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Article

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How agency alliances with complementors moderate quality assurance, product originality, and success in platform ecosystems

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ABSTRACT

Previous research on platform ecosystems has mainly focused on the relationships between users, complementors, and platform owners. However, the growing presence of agencies within platform-based markets has received little attention. Complementors are affiliated with an agency or work independently when offering products on a platform-based market. This study investigates the impact of agency affiliation on complementor success and explores how this relationship is influenced by product quality assurance and originality. Using a panel dataset of 188 mobile game applications from Google Play, we employ Generalized Least Squares (GLS) estimation to analyze agency alliance direct and moderating effects on complementor performance. Our findings indicate that an agency alliance is positively associated with complementor performance. However, it is better to work independently when complementors are capable of developing products that can differentiate themselves from competitors. This study contributes to the literature by shedding light on agencies' role as intermediaries within platform ecosystems and expands our understanding of platform dynamics.

1. Introduction

Platform ecosystems have become more dominant in today's economy. Some of the most prominent platform companies, including Apple, Google, Amazon, and Facebook, were ranked by Forbes as the world's most valuable brands (Forbes, 2025) and were also named among the best global brands on the Interbrand index (Interbrand, 2024). Broadly speaking, platforms are foundational systems upon which external firms develop complementary products, technologies, or services (Gawer, 2009; Gawer & Cusumano, 2014). A platform's purpose is to link or facilitate the exchange of products, services, or social currency (Choudary, 2015). An ecosystem refers to a set of organizations or entities that are highly co-dependent on each other's inputs and outputs (Moore, 1996). In particular, a platform ecosystem is described as a multi-sided market that enables two or more different groups to interact and encourages value-creating exchange (Cennamo & Santalo, 2013; Hagi & Wright, 2015). Attracting distinct user groups, referred to as sides or players (Gawer, 2009), crucially affects success in this market (Parker & Van Alstyne, 2005) due to the cross-side network effects in platform ecosystems (Bartels & Schmitt, 2022; Rochet & Tirole, 2003). Usually, these groups are complementors and end-users (Tiwana, 2014);

for example, job seekers and employers on online recruitment platforms or drivers and passengers on ride-sharing platforms. These groups have mutual influences, and the utility of one group depends on the presence of the other (Eisenmann et al., 2006).

A platform's most prominent role is to mediate between participants, making it easy and efficient for them to connect and exchange value (Evans & Schmalensee, 2016). Attracting both users and producers is key to platform success, and sustainable and repeated interactions are essential to nurturing platform ecosystems (Choudary, 2015). Thus, previous literature has focused on the diverse participants within these ecosystems.

The platform ecosystem generally consists of three actors, each assuming different roles. Platform owners hold property rights and design the platform's rules and components (Eisenmann et al., 2009; Schrieck et al., 2016). Complementors are supply-side actors offering complementary products or services (Gawer & Henderson, 2007; Schrieck et al., 2016). Users are demand-side actors who consume the platform's products or services (Tiwana et al., 2010). Although researchers have been investigating platform participants' strategies, their studies have mostly focused on platform owners' governance strategies (Lin et al., 2023) or complementors' product traits to succeed in a

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platform-based market (Tang & He, 2022; Wang et al., 2018). Increasing numbers of complementors and hyper-competition have caused some complementors to have mismatched strategies and capabilities. This mismatch motivates complementors to work with a contract broker, referred to as an ‘agency’ in our study. As platforms mature and ecosystems become more sophisticated, agencies are emerging as critical participants whose roles in mediating relationships and ensuring quality are growing in significance. While existing literature has extensively explored diverse participants within platform ecosystems, such as users, producers, and complementors, the role of agencies and their interactions with other players has been largely overlooked. Although some literature has acknowledged and theorized the rising significance of agencies in the platform ecosystem, empirical investigations into their roles and impacts remain scarce. Thus, our study aims to bridge this gap by empirically examining the behaviors of platform participants, shedding light on the role of agencies in platform ecosystems, and highlighting their underexplored contributions. The goal of this study is to provide a theoretical framework and empirical findings for the following questions:

Q1: How do agency alliances influence complementors’ success within platform ecosystems?

Q2: How does the influence of agency alliances vary based on complementors’ quality assurance and product originality?

Q3: Which complementors would benefit most from hiring an agency?

To answer these questions, we developed a set of hypotheses and empirically tested them in the mobile gaming market setting. This paper seeks to initiate the understanding of an agency’s role as a platform participant and illustrate the dynamics among platform ecosystem players. The remainder of the paper is structured as follows. First, we provide examples of agencies and discuss the research model for the empirical test. Next, we present the research methods and the results of the analysis. Finally, we discuss the managerial and academic implications.

2. Literature review

2.1. Research on platform ecosystems

Existing related research has examined the underlying mechanisms of platform success, demonstrating that platform owners must gain market share among end-user and complementor groups to succeed in fierce platform competition. The right design and appropriate governance are essential to coordinating a platform ecosystem with all stakeholders (Smedlund & Faghankhani, 2015). Several concepts have been proposed to identify the essential factors for effective platform design and governance. Among them are openness (Ondrus et al., 2015), control over the platform (Boudreau, 2010), access to resources (West, 2003), inter-firm coordination (Gawer & Cusumano, 2002), and user switching costs (Parker & Van Alstyne, 2018; West, 2003).

From the perspective of identifying successful complementors, researchers have analyzed market strategy (Chen et al., 2022), product portfolios (Lee & Raghu, 2011), motivation to participate (Bellotti et al., 2015; Gerber & Hui, 2013), and determinants of success (Cordova et al., 2015; Lee & Raghu, 2014; Welbourne & Grant, 2016) in various contexts. For example, Liu et al. (2014) examined the effect of the ‘freemium’ strategy in the mobile app market, offering insights to app developers on how the free version of an app affects the sales of its paid counterpart. Cordova et al. (2015) investigated the factors underlying crowdfunding success and the determinants of overfunding and found that the project funding goals and duration were crucial to fundraising success.

Studies on end-users have focused on users’ purchase decisions (Liang et al., 2018; Zhao et al., 2017), value perceptions, and satisfaction (Hsiao et al., 2016; Hsu & Lin, 2015; Zervas et al., 2015). Liang et al. (2018) assessed Airbnb consumers’ repurchase intentions and perceived

value and found that word-of-mouth, price sensitivity, and perceived authenticity positively enhanced these intentions. Hsiao et al. (2016) surveyed users to assess motivation for mobile social apps and found that perceived usefulness and satisfaction are closely connected with intentions for continuing social app usage.

2.2. The emergence of agencies

As platforms grow and interactions among participants become complex, issues such as trust, quality management, severe competition, and sustainable growth begin to emerge. To better understand these issues, we look at a new player group — agencies. Agencies may be less necessary in early-stage markets, but they can be vital as an ecosystem expands (Reillier & Reillier, 2017). Agencies are third-party service providers assisting complementors in marketing, management, monetization, sales, legal services, and customer acquisition. They are external entities built on platform systems and act as intermediaries between complementors and end-users or advertisers (VAST MEDIA, 2014). Agencies use platforms’ capabilities but are not owned by platform owners (Griborn & Nylén, 2017; Kozlowski, 2013). In this way, agencies differ from the three main roles previously mentioned and are considered a new group of participants in the platform ecosystem. Table 1 summarizes examples of agencies on various platform types and describes their roles.

