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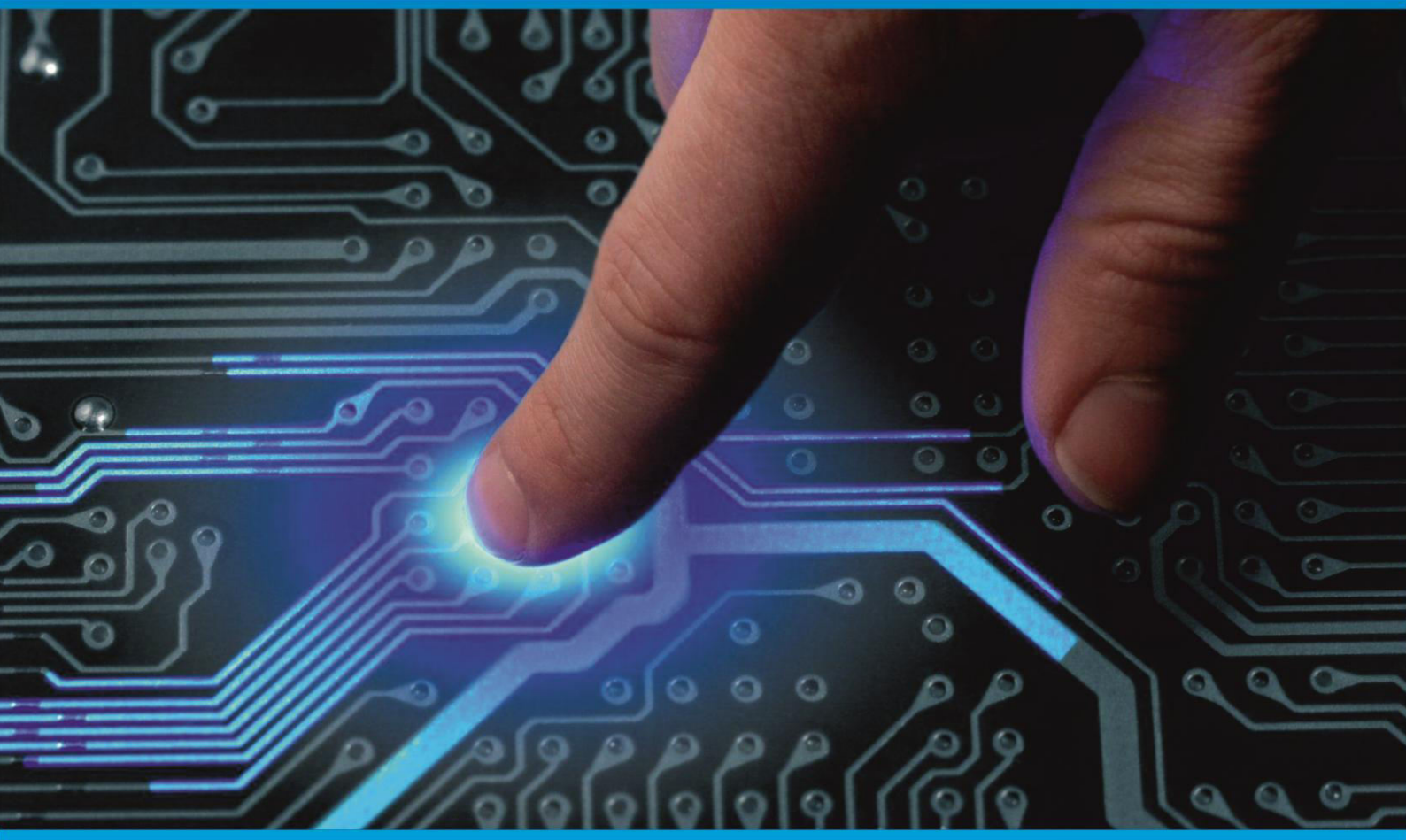

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Limitations of Kanban in Large-Scale Project Management: A Case for Hybrid Approaches

