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Abstract

Esports—a professionalized, commercialized, and spectatorial form of video game competition—is a burgeoning industrial sector that has relied on entrepreneurial community support and multi-platform media distribution modalities to catalyze its growth. In particular, the esports industry is increasingly turning towards grassroots crowdfunding to gain access to financial resources that can be used to facilitate tournament prizes. However, what remains unclear is which factors contribute to grassroots esports crowdfunding campaigns' success. We used social exchange theory to identify important social and economic attributes that may influence the outcomes of esports crowdfunding projects. For methods, we scraped crowdfunding data from Matcherino using Octoparse 8. A total of 14,497 esports crowdfunding projects were analyzed by using multiple regression analysis, as well as robustness checks that were estimated through machine learning techniques. We find that equal distribution of prize rewards, the endorsement of big brand sponsors, and genres of games significantly influence the success of esports crowdfunding. This contributes to our theoretical understanding of 1) the process of esports crowdfunding campaigns as a complex mechanism that incorporates financial incentives and social values, 2) esports as an emerging industry that is institutionalizing, 3) the heterogeneity of genre-based community, and 4) the importance of distributive justice of prize rewards for organizing grassroots esports tournaments and events. Furthermore, we discussed methodological implications regarding the use of econometrics approach and machine learning for future crowdfunding and esports research as well as managerial implications for esports entrepreneurs, esports teams and organizations, and sponsors and investors in terms of developing strategies tailored to the dynamics of esports communities.

Keywords Esports crowdfunding · Social exchange theory · Reciprocity · Prize reward distribution

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Introduction

In recent years, esports events and tournaments have received growing attention from global fans, spectators, and participants (Hamari & Sjöblom, 2017; Rogers et al., 2020). For instance, it is estimated that viewers spent 18.6 billion hours watching competitive video gaming and esports related content on Twitch[1] in 2020, an increase of 70% over the previous year (Mediafix, 2021). In some ways, the extensive esports online consumption parallels a growing trend through which social networks and communities are actively created and mobilized for resources through digital technologies and virtual platforms in the emerging esports industry (Seo, 2013; Tang et al., 2021).

It is not uncommon for emerging industries (and their market participants) to face challenges such as market capitalization and technological uncertainty (Agarwal & Bayus, 2002)—which can have a significant impact on their legitimacy and financial growth (Zimmerman & Zeitz, 2002). As a result, organizations in emerging industries often lack the ability to leverage and access an established market and investment opportunities (Gustafsson et al., 2016), so these organizations need to resort to alternative revenue sources (Rachinger et al., 2019). In the esports industry, for example, organizations utilize digital innovations—instead of traditional investment or sponsorship—to acquire new resources. Various esports entrepreneurs and start-up esports organizations (e.g., tournament organizers, leagues, teams, players) are actively seeking online crowdfunding as a primary approach for financing new venture development (Hayduk, 2021).

Crowdfunding is the practice of raising capital for a project typically in small amounts of money from a large number of individuals, generally via the Internet (Hollas, 2013). It allows smaller, grassroots organizations and individuals access to capital from a broad range of funders (Mollick, 2014). Crowdfunding projects usually involve three key parties—the project initiator, the individuals supporting the project, and the moderating platform that links both (Ordanini et al., 2011). In esports, crowdfunding has become an important intermediary through which the esports community does not only represent social support but can also be leveraged for economic gains (Mitrevski, 2017). For instance, a major esports tournament—Valve Corporation's[2] *The International* (TI)—uses crowdfunding to fund its prize pool, with the 2020 prize pool exceeding 40 million US dollars (Ocal, 2020). As TI exemplifies, major esports organizations gain strong community support and can easily acquire financial resources through crowdfunding. We do not know, however, if this holds true for small esports organizations and entrepreneurs (since esports and competitive video gaming in general still lack widespread social acceptance among the public; Pizzo et al., 2021). In other words, very little is known about the dynamics of successful esports crowdfunding campaigns that are developed for grassroots esports communities (Hayduk, 2021).

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[1] Twitch is a leading online streaming platform focusing on live video game streaming.

[2] Valve Corporation, more commonly known as simply Valve, is the developer and publisher of the video game Dota 2. Dota 2 regional competitions culminate in The International, an annual esports tournament renowned for its large prize pools.

Grassroots esports crowdfunding entrepreneurs typically utilize external third-party esports crowdfunding platforms to raise and collect funds. As such, we seek to understand how grassroots esports crowdfunding entrepreneurs navigate funding mechanisms through esports crowdfunding platforms. More specifically, we focus on identifying different attributes that explain the success of esports crowdfunding projects by leveraging secondary panel data scraped from Matcherino, the world's leading esports crowdfunding platform. By doing so, we not only provide pragmatic guidance for those working in the esports industry on how to effectively raise capital through non-traditional means (i.e., crowdfunding), but also offer heuristics of the unique modalities and dynamics of esports-based crowdfunding in comparison with others.

To guide our inquiry, we adopt a social exchange theory (SET) perspective—one of the most influential conceptual frameworks for understanding social and organizational behaviors (Cropanzano & Mitchell, 2005). According to SET, social behaviors are defined as the exchange of tangible and intangible goods or resources between individuals (Blau, 1964; Homans, 1961). Essentially, SET enables us to understand the nature of social interactions by incorporating an economic basis into social obligations. SET has been applied in crowdfunding literature to explore the factors contributing to the success of non-esports campaigns (James et al., 2021; Schmitt & Petroll, 2021; Zhao et al., 2017). In this study, we extend this line of inquiry to the context of esports crowdfunding.

Indeed, social and economic dynamics are fundamental features of the esports crowdfunding ecosystems. More specifically, esports crowdfunding campaigns often take the form of esports tournaments and competitions. Esports entrepreneurs usually choose certain game genres and organize tournaments or events for the community to participate in—in exchange for the community's contributions to tournament prize pools. Potential funders can contribute through various forms such as donating cash, purchasing tournament tickets or merchandise, or paying entry fees. In this sense, funders also become players competing for prize rewards. In some ways, this process resembles the crowdfunding system for major esports events like Dota 2 International hosted by game developers. However, esports entrepreneurs, who organize tournaments through crowdfunding platforms, often have a lower status and fewer resources than game developers. These esports entrepreneurs may therefore have to rely on unique practices and crowdfunding mechanisms to sustain the relationship with the community and further acquire necessary funding resources to succeed.

