Collaboration and Locality in Crowdsourcing

PREPRINT VERSION

Andreas Mladenow, Christine Bauer, Christine Strauss, & Michal Gregus (2015). Collaboration and locality in crowdsourcing. Proceedings of the 7th International Conference on Intelligent Networking and Collaborative Systems (INCoS 2015). Taipei, Taiwan, 2-4 September, pp 1-6. DOI: 10.1109/INCoS.2015.74

The final authenticated version is available online at IEEE via https://doi.org/10.1109/INCoS.2015.74

***Abstract*— As novel forms of crowdsourcing emerge on the market, we emphasize that the important aspect of location-dependency is more complex than assumed and, thus, suggest a typology along two dimensions of locality: the first dimension refers to whether or not the crowdsourcees interact while being collocated or dispersed; the second dimension refers to the locality of the crowdsourcees in relation to the crowdsourcer's locality (local vs. remote crowd). The resulting four types of crowdsourcing are underpinned by real-world examples. Potential advantages and challenges of the four types are discussed, particularly with respect to motivation and value. The suggested categorization shall provide the necessary basis for future research, as a systematic approach is essential to enable, yield and foster sustainability in a novel interdisciplinary research field like location-based crowdsourcing.**

Keywords: Crowdsourcing; Collaboration; Collaborative Systems; Taxonomy; Social Networks; Web-based Communities; Location-based Crowdsourcing; Collaboration-based Crowdsourcing, Tournament-based Crowdsourcing

I. INTRODUCTION

With the continuous advancement of information and communication technologies (ICT), which are increasingly integrated into people's private and professional life, social interaction is no longer bound to a specific time or location, as ICT allows for bridging the time and space gaps. In recent years, the phenomenon of 'crowdsourcing' has flourished both in practice as well as in research. Crowdsourcing leverages ICT to outsource tasks to an unspecified 'crowd', rather than to a designated 'agent' (e.g., an organization, a team, or an individual) [1, 2]. Thereby, the crowdsourcer launches an open call on an online platform (which is hosted by an electronic market intermediary) and people of the crowd self-select whether or not to contribute to the call. Thereby the platform represents the virtual place or market space, where crowdsourcer and potential crowdsourcees meet.

As the crowdsourcing phenomenon is flourishing in recent years, one might think that the concept is new. In fact, though, already in 1567 Philipp II of Spain offered a reward to anyone for finding a practical method for a precise determination of a ship´s longitudinal [3]. Then, in the 19th century, Charles Babbage, an English mathematician and engineer, hired 'the crowd' to assist in computing astronomical tables [4]. And in the Wild West, elements of the crime-solving task were crowdsourced by sheriffs whenever they posted a 'Most Wanted' poster in public places and offered a reward to anyone who would help finding a suspect [5].

However, it is basically the development of ICT that enables the current crowdsourcing boom, since every step in the entire value chain (e.g., publishing the problem statement, getting in contact with potential crowdsourcees, communicating with them, carrying out tasks, coordinating activities, reporting approaches and solutions, providing results to the problem statement, granting awards and remuneration, etc.) can now be supported by ICT; and, thus, ICT opens for a whole range of new possibilities such as bridging the time-location gaps in crowdsourcing easily.

A crowdsourcing project may be implemented in various ways: for instance, one type of crowdsourcing projects requires many people of the crowd to contribute in order to achieve jointly the targeted result (e.g., the concept of 'crowdfunding' needs crowdsourcees contributing with particular 'smaller' payments so that a certain 'bigger' amount of money may finally be raised to realize a dedicated project).

Whereas in the non-collaborative, tournament-like type of crowdsourcing, the crowdsourcer chooses among several approaches provided by the crowd and picks the best solution or contribution for realization [5] (e.g., selecting one design out of the crowd's contributions and printing it on T-shirts for sale). In addition, the crowd itself may be employed to choose among the contributions by voting for the one they most prefer and will want to buy as a product on the market.

However, to the best of our knowledge, a systematic differentiation concerning the collaboration aspect, as described above, so far has not been made explicit. While crowdsourcing typologies mainly focused on the type of task that is crowdsourced [e.g., 1, 6], the role of the initiator of a crowdsourcing project [e.g., 7], and the type of the crowdsourcing result [8], the aspect of collaboration has yet been neglected as a categorizing factor, although it is an important factor, as we will show: While crowdsourcing is frequently presented as a new concept that involves high interaction and close collaboration of the crowd [9], we will present in this paper that high interaction is only required and desired in some forms of crowdsourcing.

