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Abstract

Purpose – The purpose of this paper is to establish a social-network sp.orts lottery system to support users in predicting and simulating sports lottery betting. The community data were generated to support user decision and featured instant game records and odds data synchronisation. Furthermore, the next development cycle were evaluated through a questionnaire.

Design/methodology/approach – An extended prototype website development methodology was applied to develop the system. An online sample was collected to evaluate the function, interface, operation, and prediction designs. The χ^2 test and variance analysis were used to determine the association between facets and basic demographics. Finally, the regression model was used to identify the potentially essential predictors that influence the measurement facets.

Findings – The high frequency of Facebook users, sports lottery purchases, and sports game viewers prefer the ability to predict the results of future sports games as advanced decision-making functions. However, the agent-based virtual gift presentation function was the least preferred function.

Research limitations/implications – The study sample was limited only to users: who used PTT and Facebook; were of uneven age, education, and gender; and none segment groups. The study sample primarily comprised Taiwanese respondents. These differences might influence the practicality and prediction bias of the designed website and related models.

Practical implications – The proposed method integrates social-network messages with real-time data access by using APIs, crawler schemes, and prediction mechanisms that enable developers to devise strategies for obtaining high system satisfaction. The system can be improved by adding the results of future sports games and excluding authorised Facebook message posts.

Originality/value – A social-network-based sports lottery and prediction prototyping website was evaluated through a user-preference survey regarding design functions. The measurement results indicated that users share their opinions, predictions, and personal betting results and interact with their friends.

Keywords Satisfaction, Websites, Systems development, Agents, Social networks, Community networks

Paper type Technical paper

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1. Introduction

Social media, which is defined as a platform that provides users with Web 2.0 and mobile technologies to communicate, share, and discuss with each other (Kaplan and Haenlein, 2010; Kietzmann *et al.*, 2011), have developed rapidly and numerous community websites emerge constantly (Boyd and Ellison, 2008; McCarthy *et al.*, 2014). The value of a social network is that 58 per cent of people have used at least one type of social network. The most famous websites are Facebook (with 1,415 million users), QZone (with 629 million users), LinkedIn (with 347 million users), Google+ (with 300 million users), and Twitter (with 288 million users)[1]. Facebook (belongs into social-network platform) offers its members sophisticated privacy control (Acquisti and Gross, 2006, Light and McGrath, 2010) and has changed users' community website usage behaviour by providing functions, such as instant messaging service, audio, video, and links to friends. According to the 2014 Pew Research Centre survey results of social media, approximately 73 per cent of adults use social-network sites, and Facebook – with 71 per cent of online adults – is the most popular social-network platform. Nearly 70 per cent of Facebook users visit the site at least once a day and approximately 45 per cent of users browse multiple times in a day with high levels of engagement (Duggan *et al.*, 2014). Therefore, this study involved combining the features of communities and social networks to enhance the interaction between users who may be friends or share mutual interests to develop a sports lottery system.

The state-of-the-art sports lottery systems are discussed in the following subsections.

1.1 Development of state-of-the-art systems in overseas

Participating in lotteries is a gamble regardless of the sports or certification. Over 200 years of lottery history worldwide has revealed that several countries have adopted various types of sports lottery systems by considering crucial sports undertakings. Some bettors analyse the content and manner of sports competitions to predict the game results with confidence to win a prize. Others might provide emotional support to their favourite team, happy moment, and follow wave.

Several US states have organised sports lottery agents that operate at various sports betting venues and use various approaches. A legal norm for provisions betting behaviours has been established. Several international sports betting websites, such as bet365.com and sportsbet.com, allow betting services on several types of sports and tournaments, such as basketball, baseball, and world-cup sports games (McCarthy *et al.*, 2014). The website provides various methods for placing bets, such as win or lose, run line, in-play (bet before game starts or during a game), and game totals (bet for the total game scores).

1.2 Development of state-of-the-art systems in Taiwan

In 2010, Taiwan formally implemented a sports lottery and transferred the revenue to sponsor activity for public welfare. Players can bet online or at a lottery store. Several types of sports lottery, such as basketball lotteries, run line, game totals, and *kuai jhih cai*[2], are available. Sports lottery has become part of people's lives and is unlike lotteries that enable people to become rich overnight. However, if a user bets at several sports lotteries, then the odds are high. Furthermore, Taiwan sports lottery (TSL) website offers past game records that facilitate game prediction.

The research motivations are described as follows:

- Current online sports lottery betting sites, such as the TSL and Bet365.com, require that users place a bet using real money. These sites might not satisfy the people who intend to practice, evaluate, and share the game status to enjoy free entertainment.

- On Taiwanese or foreign sports lottery betting websites, such as PlaySport.cc, Pada.biz, sports178.com, and Pixnet Luckygo (http://channel. pixnet.net/sport/luckygo/baseball), few platforms connect players by implementing a hybrid social-network and community website for discussing and predicting the game results.
- According to our thorough review of relevant research, most of sport-betting websites provide a community mechanism for expert and individual evaluating in detail to support user betting decisions, but few sites integrate with social network platforms.
- On both Taiwanese and international sports lottery betting websites, most existing game prediction analysis messages are provided by experts who may not base the predictions on objective perspective opinions. It lacks the Web 2.0 characteristics.

Table I resumes the most relevant literatures and the major differences from this work.

This study involved using an extension prototyping system development (EPSD) method to embed into Facebook the sports lottery betting functions of a community website that enable users to bet on sports games. The principal purpose of developing a social-network-based sports lottery community system was to exploit the main functions of social network to: obtain potential users and related information; use a self-service mechanism to enrich website content; promote frequent use to encourage users to continually use the proposed application; acquire numerous users to enhance the prediction accuracy; and design the interaction and prediction mechanisms to enhance the features of the developed sites.

The objectives of this work, which were main contributions, are described as follows:

- The relationship between hybrid social networks and communities were evaluated by implementing the proposed virtual platform. The proposed website supports users in playing with virtual currency by simulating the TSL.
- An agent-based website was developed by using a prototyping system analysis and design method. The agent automatically downloads the latest game and sports lottery data and interacts with Facebook friends by performing actions, such as sending gifts.
- A series of self-service mechanisms was explored by using virtual currency to increase the use of the proposed website. Users pay the ideal number of coins to place a virtual bet and purchase virtual gifts; meanwhile, users earn virtual coins by posting and evaluating game opinions.
- Three competition prediction mechanisms, namely vote, odds, and futures, were proposed and integrated into the betting operation on the proposed website.
- Several methods are used to integrate related information and to provide an interactive Web 2.0 social network and community to enhance the prediction accuracy rate.
- A questionnaire approach was used to evaluate whether the functions, operations, interfaces, and designed mechanisms of the proposed system satisfied the requirements of users. The evaluation results were used to enhance the proposed websites.

Difference and relevant	Characteristics	Relevant literature
This work adopts the social media to develop website system	Social media Web 2.0	Burke *et al.* (2010), Thompson (2008)
To make use of Facebook for highly sophisticated privacy control	Ethics (privacy)	Light and McGrath (2010)
This study attempts to integrate social networks with sports lottery communities to enhance trust	Ethics (trust) Protection configurations	Acquisti and Gross (2006), Light and McGrath (2010), Karyda *et al.* (2009), Tan *et al.* (2012), Hugl (2011)
Several international sports betting websites bet365.com and sportsbet.com, allow betting services	Betting service	McCarthy *et al.* (2014)
Adopt the community concepts to develop a specific forum, evaluation, information, and prediction platform	Community Prediction	Huang (2012) Lin and Huang (2013)
To enable users to track game status easily and share information with friends	Knowledge sharing	Ho *et al.* (2012) Hsu and Lin (2008) Yang *et al.* (2014)
To use the features of social networks to predict future events, but not to discover relevant and credible news events	Future events Prediction	Schoen *et al.* (2013)
To support users with a communication platform to post and share information with each other	Self-service	Lin and Huang (2013), Ho *et al.* (2012)
To allow users to decide the prediction rate of betting games through multiple mechanisms, including votes, odds, and future events, not only single mechanism	Prediction method Future events Decision support	Taylor *et al.* (2004)
The related messages are aggregated into a game blog, which is a type of community blog	Data integration	Lin and Huang (2013)
To provide users with statistical reports to enable them to verify their voting and betting decisions	Prediction	Ciou (2010)
The prediction price can be used as a reference to predict whether an event occurs	Prediction Future events	Tung *et al.* (2009)
The interactive strategies, such as interacting with Facebook in real time, posting and agent-based gift delivering functions, were designed to facilitate interaction among users	Interactive	Moreira *et al.* (2013)
Although several web analytics products and services are available, such as Google Analytics, for testing and evaluating a website, but such types of tools are not suitable for use	Web development method	Nakatani and Chuang (2011)
A prototyping website development methodology	Prototyping development method	Che and Hou (2008)
To identify the main stages and tasks involved in website development	Prototyping development method Questionnaire	Schefels and Zicari (2012)

Table I.
Summaries of the relevant literatures

This paper is organised as follows: Section 2 reviews-related studies on social networks and communities, betting odds, predictions, future events, and user interaction; Section 3 describes the system development methods; and Section 4 presents the questionnaire evaluation and measurement results. Finally, Section 5 concludes this paper.

2. Literature review

2.1 Sports lottery overview

A sports lottery – which involves a game of skill, prediction, and niche consumer groups – and a public welfare lottery – which entails a game of chance, probability – are different. The users exhibit a higher level of confidence to play a sports lottery than they do a public welfare lottery; however, it is still a niche game for specific consumer groups.

Odds are defined as the ratio of the probability that a specific event will occur to the probability that it will not occur (Bertsekas and Tsitsiklis, 2002). They reflect the expectations of a team. The odds information supports users who are ready to bet. The TSL betting odds are used to set the ratio for an amount that a winner receives. The proposed website features a function for synchronising betting odds with those of the TSL to enable users to determine the odds accurately at the earliest time possible and, thus, simulates placing a bet at high odds. Regardless, the TSL betting odds are balanced according to the distribution of placed bets.

The proposed sports lottery website refers to the changes of interactive gambling technology in consumer behaviour (Brindley, 1999) and social media. The site is designed for long-term usage and not an impulse buying platform (Shen and Khalifa, 2012). The exploring functions, such as gift purchasing and earning virtual coins by posting, are designed to induce users to visit the website continually.

Except for official websites, several Taiwanese websites provide racing analysis, racing data, real-time competing results, racing forums, and sports news. Racing analysis websites – such as PlaySport.cc and Pixnet Luckygo – provide forums, game statuses, history game scores, game predictions, real-time game scores, and reference data through expert comments with Web 2.0 interactive mechanisms. The racing data websites – such as sports178 and VegasInsider MLB Matchups – provide matchup information, team statistics, and game results for query and reference. Most of the news (udn.com and PlaySport.com) and online lottery websites (sp8888.net and ESPN.com) provide real-time results and sports news. The developers of these websites download data from official websites and present them in various styles (through the concept of social network) to demonstrate the required information without predicting the outcomes.

