

A Reputation-Based Incentive Mechanism for a Crowdsourcing Platform for Financial Awareness

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Abstract. This paper presents the design of an incentive mechanism for the so-called PROFIT platform, a crowdsourcing (CS) platform that seeks to promote financial awareness and capability. More specifically, a reputation-based incentive scheme with gamification and social elements, which offers a mix of both implicit and explicit rewards to the most contributive users of the platform, is being proposed here. The incentive mechanism has been designed in a way to appeal to the various different motives of the target users of the platform, in order to encourage their active participation, sustain their interest and engagement, and promote good quality contributions. After reviewing the relevant work regarding incentive mechanisms in CS platforms, we present the rationale behind the design of the proposed scheme, following a five-step approach and presenting the novelties that we introduce, and, lastly, we conclude on some final remarks.

Keywords: Crowdsourcing · Incentives · Financial awareness · Reputation systems · Gamification · Collective Awareness Platforms for Sustainability and Social Innovation (CAPS)

1 Introduction

Recent advances in the field of communication technologies have transformed the way we think and live, and have also led to a major increase in the human knowledge capital [1]. Indeed, contemporary times are commonly referred to as the “information age”, mainly characterized by the “*diffusion of information, as well as Information and Communications Technologies*” [2]. Connectivity, sharing of knowledge and collaboration among users are now facilitated by Web 2.0 (the so-called “Participative Web”), and applications such as social networking sites, peer-to-peer (P2P) media sharing utilities, blogs, and wikis [2] that emphasize on users being active contributors of content, and not just viewers and consumers of information [1]. Moreover, it is argued that these applications cater to the needs of today’s learners, by giving them the opportunity to collaborate, network, and customize them [3]. In that context, users of various educational levels, e.g. learners, educators, and experts, are able to collaborate and take active part in the knowledge creation process. This process is also supported by the so called crowdsourcing (CS), a practice that emerged with the development of Web

2.0. Crowdsourcing is known as a distributed online process that harnesses the participation of the crowd for the achievement of particular tasks [4], and has been successfully used for educational, decision making, and knowledge creation purposes [5].

The EU-funded “PROFIT” project [6] aims at developing a CS platform that would promote financial awareness and capability. Financial awareness has been deemed essential to the society, since it can support citizens in taking informed financial decisions which will lead to more responsible and prudent personal financial behavior and, ultimately, to more active forms of participation and citizenship. Although there is nowadays a large amount of financial information, easily available due to the aforementioned technological developments, the documented human cognitive limitations of processing large volumes of information, in conjunction with the widespread financial illiteracy, indicate that there is a need for special financial awareness tools. Towards this goal, the PROFIT platform will incorporate the following functionalities/tools: (a) specialized financial education toolkits available to the wider public; (b) advanced crowdsourcing tools that process financial data, and also extract and present collective knowledge; (c) advanced forecasting models exploiting the market sentiment to identify market trends and threats; (d) novel personalized recommendation systems to support financial decisions according to the user’s profile (financial literacy level, interests, demographic characteristics); and (e) incentive mechanisms to encourage the active involvement of citizens through many different channels, such as posting of financial articles, participating in Q&A forum, voting in relevant polls, etc.

This paper deals with the last one of the aforementioned functionalities, i.e., incentive mechanisms to attract users’ attention and sustain their engagement with the platform. In order to achieve PROFIT’s goal and promote financial awareness, users’ participation and contributions are critical to keep the platform alive and load it with articles, questions, answers, and polls. Other users can see, assess, rate, comment, react to this content and provide relevant feedback, leading to a fruitful creation and exchange of new knowledge in the financial domain. Therefore, in order to achieve this, we propose a novel reputation-based incentive scheme with integrated gamification elements, combining both implicit (e.g. social status) and explicit rewards (e.g. tangible rewards) in a way that could appeal to the different target users of the PROFIT platform. In the following section (Sect. 2) we delve into related work in the area of incentive mechanisms for CS platforms, explaining the novelties that we introduce. In Sect. 3, we present our incentive mechanism through a five stage design approach in order to meet the particular needs of the PROFIT platform, and in Sect. 4 we conclude the paper with some final remarks.

2 Related Work

2.1 Theoretical Background - User Motives and Incentives in CS Platforms

The success of CS platforms depends greatly on the continuous participation of the users and their sustained engagement, and that explains the amount of studies focusing on user motives for participating in CS platforms (e.g. [7, 8]). Some common user

motives that were identified include altruism, learning/personal achievement, social motives, self-marketing, direct compensation, and enjoyment [5, 7, 9, 10]. They can be activated either by intrinsic incentives, e.g. social status and respect by others [7], or by extrinsic incentives, such as payment [5]. In our previous study [11], we investigated the connection between different user motives and corresponding incentives, as well as appropriate incentive mechanisms that could be designed in order to trigger the particular incentives. The identified incentive mechanisms were organized in four main categories, consisting of the following: (a) reputation systems, (b) gamification, (c) social incentive mechanisms, and (d) financial & career rewards. A reputation system is used to identify the most contributive (reputed) users through the implementation of a reputation metric. It usually involves some implicit or explicit rewards for users with high reputation, as well as penalties for users with very low reputation. These rewards may span from badges and social status, to career opportunities and financial awards; therefore, reputation systems are usually combined with one or more of the rest of the incentive mechanisms mentioned above. In PROFIT, we made a careful combination of all four aforementioned incentive mechanisms, in order to appeal to the different motives of the various user communities, and sustain their interest and engagement in the platform. To the best of our knowledge, no other CS platform has combined all of the above mechanisms.

2.2 Incentive Mechanisms in CAPS Platforms

PROFIT is part of the initiative “Collective Awareness Platforms for Sustainability and Social Innovation” (CAPS), which is focused on the design of online platforms that will *create awareness of sustainability problems and offer collaborative solutions based on networks* [12]. At the moment, a total of 12 projects from the first call are already running since 2013, while 22 new projects, including PROFIT, have commenced their activities this year. An open problem of CAPS projects is how to reach to their user communities; therefore, the design and incorporation of appropriate incentive mechanisms play a significant role. It is of interest, though, to overview what has been implemented in this context, so far.

The incentive mechanisms employed until now consist mainly of social incentive mechanisms, appropriate feedback (e.g. activity history, advanced visualizations) that support and motivate users who participate for altruistic or self-accomplishment reasons (e.g. learning), and, less often, simplistic reputation systems. Gamification elements or direct monetary/career rewards were not identified. An example would be DebateHub [13], a tool that facilitates the sharing and discussion of ideas between users, developed by the CAPS project Catalyst [14] which aims at improving collaborative knowledge creation. In order to achieve prioritizing of contributions and eventually promote the best ideas, a simple rating mechanism was incorporated: users have the option to upvote and downvote ideas. Social incentives mechanisms (e.g. user discussion groups, follow other users), as well as a visualization dashboard consisting of summary analytics and attention mediation feedback were implemented; however, there is no reputation system implemented that could assess users’ credibility and behavior on the platform.

Similarly, the Wikirate CAPS project [15] has created a web platform for collaborative creation and sharing of knowledge on company behavior. Users can contribute information and have access to data and visualizations reflecting company behavior in order to compare and rate these companies. There are some social incentives mechanisms (e.g. profile pages, follow other users), and users have the option to upvote or downvote other users' posts. However, there is no reputation system implemented here either. There are plans to incorporate several gamification elements, e.g. badges, in the near future [16].

