Improving business process efficiency in gaming industry companies using the cmmi (capability maturity model integration) methodology

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Abstract: This review article explores the potential benefits of implementing the Capability Maturity Model Integration (CMMI) methodology in gaming industry companies. The work begins by describing the role of ISACA and the CMMI Institute in developing professional process management standards. The article examines the structure of CMMI and its application in the context of game development. Key stages of the CMMI audit in gaming companies are highlighted, from the initial assessment to post-audit activities, and a strategy for improving business processes is formulated, considering the industry's specific characteristics. Special attention is given to existing research findings and practical examples of Particular attention is given to analyzing the feasibility of applying CMMI in gaming companies, based on the results of a technical report published by ISACA, as well as examples of CMMI-certified companies such as Tietronix, XcelTec, WebClues Infotech, ISHIR, and Team In India, which specialize in game development.

Keywords: Gaming industry, game development, game product, business processes, audit, efficiency improvement, quality assurance, continuous improvement, CMMI V3.0.

Introduction: With the rapid growth of digital technologies and increasing demand for interactive entertainment, the gaming industry is experiencing a new development phase.

According to Statista, global video game market revenue is projected to reach $475 billion by 2024, with an average annual growth rate of 7.79%, enabling the

industry to achieve a volume of $691.3 billion by 2029 [1].

As noted in Foley's article, the rapid market expansion is accompanied by intensified competition, compelling companies to focus on improving product quality, optimizing development processes, and implementing innovative technologies. The current stage of the video game industry is characterized by key challenges and opportunities, including increasing competition for audience attention, the integration of advanced technologies, labor market instability, high volatility, and significant investment demands [2].

These factors drive companies to adapt to changing conditions to remain competitive and meet the growing expectations of users. In this context, improving business processes and advancing management practices have become particularly relevant.

The unique specificity of the gaming industry, characterized by the synergy of technological innovations and creative content, necessitates a specialized approach to management and process optimization. With the increasing complexity of projects and user expectations, companies require tools to assess and enhance their business processes.

One such tool is the CMMI model, developed by the international organization ISACA. This model does not replace existing software development lifecycle models, such as Agile or Waterfall, but complements them, focusing on improving process maturity. It helps companies implement a structured management approach, optimize resources, reduce development timelines, and improve the quality of the final product.

The objective of this article is to conduct a comprehensive review and analysis of the CMMI model, emphasizing its potential to enhance the efficiency of business processes in gaming companies of various sizes.

The main objectives of the article are to:

- Examine the ISACA association and the CMMI Institute;

- Present the essence and structure of the CMMI model;

- Formulate a strategy for improving business process efficiency using the CMMI model, taking into account the specifics of the gaming industry;

- Analyze the feasibility of applying CMMI in gaming industry companies.

The theoretical significance of the article lies in exploring the potential positive impact of CMMI on the standardization and improvement of business processes in the gaming industry. This study provides insights into how applying this model can enhance process maturity and management efficiency.

The practical significance is reflected in the article's recommendations for improving the efficiency of gaming development business processes using the CMMI model and helping determine its applicability based on the capabilities and resources of a company.

1. The International ISACA Association and the CMMI Institute

The International ISACA Association and the CMMI Institute play a key role in developing and disseminating professional standards and methodologies in the fields of process management, information security, and IT.

The International ISACA Association is a leading organization that unites professionals in areas such as auditing, IT management, information security, and risk management. ISACA's primary mission is to support professional development, facilitate knowledge exchange, and establish high standards for IT industry specialists [3].

The CMMI Institute, a subdivision of ISACA, is responsible for the development and maintenance of the CMMI model. This model was initially created at Carnegie Mellon University specifically for the U.S. Department of Defense to assess the process maturity of software development contractors. Over time, its application expanded across a wide range of industries [4].

In April 2023, the new version of the model, CMMI V3.0, was released. This update aims to adapt the methodology to modern requirements. The new version emphasizes flexibility in application and process effectiveness, enabling organizations to achieve strategic goals more efficiently [5].

The combined influence of ISACA and the CMMI Institute continues to advance tools for management and process improvement in a rapidly changing business environment. The integration of methodologies developed by these organizations provides a foundation for systematically enhancing organizational processes and achieving a high level of maturity in management.