Therefore, the purpose of this study is to identify and examine important attributes that contribute to the success of esports crowdfunding campaigns through a social exchange perspective. Our study contributes to the theory and literature in entrepreneurship and management in three ways. First, because there is limited research on the role of context in crowdfunding, we extend the crowdfunding literature in the field of entrepreneurship and management by considering the role of contextual variables in influencing the performance of crowdfunding projects. Second, some entrepreneurship and management scholars have indeed investigated the effects of contextual variables such as community/community culture (Josefy et al., 2017), gender (Zhao et al., 2021), gender stereotypes (Kleinert & Mochkabadi, 2022), and language (Gorbatai & Nelson, 2015) on the outcomes of crowdfunding. By way of contrast, the results of our study justify the importance of financial rewards and reciprocity

as social and economic contextual variables in crowdfunding success. Although crowdfunding relies on public support, such projects are often different from traditional fundraising and donation activities in terms of sustaining economic vitality. As such, entrepreneurship scholars and practitioners must pay attention to the process of developing mechanisms that incorporate both financial incentives and social norms to interpret the outcomes of crowdfunding projects. Third, our study also extends the social exchange literature within entrepreneurship and management. We begin a conversation about using contextual variables to interpret a social exchange perspective, while psychometric constructs are often employed to predict individual behaviors through a lens of social exchange theory in the field of entrepreneurship and management. As Cropanzano and colleagues (2017) once argued, new theoretical insights were needed to define the social exchange construct, such as using contextual performance in an organizational setting as a construct because individual behavior "partially includes a reference to the organizational reward system" (p. 485). In the meantime, our study offers empirical implications for managers and entrepreneurs involved in crowdfunding. On the one side, our esports context provides a new opportunity to explore an option of developing rewards structures/systems in the format of sporting tournaments/competitions to sustain the attention and participation of funders, rather than traditional rewards campaigns involving simple product/service exchanges as well as venture and equity crowdfunding. On the other side, for crowdfunding portals/intermediaries/platforms, the symbiosis of financial incentives and social norms should be incorporated into the design of funding mechanisms to improve the efficacy of crowdfunding efforts.

The remainder of the study is structured as follows. First, we review relevant literature related to esports, crowdfunding, and social exchange theory. Second, we detail our research methods, including our application of multiple regression analysis and machine learning techniques to crowdfunding data ($n = 14{,}497$) to analyze attributes germane to crowdfunding campaign success. Third, we present and discuss our study's results. Fourth, we provide theoretical, methodological, and managerial implications based on our study. Finally, we conclude by highlighting our study's limitations and provide directions for future research.

Literature review

Esports and crowdfunding

As an emerging industry, esports faces a multitude of challenges since it has yet to build legitimacy (Pizzo et al., 2022). More specifically, the extent to which competitive video gaming is accepted as a professionalized sport remains in question due to a lack of governing rules, regulations, mechanisms, and structures in place (Seo, 2016). In a broader social context, esports is often assumed to be an activity for introverts, or people not who are not perceived to be especially socially active (Schiano et al., 2014). As a result, traditional investors and sponsors are likely to face greater risks when investing in esports. In addition, there is a high level of uncertainty in the esports consumer market. For instance, esports consumers tend to use adblocking software,

making it difficult for sponsors to gauge sponsorship reach and impressions. Sponsors thus have limited reach amongst the esports community and face uncertainty about their return on investment (Harpstead et al., 2019; Nielsen, 2019). As such, rather than relying on traditional sponsors and donors, esports entrepreneurs and organizations increasingly seek alternative funding sources, such as crowdfunding (Hayduk, 2021). Previous literature has illuminated the characteristics of esports participants—as young and affluent, with high levels of engagement within their online communities and a focus on social interaction (Huettermann et al., 2020; Pizzo et al., 2018; Qian et al., 2020)—in a way that presupposes the widespread crowdfunding logic and practices in esports.

Crowdfunding is not uncommon in the entrepreneurship field. An emerging stream of entrepreneurship and management research has pointed to the arising crowdfunded activities in various areas such as communities developing crowdfunding projects for saving local movie theatres (Josefy et al., 2017), entrepreneurs in the technology industry raising investment for social ventures (De Crescenzo et al., 2022), the emergence of equity-crowdfunded start-ups (Schwienbacher, 2019) and peer-to-peer lending and equity crowdfunding campaigns in FinTech (Martínez-Climent et al., 2018). For esports, crowdfunding plays an even more crucial role in a variety of esports tournaments, competitions, and events. For example, Valve employs a Battle Pass (previously known as Compendiums) crowdfunding system through which fans contribute millions of dollars (e.g., over 40 million US dollars in 2021) towards the prize pool of its Dota 2 International tournaments. In other cases, smaller grassroots esports communities, such as Fighting Gaming Community (FGC), often rely on crowdfunding not just to finance tournaments and events but also to promote and maintain their community identity (Lee, 2016).

Despite the growing importance and interest, the mechanisms of esports crowdfunding campaigns and antecedents of success factors are not extensively investigated, although a few studies have suggested that project quality, goal specification, funding allocation, and quality of rewards are prime indicators of the efficiency and success of crowdfunding campaigns (Manning & Bejarano, 2017). This line of research focuses on generalizing the technical and operational characteristics of crowdfunding campaigns and illustrating how such technicalities (e.g., goal setting) contribute to campaign success (e.g., Kuppuswamy & Bayus, 2018). Esports, however, might provide a unique context for understanding how and what campaign characteristics affect crowdfunding outcomes. Indeed, as Josefy et al. (2017) have argued, "the role of the contextual environment in which the project is launched should be especially important given the unique nature of the crowdfunding phenomenon" (p. 164). In esports, participants have a strong sense of belonging to a community (Hamari & Sjöblom, 2017), which can have two implications. First, in esports communities, there might be mechanisms of inclusion/exclusion, enabling strong identification with certain ways of doing and being while excluding others, such as the establishment of genre-based membership boundary (e.g., league of legend community vs. Dota 2 community). The point being, for an esports crowdfunding project, not everyone would be expected to be a potential funder; rather, only those gamers who are identified with a particular esports community are likely to contribute. Second, esports communities feature "a spontaneous…pervasive entrepreneurial spirit" that accentuates authentic and genuine community-based

gaming and esports related business creation and innovation (Xue et al., 2019, p. 850). For example, many esports players, teams and fans are dedicated to their own businesses—ranging from organizing esports competitions and tournaments, coaching and training players, trading self-branded apparel and gaming gear, to online streaming and broadcasting—with the purpose of making positive impacts on the esports community while rejecting the exploitation of profit-making oriented sponsors (Capps, 2020). As such, esports crowdfunding platforms facilitate an entrepreneurial ecosystem where esports entrepreneurs engage in a reciprocal process through which they not only allocate esports-specific resources but also reward would-be funders for their investment for the purpose of sustaining and reinforcing the community.

Following this logic, the funding mechanisms for esports crowdfunding projects may incorporate both social and economic features within the context of an entrepreneurial community inherent to crowdfunding success. Considering this contextual specificity, social exchange theory (SET), which emphasizes explaining the reciprocal exchanges underlying social interactions between individuals, can be used to explore the socio-economic dynamics of the funding mechanisms of esports crowdfunding. Esports crowdfunding can thus be considered as a form of social exchange through interactions between esports entrepreneurs and potential esports community funders.

A social exchange theory framework of the success factors of esports crowdfunding

SET posits that social behaviors are exchanges—the involvement of exchanges of tangible and intangible activities between at least two persons, whether rewarding or costly (Cook & Rice, 2006; Homans, 1961). This perspective suggests that a dyadic social exchange occurs when rewards are exchanged, instead of being directly dictated by the norms and rules (Homans, 1961). In this sense, SET is utilitarian in nature and mutual reciprocity is the underlying principle and unspecified obligation that governs social interactions and the rewarding system therein (Blau, 1964).