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ABSTRACT: This research article considers why Kanban, a widely used tool for work and workflow management through visualization, in many instances is not enough alone for complex projects. Kanban is universally valued for its simplicity in representing work progression and in providing groups with a mechanism for work ordering, but it can fall short when complex planning, resource assigning, and timelines for a project enter into consideration. Citing current studies and observations and interviews with leaders of projects, this study identifies both positive and negative factors in using Kanban alone. Whereas Kanban can allow groups to effectively monitor work for a single day, we have found that it is deficient in important factors for deeper requirements in a project, such as following a project's milestones, dealing with a range of groups, and communicating a general direction for a project to everyone involved in it. As a result, many leaders of a project have found that using Kanban in combination with other methodologies, such as with Scrum or traditional methodologies for planning a project, can make larger, complex projects work effectively. In this analysis, the study identifies Kanban's specific strengths, as well as, weaknesses and suggests improvements in its use through integration with the additional tools and techniques.

KEYWORDS: Kanban, Project Management, Workflow Visualization, Agile Methodologies, Hybrid Frameworks

I. INTRODUCTION

Kanban is a tool that is used to manage work and track work progression for a group of workers. Kanban began at Toyota for managing work in relation to car production. Kanban is used in many industries apart from manufacturing, as well. Teams use it to manage work through a board with work completed, work in progress, and work yet to be completed represented through cards. Kanban helps a team prioritize work and visualize work. Teams can become organized and focused with kanban, and even restrict work that can be completed at a specific point in time.

Daily work can be managed with kanban, and even a platform for work visualization for a group of workers is facilitated through kanban. As kanban is a simple model, many companies use kanban, specifically when working with flexible work in a project. Pure kanban, however, lags in terms of big and complex work in planning and tracking overall work progression for a manager in a big and complex work environment. One cannot make a proper work plan in terms of resources, consumption of time, and planning for an overall work environment. Complex work involves work with a sequence of work in relation to its completion, and big work involves work in coordination with a group of workers. In such a case, kanban will not even help a manager in planning and tracking overall work progression for a big and complex work environment.

To address such a challenge, most teams use Kanban in conjunction with other types of project management. For instance, they use Kanban in conjunction with Scrum, yet another practice that brings structure into work processes. Scrum involves specific roles and timelines, accompanied with specific planning tools that have a schedule for the team. By using Kanban with such a structured practice such as Scrum, teams have the value of visualization of work and, at the same time, manage long-term objectives and assets.

The strengths and weaknesses of Kanban alone in a project have been discussed in this paper. Existing studies regarding Kanban have been analyzed, and an interview with several industries' project managers was conducted. Real-life projects have been monitored in an attempt to understand Kanban alone in practice. In this study, an attempt will be made to illustrate when Kanban can work and when it must have additional tools' backing.

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II. BACKGROUND STUDY

Kanban is most commonly utilized for visualization and planning of work, through its board-and-card mechanism, to enable tracking of work and prioritization of work (Ikonen et al., 2010). Nevertheless, studies have discovered a range of important weaknesses when Kanban is utilized in its standalone form, specifically in complex, big-ticket projects. Kanban, in its standalone form, fails to deliver enough tools for planning, assigning, and long-term efficiency management. Kanban based projects can suffer from bottleneck and ineffectiveness in case WIP (work in progress) constraints lack proper management, specifically in changing environments for a project (Ikonen et al., 2010). Lacking proper planning and organized supervision, Kanban can cause procrastinations and inefficient use of assets, constraining Kanban's effectiveness when utilized in standalone form (Ikonen et al., 2010).

Subsequent studies reveal Kanban's insufficiency in planning and frameworks for resource management, both of which must be present for long term success in a project (Ikonen et al., 2010). In big-ticket projects with several groups working together, Kanban's work task orientation can cause conflicts over assets and inefficient workflows (Corona & Pani, 2012). Because Kanban is concerned with workflow and not with planning, Kanban fails to tackle full-fledged capacity for assets, dependency, and timeline restrictions (Corona & Pani, 2012). All these weaknesses imply Kanban in its standalone form cannot manage complex, big-ticket projects with high requirements for scheduling and collaboration between groups (Corona & Pani, 2012).

