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Fostering Collaboration by Location-based Crowdsourcing

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Abstract. Crowdsourcing is a recently developed method that relies on various alternatives of collaboration to solve problems efficiently. Crowdsourcing is a recent development to solve a variety of problems efficiently, and which implies various alternatives of collaboration. However, as novel technologies are able to exploit location-sensing capabilities of mobile devices, location-based crowdsourcing (LBCS) developed as a new concept. This paper suggests a typology for LBCS as a means for fostering collaboration with the crowd through three types of LBCS: confirmation-based, digital good-based, and physical-based. Each type is underpinned with exemplary applications. Furthermore, opportunities and challenges are analysed; and future trends in LBCS are discussed.

Keywords: Location-based Crowdsourcing; LBCS; Collaboration; Collaborative Crowdsourcing; Time-dependency; Location-dependency; Typology; Social Communities; Mobile Crowdsourcing Applications.

1 Introduction

Information and communication technologies (ICT) have the capacity to bridge time-space gaps, which in turn forms the basis for collaboration at different times and at different places. In the wide range of ICT-based collaboration alternatives, crowdsourcing represents a novel class of collaboration. In recent years, crowdsourcing concepts flourished: crowdsourcing leverages ICT to interconnect people, and to activate, coordinate, and bundle their collective capabilities to gain synergies [1, 2, 3]. Based on Howe [4], Bayus [1] described the term "crowdsourcing" as an neologism by defining it as the act of taking a task once performed by an employee, and outsourcing it to a large, undefined group of people. However, the basic idea of crowdsourcing is not new: In the 19th century, Charles Babbage, the famous English mathematician and engineer, hired "the crowd" to assist in computing astronomical tables [5]. This indicates that crowdsourcing does not necessarily need ICT; ICT is rather to be regarded as an enabler. Still, in recent years, the flourishing phenomenon of crowdsourcing is tightly associated with ICT. Examples given in literature consider the entire value chain including problem statement publication, getting in contact, communicating, carrying out tasks, coordinating activities, reporting on solutions, providing the result to the problem statement, awards, etc. as being carried out online by the crowd and thus using ICT.

One of the key elements in the physical world is "location". For some tasks it is essential that individuals forming the crowd are situated at a certain location to be able to perform a given task. However, such tasks do not seem to correspond with recent conceptions of crowdsourcing, where ICT is regarded as the key enabler supporting all phases of the crowdsourcing value chain. Still, the original crowdsourcing idea did not envisage the use of ICT; accordingly, we argue that even if activities are carried out offline in the physical world, it is still within the scope of the crowdsourcing concept.

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This phenomenon of the "collaborating crowd", where tasks are involved that require the crowd to be situated at a certain location, was recently picked up in research and was coined "location-based crowdsourcing" (LBCS) [6, 7]. Still, there is only limited knowledge on the phenomenon itself as well as on its opportunities and challenges.

Against this background, this paper aims to contribute by reducing this research gap. It specifies the concept of LBCS by developing a typology together with its underlying rationale; and selected examples of successful LBCS applications on the market will underpin the typology. Furthermore, we analyse opportunities and challenges associated with LBCS.

This paper is structured as follows: The next section presents related work and provides the theoretical background of LBCS. Built on this, Section 3 discusses the opportunities and challenges for close collaborative LBCS processes, such as saving time and distributing activities among the individuals efficiently. Section 4 introduces a typology of LBCS and presents successful examples of LBCS applications on the market. The paper closes with a conclusion and points to future research opportunities.

2 Related Work

Collaboration is an interactive, recursive process [8, 9]. Because it is directed towards an objective, the participants must intend to act or decide [9]. Many collaborative processes in real world involve people interacting with each other [10]. In this regard, the concept of "crowdsourcing," a term coined by Howe [4], describes an interactive form of service delivery on the basis of Web 2.0, where several users are involved in collaborative processes. With crowdsourcing, an organization or individual follows the strategy to outsource tasks by means of an open call (invitation) on a group of unknown actors [3]. Typically, the crowdsourcer and the crowdsourcees benefit from direct economic advantages [3] and form the basic roles in a collaborative setting. Result-based compensations of crowdsourcing include cash bonuses, small monetary rewards, price incentives, or exclusive information [11]. Furthermore, there are many crowdsourcing projects without direct compensation. In these cases, the participant is typically motivated by the desire to experience something new, to share knowledge with others, or to accomplish common goals [1].