Agencies have emerged within various platform types, from the mobile app market to crowdfunding. Contrasting with the growing phenomenon of agencies as platform players, studies on agency roles in the platform ecosystem remain limited. There is qualitative research on MCNs (Cunningham et al., 2016; Gardner & Lehnert, 2016; Griborn & Nylén, 2017), and several scholars have mentioned the presence of management agencies (Gallagher, 2017; Reillier & Reillier, 2017). For example, Reillier and Reillier (2017) referred to an agency as a ‘partner’ that collaborates with platform owners and adds value for platform participants. They mentioned Airbnb management companies such as Guesty or Hostmakers as examples of partners who manage listings and

Table 1
Agencies on platforms.

Platform type	Agency	Role description
Online video sharing (e.g., YouTube)	MCN (e.g., AwesomenessTV, Fullscreen, and Maker Studios)	<ul style="list-style-type: none"> • Affiliate with or manage YouTube channels • Assist in diverse areas such as copyrights, production, commercialization, and audience development • Provide resources and assistance in exchange for a percentage of ad revenue • Connect content creators and advertisers • Protect creators and brands against legal trouble
Mobile app market (e.g., Google Play and Apple App Store)	Game publisher (e.g., Electronic Arts, Chillingo, and Glu) Marketing agency (e.g., AppLift and AppFillip)	<ul style="list-style-type: none"> • Increase exposure among millions of apps • Execute marketing activities • Assist in internationalization and localization • Optimize for the platform a game will be released • Develop monetization plans • Promise quality to the customer
Crowdfunding (e.g., Indigogo, GoFundMe, and Kickstarter)	Crowdfunding agency (e.g., Agency 2.0, Jellop, Fundedtoday, and Crowdcheck)	<ul style="list-style-type: none"> • Attract media attention • Write and distribute press releases • Manage social media promotion • Design campaign pages and create campaign videos • Provide legal assistance

bookings on behalf of hosts. However, there is still little academic understanding of agencies on platforms and no empirical research to examine the benefits of agency services for complementors in a platform-based market.

2.3. Game publishers in the mobile gaming industry

The mobile gaming market is now the largest segment in the global gaming industry. In 2021, mobile gaming comprised 52 % of worldwide gaming revenue and overtook all legacy games, such as console and PC games (Newzoo, 2021). The distinctive feature of the mobile gaming market is that independent game companies and developers can release games on their own, without a publisher, through platforms like the Apple App Store or Google Play (Curran & George, 2012).

In the traditional video game industry, several large studios produce games for consoles and PCs. These games are full-featured products sold as cartridges or optical discs, usually through distributors. Distributors handle all the manufacturing logistics and ship games to retailers worldwide (Marchand & Hennig-Thurau, 2013). Video games are based on a publisher-driven business model, meaning the publisher is responsible for marketing, including market research and advertising (NeoGames, 2011). Conversely, mobile games are produced by many developers and distributed through a digital platform to a massive number of users. Digital distribution channels enable startups or independent developers to upload their games to a platform and directly reach customers (Behrmann et al., 2012; Rayna & Striukova, 2014). Fig. 1 shows the value chains of the video and mobile game industries.

Despite the rising trend of self-publishing in the mobile gaming market, traditional publishers still have important roles to play. Low entry barriers for mobile games encourage the proliferation of small game developers, causing fierce competition. Product visibility is critical for success when hundreds of new titles are launched daily and placed on the same virtual shelf. Thus, external publishers (or marketing agencies) with expertise in marketing activities—including promotion know-how, social media skills, and media contacts—are indispensable as most independent developers have limited experience with the business side of game development (Heinze, 2018). In addition, studies have argued that a recognized publisher positively impacts users' decision to download and install game apps (Aleem et al., 2016; Koetsier, 2017). Thus, developers entering the market using major or specialized publishers can benefit from loyal user pools (Nam & Kim, 2020).

Mobile game publishers assist developers by offering their expertise in optimization, internationalization, and localization (ElHady, 2017). Mobile games typically begin on a specific platform and later cross over to multiple other platforms (e.g., a game initially developed for the Apple iOS platform will cross over to Google Android, Blackberry, Nokia, and Amazon) (Rayna & Striukova, 2014). While large studios usually develop games for several platforms, small developers struggle with this due to differing regulations and platform openness. If developers plan to enter the global market, they should be ready for localization regarding language, local laws, and customizing content (ElHady, 2018). A study revealed that mobile app localization resulted in 128 % more downloads and a 26 % increase in revenue per country (Marcello, 2016).

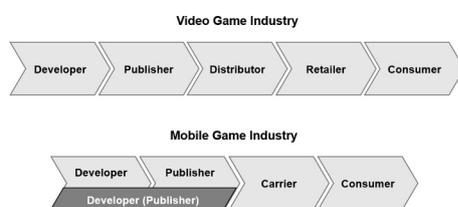


Fig. 1. Game industry value chain. Adapted from Tercek (2007) and NeoGames (2011).

3. Hypotheses development

The research model and hypotheses were designed to examine how (i) complementors' traits, including product originality and quality assurance, (ii) agency hiring practices, and (iii) agency affiliation with complementors collectively influence complementor performance on a platform.

3.1. Quality assurance

Quality assurance refers to the methods used to ensure the quality of a product or service (Khandelwal & Soni, 2019). A customer's perception of product quality is critical to their purchase decision (Boulding et al., 1993; Bou-Llusar et al., 2001; Carman, 1990; Zeithaml et al., 1996). In a platform-based market, most offerings are experiential goods, where value can only be assessed after use (Klein, 1998). For instance, on YouTube, audiences cannot evaluate the quality of a video before watching it. Furthermore, in the app market, users can determine the exact value of applications only after downloading and using them. In other words, there is significant information asymmetry between sellers and buyers, and uncertainty regarding product quality is relatively high at the time of purchase.

To minimize such risk, customers tend to search for signals to infer product quality by using various proxies of quality assurance. The impact of online customer reviews, including product ratings and the number of reviews, has been extensively studied as a primary driver of purchase decisions in platform-based markets (Cui et al., 2012; Harman et al., 2012; Liu & Park, 2015; Mudambi & Schuff, 2010). These studies indicate that online customer reviews are an informative reference for buyers. Potential buyers' purchasing decisions can also be influenced by customer behavior as they observe others' responses, and perceived prevalent behaviors influence their beliefs (Cialdini & Goldstein, 2004; Cialdini & Trost, 1998). For online shopping, product recommendations based on others' purchases significantly impact sales (Chen et al., 2011), and early investors in crowdfunding markets can signal quality to later investors (Kim & Viswanathan, 2014). Moreover, customers will likely judge product quality from external references or rely on expert opinions. Third-party product reviews (e.g., magazines, websites, and laboratory tests) (Chen & Xie, 2005), expert evaluations, or reputable user participants serve as credible signals of quality to potential customers (Kim & Viswanathan, 2014). This leads us to our first hypothesis:

H1. Complementors offering higher quality assurance will perform better in a platform-based market.