Leadership and guidance at a strategic level are also areas in which Kanban, when alone, is deficient. Project management entails more than work tracking, and it takes proactive leadership in aligning with a purpose and coordination with a group of workers. Mapping work onto a Kanban board alone does not impart direction, role definitions, and motivation complex work requires (Smith, 1999). In a similar manner, a project vision, leadership, and organized coordination processes must be present in a project in order to maintain long term success in a project. Kanban alone can result in blurred accountability, and, therefore, it can become a challenge for a project manager to drive a project towards its termination (Gr, 2014).

The social and organizational group environment of a group of workers is an additional contributing factor in Kanban's performance and use. Communication between a group, workplace environment, and reward structures have a strong bearing in Kanban's use and performance. Unlike methodologies with organized collaboration structures, Kanban does not necessarily address communications barriers, nor addresses group motivation dynamics. In case a group does not have proper communications channels and a proper group environment, Kanban alone will not deliver its desired impact. Poor communications and lack of proper group expectations result in confusions and delayed work in environments with complex and mixed group dynamics (Adams & Ruiz-Ulloa, 2003).

In response to such restrictions, studies have analyzed blended approaches fusing Kanban with alternative organized frameworks for creating an overall model for a project. For example, Scrumban fuses Kanban's visualization of work with Scrum's organized planning processes, including defined roles, sprint cycles, and planning tools for objectives. With both adaptability and organized planning, such a blended model is most effective in handling complex projects (Bhavsar, Shah, & Gopalan, 2020). In a similar way, blending Kanban with agile frameworks helps in managing dependencies, simplifying timelines, and assigning resources in a manner that maximizes efficiency and success in a project (Zayat & Ozlem Senvar, 2020).

Though Kanban is a strong tool for visualization and work improvement, it has several weaknesses when implemented in a standalone form for a project's management. Requirements for managing resources, organized planning, and leadership make it imperative to fuse Kanban with complementary tools and techniques. Scholars consistently report that for complex projects, Kanban must be part of a multi method, overall model for overcoming its weaknesses and satisfying overall requirements for a project (Zayat & Ozlem Senvar, 2020).

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III. METHODOLOGY

This study aims at investigating both Kanban's strengths and weaknesses in managing a project through a mixed methods inquiry, combining both quantitative and qualitative approaches. The objective is to have a deep understanding of Kanban in real working environments, its effectiveness, and its weaknesses.

The inquiry began with a review of pertinent studies, such as case studies, industry reports, and peer-reviewed articles, that review Kanban implementations in a variety of industries. Existing studies have postulated that Kanban maximizes efficiency in workflows, collaboration between workers, and productivity (Lei et al., 2017). For example, Kanban encourages incremental improvement in processes, reduces bottleneck and maximizes work visualization. Besides, a case study in software development shows that Kanban reduces task-switching inefficiencies and maximizes adaptability Lei et al. (2017). On the other hand, weaknesses include long-term planning and planning for resources (Ahmad et al., 2018). Gaps in information guided following empirical study.

To gain real-life information, semi-structured interviews with executives and leaders in industries such as marketing, product development, and software development, respectively, were conducted. Participants were selected for having direct experiences with Kanban as a first-rate tool for managing a project. Interviews addressed Kanban's perceived value, its weaknesses, and its adaptability in terms of changing scopes in a project. In agreement with the preceding studies, respondents testified to Kanban's effectiveness in controlling visualization of work and distribution of workloads (Ahmad et al., 2018). On the other hand, a concern about its lack of scalability in big projects, in agreement with preceding criticisms (Ahmad et al., 2018), was expressed by a portion of managers.

Beyond interviews, an empirical analysis was conducted through closely tracking projects executed purely with Kanban. Project workflows, work completion rates, and feedback over a number of cycles in a project were measured and monitored. Outcomes revealed that Kanban optimizes short-term efficiency but fails with long-term planning, a weakness in previous studies (Huang & Kusiak, 1996). By analyzing recurring trends and impediments, this work introduces empirical information to discussions about Kanban's usability in a range of project environments.