A simple reputation system in which users accumulate points according to the upvotes their posts receive from other users was implemented in the EnergyUse platform [17]. The particular platform allows citizens to discuss about energy saving with users of electricity monitors aiming at engaging them in fruitful energy debates and promoting positive behavioral change towards reduced energy consumption. It was created by the CAPS project DecarboNet [18], which is investigating the potential of social platforms in mitigating climate change. Apart from social incentives mechanisms (comment on posts, discuss with other users), EnergyUse also incorporates a basic reputation system: users can upvote posts and answers, and accumulate reputation points accordingly. It is mentioned on the platform that awards for the users will be incorporated soon.

By the time the particular paper was written, the authors did not encounter any other CAPS projects that had incorporated reputation-based incentive mechanisms or gamification elements into their platforms. However, some of them included social incentives in the form of offline meetings and social events in order to inform the wider public and increase users' interest and engagement on the platform. For example, CAP4Access [19], a CAPS project which aims at developing methods and tools for the collective gathering and sharing of spatial information for improving accessibility, has also created a web "communication platform", which features activities and meetings initiated by the CAP4Access partners, as well as the work of other activists and organizations working for accessibility in Europe.

2.3 Simple Reputation Schemes Used in Commercial CS Platforms Versus Sophisticated Ones Proposed in the Literature, and the PROFIT's Approach

As far as incentive mechanisms in other CS platforms (commercial and research projects) are concerned, these are usually a combination of reputation systems with other incentive mechanisms, i.e. gamification and financial rewards, as already mentioned. The reputation metric can be based upon various different methods, spanning from simple summation of ratings to fuzzy logic and probabilistic models [20]. Simple reputation systems are preferred in commercial CS platforms, since they are easily applicable and they are not that computationally expensive. Some indicative examples of such reputation systems in CS platforms, combined with social incentive mechanisms, include those implemented in CS news websites, such as Reddit, Slashdot, and Hacker News. The reputation metric here is mostly based on accumulation of user points ("Karma"), according to the upvotes and downvotes their contributions received

by other users. Simple reputation systems are also implemented in auction and e-commerce websites, such as Amazon and eBay, where buyers and sellers can rate each other on a scale 1–5 and leave comments. The reputation of each user is directly linked to career and financial rewards and can affect them favorably or negatively. Similarly, in online marketplaces, such as Amazon Mechanical Turk, a user's reputation score usually reflects her trustworthiness and her abilities and skills, since it is often calculated as the percentage of her successfully completed tasks.

On the other hand, more advanced and fair reputation schemes have been proposed in the pertinent bibliography. The main concern here is how to increase the system's robustness against user manipulation. As a result, complexity as well as computation burden may be here increased contrary to simpler reputation schemes. For example, Whitby et al. [21], proposed a Bayesian reputation system based on [22]. It filters unfair ratings by excluding or giving low weight to presumed unfair ratings, based on the assumption that they can be recognized by their statistical properties [21]. Similarly, Dellarocas in [23] focuses on a set of mechanisms based on controlled anonymity and cluster filtering that can be integrated into a reputation system to address unfair user behavior (e.g. unfairly high or low ratings).

At PROFIT, we followed a middle solution by designing a reputation scheme that is neither overly simplistic, nor too complicated in order to be easily implemented in a practical platform, incorporating a reputation mechanism that tracks not only contributive users but also those particular users that provide high quality contributions, and rewards them accordingly. It differentiates from other reputation systems we overviewed, by using two distinct reputation metrics, as well as a time window, in order to create a more robust solution for incentivizing users, as we will elaborate in the next sections. Additionally, a unique combination of the aforementioned incentive mechanisms are going to be incorporated, in order to create an integrated incentive system that would appeal to different user groups.

3 Design of the System

Gamification in the PROFIT platform will act as an additional service layer of the reputation system presenting the user with game design elements, such as points, badges, time constraints, levels, leaderboards, [24]. Therefore, several gamification conceptual frameworks were identified and studied. Some prominent examples include Di Tommaso's gamification framework [25], Chou's "Octalysis" framework [26], Brito's et al. "GAME" framework [27], and Werbach's six-step gamification framework [28]. Based on a combination of the above, the authors concluded on five steps that would be most suitable to follow, in order to gamify the particular platform: (a) delineation of the platform objectives and desired user's behaviors; (b) description of target users and investigation of their motives to participate in the PROFIT platform; (c) identification and design of appropriate incentive mechanisms that appeal to the targeted users' motives and trigger the desired behaviors; (d) inclusion of measures to sustain user engagement; and (e) definition of the evaluation strategy. These steps are going to be presented in the following subsections.

3.1 Objectives of the Platform and Target User Behaviors

The PROFIT platform aims at promoting the financial awareness of EU citizens and other financial market participants. Towards this goal, it is intended to trigger users' interest on the financial domain, help them improve their financial literacy levels, and motivate them to participate in relevant discussions and interactive activities in the platform, so as to raise awareness on different financial issues. Such activities include: self-assessment of their own financial knowledge levels through the financial literacy tests of the platform, upload of financial-related articles, posting of related questions or answering questions, participating in polls or creating their own, rating or commenting on other users' posts or polls, rating or commenting on the platforms' content, provide external or their own educational material, edit other users' provided educational material, etc. Additionally, what is needed is to not only encourage users' participation and contributions on the platform, but also to motivate good quality contributions that could support the platform's goal, as well as to sustain this desired behavior over time.

To reach the aforementioned goals, it is of utmost importance to communicate in the right way what the platform wants to achieve, and promote a sense of ownership of this goal among the platform participants so that they can understand and deeply share the goal. This can be supported by providing users with appropriate and timely feedback regarding the impact of their contributions on reaching this goal (e.g. through interactive visualizations, graphs, etc.), and by promoting collaboration and social interactions among users. Special feedback should also be provided to newcomers, by giving them simple guidelines on how they can participate and contribute, highlight what they can achieve from their participation, and provide them with certain rewards for their initial contributions.

3.2 Description of Target Users and Investigation of Their Motives

The proposed platform will address all kinds of users, from people with little/no financial knowledge to more financial literate users, regardless of age, gender, financial background, etc. The authors, based on relevant research [33] and the feedback from the PROFIT User Forum committee consisted of financial institutions, entrepreneurs, government bodies, educational institutions, banks' customers and other potential customers and/or final users of the PROFIT platform, concluded on the following target user groups of the proposed platform, based on the demographic category that would better reflect their financial status and needs:

- UG1: Entrepreneurs/latent entrepreneurs/social entrepreneurs/self-employed,
- UG2: Elderly/retirees/pre-retirees,
- UG3: Migrants/Members of an ethnic minority,
- UG4: Children/Parents of young children,
- UG5: Customers: Indebted/Over indebted households,
- UG6: Customers: Investors/Potential investors/Depositors,
- UG7: Unemployed/trainees,
- UG8: Active citizens/taxpayers,
- UG9: Mortgage owners/home owners/first-time buyers,

- UG10: Professionals in financial services/financial experts,
- UG11: Government executives and political-party members/local authorities,
- UG12: Collective investors/borrowers/third sector organisations.