Lee *et al.* (2012) analysed the processes to establish a TSL by using a qualitative case-study approach. They discussed the governances of specific system in Taiwan that are subjected to the availability of various resources. The online and offline betting models are used simultaneously. Several studies have discussed performance expectancy, social influence, facilitating conditions, and the perceived risk influence of users' willingness to play online lottery. Chiu *et al.* (2012) evaluated online lottery adoption according to the effects of gender, age, education, and internet experience. Gambling has typically been considered a predominant male activity (McCormack *et al.*, 2014). However, according to our survey results, the previous published studies have neglected female activity.

2.2 Social network and community

Social network is constructed by links to make up a set of social actors, such as individuals or organisations. Social network concentrates on the relationship between these actors that enable users to simulate real-life friendship. Social media enable users to semipublically or publically disclose personal information, exchange social experiences, provide social and emotional support, engage in entertainment activities, and browse personal information on other users (Burke *et al.*, 2010). Furthermore, social media provide a platform for friends to remain in contact and to develop relationships through real-time status updates (Thompson, 2008).

Most studies have presented social networks as communities. However, the current study considered social networks and communities as different concepts, despite the increase in social media sites representing the transformation of the online community (Zhou, 2011; Toral *et al.*, 2009). According to the definition of keywords "social" and "community" from Cambridge dictionary[3], "social" means a group of people with connections, interactions, and relationships between people; community means a group of people to focus on bringing people together around a common purpose or interest and engage in discussions. Table II summarises and compares from the viewpoints of relationship, common, experience flexibility, delivery, functionality, structure, identity without collaboration, explicit relationships with forums and people, new forum/group creation, and network centric navigation were included to offer the diverse concepts of social networks and communities.

Previous studies have observed that perceived usefulness (Lu and Hsiao, 2010), outcome expectation (David, 2011; Hsu and Lin, 2008), commitment (Bateman *et al.*, 2010), self-efficacy (Sexton and Tuckman, 1991), and trust (Rampersad *et al.*, 2010) influence the intention of participation and knowledge sharing (David, 2011; Zhou, 2011; Toral *et al.*, 2009; Hsu and Lin, 2008). Three social factors influence user participation: compliance, identification, and internalisation. These factors represent subjective norms, social identity, and group norms (David, 2011; Zhou, 2011; Shen *et al.*, 2010; Dholakia *et al.*, 2004). These works have reported on how the purposive value, self-discovery, interconnectivity, social enhancement, and entertainment value influence user participation. Zhou (2011) extended the theory of social influence to evaluate how user participation is influenced by compliance, identification, and internalisation (Sexton and Tuckman, 1991). The related participation intention factors – social identity, membership, and group norm – were measured to determine the usage frequency and time spent on using the community. This study aimed to use these value perceptions to allow users visit the proposed website continually.

Community members post their comments about sports game that is a type of knowledge management (KM) (Ho *et al.*, 2012; Hsu and Lin, 2008). The purpose of KM is to assist users in collaborating and making appropriate decisions (du Plessis, 2005). Ho *et al.* (2012) investigated the relationships among KM system quality, social identification, trust, and online knowledge sharing behaviours by focusing on employees in a workplace. They discovered that trust at the workplace is a stronger mediator than social identification. This study attempted to integrate social networks with sports lottery communities to enhance trust.

Boyd and Ellison (2008) regarded internet social network as a service that enable users to: establish a public or semipublic profile on a social-network platform; access a list of users by sharing a hyperlink; and browse a list of connections with their friends. This study accesses the Facebook platform to obtain a list of users who are interested in a sports lottery. We provided a community platform to collect data and opinions for improving the information overload problem of social networks because various content lists on timelines (Huang, 2012) are not updated adequately with event information. The data arrangement of friends was mixed with other data. The proposed website allows the message appears on both the designed community and social-network platform when a user intends to send a sport-game message (Lea *et al.*, 2006) to enable users to track game status and share information with friends easily (Yang *et al.*, 2014).

Several studies have investigated the technological aspect of social software (Gao *et al.*, 2010; Ip and Wagner, 2008; Lu and Hsiao, 2010; Park *et al.*, 2012).

Viewpoint	Social networks	Communities
Relationship (Araujo and Neijens, 2012; Boyd and Ellison, 2008)	The relationships revolve around a group of people you have already know or met Recommend specific peer-to-peer relationships Bound together by pre-established interpersonal relationship	Allow members to find and establish their own relationships with common purpose or around a business objective, not individual connections Bound together by a common interest or topic (Galston, 1999) The groups of people probably have never met yet (Wellman, 1999) Any user can belong to multiple groups
Common features	People may not have any common interest People may have common language or shared racial, religious, or nationality-based identities (Boyd and Ellison, 2008)	People bring together a cohesive group with common interest and profession (Galston, 1999)
Experience flexibility	Controlled	Flexibility and options Users might develop a sense of belonging based on feelings of membership, influence, and value (David, 2011; Zhou, 2011)
Delivery (Lin and Huang, 2013; Ho *et al.*, 2012; Hsu and Lin, 2008)	In general, top-down and group multicast mechanisms	Allow members post and discuss The messages are aggregated into a type of community blog (Lin and Huang, 2013)
Functionality (Chen *et al.*, 2012; David, 2011; Lin and Huang, 2013; Ho *et al.*, 2012; Hsu and Lin, 2008; Zhou, 2011)	Keep contacting with friends and family A common platform supports users interacting with relations (Lea *et al.*, 2006) The number of potential users and the number of data on users and their interactions are considerably high	Access-specific groups based on a membership type or interest The action happens in groups rather than on individuals Use to obtain questions and answers as well as help others with a common interest
Structure (Boyd and Ellison, 2008)	A spider web-like network	Characterised by a more complex overlapping and "nested" structure
Identity without collaboration (Boyd and Ellison, 2008; du Plessis, 2005; Sexton and Tuckman, 1991)	The creation of identity in the community without participation in discussion Identities can be built based on the display of memberships, which is made with the member's choices in forums (David, 2011; Zhou, 2011; Shen *et al.*, 2010; Dholakia *et al.*, 2004)	Discussion is the centre of the interaction and identity building Members create relationships based on information they posted in online discussions (Ho *et al.*, 2012; Hsu and Lin, 2008)
Explicit relationships with forums and people (Araujo and Neijens, 2012; Lin and Huang, 2013;	Individual member can share explicit relationships with other	The relationships of particular forums are implicit

Table II.
Summaries of the differences between social networks and communities

(*continued*)

Viewpoint	Social networks	Communities
Ho *et al.*, 2012; Hsu and Lin, 2008)	members (Boyd and Ellison, 2008)	
New forum/group creation (Boyd and Ellison, 2008)	The members can easily create a new forum within flatter hierarchy without limiting on the preset hierarchy (Huang, 2012)	A new forum is built within a static and specific structure The sub-forum discussion domain range is limited with the hierarchy
Network centric navigation (Lea *et al.*, 2006; Yang *et al.*, 2014)	Users have home pages and displayed on those pages are explicit links to other members Groups display links to members who have joined the group	Navigate from forum to forum like nodes in a network, with each forum often having a diverse central issue

Table II.

Some studies have examined the effects of system characteristics and discussed the effect of social influence on behavioural intention with the compliance processes (David, 2011; Park *et al.*, 2012; Zhou, 2011). However, they observed various discussions from diverse perspectives. Although some studies – such as Shen *et al.* and Zhou (2011) – have determined that there is no considerable effect on social software usage from qthe perspective of social media acceptance studies, all of them have focused on the intentions of individuals using an information technology. By contrast, this study evaluated the proposed website from the perspective of user requirements and expectations.

Developing a sports lottery betting system integrated with social-network platforms offers the following advantages:

- Several applications embedded or integrated with social-network sites were developed because the amount of potential users and data on users as well as their interactions are high (Chen *et al.*, 2012). Most of the applications can be used in analysing microblog messages to discover relevant and credible events (Schoen *et al.*, 2013). Thus, the proposed website uses the features of social networks to predict future events.
- A self-service mechanism, which enables users to describe service encounters by interacting on an electronic service instead of in a specific service team (Chen *et al.*, 2009), for enriching the website content that supports users with a communication platform to share information (Lin and Huang, 2013; Ho *et al.*, 2012; Hsu and Lin, 2008).
- High social media usage is promoted to encourage users to use the proposed application continually because numerous users regularly use social media as part of their daily lives. Social networks enable users to communicate with friends and, therefore, develop relationships (Araujo and Neijens, 2012).
- Using numerous data to enhance the prediction rate is essential. Kalampokis *et al.* (2013) analysed various areas, such as product sales predictions, to determine how social media data can be used. To reduce the complexity engendered by emotion, Taylor *et al.* (2004) used numerous social media data evaluation – such as the number of votes for a game and prediction ranking – to allow users to decide the prediction rate of betting games.

- The interaction and prediction mechanisms were designed to enhance the features of developed sites. When users intend to know the status of a sports game, the related discussions and shared messages appear on their walls based on the timeline. The related messages are aggregated into a game blog, which is a type of community blog (Lin and Huang, 2013). This enables users to observe the status of the sports game easily, thus supporting their betting decisions.

Social media ethical concerns include security and identity, privacy (Light and McGrath, 2010), utilitarian, surveillance, friendship, and user exploitation. Several academic studies (Wasike, 2013) to justify the "ethics" issues are:

- From a utilitarian perspective (West, 2003): the proposed hybrid social media allows users to associate with the members that they might never have met (Wellman, 1999). The original features of ball game and sports lottery community provide a specific forum to let users concentrate on the events (Galston, 1999). User interactive functions only limited the relations they had been included in their friends. Thus, this work aims to reduce the harms and increase the benefits from a utilitarian perspective.
- From a right perspective to privacy: the users can easily post their comments and edit contents such that it is difficult to control content (Institute of Business Ethics (IBE), 2011). The privacy concerns of the social network have been paid attention and improved (Acquisti and Gross, 2006; Light and McGrath, 2010). An enrich privacy and protection policies had been flexible to let users set their own privacy and protection configurations (Tan *et al.*, 2012; Hugl, 2011; Karyda *et al.*, 2009). Gajendra and Wang (2014) had investigated and identified the factors that might influence consumer trust and privacy on e-commerce systems. The proposed website obeys the configurations of Facebook to post the messages, comments, likes, and gifts as well as none sharing information, including vote, virtual betting, and personal prediction. User can set to public their prediction records and ranking.
- From an identity and fairness perspective: when people interact with others online, they really do not know the characteristics of other members, such as male or female, good or bad man (Boyd and Ellison, 2008). The related comments and suggestions of a game are required users' judgement (David, 2011; Zhou, 2011; Shen *et al.*, 2010; Dholakia *et al.*, 2004). This work adopts the statistical prediction reports to reduce the effect of the fairness perspective.

