

Analysis of Animation Production Management for Game Development Project Yudhistira

Bernadeth Yoelfani Simbolon
Animation Study Program
Batam State Polytechnic
Batam, Indonesia

bernadeth.yoelfani.simbolon3@students.polibatam.ac.id

Selly Artaty Zega
Animation Study Program
Batam State Polytechnic
Batam, Indonesia
selly@polibatam.ac.id

Abstract—The “Yudhistira” game development project, produced by interns from the Game Development Division during the 2024 Magang dan Studi Independen Bersertifikat (MSIB) program at Infinite Learning, involved multidisciplinary units, notably the Animation Department. This animation department managed all in-game moving elements and cinematic animations through its own pre-production, production, and post-production stages, independent of the main game pipeline. This research explores production management efficiency within the animation department. Observation and confirmatory interviews were used to examine the ‘efficiency triangle’: on time delivery, resource allocation, and animation quality under project constraints. The results show that production management met the “on time and on budget” targets, but animation quality was compromised. This project is a case study of departmental production independence.

Keywords—animation department, production management, game development, and triangle efficiency.

I. INTRODUCTION

As games have become increasingly complex, development teams have evolved from small groups to large, multidisciplinary units with specialized expertise [1]. These teams include professionals in art, programming, design, marketing, and sales [2]. Animation is a key component of game art. It shapes the user’s visual experience and enhances both active and passive engagement [3][4]. Animation production encompasses all in-game and cinematic animations, including elements for characters, object, and environments. Before animation, 2D and 3D artists complete modelling, rigging, and texturing. These steps are tailored to project requirements [5]. The rising complexity of games has led to more specialization within teams. This trend highlights ongoing growth in the game and animation industries. The demand for animation services continues to expand across multiple sectors [6].

Game Development teams often have multiple management layers, depending on project scale and size. Team organization also depends on the range of disciplines, such as audiovisual arts, user experience design, genre conventions, engineering, management, business, and marketing [7]. Unified management requires teams to deliver high-quality games on time and within budget. Teams work with senior management to keep all departments on track [1]. They must also integrate animation needs to support the game process [7].

Animation asset management is essential in modern animation production pipelines. It involves the systematic organization, storage, and retrieval of digital assets, such as character models, textures, and animation [5][8]. Effective asset management streamlines workflows and boosts team collaboration. It also improves productivity in animation and game development. Production management efficiency depends on precise identification of creative requirements, resource allocation, schedules, and budgets during pre-production [9][10].

The “triple constraint” in project management refers to balancing scope, time, and cost [9][10]. Project management is effective if it meets two out of the three criteria. Achieving all three is rarely possible [10]. Sacrificing one aspect, while not completely disregarding it, enables the project to meet its objectives [11]. Change is common in creative fields like game development. Teams add new ideas or refine features [9]. Erik Bethke (2003) adapted the triangle to include time, budget, and quality [12]. This made quality a key measure. A game’s success depends not just on deadlines and budgets but also on high-quality outcomes. For example, the “Ficusia” serial film used an efficiency feasibility test [13]. This test focused on Human Resources (HR) and timeline management, both using the Monday.com tool. This indicates that animation production often faces dynamic changes and requires real-time control. Using the “On Time, On Budget, and High-Quality” triangle helps assess the efficiency and department integration with the project system.

This study examines the development of the 3D low-poly game project Yudhistira. The Game Developer Division team in Magang dan Studi Independen Bersertifikat (MSIB) Batch 6 at Infinite Learning produced it. The program ran for four months. The team consists of a UI/UX and design specialist, a programmer, and two artists/animators responsible for asset creation. The production process is divided into UI/UX, Programming, and Animation departments. Project mentors from the MSIB Game Developer Division serve as project managers. Yudhistira is a tower defense game inspired by Indonesian folklore—specifically, the Javanese chronicle Babat Wanamarta. The game is intended for online publication and submission to the 2024 Game Design World Championship (GDWC). It fulfills MSIB program requirements and is uploaded to [Itch.io](https://itch.io) platform. After the project submission, the animation team members and project manager were interviewed. This involved collecting data and observing the animation production process to ensure relevance to the research scope [14]. The findings are used to

assess the feasibility of the production management practices implemented, exclusively in the Animation Department.

