Crowd Dynamics in Internal Crowdsourcing: insights from Higher Education

Gianluigi Viscusi[a], Christopher L. Tucci[a]

Imperial College Business School, South Kensington Campus, London, SW7 2AZ, United Kingdom

Abstract

This article aims to study crowd dynamics in small teams. In particular, we are interested in internal crowdsourcing as a venue for new idea production, highlighting the difference with regard to other cooperative models based, e.g., on communities. Another goal of the study is to identify the setting for further experiments in business domains to investigate how crowd characteristics may lower or increase "crowd capital," here defined as the total number of crowd units having a demonstrated effectiveness in idea generation or task achievement. Thus, the article aims to contribute to the research on coordination in temporary and flash teams. To this end, the article discusses the main results of six studies carried out with management students in higher education from 2014 to 2018.

Keywords [1]

Collective intelligence, internal crowdsourcing, co-creation, education.

Introduction

This article presents a work in progress that aims to study "crowd" dynamics in small teams. We are specifically interested in dynamics characterizing internal crowdsourcing [1] as a venue for innovation and new idea production, questioning the degree of efficiency and effectiveness compared to other cooperative models based, e.g., on communities [2–4]. Another goal of the study is to provide the setting for experiments in business domains to investigate how crowd characteristics may lower or increase "crowd capital," here defined as *the total number of crowd units having a demonstrated effectiveness in idea generation or task achievement*. In particular, the definition focuses on the internal resources of an organization rather than its inner context as "structure, corporate culture, and political context within the firm through which ideas for change have to proceed"[5]. The above definition of crowd capital adopts a more outcome-oriented perspective compared to other definitions emerging from this research stream [6], complementing the early tentative conceptualization by Prpić, J. & Shukla [7]. Finally, the article aims to contribute to the research on coordination in temporary groups [8]. The results of the study, developed through a set of exploratory experiments, aims also to provide insights on the dynamics emerging from the interactions on internal crowdsourcing platforms that eventually influence their design as a sociotechnical system [9], thus questioning their impact and the role of users' actions.

The paper is structured as follows. First, the theoretical background of the research is discussed. Then, the six studies are outlined together with the research method adopted. Finally, a discussion of the main results and concluding remarks end the paper.

Theoretical Background

The theoretical lens at the basis of the research discussed in this article is the framework and related typology of "crowd" dynamics proposed by Viscusi and Tucci [10]. The framework considers the number of participants a sufficient, but not a necessary condition for crowdsourcing, and

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EMAIL: g.viscusi@imperial.ac.uk (A. 1); c.tucci@imperial.ac.uk (A. 2)
ORCID: 0000-0003-0770-7108 (A. 1); 0000-0001-8733-9530 (A. 2)

distinguishes different types of crowd dynamics according to their *growth tendency*, degree of *seriality,* and the intervening role of properties such as *density*, *equality*, and *goal orientation* for distinguishing the distribution of agents within and between the different types of "crowds," namely between *groups*, *communities*, *closed crowds*, *open crowds* or *multitudes* [11]. *Closed crowds* are usually controlled by intermediaries, such as, e.g., Innocentive, that restrict growth and provide self-established boundaries; whereas groups such as *crowd crystals* may potentially lead to any of the other types of crowd.

Considering now (*online*) *communities*, they are a well-known knowledge and innovation management topic for both practitioners and academics [12]. With a community, the role of identity and beliefs in the community's cohesiveness is relevant, rendering them difficult when there are conflicting and heterogeneous goals. Furthermore, a community is "a group of people who trust each other. Trust, in turn, is confidence that other people will act, in the future, in ways we think are right...that they have a generalized disposition to do the right thing" [13]. Accordingly, *trust* emerges as a relevant characteristic at the basis of a community. It is worth noting that online communities smooth these characteristics due to their fluidity, fleeting memberships, dynamic boundaries, and multiple goals [14]; however, such goals, not necessarily conflicting, could give rise to crowd crystals or an open crowd.

