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# **Recommendation systems and crowdsourcing: A good wedding for enabling innovation? Results from technology affordances and constraints theory**

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**Abstract.** Recommendation Systems have come a long way since their first appearance in the e-commerce platforms. Since then, evolved Recommendation Systems have been successfully integrated into social networks. Now it is time to test their usability and replicate their success in exciting new areas of web -enabled phenomena. One of these is crowdsourcing. Research in the IS field is investigating the need, benefits and challenges of linking the two phenomena. At the moment, empirical works have only highlighted the need to implement these techniques for tasks assignment in crowdsourcing distributed work platforms and the derived benefits for contributors and firms. We review the variety of the tasks that can be crowdsourced through these platforms and theoretically evaluate the efficiency of using RS to recommend a task in creative crowdsourcing platforms. Adopting a Technology Affordances and Constraints Theory, an emerging perspective in the Information Systems (IS) literature to understand technology use and consequences, we anticipate the tensions that this implementation can generate.

**Keywords:** Recommendation Systems, Work Crowdsourcing, Creative Crowdsourcing, TACT, Innovation

## **1 Introduction**

Amazon, Netflix, Spotify etc. owe a part of their big success to the Recommendations Systems (Recommender Systems-RS) implementation on the process of providing tailored services to each customer, reshaping the world of e-commerce by enabling on-line retailers. Suggestions for books on Amazon, movies on Netflix, or songs on Spotify are just a few of real world consolidated examples of the industry-strength

websites differentiated the using of this technology in suggesting interesting people to follow (Twitter), interesting stories to read, friends to add (Facebook) and relevant jobs to apply for (LinkedIn). The goal of a Recommendation System, going from products to content that might interest, is to generate meaningful and useful recommendations to a collection of users and help them to handle the information overload problem. With the popular acceptance of the Web 2.0 with all his powerful mix of contents, we are facing an era of information overload where the amount of on-line information vastly outstrips any individual's capability to survey it. Reducing the information overload becomes a necessity for the user and a field of battles for IT tools developers.

The evolution of Recommendation Systems research is always in parallel with the advent of new web enabled phenomena. One of these is crowdsourcing, an umbrella term for a highly varied group of approaches that share one obvious attribute in common: they all depend on some contribution from the crowd [23]. The literature of the IS field is gathering round the issue to link the two phenomena by highlighting the necessity to investigate on the benefits that these tools can bring in the context of crowdsourcing or the opposite [29]. In the first case, empirical studies are studying the use of these approaches in one particular form of crowdsourcing systems known as a distributed paid work<sup>1</sup>. Most of these researches state that RS are needed to recommend the workers the tasks to complete (task assignment). Experimental works are providing evidence that these platforms can benefit from the suitability of RS to task assignment process and consequently, reduce the information overload for their users (easier task selection from the user perspective). But since Crowdsourcing is a paradigm that provides principles or rules to the real world problems [42] it comes in many forms and diverse contexts so there are many possibilities of intersections with Recommendation Systems. That is why in this paper we question about the possibility to use these software tools in the crowdsourcing of inventive activities [10] and investigate theoretically the benefits and challenges of this implication.

As we mentioned above the information overload is a problem affecting the web-enabled phenomena so given the big success of creative crowdsourcing, the platforms that facilitate the process will soon deal with it, due to the increasingly number of submissions of the ideas.

It is known that the application of Recommendation Systems in the e-commerce field can help to: convert a visitor into a buyer through interesting suggestions, increase the items in the shopping card through related recommendations, and satisfy returning buyers with personalized recommendations.

But can their implementation in crowdsourcing, and consequently the recommended or personalized calls to submit to, lead to an appropriate task assignment (and

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<sup>1</sup> The most famous example is Amazon Mechanical Turk, a crowdsourcing platform for outsourcing HITs (small tasks that cannot be easily automated).

symmetrically) task selection? So can this be a good idea and offer a competitive edge to those platforms that take advantage of this technology affordance?

This paper is organised as follows: section 2 and 3 present an overview of the background literature on Recommendation Systems and Crowdsourcing. Section 4 presents the importance of a Technology Affordance and Constraints Theory in order to evaluate the effectiveness of the implementation of RS in creative crowdsourcing platforms. Technology affordance and constraint theory (TACT) is an emerging perspective in the Information Systems (IS) literature to understand technology use and consequences.