3.2. Product originality

Product originality, defined as a product's newness or uniqueness as perceived by the customer relative to previous offerings (Goldenberg et al., 1999; Moldovan et al., 2011), is one of the most important dimensions leading to new product success (Cooper, 1979; Henard & Szymanski, 2001; Im & Workman Jr, 2004; Mishra et al., 1996; Szymanski et al., 2007). In previous studies, originality is often referred to as creativity (Im & Workman Jr, 2004) or innovativeness (Szymanski et al., 2007). Thousands of entrepreneurs have built businesses and introduced new products in platform-based markets, leading to fierce competition for consumer attention (Zhu & Liu, 2018). For example, the Android app market contained nearly three million apps as of February 2020, and more than 20,000 new apps are introduced monthly (AppBrain, 2022). Thus, generating awareness of a new product becomes increasingly difficult in this highly competitive and fast-growing market (Johnstone & Dodd, 2000).

Product originality results in superior product differentiation over competitive offerings (Henard & Szymanski, 2001), and unique products may meet customers' needs better than competing products (Cooper, 1979). Product originality is a strategic resource as it is intangible, rare,

and imperfectly imitable or substitutable. As such, it provides a competitive advantage to a firm (Barney, 1991; Hunt & Morgan, 1995; Im & Workman Jr, 2004). New-to-the-market or innovative products generate customer excitement, trigger their variety-seeking tendencies, and lead them to try more products (Szymanski et al., 2007). Product originality focusing on meaningful differentiation increases customer loyalty, satisfaction (Sethi et al., 2001; Song & Parry, 1997, 1999), and positive word-of-mouth (Moldovan et al., 2011). When a new product satisfies consumer needs, the likelihood of its success significantly improves (Hultink & Robben, 1995; Link, 1987; Yap & Souder, 1994). This leads us to our second hypothesis:

H2. Complementors offering original products will perform better in a platform-based market.

3.3. Agency affiliation

An agency relationship exists when one party (the principal) depends on another party (the agent) to delegate work (Jensen & Meckling, 1979). The agency (provider) is a specialist who undertakes business services such as marketing, research, or distribution on the principal's (i. e., the outsourcing user's) behalf (Bergen et al., 1992).

Many non-professionals and early entrepreneurs participate in the platform economy as supply-side complementors (Li et al., 2015). Such non-professionals are likely to suffer from behavioral biases such as limited attention (DellaVigna & Pollet, 2009) and loss aversion (Genesove & Mayer, 2001). Agency firms offer these complementors solutions by enabling them to delegate essential but non-core tasks to experts, such as marketing, distribution, management, legal issues, and customer service. According to the resource-based view, each firm has a unique bundle of resources. However, not all resources are useful in differentiating a firm from its competitors. Firms should determine which strategic resources can be exploited for sustainable competitive advantages (Barney, 1991). By outsourcing to agencies, companies can access specialized resources that improve their performance, allowing them to focus on core competencies and enhance their competitive edge (Lahiri, 2016). Hiring a professional agency is a strategic decision that outsources non-core activities, which confers advantages by reducing costs, improving customer service, prioritizing core competencies, increasing strategic flexibility, and improving effectiveness (Axelsson & Wynstra, 2002; Elmuti et al., 1998; Logan, 2000). Entrepreneurial firms tend to struggle with resource constraints, and the resource-based view dictates that organizations are most profitable when focusing resources on their strengths (Hamel & Prahalad, 1990).

Transaction cost economics (TCE) theory states that transactions determine the efficacy of one exchange over another. TCE theory provides a framework for organizations to evaluate which type of exchange minimizes transaction costs, helping them decide whether to 'make' or 'buy' non-core functions by comparing the costs of planning, adapting, and monitoring task completion under each governance structure (Williamson, 1981). When a firm is new and small, it has limited available resources and high business uncertainty (Eisenhardt, 1989; Wynarczyk & Watson, 2005). In this scenario, managers may become risk-averse and sensitive to outcome uncertainty, making them likelier to outsource professional services than to manage everything internally (Eisenhardt, 1989). Wynarczyk and Watson (2005) found that inter-firm partnerships facilitate the rapid and sustained growth of small and medium enterprises (SMEs). They argued that resource-constrained SMEs adopt inter-firm alliances to gain a competitive edge by accessing critical partnership resources. Previous studies have examined the moderating effect of agencies in various settings (Eisenberg & Mattar-elli, 2017; Reus et al., 2023; Srivastava, 2021).

An illustrative example is Devolver Digital, a prominent publisher recognized for its success in the release of independent video games. The company is distinguished by its innovative marketing strategies, which frequently incorporate elements of parody and satire, as well as by its

collaborations with Twitch streamers and YouTubers for viral marketing. Moreover, Devolver Digital actively supports its titles through sustained promotional campaigns, localization efforts to expand platform availability, and the provision of regular updates. Central to the company's strategy is its commitment to respecting developers by preserving the core identity of their games and upholding their creative vision. This approach fosters an environment in which developers can fully exercise their creativity, ultimately contributing to the production of distinctive and innovative games (Messner, 2016). A notable example of this collaborative success is *Hotline Miami*, which sold over 1.7 million copies worldwide. Through Devolver Digital's support, the developer, Dennaton Games, was able to maintain the game's retro aesthetic while extending its availability across multiple platforms, leading to widespread international recognition and commercial success. This accomplishment reflects both the creative efforts of the developers and the strategic marketing initiatives implemented by Devolver Digital. These considerations lead us to hypothesize the following:

H3. Complementors allied with an agency will perform better in a platform-based market.

H3a. The impact of quality assurance on performance is more significant for complementors allied with an agency than those working independently.

H3b. The impact of product originality on performance is more significant for complementors allied with an agency than those working independently.

To better illustrate the relationships among the proposed hypotheses, an overall research framework is provided in Fig. 2.

4. Methodology

4.1. Data collection

Our hypotheses were tested in a mobile game market setting to answer the research questions. Data were collected from various sources: Mobile Index, Think Gaming, Naver.com, and App Annie. Empirical analyses were conducted on mobile game apps in Korea's Google Play store. Game titles launched from July 2015 to March 2019 were collected, beginning with the weekly top free and paid game app charts from Mobile Index. In particular, the Mobile Index data include app ranking, estimated revenue, download numbers, rating scores, launch dates, genres, and publishers for each game title on Google Play. Weekly estimated revenue data for the listed game titles were collected from Think Gaming for performance measurements. Individual games' weekly revenues were tracked for 20 weeks after the game launch. Information about game prices, new installers, and daily active users was also collected from Think Gaming. The final dataset was a balanced panel consisting of 3760 observations from 188 mobile game apps across 20 weeks following the game release. In this sample, 116 apps were free games, and 72 were paid.

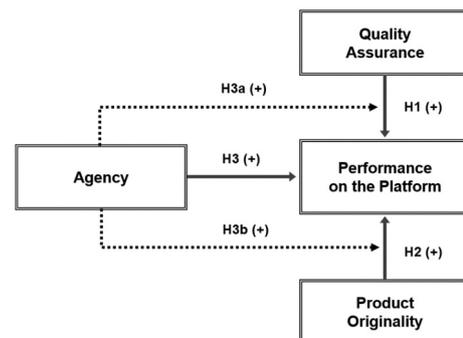


Fig. 2. Research framework.