Let us consider groups as the basic unit from which crowds and communities may arise as also shown by some of the arguments discussed above. A group can be defined as "an aggregate of organisms in which the existence of all is utilized for the satisfaction of some needs of each [15] " or else as a "self-consciously, mutually acknowledging collective with a self-conscious purpose" [16]. Taking these definitions into account, groups such as *crowd crystal* are characterized by a lack of scale, fewer ideas, as well as less input, in addition to a low degree of seriality due to the topical rather than goal orientation. However, a crowd crystal may grow in an unrestricted fashion, losing the serial nature of the crowd, becoming no longer anonymous, and finally reaching "community" status. It can also evolve towards either open or closed crowd types, requiring a stronger, specific goal orientation as well as *information capacity* [17] in terms of, e.g., analytics and storage capacity, especially for open crowds, which can be considered actual *multitudes*.

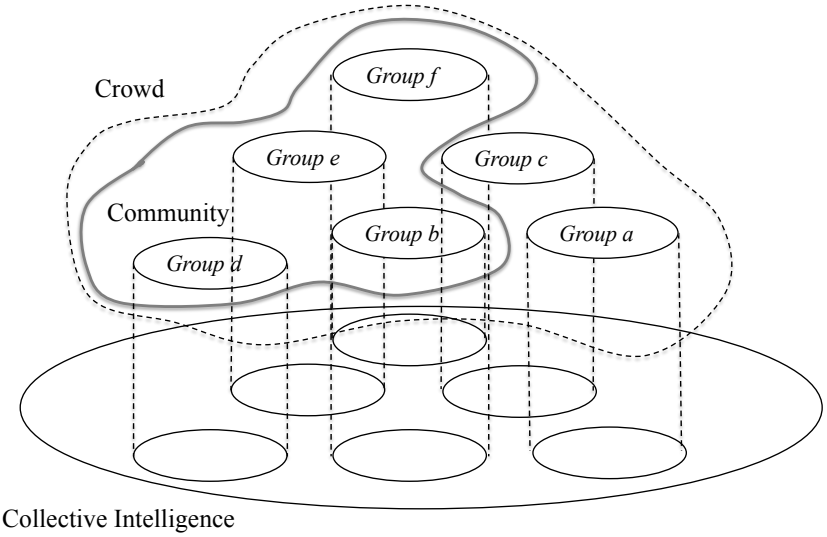

Figure 1. Emergent dynamics for collective intelligence, groups, communities, and crowds.

At the state of the art, especially from scholars interested in cognitive economy, the concept of "multitude" has received different definitions, such as, e.g., "a social body in which singularities are not required to shed their differences to form a common notion" [18]. Moreover, open crowds when considered as a type of multitude can consequently be seen as a form of organizing for productive processes [see also: –11]. This form of organizing combines technological expertise and general social knowledge in a cognitive cultural economy [see also 19], or *collective intelligence*, that is considered as "groups of individuals acting collectively in ways that seem intelligent" [20]. In general, collective intelligence, groups, online communities, and crowds may represent what Hinings, Gegenhuber, and Greenwood [21] identify as a type of digital innovation in terms of "a novel digital organizational form

is a digitally-enabled arrangement of practices, structures, and values constituting an organization's core and that is appropriate in a given institutional context." As shown in Figure 1, these crowd types are further characterized by emergent dynamics, where groups, communities, and crowds can all be considered different instances of collective intelligence, with groups as the basic unit for the subsequent set of crowd dynamics previously discussed. Nowadays, those crowd dynamics are relevant for the sociotechnical design of open innovation and crowdsourcing platforms where the question is on their role in the enactment of collaboration or competition amongst the involved users [22–24], requiring "open, socio-technical systems perspectives" ([22], p. 295). Thus, those crowd dynamics address exploring the problems raised by social and technical aspects along a continuum and analyzing the emergent variations of the sociotechnical relationships, e.g., through an experimental approach ([25], p 709), as the one adopted in the research presented below. The studies outlined in the following Section aim to explore these issues in real settings.