Furthermore, recently, the type of crowdsourcing, where location-dependent tasks are involved, was picked up in research and coined 'location-based crowdsourcing' (LBCS)

[10, 11]. In describing this concept, authors highlight the benefits of localization capabilities of mobile devices (e.g., using GPS) for identifying appropriate crowdsourcees for a task or, vice versa, for the identification of appropriate tasks for 'wanna-be crowdsourcees' [10]. Affuah/Tucci [5] argue particularly in favour of LBCS as a means to support tasks that may be accomplished at a remote place over the Internet (i.e., the crowdsourcer searches for a 'remote crowd').

However, by bringing the dimension 'location' into play, researchers in the field make aware that – despite the vast possibilities for ICT in supporting crowdsourcing to reach a global audience – there are physical limits. Indeed, when someone requires information about the current situation at a particular place next door, it is not efficient to involve a remote crowd.

Hence, in terms of networking with the crowd projects, the issues of 'collaboration' and 'location' have yet to be properly elaborated on a conceptual level. This paper aims at filling these research gaps and presents a taxonomy of crowdsourcing alongside the dimensions of locality and interaction and exemplifies these combinations by pointing to successful applications on the market.

The paper is structured as follows: The next section presents the theoretical background, including the recent shift towards location-dependency and discussed typologies of crowdsourcing in recent literature. Built on this, Section 3 elaborates on 'location' as a determining factor in crowdsourcing, and pinpoints its interplay with the tournament-based and the collaboration-based form of crowdsourcing. Section 4 discusses opportunities and challenges; the paper closes with a résumé and gives insights into future research opportunities.

II. THEORETICAL BACKGROUND

A. Factors Influencing the Decision of Networking with the Crowd

Recent literature regarding crowdsourcing has analysed factors influencing the decision to crowdsource [12], its advantages for idea generation [13, 14], problem solving [1], value capture [15], motivations for participation [16, 17, 18], and search processes [19, 20, 21].

The underlying concept of 'crowdsourcing' describes a process of social interaction, where an organization or individual follows the strategy of outsourcing tasks by means of an open call (invitation) on a group of undefined – and mostly unknown – actors [22, 1].

The incentives of both crowdsoucer and crowdsourcees lie typically in the direct economic advantages from which they benefit [22]. Crowdsourcees may receive result-based compensations, which may include cash bonuses, (small) monetary rewards, price incentives, or exclusive information [23]. Many crowdsourcing projects, though, are successful without any direct (monetary) compensation for crowdsourcees. Instead, contributing people are motivated to do so by the desire to experience something new, to share knowledge with others, or to accomplish shared goals [14].

Concerning the motivational drivers of the participants, it is necessary to differentiate between intrinsic and extrinsic values. While intrinsic values strongly refer to the engagement in crowdsourcing activities because of the variation from their daily life and the experience for its own sake, extrinsic value rather imply values such as excellence, satisfaction of the need of self-expression and uniqueness [24]. Lusch et al. [24] define psychological rewards as 'the degree of satisfaction, enjoyment, gratification, or happiness that is associated with internal or external exchange'. Finally, they emphasize that especially non-economic rewards have high potential to influence the outcomes of exchanges [24]. The crowdsourcing motivation can be clearly attributed to social factors.

In recent years, crowdsourcing became very popular on the Web and there are several online platforms that distribute crowdsourcing tasks. Among the most prominent and successful examples are www.mturk.com, www.istockphoto.com, and www.threadless.com. Thereby, most platforms on the market focus (either deliberately of inadvertently) on crowdsourcing location-independent tasks.

Only recently, we can observe a trend towards crowdsourcing tasks that are inherently location-dependent: Such location-dependent crowdsourcing projects are implemented, for instance, as location-based games with the purpose to collect urban data [25], location-based services in cities [26], local news platforms [11], and geographic information for disaster response [27], etc. This form of crowdsourcing is coined 'location-based crowdsourcing' (LBCS) [10]. Hereby, individuals, who are currently in close proximity or are promptly issued to the location where a certain task has to be accomplished, are called to carry out such a task that is bound to the specified location. Again, the participation is voluntary and potential crowdsourcees typically self-select their preferred tasks. While the location of the crowdsourcer may be relevant or not, the location of a crowdsourcee is, in any case, utterly important [28].