2. Overview of CMMI V3.0

CMMI version 3.0 [5, 6] is a modern tool designed to enhance processes and increase their maturity. The development of this methodology is based on the need for a universal and adaptable model that assists organizations in achieving strategic goals and improving process efficiency, predictability, and flexibility. It is suitable for use across various industries, including manufacturing, healthcare, government, and IT. Compared to previous versions, CMMI 3.0 places

greater emphasis on application flexibility, integration of digital technologies, real-time data analysis, and a focus on measurable outcomes.

CMMI 3.0 comprises 12 Capability Areas and 31 Practice Areas, covering different aspects of management and development. These areas are grouped into four key categories:

- Managing work: includes project, requirements, and risk management, ensuring planning, monitoring, and control to achieve set goals.

- Managing processes: covers process definition, quality management, and measurement, supporting the development, documentation, and maintenance of effective processes.

- Managing support: involves configuration, supplier, and security management, ensuring change control, selection and management of suppliers, as well as protection of organizational information and resources.

- Managing improvements: focuses on innovation, change, and performance management, promoting the search for and implementation of new ideas, effective change management, and process optimization to achieve high-performance metrics.

- The key concept of CMMI is maturity levels, which represent stages of process evolution within an organization. There are five levels, each characterized by a specific degree of standardization, control, and improvement:

- Initial: at this level, processes are informal and unpredictable. Project success depends on individual efforts rather than established processes. The organization often responds to problems reactively, leading to inconsistent results.

- Managed: processes are planned and executed according to defined policies. Basic structures for project management exist, including cost tracking, scheduling, and functionality monitoring. However, these processes may be specific to individual projects and are not necessarily standardized across the organization.

- Defined: processes are standardized, documented, and implemented organization-wide. There is a shared understanding and alignment in the approaches to performing tasks. Processes are tailored to specific projects but are based on organizational standards.

- Quantitatively managed: the organization sets quantitative goals for processes and products. Statistical methods are used for process monitoring and control, allowing for highly reliable outcome predictions. This enables more precise project management and improved product quality.

- Optimizing: the focus is on continuous process improvement through innovation and optimization. The organization actively seeks opportunities for enhancement, implements advanced practices and technologies, and adapts to changes in the business environment. Processes are flexible and capable of quickly responding to new challenges and opportunities.

Maturity levels help organizations assess current process efficiency, identify weaknesses, and plan improvement strategies. Below, Figure 1 illustrates the stepwise structure of process maturity levels in CMMI, clearly depicting the sequential and systematic improvement of organizational processes to achieve optimization:
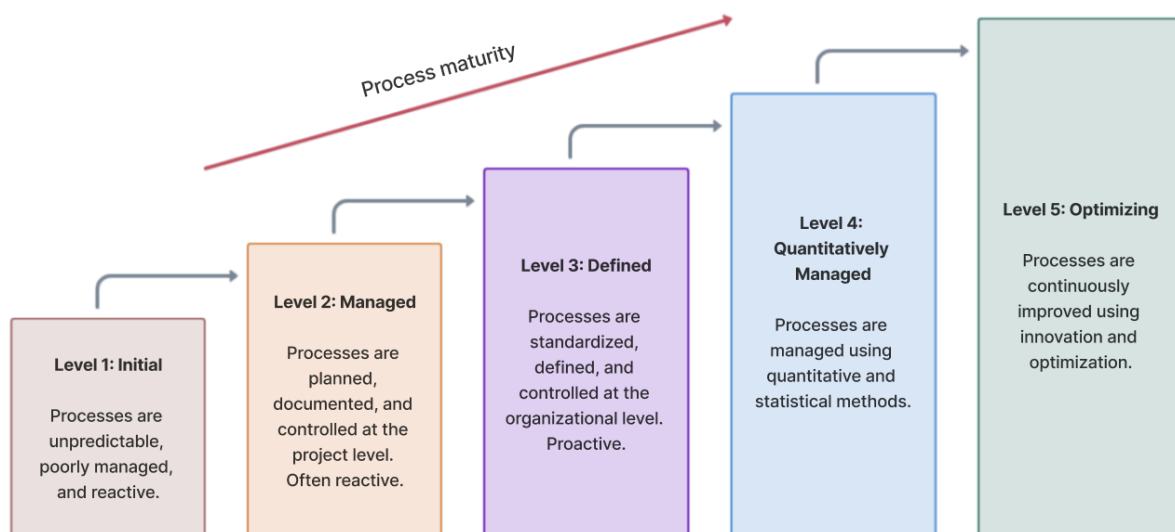

Figure 1 — CMMI process maturity levels

One of the key features of CMMI 3.0 is the departure from a fixed set of process areas, which was characteristic of earlier versions. Instead, the model adopts a modular approach, allowing each organization to select the aspects most relevant to its goals. This makes CMMI 3.0 particularly applicable to companies operating in rapidly changing environments, including dynamic industries such as game development.