In order to investigate the target users' attitudes towards a financial awareness platform and understand their motives for participating and contributing to such a platform, both literature survey and a large scale online survey was conducted. The online questionnaire¹ comprised 35 questions related to the demographic information of the participants, their financial knowledge and status, their attitude towards using technology and Internet, their ICT skills, and their motives for participating and contributing to such a platform. It was available for completion online in six languages (English, French, Italian, Greek, Croatian, and Slovenian). The English version questionnaire is available at <http://projectprofit.eu/material/#tab-id-1>.

The questionnaire was completed by 494 people of varying age, nationality, and education/professional background. 50.2% of the completed questionnaires were in English, 24.3% were in Greek, 7.1% were in Croatian, 6.7% were in Slovenian, 6.1% in Italian, and 5.7% in French (Fig. 1). The majority (296 or 59.9%) participants were male and 198 (40.1%) were female (Fig. 1). The youngest person that participated in our survey was 18 years old and the oldest was 85 years old. Overall, 40.7% of the participants were between 28 and 43 years old, 30.1% were 44–60 years old, 16.7% were 18–27 years old, and 12.6% were 61+ years old.

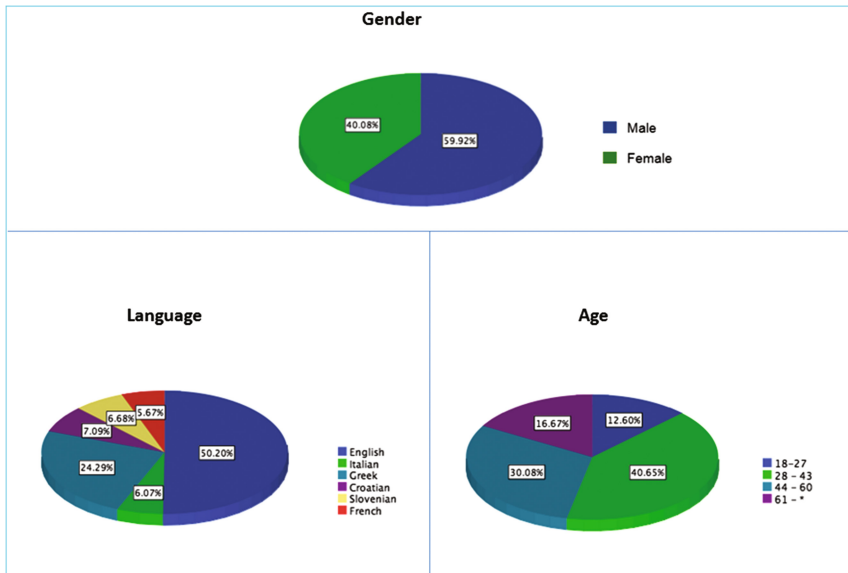


Fig. 1. Gender, language and age of respondents

¹ The realization of the PROFIT's online questionnaire has received the ethical approval from the Bio-Ethics Committee of the Centre for Research and Technology Hellas with REF No: ETH.COM-19.

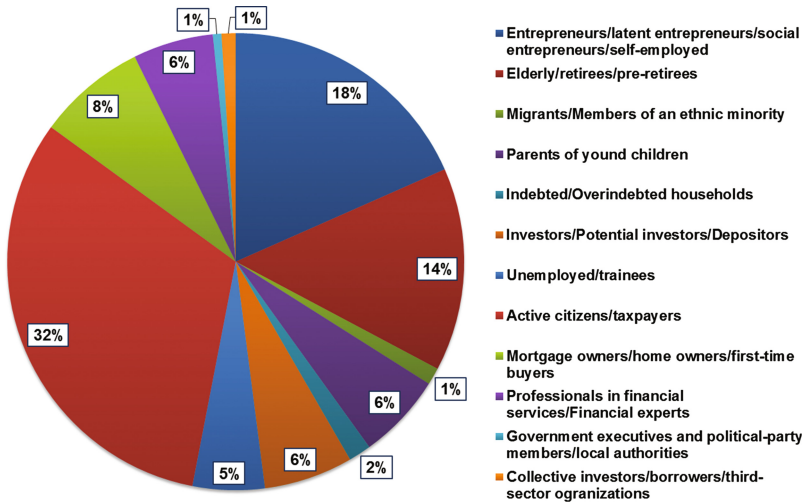


Fig. 2. Demographic category of respondents

were older than 61 years old, and only 12.6% of the participants were 18–27 years old, making young people the least represented group in our survey (Fig. 1).

As regards the demographic category in terms of financial awareness and needs (Fig. 2), the majority of the participants (31.98%) answered that they are active citizens/taxpayers (158 people). 91 people (18.4%) belong in the ‘Entrepreneurs/latent entrepreneurs/social entrepreneurs/self-employed’ category, and 71 people (14.4%) were ‘Elderly/retirees/pre-retirees’. The least represented category was ‘Government executives and political-party members/local authorities’ with only 3 people (0.6%).

The questions that are related to the work presented in this paper asked participants (a) to evaluate the potential features of the platform (services, resources, rewards, ease of use, social interactions, and personalized recommendations), (b) to rate how likely it would be to perform specific actions on the platform (post questions, provide answers, report problems or malicious users/posts, rate posts, etc.), and (c) to rate how likely it would be to contribute more to the platform if they were provided with specific incentives (small monetary rewards, social status & reputation, gamification elements, feedback and recognition from other users, career opportunities, social interactions, and more accurate personalized recommendations). These questions were of Likert type, using a scale 1–5 where 1 = “Not at all likely” and 5 = “Very likely”. For the statistical analysis of the gathered data, IBM SPSS Statistics Package version 20 was used. Appropriate measures of central tendency (mean or mode) and variability (standard deviation, range) were estimated for each variable, and non-parametric tests (Mann-Whitney U tests, Kruskal-Wallis test) were applied.

Respondents were mostly positive (mode 4) regarding the proposed features of the platform. The feature with the most positive answers was Ease of use: 69.8% of the participants answered “Very likely” and “Quite likely”. Respondents were positive (mode 4) regarding participating in polls and providing feedback to the platform, and neutral (mode 3) regarding posting questions, providing answers, and rating posts.

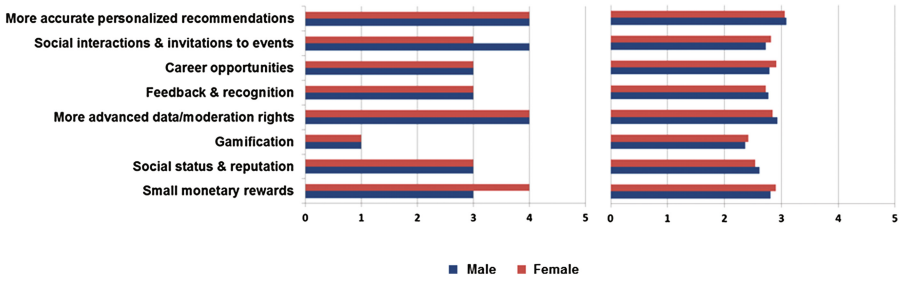


Fig. 3. Incentives according to gender (mode-left, mean-right)

Lastly, incentives that seem to be the more appealing according to the results are *social interactions & invitations to social events* according to one's contributions, *access to more advanced data & moderation rights*, and *more accurate personalized recommendations* (mode 4).