  The issue of consumer software piracy in virtual communities had been discussed in (Yu *et al.*, 2015) that the sharing behaviour should be protected. Some people might share their findings, but some people might just want to observe the findings from others without contributing and sharing their comments for other members (Karyda *et al.*, 2009). The proposed website provides the rewards to the users, who posted and shared their findings to achieve some kind of fairness.
- From a friendship, virtue and good life perspective: the ethical performance of a website facilitates an increase in trust, which in turn enhances customer commitment and loyalty that had been discussed in Gajendra and Wang (2014) and Lu *et al.* (2013). Users might lead others with a wrong direction or negative messages (Kerr *et al.*, 2012) so that one of the Web 2.0 mechanisms is used to implement offense mechanism. A warning message will be included to notify

users that the posted message might not be verified. This work adopts community power to predict the game results to reduce the bias by people and information overload.

- From a cybercrime perspective: sports lottery provides people with a leisure activity to watch ball games and has become part of lives. It does not enable people to become rich overnight. Although sports lottery still belongs into a type of gambling behaviour (Brindley, 1999; McCormack *et al.* 2014), the thresholds for users – such as the age of a user (Das and Nayak, 2013) and the amount of virtual coins a user can place in a bet – is limited in the designed website.

2.3 Prediction

Several applications are used to establish an automatic process for discovering related news on social media (Castillo *et al.*, 2013). Predicting sports game results before the game begins to enhance the anticipation for the game and increases the odds value of the user's favourite team. According to the game prediction, as shown on sport178 website, users select the games for which they want to predict the results. Other users who are nonmembers of sport178 website can refer to the prediction results. On the proposed website, users recognised the analysis results generated by their social-network friends and combined the results with those of other community members to obtain additional messages.

Regression analysis provides the most systematic analysis of game predictions. Ciou (2010) used regression analysis to analyse the average scores by considering the points scored as well as the points lost by the home and away teams in the most recent five games, and implementing approximately 20 variables in the regression analysis. Subsequently, the most relevant variables were screened and implemented into the neural network to simulate the team score (Baulch, 2001). Ciou (2010) analysed the game teams for the following competition day and recommended them to users.

The users develop a common interesting relationship through information exchange (Ku and Chang, 2002). Wellman and Gulia (1999) discussed two reasons for user interaction in a community: first, some people promote their personal identities through their understanding of professional information to help members receive the respect of others to increase their confidence; and some members gain a strong sense of belonging to a specific online community through obtaining help from others.

Possessing all information and guessing the correct team because predicting future events is not always possible. Wolfers and Zitzewitz (2004) mentioned that the prediction market, which is a burgeoning financial market, transfers knowledge on prices to reflect prediction events. This market is similar to the futures market and the objective of participants in this market is to use the content which has value to predict future events (Berg and Rietz, 2003). The prediction price can be used as a reference to predict whether an event occurs (Tung *et al.*, 2009). Participants trade futures according to judgement price movements and prediction results (Tung *et al.*, 2011a). Kalampokis *et al.* (2013) studied predicting future events and surveyed recent research on techniques, methods, and empirical studies to understand the predictive power and limitations of social media. They suggested using statistical models to make predictions based on social media data.

Prediction markets, which provide electronic markets for users trading stocks, provide an index for an event study. The contract price reflects the outcome of future events (Slamka *et al.*, 2008). The time is money that a user can buy a low price early

based on accurate prediction; hence, that particular user will be rewarded for an accurate event prediction. Users have to collect additional useful information to win high rewards among a similar pool of participants (Tung *et al.*, 2011a; Lin *et al.*, 2013; Slamka *et al.*, 2008). An official event exchange website xFuture.org was established to predict the future of markets including finance, politics, sports, and technology (especially for election prediction).

Several studies have discussed the accuracy of market predictions, and most of them have adopted a differential per cent value as a metric to evaluate the accuracy. Tung *et al.* (2011a) obtained data from the Exchange of Future Events to evaluate the Taiwanese mayoral and presidential elections and compared the accuracy with those of the historical forecasts. They conducted two tests with daily forecasts and found that the prediction markets outperformed the polls with a 9-10 per cent higher accuracy with a 2 per cent standard deviation (Tung *et al.*, 2011b). Lin *et al.* (2013) trained the xFuture data from 2006 to 2011 by using a principal component analysis with discriminant analysis model. They attributed a 97.72 per cent level of confidence to the accurate prediction group, but only a 19.58 per cent level of confidence to the inaccurate prediction group (Lin *et al.*, 2013). Slamka *et al.* (2008) tested the applicability of future events in real-money and play-money prediction markets. They revealed that both incentive schemes generate robust and valid results.

2.4 Strategy for enhancing user interaction

User interaction, which is one of the main characteristics of Web 2.0, is a basic feature for social networks that must be developed. Romm *et al.* (1997) determined that a social network should be easy-to-use and emphasised system interaction to maintain the centripetal force of the community. In addition to the convenient operations and easy-to-use human interfaces (Moreira *et al.*, 2013), several strategies, such as interacting with Facebook in real time, posting and earning virtual coins, and agent-based gift delivering functions, were designed to facilitate interaction among users.

Yu (2005) stated that a manager in a social network and community can combine the content, commercials, and comments to enhance user interaction. Continual interaction and feedback among community members satisfy user requirements. The manager accepts the proposal for the site and provides the users with feedback to facilitate user interaction.

2.5 Website development methods

Web applications development are classified into top-down and evolutionary approaches according to the type of Web applications. The top-down development approach provides a methodology for corporate Web applications Although the approach organises the complexity of these applications and produces applications that can meet business objectives (Artz, 1996), this work adopted the evolutionary approach, which is used to develop the system belong to exploratory and appropriate for learning about the technology.

One of the new trends of application development approaches is open-source software, which was used by Martínez-Torres *et al.* (2010) to analyse the structure and topology of the virtual community. Other approaches include the model-driven development approach, which is applied with unified modelling language to model Web services for context-aware Web services (Sheng *et al.*, 2010). This study explored new functions and evaluated them through social media and online community. The flow of opportunities and potential shopping experiences were also evaluated

(O'Cass and Carlson, 2010). Although several Web analytics products and services are available, such as Google Analytics, for testing and evaluating a website (Nakatani and Chuang, 2011), this study addressed a prototype website and such types of tools are not suitable for use in current phase.

3. Methodology

We extended a prototyping website development methodology (Che and Hou, 2008; Walters *et al.*, 1994). Figure 1 shows an outline of the adopted model. The procedures performed in developing the system were designing and analysing the hybrid social-network and community sports lottery system, developing interaction and prediction mechanisms, implementing the prototype website, and evaluating questionnaires. The model is a continuous improvement cycle involving prototype systems, and each phase involved reassessing the results of the previous phase to ensure that the design goals were achieved. Based on the case studies and research literature, several website development models have been established through an informal development method. Cunliffe (2000) identified the main stages and tasks involved in website development (Schefels and Zicari, 2012). They discussed the essentiality of understanding users and information providers (Cunliffe, 2000); therefore, they used questionnaires to understand user preferences and evaluate the system. In this study, a questionnaire approach involving four facets was used to ensure that the system design met the users' expectations; the questionnaire results are discussed in Section 4.

3.1 System development models

3.1.1 Data collection. Web 2.0 supports machine-based interactions, such as simple object access protocol (SOAP), to enable servers to expose proprietary application programming interfaces (APIs). Programmers use the self-descriptive format and hyperlinks as the engine of an application state. The standard format for publishing a SOAP API is the Web Services Description Language. The search function is a powerful tool for identifying useful APIs and descriptions. This study used the Facebook graph APIs and NBA sports data APIs (referred to http://developer.sportsdatallc.com/docs/NBA_API). We identified the API specifications of two previous sets of data. Any authorised users or open data were accessed using an API, and the Extensible Markup Language or JavaScript Object Notation payloads were transferred into our database to enable the data to be collected in real time. This type of interaction integrated the system with an external system. However, we observed the data from the TSL by using a designed Web crawler programme to parse the required betting odds values.

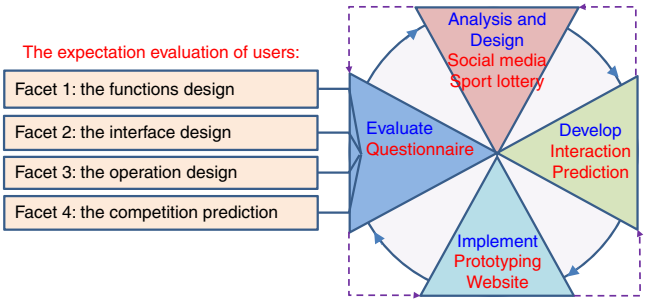

Figure 1.
The procedures of website development model

This study used the Facebook APIs to obtain user profiles, login authentication, and data on friends. When a user bets on a winning team, the system posts the congratulatory message on the Facebook wall of the user. Users can also use the Facebook APIs to post gifts on the Facebook walls of their friends. Figure 2 shows a pseudo code example of the Facebook APIs, such as lines 1-4 and 7, used to access user profile information, such as first name, last name, gender, birthday, e-mail, locale, and most recent update time, after the user is authorised by the Facebook authentication APIs coded in PHP (Hypertext Preprocessor) language. Once the login user is authorised, the designed Web page is changed into canvas mode on the Facebook website (lines 13-16).

To obtain real-time NBA information, such as daily schedules, competition teams, game scores, and final results, the NBA sports data APIs were used to access real-time and offline data, as shown in Figure 3. The offline data, such as daily schedules (lines 7-8) and competition teams (lines 13-14), are assigned a duty time at which they are automatically accessed using the system. The parsed data are stored in the designed database. The dynamical data, such as in-progress game scores (lines 16-26) and players, are periodically accessed according to the schedules. The data are then transformed and shown on the designed Web pages for reference. The system delivers the bookies into the winner's account when the final results are obtained. The updated data might be delayed for 1 min or more when the final results (line 30) are accessed because the continual requests cause denial of service. Moreover, the number of free access times is limited by the official download site.