Formal training program are still uncommon in game production, especially in animation pipeline management for game development [1][12]. Although broad project management methodologies are often used, the animation department frequently operates in cross-functional teams [12]. These teams are separate from the main game production management. There is a need for additional references, literature studies, and standard procedures. This will advance production management in game and animation production.

Furthermore, this research aims to analyze the implementation of animation production management in a game development project. It describes the methodology used and presents insights from the analysis to contribute to future knowledge. The research applies the model proposed by Erik Bethke (2003). The “On Time, On Budget, and High Quality” triangle serves as the primary framework for evaluating the efficiency and feasibility of implemented animation production management workflows. Since this research is specifically scoped to the animation department in a game development project, it will serve as a valuable source of information for beginner teams, project managers, directors, and researchers in the industry or related industries. The research questions are as follows:

1. How is production management implemented in the animation department of the Yudhistira game project?
2. To what extent does the application of the efficiency triangle (time, budget, and quality) reflect the effectiveness of this production management?

II. LITERATURE REVIEW

A. Animation Pipeline in Game Development Project

In any animation project involves a continuous process from beginning to end, defines as animation pipeline. An animation pipeline, or workflow, is a system comprising people, hardware, and software that work in a specific, sequential order to perform predetermined tasks within a predetermined timeframe, ultimately resulting in a 3D animation or other traditional animation product or asset as the final output [16]. The pipeline for an animated film also depends on the project within a company or organization. Several criteria that influence an animation pipeline [10] include:

- 1) Depends on the needs and type of animation,
- 2) Depends on the budget or cost,
- 3) Depends on the quality of the resulting film.

Despite varying requirements, pipelines always include pre-production, production, and post-production. However, before undertaking the pre-production process, briefings and pitching sessions are conducted with the involved parties, including the client, team, and other stakeholders. Therefore, the mapping of the business process flow for producing animation is shown in Figure 1.

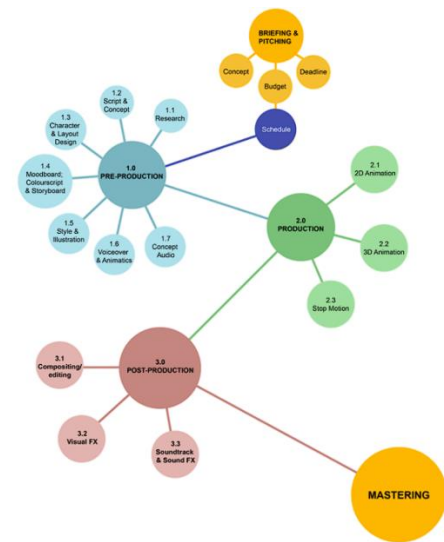


Fig. 1. Business Process Flow Mapping for Animation Production

While organizations may adapt details, the three-stage pipeline structure remains constant, supporting the animation team’s effective contribution to the broader game development process. Integration ensures the animation workflow aligns with overall project goals, as further discussed in point B. Game Management.

1) *Pre-production:* Pre-production is the research, designing, and planning phase of the entire animation project, which is split between two teams: The design team creates the idea, story, and designs, and the management team, who writes down the production plan (including budgets, teams, and time frames). The better the pre-production phase is done, the easier the production stage will be. Pre-production consists of the following steps: idea generation, story creation, script writing, storyboarding, animatic, and design.

2) *Production:* Production is the process of implementing and executing the creation of the story's setting environment; character creation and other design assets that will support the visual storytelling. This is followed by the process of creating the illusion of life in the form of animation. With each animation style or approach, which has many types, including 2D, 3D, and stop motion, it's possible that not all of the steps in Figure 1 need to be used. The production stage consists of the following steps: layouting, modeling, texturing, rigging, animating, VFX, lighting, rendering.

3) *Post-production:* At this stage, the final touches are added to the project to make it look polished and professional (the definition of polished and professional might differ in various projects, of course). Post-production artists have a number of tools that can make up the look of a project in whatever way they want. Post-production in the 3D animation pipeline includes: compositing, 2d VFX, color correction, final output.