B. Discussed Typologies of Crowdsourcing Projects

Literature shows several attempts to classify the crowdsourcing phenomenon. Among the most accepted ones are those based on the type of task that is crowdsourced [e.g., 1, 6] and those based on the initiator of crowdsourcing [e.g., 7]. Howe [1], for instance, differentiates between three types of tasks, i.e., crowdsourcing idea game, crowdsourced problem solving, and prediction markets. Brabham [6] took another approach and introduced a problem-based typology of crowdsourcing. He differentiates between knowledge discovery tasks, distributed human intelligence tasks, broadcast search, and peer-vetted creative production [6]. Gassmann et al. [7] identifies five ways of how crowdsourcing may be initiated and classifies crowdsourcing projects accordingly: crowdsourcing initiated and supported by intermediary platforms, user initiated crowdsourcing, company initiated platforms, idea market places, and public crowdsourcing initiatives. Afuah/Tucci [5] distinguish between tournament-based and collaboration-based crowdsourcing and identify crowdsourcing, under certain circumstances, being an enabler to transform remote into local search. In this respect, they state

that the search for crowdsourcees may include knowledge that is outside the focal crowdsourcers knowledge neighborhood.

However, as novel forms of crowdsourcing projects emerge in practice, existing categorizations seem too narrow in their scope and cease to provide meaning in practice. For companies that have to consider motivational aspects and provide incentives accordingly to make a crowdsourcing project work, a taxonomy that considers locality in terms of 'search for crowdsourcees' and 'interaction between crowdsourcees' appears fruitful.

Against this background, we will demonstrate that recently zoomed in aspect of 'location-dependence' is much wider and more complex than previously assumed. In this regard, the pervasive availability of mobile devices [29], offers new potential to the underlying concept of crowdsourcing [1, 10, 23]. Building on Afuah/Tucci [5], this paper focuses on different combinations of collaboration-based and tournament-based crowdsourcing along two dimensions where locality matters. Hence, we discuss a taxonomy covering the locality in the terms 'type of search' and 'interaction between crowdsourcees'.

III. Crowdsourcing in terms of Collaboration and Location

Considering recent developments covering location-based aspects, we suggest a taxonomy that is structured along two dimensions of locality: the locality for the search for crowdsourcees (i.e., whether the crowdsourcer searches for a local crowd or a remote crowd) and whether or not the crowdsourcees, who may also be collocated or dispersed, are encouraged to interact with each other. The matrix in Figure 1 shows four alternatives, which are combinations of two types of search and two types of interaction. The following paragraphs describe each alternative in each quadrant of the matrix and provide selected, successful real-world applications.

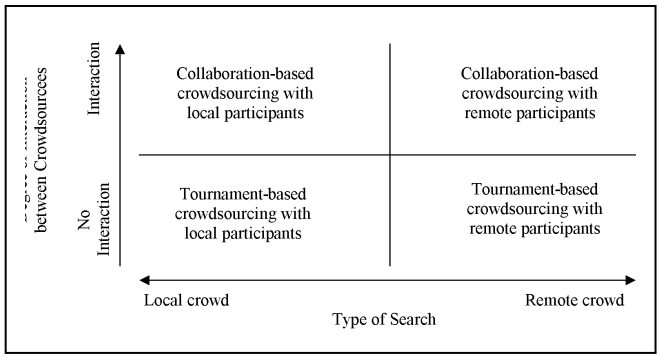

Figure 1. "Networking with the Crowd"-Projects in Terms of Locality of Search and Interaction

A. Interaction between Crowdsourcees

While for some tasks, the best solution may be created by close collaboration and interaction of people, other tasks may be better performed by having several people working individually on their approaches and having another instance (e.g., the crowdsourcer) choosing one solution out of many approaches gathered. Accordingly, also for crowdsourcing tasks, close collaboration of crowdsourcees may or may not be the best choice. The type of how to integrate the crowd has, thus, to be carefully chosen.

iStockphoto is an example where people of the crowd individually contribute their pictures, videos, and reports, and the crowdsourcer selects from the gathered information. Threadless.com also has the crowd contributing individually with their T-shirt designs. In contrast to Tackable.com, this platform lets the crowd choose among the designs by voting on them. With Lego-Ideas, the famous line of construction toys 'Lego' tries to reach both, creators that have ideas for new products as well as voters choosing their favourite ideas. The tournament-based crowdsourcees create and build their own Lego projects and submit them to the Lego-Ideas platform. Product ideas with at least 10.000 supporting online-votes get a chance to become a Lego product and the respective crowdsourcee receives 1% of the total net sale of the product. iReport.cnn.com publishes all reports, videos, and pictures that crowdsourcees submit to the platform. However, only selected contents make it into the 'official' CNN reports. Accordingly, they follow a mixed approach: On the one hand, the iReports of the crowd make up the big picture of a news story, which can only be achieved jointly, on the other hand, there is a tight competition for 'making it into the official reportings'.