On the Web, crowdsourcing has gained popularity over recent years. There are several websites that serve as platforms to distribute crowdsourcing tasks (e.g., www.mturk.com; www.istockphoto.com; www.innocentive.com; www.cambrianhouse.com; www.threadsless.com) [6]. One common feature among these platforms is that the crowdsourced tasks are location-*in*dependent. With ICT as an enabler, recent research on crowdsourcing tends to assume that all crowdsourcing tasks are carried out online and result in digital products (results). Our work, in contrast, focuses on location-dependent problems and/or tasks. Such work shows how crowdsourcing may generate value and synergies through collaboration, where some tasks are inherently bound to a certain location.

The core concept of the so-called location-based crowdsourcing (LBCS) implies location-dependent collaborative tasks. Individuals, who are currently in close proximity or are promptly issued to the location of the task, may carry out such tasks. In this context, Alt, Shirazi, Schmidt, Kramer and Nawaz [6] describe the concept of LBCS as a crowdsourcing platform that requires tasks to be performed at a specific location; these tasks are then distributed among the voluntary platform participants or the participants select their preferred tasks. As for the types of tasks, LBCS relates to those tasks that can be found in close proximity and that can be carried out fast and easily. Thus, there is a certain degree of context dependency between the situation, which the crowd worker finds him or herself in, and, for instance, the information that he or

she has to obtain at a certain location. Thereby the location of the crowdsourcer may be relevant or not; in any case, though, the location of a crowdsourcee is utterly important.

Among the vast attempts to classify crowdsourcing, there are basically two main approaches: One approach is based on the type of task that is crowdsourced, and the other is based on the initiator of crowdsourcing. For instance, Howe [4] differentiates the following three types of crowdsourcing: crowdsourcing idea game, crowdsourced problem solving, and prediction markets. Gassmann, Daiber and Muhdi [12] identify five crowdsourcing initiation approaches: Crowdsourcing initiated and supported by intermediary platforms, user-initiated crowdsourcing, company-initiated platforms, idea market places, and public crowdsourcing initiatives.

Brabham [13] followed a different approach and introduced a problem-based typology to classify crowdsourcing. He differentiates between knowledge discovery tasks, distributed human intelligence tasks, broadcast searches, and peer-vetted creative productions. For collaborative LBCS, which includes the physical element of location [e.g., 14, 15, 16, 17, 18], these typologies appear to be too narrowly drafted and call for a revised version to integrate the LBCS phenomenon.

3 Typology for Collaborative Location-based Crowdsourcing

Based on Brabham [13], we further differentiate between three LBCS models depending on the nature of the result of the collaborative task: confirmation-based result, digital good-based result, and physical-based result. Based on this novel typology, we analyse successful examples on the market.

3.1 Confirmation-based Result

In the crowdsourcing model with a confirmation-based result, the crowd has to perform a task on site and then confirms online that the task has been accomplished. For instance, the task could be to take some physical good from A to B within a certain town and typically within a defined time-window. The following selected services exemplarily represent successful platforms on the market that support the confirmation-based result type of LBCS.

WeGoLook.com. This service works consumer-to-consumer, business-to-business, business-to-consumer, as well as peer-to-peer. One of WeGoLook's services allows crowdsourcers to call crowdsourcees to perform tasks such as inspecting a product, person, or place. This kind of outsourcing is particularly useful, when the task has to be completed in a different part of the world.