More specifically, management and information technology scholars have applied SET and shown its efficacy of investigating the factors that influence funders' intention as well as the mechanisms positively related to the outcomes of crowdfunding projects (James et al., 2021; Schmitt & Petroll, 2021; Zhao et al., 2017), generally including what is involved in exchanges and what principles guide exchanges (James et al., 2021).

Rewards

One of the propositions is that rewards significantly influence the exchange relationship in crowdfunding (James et al., 2021). Indeed, much of the crowdfunding research emphasizes the importance of *tangible rewards* for funders, and how different types of rewards can further enhance the performance of crowdfunding activities for entrepreneurs (e.g., Frydrych et al., 2014; Wei Shi, 2018). Short et al. (2017) have specifically noted that several rewards-based forms—including product-based crowdfunding,

equity crowdfunding, and lending and debt-based model—exist to back entrepreneurs, and each of them encompasses varying levels of economic expectations of funders in terms of financial or material return. Equity crowdfunding involves entrepreneurs selling small portions of ownership stakes to funders, while debt crowdfunding involves entrepreneurs receiving microloans from backers. In both cases, funders function as investors and expect a certain level of financial returns. For example, Cholakova and Clarysse (2015) conducted 155 surveys of investors from Sympid (an equity crowdfunding platform in the Netherlands) by using self-determination theory, and provide empirical evidence that funders are motivated by financial gains and utilitarian outcomes, whereas nonfinancial motives do not play a significant role. In products-based crowdfunding, funders usually receive early access to products or exclusive versions of the products they fund (Short et al., 2017), making them, in some ways, more like consumers (Hobbs et al., 2016; Kuppuswamy & Bayus, 2018). Zheng et al. (2017) demonstrated that in products-based crowdfunding projects, the higher the utilitarian and hedonic values of the products/rewards, the more satisfied the funders. Tyni (2020) further extended these findings to a games crowdfunding context and made a similar argument that "more individualistic, gain-seeking related motivations such as usefulness and seeking cost benefits were proved to be dominant predictors of continued backing" (p. 97). Interestingly, Tyni found that factors such as product quality, community, and co-creation were not significant in relation to motivation for games crowdfunding.

In esports crowdfunding, the proposed outcomes of campaigns usually take the form of organized tournaments and competitions, and the expected rewards would be an esports tournament prize. In this way, esports funders become tournament players and backers by participating in competitions and providing monetary resources to the prize pool. Meanwhile, they anticipate receiving a proportionate share of the pool of funding (prizes) for exchange. Scholars used tournament theory to explain the structure of prize pools and found that prize money distribution and earnings are highly unequal amongst esports players in major esports tournaments sponsored by gaming developers (Coates & Parshakov, 2016; McLeod et al., 2021). In other words, winners take home most of the prize pools whereas the rest of the participants are allocated with minimal prize rewards. This not only highlights the importance of player performance and productivity, but also increases the excitement and entertainment for fans and potentially grows the industry. Unlike the major esports tournament prize pool allocation, small community based esports tournaments are generally focused on communities and entrepreneurs, which perhaps, to some extent, prioritize an equitable distribution of prize funds to 1) benefit and encourage as many participants as possible, and 2) reinforce a reciprocal process for future exchanges within the esports community. Therefore, we expect that *the allocation of prize rewards* is an important feature for affecting the success of esports crowdfunding campaigns (see Fig. 1).

Hypothesis 1: There is a significant relationship between the distribution of prize rewards and the outcomes of esports crowdfunding campaigns.
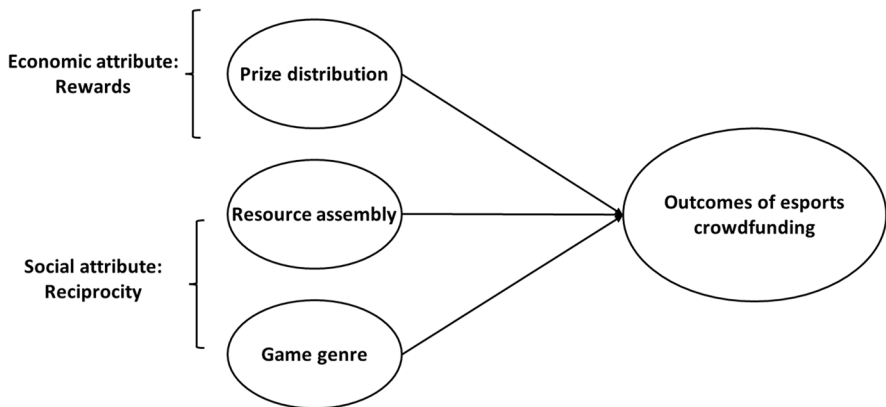
Fig. 1 A conceptual model of esports crowdfunding

Reciprocity

It is important to note that esports entrepreneurs and backers often engage in more than purely economic exchanges. As Blau (1964) indicated, "only social exchange tends to engender feelings of personal obligation, gratitude, and trust; purely economic exchange as such does not" (p. 94). Indeed, "one of the basic tenets of SET is that relationships evolve over time into trusting, loyal, and mutual commitments" which requires the establishment of exchange norms and rules (Cropanzano & Mitchell, 2005, p. 875). Most of the management literature highlights reciprocity as an important principle and rule for overseeing the exchange process (Cropanzano & Mitchell, 2005; Westphal & Zajac, 1997). In other words, a high-quality exchange is characterized by social feelings and behaviors that reflect a mutual sense of reciprocity.

Reciprocity is inextricably tied up to crowdfunding success, as evidenced by copious crowdfunding literature (André, et al., 2017; Cordova et al., 2015; Zvilichovsky et al., 2015). For example, Zvilichovsky et al. (2015) observed the existence and importance of direct reciprocity (between campaign owner and backer) and indirect reciprocity (community at large) for campaign success through investigating 78,061 projects on Kickstarter platform. Similarly, André et al. (2017) connected reciprocity to gift giving which significantly impacts the performance crowdfunding campaign. In their view, reward-based crowdfunding platforms foster—while simultaneously being supported by—reciprocity among the community. Indeed, the "feelings of mutual identification and unwritten social norms of (specific and generalized) reciprocity build social capital relations among platform members, leading them to show support to other members" (Cordova et al., 2015, p. 76).

While the existing crowdfunding literature largely considers reciprocity as a normative practice, we argue that the various actors and communities involved and operating within esports engage in a heterogenous exchange process. To be specific, reciprocity is not a holistic concept as different crowdfunding projects within different esports communities might show varying levels of reciprocity in practice. More specifically, *resource assembly* and *genre-based community* might be indicative of the reciprocal dynamics in esports crowdfunding. Resource assembly refers to the way through

which crowdfunding project creators mobilize and organize various resources (James et al., 2021). As previously mentioned, esports crowdfunding projects are created and organized around esports tournaments and competitions. So if an esports crowdfunding organizer is a verified esports team or player or the organizer is able to secure the sponsorship by corporations such as game developers, it could be argued that the crowdfunding project creator has credibility and trustworthiness in terms of assembling resources (e.g., facilities, staff, volunteers, and sponsorship) to facilitate the events and tournaments. This might help reduce risk and encourage the reciprocated participation of funders/players, leading toward success.