B. Game Design Management

Game production management involves coordinating across multiple departments to ensure that all development components progress simultaneously, while adhering to

project objectives and timelines. For the Yudhistira project, this coordination was achieved through the use of two primary management tools: the Game Design Document (GDD) and Kanban Gantt chart tracking. The GDD functioned as the blueprint of the game, containing detailed descriptions of gameplay mechanics, character designs, story elements, art styles, and technical specifications [17]. It served as the central reference for all departments—programming, UI/UX, and animation—ensuring a unified vision of the game throughout development.

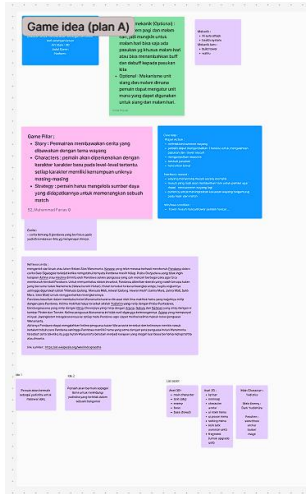


Fig. 2. GDD of game project Yudhistira

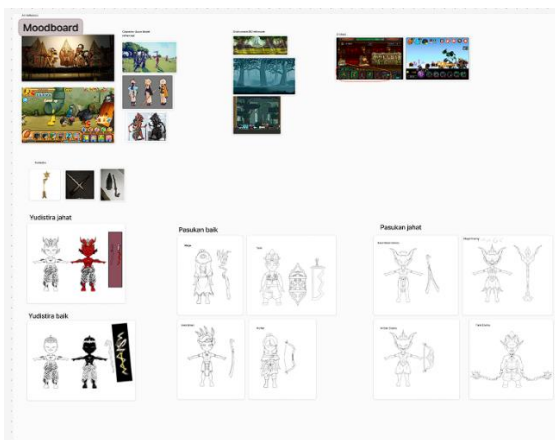


Fig. 3. GDD of game project Yudhistira

Additionally, workflow tracking was supported through the Kanban system, which was integrated with Gantt chart visualization for enhanced visibility. Kanban, a visual management method derived from lean project management, enables teams to monitor task progress, identify bottlenecks, and enhance overall productivity by limiting the work in progress [18]. The Gantt-chart representation complemented Kanban by mapping task dependencies across time, enabling the team to adjust workloads and ensure milestones were completed within the given internship duration. These tools enabled the Yudhistira team to strike a balance between flexibility and structure in their creative process, an approach that is increasingly recommended in game production management [19].

C. Efficiency Theories in Project Management

The efficiency of project management is often evaluated through the project management triangle, also known as the “triple constraint,” consisting of time, budget, and quality. According to Bethke (2003), efficiency in game development requires a balance among these three parameters, although achieving all three simultaneously is widely considered unattainable [20]. Typically, prioritizing two constraints requires compromising on the third—for instance, maintaining strict time and budget limits may require lowering the quality of outputs.

Recent studies reinforce this framework while integrating contemporary perspectives on creative industry management. Modern agile-based frameworks emphasize adaptability, continuous delivery, and stakeholder feedback as complements to the triangle [21]. Furthermore, in creative fields such as animation and game development, the fluidity of scope adds another layer of complexity, as new ideas or adjustments frequently emerge during production [22]. Within such contexts, the efficiency triangle serves as a guiding principle:

1. **On Budget and On Time**—means the developer must accept the sacrifice of quality.
2. **High Quality and On Budget**—means the developer must accept a late game.
3. **High Quality and On Time**—means the developer must accept extra spending.



Fig. 4. Efficiency Triangle based on Bethke (2003)

This theoretical foundation underlines the present study, where the triangle will be applied to evaluate the efficiency of production management in the animation department of the Yudhistira project.

D. Animation Department Production Management

Within the Yudhistira game project, the animation department played a central role in shaping the player’s visual and immersive experience. To assess the efficiency of its production management, the department’s workflow is analyzed using the adapted triangle framework of on-time, on-budget, and high quality.

1. On Time Delivery Through Structured Animation Pipeline

The Yudhistira project was constrained to a four-month development timeline, consistent with the duration of the MSIB internship program. To ensure timely delivery, the animation team followed a

structured animation pipeline, comprising preproduction, production, and post-production stages. These stages aligned with the broader workflow of the entire game project and were preceded by initial briefings and pitching with the mentor from Infinite Learning. This structured approach was critical in preventing delays and ensuring synchronization with other departments [23].

