

Evaluation of the Effectiveness of Risk Management Strategies in Agile and Waterfall Project Management Methodologies

ELIZABETH A. CORRALES MARQUEZ, University of Belgrade
Faculty of Organizational Sciences, Belgrade

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Managing risks effectively is a critical challenge in IT projects, where change and uncertainty are constant. This study explored how Agile and Waterfall methodologies perform in risk management within the Honduran IT industry. Results show that Agile is widely preferred for software development projects due to its iterative nature, adaptability, and rapid response to emerging risks. Waterfall, however, remains valuable for projects with well-defined requirements, such as IT infrastructure, where structured planning provides stability. Overall, the study emphasizes that aligning methodology with project type, stakeholder expectations, and team composition is key to effective risk mitigation, offering practical guidance for IT managers in Honduras and similar settings.

Key Words: project risk management, waterfall methodology, agile methodology, Honduras

11. INTRODUCTION

Projects are inherently risky endeavors where the selection of the right methodology is key. Project risk management helps organizations anticipate, assess, and address potential issues before they impact project outcomes. In the information technology (IT) sector—where rapid innovation, tight deadlines, and evolving stakeholder demands are constant—the choice of project management methodology plays a crucial role in how well risks are managed. As companies aim to boost efficiency and meet stakeholder expectations, selecting the right approach to risk management has become more critical than ever. Two of the most well-known and used methodologies are Agile and Waterfall, where different approaches in project execution and risk mitigation are applied.

This study aims to compare how effectively Agile and Waterfall methodologies manage risks, focusing on their use in IT projects across Honduras. Latin America stands out as a favorable outsourcing market for software engineering due to its cost efficiency and

adaptable talent pool [1]. Honduras specifically has experienced a rapid growth in the IT industry in the past 10 years [2], and is also expected to expand by more than \$ 80 million in the next 5 years [3].

While there is plenty of research on project risk management in general, very few studies explore how local factors - such as industry characteristics, company culture, and team roles - shape these practices in specific regions. By centering on Honduras, this research offers insights that are not only globally relevant but also deeply connected to the realities of the local IT industry.

2. PROJECT RISK MANAGEMENT

The process of managing risks in projects has been conceptualized in various ways, yet most frameworks share a common logic that revolves around identifying, analyzing, responding to, and monitoring risks throughout the project lifecycle. Boehm [4] proposed one of the earliest structured approaches, distinguishing two main stages - risk assessment and risk control - supported by activities such as identification, analysis, prioritization, planning, resolution, and monitoring.

Building on this foundation, Fairley [5] developed a more detailed seven-step model tailored to information technology projects. His process begins with identifying potential risk factors and assessing their likelihood and impact, followed by the creation of

Author's address: Elizabeth Corrales Marquez,
University of Belgrade, Faculty of Organizational
Sciences, Belgrade, Jove Ilića 154

e- mail: elizabeth.corrales@outlook es

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mitigation strategies, continuous monitoring, crisis response, and eventual recovery.

Chapman and Ward [6] expanded the perspective by introducing the SHAMPU framework (Shape, Harness, and Manage Project Uncertainty), which incorporates nine iterative stages. This model emphasizes not only identifying and assessing risks but also clarifying responsibilities, evaluating uncertainties, and managing implementation, framing risk as an integral part of overall project uncertainty management.

Similarly, the Project Management Institute [7] defines six core processes: risk management planning, identification, analysis, response planning, implementation, and monitoring. These reflect the practical, cyclical nature of risk management across industries.

Despite the variations among these models, there is consensus regarding the essential elements that constitute effective risk management. The process must be flexible and adapted to each project's context, scope, and industry characteristics. As Petrović et al. [8] emphasize, risk management should align with all other aspects of project management to ensure coherence and effectiveness.

3. PROJECT MANAGEMENT METHODOLOGIES IN RISK MANAGEMENT

While risk management frameworks provide a general foundation for understanding how risks are managed across projects, their practical application can vary significantly depending on the type of project and the project management methodology used.

Agile and Waterfall, as two dominant approaches in the IT industry, apply these risk management principles in distinct ways. Each methodology integrates risk management practices within its structure, emphasizing the differences in adaptability, timing, and responsiveness to project uncertainties.