We also analysed the participants' responses according to their gender, age, and user group. What we saw is that incentives do not present significant differences between males and females that both seem to be more interested in receiving *more accurate personalized recommendations*, with females showing a slightly higher than males interest in *career opportunities* and *small monetary awards*, while males showing a slightly higher interest than females in gaining *access to more advanced/moderation data*, as well as *social status, reputation* and *recognition* from the community (Fig. 3). Nevertheless, both males and females seem equally interested in using the PROFIT platform, as 179 (60.9%) of male participants and 103 (52.8%) of female participants stated that it would be quite/very likely that they use the platform.

Regarding differences between different ages target groups, we saw that in general younger people (age 18–43) were more interested in the different incentives, with a strong preference on *career opportunities*, *small monetary rewards*, *access to more accurate personalized recommendations* and *social interactions*, while their older counterparts (age 44+) show some interest only for the *more accurate personalized recommendations* and access to *more advanced data/moderation rights*. The majority (mode) of the youngest group (age 18–27) was also positive regarding the *gamification elements* and the “*social interactions and invitation to events*”; the majority of the 28–43 age group was also positive on receipt of *feedback and recognition* according to

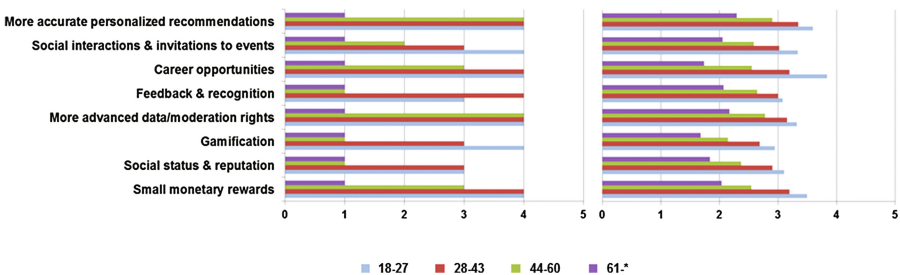


Fig. 4. Incentives based on respondents' age (mode-left, mean-right)

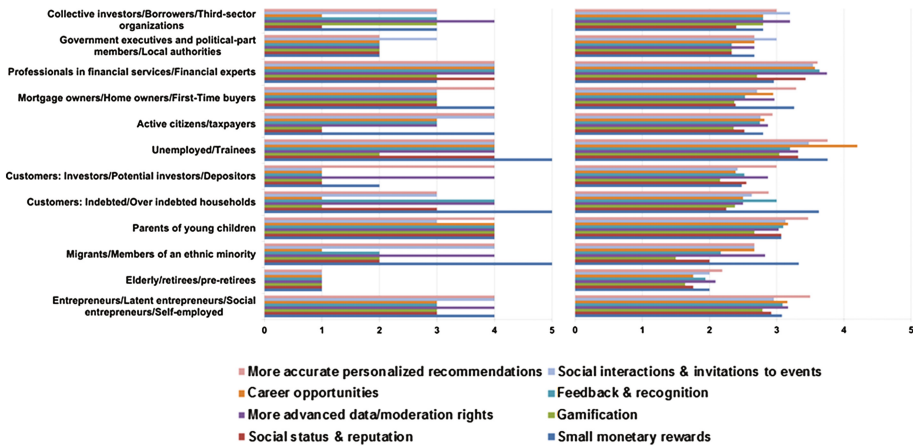


Fig. 5. Incentives based on demographic category (mode-left, mean-right)

their contributions, the majority of the age 44–60 group was positive regarding the *more accurate personalized recommendations* and access to *more advanced data/moderation rights*, while the majority of the age 61+ group was negative in terms of all listed incentives (Fig. 4).

Lastly, as depicted in Fig. 5, there were also identified differences which stem from the respondents' financial status and needs, as these are reflected on their chosen demographic category. *Small monetary rewards* seem to be the strongest incentive for the majority of unemployed/trainees, indebted/over indebted households and migrants/members of ethnic minorities. *Career opportunities* also constitute a strong incentive for unemployed/trainees, while *social interactions*, gaining *social status and reputation* as well as *feedback and recognition* from the community also are of interest to them. Interestingly, these same incentives are also a motivating factor for professionals in financial services/financial experts, who seem to be interested in self-marketing and socializing, being quite positive towards *feedback and recognition according to their contributions*, *social status and reputation*, *social interactions* on the platform, and *invitations to social events*. Parents of young children, who may be concerned regarding the financial education of their children and enjoyable ways to motivate them in being informed in this area, are among the groups who gave the most positive responses regarding gamification elements. Lastly, it should also be mentioned that elderly/retirees/pre-retirees seem to be the least interested in the aforementioned incentives as compared to the other demographic categories, scoring low on all of them.

From the holistic analysis of the questionnaire [33] it was concluded that respondents who could be characterized as more “experienced” based on their financial literacy level, (e.g. professionals in financial services) seem to be more interested in using such a platform and have a more positive attitude concerning the incentive mechanisms mentioned in the online questionnaire. These users would more likely join such a platform not so much for gaining financial knowledge (which they should already possess), but for the more advanced features provided by the platform (e.g.,

financial forecasting based on market sentiment) that could be of interest to them. Moreover, these users could also be motivated by having the opportunity to contribute their knowledge either for altruistic purposes (i.e., contributing financial information for the good cause of promoting financial awareness globally), or for self-marketing and gaining social status/reputation by promoting their skills through their activities on the platform. Therefore, their dominant motives for participating comprise altruism, self-marketing, social motives, and direct compensation.

“Moderate” users in terms of financial literacy (e.g. insurance/mortgage/home owners and first-time buyers) are potentially motivated by their will to learn more about specific financial matters and get relevant recommendations, as well as socialize and network with other users of the platform. Lastly, users that may be characterized as less financial literate or less financially independent (e.g. unemployed/trainees) may participate in order to get informed, ask questions, socialize, explore career opportunities, or gain small monetary rewards (e.g. prizes).

As a concluding remark regarding user incentives, we argue that the motives and reasons for participating in the PROFIT platform vary according to the age, and user group of the participants. We can also expect that their participation levels and patterns on the platform would differ greatly. Therefore, the incentive mechanism that will be incorporated into the platform should make a careful combination of different incentive mechanisms in order to appeal to the majority of them and be effective for all target users.

Finally, it should also be mentioned that participants in the survey were also given the opportunity to suggest features for the PROFIT platform. Most of their answers were focused on the importance of an appealing user interface and an easy to use web platform/application. Nonetheless, among their suggestions were also Question & Answer Forums, private and instant messages, awards, opportunities to socialize with other users and ways to exchange knowledge with them.

