Exclusive Games Access in A Cross-Platform Environment – An Analysis of How Game Producers Maximize Long-Term Profit

Maryam Hassanlou
California State University, San Marcos, San Marcos, California, USA

Yi Sun
California State University, San Marcos, San Marcos, California, USA

Fang Fang*
California State University, San Marcos, San Marcos, California, USA

In the rapidly growing video gaming industry, multiple key players shape its trajectory: game developers, publishers, and hardware/software platform providers. Our study investigates the strategic decisions of game publishers in maximizing profits through exclusive game access. Focusing on the dynamic relationship between publishers and platforms, we propose a multi-objective model to analyze why and when publishers opt for exclusive deals with certain platforms, potentially disadvantaging other platforms, and their players. Based on Integer Goal Programming, we designed the model to optimize multiple objectives of profit and user experience with constraints. Utilizing the MATLAB R2023a Optimization solver, we provide optimized access allocations for platforms and game features, to support the supply chain equilibrium strategy of game development and subscription businesses. This contribution enhances our understanding of the cross-platform gaming landscape by shedding light on the complex dynamics between publishers and platforms.

* Corresponding Author. E-mail address: fangfang@csusm.edu

I. INTRODUCTION

In the new era of electronic entertainment, the video gaming industry stands out as one of the most rapidly advancing sectors within the broader entertainment domain. With a global revenue estimated at USD 224.9 billion in 2022, the industry is projected for sustained growth at a rate of 10.5% annually through 2032, creating a US$610.6 billion industry (Precedence Research, 2023).

The video gaming industry involves multiple key players (Figure 1): game developers, responsible for creating games with intricate storylines and captivating artworks; game publishers, who commission, finance, and distribute video games from developers; and hardware/software platform providers, offering platforms for video games to run on. Additionally, game players decide which game to play and determine the platform to acquire for gaming. Developers may operate independently or as subsidiaries of publishers. Often, they lack the resources to produce, deliver, and support a game independently. Consequently, they frequently rely on publishers for assistance in bringing their products to platforms and gaining visibility within the gaming community. The interdependent relationship between publishers and platform providers is essential for bringing a game to market. Games can be developed for a single platform or adapted to run on multiple platforms as needed.