An alternative method was used to obtain data from the TSL because the official website did not provide odds access APIs. We developed a Web crawler programme to retrieve the odds data. The library functions from URLlib (https://docs.python.org/3/howto/urllib2.html) and HTMLParser (https://docs.python.org/2/library/htmlparser.html) were imported to manage the Web page parser in Python language. Figure 4 shows the sample codes. A download Web page (lines 13-16) was split into multiple lines (line 19) that were fed into the handle routine (line 1) to parse the data into fielders (lines 2-11). The team and odds fielders were used in this study to synchronise the proposed website and TSL odds. One of the difficulties in parsing the target Web page is that the URL and Web structures may be changed in a short period. Hence, we had to implement the related check functions to avoid parsing data errors and notice mechanisms.

```
1  facebook = new Facebook(array('appId' => FB_APPID, 'secret' => FB_SECRET,
2          'cookie' => true,));
3  if(empty(_SESSION['user']))
4          user = facebook->getUser();    // Get User ID
5      if (user)
6              try     // check whether the login user's authentication has been obtained.
7                      user_profile = facebook->api('/me');
8                      _SESSION['user'] = user_profile;
9              catch (FacebookApiException e)
10                     error_log(e);
11                     user = null;
12     else
13             loginUrl=facebook->getLoginUrl(array('next'=>
14             'http://apps.facebook.com/mlbnbalottery/','redirect_uri'=>
15             'http://apps.facebook.com/mlbnbalottery/','canvas' => 1, 'fbconnect' => 0, 'cancel_url'
16             => 'https://www.facebook.com/' ));
```

Figure 2.
An example of Facebook API pseudo codes to access user profile

```
daily=file_get_contents('http://api.sportsdatallc.org/nba-t2/REG/status/2012/schedule/daily.xml?ap
      i_key=' + api_key);    // try to access daily.xml (status)
if(!xml_status == simplexml_load_string(daily))
      show error message 'Get daily.xml error';
else
      now = obtain the current time;
      for (each game) // Generate a 'list' array by gid, date, and status.
            gid=obtain game id;
            schedule= obtain the game schedule and change the time zone from EDT to NKT;
            if(schedule < now)
                  list[gid]['status'] = "closed";
            else
                  list[gid]['status'] = obtain the game status;
            list[gid]['home_name'] = obtain the home team id;
            list[gid]['away_name'] = obtain the away team id;
      for (each scheduled game)
            if(schedule < now)
                  list[gid]['status'] = require to obtain the live score; //try to obtain statistics.xml
                  xml_statistics=  implexml_load_file('http://api.sportsdatallc.org/nba-t2/statistics?
                              game_id='. gid .'&api_key=' . api_key) );
                  if (check xml_statistics error)
                        //show the error for getting statistics.xml;
                  else
                        if(match period == "FullTime")
                              update the game status in play
                              list[gid]['home_score']=obtain home team score;
                              list[gid]['away_score']= obtain away team score;
            else
                  list[gid]['home_score'] = 0; // reset the score of home team.
                  list[gid]['away_score'] = 0; // reset the score of away team.
      sleep(rand(1,3));
```

Figure 3.
An example to use NBA sports data API pseudo codes to obtain; the related competition information

```
void handle_data(self, data)
      if (check == 0)    // to read the game id
            Output_to_File('$' + data+'$');
            check = 1;
      if (check == 1)    // to read the competition team name
            Output_to_File (data + ' $');
            check = 2;
            return None;
      if (data.isspace())
            return None;
            …..
Sports_Lottery_Web = urllib.request.urlopen(https://www.sportslottery.com.tw/zh/web/guest/
                  sports-betting#m/all/s-442/c/t-4102/278/1);
Web_Content = Sports_Lottery_Web.read().decode('utf_8','replace'); // To decode the Web site.
Sports_Lottery_Web.close();
Parser = WeaterHTMLParser();
try:
      for (line in Web_Content.splitlines())
            if (hasattr(Parser, 'stop') and Parser.stop) break;
            Parser.feed(line);
except HTTPError as e;
Parser.close();
```

Figure 4.
The designed web crawler pseudo codes obtain the odds data from TSL official site

3.1.2 Main functions. Initially, the website offers *n* virtual coins to users when they log into the proposed website for the first time to enable them to bet on a basketball game or purchase virtual gifts for their friends. The main functions of the website are betting, discussion forums, ranking, and competition prediction, as shown in Figure 5. The competition prediction system uses voting, odds, and future event data to estimate results and, thus, facilitate decision making. The betting function enables users to place new orders for sports lottery bets and futures, and the interface for this function is similar to the TSL website. A discussion forum was designed to enable users to discuss and post opinions. A ranking page shows the top ten users who possess the highest amount of virtual coins, purchased gifts, votes, and posted messages.

3.1.3 Prediction model. Three prediction systems (including vote, odds, and future event) were implemented to estimate the tournament results for users, as shown in Figure 6.

- Prediction by voting: users of the proposed website can view prediction results for basketball games by clicking a vote or evaluation options button. At the bottom of each page, team vote buttons are shown to enable users to evaluate the probability of winning the most recent game. The higher the number of user votes is, the higher the number of fans a team has, suggesting that the team has a high probability of winning the game. A simple equation $V_A/(V_A+V_B)\times 100$ per cent was used in this study to define a winning ratio.
- Prediction using odds: the proposed website provides betting odds, which are based on the odds of the TSL. Users can observe the formal and simulated odds for estimating the tournament results. The recorded history for each team and the pair of teams were collected to compare the accuracy rates of the formal and simulated odds. In addition, we used these records to generate a prediction value. Given team betting odds 1.5, 2, and 1.75 for the previous three games vs a team, the estimation value is calculated using the equation $\sum$betting odds/the number of games. Accordingly, the users can observe the rate of the betting odds up to the day of the game and assess the win rate of the team.

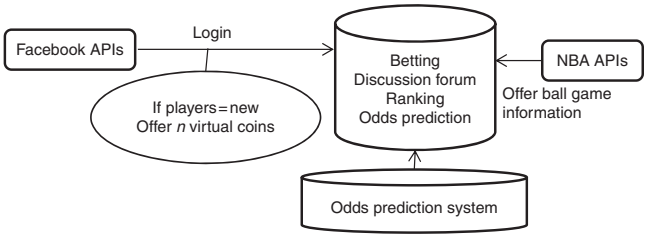

Figure 5.
System architecture

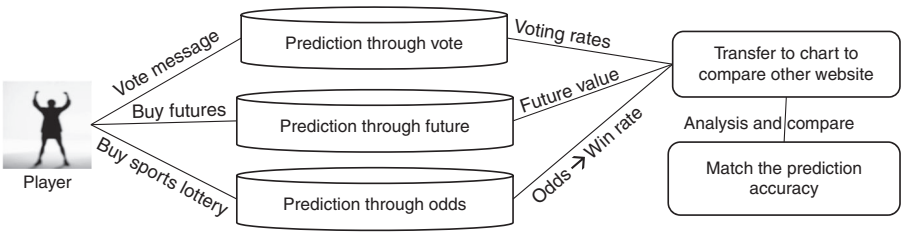

Figure 6.
Tournament prediction flow

- Prediction using future events: the website uses the concept of futures to predict future events by developing a prediction by using a future basketball game function. Users purchase futures of the winning team before the basketball game begins. The website uses the futures price to estimate the win rate for each team. A higher futures price for betting on a team indicates that the team has a higher chance to win the game. The features of this mechanism are that: the future price changes sensitivity to reflect the status of the team; and the gearing ratio is much higher than the general odds to encourage users to bet carefully on a game. Given initial price $p_i = 100$ one month before a game start, users expected to pay $p_j = 120$ three weeks before the game start because the team status was good. However, the price might fall to $p_j = 60$ at any time when a main player was injured. A simple equation $(p_j - p_i)/p_i \times 100$ per cent was used in this study to define a winning ratio. Thus, the prediction value is expected to be highly corrected time-by-time.

The website provides rankings and a simple chart showing the number of votes, and users can refer to the chart when betting on the basketball game.

3.2 Questionnaire

To understand whether the users accepted the proposed website, a questionnaire comprising four facets: functions, interfaces, operations, and competition predictions were designed, as shown in Figure 1. The corresponding questions and question abbreviations are listed in the Appendix. The four evaluation facets are detailed as follows:

- Facet 1 measures users' satisfaction with the features of the website corresponds to whether the website functions encourage users to continue using the website. Five questions were developed to cover the main functions of the proposed website, including synchronisation of the odds between the TSL and the proposed platform, gift transaction, news, and discussion information.
- Facet 2 measures the degree to which the convenience of the website users was affected to evaluate the interface design of the website. Five questions addressing configurations, colour design, text, and feelings elicited by the interfaces were developed to evaluate the degree to which the interface design corresponded to the expectations of users.
- Facet 3 measures the gap between the requirements and convenience on the operation design of the website. Three questions addressing the required time to implement data synchronisation with Facebook, deliver gifts, and post messages to Facebook walls were developed to cover the operation design of the proposed website.
- Facet 4 measures the extent to which the basketball game prediction results provided by the website enabled users to win a high number of virtual coins and refer the prediction results to enhance TSL guess ratio. Three questions were developed to determine the degree to which the website enabled users to estimate the tournament results by using the three prediction mechanisms and comparing the results from the charts.

The questionnaire items, which are shown as Table III, adapted from Table I the most relevant literatures. The questionnaires were reviewed by several system development

Questionnaire item	Feature	Literature
FD1	Betting service	McCarthy *et al.* (2014)
FD2 and OD2	Embedded in the Facebook Relationship	Boyd and Ellison (2008), Light and McGrath (2010), Moreira *et al.* (2013), Rauniar *et al.* (2014)
FD2, FD4, and OD2	Information exchange Knowledge sharing Data integration	Ho *et al.* (2012), Hsu and Lin (2008), Lin and Huang (2013), Yang *et al.* (2014)
FD3 and FD4	User interaction in a community	Galston (1999), Ku and Chang (2002), Moreira *et al.* (2013), Romm *et al.* (1997), Wellman and Gulia (1999)
ID1	System configurations	Light and McGrath (2010)
ID2-ID4	System satisfaction (e.g. privacy)	Chen *et al.* (2009)
FD5, ID5, CP1, and CP3	Outcome expectations	Rauniar *et al.* (2014)
ID1 and ID4	Convenient operation Easy to use	Moreira *et al.* (2013), Romm *et al.* (1997)
OD3	Agent-based delivery	Davis *et al.* (1989), Moreira *et al.* (2013)
CP1 and CP2	Prediction Future events Decision support	Berg and Rietz (2003), Huang (2012), Lin and Huang (2013), Schoen *et al.* (2013), Taylor *et al.* (2004), Tung *et al.* (2009)

Table III.
The literatures for the questionnaire items adaptation

experts, who worked as the system development managers in private companies. Several items, such as FD1, FD2, OD1, and CP2, were also suggested by them. The validity of the scales of the questionnaire was verified by Cronbach's α values.

The basic demographic variables examined in this study were gender, age, education, frequency of Facebook use (FFU), NBA game viewing frequency (NGVF), the system used to place bets on the lottery, and lottery betting frequency (LBF).