Waterfall Methodology

The Waterfall methodology is one of the earliest and most traditional approaches to software development and project management. Described as a linear and sequential model [9–11], it requires each project phase - such as requirements, design, coding, testing, and operation - to be completed before the next begins [12, 13]. Progress flows in one direction, much like water cascading down a waterfall, a metaphor highlighting the model's structured and irreversible nature [14].

This methodology places heavy emphasis on upfront planning, documentation, and predefined milestones. Each phase demands formal reviews and approvals before proceeding, ensuring that every step is

properly validated [11]. While this documentation can slow development, it also enhances traceability and supports long-term maintenance [15]. The approach works best in projects where requirements are stable and clearly defined, such as in construction, manufacturing, or safety-critical IT systems [9, 14, 16].

From a risk management perspective, the Waterfall methodology aims to control uncertainty through extensive pre-project planning. Risks are identified, analyzed, and planned before development begins, with formal mechanisms for monitoring and controlling them during execution [17]. However, because of its linear nature, this methodology is less tolerant of change or unexpected events [15]. Once development starts, adapting to new risks - such as shifting requirements or technological changes - can be difficult and costly [13, 18].

A key limitation of Waterfall is that major risks often manifest late, typically during the testing or delivery stages, when corrections are most expensive and time-consuming [19]. Errors or design flaws detected at this point may require revisiting earlier -, leading to schedule delays and budget overruns. For this reason, effective risk monitoring and role clarity throughout the project are crucial [20, 21].

Recent research has attempted to modernize - risk management capabilities. For example, Bisoño et al. [22] introduced a dynamic programming model based on Elmaghraby's [23] framework, enabling more flexible and data-driven decision-making during project execution. This approach provides managers with quantitative tools to assess trade-offs, optimize resource allocation, and better adapt to emerging risks.

Agile Methodology

Agile methodology emerged in the late twentieth century as a response to frequent delays and cost overruns in software development. It represents a flexible and iterative approach that divides projects into short, manageable cycles known as sprints [18]. Each sprint allows teams to continuously refine priorities, apply feedback, and improve both the product and process [24]. Unlike the Waterfall model, Agile prioritizes collaboration, adaptability, and customer engagement, valuing responsiveness to change over strict adherence to initial plans [11, 25].

Agile frameworks such as Scrum and Kanban emphasize teamwork, transparency, and continuous delivery [13, 26]. Scrum divides work into short iterations, where teams review progress through daily meetings, sprint reviews, and retrospectives - naturally supporting ongoing risk monitoring and mitigation.

Although Agile does not prescribe a formalized risk management framework, it treats risk as exposure to potential negative outcomes [27]. The Scrum Guide

mentions risk indirectly through practices that reduce uncertainty: short sprints, iterative delivery, and transparent processes [28]. According to Sutherland [29], common risks in Agile projects include financial, business, and technical ones, which are mitigated through adaptive cycles.

In Agile projects, risk management occurs continuously throughout the sprint cycle [21, 30]. Risks are discussed during sprint planning, tracked in a simple register, revisited daily during stand-ups, and reviewed at sprint retrospectives. This cycle follows several key steps: identifying and assessing risks, integrating mitigation actions into the backlog, and monitoring them through regular Scrum events [30].

Moran [27] and Wanner [28] emphasize that integrating risk management into Agile should support rather than constrain agility. Agile teams use existing tools-such as product backlogs and Kanban boards-to track risks naturally within their workflow. Risk responsibility is shared across the team, and short sprints allow for faster responses and early detection of issues.

The Boston Consulting [31] expands on this with a governance-oriented model that aligns Agile risk management with organizational compliance. Their framework stresses continuous monitoring, flexible resource allocation based on risk intensity, and the integration of risk oversight within Agile governance structures.

Overall, Agile's risk management is embedded in daily practices rather than handled as a separate process. Its iterative nature enables rapid identification and response to emerging risks, making it highly effective in dynamic and uncertain environments. However, maintaining transparency, coordination, and communication remains crucial to ensure that flexibility does not compromise control [21, 30].

4. METHODOLOGY AND DATA COLLECTION

This study utilizes a mixed methods approach, combining qualitative and quantitative data analysis. The comprehensive review of existing literature provided an understanding of how Agile and Waterfall methodologies address risks in different project contexts within the IT industry. To collect primary data, online surveys were conducted with project managers and project team members in the IT industry in Honduras.