2. Budget Efficiency as Resource Allocation

The Yudhistira project was developed independently by four student interns without a financial budget from Infinite Learning. Consequently, production depended solely on the team's available hardware, software, and human resources. Although no direct costs were incurred, this situation underscores the importance of resource allocation as a measure of budget efficiency. Literature suggests that access to funding can substantially improve the quality and scope of production in game projects [24]. The lack of a budget, therefore, required more rigorous prioritization of resources, task assignments, and time management.

3. Maintaining Animation Quality within Constraints

Despite time and budget limitations, the project aimed to produce high-quality, low-poly animation outputs that were consistent with its design objectives. The choice of the low-poly model is based on efficiency in the work process, faster production times, and a lightweight file size, which can support maximum game performance [29]. Due to its efficient nature, low-poly is often used in video game development, animation, and real-time applications. The main advantages of this approach are its efficiency in the rendering process, low memory usage, and the ability to run on medium to low-spec hardware.

Yudhistira was developed as a 3D low-poly tower defense game, with strong Indonesian cultural themes derived from the Babat Wanamarta folklore. The animation department contributed by producing character animations, environmental assets, and gameplay elements that were stylistically coherent and technically functional. Maintaining quality under constraints required creative problem-solving, streamlined workflows, and close alignment with the GDD specifications [25].

III. METHODOLOGY

A. Research Design

This research employs a qualitative, exploratory case study method to analyse the implementation of effectiveness and efficiency parameters in production management within the animation department during the game project "Yudhistira". The qualitative analysis supports logical reasoning based on factual and accurate data [26][30]

A qualitative analysis case study is a research study about an object, an individual, a group, a condition, or a situation [26]. By using a case study, a researcher can refer to a real-life situation, allowing them to conduct a series of observations [26]. An explanatory interview aims to explain the relationship between two or more phenomena or variables. This research focuses on the fundamental question "why?" Thus, researchers often classify this type of explanatory

research, also known as confirmatory research, as a form of correlational research. This explanatory research clarifies the correlation between two or more variables, highlighting the pattern, direction, nature, form, and strength of the relationship [27]. This qualitative, explanatory case study research method supports an in-depth understanding by examining the core of the animation department's workflow based on the data collected, which ultimately plays a significant role in the overall success of game production management. The workflow consists of three phases: pre-production, production, and post-production [16]. At each phase, this research aimed to test the compatibility of the implementation of the effectiveness and efficiency parameters.

B. Data Collection Techniques

The data collected in this study were obtained through observation, confirmatory interviews, and documentation regarding the research design.

sources:

1) Observation

The author conducted observations during the development of the Yudhistira game project, specifically during the four-month MSIB period. During this period, the author also actively wrote weekly reports that were required to be submitted to Infinite Learning. The documentation from these weekly reports served as supporting material for validating the observations.

2) Confirmatory Interview

In conjunction with the explanatory case study method grounded in correctional research [27], the author completed a confirmatory interview to explain the "On Time, On Budget, and High Quality" efficiency triangle in the production management of Animation Department.

The confirmatory interview content focused on those who work directly on the animation aspect of the game, including the project manager, animator, and game designer.

TABLE I. INFORMANT TABEL

Informant Name	Position
Andi Suryawan	Project Manager
Arik Athallah	Member of Animation Department
M. Farras	Member of Game Developer Department

TABLE II. CONFIRMATORY INTERVIEW OF ANDI SURYAWAN

No	Informant	Andi Suryawan
1	Is the initial planning to work on standard animation pipeline, which is, pre-production, production, and post-production considered an efficient way of working?	Yes, the initial planning to follow the standard animation pipeline pre-production, production, and post-production is considered an efficient way of working. This structured approach helps ensure that each stage is well-prepared and executed, reducing the risk of major revisions later and improving overall workflow clarity, especially in collaborative projects like Yudhistira.
	Is the use of management tools Trello and Google Sheets considered efficient in organizing	Yes, the use of management tools like Trello and Google Sheets is considered efficient in organizing work time and distributing

