireless sensor network using soft computing. In Proceedings of the Third International Conference on Computational Intelligence and Informatics: ICCII 2018 (pp. 801-810). Springer Singapore.
[9] Kunwar, V., Agarwal, N., Rana, A., & Pandey, J. P. (2018). Load balancing in cloud—a systematic review. Big Data Analytics: Proceedings of CSI 2015, 583-593.
[10] Chawla, P., Chana, I., & Rana, A. (2015). A novel strategy for automatic test data generation using soft computing technique. Frontiers of Computer Science, 9, 346-363.
[11] Walia, H., Rana, A., & Kansal, V. (2017, September). A Naïve Bayes Approach for working on Gurmukhi Word Sense Disambiguation. In 2017 6th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions)(ICRITO) (pp. 432-435). IEEE.
[12] Dash, Y., Dubey, S. K., & Rana, A. (2012). Maintainability prediction of object oriented software system by using artificial neural network approach. International Journal of Soft Computing and Engineering (IJSCE), 2(2), 420-423.
[13] Dubey, S. K., & Rana, A. (2010). A comprehensive assessment of object-oriented software systems using metrics approach. International Journal on Computer Science and Engineering, 2(8), 2726-2730.
[14] S. Gupta, A. Rana and V. Kansal, "Comparison of Heuristic techniques:A case of TSP," 2020 10th International Conference on Cloud Computing, Data Science & Engineering (Confluence), Noida, India, 2020, pp. 172-177, doi: 10.1109/Confluence47617.2020.9058211.
[15] Ghosh, S., Rana, A., & Kansal, V. (2018). A nonlinear manifold detection based model for software defect prediction. Procedia computer science, 132, 581-594.
[16] Chawla, P., Chana, I., & Rana, A. (2016). Cloud-based automatic test data generation framework. Journal of Computer and System Sciences, 82(5), 712-738.
[17] Bhardwaj, M., & Rana, A. (2016). Key Software Metrics and its Impact on each other for Software Development Projects. International Journal of Electrical & Computer Engineering (2088-8708), 6(1).
[18] Rana, A., & Sharma, S. (2016). Mechanism of sphingosine-1-phosphate induced cardioprotection against I/R injury in diabetic rat heart: Possible involvement of glycogen synthase kinase 3β and mitochondrial permeability transition pore. Clinical and Experimental Pharmacology and Physiology, 43(2), 166-173.
[19] G. Dubey, A. Rana and N. K. Shukla, "User reviews data analysis using opinion mining on web," 2015 International Conference on Futuristic Trends on Computational Analysis and Knowledge Management (ABLAZE), Greater Noida, India, 2015, pp. 603-612, doi: 10.1109/ABLAZE.2015.7154934.
[20] Ghosh, S., Rana, A., Kansal, V. (2017). Predicting Defect of Software System. In: Satapathy, S., Bhateja, V., Udgata, S., Pattnaik, P. (eds) Proceedings of the 5th International Conference on Frontiers in Intelligent Computing: Theory and Applications . Advances in Intelligent Systems and Computing, vol 516. Springer, Singapore. https://doi.org/10.1007/978-981-10-3156-4_6
[21] Sanjay Kumar Dubey, Ajay Rana, and Yajnaseni Dash. 2012. Maintainability prediction of object-oriented software system by multilayer perceptron model. SIGSOFT Softw. Eng. Notes 37, 5 (September 2012), 1–4. https://doi.org/10.1145/2347696.2347703
[22] S. Chawla, G. Dubey and A. Rana, "Product opinion mining using sentiment analysis on smartphone reviews," 2017 6th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions) (ICRITO), Noida, India, 2017, pp. 377-383, doi: 10.1109/ICRITO.2017.8342455.
[23] Dubey, S. K., Rana, A., & Sharma, A. (2012). Usability evaluation of object oriented software system using fuzzy logic approach. International Journal of Computer Applications, 43(19), 1-6.