The quantitative phase of the study collected data using multiple-choice and Likert-scale questions to assess the perceived effectiveness of risk management strategies in Agile and Waterfall methodologies.

The 5-point Likert scale, from „Strongly Disagree“ to „Strongly Agree“, allowed for nuanced evaluation and facilitated systematic comparison and statistical

analysis across both approaches. The qualitative phase utilized openended questions to explore participants' perspectives on the challenges and effectiveness of implementing risk management practices.

Responses were transcribed and analyzed thematically to identify recurring patterns, key challenges, and insights into practical application within each methodology. Participants were selected based on their professional experience in the IT industry, with inclusion criteria requiring at least one year of experience, current employment in roles such as project manager, developer, or business analyst (or similar positions), and affiliation with companies based in Honduras.

The study surveyed 105 professionals from the IT industry, selected to ensure diversity of perspectives while considering practical constraints in data collection. Although a larger sample could have strengthened the statistical validity, this number of participants provided sufficient depth and representativeness to draw meaningful conclusions. The limitations in this study include geographical scope, sample size, role distribution, and reliance on self-reported perceptions, which may affect broader relevance and introduce bias. Participants' varying familiarity with methodologies could also have influenced results.

5. RESULTS

Knowledge of Project Management Methodologies

The results revealed notable differences in participants' knowledge of project management methodologies based on their professional roles. Project managers demonstrated the highest level of expertise, with 72% identifying themselves as either experts or very knowledgeable.

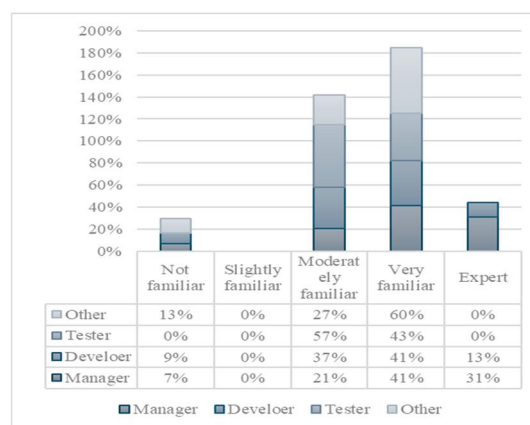


Figure 1 - Knowledge of Project Management Methodologies by Roles

Developers also showed a solid understanding of project management principles, whereas testers and respondents in other roles displayed moderate

awareness without considering themselves experts. Responses showed a polarized pattern – participants either had strong knowledge or none, with no „somewhat familiar“ responses reported. These results can be visualized in the following graph.

Perceptions of Effectiveness in Risk Management

When evaluating risk management effectiveness, Agile was consistently preferred across all professional roles, with 62–85% of respondents favoring it over Waterfall. Participants highlighted Agile’s adaptability, responsiveness to uncertainty, and ability to manage evolving risks as primary strengths. In contrast, Waterfall received minimal support, often described as rigid and slower to adapt to changing project conditions. Notably, no respondent selected „Neither“, suggesting that both methodologies are perceived as having some value in risk management, depending on the context.

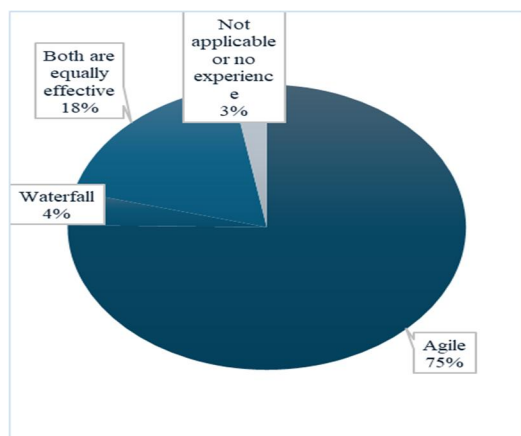


Figure 2 - Perceived Effectiveness of Risk Management by Methodology

Table 1. Results of the most significance differences in risk management between Agile and Waterfall methodology according to respondents

Topic	Description
Risk time identification	Waterfall identifies risks early in the planning phase while Agile does this continuously.
Flexibility and adaptability	Agile allows greater flexibility in risk management while Waterfall follows a strict plan.
Communication and cooperation	Agile encourages frequent interaction with stakeholders while Waterfall follows a structured approach.
Risk response speed	Agile allows for a faster response while Waterfall has a slower adaptation process.
Suitability for project types	Agile is suitable for developing project while Waterfall is better for projects with clear and long-term goals.