Several types of scales, such as five- and seven-point Likert scale, can be used for this work. Each scale possesses its own niche for questionnaire. To evaluate the acceptance rate of the facets, a five-point Likert scale, anchored with 1 = strongly disagree and 5 = strongly agree (John, 2008), was used to measure subjects' tendency to agree with the items in the questionnaire. We designed the questionnaire by using several confirmation questions to prevent the respondents from behaving irresponsibly. In other words, when the subjects did not answer the questionnaires seriously, they were screened. This approach was effective, and cognitive bias on the part of the respondents was prevented.

3.3 Statistical analysis

The sample was collected from two different mechanisms, PTT and Facebook, using a convenience sampling approach. The website was published as a Facebook application approximately three months before the date on which the questionnaire was posted. No mechanism was used to screen the respondents using the system before answering the questions to ensure that the respondents represented users with different levels of experience. We posted the questionnaire on related Bulletin Board System boards and Facebook. Thus, the characteristics of users in PTT are different from those in Facebook such that our sample should include diversified populations. Further, we adopt a regression model to reduce the bias of the sampling to omit the covariates (Gail *et al.*, 1984; Albert *et al.*, 2014).

The Cronbach's α coefficient was used to evaluate the internal consistency of each facet, and correlation analysis was performed to evaluate whether the questions were significant to enable conclusions on the system functions, operations, and interface implementations.

Descriptive statistics were used to summarise the basic characteristics of the internet respondents. In particular, the sample proportion was computed for each question in the facets. A greater sample proportion indicated that the proposed functions and designs were closer to the user expectations. Furthermore, the sample mean and standard deviation for each question and each facet were computed to compare the relative importance of each question among the sample. In addition, the χ^2 test was used to assess the association between the questions and demographic variables. Finally, the ANOVA model was used to evaluate the association between the facets and demographic variables to understand how the proposed system can be improved to satisfy user requirements and the multiple comparisons was assessed by Tukey's method. In particular, this study intended to identify the users who exhibited low levels of agreement in the functions and design style. Finally, the regression model was used to access the overall influence of these demographic variables on four facets and to identify most significant characteristics that were associated with four facets.

4. System evaluation and analysis results

A total of 277 respondents completed the questionnaires. Among the respondents (Table IV), 176 were men and 101 were women. Most of the respondents were aged 18-29 years, 74.37 per cent of the respondents used Facebook daily, more than half of the respondents watched an NBA game one to two times weekly, 48.38 per cent of the respondents had lottery purchasing experience, and most of the respondents had

Class	Option	Count	%
Gender	Male[a]	176	63.54
	Female	101	36.46
Age	18-29[a]	184	66.43
	30-39	60	21.66
	>40	33	11.92
Education	Lower than senior high school	48	17.33
	Undergraduate school	142	51.26
	Graduate school[a]	87	31.41
Frequency of facebook use	None	12	4.33
	1-6 times a week	59	21.30
	Every day	206	74.37
NBA game viewing frequency	None[a]	97	35.02
	1-2 times a week	131	47.29
	3-4 times a week	21	7.28
	5-6 times a week	4	1.44
	Every day	24	8.66
Lottery betting frequency (per month)	None[a]	151	54.51
	<5	87	31.41
	>6	39	14.08
Has lottery betting experience	No	143	51.62
	Yes[a]	134	48.38

Note: [a]The reference group

Table IV. The number of statistics for basic information

experience in placing bets in the TSL. The mean score for each question was computed. The mean scores for CP1-CP3 were higher than 3.8. The respondents expressed the greatest satisfaction with the ability of the website to predict the results of future games. The respondents expressed the lowest satisfaction with the mechanism through the website automatically sends virtual gifts to friends.

The Cronbach's α coefficients for Facets 1 to 4 were 0.82, 0.86, 0.73, and 0.88, respectively. Because all of these coefficients were greater than 0.7, the internal consistency of each facet was acceptable, and the responses for the questions of each facet were consistent and were not polarised. The mean scores of Facets 1, 2, and 4 were higher than 3.5, indicating that the proposed website conformed to the requirements of the respondents regarding the visualised design. However, additional information on the results of future games is required, and the operation function of the proposed website did not completely satisfy the respondents.

The χ^2 test revealed that ID2, ID3, OD1, and OD2 were significantly associated with FFU. The interface and operation design of the website were crucial features noticed by the Facebook users, particularly for the proposed website embedded into Facebook. The game prediction mechanism (CP1), which assists users in predicting game results, was significantly associated with the frequency of viewing NBA games. In addition, using the odds from the TSL as the game odds was significantly associated with the LBF. People who paid a considerable amount of attention to the NBA games reported that the competition prediction functions were useful, and those who paid money to purchase the odds reported that the simulated sports lottery incorporating real-time data were highly useful. Thus, the real-time interactive functions are critical features that must be included in future versions of the system.

ANOVA model was used to assess the bivariate association among the four facets (Table V) and user backgrounds, social networks, and lottery experiences. This table shows the average values, standard deviations, and p-values as well as the multiple comparisons for each facet. The findings are illustrated as follows:

- Gender: women demonstrated higher mean values for Facets 1-3 than men and were less concerned about the prediction (Facet 4). In particular, the difference in mean Facets 2 and 3 were statistically significant at 0.05.
- Age: respondents whose age ranged between 30 and 39 years were least satisfied with Facets 1, 2, and 4. The highest mean score for four facets was provided by respondents whose ages were older than 40 years old. The difference in mean function for the system was statistically significant. The lowest mean score were given by the respondents who were at their 30s. This would indicate that this group might have more technical skills and have demands on how to function the system friendly.
- Education: the mean scores for each facet were recorded for respondents with slightly different by respondents with different education degrees. The difference in mean scores for Facet 4 was significant. In particular, higher educational respondents reported a higher mean prediction. They might have more knowledge in sports lottery and therefore be more satisfied with the prediction design.
- FFU: respondents who used Facebook everyday were more likely to be satisfied with the system regarding for four facets. In particular, the score of Facet 3 for respondents who used Facebook everyday was statistically higher than that of those who did not. The mean score difference between them was 0.25 units.

Class	Option	Facet 1 (function) Avg.	SD	p	C^a	Facet 2 (interface) Avg.	SD	p	C^a	Facet 3 (operation) Avg.	SD	p	C^a	Facet 4 (prediction) Avg.	SD	p	C^a
Gender	Male	3.50	0.83	0.358[c]		3.56	0.73	*0.017*[c]		3.13	0.91	*0.006*[c]		3.89	0.83	0.221[c]	
	Female	3.57	0.57			3.75	0.56			3.40	0.71			3.79	0.63		
Age	< 29	3.55	0.68	*0.024*[b]	1 > 2	3.64	0.68	0.135[b]	1 > 2	3.18	0.86	0.352[b]	1 < 2	3.88	0.75	0.203[b]	1 > 2
	30~39	3.32	0.95		1 < 3	3.51	0.68		1 < 3	3.27	0.90		1 < 3	3.71	0.92		1 < 3
	> 40	3.73	0.56		2 < 3*	3.80	0.58		2 < 3	3.40	0.67		2 < 3	3.98	0.48		2 < 3
Education	< SHS	3.55	0.76	0.986[b]	1 > 2	3.76	0.66	0.325[b]	1 > 2	3.29	0.87	0.841[b]	1 < 2	3.60	0.69	*0.007*[b]	1 < 2
	US	3.52	0.66		1 > 3	3.59	0.65		1 > 3	3.22	0.85		1 < 3	3.84	0.74		1 < 3
	GS	3.52	0.86		2 < 3	3.63	0.73		2 < 3	3.20	0.84		2 > 3	4.02	0.79		2 < 3*
FFU	Day	3.56	0.71	0.247[c]		3.64	0.65	0.684[c]		3.29	0.81	*0.032*[c]		3.87	0.75	0.590[c]	
	Others	3.44	0.82			3.60	0.76			3.04	0.94			3.81	0.80		
NGVF	None	3.47	0.68	0.659[b]	1 < 2	3.64	0.69	0.112[b]	1 < 2	3.21	0.82	0.258[b]	1 < 2	3.72	0.71	0.091[b]	1 < 2
	Seldom	3.56	0.78		1 < 3	3.69	0.64		1 > 3	3.30	0.87		1 > 3	3.91	0.79		1 < 3
	Usually	3.54	0.77		2 > 3	3.45	0.74		2 > 3	3.07	0.83		2 > 3	3.97	0.76		2 < 3
LBF	None	3.48	0.74	*0.03*[b]	1 < 2	3.58	0.69	*0.001*[b]	1 < 2*	3.28	0.80	*0.001*[b]	1 < 2	3.77	0.81	0.105[b]	1 < 2
	< 5	3.68	0.67		1 > 3	3.83	0.54		1 > 3	3.33	0.83		1 > 3*	3.98	0.61		1 < 3
	> 6	3.33	0.86		2 > 3*	3.38	0.79		2 > 3*	2.78	0.93		2 > 3*	3.91	0.83		2 > 3
HLBE	No	3.49	0.73	0.433[c]		3.61	0.64	0.615[c]		3.30	0.79	0.173[c]		3.80	0.77	0.217[c]	
	Yes	3.56	0.76			3.65	0.72			3.16	0.91			3.91	0.75		
PTSL	None	3.49	0.73	0.67[b]	1 < 2	3.61	0.64	0.871[b]	1 < 2	3.30	0.79	0.285[b]	1 > 2	3.80	0.77	0.465[b]	1 < 2
	TSL	3.55	0.72		1 < 3	3.65	0.65		1 < 3	3.14	0.84		1 < 3	3.91	0.70		1 < 3
	OSL	3.66	1.21		2 < 3	3.62	1.33		2 > 3	3.37	1.59		2 < 3	3.93	1.29		2 < 3

Notes: FFU, frequency of Facebook use; SHS, senior high school; US, undergraduate school; GS, graduate school; NGVF, NBA game viewing frequency; LBF, lottery betting frequency (per month); HLBE, has lottery betting experience; PTSL, purchase type of sports lottery; TSL, Taiwan sports lottery; OSL, other sports lottery; Avg., average value; SD, standard value; p, p-value; C, multiple comparisons. [a]Tukey test; [b]F-test; [c]t-test

Table V.
Bivariate analysis for the background of users, social network, and lottery experiences and the four facets

- NGVF: the respondents who never watched NBA games were dissatisfied with function and prediction (Facets 1 and 4) of the system, but were more satisfied with interface and operation (Facets 2 and 3) of the system. All the differences were not statistically significant at 0.05. Nevertheless, the mean difference in predictions was significant at 0.1. In particular, respondents who watched the NBA games reported higher mean in prediction than those who never watched. This might mean that the system would provide useful information in prediction if the respondents knew NBA games.
- LBF (per month): regarding the four facets, the respondents, who performed lottery bets less than five times per month, were highly satisfied with the system. Furthermore, except for the prediction ability, the frequency of lottery betting was significantly associated with the other three facets. The most frequent users for lottery betting were the least satisfied with function, interface, and operation facets of the system, whereas the respondents who never betting the lottery. In addition, the frequent lottery betting users were more dissatisfied with the system interface function than the occasional lottery betting users. Regarding functional ability, the occasional and frequent lottery betting users exhibited similar opinions about satisfaction. The frequent lottery betting respondents were more familiar with internet betting system. In turn, they had more expectation on function, interface, and operation facets. Although the respondents who betted frequently gave low satisfaction scores of these faces, they were satisfied with the prediction design.
- Has lottery betting experience (HLBE): except for the operational function, users who placed bets in the TSL were more satisfied with the system regarding the three other facets. Nonetheless, the difference between different lottery betting experiences in the four facets was not statistically significant.
- Purchase type of sports lottery (PTSL): the mean differences among the PTSL were not significant.