3.3 How to Trigger User Motives - Incentive Mechanisms Applied and Designed

Based on a previous work [11], as well as the conclusions from the results of the online survey mentioned above, the authors decided that in order to correspond to the motives of all the aforementioned user groups, the PROFIT platform should combine a variety of different incentive mechanisms (reputation system, gamification, social incentive mechanisms, and financial rewards). More specifically, a reputation system would correspond to user’s self-marketing motives by giving them the opportunity to showcase their social status and demonstrate their skills. Users’ altruism can be triggered by the opportunity to contribute for a good cause (in that case promotion of financial awareness to other users), as well as feedback (through appropriate design elements like visualizations, graphs, etc.) regarding the impact of personal contributions to the platform community. Gamification mostly appealing to the younger age groups elicits user motives such as enjoyment, intellectual curiosity, learning and personal achievement, by allowing the most contributive users to unlock new features (e.g., access to more advanced functionalities, moderation rights on the platform, etc.),

gain rewards (e.g. badges representing the user's achievements), and upgrade their level (e.g. avatar changing accordingly to represent user's contribution levels). However, elements that may raise unnecessary competition (e.g., leaderboards) are going to be avoided in the particular platform, or used under certain conditions. Social incentives mechanisms, such as "follow" and "conversation" functionalities and social feedback (comments, ratings, etc.), appeal to the users' social motives by allowing them to present a good social image according to the values of the online community and gain appreciation by others, while they can also encourage altruistic actions. Lastly, suitable incentives for direct compensation, such as discounts on products and prizes, will also be included in the platform. In what follows, the incentive mechanisms applied are being presented in more detail.

Reputation System: A Way to Measure User Progress. In order to measure user progress, two distinct reputation metrics are going to be implemented; one to reflect the participation level of the user (R_p), and one to reflect the quality of the provided contributions (R_q). The reputation metrics will provide feedback to the users as to what extent they are engaged with the intended behaviors. These two reputation metrics would be visible on the user dashboard, alongside with visualizations of user activity. Having two separate reputation metrics allows to distinct contributive users from those users who are not only frequent contributors, but they also provide contributions of a high quality. It is important to track both the number of contributions as well as the level of their quality, so as to particularly promote very active users with high quality contributions. In the following, we explain how the two reputation metrics are calculated.

More specifically, users will be able to gain points for each of their actions on the platform, according to their importance for the platform purposes. For example, a user will be awarded 15 points each time she posts financial information on the platform, each time she adds new educational material, and each time she provides an answer to a financial related question posted by another user (Table 1). The participation level of the user (R_p) is then judged by the sum of her accumulated points on the platform. Actions that promote user collaboration and are beneficial to the community are awarded with more points (e.g. answer to other users' questions; participate in polls created by other users, etc.). Moreover, in order to promote high quality contributions, we encourage users to rate other users' posts on a scale 1 to 5, by rewarding them with a high number of points. Lastly, users are encouraged to assess and (re) assess their literacy level by taking the related test (15 points); in this way, the platform can provide them with more suitable information for their level and assess its success by tracking the users' financial literacy improvements.

On the other hand, the quality-based reputation metric is going to be recalculated on a weekly basis, in order to reflect the latest behavior of the user, based on the following formula:

$$R_q^{u_x} = \sum_{\forall p_{u_x, u_i}} r_{p_{u_x, u_i}}^{u_i} \cdot R_q^{u_i} / \sum_{\forall p_{u_x, u_i}} R_q^{u_i} \quad (1)$$

Table 1. Points awarded to users according to their actions

Actions awarding points	Points
Invite a friend through social media	+2
Write and post financial information	+15
Upload financially-related content (created by others)	+10
Post a question	+5
Answer to a question posted by another user	+15
Create a poll	+5
Participate in a poll	+8
Post a comment on another user's contribution	+5
Post a comment on educational material provided by the platform	+7
Share own post on social media	+5
Share another user's post on social media	+7
Rate on a scale 1–5	+8
Flag inappropriate post	+5
Share another user's post on social media	+7
Add new educational material	+15
Edit other user's educational material	+10
Take financial literacy test	+15

Where, $R_q^{u_x}$ is the quality-based reputation of the user u_x , p_{u_x} is a particular post of the user u_x , and $r_{p_{u_x}}^{u_i}$ is the rating provided by user u_i for the post p_{u_x} and can take discrete values between 1 and 5. Thus, the quality-based reputation of a user is calculated based on the weighted average of the ratings her posts (over the week) received by other users, where the weights are the quality-based reputations of these other users. In this way, ratings by more reputed users weight more to the calculation of the respective user quality reputation. R_q can take values within [1, 5]. Newcomers' default R_q is set to 3 and can be adapted each week according to the user's contributions and ratings they received. In case a user has not contributed anything in the platform within a week, R_q remains the same as in previous week, while the lack of contributions within this week is reflected in the participation-based reputation R_p . By re-calculating the quality reputation metric of users each week, we protect the system against potential malicious or misbehaving users that seek to gain reputation fast and then decrease their participation levels or the quality of their contributions and ratings [29] with no costs at the benefits they can receive from the platform; any behavior change will be promptly tracked by the system and will be reflected on the user accumulated points (R_p) and/or quality reputation (R_q) scores, respectively, with the relative consequences on the users' rewards and rights, as will be explained in the gamification elements paragraph below. These two reputation metrics provide users with information regarding their progress and will be visible on the user profile page (Fig. 8).

The proposed reputation system also provides certain awards or penalties for users according to their reputation scores. Awards vary from social status gained in the platform, depicted with the use of certain gamification elements, to moderation rights in

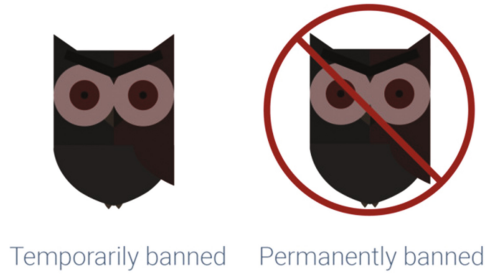


Fig. 6. User avatar for banned users

the platform, as well as tangible rewards (e.g. small monetary prizes), as described below. Penalties affect the users' social status negatively. They consist of changing the avatar that appears below the "Badges" and indicates a user's level to a specific icon, "warning" other users that this user's posts were flagged as inappropriate by moderators (Fig. 6); giving administrators the right to ban malicious/misbehaving users so that they cannot post and comment on the platform for a certain period of time (e.g. a week); and permanently expelling users with a history of 6 or more repeated bans from the platform.

Gamification Elements. Gamification elements that are going to be included in the design of the PROFIT platform comprise user avatars, levels, special achievements, progress charts and badges. More specifically, by increasing their participation based reputation (R_p), users unlock levels and gain more rights on the platform. There are six levels on the platform: newcomer, experienced, casual, master, expert, moderator, as well as six corresponding icons (Fig. 7). The icon corresponding to a specific user's level is visible on a user's profile below her acquired badges, as mentioned before. Users begin at the newcomer level with basic functionalities and avatar, and they move up to the casual level, where they can create their own community polls, when their R_p reaches 300 points. After that, they may unlock the experienced level when their R_p reaches 1000 points, the master level when R_p reaches 2000 points, etc. (Table 2). It should be noted that users of top level which have been given moderation rights on the platform are going to be able to hide inappropriate content. In all above cases, users can upgrade their level, only if their quality reputation scores (R_q) are above 3. Thus, a user



Fig. 7. User avatars according to level

Table 2. Levels & privileges according to level

Level	Name	Minimum points (R_p)	Privileges/functionalities unlocked
1	New	1	<ul style="list-style-type: none"> • Basic avatar • Search for articles and add to watch list • Follow other people • Post question • Answer questions • Share to social media • Participate in polls • Rate other users' contributions • Rate platform's material
2	Casual	300	<ul style="list-style-type: none"> • Avatar changes • Comment on other users' contributions • Comment on platform's material • Create poll
3	Experienced	1000	<ul style="list-style-type: none"> • Avatar changes • Get more personalized recommendations on users/articles • View position on private leaderboard • Participate in competitions for FEBEA tangible rewards
4	Expert	2000	<ul style="list-style-type: none"> • Avatar changes • Provide additional educational material • Flag inappropriate posts to administrators
5	Master	4000	<ul style="list-style-type: none"> • Avatar changes • Help translate the site in other languages • Edit educational material and/or others' posts
6	Moderator	8000	<ul style="list-style-type: none"> • Avatar changes • Access to moderators and initiators (PROFIT partners) forum • Moderation rights: <ul style="list-style-type: none"> – Hide/remove inappropriate content – More statistics on accounts, traffic patterns, preferences, visitors • Organize local user meetings • Propose and coordinate the new PROFIT directions

may advance to a particular level depending both on the amount of her contributions (R_p) as well as the quality of them (R_q).