Participants also shared their perceptions of the main differences between Agile and Waterfall methodologies in managing risks. Five key areas emerged as the most commonly agreed-upon distinctions: timing of risk identification, flexibility and adaptability, communication and collaboration, speed of risk response, and suitability for different project types.

When asked about project types, results revealed distinct patterns. Almost all respondents (96%) considered agile the most effective for risk management in Software development projects while Waterfall gained stronger support in IT infrastructure projects, particularly among managers (52%), reflecting its structured and predictable planning style. For projects in data analytics and cloud services opinions were divided, with Agile preferred by 35–38% and Waterfall by 22–28%

For other project types, hybrid approaches were viewed as more suitable.

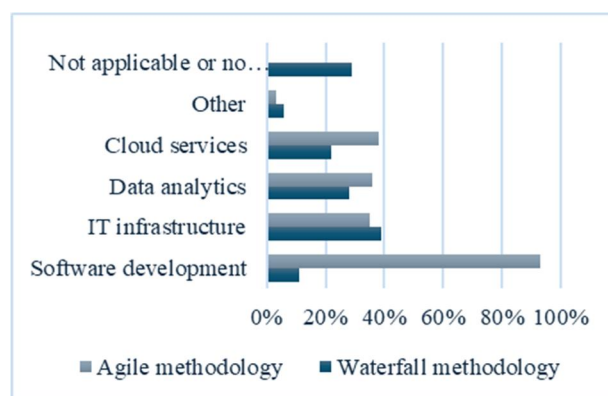


Figure 3 - Perceived effectiveness of Agile and Waterfall methodologies across project types

Methodology Selection Factors

Most organizations decide between Agile and Waterfall primarily based on stakeholder preference, followed by project complexity and size. Some companies rely exclusively on Agile, often due to prior success or staff training in Agile practices.

Others adopt a hybrid model, combining elements of both methods to balance flexibility with structure. A few organizations have institutionalized Agile as a mandatory standard, emphasizing its growing influence in contemporary IT project management.

6. DISCUSSION

The findings indicate that greater experience with the Waterfall methodology does not necessarily translate into its preference. Despite 46% of developers reporting over five years of experience with Waterfall, the majority strongly favored Agile for both risk management and software delivery.

Agile proved to be the most effective approach for software development projects, while its suitability in other areas varied depending on project complexity and professional perspective. This aligns with Ogirri and Idugie [32], who found that Agile outperforms Waterfall in efficiency and risk management while acknowledging that contextual factors influence effectiveness.

Hybrid approaches also emerged as valuable alternatives. Case studies from CERN [33] and Gaborov et al. [34] demonstrate that combining Agile adaptability with Waterfall structure enhances planning, monitoring, and responsiveness. Similarly, in this study, 20% of respondents reported already using hybrid models, suggesting growing recognition of their practicality.

Regional research reinforces these trends. In Bosnia and Herzegovina, 92.7% of IT companies reported using Agile methodologies, while traditional approaches remain influenced primarily by management preference and organizational culture [35]. This reflects the present study's findings, where senior management strongly shaped methodology selection. A recurring pattern across both literature and survey results concerns response speed to risk. Agile methodologies enable rapid adaptation through iterative cycles and continuous communication, whereas Waterfall's rigidity often delays necessary adjustments. This supports the work of Gaborov et al. [34] and Mishra and Alzubii [36], who reported that Agile projects fail less frequently - 10% compared to 30% under Waterfall.

Overall, both methodologies remain relevant in modern project management. However, Agile dominates in dynamic and fast-changing IT environments, while hybrid approaches bridge the gap by combining the strengths of both. Ultimately, it is not the methodology itself but the appropriate and context-driven application of these frameworks that ensures successful project outcomes.

7. CONCLUSION

This study provides context-specific insights into the effectiveness of risk management strategies within Agile and Waterfall methodologies in the Honduran IT industry. By highlighting how Agile's iterative and flexible approach supports dynamic software projects, and how Waterfall's structured planning benefits projects with fixed requirements and high documentation needs, the research emphasizes that the choice of methodology should be guided by project type, stakeholder requirements, and risk profile rather than a universal preference.