Elderly respondents, who betted lottery less frequent, were more satisfied the function of the system (Facet 1). Female respondents, who also betted lottery less frequent, were more satisfied the interface of the system (Facet 2). Based on p-values and multiple comparisons, male respondents with a high lottery purchase frequency and a low FFU expressed dissatisfaction with the operation design of the prototype system (Facet 3). The respondents with a high lottery purchase frequency reported that the current design version must be improved. Respondents with a higher education expressed satisfaction with the prediction function (Facet 4). The competition prediction function will be implemented in future versions. Because this website is intended to serve users who frequently use Facebook and high NGVF in Taiwan, the operation design must be improved, particularly for the respondents with a high lottery purchasing frequency.

A regression model was then used to assess the multivariate association among the four facets and user backgrounds, social networks, and lottery experiences (Table VI). Mean interface design for respondents who were not betting often was 0.26 higher than those who were never betting. The other predictors were not significant associated with interface design.

The operation designs were statistically associated with education, FFU, and LBF. In particular, the most significant predictor was the LBF. The mean operation design

Table VI. Estimates of the users' background, social network, and lottery experiences for predicting the four facets based on regression

Item		Facet 1 (function) PE	*Pr* > |*t*|	SE	Facet 2 (interface) PE	*Pr* > |*t*|	SE	Facet 3 (operation) PE	*Pr* > |*t*|	SE	Facet 4 (prediction) PE	*Pr* > |*t*|	SE
Intercept		3.40	*< 0.0001*	0.00	3.49	< 0.0001	*0.00*	3.07	*< 0.0001*	0.00	3.88	*< 0.0001*	0.00
Gender	Female	0.08	0.4805	0.05	0.15	0.1359	0.11	0.23	0.0655	0.13	0.03	0.8273	0.02
Age	⩾30	−0.07	0.5053	−0.04	0.00	0.9913	0.00	0.22	*0.0493*	0.12	−0.08	0.4306	−0.05
Education	< SHS	0.10	0.6906	0.04	0.14	0.5401	0.06	−0.10	0.7292	−0.03	−0.28	0.3016	−0.10
	US	0.24	0.1010	0.15	0.09	0.4950	0.06	−0.03	0.8680	−0.01	−0.02	0.9046	−0.01
FFU	Others	−0.09	0.4163	−0.05	−0.03	0.7695	−0.02	−0.24	*0.0498*	−0.12	−0.02	0.8883	−0.01
NGVF	Seldom	0.14	0.2285	0.09	0.09	0.3595	0.07	0.22	0.0746	0.13	0.16	0.1656	0.10
	Usually	0.15	0.3230	0.08	−0.09	0.4955	−0.05	0.11	0.5129	0.05	0.22	0.1620	0.11
LBF	< 5	0.16	0.2678	0.10	0.26	*0.0346*	0.18	0.03	0.8315	0.02	0.21	0.1478	0.13
	> 6	−0.19	0.3061	−0.09	−0.12	0.4653	−0.06	−0.47	*0.0207*	−0.19	0.14	0.4385	0.07
PTSL	Yes	0.05	0.7440	0.03	0.03	0.8228	0.02	0.00	0.9923	0.00	−0.10	0.4722	−0.07

Notes: PE, parameter estimates; SE: standardised estimates

for the respondents who betted the lottery frequently reported 0.47 lower than those who never betted. Respondents who were 30 years old and over were more satisfied with the operation design, while mean operation design for respondents who used Facebook frequently was 0.24 higher than those who seldom used. Age was not significantly associated with the operation design. Nevertheless, after controlling for the user's background, social network and lottery experiences, it became significant. The FFU and lottery betting might be the mediator for this association since older respondents might use the Facebook less often, but purchase lottery more often.

The function and prediction designs were not associated with the users' background, social network, and lottery experiences.

5. Summary and suggestions

5.1 Findings and managerial implications

In sports lotteries, participants bet that a certain team wins game to obtain a reward. Users can easily log in to Facebook and use virtual coins to bet on basketball games on the proposed website. The proposed website provides a platform on which users, who enjoy basketball games, can convene and share messages with the community and social network members. Based on the results, an average score of 3.56 was registered for the user satisfaction. This means that several improvements on the functions, interface, operation, and prediction of the website must be performed to satisfy user requirements and expectations. In addition, other possible factors influence user expectations, such as trust, usability, technology acceptance factors (Davis *et al.*, 1989), knowledge sharing factors, social influence factors, critical mass, playfulness, self-efficacy, personal outcome expectations, social persuasion, information quality, and usage behaviour (Rauniar *et al.*, 2014). We will continually improve the evaluation results for the next development cycle.

The main contributions of this study are that: first, the game status and odds on the proposed website are synchronised with those of the official NBA website and TSL; second, three types of prediction method, vote, future event, and odds, are used to support users with making decisions and to increase the win rate in betting, particularly predictions for bets in the TSL; third, several methods are used to integrate related information and to provide an interactive Web 2.0 social network and community to enhance the prediction accuracy rate; and fourth, the questionnaire was developed to evaluate whether the design features and basketball game prediction functions satisfied user requirements. In this phase, a prototype system was developed to survey user preferences regarding the design functions. The related findings will be used to enhance the next version.

From the viewpoint of theoretical contributions, the perceptions of the users, and their acceptance of the designed website were examined using descriptive and inferential statistics methods. A high mean percentage indicated favourable perceptions of the users towards the related functions. Conversely, a low mean percentage indicated that the users disagreed with the current design. The Cronbach's α coefficients revealed that the reliability of the questionnaire was satisfactory, and the detailed the average agreement equivalent test (Table V) was conducted to determine the relationship between the basic data and designs. In addition, the measurement results indicated potential directions for improvement.

From the viewpoint of practical implication, this study extended the general prototype system development method (Che and Hou, 2008; Walters *et al.*, 1994) to integrate social network blog messages with real-time basketball game and sports lottery odds.

The proposed website was evaluated using a questionnaire to determine whether the users were satisfied with the functions, interfaces, prediction, and interactive designs. The related mechanisms and procedures are preferred models for developing a social-network-based sports lottery community website. The current version can be extended if the enriched content and interactive mechanisms are analysed.

The social media platform can be used to implement the prediction and interaction scheme in the proposed sports lottery website, thus enhancing interaction among the users who share similar interests (Zhou, 2011; Toral *et al.*, 2009). Users who share mutual interest appreciate sharing game opinions, predictions, and personal betting results as well as interacting with their friends. However, the person-to-person interactive function, which elicits a privacy concern (Acquisti and Gross, 2006; Light and McGrath, 2010), might not be accepted by users. Message sharing and predictions are integrated into personal betting results and the interactive website.

The required number of users to enhance prediction accuracy is one of our future work. For example, the voting method let users vote with their favourite, intention, guess, etc. with limited information that is still an open issue. Hence, the designed prediction mechanism concentrates on the process and representation of the prediction values to support user making decision (du Plessis, 2005). Then, we design a table of the ranking prediction accuracies of the proposed prediction schemes and top ten prediction users.

From a managerial perspective, the research results and limitations can be attributed to the differences between virtual betting and real betting conditions. These differences might influence the practicality and prediction bias of the designed website and related models:

- The game status and odds on the proposed website are synchronised with those of the official NBA website and Taiwan's lottery. The data synchronisation is scheduled to automatically execute without manual operation such that the manager do not need to handle this task. The data update can catch up the official websites in real time that enables the related functions execution in real time. Furthermore, the self-recovery and self-optimisation mechanisms are included for the exception events. The related logs are generated for the manager to trace the executed results.
- Three types of prediction method, vote, future event (Slamka *et al.*, 2008), and odds, are used to support users with making decisions and to increase the win rate in betting, particularly predictions for bets in the TSL. The statistical methods are used in prediction to elaborate the social power that reduces the bias or the effect by small amount of members (Gail *et al.*, 1984; Albert *et al.*, 2014). Furthermore, the privacy of the individual user can be protected to avoid personal attack for the wrong protection so far as to hide the personal preferences.
- Several methods are used to integrate related information and to provide an interactive Web 2.0 social network and community to enhance the prediction accuracy rate. A serial of related interactive functions are enhanced through self-service concepts (Chen *et al.*, 2009). For example, the users are encouraged to earn the virtual coins through posting comments, vote, reply message, and evaluate posted comments. Once a user owns accumulates chips, he/she can bet the sports lottery to simulate and earn more chips. Large amount chips can use to continually play virtual sports lottery and observe the relative online services.
- The high number of users using the proposed website generates highly accurate predictions. This work had demoed an agent-based virtual gift presentation function, which is one of website management and marketing strategies.

The earned virtual coins can use for gift purchase and the relative online services, which are provided by the designed agents, to interact with friends. The interactive processes provide us highly chance to promote the proposed website and attract more users to join the website so that the accuracy of prediction, the scare of the website usage, etc., are enhanced.

- This study adopted an EPSD approach (Che and Hou, 2008; Walters *et al.*, 1994) to improve the function, interface, operation, and competition prediction of the proposed sports lottery websites. The advantage of the EPSD approach was used to explore new services and apply user requirements.
- The current version of the proposed system is a first-stage prototype system. We used the prototype to evaluate whether the design functions satisfied the requirements of the users. The evaluation results had shown that the main functions of the design satisfied the requirements of the users according to the questionnaires; however, some functions must be adjusted. For example, the gift function that enables users to post to Facebook walls might not be favourable, and the update period must be adjusted. These functions must be reconstructed and tested.