Method

This article presents an exploratory study eventually adopting Internet-mediated research [26] and qualitative experiments [27–29]. Accordingly, this paper discusses six studies (including the pilot study) carried out in 2014, 2015, 2016, 2017, 2018 in higher education institutions in Italy and Switzerland. The pilot study was carried out in the 2014 winter semester at EPFL, Switzerland. The studies involved students in a Master's course in Management of Information Systems (University of Milano-Bicocca, Italy, 2016) Information Technology and e-Business Strategy (EPFL, Switzerland, 2014, 2015), and Information Technology & Digital Strategy (EPFL, Switzerland, 2016, 2017, and 2018). The average number of students for each crowdsourcing exercise was 30 and the goal of the competition was to identify a business model for a new company, discussing it, and motivating it in a text of 3000 characters. The groups in Switzerland were made up of people with different backgrounds, with participants from the management course working with people from Life Sciences, Engineering, Computer Science, Chemistry, Architecture, etc.; whereas in Italy, the groups included mainly computer scientists and psychologists. The challenge was divided into three phases:

- *Submit*: every group advanced its proposal. Each user was randomly assigned a temporary identity to avoid any biases concerning the identity of participants.
- *Vote*: each user was asked to vote on the other groups' proposals. While voting, each user could save comments on the proposals, which were published only during the Discuss phase.
- *Discuss*: each user was asked to comment on the other proposals.

It is worth noting that the 2018 challenge was divided into only two phases: *Submit* ideas and *Discuss & develop*, with no voting phase. Moreover, the pilot contest was held with the CROWDICITY idea management platform (https://crowdicity.com), while the subsequent three crowdsourcing exercises were carried out via the OXWAY platform (https://oxway.co), a crowdsourcing and collective intelligence platform from a start-up based in Milan, Italy, and London, UK. The fifth study has been carried out via the VIIMA platform (https://www.viima.com/), an open innovation platform from Viima Solutions Oy, a company based in Espoo, Finland. Finally, in 2018, the crowdsourcing exercise was held on the Moodle eLearning platform adopted for the course by using dedicated fora. The different technological platforms may eventually have a different impact on the crowd dynamics as discussed below.

Discussion of the studies

During the pilot study, the 30 students were asked to form six groups of five. Every group had to elect a captain, i.e., the editor of the group's proposal. The captain could amend her/his group's proposal during the *Submit* phase and/or during the *Discuss* phase. Posting, voting, commenting was recognized as class participation. Participants' names were disguised using anonymous identifiers (IDs). At the end of the challenge, the top group was given a symbolic prize and the maximum grade for this part of the

assessment. During the *Voting* phase, the individuals were anonymous and ignored the instruction to only vote for the other groups; thus, they favored their own projects, defending their own proposals and giving them higher votes than the others. In general, despite the limited number of members and their mutual acquaintance from the class, the groups acted as *crowd crystals* oriented to *crowd* types rather than as a *community* with factors such as identity, membership, or friendship seeming less relevant with regard to the unifying focus on the outcome: having the winning proposal supported individually by the group members and without reference to real team coordination.