Nevertheless, users may also lose their status and move down levels, if their weekly quality reputation is bad or they have remained inactive for a prolonged period of time. By implementing this time window, we are trying to sustain their interest and activity on

the platform. Moreover, we are also trying to prevent and deter misbehaving or malicious users as explained above. More specifically, for experienced level users and above, if their quality reputation scores (R_q) falls under 3, or their accumulated points for a week are zero, 500 points will be subtracted from their participation reputation (R_p).

Additionally, users will also be presented with illustrated avatars that change according to the user level, as well as badges to indicate that they have unlocked various special achievements (Table 3). Some special achievements include the “Best-author award”: given to the author of the weekly featured article (article with highest rating), the “Loyalty award”: awarded to users that make at least one contribution per day for a month, the “Exceptional Contribution Award”, awarded to users whose articles/answers rated over 3/5 at a month’s period, etc. These special achievements are acting as milestones and their role is to reward active users with exceptional contributions on the platform. There are also badges to encourage newcomer’s participation, like the “First article award” given to the users that posted their first article, the “Sociable award” given to the users who completed the “about me” profile section, and uploaded a profile photo, and the “Eager-to-learn award”: given to the user who posted the most questions (per month). Last, there are badges given to reward other kind of desired behavior in the platform, like reporting of platform bugs (Bug-hunter award), and improvement of financial literacy level (Financial literacy improvement award). For all achievements listed in Table 3, users will not only be awarded with badges that are permanently showcased on their profiles as small icons (Fig. 8), increasing their social status, but also with some extra “bonus” points. Some badges and the respective points can be gained more than once; in this case a number placed next to the respective badge indicates how many times this badge has been awarded to a certain user.

Social Incentive Mechanisms. It has been shown [30] that people learn by social observation and tend to act like people they observe even without external incentives. In particular newcomers can become more aware of the platform functionalities and how these can be used, when observing the contributions of their friends. On the other hand, the feedback received on one’s contributions can act as a motivating factor for even more contributions [30]. Therefore, various such kinds of social incentive mechanisms were incorporated in the platform, including elements that facilitate social interactions, such as the functionality to follow other users or to comment on others’ posts, to exchange private messages with other users, and to share posts on social media. Public leaderboards that show the ranking of users according to their scores are going to be excluded from the design of the platform, in order to avoid competitive behaviors that may deter newcomers and low ranked users. Instead, users of level 3 (experienced) and above are going to be presented with private leaderboards on their (private) activity dashboards (Fig. 9). Using their private activity dashboard, users will be able to access, among others, lists with their followers and the users they follow, as well as any messages they have exchanged. Users will also receive recommendations on other similar users that they could follow, according to their interests. Lastly, they will be prompted to invite their friends to the platform using their social media accounts by rewarding them with 2 points for each invitation.

Table 3. Examples of special awards

Examples of special awards (achievements)	Bonus points & reward
First article award: after creating an article for the first time	<ul style="list-style-type: none"> • Special icon on user profile page • Achievement showcased permanently on profile with a badge
Sociable award: given upon completing the “about me” profile section, and uploading a profile photo	<ul style="list-style-type: none"> • +35 points & special icon on user profile page • Achievement showcased permanently on profile with a badge
Eager-to-learn award: user with the most questions (per month)	<ul style="list-style-type: none"> • +55 points & special icon on user profile page • Achievement showcased permanently on profile with a badge
Popularity award: created an article that was shared over 50 times on social media	<ul style="list-style-type: none"> • Special icon on user profile page • Achievement showcased permanently on profile with a badge
Best author award: weekly featured article (higher rating)	<ul style="list-style-type: none"> • +60 points & special icon on user profile page • Article featured in homepage • Achievement showcased permanently on profile with a badge
Bug-hunter award: given to users who reported 5 or more bugs in the platform	<ul style="list-style-type: none"> • +85 points & special icon on user profile page • Achievement showcased permanently on profile with a badge
Loyalty award: for users that make at least one contribution per day for a month	<ul style="list-style-type: none"> • +100 points & special icon on user profile page • Achievement showcased permanently on profile with a badge
Financial literacy improvement award: awarded to users who improved their score on the literacy test	<ul style="list-style-type: none"> • +100 points & special icon on user profile page • Achievement showcased permanently on profile with a badge
Financial educational material award: awarded to users whose educational material received at least 10 ratings and the average rating was above 3/5	<ul style="list-style-type: none"> • +150 points & special icon on user profile page • Achievement showcased permanently on profile with a badge
Exceptional contribution award: 90% articles/answers rated over 3/5 at a month’s period (at least 5 articles/answers)	<ul style="list-style-type: none"> • +160 points & special icon on user profile page • Achievement showcased permanently on profile with a badge