4.2. Variables and measurement

4.2.1. Dependent variable

Google Play provides three game app charts: Free, Paid, and Top Grossing. However, it does not reveal how the ranking is determined, the number of downloads, or sales figures. For this reason, the rank of an app (Garg & Telang, 2013; Lee & Raghuram, 2014) or estimated number of downloads (Liu et al., 2014) has generally been used to measure an app's performance in mobile app market studies. Some recent studies have begun to utilize mobile app analysis databases (e.g., Think Gaming or Mobile Index), using revenue data as a proxy for an app's performance (Alomari et al., 2016; Bormann, 2017; Nam & Kim, 2020). Consistent with this trend, we collected data for a mobile game app's sales performance from Think Gaming (www.thinkgaming.com), which provides the estimated revenue for all mobile game apps in Apple's App Store and Google Play. Products in the mobile app market are known to have a fast life cycle, as demonstrated in Fig. 3, which shows how downloads change after an app launch. AppBrain (www.appbrain.com) performed a cohort analysis of all apps on Google Play and published which percent had more than 500, 5000, and 50,000 downloads, demonstrating that app downloads increase for up to 20 weeks and then flatten. Thus, we collected mobile game revenue data for 20 weeks after launch.

Revenue: Many mobile games are free to download, and most of their revenue is earned through in-game purchases (selling beneficial items that increase the gameplay experience) or advertisements. Therefore, *Revenue*, a dependent variable, is measured as total weekly revenue, including upfront app purchase revenue (for paid game apps only), in-app purchases (i.e., fees for obtaining advanced features or unlocking levels in a game), and advertising revenue (i.e., revenue from banner ads or video ads).¹

4.2.2. Explanatory variables

Agency: Mobile game developers launch their games independently on an application platform or through a game publisher. We consider there to be an agency alliance if a developer releases a mobile game through a publisher. However, Google Play does not classify developers and publishers separately. Thus, we collected and validated publisher and developer information from game magazines, game reviews, and mobile application analytics websites. We created a dummy variable, *Agency*, to indicate whether a developer allied with an external publisher. Among the 188 games in our dataset, 49 were launched by external publishers, and 139 were published by independent game developers.

Quality Assurance: Developers often update a game after launch, adding new features, fixing bugs, and incorporating user feedback. Therefore, game updates can reflect game quality and developers' efforts (Lee & Raghuram, 2014). AppBrain provides the activity history and version change information of almost all apps on Google Play. Similarly, App Annie (www.appannie.com) presents detailed information on app update history, including the date and descriptions of updates. We checked these websites and counted each game title's weekly updates (with a version number change).

Game Originality: We assessed game creativity to evaluate product originality. Studies on computer game creativity argue that game design is at the intersection of multiple creative domains, introducing six creative facets that contribute to a game's look, feel, and experience (Liapis et al., 2014, 2018). A description of each facet and examples are summarized in Table 2. The gameplay facet highlights the end user's experience playing the game, while the other facets focus on how developers create a game. As we could not evaluate each player's experience, we measured five creative facets, excluding gameplay. Each game app was

compared with previously released apps in the same genre to evaluate its originality. We manually assessed game creativity based on five creative facets: visuals, audio, narrative, rules, and levels. A 5-point Likert scale was used to score each facet, with 1 indicating common and 5 indicating unique characteristics. We then aggregated these scores into a game creativity index by averaging the facet scores. We considered a game original when the game creativity index exceeded 4, assigning a binary value of 1 if the score was above 4 and 0 otherwise. Two authors independently evaluated game creativity and then compared and validated the scores. After this procedure, our sample comprised 99 creative and 89 non-creative apps.

4.2.3. Control variables

Prior Experience: Google Play encompasses 17 game genres covering a wider variety of games, with sub-categories that include educational games, word games, role-playing, board games, sports, simulations, arcade games, action, adventure, music, racing, strategy, cards, casino, casual games, quizzes, and puzzles. Each game genre represents a specific domain and defines key features such as gameplay interaction, narrative style and rules, visual appearance, and music (Arsenault, 2009). Prior experience was measured as the number of games in the same genre a publisher released before launching game i . For example, if a publisher launched racing game i in week t and already released three racing games before week t , a publisher has experience in three games (listed as '3' in our dataset). In our dataset, the average prior experience of publishers is 5.8. When a developer outsources publishing activities (hiring an agency), the prior experience variable represents an agency's experience. When a developer publishes games independently, prior experience refers to the developer's experience.

Intellectual Property (IP): Borrowing popular IP from an original source provides an advantage in customer awareness and lowers the entry barrier for new users. Loyalty or inertia to a renowned game leads to a larger network effect. Therefore, using an existing IP is potentially associated with the success of a mobile game (Clements & Ohashi, 2005; Nam & Kim, 2020; Shankar & Bayus, 2003). IP is measured as a dummy variable representing whether the game converts an existing PC/console game into a mobile game or uses a well-known brand/character in the entertainment industry. Within our sample, 77 apps have IP.

Series: Many developers tend to release sequels to popular games in mobile game markets. For instance, *Candy Crush Saga* is a three-match puzzle game. After its significant success, *Candy Crush Soda Saga*, *Candy Crush Jelly Saga*, and *Candy Crush Friends Saga* were released sequentially by King. Sequels reduce risk by tying a game to a brand that has already been successful (Chaffin, 2015). As consumers are already aware of information about key features, they can more confidently select the product (Basuroy & Chatterjee, 2008; Keller et al., 2011). Additional sequel products enable firms to enhance brand value and perceptions of brand quality by repeatedly creating positive associations between customers and brand ideals (Basuroy & Chatterjee, 2008). *Series* is measured as a dummy variable that represents whether the game is a sequel; there are 39 series apps in our data.

Table 3 provides the definitions and sources of the key variables used in analyses, and Table 4 presents the descriptive statistics.

4.3. Empirical models

Two econometric models were used to test our hypotheses. Given that several hypotheses involve both main and moderating effects, interaction terms were created and included in the econometric models along with the key independent variables and a set of control variables.

$$\text{Revenue}_{i,t} = \alpha_0 + \alpha_1 \text{Quality}_{i,t-1} + \alpha_2 \text{Originality}_i + \alpha_3 \text{Agency}_i + \alpha_4 \text{Experience}_i + \alpha_5 \text{IP}_i + \alpha_6 \text{Series}_i + \varepsilon_{i,t}$$

Model 1 (for H1, H2, and H3)

¹ Revenue was collected from the Think Gaming database, which only provides total estimated revenue and does not disclose revenue percentages for app purchases, in-app purchases, and advertisements or how it was calculated.