The first study after the pilot was carried out in the 2015 winter semester at EPFL. Specifically, from November 16th to December 9th, students in the Master's course in Information Technology and e-Business Strategy were involved in a crowdsourcing exercise. During the voting phase, the individuals were anonymous and ignored the instruction to only vote for the other groups. Under the cover of anonymity, they favored their own projects, defending their own proposals and giving them higher votes than the others (average of 2.8 for outside evaluations vs. 4.0 for own evaluations). This was mitigated by the later *Discuss* phase. Referring to the above-mentioned crowd types, the groups acted as a crowd crystal rather than a community, despite the limited number of members and their mutual acquaintance from the class. In addition, the analysis of the comments during the *Discuss* phase demonstrated also in this case little relevance of factors such as *identity*, *membership*, or *friendship*; whereas having the winning proposal emerged as a unifying element within the group (they were focused on the outcome). Although each group was more or less effective in defending, promoting, and improving the group's proposal, there was little evidence of team spirit (they supported the proposal but individually and without reference to real team coordination). Furthermore, we observed the case of groups partitioned by activity level and pushed by the activity of two members out of five as in the case of the winner of the challenge. This may imply that a team could be more effective in finding a solution when the team is only nominally a team, being instead actually a crowd crystal. One implication of this, on one hand, may question the performance of community-oriented investments in team-building; on the other hand, it also opens opportunities for organizations to use prior challenges to look for the best contributors and then gather them in another (*crowd crystal*) team, potentially producing effective results on similar topics and issues as well as new "crowd capital" (the total number of crowd units having a demonstrated effectiveness in idea generation or task achievement).

The second study was carried out in the 2016 spring semester at the University of Milano-Bicocca. Specifically, from May 27th to June 19th, students in the Master's course in Management of Information Systems participated. The 34 students were asked to form 11 groups of two (three groups), three (four groups), and four (four groups). Compared to the previous studies, in this study, one group of three people did not vote for itself, and a group of two did not put forward a proposal at all, thus failing to compete for the prize. Nonetheless, it is worth noting that this latter group had a member who actively participated in the discussion phase, thus exhibiting a community-like collaborative orientation rather than a competitive contest one (age, education, and current employment could be worth investigating, considering the two members of this group were persons returning to higher education and actually working full time in companies or public administration). Although the teams in this as well as the pilot study exhibited on average a similar degree of collaboration, the members of the teams of this study shown higher individual collaboration compared to the pilot study as well as team coordination (Median Team Collaboration 0.8 and 0.4 respectively). It is worth noting that in both the pilot study and in this study, the average "collaborative" team had two members. That point could be a first insight worth investigating in future work for identifying crowd capital units and the appropriate flash team number in crowd crystals (e.g., three members for teams in a crowd may have 70% of observed collaboration).

The third study was carried out in the 2016 winter semester at EPFL. Specifically, from November 24th to December 18th, students in the Master's course in Information Technology and Digital Strategy participated. The 25 students were asked to form eight groups of three (seven groups) and four (1 group). The exercise considered in the third study demonstrated the lowest degree of participation by each group (overall groups median = 0.2) with two groups relying on the activity of only one member and two groups of three persons having the activity of the other two members close to zero. It is worth noting that one of these two groups had one of its members unable to access the discussion and the other was actually the team winning the prize for the crowdsourcing exercise; thus, the case resembles again what we observed in the pilot study (having the winning proposal supported individually by the group

members without real team coordination). Finally, in this study as well, the average collaborative members were two (two out of three members for five out of eight groups).

The fourth study was carried out in the 2017 winter semester at EPFL. Specifically, from November 23rd to December 15th, students in the Master's course in IT and Digital Strategy participated. The 26 students were asked to form eight groups of three (six groups) and four (two groups) persons. As mentioned above, the fourth study was carried out through the basic/free version of VIIMA, an open innovation platform, which did not allow designing the challenge with strict separation between the different phases, thus resulting in initiatives more suitable for ideation than crowdsourcing. Consequently, we adapted the structure of the challenge, having only two main continuous phases: the *Submit Ideas* phase, and a unified *Vote/Discuss & Develop* phase. The figure of the captain was kept also for this challenge. It is worth mentioning that the openness of the structure of the challenge resulted in a higher degree of participation by each group (overall groups median = 0.5) than the other three exercises carried out in Switzerland. It is also worth noting that in this study the average "collaborative" teams had three members (with the full collaboration of members in three out of six groups of two members), the groups made up of four members relied on the activity of only one member (the "captain"), and one group of three had none of the members active in the discussion.