Genre is another important factor that influences the heterogeneity of reciprocity (Jang & Byon, 2020). To wit, a genre is more than just a collection of games of the same type; it represents a subculture where gamers and esports players share gaming experiences and develop their own norms, rules, values, and practices insomuch members establish a sense of belonging, trust, engagement, and commitment. For example, the fighting game community (FGC) develops a culture of racial diversity (Epps, 2020) whereas multi online battle arena (MOBA) communities (e.g., the LoL community) are notorious for toxic masculinity (LeJacq, 2015). As such, the members of a specific genre-based community would select and support projects that adhere to the values and norms of the community they identify with. Therefore, different crowdfunding projects within and across genre-based communities may elicit different reactions and reciprocations, which ultimately influences project outcomes. Following these modes of logic, we argue that *resource assembly* and *genre-based community* are important factors that influence the success of esports crowdfunding campaigns. Taking into account all the arguments above, we thus develop the following hypotheses (see Fig. 1).

> *Hypothesis 2: There is a significant relationship between resource assembly and the outcomes of esports crowdfunding campaigns.*
> *Hypothesis 3: There is a significant relationship between game genre and the outcomes of esports crowdfunding campaigns.*

Methods

Data collection

In order to collect data for the empirical analysis, data was scraped from Matcherino[3] using Octoparse 8. Founded in 2015, Matcherino is a leading esports event management platform. It has a repertoire of integrated tools and functionalities (e.g., PayPal, Twitch) to support esports event organizers and streamers to better engage their followers, boost ticketing and merchandise sales, and improve efficiency and transparency of community donations. A panel of 14,497 crowdfunding projects on Matcherino were extracted to formulate the empirical data frame spanning a course of 4 years since its inception.

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[3] Matcherino is a crowdfunding platform that allows anyone to organize an esports tournament and set up donations and distribute prize winnings (Mitrevski, 2017).

Measures

Scraped metrics include two main categories: rewards (allocation of prize rewards) and reciprocity (resource assembly and genre-based community). More specifically, the category of rewards includes the payout distribution plan of a prize pool (P). The reciprocity category is captured by big brands (BB), fundraising type (FT), the total amount raised (AR), the number of donors (NOD), game title (GT), and game genre (GEN). In addition, we consider the operation of campaigns which consists of crowdfunding source (CT), time completed (Year), and the anticipated amount sought by tournament organizers (GOAL; Hobbs et al., 2016). Prior to the main analyses, we conducted pre-processing data cleansing and a screening procedure to codify these scraped metrics.

First, a discrete binary outcome of funding success (SUC) combined with two measures of entrepreneurial activities AR and NOD were employed as key dependent variables to gauge the overall success of crowdfunding projects. A dummy variable SUC was created when two conditions were met. A project whose fundraising total is greater than zero, and equal to or larger than predetermined fundraising goals was coded as being successful (1), otherwise 0. FT is a categorical variable that indicates four different statuses granted for a published tournament organizer including non-verified registered organizers, verified organizers, verified partners, and a combination of both. Verified organizers are defined by demonstrating a proven track record of successfully arranging professional events previously. On the other hand, a verified partnership requires users to submit a partnership application form for approval. A verified partner can have access to marketing coupons, sponsorship quests, and promote tailored merchandise sales through published tournament portal (Christopher, 2021).

CT indicates revenue sources from which funding was raised for each esports project. These revenue sources comprise of entry fees/ticketing sales (ET), auxiliary product and merchandise sales (MS), and monetary donations (MD). A categorical variable and related five dummy variables were generated using the combo of all resources as a baseline group where 1=EF, 2=MS, 3=MD, 4=MS plus MD, 5=ET plus MD. BB is a dummy variable to determine if a tournament sponsored by well-recognized sponsors and brands such as Blizzard.

Classification for genre was adapted from coding defined by previous literature (i.e., Baker & Pizzo, 2021; Funk et al., 2018; Holden & Baker III, 2019; Pedraza-Ramirez et al., 2020). The genres of esports crowdfunding projects were classified into one of the following seven categories: first and third-person shooters (Shooting; e.g., CS:GO; Counter-Strike: Global Offensive), real-time strategy (RTS; e.g., StarCraft II), fighting games (Fighting; e.g., Street Fighter), digital collectible card games (DCCGs; e.g., Universal Fighting System), sport-simulation games (SSG; FIFA20), multiplayer online battle arena games (MOBA; e.g., League of Legends) including massively multiplayer online role-playing games (MMORP), and others (e.g., augmented reality, action-adventure survival, and battle royal). Six dummy variables were then created to represent each of these game genres treating the last category as a reference group. Collectively, all measures were included in the regression analysis, as well as the robustness checks that were conducted using machine learning models.

Econometric approach

In order to estimate results from the data collected on esports crowdfunding, this study utilized various forms of multiple regression analysis. Specifically, the empirical analysis was conducted by utilizing the regression method that best suited the data, especially the dependent variable – from each model. To begin with, considering that the dependent variable of success (*SUC*) in Model 1 is measured as either a 1 for success or 0 for failure, we estimated the model using a logistic regression as is commonly done in research when a dependent variable is binary (Gujarati, 2003). Next, as the second model's dependent variable (*AR*) was a continuous variable, we utilized a standard Ordinary Least Squares (OLS) regression to estimate the results. Finally, as the dependent variable in the third model counted the number of donors (*NOD*), a Poisson regression was estimated because values were measured as integers. In this manner, three different regression techniques were utilized to estimate the results.

Before estimating each of these models, additional econometric tests were conducted on all three models. First, a Breusch-Pagan test for heteroscedasticity was calculated for all three of the regressions estimated as robustness checks. In each case, the test returned a significant result ($p < 0.001$), indicating that heteroscedasticity was an issue within the dataset. In order to correct for this, each regression was estimated using White's robust standard errors (Gujarati, 2003), a common approach to dealing with heteroscedasticity in econometric models (Wooldridge, 2010). Next, to consider the potential for multicollinearity within the data, we also calculated the Variance Inflation Factor (VIF) scores for all the variables included in the models. The VIF scores for all measures in the dataset returned scored under 2.5, suggesting that collinearity between variables was not an issue within the models. The results for all three models can be found in Table 1 alongside the results from polynomial regressions determined through the machine learning approach that were estimated as an additional robustness check.

Robustness check

In order to further probe the findings from our initial estimated results, a machine learning approach was used to select a set of important features that optimize the prediction accuracy of esports crowdfunding success, we employed a supervised machine learning-based recursive feature elimination method as highlighted in prior sport management study (Su et al., 2022). We used the random forest classifier to cross-validate the prediction accuracy of the supervised model. Packages including Random Forests, Recursive Feature Elimination Cross Validation (RFECV) were imported from Scikit-Learn in Python, version 3.8.