5.2 Research limitations

We attempted to resolve limitations, such as the URL authentication problem when embedding the website into Facebook. However, several research limitations still require advanced optimal solutions:

- Development of the function used to access the formal odds from the TSL website is ongoing because the HTML format of the official website changes periodically.
- NBA APIs can be used to access the game results for machine reading, but the data are updated at a delay in relation to the real game status. Consequently, the proposed platform used for observing the results exhibits a delay of approximately 1 min.
- This convenient sample encompassed only respondents who engaged in sports lottery betting or used Facebook. Hence, a sample with younger respondents was selected. However, the system is designed for respondents who access the internet frequently. The biased aging sample for evaluating the system might have exerted limiting effects.
- The sample was limited to users who used PTT (which is classified into community platform) and Facebook (which belongs in the social-network platform); therefore, the results must be generalised to other samples, such as the people who exhibit both social media and sports lottery playing experiences.
- The convenient sampling method was used to collect the users' reflections. Some of the 277 respondents may have been Facebook users who engaged in sports lottery betting less frequently. Some respondents may have often watched the NBA, but engaged in less sports lottery betting. Although the respondent structure was mixed with various types of user, the respondents were the target users of the proposed website to achieve this study's objective of designing a hybrid social and community platform. Thus, the influence of the diversified respondents in reflecting the survey results is limited.
- User behaviours, such as subjective norm, identification, internalisation, motivations (usefulness and the roles of social influences), and compliance were not evaluated. We conducted this study in Taiwan, which features a collectivistic culture and sports lottery rules; therefore, the usage of the developed website is limited in Taiwan.

5.3 Future study

Our future work includes studying and comparing how various groups (sports lottery players, sports fans or followers, social network users, and sports communities) influence the website development. The demassification research facilitated our design of ethnicity websites and the integration and interaction between these sites must be explored and evaluated.

The prediction functions must be enhanced and used by users to enable the prediction results to be compared with the game results. Accordingly, future study will provide advanced basketball game prediction functions for user reference. The objective for the subsequent version of the proposed website is to increase the prediction rate and, thus, support users in betting in the TSL. The procedures of website development model will be repeated to enhance the system.

The respondents were not categorised according to their behavioural orientation, interests, and cultures. The collected samples comprised PTT and Facebook users, and most of the respondents were students, although older users have started using social media. The collected samples caused some biases in the measured results. Although they constitute the major group of people who might be interested in the proposed website, in our future study, we will generalise our results with various groups of internet users. Furthermore, the current step is to explore new features of the sports lottery system through a cross-sectional study. However, the users' system usage experiences and their daily lottery lives are dynamic and require longitudinal accumulations. Therefore, a longitudinal evaluation and test might reveal deep insights into the proposed sports lottery website development.

Notes

1. Refer to www.statista.com/statistics/272014/global- social-networks-ranked-by-number-of-users/
2. Kuai Jhih Cai: special bets in TSL that player can bet for some questions asked by Taiwan sports lottery. For example, what score Jeremy Lin, who plays in HOUSTON ROCKETS, will get in playoff game.
3. Refer to http://dictionary.cambridge.org/dictionary/british/

References

Acquisti, A. and Gross, R. (2006), "Imagined communities: awareness, information sharing, and privacy on the Facebook", *Proceedings of Privacy Enhancing Technology (PET 2006), Cambridge, 28-30 June*.

Albert, J.M., Wang, W. and Suchitra Nelson, S. (2014), "Estimating overall exposure effects for zero-inflated regression models with application to dental caries", *Statistical Methods in Medical Research*, Vol. 23 No. 3, pp. 257-278.

Araujo, T. and Neijens, P.P. (2012), "Friend me: which factors influence top global brands participation in social network sites", *Internet Research*, Vol. 22 No. 5, pp. 626-640.

Artz, J.M. (1996), "A top-down methodology for building corporate web applications", *Internet Research*, Vol. 6 No. 2/3, pp. 64-74.

Bateman, P.J., Gray, P.H. and Butler, B.S. (2010), "The impact of community commitment on participation in online communities", *Information Systems Research*, Vol. 22 No. 4, pp. 841-854.

Baulch, M. (2001), "Using machine learning to predict the results of sporting matches", Department of Computer Science and Electrical Engineering, University of Queensland, Queensland.

Berg, J.E. and Rietz, T.A. (2003), "Prediction markets as decision support systems", *Information Systems Frontiers*, Vol. 5 No. 1, pp. 79-93.

Bertsekas, D.P. and Tsitsiklis, J.N. (2002), *Introduction to Probability*, 2nd ed., Athena Scientific, Nashua, NH.

Boyd, D.M. and Ellison, N.B. (2008), "Social network sites: definition, history, and scholarship", *Journal of Computer-Mediated Communication*, Vol. 13 No. 1, pp. 210-230.

Brindley, C. (1999), "The marketing of gambling on the internet", *Internet Research*, Vol. 9 No. 4, pp. 281-286.

Burke, M., Marlow, C. and Lento, T. (2010), "Social network activity and social well-being", *Proceedings of the 28th international conference on Human Factors in Computing Systems, Atlanta, GA, 10-15 April.*

Castillo, C., Mendoza, M. and Poblete, B. (2013), "Predicting information credibility in time-sensitive social media", *Internet Research*, Vol. 23 No. 5, pp. 560-588.

Che, D. and Hou, W.C. (2008), "Determined: a system with novel techniques for XML query optimization and evaluation", *International Journal of Web Information Systems*, Vol. 4 No. 1, pp. 48-77.

Chen, K.H., Shen, K.S. and Ma, M.Y. (2012), "The functional and usable appeal of Facebook SNS games", *Internet Research*, Vol. 22 No. 4, pp. 467-481.

Chen, S.C., Chen, H.H. and Chen, M.F. (2009), "Determinants of satisfaction and continuance intention towards self-service technologies", *Industrial Management & Data Systems*, Vol. 109 No. 9, pp. 1248-1263.

Chiu, Y.T., Lee, W.-I, Liu, C.-C. and Liu, L.-Y. (2012), "Internet lottery commerce: an integrated view of online sports lottery adoption", *Journal of Internet Commerce*, Vol. 11 No. 1, pp. 68-80.

Ciou, S.M. (2010), "Using data mining technology for sports lottery prediction", Master's thesis, Chinese Culture University Department of Information Management, Taipei.

Cunliffe, D. (2000), "Developing usable web sites – a review and model", *Internet Research*, Vol. 10 No. 4, pp. 295-308.

Das, S. and Nayak, T. (2013), "Impact of cyber crime: issues and challenges", *International Journal of Engineering Sciences & Emerging Technologies*, Vol. 6 No. 2, pp. 142-153.

David, C. L. (2011), "Online social network acceptance: a social perspective", *Internet Research*, Vol. 21 No. 5, pp. 562-580.

Davis, F.D., Bagozzi, R.P. and Warshaw, P.R. (1989), "User acceptance of computer-technology – a comparison of two theoretical-models", *Management Science*, Vol. 35 No. 8, pp. 982-1003.

Dholakia, U.M., Bagozzi, R.P. and Pearo, L.K. (2004), "A social influence model of consumer participation in network- and small-group-based virtual communities", *International Journal of Research in Marketing*, Vol. 21 No. 3, pp. 241-263.

Duggan, M., Ellison, N.B., Lampe, C., Lenhart, A and Madden, M. (2014), "Social media update 2014", Pew Research Center, January 2015, available at: www.pewinternet.org/2015/01/09/social-media-update- 2014/ (accessed 9 January 2015).

Du Plessis, M. (2005), "Drivers of knowledge management in the corporate environment", *International Journal of Information Management*, Vol. 25 No. 3, pp. 193-202.

Gail, M.H., Wieand, S. and Piantadosi, S. (1984), "Biased estimates of treatment effect in randomized experiments with nonlinear regressions and omitted covariates", *Biometrika*, Vol. 71 No. 3, pp. 432-444.

Gajendra, S. and Wang, L. (2014), "Ethical perspectives on e-commerce: an empirical investigation", *Internet Research*, Vol. 24 No. 4, pp. 414-435.

Galston, W.A. (1999), "Does the internet affect community? Some speculation in search of evidence", in Kamarck, E.C. and Nye, J.S. Jr (Eds), *Governance in a Networked World*, Hollis Publishing, Hollis, NH, pp. 45-62.

Gao, Q., Dai, Y., Fan, A. and Kang, R. (2010), "Understanding factors affecting perceived sociability of social software", *Computers in Human Behavior*, Vol. 26 No. 6, pp. 1846-1861.

Ho, L.A., Kuo, T.H. and Lin, B. (2012), "How social identification and trust influence organizational online knowledge sharing", *Internet Research*, Vol. 22 No. 1, pp. 4-28.

Hsu, C.-L. and Lin, J.C.-C. (2008), "Acceptance of blog usage: the roles of technology acceptance, social influence and knowledge sharing motivation", *Information & Management*, Vol. 45 No. 1, pp. 65-74.

Huang, E. (2012), "Online experiences and virtual goods purchase intention", *Internet Research*, Vol. 22 No. 3, pp. 252-274.

Hugl, U. (2011), "Reviewing person's value of privacy of online social networking", *Internet Research*, Vol. 21 No. 4, pp. 384-407.

Institute of Business Ethics (IBE) (2011), "The ethical challenges of social media", *Business Ethics Briefing*, Vol. 22 No. 22, pp. 1-4, available at: www.ibe.org.uk/userassets/briefings/ibe_briefing_22_the_ethical_challenges_of_social_ media.pdf

Ip, R.K.F. and Wagner, C. (2008), "Weblogging: a study of social computing and its impact on organizations", *Decision Support Systems*, Vol. 45 No. 2, pp. 242-250.

John, D. (2008), "Do data characteristics change according to the number of scale points used? An experiment using 5-point, 7-point and 10-point scales", *International Journal of Market Research*, Vol. 50 No. 1, pp. 61-77.

Kalampokis, E., Tambouris, E. and Tarabanis, K. (2013), "Understanding the predictive power of social media", *Internet Research*, Vol. 23 No. 5, pp. 544-559.

Kaplan, A.M. and Haenlein, M. (2010), "Users of the world, unite! The challenges and opportunities of social media", *Business Horizons*, Vol. 53 No. 1, pp. 59-68.

Karyda, M., Gritzalis, S., Park, J.H. and Kokolakis, S. (2009), "Privacy and fair information practices in ubiquitous environments: research challenges and future directions", *Internet Research*, Vol. 19 No. 2, pp. 194-208.

Kerr, G., Mortimer, K., Dickinson, S and David, S.W. (2012), "Buy, boycott or blog: exploring online consumer power to share, discuss and distribute controversial advertising messages", *European Journal of Marketing*, Vol. 46 No. 3/4, pp. 387-405.

Kietzmann, J.H., Hermkens, K., McCarthy, I.P. and Silvestre, B.S. (2011), "Social media? Get serious! Understanding the functional building blocks of social media", *Business Horizons*, Vol. 54 No. 3, pp. 241-251.