	work time and distributing animation tasks since the initial planning? Is there a specific reason for using Trello and Google Sheets?	animation tasks from the early planning stage. Trello is effective for visual task management using boards and cards, which helps track progress and assign responsibilities clearly. Google Sheets, on the other hand, is useful for documenting schedules, timelines, and task lists in a flexible and accessible format. The specific reason for using these tools is their simplicity, accessibility, and ability to support collaboration in real-time, which is especially important when the team is small or working remotely.
2	Does the division of tasks based on members' abilities in the animation department make the production process run efficiently? In terms of, the animation department can reduce work overlap with other departments, miscommunication, and repetition of work (due to revisions).	Yes, dividing tasks based on members' abilities in the animation department helps the production process run more efficiently. It minimizes work overlap with other departments, reduces miscommunication, and lowers the chances of repeating work due to revisions. By assigning tasks according to each animator's strengths, the team can focus on their expertise, which streamlines collaboration and improves overall productivity.
	Does the animation department have its own coordinator, apart from the main game production coordinator?	No, the animation department does not have its own coordinator separate from the main game production coordinator.
3	Is the effectiveness of the assigned work order, and the team's ability to address problems and revisions, considered to make the animation department work efficiently until the end?	Yes, the effectiveness of the assigned work order and the team's ability to handle problems and revisions have contributed to the animation department working efficiently until the end. Clear task assignments help maintain focus and workflow, while the team's adaptability ensures issues are resolved promptly, minimizing delays and maintaining overall productivity.
	Is this kind of game project worth continuing for the next batch based on your experience?	Yes, the game project is worth continuing for the next batch, with a few adjustments needed in the execution to improve efficiency and quality.

Tabel II. is the answer of respondent about the implementation of efficiency in the Animation Department.

TABLE III. CONFIRMATORY INTERVIEW OF ARIK ATHALLAH

No	Informant	Arik Athallah
1	Is the initial planning to work on standard animation pipeline, which is, pre-production, production, and post-production considered an efficient way of working?	It's pretty good using the gdlc method.
	Is the use of management tools Trello and Google Sheets considered efficient in organizing work time and distributing animation tasks since the initial planning? Is there a specific reason for using Trello and Google Sheets?	Very helpful.
2	Does the division of tasks based on members' abilities in the animation	In terms of task distribution, the members are actually

	department make the production process run efficiently? In terms of, the animation department can reduce work overlap with other departments, miscommunication, and repetition of work (due to revisions).	still beginners, including me, especially in the animating for game project.
	Does the animation department have its own coordinator, apart from the main game production coordinator?	No, it doesn't.
3	Is the effectiveness of the assigned work order, and the team's ability to address problems and revisions, considered to make the animation department work efficiently until the end?	Yes, it is true that this project is carried out according to the members' capabilities.
	Is this kind of game project worth continuing for the next batch based on your experience?	It's very worthy, the concept is good, but because our team was just formed and had limited skills, it wasn't optimal, but if we want to continue and improve the game to make it even better, it's definitely possible.

Tabel VI. is the answer of respondent about the implementation of efficiency in the Animation Department.

TABLE IV. CONFIRMATORY INTERVIEW OF ANDI SURYAWAN: EFFICIENCY PARAMETER.

No	Informant	M. Farras
1	Is the initial planning to work on standard animation pipeline, which is, pre-production, production, and post-production considered an efficient way of working?	Yes, the three stages helped a lot.
	Is the use of management tools Trello and Google Sheets considered efficient in organizing work time and distributing animation tasks since the initial planning? Is there a specific reason for using Trello and Google Sheets?	Not really. For our team, the use of Trello is useful but it's kind of new to the team so we're not able to use it properly at the time.
2	Does the division of tasks based on members' abilities in the animation department make the production process run efficiently? In terms of, the animation department can reduce work overlap with other departments, miscommunication, and repetition of work (due to revisions).	Yes, it made the production quite smoothly.
	Does the animation department have its own coordinator, apart from the main game production coordinator?	I don't have much info about that.
3	Is the effectiveness of the assigned work order, and the team's ability to address problems and revisions, considered to make the animation department work efficiently until the end?	I don't have info to that.
	Is this kind of game project worth continuing for the next batch based on your experience?	Yes, making this kind of games especially in Indonesia, is something new and could have a potential in the entertainment industry. I believe if we managed to efficiently develop

		the game industry in the country, it could strive and even became as big as the other countries.
--	--	--

Tabel VIII. is the answer of respondent about the implementation of efficiency parameter.