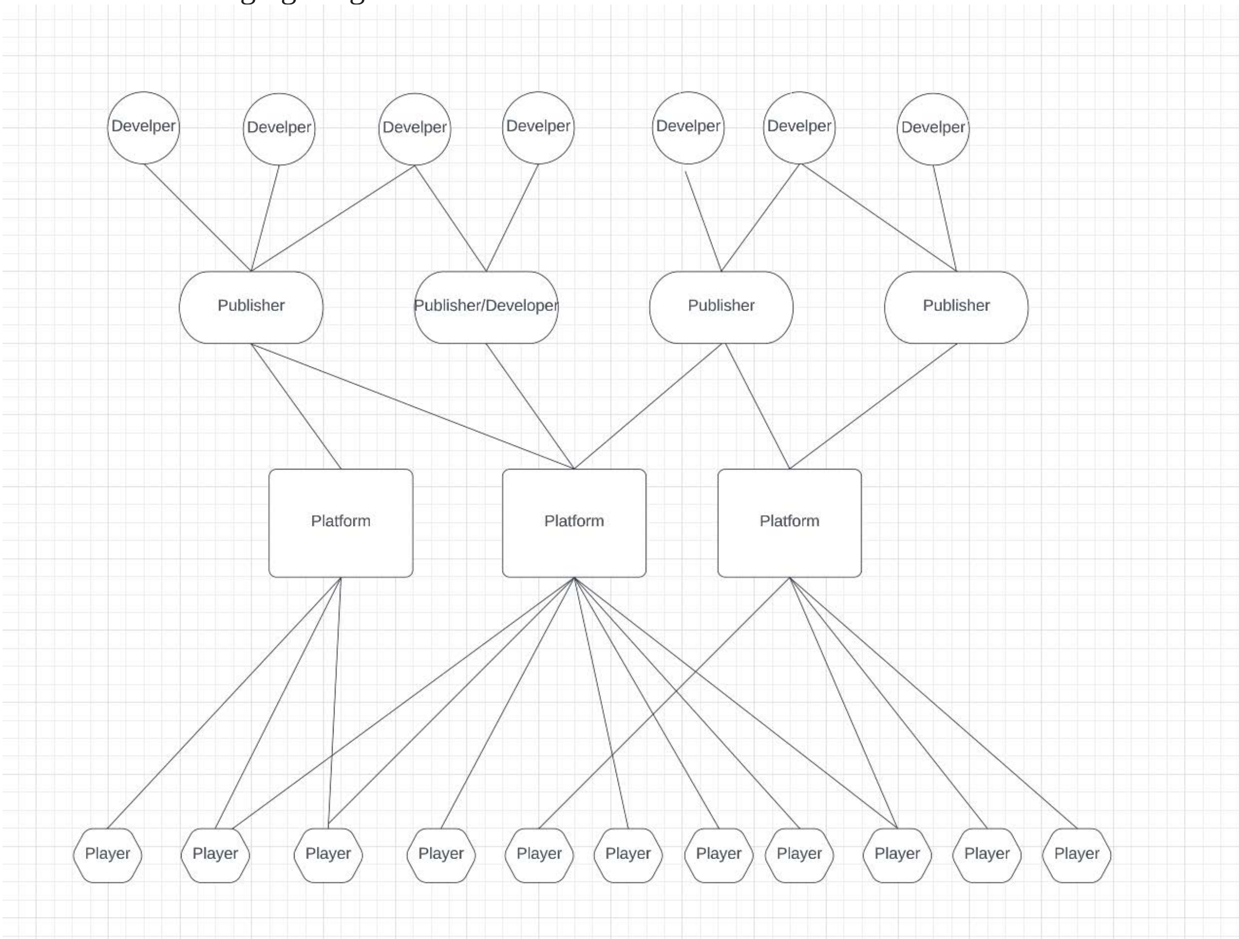

FIGURE 1. GAME INDUSTRY PLAYERS AND THEIR RELATIONSHIP

Our study focuses on the relationship between publishers and platform providers, exploring how publishers strategically ally with the latter to maximize profits and game qualities. The research will delve into the supply chain equilibrium strategy of game subscription businesses, including the channels they choose and the charges, from the perspective of publishers. We focus on the relationship between publishers and platforms, assuming an alignment of interests between game developers and their publishers, wherein both parties seek to maximize profits and game quality.

To analyze why and when publishers engage in exclusive deals, disadvantaging players on one platform over another, we developed a binary multi-objective model with multiple constraints. We will implement Integer Goal Programming (IGP) to tackle the problem. The optimization model will be solved using the MATLAB R2023a Optimization solver. We will then conduct numerical experiments to demonstrate the model's agility and robustness.

We organize the remainder of this paper as follows: Section 2 reviews the current interactions and incentives among all players in the gaming industry, providing a rationale for our model and approach. Section 3 introduces an analytical game-theory model to analyze the publishers' decisions.

Numerical analyses and results are presented in Section 4, followed by a series of sensitivity analyses in Section 5. Finally, Section 6 discusses the strengths, limitations, and potential future extensions of this study.

II. LITERATURE REVIEW AND RATIONALES

The rapid expansion of the gaming industry in recent times can be attributed to various factors. A significant contributor has been the global lockdowns enforced due to the Covid-19 pandemic (Hall, 2020). Additionally, technological advancements, including the impressive capabilities of real-time graphics rendering, the widespread availability of mobile devices, and the increasing internet penetration rate, play pivotal roles in propelling the market's growth (Grand View Research, 2023).

Consequently, multiple academic research has delved into the video game industry, exploring the dynamic relationships among key players. Fang et al. (2016) examined publishers' strategies, analyzing the impact of releasing different versions of a game on pricing dynamics. Haviv et al. (2020) investigated the spillover effects within platform economies concerning the sales of video game software. Zhou (2017) explored the two-sided market of video game sales, concluding that the dynamic behavior of platform participants significantly influences platform adoption and the affiliated product market. Our research differs from others by focusing exclusively on the relationship between publisher and platform.

Publishers are active in creating and distributing games to various platforms. Some prominent names in the industry include Activision Blizzard, Electronic Arts, Take-Two Interactive, Bandai Namco Entertainment, Bethesda Softworks, Ubisoft, and Sega. Some even have their in-house game developers. These publishers cater to a diverse range of platforms, which can be categorized as hardware platforms, virtual machines, or software platform players. Key players in the hardware platforms include Nintendo, Microsoft, and Sony, alongside the broader landscape of PCs (Windows and Mac) and mobile devices (Android and IOS). Virtual machine vendors include Oculus, Apple Vision, Samsung, Sony, etc. On the software side, platforms like Tencent, Facebook, and NetEase also play a significant role in the digital gaming ecosystem. It's noteworthy that several publishers operate independently of specific platforms, although certain platforms have established their own in-house publishers or studios. For instance, Sony owns Naughty Dog, while Microsoft possesses the ownership of Bethesda Game Studios and Mojang Studios.