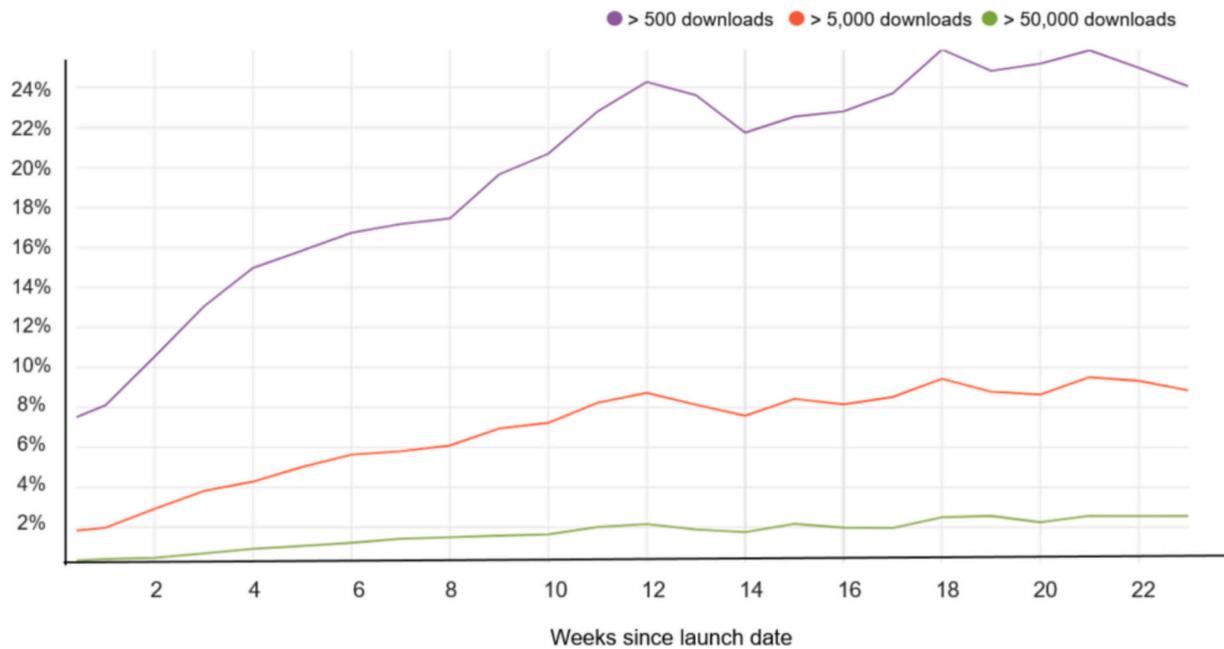


Fig. 3. Downloads per app since launch date. Adapted from AppBrain (2022). Accessed May 2, 2022. <https://www.appbrain.com/stats/android-app-downloads>.

$$\begin{aligned}
 \text{Revenue}_{i,t} = & \beta_0 + \beta_1 \text{Quality}_{i,t-1} + \beta_2 \text{Originality}_{i,t} + \beta_3 \text{Agency}_i \\
 & + \beta_4 \text{Quality}_{i,t-1} * \text{Agency}_i + \beta_5 \text{Originality}_{i,t} * \text{Agency}_i \\
 & + \beta_6 \text{Experience}_i + \beta_7 \text{IP}_i + \beta_8 \text{Series}_i + \varepsilon_{i,t}
 \end{aligned}$$

Model 2 (for H3a and H3b)

In both models, the dependent variable *Revenue_{i,t}* is the total revenue of game *i* during week *t*. A logarithmic transformation is made for revenue to control size disparities among the variables and improve the stable linear relationship between the dependent variables and the predictors. Model 1 is estimated based on all the games in the dataset and tests H1, H2, and H3, which examine independent variables’ direct impact on revenue. Model 2 tests H3a and H3b, which examine the interactions between agency alliance and the originality or quality of games.

As we used a typical panel dataset, several specification tests were performed to examine whether these models were subject to specification errors and violations of the ordinary least squares (OLS) estimation assumptions. We began with heteroskedastic and autocorrelation checks by conducting Breusch-Pagan and Durbin-Watson tests. The Breusch-Pagan test result (BP = 12.693, *p*-value = 0.04818) indicated the presence of heteroskedasticity, while the Durbin-Watson test result (DW = 2.1405, *p*-value = 0.8381) indicated no autocorrelation (Durbin & Watson, 1971; Krämer & Sonnberger, 1986). These findings contradict the use of OLS estimation assumptions. The GLS (generalized least squares) estimation was applied to address these issues. The lagged independent variables were used to account for any potential time lag between the independent and dependent variables.

The correlation matrix is presented in Table 5. The maximum value of the variance inflation factors (VIF) is substantially below the conventional threshold of 10. Thus, we conclude that multicollinearity is unlikely to affect our estimates.

5. Analysis and results

5.1. Results

The results of the GLS estimations are summarized in Table 6. To examine the impact of the three explanatory variables on game revenue (H1, H2, and H3), the dependent variable *Revenue* was regressed on

Quality, *Originality*, and *Agency*, controlling for factors such as *Experience*, *IP*, and *Series*. As shown in the results of Model 1, the coefficients for *Quality* (α_1) and *Originality* (α_2) were both positive and significant at the 0.01 level. Similarly, the *Agency* dummy (α_3) coefficient was positive and significant. As expected, games with higher quality assurance and product originality had positive relationships with revenue, supporting H1 and H2. Regarding hiring an agency, games published through an external agency had better sales performance than those published independently by developers, supporting H3.

Model 2 was used to test H3a and H3b, including the interaction terms between the *Agency* variable and the two independent variables, *Quality* and *Originality*. Table 6 shows that the coefficient estimate for the interaction term *Agency* * *Quality* (β_4) was positive but not significant. Thus, H3a was not supported but positive. Additionally, the interaction term *Agency* * *Originality* (β_5) coefficient was negative and significant at the 0.01 % level. Hence, H3b was not supported. It can be interpreted that developers with original mobile games fare better working alone than with an agency, whereas the impact of an agency alliance is questionable for developers with quality games. Despite this, the direct effect of the *Agency* variable on revenue still shows a positive and significant coefficient (β_3), implying that an agency alliance is generally beneficial and firms with low product originality can perform better when working with an agency.

Fig. 4 presents the plots of the interaction effects. A negative relationship was observed between product originality and revenue for mobile games published by an agency, whereas the relationship was positive for mobile games published by a developer. An impressive finding was that a developer’s line was steeper than an agency’s, indicating a clear advantage for self-publishing when a developer has highly original products.

The estimations of Models 1 and 2 indicate that the *Experience* variable positively influences *Revenue*. To understand this variable’s role, a follow-up analysis was conducted to determine whether the prior experience of developers and agencies played different roles. Model 3 was estimated against mobile games published by external agencies and independent developers, respectively. The variables of *Agency Experience* (the value of prior experience when *Agency* = 1) and *Developer Experience* (the value of prior experience when *Agency* = 0) were constructed.

Table 2
Creative facets of games^a.

Game facets	Description
Visuals	<ul style="list-style-type: none"> • Visual outputs that convey information to players • Photorealistic visuals: direct object representations (e.g., FIFA series (EA Sports 1993)) • Caricaturized visuals that elicit a specific emotion (e.g., melancholy due to the black and white theme of Limbo (Playdead 2010)) or visual cues offered through item exaggeration, even in low-resolution (e.g., extraordinarily large weapons in Final Fantasy VII (Square Enix 1997)) • Abstract visuals that design memorable characters using as few pixels or colors as possible (e.g., the 8-bit art of early games)
Audio	<ul style="list-style-type: none"> • Plays a significant role in the feel and mood of a game • Puts players at ease with rhythmic, repetitive sequences (e.g., Moon Hunters (Kitfox Games 2016)) • Increases players' tension with staccato cacophonous string instruments (e.g., Amnesia: The Dark Descent (Frictional Games 2010)) • Energizes the player through fast heavy metal tracks to perform frantic run-and-gun gameplay (e.g., Doom (Bethesda 2016))
Narrative	<ul style="list-style-type: none"> • Extensive storylines to connect different locales and quest lines • An in-world narrative provides motivation to play and complete the game • Thousands of lines of dialogue authored by multiple game writers (e.g., Heavy Rain (Quantic Dream 2010) or Mass Effect (Bioware 2007)) • Interactive narratives where the computer selects a fitting response from the prewritten dialogues of a virtual character based on the context of the current discussion (e.g., Façade (Mateas & Stern, 2005) or Prom Week (McCoy et al., 2012))
Rules	<ul style="list-style-type: none"> • Provides the structures and frames for play (winning and losing conditions) • Defines the limits and goals of player interaction • Determines the transitions between game stages (e.g., Pac-man (Namco 1980) eats the last pellet, then the level is won)
Levels	<ul style="list-style-type: none"> • The spatial navigation of levels • Determines how the player can progress from one point to another • A two-dimensional arrangement (e.g., Super Mario Bros (Nintendo 1985)) • A three-dimensional arrangement (e.g., Call of Duty: WWII (Infinity Ward 2003)) • An extensive open game world (e.g., Minecraft (Mojang 2011))
Gameplay	<ul style="list-style-type: none"> • The game player experience • Players exhibit creativity in developing new playing strategies • Players often bypass the intended challenge and accidentally discover new skills