Finally, the fifth study was carried out in the 2018 winter semester at EPFL. Specifically, from November 14th to December 14th, students in the Master's course in Information Technology and Digital Strategy participated. The 28 students were asked to form seven groups of four persons. As already mentioned, the crowdsourcing exercise was conducted on the Moodle eLearning platform adopted for the course by using dedicated fora and was made up only of the *Submit* ideas and *Discuss & develop*, with no voting phase. While basically confirming what was observed in the previous studies, the 2018 contest demonstrated the relevance of the factors identified by [30], when looking for example at the participation in the co-creation aspects of the contests, such as discussion and feedback to the proposals in the online forum (for example in the 2018 study 75% of women were active participants vs. 55% of men). Finally, among the three productive members, two people were usually more effective in ideation activities.

Conclusion

In this paper, we have presented the early results of a study where we have investigated crowd dynamics in small teams through a set of exploratory experiments. Besides the pilot, regarding the outcome of the five studies, we saw that three members for teams in a crowd may have 70% of observed collaboration, with two members usually leading the ideation phase, a result worth investigating in future work for identifying crowd capital units and the appropriate flash team number in crowd crystals. Considering now characteristics exhibited by the groups in the studies, and especially to trust as a property of communities, if we look at opportunistic behaviors, in only a few cases did group members vote exclusively for their own idea (for example, two out of 14 total votes in the fourth study). Nevertheless, considering the outcome of the challenges, the studies confirmed what was observed in the pilot study having the winning proposal supported individually by the group members without real team coordination. Accordingly, for example, in the fourth study, the winning, as well as the three final selected ideas, were produced by groups with only one member active on the platform during the discussion phase, while in the third study two groups were relying on the activity of only one member and two groups of three persons had the activity of the other two members close to zero. Thus, also in the fourth case that had in place an open innovation environment, the winning group, as well as the other two finalists, acted as *crowd crystals* oriented to *crowd* types rather than as a *community*, having the unifying focus on producing the winning proposal supported individually by the group members and without exhibited team participation in the discussion. However, these groups showed more engagement and collaboration in the design phase of the proposal rather than in the social and co-creation aspects of the challenge. Furthermore, considering the 2018 study with a homogeneous set of groups of four people, the observed collaboration and online participation to the discussion phase was ~60%, with four teams out of seven with only two active members in the ideation activities. Considering the different countries and platform settings, it is worth noting that the Italian sample exhibited a level

of individual collaboration and team coordination with a crowdsourcing platform that in the case of Switzerland has been observed in the fourth study where an open innovation platform was adopted instead.

In conclusion, these observations can be confronted with what has been pointed out by Majchrzak & Malhotra [31] that "requirements for crowdsourced co-creation are not easily implementable in a participation architecture because of three tensions they raise" that are "Tension 1: simultaneously encouraging competition and collaboration;" "Tension 2: idea evolution takes time but crowd members spend little time;" and "Tension 3: creative abrasion requires familiarity with collaborators; yet crowds consist of strangers" ([31], p.264). However, the studies have shown that at least Tension 1 may anyway lead to an outcome that in most cases is also the result of co-creation (although of groups of three people), especially when the crowd as a collective intelligence is recognized as made up of multiple collective intelligences represented by groups, explicitly identified and formed (as in the studies), or potentially emergent and dynamically yet to be identified (hypothesis for future work). As for Tension 2, it nonetheless depends on the evaluation of the outcome of each challenge (is the winning idea resulting in a real innovation once implemented by the seeker organization?) and the measurement of the time spent for each challenge by the winners. In the current studies, the time spent online in the discussion seemed to be irrelevant to the final outcome, but we do not have data on the time spent offline for the design phase (apart from the comments on the engagement). Finally, Tension 3 seems confirmed by the studies where they also have shown how the crowdsourcing nature of the challenges has generally lowered the effect of the acquaintance amongst the students deriving from being in the same class, and participation increased when an open innovation platform was adopted instead of a pure crowdsourcing one.

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