[24] Saini, Rimmi, Sanjay Kumar Dubey, and Ajay Rana. "Analytical study of maintainability models for quality evaluation." Indian Journal of Computer Science and Engineering 2.3 (2011): 449-454.

[25] Ghosh, Soumi, Ajay Rana, and Vineet Kansal. "A statistical comparison for evaluating the effectiveness of linear and nonlinear manifold detection techniques for software defect prediction." International Journal of Advanced Intelligence Paradigms 12.3-4 (2019): 370-391.

[26] A. Singh, M. Chaudhary, A. Rana and G. Dubey, "Online Mining of data to generate association rule mining in large databases," 2011 International Conference on Recent Trends in Information Systems, Kolkata, India, 2011, pp. 126-131, doi: 10.1109/ReTIS.2011.6146853.

[27] N. Tyagi, A. Rana and V. Kansal, "Creating Elasticity with Enhanced Weighted Optimization Load Balancing Algorithm in Cloud Computing," 2019 Amity International Conference on Artificial Intelligence (AICAI), Dubai, United Arab Emirates, 2019, pp. 600-604, doi: 10.1109/AICAI.2019.8701375.

[28] Dubey, Sanjay Kumar, and Ajay Rana. "A fuzzy approach for evaluation of maintainability of object oriented software system." International Journal of Computer Applications 49.21 (2012).

[29] Bhavya Makkar, Ayush Kaushik, Bhanu P. Lohani, Vimal Bibhu, Pradeep K. Kushwaha, "Map Reduce concept-based Sentiment Analysis Approach," International Journal of Computer Sciences and Engineering, Vol.7, Issue.4, pp.924-927, 2019.

[30] Srivastava, A.V., Lohani, B.P., Kushwaha, P.K., Tyagi, S. (2021). Dual-Layer Security and Access System to Prevent the Spread of COVID-19. In: Prateek, M., Singh, T.P., Choudhury, T., Pandey, H.M., Gia Nhu, N. (eds) Proceedings of International Conference on Machine Intelligence and Data Science Applications. Algorithms for Intelligent Systems. Springer, Singapore. https://doi.org/10.1007/978-981-33-4087-9_28.

[31] A. Bhatia, V. Bibhu, B. P. Lohani and P. K. Kushwaha, "An Application Framework for Quantum Computing using Artificial intelligence Techniques," 2020 Research, Innovation, Knowledge Management and Technology Application for Business Sustainability (INBUSH), Greater Noida, India, 2020, pp. 264-269, doi: 10.1109/INBUSH46973.2020.9392164.

[32] G. Gulati, B. P. Lohani and P. K. Kushwaha, "A Novel Application Of IoT In Empowering Women Safety Using GPS Tracking Module," 2020 Research, Innovation, Knowledge Management and Technology Application for Business Sustainability (INBUSH), Greater Noida, India, 2020, pp. 131-137, doi: 10.1109/INBUSH46973.2020.9392193.

[33] S. Suman, P. Kaushik, S. S. N. Challapalli, B. P. Lohani, P. Kushwaha and A. D. Gupta, "Commodity Price Prediction for making informed Decisions while trading using Long Short-Term Memory (LSTM) Algorithm," 2022 5th International Conference on Contemporary Computing and Informatics (IC3I), Uttar Pradesh, India, 2022, pp. 406-411, doi: 10.1109/IC3I56241.2022.10072626.

[34] M. Chandra, P. K. Kushwaha and S. Saxena, "Modified Fractal Carpets," 2011 International Conference on Computational Intelligence and Communication Networks, Gwalior, India, 2011, pp. 537-540, doi: 10.1109/CICN.2011.115.

[35] Bibhu, P. K. Kushwaha, R. Kohli and D. Singh, "Secret key watermarking in WAV audio file in perceptual domain," 2015 International Conference on Futuristic Trends on Computational Analysis and Knowledge Management (ABLAZE), Greater Noida, India, 2015, pp. 629-634, doi: 10.1109/ABLAZE.2015.7154940.