The integration of modern technologies and approaches, such as Agile and DevOps, further enhances the model's versatility. These methods are frequently used in organizations where development speed and process flexibility are critical. CMMI 3.0 facilitates the harmonization of these methodologies with other management aspects while maintaining overall standardization.

Another significant innovation is the use of a digital platform for process maturity assessment [7]. Figure 2 illustrates an example of the interface of this digital platform:
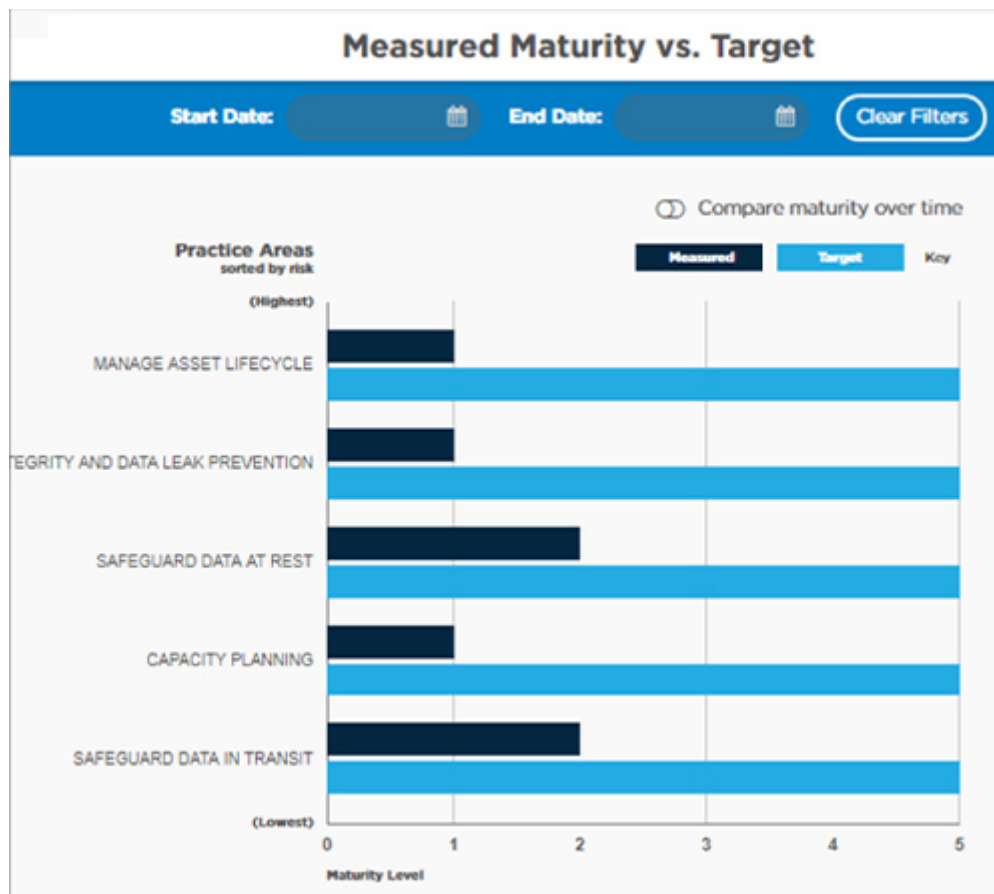

Figure 2 — Example of the CMMI digital platform interface [7]

This platform enables organizations to conduct real-time audits, collect analytical data, and identify weaknesses. It not only accelerates the assessment process but also makes it more accurate and transparent.

Implementing CMMI 3.0 allows organizations to achieve significant results: improving product quality, reducing defects, shortening project timelines, and enhancing collaboration across departments. The model serves not only as a standardization tool but also as a strategic resource for growth and competitiveness.

Thus, CMMI 3.0 represents a universal and adaptive tool for improving process maturity. Its flexibility, integration with digital technologies, and focus on outcomes make it indispensable for modern organizations striving for sustainable development.