^a The items in parentheses where there is no comma between the name and the year indicate the game publisher and the game's release year.

$$\text{Revenue}_{i,t} = \delta_0 + \delta_1 \text{Quality}_{i,t-1} + \delta_2 \text{Originality}_i + \delta_3 \text{Experience}_i + \delta_4 \text{Experience}_i * \text{Quality}_{i,t-1} + \delta_5 \text{Experience}_i * \text{Originality}_i + \delta_6 \text{IP}_i + \delta_7 \text{Series}_i + \varepsilon_{i,t}$$

Model 3

The direct effect of experience on revenue and the results reported in Table 6 demonstrate that the coefficient estimate for *Experience* (δ_3) was

Table 3
Definitions of key variables.

Variable		Definition	Source
Revenue	<i>Revenue_i</i>	Weekly total revenue of game <i>i</i> (Revenue is a log-transformed value)	Thinkgaming.com
Agency	<i>Agency_i</i>	Whether a developer allied with an external publisher for game <i>i</i> (0 = No, 1 = Yes)	Appannie.com, Hungryapp.co.kr, Naver.com
Quality Assurance	<i>Quality_i</i>	The number of updates for game <i>i</i> over a week	Appannie.com, AppBrain.com
Game Originality	<i>Originality_i</i>	Whether game <i>i</i> is original (0 = No, 1 = Yes)	Play.google.com
Prior Experience	<i>Experience_i</i>	Total number of published games in the same genre as launched game <i>i</i>	Appannie.com, Mobileindex.com
IP	<i>IP_i</i>	Whether there is existing/original IP for game <i>i</i> (0 = No, 1 = Yes)	Naver.com, Web searching
Series	<i>Series_i</i>	Whether game <i>i</i> is the sequel of a published game (0 = No, 1 = Yes)	Play.google.com, Appannie.com

positive and significant in Model 3a but negative and significant in Model 3b. These opposing findings may reflect the developer's behavioral characteristics. Some developers tend to release games that are similar within the same genre by altering characters or backgrounds, or making minor rule changes. As a result, the originality of these games tends to be minimal. However, even when numerous games fall under the same genre, agencies can maintain a diverse portfolio by collaborating with various developers. To confirm this reasoning, the relationship between *Experience* and *Originality* was examined, and the developer's experience was observed to have a negative relationship with product originality, while the agency's experience had a positive relationship.

Additionally, the interaction effects of agencies' prior experience and game properties (quality and originality) on revenue were assessed (Model 3a). Similarly, the interaction effects of developers' prior experience were tested (Model 3b). The coefficient estimate for the interaction term *Experience* * *Quality* (δ_4) was positive but not significant in both Models 3a and 3b. Regarding the experience and originality interaction, the coefficient estimate for the interaction term *Experience* * *Originality* (δ_5) was negative and significant in Model 3a but positive and significant in Model 3b. This implies that the interaction effect of prior experience and game originality on revenue works differently for agencies and developers. When a game is highly original, an alliance with an agency hurts revenue despite the agency's significant experience in a specific game genre, which is consistent with the results of Model 2. Conversely, developers' prior experience in a specific game genre intensifies the positive relationship between game originality and revenue. Fig. 5 depicts these findings, where the 'experienced agency' line demonstrates the importance of an agency's experience in increasing revenue. In contrast, the 'experienced developer' line shows that a developer's experience increases revenue only when product quality is high.

5.2. Sensitivity analysis

We also conducted a set of sensitivity tests to ensure the robustness of our results. First, a potential confounding factor in our study is the lag effect of the *Quality Assurance* variable. *Quality Assurance* was measured by the number of weekly updates per game title. Although we employed lagged independent variables in our estimation, the update's effects may take longer to realize. To account for this possibility, we took a one-week lag of our dependent variable and ran regressions. We find that the results are largely consistent with what was reported in Table 6, implying that the lag effect does not play a significant role in our analyses.

Moreover, we classified the updates into minor and major changes based on the commonly used terms in update descriptions (e.g., minor updates: bug, fix, crash, stable, etc. and major updates: level, content, feature, item, etc.). We then investigated whether a minor or major update caused any changes in our estimation. The results reveal the same outcomes (with the same coefficient signs and similar significance levels) as the original analysis (see Table 7). However, when estimating the models with a major update group, the coefficient estimate for the interaction term *Agency* * *Quality* is positive and significant (see Table 7, Model 2 in the major update group). This outcome suggests that an agency alliance may be more beneficial for complementors when they

Table 4
Summary of descriptive statistics.

Variable	Mean	Std.Dev.	Min.	Max.		N	%
Revenue	146,092.8	491,444	55	6,427,881		188	100
Agency	0.26	0.44	0	1	Yes	49	26.06
					No	139	73.94
Quality Assurance	0.43	0.77	0	12		188	100
Game Originality	0.53	0.5	0	1	Yes	99	52.66
					No	89	47.34
Prior Experience	5.8	7.3	1	39		188	100
IP	0.41	0.49	0	1	Yes	77	40.96
					No	111	59.04
Series	0.21	0.41	0	1	Yes	39	20.74
					No	149	79.26

Table 5
Correlation matrix.

Variable	1	2	3	4	5	6	7	VIF
1. Revenue	1							
2. Agency	-0.027	1						1.066
3. Quality assurance	0.058	-0.099	1					1.071
4. Game originality	0.150	-0.044	0.002	1				1.043
5. IP	0.112	0.171	-0.241	0.010	1			1.171
6. Series	0.227	0.025	-0.081	-0.172	0.241	1		1.112
7. Prior experience	0.073	0.182	0.011	0.056	0.178	0.131	1	1.081

Table 6
Model estimation results.