To simplify the analysis, we assume that the goals of the game developers align with the publishers during negotiations with platform providers. For each game, the publisher determines whether it will be cross-platform or exclusive to a particular platform. Once this decision is made, the game is then developed specifically for the chosen platform(s). To engage with a game, a player must acquire the platform(s) for which the game was designed. In the case of an exclusive game, players are required to obtain that specific platform. Conversely, for games distributed across multiple platforms, players have the flexibility to choose the platform on which they wish to purchase the game. If a player already possesses a particular platform, they can opt to purchase the game for that platform or invest in a new platform, incurring additional costs. Typically, players with multiple platforms enjoy the freedom to acquire the game for any one of their platforms. Unfortunately, consumers still face the need to purchase distinct copies of games if they desire to play the same game on different platforms.

Exclusive games have been a longstanding trend in the gaming industry, maintaining their popularity even today. For instance, the critically acclaimed video game "The Last of Us," developed by Naughty Dog, was exclusively designed for the Sony PlayStation until the year 2023. Similarly, the iconic "Halo" franchises have consistently been released exclusively on Microsoft's Xbox video game console. If players plan to play titles like "Animal Crossing" or "Super Mario," their only option is to acquire Nintendo consoles, as these games are specifically tailored for Nintendo's platforms.

The alliances forged between publishers and platform providers play an important role in fostering platform loyalty among players while also incentivizing platform providers to actively market on behalf of the publishers. Moreover, various platforms require different programming and boast distinct features and capabilities, necessitating publishers to create multiple different copies of the same game and potentially customize each copy to align with the unique requirements and expectations of each platform. This approach, while broadening the game's reach, often results in increased development costs and time. Conversely, a focused strategy on a single platform allows developers and publishers to channel their expertise into crafting a singular, high-quality game. This concentration can lead to enhanced art direction, superior game design, and fewer technical issues, all achieved with reduced costs and development time. Publishers and developers, immersed in the intricacies of a specific platform, gain a strategic advantage over counterparts coping with the complexities of ensuring portability across multiple platforms. However, exclusive game offerings might impact the affordability of the game for players on different platforms.

Nevertheless, the incentives for publishers to offer cross-platform games are plentiful. Recognizing that each player has their preferred platform, the prospect of purchasing a new platform solely for a specific game can be a financially demanding proposition for many individuals. Introducing cross-platform games can help mitigate the financial burden on players, making access to a game more affordable. Consequently, this approach has the potential to maximize impact by reaching a broader target audience. Beyond cost considerations, cross-platform games contribute to a more inclusive and interconnected gaming community, enriching the overall gaming experience for players. They bring together players from diverse platforms, enabling them to engage in competitive or cooperative gameplay. This union of players fosters a higher level of shared social experience, breaking down platform-specific barriers.

While developing cross-platform games may introduce challenges such as increased costs and extended time to market, it might be a worthy endeavor considering the potential for expanded reach and revenue. Typically, the game development process begins with the creation of a single code base, incorporating the majority of the plot and artwork (Starloop Studios, 2023) This foundational code can be designed to be platform-independent, allowing for subsequent adaptation to different platforms, albeit with additional costs. Despite the initial investment, the economy of scale inherent in using a single code base for multiple platforms often results in a more cost-effective overall development process compared to creating independent games for each platform from the ground up. This approach not only streamlines development costs but also contributes to a reduction in maintenance expenses and time. Updates, patches, and improvements can be implemented at the core code base, with these changes propagated to all platforms later. Consequently, the cross-platform strategy not only maximizes efficiency in development but also offers long-term advantages in terms of cost-effectiveness and simplified maintenance processes.

Game features refer to distinct aspects or functionalities within a game that enhance the gameplay experience, entertainment value, engagement, and complexity. Some examples are Power-Ups and abilities, multiplayer modes, customization of characters and environments, quests and missions, achievements and trophies, etc. Typically, games designed for cross-platform play strive to offer uniform features and experiences across all supported platforms. However, certain publishers may opt to enter exclusive agreements with a specific platform, granting it unique features and exclusive content. This strategic decision not only enhances the platform's appeal but also provides a distinctive gaming experience for users on that platform. Furthermore, publishers might opt to exclude certain platforms from their releases, focusing their efforts on a select few. This decision stems from a blend of technical and marketing considerations.