A successful example of collaboration-based remote search is marblar.com. This application builds on the fact that most technologies, developed in a university setting, fail and local search might not be well suited for putting the scientific ideas into practice. Marblar.com aims at harnessing the collective imagination of the crowd all over the Internet. They invite people to come up with potential uses for a new kind of developed technology, which is explained and demonstrated in videos and slideshows. Based on the crowd's contributions, the crowdsourcers (inventors) consider whether a product idea is worth any further investigation for a product. Furthermore, in the market research and in the technical feasibility phase, marblar.com's users are again involved for fine-tuning the product idea. Finally, commercial partners and inventors cooperate aiming at commercializing the idea.

WeGoLook.com, in contrast, is an example for crowdsourcing tasks that do not require close interaction of crowdsourcees since the tasks on this platform are typically carried out individually. Crowdsourcees typically perform tasks such as inspecting a product, person, or place, which are activities that do not require teamwork but can be performed by one single person. For instance, a crowdsourcee may take care that an item is packed properly, and being shipped to a certain destination.

One of the most discussed crowdsourcing platforms [16], mturk.com, is a marketplace for work service by the famous online retailer Amazon. It offers a tournament-based crowdsourcing service, too. Regarding this application, the remote search for crowdsourcees all over the Internet implies no location-dependency for any mturk workers as a precondition. The mturk worker, who may work from home, is invited to solve rather simple knowledge-based problems from mturk requesters. In terms of location, however, the crowdsourcee may be confronted with tasks that include local knowledge such as

counting items on a specific place. Other than WeGoLook.com, where handling of tangible goods at a specific location is requested, mturk.com does not necessarily require any certain location for participation, but some tasks may demand specific knowledge of a location from the crowdsourcee.

Finally, Fold.it is an online puzzle video game about protein folding, which was created at the University of Washington. The 'scientists' (i.e., the 'crowdsourcers) intentions are to reach a huge audience via remote search to solve problems for science by playing a game where the crowdsourcee is invited to shape proteins. In any case, the location of the particpants, whether playing the game in Washington or anywhere else, seems not to be relevant to the crowdsourcers. The game offers both types of tasks to crowdsourcees, tournament-based as well as collaborative tasks: The crowdsourcee may choose whether to solve the puzzles as a soloist or in a team with other players. In fact, playing in teams with direct interaction between crowdsourcees and the location where they interact may have beneficial impacts on the outcome. However, it seems that due to the fact that in this game solving puzzles for science does not include a financial compensation for the participants, the tournament-based characteristic is dominant for mostly motivational reasons.

B. Local versus Remote Type of Search

When crowdsourcers look for solutions to a specific problem, which should be solved within their (geographical) area, they may use a local search to acquire crowdsourcees. If the expertise required to solve a given problem is outside the crowdsourcer's location, he or she may perform a remote search, which might be as broad as a global search to obtain the required knowledge, or might be directed to a specific remote location or area (e.g., a certain Café in Paris) [5].

For example, the 'locality' aspect may be as specific as searching for crowdsourcees being at a particular town such as, for instance, a local search for volunteers helping to organize an event (e.g., for a local meeting). A local search may also be suitable for leveraging knowledge within a local competence center. For instance, if specific knowledge in the domain of 'reproduction' is required, the Reproduction Center of the University of Veterinary Medicine in Vienna may be a prime address. If the crowdsourcer is part of this center, it might be advicable to search locally for the specific knowledge within this domain. However, when interdisciplinary knowledge is required, it will be advisable to expand the search including people from outside the specific competence center, and search globally for this knowledge. Note, 'global search' may also include 'local search' within the domain.