Dependent:	Model 1	Model 2	Model 3a (apps published by agencies)	Model 3b (apps published by developers)
Revenue				
Constant	9.191*** (0.067)	9.181*** (0.067)	9.858*** (0.056)	9.711*** (0.055)
Agency	0.506*** (0.067)	0.481*** (0.067)	-	-
Quality	0.141*** (0.038)	0.139*** (0.038)	0.139*** (0.038)	0.133*** (0.038)
Originality	0.641*** (0.057)	0.638*** (0.057)	0.600*** (0.058)	0.620*** (0.058)
Agency * Quality	-	0.154 (0.07)	-	-
Agency * Originality	-	-0.709*** (0.131)	-	-
Experience ^a	0.178*** (0.022)	0.187*** (0.022)	0.304*** (0.028)	-0.039* (0.023)
Experience * Quality			0.040 (0.041)	0.021 (0.031)
Experience * Originality			-0.325*** (0.057)	0.373*** (0.044)
IP	0.113* (0.061)	0.109* (0.060)	0.108* (0.061)	0.182*** (0.061)
Series	0.949*** (0.076)	0.928*** (0.075)	1.033*** (0.075)	1.037*** (0.077)
Observations	3760	3760	3760	3760
Fit Statistics (Wald χ^2)	139.2***	136.6***	242.6***	120.3***

^a The *Experience* variable refers to an agency’s experience in Model 3a, whereas it refers to a developer’s experience in Model 3b.

* $p < 0.1$.
*** $p < 0.01$.

actively try to improve product quality (e.g., adding new features or items) rather than react to negative feedback (e.g., fixing bugs).

Second, a potential limitation in our analysis is that our data set only contains games appearing in the top charts. Google Play publishes up to 200 top-ranked games in each of the free and paid categories. We gathered the list of game titles from the top charts and collected weekly revenue data from Think Gaming, which provides this data for the top 1000 ranking apps. Hence, our sample may be subject to the usual

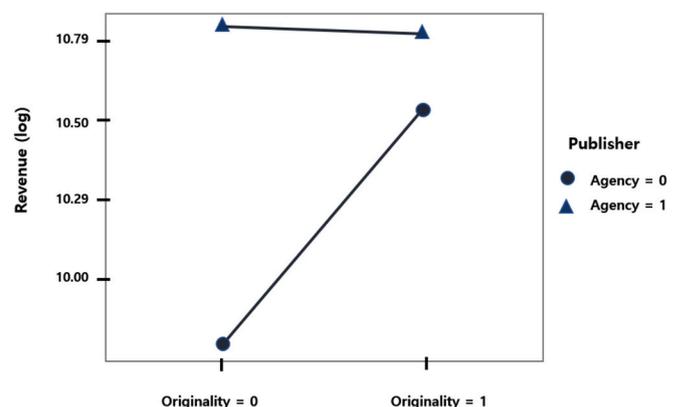


Fig. 4. The moderating role of an agency alliance.

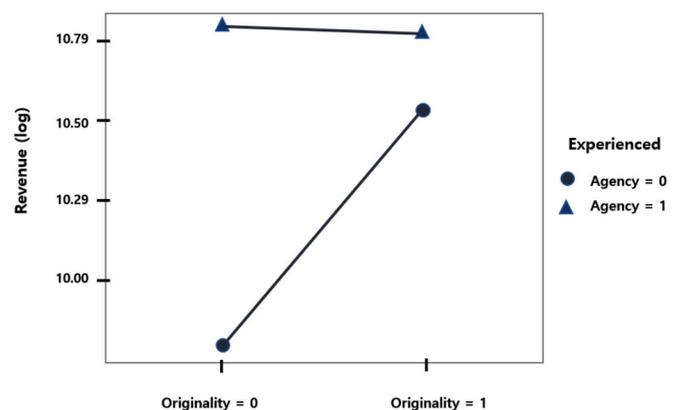


Fig. 5. The moderating role of experience.

caveats of a truncated sample as it is based on games that have appeared at least once in the weekly top 200 charts during the study period. As we needed to collect 20 weeks of revenue data, our final sample only included games that remained in the top 1000 rankings for at least 20

Table 7
Sensitivity analysis (1).

Dependent: Revenue	Minor updates		Major updates	
	Model 1	Model 2	Model 1	Model 2
Constant	9.216*** (0.065)	9.218*** (0.065)	9.234*** (0.067)	9.224*** (0.067)
Agency	0.503*** (0.067)	0.468*** (0.067)	0.502*** (0.067)	0.470*** (0.067)
Quality ^a	0.242*** (0.062)	0.210*** (0.062)	0.082* (0.049)	0.096* (0.038)
Originality	0.625*** (0.057)	0.611*** (0.057)	0.646*** (0.057)	0.639*** (0.057)
Agency * Quality	–	–0.076 (0.147)	–	0.267** (0.125)
Agency * Originality	–	–0.719*** (0.131)	–	–0.740*** (0.131)
Experience	0.183*** (0.022)	0.192*** (0.022)	0.177*** (0.022)	0.187*** (0.022)
IP	0.106* (0.060)	0.101* (0.060)	0.100* (0.061)	0.104* (0.060)
Series	0.945*** (0.076)	0.926*** (0.076)	0.948*** (0.076)	0.924*** (0.075)
Observations	3760	3760	3760	3760
Fit Statistics (Wald χ^2)	138.0***	127.7***	128.4***	127.5***

^a Quality refers to minor updates in the minor updates group, whereas it refers to major updates in the major updates group.

- * $p < 0.1$.
- ** $p < 0.05$.
- *** $p < 0.01$.

weeks after release. To see whether our results are biased by the fact that the games in our sample are top performers in the mobile game market, we categorized our data into two subsets based on revenue. The threshold values used for the categorization are the top and bottom 25 % revenue values. We then reran our models against each subset and compared the coefficient estimates for the independent variables with those reported in Table 6. The coefficients of key variables such as *Agency*, *Originality*, and the interaction term *Agency * Originality* show a pattern consistent with the original analysis (see Table 8). Conversely, the coefficient of the *Agency* variable becomes insignificant when estimating the top 25 % revenue group. This outcome suggests that the benefit of hiring an agency may be more applicable to small complementors as the developers in the top 25 % group are relatively larger

Table 8
Sensitivity analysis (2).

Dependent: Revenue	Top 25 %		Bottom 25 %	
	Model 1	Model 2	Model 1	Model 2
Constant	12.078*** (0.099)	12.051*** (0.102)	8.243*** (0.101)	8.156*** (0.106)
Agency	–0.030 (0.081)	–0.038 (0.079)	0.368*** (0.107)	0.389*** (0.111)
Quality	–0.069 (0.044)	–0.042 (0.050)	–0.095 (0.067)	–0.087 (0.064)
Originality	0.163** (0.081)	0.293*** (0.086)	0.180** (0.082)	0.212*** (0.083)
Agency * Quality	–	–0.142 (0.101)	–	–0.327* (0.186)
Agency * Originality	–	–0.610*** (0.157)	–	–0.659*** (0.242)
Experience	0.074** (0.035)	0.035 (0.037)	0.046 (0.032)	0.065** (0.032)
IP	0.068 (0.080)	0.003 (0.081)	0.097 (0.088)	0.172* (0.093)
Series	0.093 (0.087)	0.192** (0.088)	0.188 (0.116)	0.200* (0.117)
Observations	940	940	940	940
Fit Statistics (Wald χ^2)	12.5**	12.6**	12.0**	11.8**

- * $p < 0.1$.
- ** $p < 0.05$.
- *** $p < 0.01$.

than the bottom 25 %. We recognize that the number of observations for each subset is small; thus, the variables that are not significant may be due to a lack of observations. The variables that appear significant despite the small number of observations imply their effects are very strong. Overall, the additional analyses yield robust support for the main analysis.