The findings have practical implications for IT organizations: aligning methodology with project

characteristics can enhance risk mitigation and project success, bridging the gap between the best global practices and localized industry needs. Additionally, the study demonstrates that perceptions of effectiveness vary by professional role, emphasizing the importance of considering team composition when selecting project management approaches. However, the following limitations of this study should be considered: geographical scope, sample size and reliance on self-reported perception by participants with varying levels of familiarity with each methodology.

Future research could expand on these results by examining larger, multi-country samples, exploring hybrid methodologies, or investigating how different roles implement risk management strategies in practice. Overall, the study reinforces that effective risk management depends on adapting methodology to project-specific demands, offering actionable guidance for IT organizations in Honduras and beyond to improve project outcomes.

REFERENCES

- [1] Deloitte, Deloitte Global Outsourcing Survey 2022, 2022.
- [2] M. Kendall, *Honduras Tech Gaining Strong Government Support, Accelerating Upward Momentum - Nearshore Americas*, <https://nearshoreamericas.com/honduras-tech-gaining-strong-governmentsupport-accelerating-upward-momentum/>.
- [3] Statista, *Revenue in the IT Services Market in Honduras 2029*, <https://www.statista.com/statistics/1397417/revenue-it-services-market-honduras/>.
- [4] B. W. Boehm, Software risk management: principles and practices, *IEEE Softw.* 8, 32 (1991).
- [5] R. Fairley, Risk management for software projects, *IEEE Softw.* 11, 57 (1994).
- [6] C. Chapman and S. Ward, *Project Risk Management: Processes, Techniques and Insights*, 2nd ed. Wiley, 2003.
- [7] PMI, *A Guide to the Project Management Body of Knowledge*, 6th ed. Project Management Institute, 2017.
- [8] D. Petrović, P. Jovanović, and R. Raković, *Upravljanje Projektnim Rizicima* ZUHRA, Beograd, 2010.
- [9] V. Rastogi, Software Development Life Cycle Models-Comparison, Consequences, (IJCSIT) *International Journal of Computer Science and Information Technologies* 6, 168, 2015.
- [10] N. Ruparelia, Software development lifecycle models, *ACM SIGSOFT Software Engineering Notes* 35, 8, 2010.