By blending a review of the literature, qualitative interviews, and empirical observations, a complete analysis of Kanban is discussed in this work. The review of the literature constructed a theoretical background, with real life information and insights derived through qualitative and empirical observations, respectively. With the mixed methods analysis, a balanced analysis is assured, and pragmatic recommendations can be derived for optimizing Kanban, particularly when mixed with alternative methodologies for a project's management (Ahmad et al., 2018) (Lei et al., 2017).

IV. EMPIRICAL STUDY

The empirical analysis examined Kanban performance in a range of industries, including software development, marketing, and manufacturing, in terms of its use in managing projects. Analysis purpose was to assess Kanban effectiveness in its standalone form and when in combination with other frameworks for managing projects. For comparison, two sets of projects were grouped for analysis. One group of projects used Kanban alone, and the other group of projects used Kanban in combination with organized methodologies such as Scrum or Waterfall.

Performance factors such as cycle time, a measurement of work completion duration, and prioritization accuracy, a measurement of effectiveness in prioritization of work items in terms of urgency and importance (Adams & Ruiz-Ulloa, 2003), for both groups of projects were documented in a systemic manner. Level of team satisfaction with Kanban when in its standalone form and when in combination with other frameworks (Bhavsar, Shah, & Gopalan, 2020) was measured in an attempt to understand Kanban usability in both forms.

Empirical observations revealed that Kanban only projects encountered a range of complications, including difficulty in coordination between work items' dependencies. With no systemic timeline, it was not easy to verify one work item's completion before allowing its follow-on work items to commence. In big projects with many stakeholders, such a weakness in Kanban represented a significant issue. Teams using Kanban alone could not develop concrete timelines, and therefore, could not maintain long-term coordination in terms of work items and timelines, an issue in big projects with many work items and timelines (Ikonen et al., 2011). In contrast, Kanban when in combination with other methodologies exhibited increased coordination between work items and timelines, and therefore, facilitated efficient work items' execution (Ahmad et al., 2016).

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To supplement observational data, semi structured interviews with both groups' project managers were conducted. Project managers who used Kanban alone emphasized its value in mapping out work for a day and following workflows but concurred that it presented a challenge in defining long-term objectives and managing stakeholder expectations, in that Kanban did not have prescriptive structure. In scenarios with high demand for tracking and planning for specific milestones and dependencies, such an issue arose (Huang & Kusiak, 1996). Project managers who used Kanban in combination with other methodologies, however, enjoyed heightened success in balancing stakeholder objectives, managing dependencies, and maintaining timelines (Corona & Pani, 2012).

The study confirms that, despite Kanban being strong in transparency and adaptability in work, it proves challenging when used alone in a role in a project management position - especially in complex, interrelated work environments. According to the study, combining Kanban with organized frameworks can mitigate such weaknesses, offering a balanced model that incorporates adaptability with planning. (Santos et al., 2018; Zayat & Ozlem Senvar, 2020)

V. RESEARCH FINDINGS

The study confirms that, despite its weaknesses in its use alone in terms of utilizing Kanban, it is effective in tracking and controlling performance in individual projects. Kanban's biggest weakness in its use alone is its lack of prioritization in planning for future work. Kanban boards best apply for simple, narrow scoped projects, whose sole function is in managing work for a single day and allowing groups to prioritize immediate aims (Adams & Ruiz-Ulloa, 2003). As effective for simple, direct projects, such a system proves inadequate when working with complex, multi-step, long-term projects lasting several months. Kanban lacks organized tools for developing timelines and adhering to long-term aims, and for that reason, it proves difficult for a manager to maintain timelines and follow through with long-term aims in its use alone (Ikonen et al., 2011).

A second biggest weakness in Kanban alone is its lack of effective management of assets. In big, complex projects, such assets such as manpower, tools, and budgets must have careful distribution in a manner that will not result in a bottleneck and clashes (Ahmad et al., 2016). Traditional techniques for managing a project include tools for planning for assets, in an attempt to allow a manager to assign assets in relation to phases in a project. Kanban, in its use alone, lacks inbuilt tools for planning for assets, and for that reason, in cases of several groups working in a coordinated manner, it proves challenging in cases with many groups working in a coordinated manner (Huang & Kusiak, 1996).