A few years ago, Sony and Activision entered into an exclusive agreement for the popular video game Call of Duty. This deal granted PlayStation players a competitive edge over PC and Xbox players, allowing them to level up their weapons and characters faster and gain quicker access to Battle Pass content through additional tier skips. The tier skips mean they'll get access to Battle Pass content quicker. In addition, even though players on PC and Xbox pay the same amount for their copy of the latest Call of Duty published by Activision in 2021, they'll go without an entire game mode for an entire year and be subject to a competitive disadvantage if they have cross-play enabled and compete with players using Sony Playstation (Ivan, 2021). Subsequently, another agreement between Sony and Activision restricted Call of Duty titles from being available on Game Pass, Xbox's subscription platform, for a designated period (William, 2022). This arrangement further shaped the gaming landscape, impacting accessibility and gameplay experiences across different platforms.

In the quest for a competitive edge, platforms often strategically acquire publishers and developers, ensuring an uninterrupted stream of exclusive games. For instance, SONY has a portfolio of developers and studios, resulting in many games exclusively available on PlayStation platforms. Adding an intriguing twist, in January 2022, Microsoft, the owner of Xbox, announced a monumental $68.7 billion acquisition of Activision. The implications of making games, particularly the popular Call of Duty franchise, exclusive to Xbox or limiting availability on other platforms, remain uncertain. While both Microsoft and Sony have engaged in acquisitions, it doesn't automatically translate into an abundance of exclusive games for their consoles. Notably, Microsoft, in its bid to address concerns raised by the Federal Trade Commission, pledged to keep games like Call of Duty available to other platforms for an extended period, suggesting a commitment to maintaining a degree of cross-platform accessibility. The evolving landscape of publisher/developer ownership continues to shape the gaming industry, particularly in terms of game exclusivity.

The decision to offer games exclusively on one platform or across multiple platforms is a crucial one for independent publishers, influencing their profit maximization strategies. Few research has explored this question in the context of game releases. This paper aims to bridge the gap by investigating the optimal pricing and alliance strategies for publishers in this thriving video gaming industry. The primary focus of this study is to understand the conditions under which exclusive offerings or multi-platform releases can become financially advantageous for a publisher. Furthermore, this study aims to enhance the overall quality of games deployed across multiple platforms. Given the shared base code among platforms, variations in the quality of different copies are largely attributed to the additional features implemented on each platform. Analyzing and optimizing these features become key considerations for publishers trying to elevate the overall gaming experience across diverse platforms. Through this comprehensive exploration, the paper aspires to provide valuable insights into the nuanced decision-making processes that can steer publishers towards both financial success and heightened game quality in this industry.

This study employs the Analytic Hierarchy Process (AHP) and the Brown-Gibson (BG) methods to evaluate the attributes of game features. The AHP is a multi-criteria decision-making methodology particularly suitable for situations where due regard for individual beliefs is critical. This approach utilizes pair-wise comparisons and eigenvectors to prioritize alternatives, based on the theoretical framework introduced by Saaty [1980, 1982] and further developed by scholars like Arbel and Oren [1986], and Harker and Miller [1990].

To help alleviate criticisms of AHP's pair-wise comparisons, which are labor intensive and could be unreliable under some circumstances, the study integrates the BG method to enhance the assessment of quality. The BG method uses actual data to derive the relative merits of alternatives along criteria that can be measured objectively. It only relies on human judgments for intangible criteria. For a detailed discussion of how AHP and Brown-Gibson work together and their practical applications, readers are referred to the research conducted by Sun, He, and Leu (2007).

III. MODEL FORMULATION

For convenience, we assume there are I number of video game platforms. A publisher needs to decide which platform(s) to release its game on. It also needs to choose which feature(s) j to include on each platform i. We assume that the cost of developing the basic game is C and adapting it to platform i will have a marginal cost of C_i.

The initial cost of developing the game's base code is C, and adapting it to platform i incurs a marginal cost of Ci. Additionally, each feature added to platform i has an associated cost of C_{ij}. The quality of feature j on platform i, denoted as Q_{ij}, can be measured in terms of various factors such as security, robustness, desirability, latency, playability, etc. Prices the publisher can charge platform i for the basic game and features are P_i and P_{ij}, respectively. The publisher allocates a specific budget, denoted as B_i, for the development of the game on each platform i. Time considerations play a crucial role in this decision-making process. The time required for adapting the basic game to platform i is denoted as T_i, while the time needed for developing and adding feature j to platform i is denoted as T_{ij}. Additionally, we assume that the overall time to bring the game to market for platform i is represented by TA_i.