3. Enhancing business process efficiency using the CMMI model with consideration of the gaming industry's specifics

This section details the procedure for improving business process efficiency using the CMMI model. The following sources were selected as they provide valuable recommendations for organizing the improvement process:

- "CMMI Model Quick Reference Guide" [6];

- Stylianos Gavriel's master's thesis, "Design and Implementation of an Assessment Method Based on the Capability Maturity Model Integration (CMMI)" [8];

- The article "How to Improve a Process: Step-By-Step

Guide" [9], was published on the Process Street platform.

The procedure for enhancing business processes using CMMI in gaming companies can be presented as an audit and structured into several key stages, each

playing a critical role in forming a comprehensive understanding of organizational maturity.

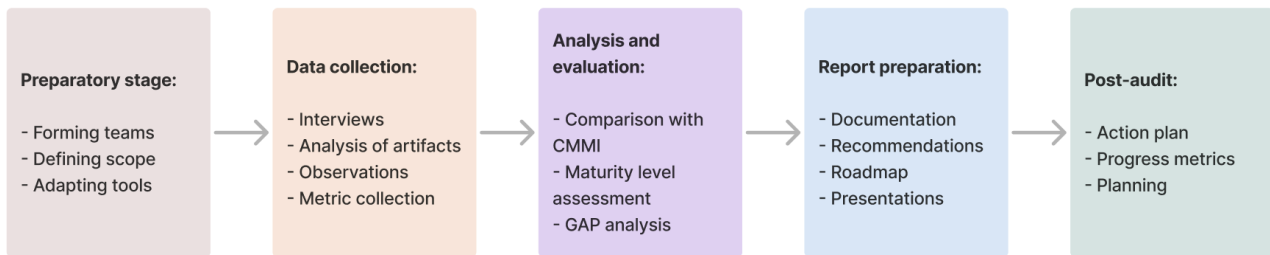The key stages of business process auditing are illustrated in Figure 3:

Figure 3 – Stages of business process auditing

As shown in Figure 3, the audit of business processes begins with preparation, which involves forming a team of experts with competencies in both CMMI and game development. This stage is crucial as it establishes the foundation for the entire process, defining the audit's scope and adapting assessment tools to the specifics of game development.

The next stage—data collection—is a multilayered process involving both quantitative and qualitative methods. This stage includes not only the analysis of documentation and development artifacts but also direct interaction with the team through interviews, observations, and the study of production metrics. This comprehensive approach provides insight into both formal processes and informal practices, which often have a significant impact on the creative environment of game development. Key metrics, such as productivity, response time to changes, and player feedback, should be considered to more deeply evaluate the actual efficiency of processes.

The subsequent analysis and evaluation of collected data form the foundation of a CMMI audit. This stage involves comparing company practices with the CMMI reference model while accounting for the specific characteristics of the gaming industry. This process requires a deep understanding of both the formal requirements of CMMI and the unique aspects of game development. For example, when evaluating requirements management processes in the context of the gaming industry, it is essential to consider the iterative nature of game design and the frequent changes in game mechanics based on feedback from testers and players.

Auditors analyze how the company balances the need to follow established processes with the necessity for creative freedom, which is critical for the development of innovative gaming products. This analysis may include an evaluation of the flexibility of development processes, the ability to quickly adapt to market or

technological trends, and the efficiency of integrating creative and technical aspects of development.

Special attention during the audit is given to processes specific to the gaming industry, such as balancing game mechanics, optimizing performance for various platforms, and integrating monetization models into gameplay. These processes lack direct analogs in the standard CMMI model, necessitating the development of specialized evaluation criteria. It is essential to consider current gaming industry trends, such as rapidly changing technologies and user experience requirements, which make process flexibility and adaptability particularly critical. The evaluation of these aspects should not merely involve comparison with a benchmark but should be adapted to the unique needs of each game development company.

It is important to note that the analysis and evaluation process is not a mechanical comparison but requires deep analysis and interpretation that accounts for the unique context of each gaming company. The result is not just an assessment of the current maturity level but also the identification of key areas for improvement that can drive growth in efficiency and development quality.

Following the analysis and evaluation, an audit report is prepared. This report does not merely document results but also includes the development of practical recommendations and a roadmap for achieving the next maturity level. These recommendations must be not only theoretically grounded but also practically applicable within the dynamic and creative environment of game development.

The process does not end here. A post-audit phase follows, often underestimated but playing a key role in transforming audit results into real improvements. During this phase, a concrete action plan is developed, and specific metrics for tracking progress are established, such as response time to changes, reduction in the number of defects, increased development productivity, and improved user

satisfaction. Further steps aimed at achieving key performance indicators (KPIs) are defined. These actions form the foundation for the continuous improvement of processes, ensuring the sustainability of implemented changes rather than merely their short-term effectiveness.