6. Discussion

6.1. Key findings

This study’s main empirical question focuses on whether affiliating with an agency affects complementors’ performance in platform-based markets and, if there is an effect, how the agency interacts with the complementors’ product or service attributes. We tested our hypotheses using mobile game market data, and our findings provide empirical evidence that helps answer these questions.

First, we found that quality assurance and product originality positively influence complementors’ performance (H1 and H2). The characteristics of experience goods and information asymmetry between users and complementors increase users’ perceived purchase risks in the platform-based market. Our findings provide strong evidence that users seek a signal of product quality before they make purchase decisions. Complementors offering more quality assurance perform well and are likelier to succeed in the market. Furthermore, the platform ecosystem has led to highly competitive markets with low entry barriers. As substantial products are available for users to choose from, product originality is crucial for complementors to differentiate their products, capture users’ attention, and gain a competitive edge.

Second, we found support for an agency alliance effect (H3), suggesting that complementors who partner with an agency are likelier to perform better than those working independently. Having found support for H3, we analyzed how an agency alliance interacts with the product or service attributes provided by complementors. Although we hypothesized that this alliance would positively moderate the effects of product quality assurance on complementor performance, a significant positive impact on performance was not observed (H3a). A counterintuitive finding was that an agency alliance had a significant negative impact on the interaction between product originality and complementor performance (H3b). The rejection of H3a and H3b implies that hiring an agency is not always beneficial, as it may not provide a significant advantage over other players for complementors who can offer reliable quality assurance. More importantly, complementors providing highly original products may find that agency costs exceed the benefits of purchasing specialized business services.

Third, we focused on the role of experience and investigated whether experienced agencies or complementors had a more significant impact on success in platform-based markets. Regarding an agency’s experience, our results suggest that the impact of experience on performance is significantly positive. However, it has a negative moderating effect on the relationship between product originality and performance (Model 3a). These findings are consistent with the results of our primary hypotheses (Model 2), implying that hiring an experienced agent may be a better decision than hiring a less experienced one. Meanwhile, complementors providing highly original products are still better off working independently.

Interestingly, complementor experience has a significant negative impact on performance but intensifies the relationship between product originality and performance (Model 3b). These results may be attributed to several causes. Our analysis measured experience using the number of products launched in target markets. Agencies offer assistance on behalf of complementors in specialized areas such as promotion, advertisement, legal issues, and customer management. When the agency has significant experience working with complementors in the same market segment, the agency’s expertise in that market strengthens over time. However, a complementor’s experience launching products in the same

market segment may not be directly linked to its competitiveness. Merely producing a high volume of low-quality or similar products does not appear to be an effective method for developing expertise. We can analyze this situation through the analogous relationship between an electronics store and a television manufacturer. Supposing an agency is a specialty electronics store, having many brands increases its competitiveness. However, if the complementor is a television manufacturer, having many similar models does not mean that they have an advantage over other producers.

6.2. Contributions

This research is expected to contribute to the platform ecosystem literature in several ways. First, although past research has acknowledged the importance of participants in platform success, it has primarily focused on three roles: platform owner, complementors, and end-users. While some literature has recognized and theorized the emerging role of agencies in the platform ecosystem, empirical studies on agencies remain scarce. By addressing this gap, this study offers new insights into the role of agencies as platform participants. Platforms are commonly defined as systems that facilitate direct interactions and transactions between participants (Hagiu, 2014; Reillier & Reillier, 2017). In traditional markets, agencies act as key intermediaries, facilitating transactions through relationships, negotiations, and direct client interactions. They build trust through reputation and long-term engagement and exercise considerable control over pricing and terms. In contrast, on digital platforms, the intermediary role is largely assumed by the platform itself, using algorithms and automated systems to match buyers and sellers. However, as platforms grow, the increasing number of providers and users can lead to market saturation, making it difficult for providers to gain visibility and for users to find suitable products. This decline in matching quality recreates opportunities for agencies to emerge as intermediaries. Agencies assist users by curating and recommending relevant products to help them navigate information overload, while also supporting providers who lack resources such as marketing and distribution capabilities. By exploring this dynamic, this study contributes to a deeper understanding of the strategic role of agencies within the platform ecosystem.

Second, we empirically investigate the moderating role of agency affiliation alongside its direct effects. Our research highlights agencies' importance in enhancing complementor performance, particularly concerning product originality and quality assurance. We identify a new strategic mechanism for complementors' decisions and offer a deeper understanding of platform dynamics, especially the relationship between complementors and agencies. Regarding practical implications, we propose that platform owners recognize an agency's role as a new categorical player and utilize it to facilitate platform sustainability. In the platform ecosystem, liquidity refers to the presence of a sufficient number of producers and consumers to sustain successful interactions. Achieving liquidity and positive cross-side network effects is widely recognized as the most critical milestone in the early stages of a platform (Parker et al., 2016). However, as it matures, it is not only liquidity that matters but also the quality of matching between users and complementors, as well as frequent interactions between them, which are crucial metrics for evaluating sustainable platform growth. The low barriers to entry inherent in platform ecosystems often result in an oversupply of low-quality offerings, making it challenging to identify high-quality products. This phenomenon increases search costs, exacerbates dissatisfaction with product quality, and accelerates customer churn. Agencies can address this issue by acting as intermediaries that identify and promote high-quality offerings, thereby mitigating the noise caused by product oversupply. In this respect, platform owners must expand their understanding of platform participants and consider agencies as essential intermediaries between complementors and users.

For complementors, an agency alliance may be considered a strategic option to penetrate the market, depending on its capabilities and

available resources. In a highly competitive market, it is difficult for new and small firms to attract attention, and they typically have insufficient resources to do everything in-house. For these complementors, hiring an agency is a strategic way to acquire complementary assets and increase the chances of success. In addition, it is recommended that they cooperate with agencies with substantial experience in the target market. Nevertheless, the benefits of an agency alliance also come with a price in terms of agency costs. Furthermore, for complementors with competitive advantages or product differentiation, it is more effective to work independently by taking advantage of a platform's capabilities and installed base.

6.3. Limitations

Despite its important conceptual contributions and practical implications, this study has several limitations. First, we conducted our empirical test using data from the mobile game market. As this market features stiff competition and a short product life cycle, we performed analyses using a sample comprising 20 weeks of data following game launches. Thus, our analysis represents a short-term result and may overlook the long-term effects of agency affiliation. In the mobile app market, a game's initial popularity or success rarely changes over time. However, if we were to examine a longer time frame of data, we could interpret results more precisely. Therefore, future studies could complement our research by analyzing an extended period.

Second, our sample only includes games that perform relatively well in the market, as the mobile app database we used provides revenue data for the top 1000 apps. Although the sensitivity analysis verified that our results were not biased, our sample would have been more balanced with randomly selected data from the mobile app market.

Last, our research model was composed of limited variables due to data availability. Therefore, we could not include other factors that may influence complementors' performance and the interaction of agency alliances. For example, user satisfaction, pricing policy, or product portfolio could be important factors for complementor performance (Lee & Raghu, 2011, 2014; Liu et al., 2014). Thus, we encourage future research to examine how other variables are related to the effect of agency alliance and complementor performance.

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CRedit authorship contribution statement

JiYu Kim: Writing – original draft, Formal analysis, Data curation, Conceptualization. **Jaesun Yeom:** Writing – review & editing, Methodology. **Han-Gyun Woo:** Writing – review & editing, Methodology, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The authors do not have permission to share data.

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