TABLE 1. SUMMARY OF NOTATION

Parameters
I: total number of platforms $I = 1 \ldots I$

J: total number of game features *j= 1… J*
P_i: price of basic game for platform *i*
P_{ij}: price of feature j on platform *i*
C: cost of developing the basic game
C_i: marginal cost of adapting the base game to the platform *i*
C_{ij}: cost of adding feature j on platform *i*
Q_{ij}: quality of feature j on platform *i*
B_i: total available budget for adapting the basic game to platform i with features
T_i: time to adapt the basic game to platform *i*
T_{ij}: time to implement feature j on the platform *i*
TA_i: maximum time allowed to adapt basic game with features to platform *i* for market once basic game is developed.

Decision Variables
Y_i: binary variable; takes 1 if platform *i* is selected by a publisher
X_{ij}: binary variable; takes 1 if a publisher offers feature *j* to the platform *i*

$$Max\ Z_1 = \sum_{i=1}^{I}((P_i - C_i) * Y_i + \sum_{i=1}^{I}\sum_{j=1}^{J}(P_{ij} - C_{ij}) * X_{ij} - C$$

$$Max\ Z_2 = \sum_{i=1}^{I}\sum_{j=1}^{J} Q_{ij} * X_{ij}$$

Subject to:

$$Y_i \geq X_{ij}\ ; \quad \forall\ i \qquad (1)$$

$$C_i * Y_i + \sum_{j=1}^{J} C_{ij} * X_{ij} \leq B_i\ ; \quad \forall\ i \qquad (2)$$

$$T_i + \sum_{j=1}^{J} T_{ij} * X_{ij} \leq TA_i\ ; \quad \forall\ i \qquad (3)$$

$$X_{ij}\ , Y_i \in \{0, 1\}\ , \quad \forall\ i, j$$

IV. NUMERICAL EXAMPLE

The following hypothetical numerical example, coupled with the sensitivity study in the subsequent section, has been chosen to showcase the agility and robustness of the proposed model.

In this illustrative experiment, we consider a scenario where a publisher plans to release a game in a market encompassing 10 video game platforms. The publisher's decisions involve determining the platforms for game development and specifying the features of each selected platform. For this experiment, we constrained the number of game features to 100.

The price for the basic game can be negotiated with the platform and can range from 5 to 10 million dollars. Individual features incur costs ranging between $5,000 to $10,000. The cost of developing the base code is a fixed amount of 3 million dollars.

The costs of adapting the base code to each platform are randomly generated and range between $500,000 and $1,000,000. Additionally, the costs for adding features to the game adapted for each platform are randomly generated, ranging between $1,000 and $3,000. The evaluation of feature quality on each platform is conducted through the application of AHP and BG methodologies. Quality ratings are assigned on a scale ranging from 0 to 10, allowing for a comprehensive assessment of the features offered on each platform.

The total available budget for adapting the base code to a platform with features is randomly generated and ranges between $1,000,000 and $1,500,000. The time required to adapt the base code to each platform is also randomly generated, falling within the range of 50 to 100 days. Additionally, the time needed to implement feature *j* on a particular platform is randomly generated and spans between 1 and 10 days. To meet market release requirements, the maximum allowable time for adapting the base code with features to platform *i* is randomly generated, ranging between 200 and 300 days.

The total available budget for adapting the base game to a platform with features is randomly generated and ranges between $1,000,000 and $1,500,000. The times to adapt the base game to each platform are randomly generated and range between 50 and 100 days. The time to implement feature *j* on a particular platform is randomly generated and ranges between 1 and 10 days. The maximum time allowed to adapt the basic game with features to platform *i* for the market, once the base game is developed, is randomly generated and ranges between 200 and 300 days.

We introduced a multi-objective model and utilized the Integer Goal Programming technique to address it. However, as our objectives are not in the same measurement scales, we need to employ normalization or scaling techniques to bring the objectives to a comparable range before combining them. To achieve this, we converted each objective function into a common scale by normalizing them using min-max technique. This step is necessary to ensure that the different objectives are comparable and have similar magnitudes.

We used MATLAB R2023a Optimization solver for the supposed numerical example to find the best assignments of platforms and features. Subsequently, we conducted sensitivity analysis to assess the model's robustness and verify the reliability of the results. The result is shown in Table 2.