- [11]S. Balaji, Waterfall vs V-Model vs Agile: a Comparative Study on SDLC, *International Journal of Information Technology and Business Management* 2, 26, 2012.
- [12]I. Sommerville, *Software Engineering* Pearson, 2016.
- [13]B. A. Andrei, A. C. Casu-Pop, S. C. Gheorghe, and C. A. Boiangiu, A Study on Using Waterfall and Agile Methods in Software Project Management, *Journal of Information Systems and Operations Management* 13, 125, 2019.
- [14]A. Saravanos and M. X. Curinga, Simulating the Software Development Lifecycle: The Waterfall Model, *Applied System Innovation* 6, 1, 2023.
- [15]H. K. Aroral, Waterfall Process Operations in the Fast-paced World: Project Management Exploratory Analysis, *International Journal of Applied Business and Management Studies* 6, 91 2021.
- [16]Alan Dennis, Wixom Barbara, and R. Roth, *Systems Analysis and Design*, 7th ed. Wiley, 2018.
- [17]W. W. Royce, Managing the development of large software systems, In Proceedings, *IEEE Wescon*, 1970.
- [18]J. A. A. Luna, N. Osuna-Millán, J. M. F. Parra, and R. F. R. Cisneros, Hacia la selección de una metodología adecuada de gestión de proyectos de TI, *Revista Ibérica de Sistemas e Tecnologías de Informação* 631, 2022.
- [19]C. Fagarasan, O. Popa, A. Pisla, C. Cristea, and F. of E. E. Drives Department, Agile, waterfall and iterative approach in information technology projects, IOP Conderence Series. *Materials Science and Engineering*. 1169, 1, 2021.
- [20]H. Hijazi, T. Khmour, and A. Alarabeyyat, A Review of Risk Management in Different Software Development Methodologies, *International Journal of Computer Applications* 45, 8, 2012.
- [21]H. Taller, *Risk Management in Agile and Waterfall Environments*, <https://www.ptc.com/en/logs/alm/-sd-lc-risk-management-in-agile-and-waterfallenvironments>.
- [22]I. N. Bisono, V. Arvin, and H. Soewandi, Quantifying Risk in Waterfall Methodology: Case Study at Aplikasi Super, *Management Studies and Entrepreneurship Journal* 5, 8728, 2024.
- [23]S. Elmaghaby, On the fallacy of averages in project risk management, *European Journal of Operational Research* 165, 307, 2005.
- [24]H. Vite Cevallos, K. Montero, and J. Cuesta, Metodologías ágiles frente a las tradicionales en el proceso de desarrollo de software, *Espirales: Revista Multidisciplinaria de Investigación* 2, 114, 2018.
- [25]R. K. Wysocki, *Effective Project Management: Traditional, Agile, Extreme*, Wiley, Indianapolis, Indiana, 2014.
- [26]P. Matković and P. Tumbas, A Comparative Overview of the Evolution of Software Development Models, *Journal of Industrial Engineering and Management* 1, 163 2010.
- [27]A. Moran, Risk Management in Agile Projects, *ISACA Journal* 2, 1, 2016.
- [28]R. Wanner, *How to Manage Risk in Agile Projects*, <https://rolandwanner.com/how-to-manage-risk-in-agile-projects/>.
- [29]J. Sutherland and J. J. Sutherland, *Scrum: The Art of Doing Twice the Work in Half the Time*. Crown, 2014.
- [30]M. Carmichael, *Making Risk Management for Agile Projects Effective*, <https://www.isaca.org/-resources-news-and-trends/isaca-now-blog/2023/making-risk-management-for-agile-projects-effective>.
- [31]J. Bickford, P. Malik, S. Bochtler, B. O'Malley, and B. Rehberg, *Making Risk Management Work for Agile*, extension:-//mjdgcandcagmikhblbjnlkmfnje-amfikk/https://web-assets.bcg.com/img-src/BCG-Making-Risk-Management-Work-for-Agile-July-2019_tcm9-225427.pdf.
- [32]K. Ogirri and I. Idugie, A Comparative Analysis of Traditional versus Agile Project Management Methodologies on IT Project Outcomes, *Asian Journal of Research in Computer Science* 17, 1, 2024.
- [33]G. Sirisha, V. Ramesh, D. John, B. Ramakrishna, D. Bisen, and D. Haralayya, Project Management Methodologies: A Comparative Analysis of Agile and Waterfall Approaches, *Library Progress (International)* 44, 17237, 2024.
- [34]M. Gaborov, D. Karuović, M. Kavalic, D. Radosav, D. Milosavljev, S. Stanisljev, and J. Bushati, Comparative analysis of agile and traditional methodologies in IT project management, *Journal of Applied Technical and Educational Sciences* 11, 1, 2021.
- [35]L. Čenanović, *Metode Projektnog Upravljanja u IT Industrij u BiH*, Master rad, Univerzitet u Sarajevu, 2023.
- [36]A. Mishra and Y. I. Alzoubi, Structured software development versus agile software development: a comparative analysis, *Int J Syst Assur Eng Manag* 14, 1504, 2023.

REZIME

EVALUACIJA EFIKASNOSTI STRATEGIJA UPRAVLJANJA RIZIKOM U AGILE I WATERFALL METODOLOGIJAMA UPRAVLJANJA PROJEKTIMA

Efikasno upravljanje rizicima je ključni izazov u IT projektima, gde su promene i neizvesnost stalne. Ova studija je istražila kako se agilne i vodopadne metodologije pokazuju u upravljanju rizicima u IT industriji Hondurasa. Rezultati pokazuju da je agilna metodologija široko preferirana za projekte razvoja softvera zbog svoje iterativne prirode, prilagodljivosti i brzog reagovanja na nove rizike. Vodopadna metodologija, međutim, ostaje vredna za projekte sa dobro definisanim zahtevima, kao što je IT infrastruktura, gde strukturirano planiranje pruža stabilnost. Generalno, studija naglašava da je usklađivanje metodologije sa tipom projekta, očekivanjima zainteresovanih strana i sastavom tima ključno za efikasno ublažavanje rizika, nudeći praktične smernice za IT menadžere u Hondurasu i sličnim okruženjima.

Ključne reči: *upravljanje rizicima projektima, vodopad metodologija, agilna metodologija, Honduras*