3) Documentation Review

Documents such as production schedules, project management records, and animation guidelines were examined to validate interview data. These documents provide concrete evidence regarding timelines, resource allocation, and quality standards.

In the "Yudhistira" game project, the team utilised Trello and Google Sheets as management tools to actively manage and document progress, errors, revisions, and additional notes.

Project Start: Rab, 3/6/2024
Today: Rab, 3/6/2024
Display Week: 1

TASK	ASSIGNED TO	PROGRESS	START	END
Design				
Mencari referensi	Farras	100%	3/6/24	3/7/24
Membuat GDD kasar	Farras	100%	3/7/24	3/11/24
prototype - GDD Final	Dimas / Farras	100%	3/12/24	3/19/24
Concept Art Character/Weapon	Athallah	100%	3/7/24	3/19/24
Produksi				
Asset Game	Athallah, Farras	100%	3/20/24	4/30/24
UI/UX	Farras	100%	3/20/24	4/30/24
Programming	Winner, Dimas	100%	3/20/24	4/30/24
Final				
Polishing		50%	5/1/24	5/30/24
fixing bug		25%	5/10/24	5/11/24
Testing		50%	5/11/24	5/30/24
Trailer		100%	5/15/24	5/22/24
Submit Game		100%	5/29/24	5/29/24

Fig. 5. Google Spreadsheet as management tool for Yudhistira

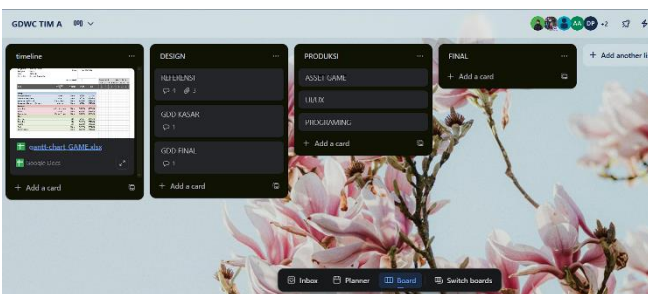


Fig. 6. Trello as management tool for Yudhistira

Google Drive also plays as management tools, specifically for animation and game assets throughout different folders and specification.

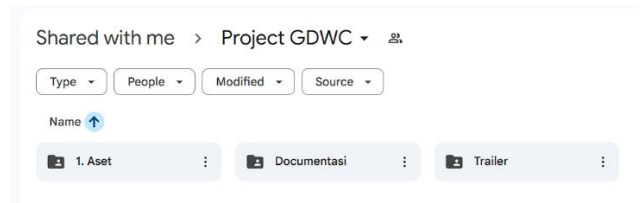


Fig. 7. Google Drive as management tools for assets creation

For example, characters in the game divided into 2 types, which Good and Evil character. The two types divided into separated folders, and also put into the 'Work in Progress (WIP)' folder and 'Done' folder as Figure 8 provided.

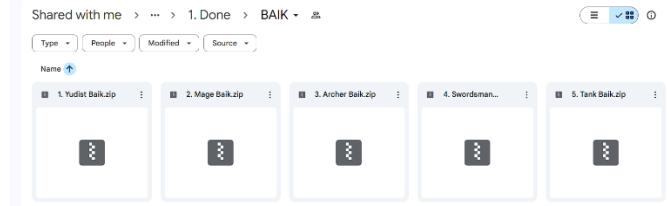


Fig. 8. Folders of game assets in Google Drive

C. Modes of Data Analysis

The qualitative phases are data reduction, data display, and interpretation of the conclusion or verification [Huberman]. The qualitative analysis phases in this research are as follows:

1) Data Reduction

Choosing, organising, simplifying, and transforming 'rough' data based on field notes, interview transcripts, documentation, or observation records [26]. The author conducted a confirmatory interview with the research subjects, reviewed the documentation of management tools, and processed the weekly reports archive, as data resources to analyse the compatibility of the effectiveness and efficiency parameters of the implementation in the game project, "Yudhistira".