A good example illustrating the different perspectives regarding locality of both, crowdsourcer and crowdsourcee, offers trnd.com, a European platform for a marketing community focusing on viral marketing. Companies such as Procter & Gamble, Unilever, or Nestlé are the main crowdsourcers on this platform. As direct communication with each consumer on a local level is quite cost-intensive with limited impact, trnd.com offers its member companies the possibility to 'book' word-of-mouth campaigns in order to trigger conversations between consumers. For potential crowdsourcees, the platform allows to apply for becoming so-called 'connectors'. When being selected for a campaign by trnd.com, the crowdsourcee receives test samples and product incentives from the crowdsourcer. If the crowdsourcee is satisfied with the product, he or she should give personal recommendations to family and friends within the neighborhood. Making the crowdsourcee a 'connector' for viral marketing among consumers, local search becomes easier in terms of operational handling, and improves cost-benefit-ratio (i.e., efficiency).

In contrast to trnd.com, the following example represents a case where local search is not a good choice since the expertise for solving the problem is only to be found outside the crowdsourcer's location. Likewise, addressing the global crowd will not be advisable, as only a specific group will be knowledgeable. Let us assume that some people may want to know how crowded a particular location (e.g., restaurant, club) is where they intend to go. The Localmind.com application would allow for directly asking people who are currently checked-in at this location (remote search). Based on the answers, the crowdsourcer can make better (because better informed) decisions about whether or not to move on to a certain location. Hence, such applications target the most knowledgeable ones about the current situation.

If feedback needs to be collected from a representative group of people, a global search may be adequate. For instance, Threadless.com allows the crowd not only to submit their own ideas for T-shirt designs; they also use the crowd for selecting the most promising design by having the crowd voting on a set of designs and bringing only the highest ranked one to the market. In relying on a local search, the votings would only be representative for a certain local region, while a remote search would integrate a wider perspective. While a locally representative voting may be leveraged by making the T-shirt design available in a local store only, a wider scope of crowdsourcees seems more appropriate for an internationally accessible online shop.

IV. Discussion

Depending on the crowdsourcing-concept and the way participants provide their input, the crowd offers a great potential to a company or an organisation such as achieving goals with more efficient and higher quality results, having access to a very large knowledge base and skills pool, as well as cost reduction [19]. In practise, four combinations of collaboration-based and tournament-based crowdsourcing along two dimensions of locality occur. In order to implement crowdsourcing concepts, we argue that a systematisation is needed allowing for coordination of potential participants. The capabilities of mobile devices such as smartphones [20] help people to solve problems faster and cheaper than with traditional methods and support a variety of tasks [19] on a local basis.

Concerning the suggested taxonomy, some challenges should be discussed: LBCS raises critical issues such as security, safety, and privacy concerns (e.g., a physical product is damaged, a document is uploaded by mistake, or certain information is provided incorrectly by any crowd-member).

Furthermore, from a business perspective, it is essential to generate appropriate incentives for the crowd that take into

consideration various situations and/or locations that crowdsourcees might be in; besides financial benefits, a tournament-based environment may trigger motivational forces [24], which ultimately play a decisive role when a potential crowdsourcee has to decide upon participating or not [18]. For instance, crowdsourcees of the successful example Lego, whose idea have been chosen for a new product launch from the platform Lego-Ideas earn 1% royalties of the total net sales of the specific product. Besides financial incentives, Lego heavily relies on the passion of their fans to engage in crowdsourcing projects. By regularly reviewing, assessing and most importantly launching the best ideas submitted as a new product, crowdsourcees are strongly motivated by psychological factors. The engagement in product idea generation, the experience of creating own prototypes, as well as the need of self-expression on the platform, and the uniqueness of the created product idea may be typical motivational values for the participants [24].

From a location-based perspective of the winners, the outcomes such as the Japanese 'Hayabusa'-product line as well as the American 'Ghostbusters'-product line are strongly influenced by personal cultural backgrounds of the crowdsourcees. Although there is a voting process including thousands of so-called 'fans', it should not be ignored that their votes may not be representative for the majority of customers (that are rather non-voters) on the mass market.

Local, regional or worldwide reputation of a company seems to be another significant driver for participating in crowdsourcing projects. While some big enterprises such as Lego ('Ideas' formerly known as 'Cuuso') and Amazon ('mturk') invite crowdsourcees beyond regional levels, some others would rather attract participants from a certain country (like e.g., the British platform marblar.com attracts mainly participants from Great Britain). Hence, the reputation and the success rate of such a concept have mutual influence on both dimensions in our taxonomy. As a consequence, positive network externalities (i.e., overcoming the penguin problem [30]) are essential for the success of crowdsourcing platforms. Penetration rates, number of active users, reputation and success rate are mutually dependent driving factors [31] that may lead crowdsourcing concepts to their full functionality and, thus, their popularity.