The continuous improvement cycle for business processes is clearly illustrated in Figure 4:

Figure 4 – Continuous business process improvement cycle

A key aspect of improving business processes involves the implementation of CMMI best practices adapted to the realities of game development. This includes:

1. Enhancing requirements management processes to account for the iterative nature of development and the need for rapid adaptation to player feedback.

2. Optimizing project planning and tracking processes by integrating Agile methodologies with CMMI's formal practices to ensure flexibility and predictability in development.

3. Refining configuration and change management processes, which are critical for effectively controlling complex game projects with numerous interdependent components.

4. Strengthening quality assurance (QA) and testing practices, including automation.

5. Developing supplier and external resource management processes, which are particularly important given the growing trend of outsourcing in game development.

6. Implementing continuous integration and delivery (CI/CD) processes tailored to the specifics of game development and the need for frequent updates in live services.

Project management processes in the gaming industry often combine elements of various methodologies adapted to the creative nature of development. A CMMI audit evaluates the effectiveness of these hybrid approaches, assessing their ability to balance structure with the flexibility necessary for innovative game creation.

Evaluating QA and testing processes in game development requires particular attention to aspects such as UX testing to assess player perception, gameplay balance testing, server stress testing for multiplayer games, and performance optimization across platforms. A CMMI audit analyzes the extent to which these processes are integrated into the overall development cycle, including continuous testing at all stages, and their contribution to improving the final product's quality and user satisfaction.

The adoption of DevOps practices within the CMMI framework can significantly enhance the efficiency of business processes in gaming companies. This can substantially reduce update release times and increase release stability, which is critical for modern game projects, particularly in the "Games as a Service" (GaaS) segment.

An essential aspect of improving business process quality is fostering a culture of continuous learning and improvement. This includes creating effective mechanisms for collecting and analyzing metrics, conducting regular retrospectives, and encouraging initiatives to enhance processes at all organizational levels.

4. Analysis of the feasibility of applying CMMI in the gaming industry

This section provides an analysis of the feasibility of implementing the CMMI model in the gaming industry. The analysis includes the following stages:

1. Identifying potential improvements through CMMI implementation in gaming companies.

2. Assessing the applicability of the model for game developers considering their resources and capabilities.

The analysis is based on the following data:

- The "CMMI Technical Report: Performance Results" [10], prepared by ISACA in April 2024, demonstrates the impact of the model on key operational aspects in various organizations, including those in the IT sector.

- Documented examples of IT companies specializing in game development that have successfully achieved official CMMI certification.

The relevance of this data to the gaming industry is due to the significant similarities between game development processes and those in other IT sectors. This similarity supports the use of the analysis results to substantiate the feasibility of applying the CMMI model in game development.

4.1 Potential improvements through CMMI implementation

The implementation of the CMMI model significantly impacts critical aspects of a company's operations, as evidenced by data from ISACA's CMMI Technical Report for 2019–2023. This report analyzed over 14,000 organizational assessments, identifying key areas of improvement, summarized in Table 1.

Table 1. Key improvement areas with CMMI implementation

Improvement category	Results	Details
Quality	Reduction in defect density	Average reduction of 31%: fewer defects in products, reducing costs for corrections.
	Increase in defect detection pre-release	28% increase: preventing errors before release improves the final product's quality.
Performance	Improved productivity	Average growth of 20%: higher output with the same resources.
	Reduction in workload deviations	30% reduction: minimizing rework and resource overuse.
Timeliness	Increased on-time task completion	Average growth of 33%: greater adherence to deadlines strengthens client trust.
	Reduction in time deviations	19% reduction: enhanced accuracy in project timelines.
Customer satisfaction	Improved customer satisfaction	13% increase: higher quality of service and products strengthens customer loyalty.
	Better SLA adherence	Improved accuracy in meeting service-level agreements enhances the company's reputation.
Cost optimization	Reduced costs	Average cost reduction of 14%: process cost optimization.
	Reduced budget deviations	15% reduction: improved financial planning and execution accuracy.
Additional benefits	Increased process maturity	79% of organizations achieved maturity level 3; 20% reached level 5.
	Integration of modern approaches like Agile and DevOps	Improved process adaptability and flexible methodology integration.
	Use of digital platforms for process maturity assessment	Faster assessments with more precise business process maturity analysis.