2) Data Display

The author will summarise and systematically organise the collected data to emphasise key points and determine their relevance to the research objectives. The author will then present the processed data using various matrices, diagrams, and bar charts, following the display techniques proposed [26]. To display the findings, the author will use tables to present the results of confirmatory interviews and include images needed to support the documentation of management tools.

3) Interpretation of Conclusion and Verification

The conclusion focused on analysing the relevance and differences, as well as the compartmentalisation of research subjects with their respective provided data [26]. Moreover, continuing to the last step, verification is intended to measure data compatibility with the intent contained in the basic concepts of the research, objectified.

IV. RESULTS

The author begins by summarising the results of the confirmatory interview conducted with three selected members of the game project "Yudhistira". This interview aimed to test the compatibility of triangle efficiency across the pre-production, production, and post-production stages.

Each respondent shared their perspectives based on their roles and direct involvement in the animation production process. The next step is to provide information based on observation and documentation review. The results of collected data served in 3 parts following the triangle efficiency model:

1) *On-Time Delivery Through Structured Animation Pipeline*

Observation during the internship project indicated that the Yudhistira game development was completed within the planned timeframe. The project was initially targeted to be finalized one week before the Global Game Development Competition (GDWC) submission, with a backup deadline set for three days prior. In practice, the game was delivered two days before the submission deadline. This outcome highlights both the strength and limitation of the time management strategy applied. On the one hand, the delivery ensured the product could undergo basic beta testing and bug fixing, a crucial step in game publishing. On the other hand, several animation assets remained incomplete or required revision, particularly in the character rigs and motion smoothness, resulting in jitter and unfinished polish. The final output of the animation assets met the GDD, which is low-poly type.



Fig. 9. UI Interface of game project Yudhistira



Fig. 10. UI Interface design of game project Yudhistira



Fig. 11. Game play of game project Yudhistira



Fig. 12. Game play of game project Yudhistira

Confirmatory interviews reinforced this observation, as respondents consistently noted that while the structured pipeline supported progress, the time allocation was not sufficient for refining details. The animation team's adherence to the general pre-production, production, and post-production stages aligned with industry practice, yet the pressure of the internship's four-month duration forced prioritization of core deliverables over visual polish.

Documentation review of the project's Gantt chart (Figure 3) and Trello board (Figure 4) further illustrated the emphasis on deadline management. While Trello was used mainly for high-level task assignment and communication with remote mentors, Google Sheets with a Gantt chart structure was the primary reference point. The visibility of overlapping tasks allowed the animation team to synchronize with programmers, ensuring assets were delivered on time for integration. Nevertheless, the time efficiency came at the expense of final polish, illustrating the trade-off described in project management theory between timeliness and quality.

2) *Budget Efficiency as Resource Allocation*

The Yudhistira project was developed without a financial budget, as it was conducted as part of the MSIB internship program with four student developers and mentorship support from Infinite Learning. This condition presented both a challenge and a unique context for analyzing budget efficiency. Since no direct monetary resources were allocated, efficiency was measured through the utilization of human resources, software tools, and available institutional facilities.

From observation, the reliance on free and open-source tools, as well as institution-provided software licenses, allowed the project to progress without financial constraints. However, this also limited the ability to upgrade certain aspects, such as advanced rigging plugins or premium asset libraries, which might have improved animation quality and development speed. Interview results revealed that respondents perceived the absence of budget as both liberating—due to the focus on creativity rather than financial concerns—and limiting, since the lack of funding hindered scaling or polishing the game beyond its learning objectives.

The documentation review underscored this balance. Trello and Google Sheets, both free and user-friendly, enabled project management with no additional cost. However, the absence of financial incentives or external funding also meant that team motivation was primarily intrinsic, dependent on the students' commitment to completing the internship successfully. As a result, the project demonstrated how

budget efficiency in a zero-cost context translates into maximizing available resources, rather than balancing expenses against outputs.