Localmind.com. This application allows users to direct questions about a specific location to people who have checked-in at this location (e.g., restaurant, club). Users may want to know what is happening at a particular place, or how crowded a club is, or if a restaurant has good seats available. Based on the answers, the crowdsourcer can make better-informed decisions about whether or not to move to a certain location.

TaskRabbit.com. This portal supports errands type tasks on a consumer-to-consumer basis. In one part of the services they offer, to find crowdsourcees that act as personal assistants, for instance, cleaning a home or assembling furniture, etc.

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3.2 Digital Good-based Result

The crowdsourcing model where a digital good is delivered as a result may be exemplified by asking the crowd to take a picture of a certain object, and submit the digital picture to the crowdsourcer. The following platforms in the field of news reporting represent examples for the digital-good-based result type of LBCS.

iReport.cnn.com. The US-based TV channel CNN invites everyone (the crowd) to contribute reports, videos, or photos of breaking news. This is particularly interesting, when the iReporter (i.e., the crowdsourcee) is part of the reported story and could, e.g., eyewitness natural phenomena, disasters or accidents on-site. Such crowdsourced reports have the added value that emotions on-site are passed on unaltered to viewers and readers: amateur reporters typically capture what they are experiencing at the moment, and consequently pass on their own personal story. This added value partly stemming from the immediate and instantaneous reporting combined with the emotional and exciting experiences of iReporters proves to be in demand by news channels.

Tackable.com. This application is based on the following idea: An editor or a reporter (i.e., the crowdsourcer) publishes an order within the Tackable application to take a photo from or of a specific location. Users of this application (i.e., the crowdsourcees) may then carry out the indicated task, and share photos on the application's platform. The editor/reporter chooses from the received photos and includes them in online reports or print media. Furthermore, the submitted photos are made accessible on a map (geo-tagging) and users may also share them on various social networks. The great advantage of this concept seems to lie in the fact that it is not based on friendship networks but on the geographical location of the users. This makes it possible to efficiently access actual, relevant photos. In order to motivate users sufficiently, they receive "karma points" for each completed task and top ranked users receive prizes.

3.3 Physical-based Result

The crowdsourcing model, where the crowd shall perform a task on-site, which requires physical distribution, we coined "physical-based result" type. For instance, the crowd has to collect some goods that are only available at the certain location and has to ship them physically to the crowdsourcer. The following two platforms support the physical-based result type of LBCS in their portfolio.

WeGoLook.com. Part of the service portfolio allows crowdsourcers to call for customized tasks such as courier and shipping services. For instance, crowdsourcees ensure an item is properly packed and is being shipped. At the destination another crowdsourcee may receive the item at pickup and verify that the item arrived safely.

TaskRabbit.com. This portal supports errands type tasks such as delivering groceries or running errands, etc. on a consumer-to-consumer basis. Therefore, many results are physical based.

Against this background, we suggest a revised typology for LBCS, which considers that, while the problem statement is typically published online, a task is involved which has to be carried out offline on-site; thereby the results of going through the crowdsourcing value chain may be of a different nature as depicted in Table 1.

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Table 1. Overview on LBCS-Typology: Characteristics and Exemplary Applications

LBCS-Type	**Characteristic of Collaborative Task**	**Exemplary Task**	**Exemplary Applications**
Confirmation-based	online confirmation on the completion of the task	"Take some physical good from A to B under time constraints."	WeGoLook.com Localmind.com TaskRabbit.com
Digital good-based	completed task is in form of or contributes to a digital good	"Take a picture of a certain place in town and submit the digital picture to the crowdsourcer."	iReport.cnn.com Tackable.com
Physical-based	completion of task requires physical presence at determined location	"Collect some goods that are only available at a certain location and ship it to the crowdsourcer."	WeGoLook.com TaskRabbit.com

4 Opportunities and Challenges for Collaboration in Location-based Crowdsourcing

To implement the LBCS concept, a system is needed that allows for coordination of the potential crowdsourcing members at the right time at the right place. Thereby, the physical element of LBCS poses some restrictions compared to fully ICT-reliant crowdsourcing in the digital world – still, LBCS also offers great potential. The capabilities of mobile devices are helping people to learn more about their surroundings, solving problems faster and cheaper than traditional methods and support a variety of collaborative tasks on a local basis.