Ku, L. and Chang, H.J. (2002), "Human relationships in virtual communities: a study of Jade Air", *Mass Communication Research*, Vol. 72, pp. 55-83.

Lea, B.R., Yu, W.B., Maguluru, N. and Nichols, M. (2006), "Enhancing business networks using social network based virtual communities", *Industrial Management & Data Systems*, Vol. 106 No. 1, pp. 121-138.

Lee, P.C., Huang, H.C., Jiang, R.S. and Lee, K.W. (2012), "The establishment of a sports lottery in Taiwan", *International Journal of the History of Sport*, Vol. 29 No. 4, pp. 601-618.

Light, B. and McGrath, K. (2010), "Ethics and social networking sites: a disclosive analysis of Facebook", *Information Technology & People*, Vol. 23 No. 4, pp. 290-311.

Lin, F.R. and Huang, H.Y. (2013), "Why people share knowledge in virtual communities?: the use of Yahoo! Kimo Knowledge+ as an example", *Internet Research*, Vol. 23 No. 2, pp. 133-159.

Lin, H.W., Tung, C.Y. and Yeh, J. (2013), "Multivariate methods in assessing the accuracy of prediction markets ex ante based on the highest-price criterion", *The Journal of Prediction Markets*, Vol. 7 No. 3, pp. 29-44.

Lu, H.-P. and Hsiao, K.-L. (2010), "The influence of extro/introversion on the intention to pay for social networking sites", *Information & Management*, Vol. 47 No. 3, pp. 150-157.

Lu, L.C., Chang, H.H. and Yu, S.T. (2013), "Online shoppers' perceptions of e-retailers' ethics, cultural orientation, and loyalty: an exploratory study in Taiwan", *Internet Research*, Vol. 23 No. 1, pp. 47-68.

McCarthy, J., Rowley, J., Ashworth, C.J. and Pioch, E. (2014), "Managing brand presence through social media: the case of UK football clubs", *Internet Research*, Vol. 24 No. 2, pp. 181-204.

McCormack, A., Shorter, G.W. and Griffiths, M.D. (2014), "An empirical study of gender differences in online gambling", *Journal of Gambling Studies*, Vol. 30 No. 1, pp. 71-88.

Martínez-Torres, M.R., Toral, S.L., Barrero, F. and Cortés, F. (2010), "The role of internet in the development of future software projects", *Internet Research*, Vol. 20 No. 1, pp. 72-86.

Moreira, P.M., Reis, L.P. and de Sousa, A.A. (2013), "An agent-based framework for intelligent optimization of interactive visualizations", *Proceedings of the 5th International Conference on Agents and Artificial Intelligence (ICAART)*, *Barcelona*, *February*.

Nakatani, K. and Chuang, T.-T. (2011), "A web analytics tool selection method: an analytical hierarchy process approach", *Internet Research*, Vol. 21 No. 2, pp. 171-186.

O'Cass, A. and Carlson, J. (2010), "Examining the effects of website-induced flow in professional sporting team websites", *Internet Research*, Vol. 20 No. 2, pp. 115-134.

Park, N., Lee, S. and Kim, J.H. (2012), "Individuals' personal network characteristics and patterns of Facebook use: a social network approach", *Computers in Human Behavior*, Vol. 28 No. 5, pp. 1700-1707.

Rampersad, G., Quester, P. and Troshani, I. (2010), "Examining network factors: commitment, trust, coordination and harmony", *Journal of Business & Industrial Marketing*, Vol. 25 No. 7, pp. 487-500.

Rauniar, R., Rawski, G., Yang, J. and Johnson, B. (2014), "Technology acceptance model (TAM) and social media usage: an empirical study on Facebook", *Journal of Enterprise Information Management*, Vol. 27 No. 1, pp. 6-30.

Romm, C., Pliskin, N. and Clarke, R. (1997), "Virtual communities and society: toward an integrative three phase model", *International Journal of Information Management*, Vol. 17 No. 4, pp. 261-270.

Schefels, C. and Zicari, R.V. (2012), "A framework analysis for managing feedback of visitors of a web site", *International Journal of Web Information Systems*, Vol. 8 No. 1, pp. 127-150.

Schoen, H., Gayo-Avello, D., Metaxas, P.T., Mustafaraj, E., Strohmaier, M. and Peter Gloor, P. (2013), "The power of prediction with social media", *Internet Research*, Vol. 23 No. 5, pp. 528-543.

Sexton, T.L. and Tuckman, B.W. (1991), "Self-beliefs and behavior: the role of self-efficacy and outcome expectation over time", *Personality and Individual Differences*, Vol. 12 No. 7, pp. 725-736.

Shen, A.X.L., Cheung, C.M.K., Lee, M.K.O. and Chen, H. (2010), "How social influence affects we-intention to use instant messaging: the moderating effect of usage experience", *Information Systems Frontier*, Vol. 13 No. 2, pp. 157-169.

Shen, K.N. and Khalifa, M. (2012), "System design effects on online impulse buying", *Internet Research*, Vol. 22 No. 4, pp. 396-425.

Sheng, Q.Z., Yu, J., Segev, A. and Liao, K. (2010), "Techniques on developing context-aware web services", *International Journal of Web Information Systems*, Vol. 6 No. 3, pp. 185-202.

Slamka, C., Soukhoroukova, A. and Spann, M. (2008), "Event studies in real- and play-money prediction markets", *The Journal of Prediction Markets*, Vol. 2 No. 2, pp. 53-70.

Tan, X., Qin, L., Kim, Y. and Hsu, J. (2012), "Impact of privacy concern in social networking web sites", *Internet Research*, Vol. 22 No. 2, pp. 211-233.

Taylor, S.E., Sherman, D.K., Kim, H.S., Jarcho, J., Takagi, K. and Dunagan, M.S. (2004), "Culture and social support: who seeks it and why?", *Journal of Personality and Social Psychology*, Vol. 87 No. 3, pp. 354-362.

Thompson, C. (2008), "Brave new world of digital intimacy", *New York Times*, 7 September, p. 5.

Toral, S.L., Martinez-Torres, M.R., Barrero, F. and Cortes, F. (2009), "An empirical study of the driving forces behind online communities", *Internet Research*, Vol. 19 No. 4, pp. 378-392.

Tung, C.Y., Chou, T.-C., Lin, J.W. and Lin, H.Y. (2011a), "Comparing the forecasting accuracy of prediction markets and polls for Taiwan's presidential and mayoral elections", *The Journal of Prediction Markets*, Vol. 5 No. 3, pp. 1-26.

Tung, C.Y., Chou, T.C., Lin, J.W. and Lin, H.Y. (2011b), "Analysis on the prediction results of the 2009", *Journal of Electoral Studies*, Vol. 18 No. 1, pp. 63-94.

Tung, C.Y., Lin, H.Y., Lin, J.W., Hwang, G., Chou, T.C., Liu, C.K. and Chao, W.C. (2009), "Prediction on Taiwan's elections: application and empirical studies of prediction markets", Election Study Center, National Chengchi University, Vol. 16 No. 2, pp. 131-166.

Walters, S.A., Broady, J.E. and Hartley, R.J. (1994), "A review of information systems development methodologies", *Library Management*, Vol. 15 No. 6, pp. 5-19.

Wasike, J. (2013), "Social media ethical issues: role of a librarian", *Library Hi Tech News*, Vol. 30 No. 1, pp. 8-16.

Wellman, B. (1999), "The network community: an introduction", in Wellman, B Ed., *Networks in the Global Village. Life in Contemporary Communities*, Westview Press, Boulder, CO, pp. 1-47.

Wellman, B. and Gulia, M. (1999), "Net surfers don't ride alone: virtual communities as communities", *Networks in the Global Village. Life in Contemporary Communities*, Westview Press, Boulder, CO, pp. 331-366.

West, H.R. (2003), *An Introduction to Mill's Utilitarian Ethics*, Cambridge University Press, Cambridge, ISBN-13: 978-0521535410.

Wolfers, J. and Zitzewitz, E. (2004), "Prediction markets", *Journal of Economic Perspectives*, Vol. 18 No. 2, pp. 107-126.

Yang, M.H., Weng, S.S. and Hsiao, P.I. (2014), "Measuring blog service innovation in social media services", *Internet Research*, Vol. 24 No. 1, pp. 110-128.

Yu, C.P., Young, M.L. and Ju, B.C. (2015), "Consumer software piracy in virtual communities: an integrative model of heroism and social exchange", *Internet Research*, Vol. 25 No. 2, pp. 317-334.

Yu, T.K. (2005), "An empirical research into the online behavior model in a virtual community – the case of cross validation in causal modeling", *Chiao Da Management Review*, Vol. 25 No. 1, pp. 67-95.

Zhou, T. (2011), "Understanding online community user participation: a social influence perspective", *Internet Research*, Vol. 21 No. 1, pp. 67-81.

Further reading

Carfi, D. and Musolino, F. (2011), "Game complete analysis for financial markets stabilization", MPRA Paper No. 34901, 20 November, Munich.

Ellison, N.B. (2007), "Social network sites: definition, history, and scholarship", *Journal of Computer-Mediated Communication*, Vol. 13 No. 1, pp. 210-230.

Ross, C., Orr, E.S., Sisic, M., Arseneault, J.M., Simmering, M.G. and Orr, R.R. (2009), "Personality and motivations associated with Facebook use", *Computers in Human Behavior*, Vol. 25 No. 2, pp. 578-586.

Sanfey, A.G. (2007), "Social decision-making: insights from game theory and neuroscience", *Science*, Vol. 318 No. 5850, pp. 598-602.

Appendix. A list of the questionnaire items

Facet 1: The functions of the Web site

FD1. The Web site used the Taiwan Sports Lottery odds as the game odds.

FD2. The Web site discussion forum uses different team classifications and is embedded in the Facebook wall.

FD3. Users can sell gifts at 20% off virtual coins and receive virtual coins.

FD4. The Web site offers basketball-game-related news and discussion information.

FD5. Do the features in this Web site correspond to your expectations?

Facet 2: The interface design of the Web site

ID1. Do the Web site configurations correspond to your expectations?

ID2. Do the Web site colour designs correspond to your expectations?

ID3. Are the Web site texts clear?

ID4. Is using the Web site convenient?

ID5. Are the information and features of the Web site clear?

Facet 3: The operation design of the Web site

OD1. The Web site has a 1-min delay in updating the game results.

OD2. Does the Web site embedded into Facebook correspond to your expectations?

OD3. The Web site sends gifts to your Facebook friends automatically.

Facet 4: The competition prediction of the Web site

CP1. Does the ability of the Web site to offer game predictions correspond to your expectations?

CP2. The Web site offers predictions according to votes, future events, and odds that help you predict game results.

CP3. Does displaying the prediction results on charts help you predict game results?

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