Procedurally, an exploratory filter method was administered first to identify features with a significant number of missing values or highly correlated features in the data frame. A feature with more than two-thirds missing values was eliminated from the feature selection algorithm. A correlation heatmap was developed to facilitate the identification using a recommended cut-off of 0.8 (see Fig. 2). Features with a

Table 1 Results of Polynomial and Panel Regression Models with the Identified Features

	Model (1) SUC[a]	Model (2) AR[a]	Model (3) NOD[a]	Model (4) SUC[b]	Model (5) AR[a]	Model (6) NOD[b]
Winner payout	<0.001[*]	0.992[***]	0.003[***]	.001	0.690[***]	.003
	(<0.001)	(0.017)	(0.002)	(.000)	(.018)	(.002)
Big brands	5.288[***]	18.984	35.517[***]	7.922[***]	47.290	26.55[***]
	(0.243)	(47.018)	(5.304)	(0.345)	(45.55)	(4.909)
Runner-up payout	<0.001	1.609[***]	0.010	.002[*]	0.816[***]	0.046
	(<0.001)	(0.042)	(0.013)	(.001)	(0.105)	(0.038)
Shooting	2.341[***]	44.379	34.025[***]	3.238[***]	73.56	21.42[***]
	(0.119)	(57.874)	(4.921)	(0.168)	(50.42)	(4.842)
RTS	3.550[***]	-18.898	32.326[***]	4.451[***]	-14.81	19.02[***]
	(0.093)	(13.608)	(2.057)	(0.121)	(12.42)	(2.520)
Fighting	2.306[***]	22.678	51.486[***]	3.796[***]	16.37	34.80[***]
	(0.107)	(14.915)	(2.656)	(0.149)	(20.86)	(2.702)
DCCG	3.284[***]	84.009	27.713[***]	3.268[***]	73.56	20.37[***]
	(0.131)	(48.630)	(3.652)	(0.181)	(50.42)	(3.790)
SSG	2.854[***]	-6.296	17.203[***]	4.779[***]	-3.159	-0.425
	(0.094)	(9.929)	(1.255)	(0.141)	(14.22)	(1.820)
MOBA	2.048[***]	-15.338[*]	23.439[**]	2.544[***]	2.051	17.35[***]
	(0.110)	(6.290)	(1.721)	(0.131)	(8.059)	(1.737)
$Year^2$	-0.001[***]	-0.001	-0.001[**]	-0.104[***]	-1.607	-1.300[***]
	(<0.001)	(0.002)	(<0.001)	(.011)	(2.907)	(0.310)
Pseudo R^2/R^2	0.349	0.952	0.3022	0.528	0.754	0.110
χ^2/ F	1733.45	28,523	237.64	2515.14	2700.91	116.82
Observations	14,497	14,497	14,497	14,497	14,497	14,497
Machine Learning	No	No	No	Yes	Yes	Yes

Robust standard errors in parentheses

DCCG digital collectible card games, *CT* crowdfunding type, *MOBA* multiplayer online battle arena, *RTS* real time strategy games, *SSG* sport simulation games

*$p < .05$; **$p < .01$; ***$p < .001$

[a]Focal dependent variables in polynomial regression models

[b]Focal dependent variables in regressions estimated as a robustness test

correlation coefficient greater than 0.8 were removed to avoid potential multicollinearity and improve the efficiency and performance for the subsequent predictive machine learning modeling. This procedure is recommended to reduce computational costs for machine learning algorithms that involves big data (Watanabe et al., 2021). Next, we performed REFCV with random forest classifier to proceed with a supervised selection from all possible combinations of subsets of features. A backward elimination mechanism was set by eliminating one feature at each iteration. We used a 75/25 split to form training and testing datasets, followed by the employment of confusion matrix and cumulative feature importance graph to retain an optimal set of features that yield the highest prediction accuracy. Features with either zero or low importance scores were excluded.
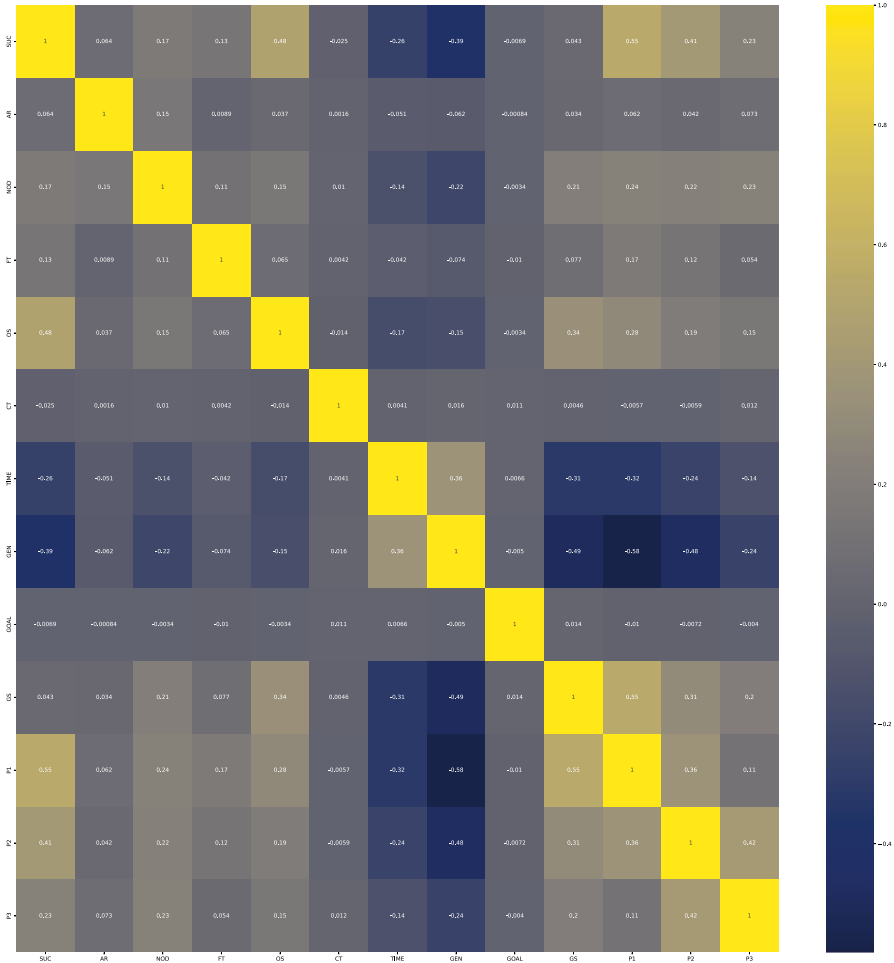
Fig. 2 Correlation heatmap for supervised feature selection of esports crowdfunding success. AR=Amount raised, BB=big brands, CT=crowdfunding type, FT=fundraiser type, GEN=Game Genre, Goal=projected amount raised, GS=goal setting, NOD=number of donors, P1=winner payout, P2=runner-up payout, P3=3rd place payout, SUC=succeeded

Supervised feature selection

As shown in Fig. 2, none of the included features had cross-factor correlations higher than the recommended benchmark of 0.8, resulting in no elimination of features for the machine learning modeling.

The findings of RFECV revealed that the out-of-bag estimate was 0.913 and accumulative accuracy score derived from the confusion matrix was 0.889 indicating that retaining of 5 features (see Fig. 3) represented the optimal solution to yield the highest prediction accuracy.