A further drawback of Kanban is its ineffectiveness in managing work dependencies and risks. Kanban boards have explicit visualization of work, but not explicit definitions of work dependencies, an issue particularly in large projects with sequential work execution (Santos et al., 2018). Inability to have inbuilt tracking for work dependencies raises a high probability of work items being executed out of sequence, and therefore, inefficient use of resources and delayed delivery of a project. This issue has been common in Kanban implementations, most prominently in high risk ventures with critical sequencing of work (Corona & Pani, 2012).

A drawback of Kanban being a single practice for a project is its poor performance in providing high level overviews of a project to its stakeholders. Kanban boards visualize individual work completion, but with little opportunity for reporting tools for high level overviews of a project (Zayat & Ozlem Senvar, 2020). Clients, senior management, and external stakeholders require high level overviews and high level reporting about the project's progression. Because Kanban fails to naturally present such high level information about the whole project, disalignment between the project's stakeholders, and its working group can occur, and therefore, uncertain objectives and miscommunication about the project (Bhavsar, Shah, & Gopalan, 2020).

Furthermore, Kanban fails to explicitly state work distribution and roles, a critical part of a project's management. Well-established work distribution and roles promote accountability and make each part of a project receive its proper care and consideration. Kanban, however, prioritizes work flow over work distribution, and therefore, creates uncertainty about work items and work owners (Ahmad et al., 2018). Inability to have explicit work distribution can cause delays, misconceptions, and conflicts, most prominently in big, multidisciplinary groups with work distribution to specify (Ikonen et al., 2010).

These findings illustrate Kanban as an effective tool for work tracking and workflow optimization but not necessarily for complex and large projects' requirements. For general project management, Kanban will have to be supplemented with methodologies that involve planned structures, resource management, risk management, and role definitions

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(Adams & Ruiz-Ulloa, 2003. With such a mixed model, companies can apply Kanban's flexibility but counter its structural weaknesses, and in conclusion, produce effective delivery in complex environments.

VI. LIMITATIONS

This study provides useful information about Kanban's weaknesses when it is implemented alone for managing a project, but several restrictions have to be taken into consideration. One such restriction is in terms of a sample size. Fewer projects in this work, relatively speaking, were examined, and such a small group could limit generalizability of the findings. Having a larger sample, with a range of projects in a range of companies, could have produced a larger and possibly more in-depth dataset, with an opportunity for even more specific inferences (Adams & Ruiz-Ulloa, 2003).

A restriction of this work is its narrow range of industries. Most of the examined projects in this work pertained to software development, manufacturing, and similar industries, for whom Kanban is a particularly fitting tool for use with a task-related orientation. Industries with high regulative requirements, such as hierarchical decision processes in, for example, healthcare, finance, and education, could have specific requirements for managing a project not examined in this work. Kanban's use in such alternative industries is not certain, and future works have to explore its effectiveness in a larger range of industries (Ahmad et al., 2016).

A further weakness of this study is its use of qualitative data collected through interviewing project managers, and with it, the danger of response bias. Responses from managers will naturally have a subjective bias, and individual experiences and biases can inform them, and discrepancies in reported results can occur (Ikonen et al., 2011). As useful information regarding Kanban's actual practice, the small cohort of interviewed project managers cannot necessarily represent a range of experiences in a range of companies. In future studies, a larger and mixed cohort of project managers could be surveyed, minimizing individual biases and allowing for a greater generalizability of results (Bhavsar, Shah, & Gopalan, 2020). Including quantitative performance statistics, such as productivity, error, and efficiency, would make for a balanced and objective analysis of Kanban's strengths and weaknesses.

Mitigation of these weaknesses in future studies will make for a strengthened case and increased generalizability of results in a range of industries and types of projects, and enable a sounder conclusion regarding Kanban's effectiveness and its best integration with other frameworks for managing a project (Zayat & Ozlem Senvar, 2020).