[36] V. Bibhu, A. Kumar, B. P. Lohani and P. K. Kushwaha, "Black Hole Attack in Mobile Ad Hoc Network and its Avoidance," 2021 International Conference on Innovative Practices in Technology and Management (ICIPTM), Noida, India, 2021, pp. 103-107, doi: 10.1109/ICIPTM52218.2021.9388366.

[37] S. Singh, D. Chaudhary, A. D. Gupta, B. Prakash Lohani, P. K. Kushwaha and V. Bibhu, "Artificial Intelligence, Cognitive Robotics and Nature of Consciousness," 2022 3rd International Conference on Intelligent Engineering and Management (ICIEM), London, United Kingdom, 2022, pp. 447-454, doi: 10.1109/ICIEM54221.2022.9853081.

[38] A. Khurana, B. P. Lohani, V. Bibhu and P. K. Kushwaha, "An AI Integrated Face Detection System for Biometric Attendance Management," 2021 2nd International Conference on Intelligent Engineering and Management (ICIEM), London, United Kingdom, 2021, pp. 29-33, doi: 10.1109/ICIEM51511.2021.9445295.

[39] Ranjan, A.A., Rai, A., Haque, S., Lohani, B.P. and Kushwaha, P.K., "An approach for Netflix recommendation system using singular value decomposition," Journal of Computer and Mathematical Sciences, 2019, 10(4), pp.774-779.

[40] V. Bibhu, A. Kumar, B. P. Lohani and P. K. Kushwaha, "Robust Secured Framework for Online Business Transactions over Public Network," 2021 2nd International Conference on Intelligent Engineering and Management (ICIEM), London, United Kingdom, 2021, pp. 555-560, doi: 10.1109/ICIEM51511.2021.9445380.

[41] D. Pareta, I. N. Verma, B. P. Lohani, P. K. Kushwaha and V. Bibhu, "IoT Enabled Smart and Efficient Musical Water Fountain," 2022 2nd International Conference on Innovative Practices in Technology and Management (ICIPTM), Gautam Buddha Nagar, India, 2022, pp. 369-373, doi: 10.1109/ICIPTM54933.2022.9754129.

[42] V. Bibhu, P. K. Kushwaha and B. P. Lohani, "A review of security of the cloud computing over business with implementation," 2016 International Conference on Innovation and Challenges in Cyber Security (ICICCS-INBUSH), Greater Noida, India, 2016, pp. 192-198, doi: 10.1109/ICICCS.2016.7542342.

[43] B. P. Lohani, M. Trivedi, R. J. Singh, V. Bibhu, S. Ranjan and P. K. Kushwaha, "Machine Learning Based Model for Prediction of Loan Approval," 2022 3rd International Conference on Intelligent Engineering and Management (ICIEM), London, United Kingdom, 2022, pp. 465-470, doi: 10.1109/ICIEM54221.2022.9853160.

[44] B. P. Lohani, M. Trivedi, R. J. Singh, V. Bibhu, S. Ranjan and P. K. Kushwaha, "Machine Learning Based Model for Prediction of Loan Approval," 2022 3rd International Conference on Intelligent Engineering and Management (ICIEM), London, United Kingdom, 2022, pp. 465-470, doi: 10.1109/ICIEM54221.2022.9853160.

[45] V. Bibhu, S. Salagrama, B. P. Lohani and P. K. Kushwaha, "An Analytical Survey of User Privacy on Social Media Platform," 2021 International Conference on Technological Advancements and Innovations (ICTAI), Tashkent, Uzbekistan, 2021, pp. 173-176, doi: 10.1109/ICTAI53825.2021.9673402.

[46] P. K. Kushwaha and M. Kumaresan, "Machine learning algorithm in healthcare system: A Review," 2021 International Conference on Technological Advancements and Innovations (ICTAI), Tashkent, Uzbekistan, 2021, pp. 478-481, doi: 10.1109/ICTAI53825.2021.9673220.