3) *Maintaining Animation Quality within Constraints*

The final output of the game project Yudhistira game was a playable 2D low-poly vertical-scrolling game with strong Indonesian cultural elements embedded in its character designs and weapons. From an animation perspective, all core characters were completed with full attributes and functional motion. However, observations revealed significant technical constraints in the animation quality. Jittery movements, suboptimal rigging, and incomplete polish were noticeable, reducing the overall smoothness and visual appeal of the final product.

Confirmatory interview findings echoed this limitation, with respondents agreeing that while the animation assets met functional requirements and represented the intended artistic direction, they did not fully reflect professional standards of polish. This is consistent with the literature on project management efficiency, which emphasizes the trade-off: when time and resource constraints dominate, quality often becomes the sacrificed element.

The documentation review supported this conclusion. The structured pipeline—design, production, and final integration—ensured that every character asset was delivered into the game system. However, the late-stage revisions required to fix character-weapon synchronization and prevent rigging failures during integration were only partially resolved due to time pressure. This illustrates how the animation team prioritized deliverability over refinement, a pragmatic but imperfect balance under the given constraints.

V. DISCUSSION AND CONCLUSION

A. Discussion

The findings of this study highlight both the strengths and weaknesses of the animation production management in the Yudhistira game project. The animation pipeline proved efficient in terms of structured task allocation and alignment with the overall game development process. Deliverables were produced within the limited four-month internship period, and the use of a Gantt chart helped maintain synchronization with other departments. In this regard, the pipeline demonstrated time efficiency, ensuring that all essential animation assets were completed and integrated into the final build before the GDWC submission.

However, inefficiencies became evident in the quality dimension. Character animations often displayed jitter, rigging inconsistencies, and unfinished polishing. These shortcomings were largely caused by a combination of factors: limited technical skills in advanced rigging, reliance on free tools with restricted functionality, and compressed timelines that prioritized functionality over refinement. Communication between remote and on-site members also contributed, as asynchronous updates occasionally delayed feedback cycles.

When compared to existing literature, the results align with the principles of Bethke's (2003) triangle, which argues that achieving all three constraints—on-time, on-budget, and high-quality—is practically unattainable. In this project, time and cost were controlled, but quality was sacrificed, echoing the theoretical trade-off. Similarly, the project workflow

demonstrated characteristics of Agile methods, such as iterative testing and constant adjustment, yet without the full flexibility of Agile due to the fixed internship timeline. These findings suggest that while the animation department operated within established project management theories, its limitations highlight the gap between academic or student-driven projects and professional industry standards.

The implications for future animation production management in game development are significant. First, structured pipelines should continue to be used, as they provide clarity and ensure on-time delivery. Second, skill development in specialized areas such as rigging and polish should be prioritized through targeted training or access to advanced tools. Third, improved communication systems, potentially supported by real-time collaboration platforms, may reduce delays and strengthen coordination between departments. Finally, simulation of budget allocation—even in zero-cost projects—could provide valuable practice in resource management and prepare teams for industry conditions.

Despite these insights, this study is limited by its reliance on a single case project, a small team size of four members, and qualitative measures such as observation, interviews, and document review. While these methods provide rich contextual data, they restrict the generalizability of the findings. Future research should incorporate multiple projects, larger teams, and mixed-method approaches, including quantitative data such as production time logs or quality rating scales.

B. Conclusion

This research examined the implementation of animation production management in the Yudhistira game project, focusing on the efficiency triangle of on-time delivery, budget/resource efficiency, and maintaining quality. The results showed that the structured animation pipeline enabled timely completion and resource-efficient production, consistent with project management literature. However, quality was compromised due to limited skills, tool constraints, and compressed schedules.

The study confirms the relevance of Bethke's project management triangle and Agile-informed practices in the context of student-led projects. It also emphasizes the inherent trade-offs in managing time, budget, and quality, particularly when projects are conducted under strict timeframes and with limited resources.

Recommendations for future projects include

- 1) continuing the use of structured pipelines for task management,
- (2) improving team skill sets in specialized animation areas,
- (3) enhancing communication with collaborative tools, and
- (4) simulating budgetary practices to prepare for industry-standard project management.

While limited in scope and methodology, this study contributes to understanding how animation departments can manage production within the constraints of academic or learning-based projects. It underscores the importance of balancing efficiency parameters and provides a foundation for refining animation production management practices in future game development initiatives.