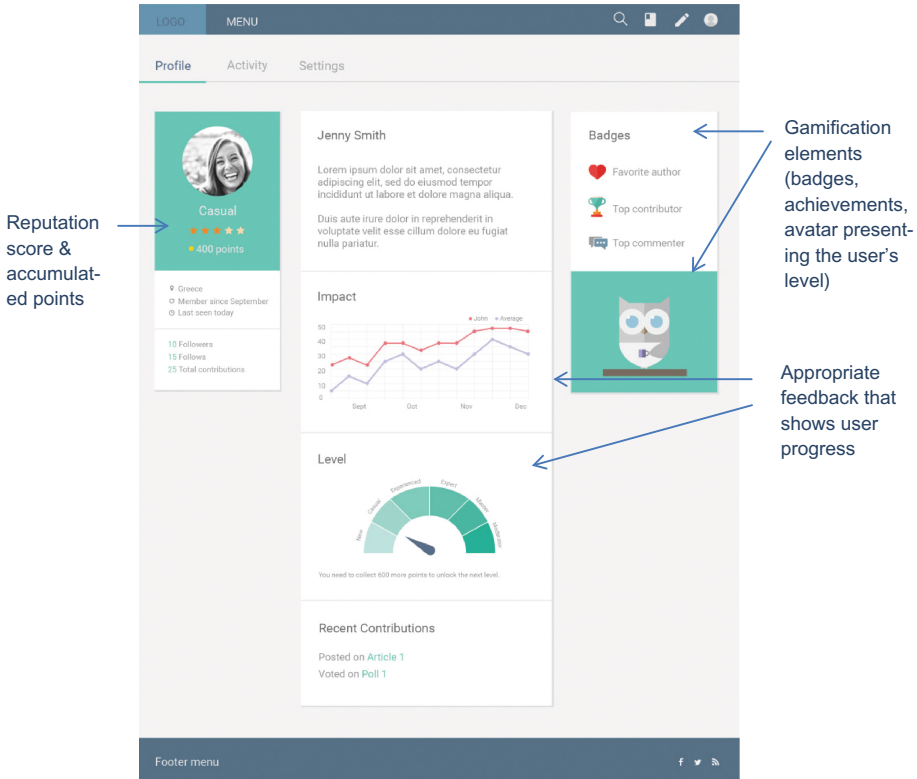


Fig. 8. User profile

Monetary Incentives/Awards. Financial incentives that could spark users' interest include the possibility to enter a competition for a tangible reward (e.g. a laptop), which could also act as an initial motivator to join the platform, as well as discounts on financial products provided by local cooperatives and alternative banks. In particular, these tangible rewards will be provided by the members of the "Federation for alternative and ethical banks" (FEBEA) to attract users' participation. These tangible rewards will be provided to users in the form of a competition as an initial motivator to trigger users' interest in the platform, as well as to users that have reached a certain level (experienced and above). This is in line with the studies in [31] that proposed using small monetary rewards as initial motivating factor to attract users, and then sustain their engagement by combining small prizes with other incentive mechanisms, such as gamification elements.

Design of PROFIT User Profile - Dashboard and Social Interaction Activities. Lastly, much attention was also paid in order to provide an appropriate design interface for supporting all aforementioned incentive mechanisms, easily accessible. As can be seen in Fig. 8 which constitutes the mockup of a user's profile, as viewed from that particular user, user level, reputation, and activity points were placed on the top left

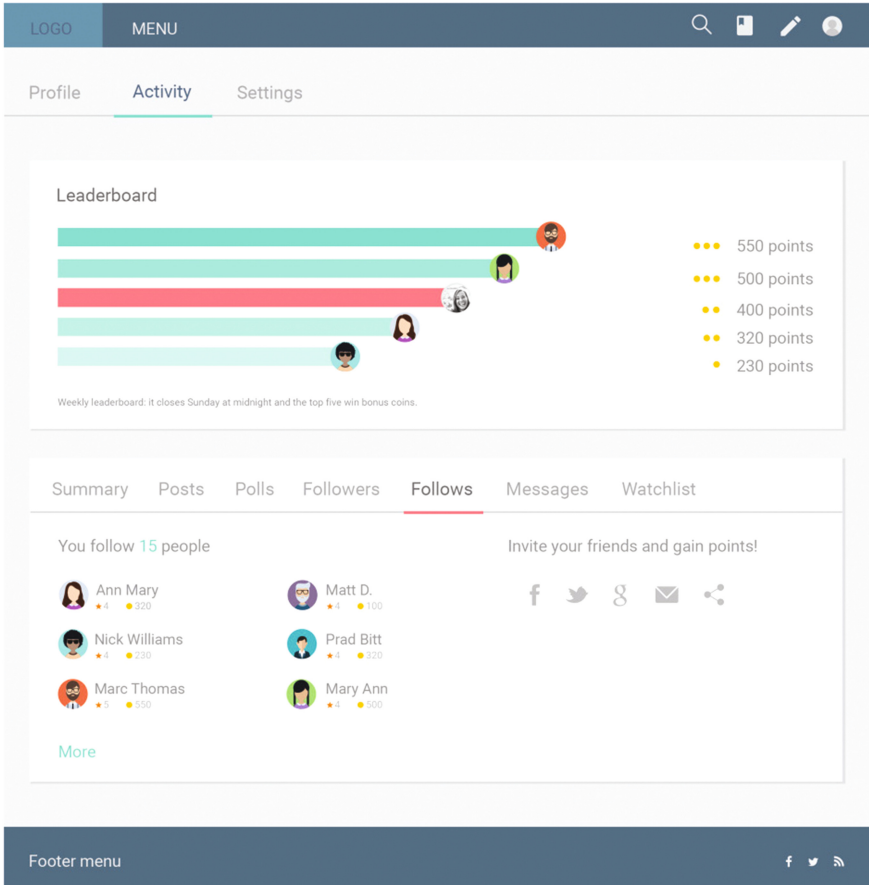


Fig. 9. User activity dashboard

panel, below the user profile photo, in order to make this important information about a user easily accessible. Users can also add some basic profile information and choose whether to showcase or hide their recent activity.

Moreover, visual indicators that provide clear feedback regarding user progress, and can also trigger and/or sustain altruistic motives are going to be included. These consist of an “impact” multi line chart for each user, which shows the number of ratings above 3 her posts receive per week, and a “levels” gauge chart with a dial indicating the current level of the user and the number of points needed to move to the next one. That way, users will have a clear view regarding how much they contribute to improving the financial awareness of other users, as well as their personal progress on the platform. Additionally, they will have the option to make those visualizations private and “hide” them from their – otherwise - public profile pages. Badges which represent achievements on the platform are by default visible to visitors, and below those there is the user avatar – a gamification element that indicates user level in a more “playful” way.

As regards the user dashboard, that would be a private page where a user can access her activity on the platform so far. Apart from activity summary, users can see how many posts (e.g. questions, answers, comments, etc.) they have made, the number of polls they have created and voted to, the people they follow, their followers, etc.