The data from the CMMI Technical Report demonstrates that the implementation of the model leads to significant improvements in business process management. Organizations achieve sustainable enhancements in product quality, increased productivity, reduced time and budget deviations, and higher customer satisfaction. A noteworthy indicator is the success rate of CMMI implementation, which stands at 86%, highlighting the model's effectiveness in achieving organizational strategic goals.

The IT sector holds a leading position among CMMI implementation areas, accounting for 61% of all applications. This underscores the model's relevance for projects requiring a combination of strict process

management with high flexibility and adaptability. This indicator emphasizes that the gaming industry, as part of the IT sector, particularly benefits from CMMI implementation due to improvements in quality, cost optimization, and the integration of modern approaches such as Agile and DevOps.

These findings confirm the feasibility of using CMMI as a strategic tool to enhance competitiveness, sustainability, and efficiency in the dynamic conditions characteristic of the gaming industry.

4.2 Evaluation of CMMI applicability based on game developers' capabilities and resources

To evaluate the applicability of the CMMI model for the gaming industry based on the capabilities and resources available to companies, the following classification is introduced based on company size:

- Small studios (~up to 25 employees/limited resources).
- Medium-sized companies (~up to 100 employees/moderate resources).
- Large companies (~over 100 employees/significant resources).

Table 2 provides examples of IT companies certified at various CMMI maturity levels that specialize in game development:

Table 2. Game application developers certified in CMMI

Company	Description	Number of employees	Company category	CMMI maturity level
Tietronix [11]	Provides software development services, specializing in solutions for the aerospace, medical, and educational sectors. Also develops games and simulations for education, training, professional development, and entertainment across various platforms.	50+	Medium	Level 3
XcelTec [12]	Offers software, mobile app, and web development services, focusing on high-quality IT services for various industries, including game application development.	100+	Large	Level 5
WebClues Infotech [13]	A globally recognized provider of web and mobile solutions with offices in India, the USA, and the UAE, helping define business processes and accelerate growth through next-generation digital solutions, including AI-driven game development technologies.	200+	Large	Level 5
ISHIR [14]	A leading software development company with offices in Dallas, Texas, and New Delhi, India. Provides custom software development, digital transformation, cloud optimization, and automation solutions, including game application development.	250+	Large	Level 3
Team In India [15]	A division of Dotsquares specializing in software and web solutions, including mobile applications, web design, and digital marketing. Also focuses on game	1,000+	Large	Level 3

	application development across various platforms.			

The presented data suggests that the implementation of the CMMI model is more common among medium-sized and large companies. Medium-sized companies, with moderate resources and more complex processes, can derive substantial benefits from the structuring and optimization provided by the model. Large companies, possessing significant resources and complex organizational structures, more frequently achieve higher maturity levels (4-5), enabling the integration of practices for continuous improvement and innovation.

As a minimum goal for medium-sized and large companies considering the adoption of CMMI, achieving maturity level 3 is recommended. This level ensures process standardization and manageability, which are essential for sustainable company growth. Attaining higher maturity levels (4-5) should be a strategic objective for organizations aiming for long-term efficiency gains and competitiveness.

For small companies with simpler processes and limited resources, full implementation and certification of CMMI may be excessively costly and redundant. However, such companies could aim for maturity level 2 or selectively apply specific practices from the model to improve fundamental processes without pursuing official certification.

CONCLUSION

The findings of this study highlight the significant potential of the CMMI methodology for enhancing business processes within the gaming industry. According to the analysis, using the model can facilitate process standardization, improve product quality, and reduce time and financial expenditures. Simultaneously, the model's flexibility allows companies to account for dynamic market changes and adapt their processes to ever-growing demands.

The culture of continuous improvement underlying CMMI potentially establishes conditions for sustainable growth and enables companies to respond to changes with minimal costs. The integration of cutting-edge technologies further expands CMMI's capabilities, offering automation of routine tasks, enhanced predictive accuracy, and optimized project management. These prospects make the model particularly attractive for gaming companies seeking long-term growth and strengthened competitive positions.

Thus, the CMMI methodology emerges as a tool that,

when properly adapted to the specifics of game development, can serve as a foundation for strategies aimed at improving quality, reducing costs, and adapting to changes. However, to substantiate these assumptions, further research is required to explore its practical applicability in the context of specific companies within the gaming industry.

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