VII. FUTURE RESEARCH DIRECTIONS

Although this research yields useful information about Kanban's weaknesses and hybrid capabilities, future studies must build on these observations. One of the key directions is investigating Kanban's usability in a variety of industries. In this study, Kanban's use in software development, marketing and manufacturing was examined, but industries including healthcare, finance, and education have alternative project structures and compliance requirements (Adams & Ruiz-Ulloa, 2003). Future studies must investigate whether Kanban must adapt in these industries, and whether new hybrid approaches will be necessary for them.

A key future direction for studies is quantitative performance measurement. In contrast to this study's use of rich, qualitative information derived from interviews and observations, including objective performance factors such as work completion time, errors, and productivity rating, would yield a more nuanced view of Kanban's efficiency (Ahmad et al., 2018). Organizations could make fact based choices about combining Kanban with organized methodologies through a data intensive approach.

A future direction for studies must include investigating Kanban's performance in virtual and hybrid work environments, with increased use of such environments in modern workforces (Ahmad et al., 2018). Most companies utilize software Kanban tools such as Jira, Trello, and Monday.com, but their contribution to collaboration, accountability, and efficiency in workflows in virtual environments is an unanswered question (Ahmad et al., 2018).

Knowledge about how software tools can boost, and possibly inhibit, Kanban's performance will serve remotely working teams well. AI and predictive analysis can integrate with Kanban workflows and boost productivity. AI tools can scan for workflows, forecast potential bottlenecks, and make recommendations for optimized distribution of work, and therefore, for efficient execution of work (Al-Baik & Miller, 2014). AI-facilitated Kanban studies could lay the ground for a new era of smart, flexible, and fact intensive work management software.

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VIII. PRACTICAL RECOMMENDATIONS

Based on the conclusion drawn in this study, a range of approaches must be taken into consideration for project managers in order to maximize Kanban effectiveness in complex projects. One such suggestion is a mixed model blending Kanban with organized methodologies such as Scrum or Waterfall (Bhavsar, Shah, & Gopalan, 2020). By having organized planning tools, Kanban's flexibility can be retained and its weaknesses in long-term delivery of a project can be addressed.

The use of electronic Kanban tools is a suggestion in its own right. Software such as Jira, Trello, and Asana have reporting, dependencies between tasks, and analysis of workflows, and make tracking easier and coordination between workers easier (Ikonen et al., 2011). Kanban's strengths can be leveraged and its weaknesses in work management reduced through such tools.

Role and accountability definitions must form part of Kanban workflows, according to project managers. As Kanban doesn't specify explicit roles, structures such as the RACI matrix (Responsible, Accountable, Consulted, Informed) can make roles explicit and accountability easier (Gr, 2014).

The creation of WIP (Work-in-Progress) constraints is a critical practice for maintaining workflows efficient. Defining explicit WIP constraints keeps workloads in Kanban workflows at a level not overburdening workers, and enables work to flow through Kanban workflows (Santos et al., 2018).

The integration of AI and predictive analysis in Kanban workflows can enhance productivity. AI tools can scan workflows, make future bottleneck forecasts, and make recommendations for optimized work distribution, and thus make delivery of a project efficient (Al-Baik & Miller, 2014).

IX. CONCLUSION

This study critically evaluates the effectiveness of Kanban in its standalone use in managing a project, appreciating its visualization and planning for workflows and work, but criticizing its ineffectiveness in managing complex, high value projects. Empirical observations and expert testimony confirm that Kanban, in its standalone form, cannot effectively manage planning for resources, inter-task dependencies, and long-term planning.

It is found from research that combining Kanban with complementary methodologies, including Scrum and Waterfall, can mitigate its weaknesses, however, in such a case, it does not remain just Kanban anymore. Online Kanban tools, AI powered tracking, and intentional hybrid approaches can expand Kanban's effectiveness in managing a project, too.

Future studies can expand the effectiveness of Kanban in a range of industries, its integration with Artificial Intelligence, and its effectiveness in a work environment with a combination of in person and virtual workforces. In conclusion, Kanban is a powerful tool, but its most effective use comes in its combination with complementary methodologies for added efficiency and success in a project.

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