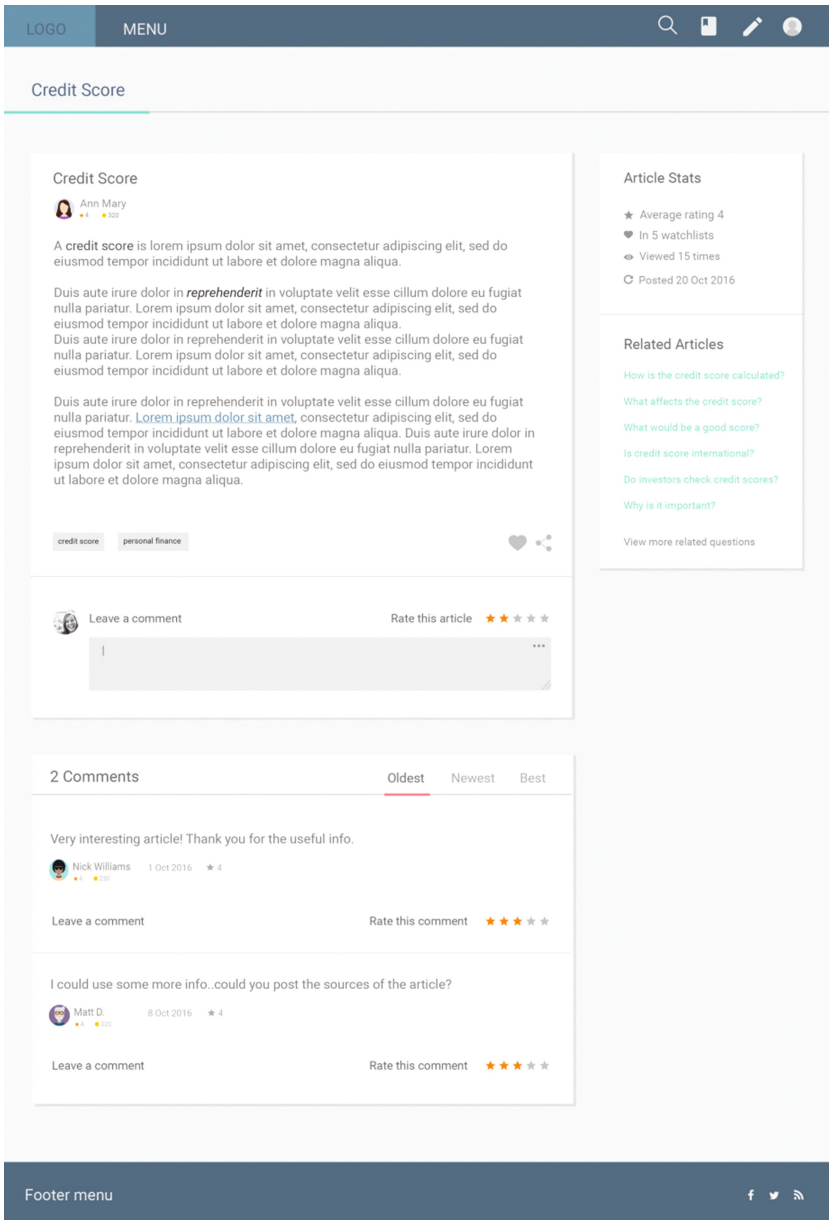


Fig. 10. Article posted by user

Additionally, as mentioned before, users that have reached level 3 (experienced) will also have access to a weekly private leaderboard, showing their ranking among their friends and the points they have accumulated that week.

Last, various social interactions were also taken into consideration and incorporated at the design of the platform. As can also be seen in Fig. 10, users can share posts through their social media accounts, add posts on their watch list to access them later, voice their opinion by rating posts and commenting, and communicate with other users, either by leaving public comments under their posts or via private messages (chat). Users can also see a summary of a user’s profile by moving their mouse cursor over her profile picture (Fig. 11) and will be prompted to invite their friends to the platform by gaining points (Fig. 9).

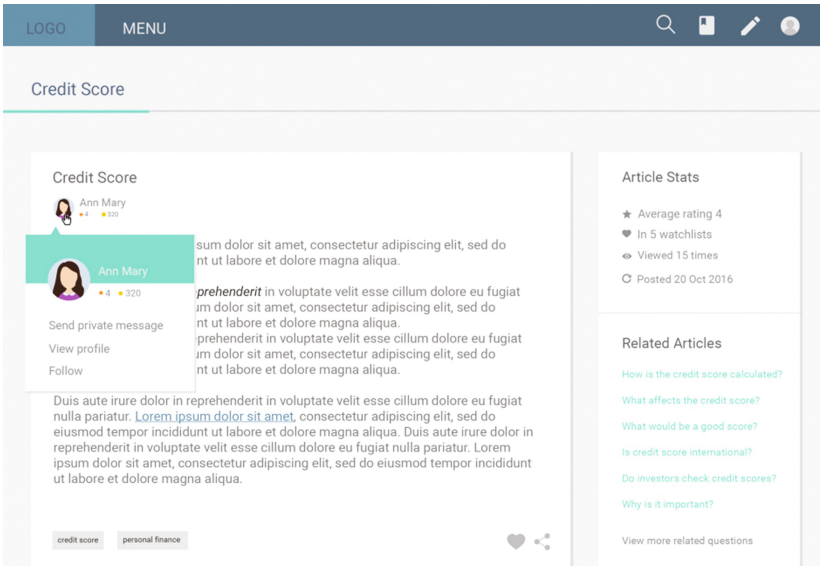


Fig. 11. Social interaction capabilities with the author of the post

3.4 Sustain User Engagement

The PROFIT incentive mechanisms that were described above were designed in a way to sustain user engagement throughout time. It is reasonable that as soon as users reach and safeguard the highest levels or achievements, they might lose their interest in further contributing; this becomes evident from a study by [32], in which users that were given a badge in Wikipedia with no hope of receiving another in the future would later decrease their participation dramatically. In PROFIT, in order to avoid such a situation, we give users the opportunity to gain badges more than once, showing the number each time a badge has been gained next to the badge’s icon, while we also incorporate a level “degradation” mechanism, in case users stop contributing, as we explained in Sect. 3.3, and the “Gamification elements” paragraph. More specifically,

users need to continue contributing to the platform and provide good quality contributions, in order to sustain their level and respective rights; otherwise they subsequently move down level and lose their rights accordingly. In addition, short-term, mid-term and long-term goals are provided to keep the users' interest alive. More specifically, the short-term goals include: (a) a weekly article award for the highest rated article that is going to be featured on the homepage of the platform, increasing the author's social status on the platform; (b) collection of points in order to level up and unlock privileges in the platform (e.g. become moderator, view advanced activity visualizations); and (c) unlock achievements that can be permanently showcased on user profile in the form of badges, increasing that user's social status.

The medium-term goals consist of the following: (a) the opportunity to increase personal financial knowledge and become more self-accomplished through discussions with other members of the platform and by using the educational material provided on the platform, as well as any informative posts by other users; (b) competition for small financial rewards (e.g. monthly discounts on products) or other tangible rewards addressed to users of a certain level and above provided by local cooperatives and alternative banks; and (c) become a mentor or expert and help other users while increasing personal social status. Lastly, the long-term goals on the platform would be to become a platform moderator with the highest privileges; that could also allow participation in the forum with other moderators and the PROFIT initiators/partners to coordinate the next directions of the PROFIT platform, towards increasing financial awareness globally.

3.5 Evaluation of the Incentive Scheme

Finally, the afore-described incentive scheme, which is currently under development, is going to be iteratively evaluated, using both test data (first prototype of PROFIT platform phase), and real data (second and third prototypes of PROFIT platform phase). Therefore, any usability and technical faults will be addressed. Moreover, the effectiveness of the incentive mechanisms is also going to be assessed and, consequently, the incentive scheme could be further improved and enriched with more sophisticated functionalities. The proof of concept PROFIT platform that will be created will undergo integrated assessment with real users from the pilot organizations and the authors will be in position to: (a) ensure the proper functioning of the proposed reputation system in real-world scenarios; and (b) conduct various research activities allocating users randomly in control and treatment groups, in order to evaluate the effects of various distinct elements of the platform on their engagement levels (e.g. the incorporation of private leaderboards). It should also be noted that interested parties will have the opportunity to experiment with the PROFIT workbench during PROFIT workshops, stands, and demonstrations and provide us with valuable feedback and comments.

4 Conclusions

In this paper we presented the reputation-based incentive mechanism proposed for the PROFIT platform in order to trigger the targeted users' interest, motivate their participation and good quality contributions, and sustain their engagement. In order to design the incentive mechanism for the particular platform, we went through psychological and other studies that investigate users' motives under the context of crowdsourcing, as well as the mapping with the corresponding incentives and incentive mechanisms incorporated in well-known CS platforms, and concluded on using a mix of reputation, gamification, social, extrinsic awards and design elements, appropriately combined in order to appeal to all different target users of the platform. The reputation scheme proposed is neither too simplistic, in order to be capable of deterring malicious or misbehaving activity, nor too complex or time consuming, in order to be efficiently implemented in a real-world platform. The design elements integrated seek to help users understand their unique contribution and impact on the platform, and have a positive effect on their participation level. The effectiveness of the proposed incentive mechanism will be evaluated in real-world scenarios, facilitating us to identify any possible flaws and improve it further.

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