V. Conclusion

How do crowdsourcing projects take place in terms of collaboration and location? As crowdsourcing applications increasingly use location-sensing capabilities of mobile devices to match crowdsourcing task and crowdsourcee, existing taxonomies seem not sufficient to reflect emerging prospects concerning acquisitions of crowdsourcees on a local, regional, or global level. The high degree of diffusion of mobile devices allows the involvement of dispersed participants at low costs. Thus, the factor "locality" becomes decisive for the recruitment of participants and – as a consequence – for the success of such concepts.

Against this background, this paper focuses on covering location-based aspects and suggests a taxonomy that is structured along two dimensions of locality. The scope of alternatives for crowdsourcing depends on the characteristics of a specific problem, such as the crowd, the solutions to be evaluated by the venue crowdsourcer, the knowledge required by the solution on a problem, etc. In this paper, the authors emphasize on the aspect of location for acquisition of crowdsourcees and introduced a taxonomy for crowdsourcing with the focus on interaction and locality of the participants. It is argued that the two types of crowdsourcing (i.e., tournament-based and collaboration-based), may strongly depend on the provided dimensions of locality. Furthermore, opportunities and challenges in the context of location are discussed.

The elaborated categorization provides a basis for future research, which could outline technical perspectives concerning LBCS, e.g., it may address matching algorithms that identify crowdsourcee-task combinations for location-based services. Therefore, someone may use smartphone's sensors, which help to derive (or to infer) a potential crowdsourcee's location, to attract a 'suitable' person in a favorable place for a certain task in order to create high-quality results. This approach enables the crowdsourcer to identify the 'right crowd' immediately, or alternatively, the LBCS portal would suggest to potential and registered crowdsourcees which tasks are available and would fit for them in terms of place and time. Furthermore, future research could address methods to determine which type of crowdsourcing shall be preferred for a given objective in a real-world application or setting (e.g., expected values of effectiveness, efficiency, quality, etc.). A general approach could explore the effects of combinations of collaboration-based and tournament-based crowdsourcing along the dimensions of locality.

References

[1] Howe, J. The rise of crowdsourcing. Wired 14 (6), pp. 176-183 (2006)

[2] Howe, J. Crowdsourcing: How the power of the crowd is driving the future of business. Random House (2008)

[3] O´Conner J.J., Robertson, E.F. Longitude and the Académie Royale. MacTutor History of Mathematics (1997).

[4] Babbage, C. On the Economy of Machinery and Manufactures. Ldn. Knight (1831)

[5] Afuah, A., Tucci, C.L. Crowdsourcing as a solution to distant search. Academy of Management Review, 37, pp. 355–375 (2012)

[6] Brabham,D.C. 'Crowdsourcing as a Model for Problem Solving: An Introduction and Cases', Convergence: The International Journal of Research into New Media Technologies 14 (1), pp. 75–90 (2008)

[7] Gassmann, O., Daiber, M., Muhdi, L. Der Crowdsourcing-Prozess. In: Gassmann (Editor): Crowdsourcing - Innovationsmanagement mit Schwarmintelligenz. Hanser, Munich, pp. 31-55 (2010)

[8] Estellés-Arolas, E., González-Ladrón-de-Guevara, F. Towards an integrated crowdsourcing definition. Journal of Information science, 38(2), 189-200 (2012)

[9] Kittur, A. Crowdsourcing. Collaboration, and Creativity. ACM Crossroads,17 (2), pp. 22-26 (2010)

[10] Alt, F., Shirazi, A. S., Schmidt, A., Kramer, U., Nawaz, Z. Location-based crowdsourcing. NordiCHI2010. ACM, pp. 13-22 (2010)

[11] Väätäjä, H., Vainio, T., Sirkkunen, E. Location-Based Crowdsourcing of Hyperlocal News – Dimensions of Particip. Preferences. GROUP'12. ACM, pp. 85-94 (2012)

[12] Thuan, N. H., Antunes, P., Johnstone, D. Factors Influencing the Decision to Crowdsource. In Collaboration and Technology (pp. 110-125). Springer (2013)