The visual representation of Fig. 4 shows a ranked set of features based on the relative importance scores. The top five included winner payout (P1; *relative importance*

Fig. 3 Feature selection results of the recursive feature elimination with random forest classifier cross validation
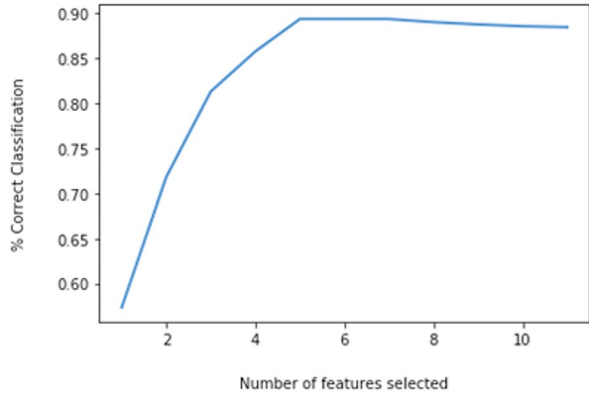
score = 0.285), BB (*relative importance score* = 0.149), runner-up payout (P2; *relative importance score* = 0.148), GEN (*relative importance score* = 0.126), and Year (*relative importance score* = 0.091). GS (e.g., whether a goal was set), CT (e.g., ways of which tournament organizers chose for fundraising), and Goal (e.g., predetermined fundraising total at launch) which were assigned with the lowest relative importance scores, indicating that they represented irrelevant features in predicting the success of crowdfunding projects.
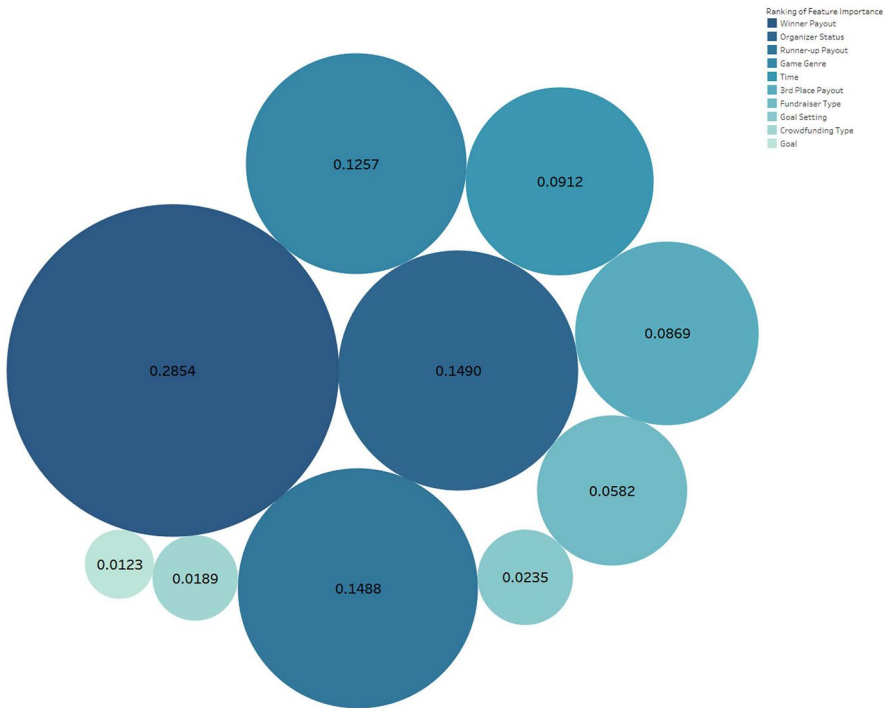

Fig. 4 Visual analysis of feature importance

Results

Considering the results for the models measuring the success of esports crowdfunding (Models 1 and 4), it was evident that the results held mostly consistent across most measures. Notably, big brands, game types (Shooting, RTS, Fighting, DCCG, SSG, MOBA,) and the quadratic year term were all significant and had coefficients with similar signs in both the logistic regression (Model 1) and the polynomial machine learning models (Model 4). The main difference between these two models was that winner payout was significant in Model 1, while runner-up payout was only significant in Model 4. Overall, these findings suggest that the payouts for the top performers are important in determining the success of a crowdfunding campaign, however, there is some uncertainty in regards to which performer's payout is critical.

Continuing to the next set of models focused on the amount raised (*AR*) through crowdfunding, the linear regression (Model 2) and the polynomial (Model 5) again returned similar results. Notably, both found the winner and runner up payout measures to be positive and significant in relation to *AR*. Moreover, all other measures were insignificant in both models, except for the variable measuring games within the MOBA genre, which were negative and significant in Model 2, but insignificant in Model 5. Finally, the last two regressions measuring the number of donors (Models 3 and 6) also generally returned similar results to one another. Similar to the first set of models (Models 1 and 3), big brands and most game types (Shooting, RTS, Fighting, DCCG, MOBA) had a positive and significant relationship with the number of donors, while the quadratic year term had an inverse relationship. Notably, winner payouts and SSG games were significant in the Poisson regression (Model 3), but were not statistically significant in the estimated results from the polynomial regression (Model 6). Overall, the robustness checks (Models 4 through 6) returned similar results between the polynomial regressions (Models 1 through 3), indicating the strength of the estimated results from our model.

In probing the findings further, as demonstrated in Fig. 5, the results of all estimated regressions showed an inverse U-shape trajectory in esports crowdfunding success over-time. The negative coefficients of the quadric year term (*Year*^{2}) were identified across three logistic polynomial models (β_{SUC} = –0.104, $p < .001$; β_{AR} = –1.607, *n.s.*; β_{NOD} = –1.300, $p < .001$), as well as in all three regressions estimated as robustness checks. Notably, within the polynomial regressions, both the total amount raised, and the number of donors reached a plateau in 2017. Furthermore, if a tournament were sponsored by a well-recognized brand, the probability that the tournament being successfully funded would increase from 56 to 67%, holding all else constant (see results of logistic polynomial regression in Model 4 and 6 in Table 1). Table 1 provides a summary of all the base regression results, as well as the machine learning robustness checks.

Interestingly, payout distribution was not uniformly associated with the success rate of esports crowdfunding. The prize pool being allocated more in runner-up account (β_{SUC} = .002, $p < .05$; β_{AR} = .816, $p < .001$) rather than rewarding the winner exclusively, led to a higher level of success rate and money collected. The results indicated that a more diversified and even payout distribution could represent an effective incentive program to promote goal achievement of esports fundraising and motivate donating
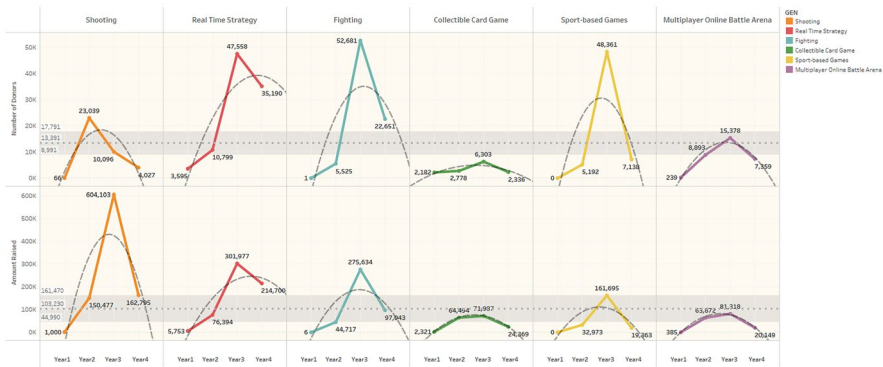
Fig. 5 Visualization of changes in esports crowdfunding success by game genres over time. The across-year averages and related confidence intervals were shown in the highlighted banded areas

behaviors. While winner payout was not significantly associated with the success rate of esports crowdfunding projects, it was positively linked to fundraising totals ($\beta_{AR} = 0.690$, $p < .001$) implying that a more aggressive incentivizing mechanism was able to receive better reciprocity from their grassroots supporters