Regarding the challenges for companies to implement a LBCS project, Hammon and Hippner [2] exemplarily outline common problems that may arise in any kind of crowdsourcing ventures; these challenges are likely to be transferrable to LBCS . The major challenges of such an LBCS project may typically arise in an early stage. On the one hand, it is difficult to estimate the costs for the implementation of the project. On the other hand, content (i.e., tasks) and number of users are strong drivers in the project. As a consequence, crowdsourcing concepts may reach their full functionality and, thus, their popularity only with an increasing number of users. Furthermore, the reputation and the success rate of such a concept have mutual influence. Online-traffic generated collaboratively increases with popularity and quality of the LBCS application; and, vice versa, ample online-traffic influences the popularity and quality of the LBCS application positively.

A further challenge is to generate appropriate incentives for the crowd in various situations, so that the result fulfils its intended purpose and creates the expected values for the actors involved [3]. Some issues that might occur are particularly related to LBCS, e.g., reliability issues: if certain information is provided incorrectly or a picture is uploaded by mistake, the crowdsourcer may not be aware of the error. However, it seems even more problematic if a physical product is damaged (e.g., when transporting the product from one place to another). For such cases, critical issues arise, namely damage liabilities and compensation. Other crucial issues refer to security, safety, and privacy aspects.

Furthermore, there is a noticeable difference, whether the crowd is supposed to do a certain task (e.g., many people take pictures of an object) or an individual person carries out some task (e.g., taking an object from

A to B, it is likely fulfilled by one person only). If a crowd is taking pictures and one out of a few is good, than then the task is fulfilled. However, if an individual carries out the task, there are high expectations for this individual to deliver a high quality product quickly.

Moreover, quality assurance the different types of LBCS bear different challenges. For instance, if the task is to take a picture of the Eiffel Tower, it could happen that some people of the crowd do not carry out the task correctly (e.g., taking pictures of other construction and uploading these pictures specifying these as ones of the Eiffel Tower). If crowdsoucers are knowledgeable, they will be able to identify the right pictures. Otherwise there are several scenarios: if several people make mistakes by taking pictures of wrong sights, while others fulfil the task correctly, the crowdsourcer will easily be in a position to differentiate between the correct and the wrong pictures. However, if everyone but one is doing a bad job, the crowdsourcer will have difficulty identifying the correct picture.

Further opportunities for novel location-based services may arise by leveraging data collected by LBCS. For instance, the game Ingress, requires the crowd of gamers to tag so-called "portals" (usually special sights at various locations) and provide a picture of the portal. This information that is collected in the game may later be used in another context as a basis for a completely different location-based service.

5 Conclusion

Collaboration at any time and any place is enabled by ICT, and crowdsourcing represents one out of numerous alternatives to create value by collaboration. In this paper, we focus on LBCS, and introduced a typology for LBCS to foster collaboration with the crowd. Three basic types are identified, i.e., confirmation-based, digital good-based, and physical-based LBCS. We characterized each type and underpinned them with examples. Furthermore, we discussed opportunities and challenges in the context of LBCS.

Future work may address matching algorithms that identify good crowdsourcee-task combinations. For instance, an LBCS service may use smartphones' GPS signals (or other sensors, which help to derive or to infer a potential crowd worker's location) to match a suitable person for a certain task in order to create a qualitative and/or timely outcome. This idea may be developed further in two possible directions: Either the crowdsourcer would be enabled to identify the "right crowd" immediately, or alternatively, the LBCS portal would suggest to potential and registered crowdsourcees which tasks are available and would be suitable for them in terms of place and time. In addition, building on the concept of ubiquitous computing, the idea of sensors that describe a situation and could tell if someone fits the given task (e.g., suitable in terms of location, skills and equipment as well as in availability of time and resources), might be relevant future trends for LBCS.

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