[13] Lemeister J. M., Huber, M., Bretschneider, U., Krcmar, H. Leveraging Crowdsourcing: Activation-Supporting components for IT-based ideas competition. In: Journal of Management Information Systems (JMIS),. 26, pp. 197-224 (2009)

[14] Bayus, B.L. Crowdsourcing. New Product Ideas over Time: An Analysis of the Dell IdeaStorm Community, Management Science 59 (1), January, pp. 226–244 (2013)

[15] Afuah, A., Tucci, C. L. Value Capture and Crowdsourcing. Academy of Management Review, 38(3), 457-460 (2013)

[16] Kittur, A., Chi, E. H., Suh, B. Crowdsourcing user studies with Mechanical Turk. In Proceedings of the SIGCHI conference on human factors in computing systems (pp. 453-456). ACM (2008)

[17] Brabham, D. C. Moving the crowd at Threadless: Motivations for participation in a crowdsourcing application. Inf., Communication & Soc., 13(8), 1122-1145 (2010)

[18] Zheng, H., Li, D., Hou, W. Task design, motivation, and participation in crowdsourcing contests. Int. Journal of Electronic Commerce, 15(4), 57-88 (2011)

[19] Bozzon, A., Brambilla, M., Ceri, S. Answering search queries with crowdsearcher. In Proceedings of the 21st international conference on World Wide Web, pp. 1009-1018). ACM (2012)

[20] Yan, T., Kumar, V., Ganesan, D. Crowdsearch: exploiting crowds for accurate real-time image search on mobile phones. In Proceedings of the 8th international conference on Mobile systems, applications, and services pp. 77-90. ACM. (2010)

[21] Carvalho, V. R., Lease, M., Yilmaz, E. Crowdsourcing for search evaluation. In ACM Sigir forum (Vol. 44, No. 2, pp. 17-22). ACM (2011)

[22] Mladenow, A., Bauer, C., Strauss, C. Social Crowd Integration in New Product Development - Crowdsourcing Communities Nourish the Open Innovation Paradigm. Global Journal of Flexible Systems Management 15 (1) , pp. 77-86 (2014)

[23] Horton, J., Chilton, L. The labor economics of paid crowdsourcing. Proceedings of the 11th ACM Conference on Electronic Commerce (2010)

[24] Lusch, RF., Brown, SW., Brunswick, GJ. A General Framework for Explaining Internal vs. External Exchange. Journal of the Academy of Marketing Science, Vol. 20, No. 2, pp. 119 – 134 (1992)

[25] Celino, I., Cerizza, D., Contessa, S., Corubolo, M. Urbanopoly - a Social and Location-based Game with a Purpose to Crowdsource your Urban Data. In: Proceedings of the 4th IEEE SocialCom, Workshop on Social Media for Human Computation, pp. 910-913, DOI: 10.1109/SocialCom-PASSAT.2012.138 (2012)

[26] Bentley, F., Cramer, H., Müller, J. Beyond the bar: the places where location-based services are used in the city. Personal and Ubiquitous Computing (2014)

[27] Goodchild, M.F., Glennon, J.A.Crowdsourcing geographic information for disaster response: a research frontier. Int. Journal of Digital Earth 3 (3), pp. 231-241 (2010)

[28] Bauer C., Mladenow, A., Strauss, C. Fostering Collaboration with Location-based Crowdsourcing. *ooperative Design, Visualization, and Engineering*. Springer International Publishing, 2014. 88-95

[29] Chatzimilioudis, G., Konstantinidis, A., Laoudias, C., & Zeinalipour-Yazti, D. Crowdsourcing with smartphones. Internet Computing, IEEE, 16(5), pp. 36-44 (2012)

[30] Choi, J. P. Herd behavior, the "penguin effect," and the suppression of informational diffusion: an analysis of informational externalities and payoff interdependency. The Rand Journal of Economics, pp. 407-425 (1997).

[31] Mladenow, A., Kryvinska, N., Strauss, C. Towards cloud-centric service environments. Journal of Service Science Research 4 (2), pp. 213-234 (2012)

[32] Hollingshead, AB. McGrath, Joseph E. Computer-assisted groups: a critical review of the empirical research. In: Guzzo, RA., Salas, E., Ed. (1995), Team effectiveness and decision making in organizations. Jossey-Bass, pp. 46-78 (1995)J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68–73.