The results of polynomial regressions and the robustness checks together with visual representation in Fig. 5 demonstrated that five popular game genres including Shooting ($\beta_{SUC} = 3.238$, $p < .001$; $\beta_{NOD} = 21.42$, $p < .001$), RTS ($\beta_{SUC} = 4.451$, $p < .001$; $\beta_{NOD} = 19.02$, $p < .001$), Fighting ($\beta_{SUC} = 3.796$, $p < .001$; $\beta_{NOD} = 34.80$, $p < .001$), DCCG ($\beta_{SUC} = 3.268$, $p < .001$; $\beta_{NOD} = 20.37$, $p < .001$), and MOBA ($\beta_{SUC} = 2.544$, $p < .001$; $\beta_{NOD} = 17.35$, $p < .001$) had a significantly higher success rate and were able to attract more donors compared to the reference genre group such as action and adventure survival games.

Sport-based games were also more likely to achieve their predetermined financial goals ($\beta_{SUC} = 4.779$, $p < .001$) while having less traffic ($\beta_{NOD} = -0.425$, $p < .001$) than the baseline genre counterpart. Taken collectively, the visual analysis indicated that shooting games had the highest amount raised among the seven game genres while RTS and Fighting attracted more donors over time. Finally, sport games had lower goal thresholds and were therefore more likely to be funded.

The results from both the base regressions (Models 1 through 3) and the machine learning polynomial regressions (Models 4 through 6) also corroborated with patterns illustrated in the visualization shown in Fig. 5, where differences across six game genres did not exert significant heterogeneous impact on crowdfunding success over time. Overall, the results of the robustness checks presented comparable patterns in assessing the effects of each identified feature even after introducing statistical approaches to control for the nature of the dependent variable in each model, as well as controlling for other econometric issues.

Among those who were successfully funded, tournament managers who were registered as both verified organizer and partner by Matcherino, on average, raised the highest amount of funding ($\mu = \$1270.73$) when they were sponsored by well-recognized

corporate brands. On the other hand, counterintuitively, although failed to achieve their fundraising goals, non-verified tournament organizers can still attract a significant number of investors when they were able to be endorsed by big brands. This finding might imply that rather than being quested by tournament organizers, sponsors were proactively looking for tournaments or channels capable of securing high volume traffic through streaming services (e.g., Twitch) in the fast-pacing digital economy of esports (Watanabe et al., 2022). We further elucidate upon our results in the following discussion.

Discussion and conclusion

Crowdfunding provides resources and opportunities for the emerging esports industry—in particular grassroots esports entrepreneurs—to survive and grow. Understanding the dynamics of esports crowdfunding campaigns through a social exchange perspective is therefore important for exploring how both economic and social interests are inextricably embedded within the exchange process between esports entrepreneurs and would-be funders within and across different esports communities. More specifically, following SET, our findings demonstrate that the importance of rewards (the allocation and distribution of rewards) and reciprocity practice (including the endorsement of major sponsors as a strategy of resource assembly and genre-based community) for successfully facilitating esports crowdfunding entrepreneurial campaigns.

Theoretical implications

Based on SET, we provide a theoretical explanation of the nature and process of esports crowdfunding campaigns—which emphasizes a complex mechanism that incorporates financial incentives and social values. There is often a clear distinction between rewards-based and donations-only crowdfunding projects in crowdfunding literature (André, et al., 2017) while scholars tend to debate either "economic motives" (Macht & Weatherston, 2014) or the "public good" (Boudreau et al., 2015) for understanding the intentions and behaviors of backers. Yet our study shows that crowdfunding is an exchange where both entrepreneurs and backers are involved in developing reciprocal interdependence as it relates to mutual arrangements around rewards, resources, and community (Cropanzano & Mitchell, 2005). The salience of mutual reciprocity manifested through esports crowdfunding is perhaps due to that esports is still at its early stage where esports entrepreneurs, together with funders/participants, need to develop both tangible capacities (i.e., material resources and reward structures) and intangible/symbolic competency (i.e., the community) for building legitimacy to enhance survival. How esports crowdfunding can be related to legitimacy and entrepreneurship may guide future research.

Furthermore, these findings contribute to our theoretical understanding of esports as an emerging industry that is institutionalizing. We can surmise that brand endorsement has a significant impact on the outcome of esports crowdfunding projects. This raises an interesting question as the esports community is ostensibly recognized for upholding authenticity, originality, and independence while resisting and rebuking

the involvement of big-name corporations and sponsors (Taylor, 2012). One possible explanation could be that esports has gradually become institutionalized as increasing powerful and resourceful corporate actors enter the field—which could potentially shape the spread of new practices (e.g., the creation of franchise model in Overwatch and LoL tournaments). Management and organizational scholars often allude that there usually exist "two or more strong, competing or conflicting belief systems" (Scott, 1994, p. 211) in emerging institutional fields (Lounsbury, 2007; Purdy & Gray, 2009), but ultimately these logics may merge, or one logic may dominate, leading to new organizational practices (Besharov & Smith, 2014). In light of this, the field of esports which was originally characterized by competing logics (i.e., community vs. commercial) perhaps would be predominated by a commercial logic. For example, we have seen traditional sports teams and technology conglomerates acquiring or investing in esports teams or organizations recently (e.g., the Microsoft acquired Blizzard with almost 68 billion US dollars in 2022) while the esports field has been infiltrated with viral narratives around economic growth, business investment, consumption practices, and esports-sport synergy (Newman et al., 2022). Longitudinal studies may be conducted in the future to shed light on how the esports field is institutionalized.

Our results also demonstrate the importance of genre-based community in relation to the success of esports crowdfunding projects. This suggests that the esports community is not a holistic construct—whereas there exist a variety of subcultures based on the genres of games. Some subcultural communities (e.g., shooting) have a higher level of reciprocated participation in funding and result in higher success rate whilst some (e.g., action and adventure survival games) are less successful. There are two possible explanations for this finding. First, some genres have a larger population of players and fans in general, which directly impacts the number of funders for relevant crowdfunding projects for those genres. Second, the way esports players identify themselves within their community is usually based on unique cultural norms and practices endogenous to the communities. While esports players in some esports communities are more identified with the community and therefore more committed to the success of the crowdfunding projects hosted within, others may be less so. In addition, it is also possible that players/funders will often support those crowdfunding projects that are consistent with the community principles and beliefs they identify with. For example, female and minority-initiated crowdfunding campaigns might have difficulty succeeding in MOBA communities because of the sexism and misogyny prevalent in the communities. Perhaps this could indicate a future trend for research on diversity and inclusion within esports.