TABLE 2. RESULTS INCLUDING DECISION VARIABLES AND OBJECTIVE FUNCTION

Objective Function 1 Value (Overall Profit)	69,223,988
Objective Function 2 Value (Overall Quality of Features)	2,555
Overall number of Assignment features to platform	512
Number of Platform Selected	10

V. SENSITIVITY ANALYSIS

In this section, we conducted numerical experiments to demonstrate the agility and robustness of the model. Various parameter values were deliberately varied to assess the model's sensitivity and extract managerial insights.

Table 3 illustrates the sensitivity of objective function values to different marginal costs of adapting the base code to the platform in the model, with C fixed at 3 million dollars. Five distinct levels of C_i were created by multiplying the original cost with factors of 1/4, 1/2, 1, 2, and 4. The results demonstrate that, while keeping the cost of building the base code constant, a higher adaptation cost corresponds to lower profit while only marginally increasing the overall quality.

In Table 4 shows the sensitivity of objective function values to different costs of adding features to the platform in the model, with both C and C_i fixed. Five levels of C_{ij} were established by multiplying the original cost with factors of 1/4, 1/2, 1, 2, and 4. The results indicate that, with the costs of building and adapting the base code being held constant, an increase in feature cost corresponds to lower profit, while the overall quality remains unaffected.

Tables 5 shows the sensitivity of objective function values to the different times required to implement the features in the model, we introduced 5 levels of T_{ij} by scaling the original cost with factors of 1/4, 1/2, 1, 2, and 4. Our findings indicate that rushing the time frame to market results in a notable decrease in overall profit and a significant reduction in overall quality.

In Table 6, we explore the sensitivity of objective function values to different prices for implementing features in the model. With P_i fixed at 5-10 million, we established five levels of P_{ij} by multiplying the original price with factors of 1/4, 1/2, 1, 2, and 4. The results indicate that a higher price for features has the potential to increase profit, albeit with a slight reduction in overall quality.

TABLE 3. DIFFERENT MARGINAL COSTS OF ADAPTING THE BASE GAME TO THE PLATFORM

	C_i				
	0.25	0.5	1	2	4
Objective 1	**75,152,266**	**73,176,174**	**69,223,988**	**11,482,570**	**5,975,566**
Objective 2	**2,555**	**2,555**	**2,555**	**2,565**	**2,565**

TABLE 4. DIFFERENT COSTS OF ADDING FEATURES ON PLATFORM ON COST

	C_{ij}				
	0.25	0.5	1	2	4
Objective 1	**69,985,510**	**69,740,112**	**69,223,988**	**63,991,302**	**43,180,375**
Objective 2	**2,528**	**2,552**	**2,555**	**2,538**	**2,580**

TABLE 5. DIFFERENT TIME TO IMPLEMENT FEATURE *J* ON THE PLATFORM

	T_{ij}				
	0.25	0.5	1	2	4
Objective 1	**71,642,874**	**70,570,437**	**69,223,988**	**68,263,512**	**67,606,626**
Objective 2	**4,917**	**3,763**	**2,555**	**1,686**	**1,148**

TABLE 6. DIFFERENT PRICE OF FEATURE *J* ON PLATFORM *I*

	P_{ij}				
	0.25	0.5	1	2	4
Objective 1	**66,236,221**	**67,219,732**	**69,223,988**	**73,234,441**	**81,204,692**
Objective 2	**2,573**	**2,540**	**2,555**	**2,552**	**2,528**

VI. CONCLUSIONS

In this paper, we proposed a multi-objective maximization model. This model is designed to assist publishers in evaluating and determining the optimal platforms for publishing, as well as the features to be included on those platforms. The objectives include both profit maximization and the enhancement of overall feature qualities across platforms. Both objectives are vital for the sustained success of publishers in the dynamic game industry. Considerations in our model include measuring feature qualities, adhering to time constraints for market release, and managing budget constraints for development. Additionally, we conducted multiple sensitivity analyses on factors such as price, cost, and time to market, providing a better understanding of their impacts on the model's outcomes.

There can be several natural extensions to this model. First, we can study a competitive market in which multiple publishers seek profit maximization by making alliances and exclusive deals with platforms to gain strategic advantage. An exemplary case study in this regard involves the dynamic rivalry between Activision Blizzard's Call of Duty franchise and Electronic Arts' (EA) Battlefield series. Second, this research utilized generated data. While we created a simulated environment to approximate real-life data, incorporating actual data in future studies would provide a more accurate validation of the model and enhance the study's credibility.

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