Lastly, this study extends our understanding to the prize structure of esports tournaments by showing that the distribution of prize rewards is a key driver that significantly impacts the success of crowdfunding projects in esports. Notably, equitable payouts across top-earning competitors—vis-à-vis winner-take-all—appear to be an effective approach with a higher success rate for achieving funding goals. First, this finding is consistent with the idea that distributive justice—equity considerations on allocations of rewards—is an important predictor of organizational outcome that is commonly presented in management and organizational literature (see McFarlin & Sweeney, 1992). Therefore, it is more likely that the esports community (at least at

the grassroots level) has placed a high value on the fairness of the reward allocation. It seems rational and reasonable as esports players/funders, in the context of esports crowdfunding, contribute both resource (money) and labor (participating in competition) for facilitating the tournaments. In this sense, they can be considered both shareholders and players, and would naturally expect a fair return based on their financial investment and labor production.

Previous esports literature offers different perspectives regarding the effectiveness of various esports tournament prize distribution methods. In their study, Coates and Parshakov (2016) found that there is an enlarged gap between winners and the rest of the players at elite esports tournaments whereas the prize spread is smaller for the low-level tournaments. Based on an economic logic that focuses on maximizing performance, they attributed such differences to the degree of risk-aversion and further argued that a more equal distribution is problematic as players may have more incentives to shirk. For McLeod et al. (2021), the large payout gaps reflect income inequality and would cause social problems in the long run while industrial stakeholders employ unequal distribution of prizes as a strategy to exploit esports labors. In our study, we have proved the effectiveness of equalized reward allocation in the case of esports players providing both financial and labor contributions.

Methodological implications

We have also noted some implications for the use of machine learning for future esports and crowdfunding research. First, the use of big data analytics techniques to uncover key features in this study provides the ability to examine esports crowdfunding projects through a new lens. Using the Recursive Feature Elimination Cross Validation procedure, the optimal number of features was found for optimized accuracy on the model. While these can vary depending on the datasets used, the use of machine learning appears to be an efficient tool to not only determine feature importance, but also in yielding the optimal number to select for best performance. Thus, our supervised feature selection model allowed us to distinguish and confirm five features including Winner Payout (P1), Runner-up Payout (P2), Big Brands (BB), Genre (GEN) and Year, which accord with the objective of this study in finding key attributes for the success of esports crowdfunding.

Additionally, it is relevant to notice features with the lowest importance scores in our analysis, as it gives deeper insight on success contributors in this study. Identifying factors and attributes to the success of esports crowdfunding not only fulfilled our goal of explaining relationships, but also contributed to building predictive models. Indeed, after finding an optimal number of features using machine learning we found high values for our out-of-bag estimate, as well as for our accumulative accuracy which confirm our feature selection findings. At the same time, it must be acknowledged that the standard econometric approaches used to analyze the data within this study produced similar results as the machine learning approach, and in some cases returned models with higher R-squared values. As such, while machine learning can be a valuable tool in research, there is the need for further comparison of its performance in relation to existing statistical approaches to analyzing data.

Managerial implications

The implications of our study can be applied by entrepreneurs to develop strategies and policies tailored to the dynamics of the esports industry. First, our study shows that crowdfunding can be used as an effective technology for esports entrepreneurs to allocate financial resources for hosting esports tournaments. In contrast to the manner in which game developers allocate community money via in-game content purchase for a few elite teams/players, esports crowdfunding platforms (e.g., Matcherino) focus on collecting money from the community to benefit the community. Accordingly, entrepreneurial esports organizations and stakeholders who create and host esports tournaments events through crowdfunding must consider distributive justice in terms of prize reward allocation to increase their chances of success. That being said, a relative equal distribution of prize money, instead of a winner-take-all approach, will attract more esports players to participate and contribute financial resources at the grassroots level and increase the likelihood of crowdfunding success. It may be important for esports crowdfunding entrepreneurs to consider 1) what winning criteria should be developed and 2) how many winners should be included— instead of performances or rankings—before calculating payouts. For example, the prize pool can be equally distributed amongst the top three; or the total prize pool can be divided equally by all winners (depending how the entrepreneurs set up the winning criteria). Additionally, different compensation models could be built into crowdfunding platforms for esports entrepreneurs to pick.

Second, esports crowdfunding platforms may open up a new opportunity for both endemic and non-endemic sponsors to be involved in grassroots esports tournaments and events. Our results show that sponsors with higher status and reputation will be more likely to be recognized by esports communities and gain success in crowdfunding. This demonstrates that a common notion that esports communities refuse sponsorship to maintain authenticity may not be true (see Finch et al., 2020). Esports can, otherwise, provide new opportunities that "make it more flexible for brands to jump in" (Lee, 2021, para. 9). As a starting point, esports crowdfunding platforms (e.g., Matcherino) can help sponsors familiarize themselves with the esports community and raise awareness. Crowdfunding platforms, for example, can offer sponsors the option of 1) investing in the title sponsorships of esports tournaments and directly contributing cash to the prize pools, or 2) becoming promotional partners by providing food, services, equipment, and technologies to facilitate the organization and planning of esports events. In addition, for sponsors and investors, understanding the cultural differences among genre-based esports communities is important when developing business relationships with esports crowdfunding platforms and esports stakeholders (Holden & Baker III, 2019). Sponsors, for example, should approach shooter game communities differently from the way they interact with fighting game communities. In this context, crowdfunding managers might need to create effective communication mechanisms (e.g., information and education seminars; relevant esports documents and reports; setting up liaisons) to help potential sponsors, investors, and partners understand the culture of different esports communities.

Lastly, our study provides an important managerial implication for the future expansion of crowdfunding activities in esports worldwide. While esports grows exponentially and the value of the esports industry has been acknowledged globally (e.g., according to Nordland (2022) the European Parliament passed a resolution recognizing the value of esports and gaming industries and recommending a long-term support and funding strategy), the crowdfunding system can be employed as an effective funding model to generate global resources to support grassroots esports entrepreneurs and teams in various countries and regions. Our study then initiates a discussion regarding the appropriate mechanisms for building a successful and sustainable funding ecosystem that can be extended on a global scale.

Limitations and future research

The main purpose in this study aims to decipher key economic and social factors and attributes for success in esports crowdfunding ventures through a social exchange theoretical perspective. Other contextual factors, such as the role of governments, country-level variables, and the bias of crowdfunding platforms, can be considered for measuring the success of esports crowdfunding in the future. In addition, funders and project creators can build trust and social networks that add to the dynamics of crowdfunding and should be explored in the future.

A possible way of furthering our investigation would be to enrich our current dataset with unstructured text data, providing information about the projects seeking for crowdfunding efforts. Indeed, other applications of using such data structures were proven to contribute to better predictions models when drifting away from traditional approaches (Stevenson et al., 2021).

Then, our study relied on a fundamentally supervised learning technique, using only labeled data (i.e., SUC variable, following a binary resulting in "0" or "1"). While our main objective required a target variable showing whether a certain crowdfunding esports projects was successful or not, it would be relevant to pursue unsupervised learning techniques, such as K-Means clustering or Hierarchical clustering methods, with the goal of finding a new definition of success for projects. Hence, the absence of labels would determine new clusters in the data, and therefore, allow researchers to find new insights regarding the key factors in crowdfunding success in esports.

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