## **2 Background Literature of the Recommendation Systems**

Recommendation Systems are among the most used technologies of Web 2.0 like blogs, wikis, podcasts, social networks. The best definition so far defines the RS as programs which attempt to recommend the most suitable items (products or services) to particular users (individuals or businesses) by predicting a user's interest in an item based on related information about the items, the users and the interactions between items and users [6]. RS intersect several sub-disciplines of IS as machine learning, data mining, human computation and information retrievals and their applications have been pursued in diverse domains. Beyond computer science, Recommendation Systems are also studied in marketing and, consequently, in customer behavioural science where, of course, the focus is on how RS affect customers.

The main purpose of these tools is to assist users in their decision making process and, when properly implemented, they allow users to filter the relevant from the irrelevant [26], [28]. Recommendation Systems differs from conventional filtering systems because recommendations are based upon subjective values assigned by people, namely, the quality of items, rather than more objective properties (such as text content of a document) of the items themselves [33]. Regarding to how these techniques are formed they can be classified into the following three categories: Content based, Collaborative and Hybrid recommendations.

Collaborative-based or so called social-based are an alternative approach to the previous approaches, aiming to improve the limitations of content-based approach by exploiting the role of the community and recommending on the assumption that similar users have similar interests [4]. In the real world examples the firms use a mixture of user's own profile (past behaviour) and his/her friends to compute recommendations (social based). There is an extensive literature on how recommendation systems affects the e-commerce. The main idea is that in the e-commerce domain the recommendation of items can often help a customer find what he is interested in and, therefore can help in driving sales. Such systems have an obvious appeal in an environment where the users deal with information overload.

### 3 The State of Art of Crowdsourcing

#### 3.1 The Evolution of Crowdsourcing Due to the Blooming of Advanced Web Technologies and their Applicability in Continuous Increase

The term “crowdsourcing” was coined in an article appearing in Wired magazine by Jeff Howe who defined it as “the act of taking a job traditionally performed by a designated agent (usually an employee) and outsourcing it to an undefined, generally large group of people in the form of an open call” [23].

But the first example goes back to 1714, when the British government needed a solution to “The Longitude Problem” that made sailing difficult and dangerous. The British government offered 20,000 pounds for lay people to find a solution, to develop a simple and practical method for the precise determination of a ship’s longitude, and the problem was solved by a working-class person with little education. So the idea of orchestrating a crowd to produce value has been around for centuries but the increasing evolution of web 2.0 makes it possible to reach an infinity number of people in real time. The definition of crowdsourcing is such a field of battle that Estellés-Arolas and González Ladrón-de-Guevara [19] made a comprehensive effort to integrate the others definition counting more than 40 different definitions of crowdsourcing and suggesting a synthesized one. Crowdsourcing to solve problems is not something new *per se*. What is missing in the Howe’s definition is the point out of the reliance on the advanced internet technologies of what we define crowdsourcing nowadays. Someone even call it a new distributed computing model [1].

Excluding the capabilities of Web 2.0 tools this phenomenon will not be the same that we refer to in this hyper competitive environment we live in. Saxton’s work is one of the limited research papers that marks explicitly the presence of web 2.0 in the conceptualize of crowdsourcing referring to Crowdsourcing as a sourcing model in which organizations use predominantly advanced internet technologies to harness the efforts of a virtual crowd to perform specific organizational tasks. Doing so they conceptualizing crowdsourcing as a type of sourcing model that lies at the intersection of outsourcing and sophisticated internet technologies. The definition of Chanal and Caron-Faran [12] as *the opening of the innovation process of a firm to integrate numerous and disseminated outside competencies through web facilities*, in addition to the web facilities highlights the openness of the innovation process making conceivable to consider crowdsourcing as one particular manifestation of open innovation [36] which is known as the opens the boundaries of the firms [13].

### **3.2 The Many Faces of Crowdsourcing**

The most common uses of crowdsourcing in the business and so accordingly the most studies and referred in the academic literature are for outsourcing HIT's or gathering ideas. The gathered ideas can be implemented in: new product development [16] new marketing campaign [39], problem solving [7] [9], business model innovation [38] etc. Since the phenomenon is manifested in many forms the academics still keep working on the classifications of the phenomenon and keep generating taxonomies but still there is no classification shared between the academics. In these paper we are going to use the categorization of Burger-Helmechen and Pénin on the crowdsourcing of inventive activities referring to the ones when the firm uses the crowd to solve problems (to bring ideas), as opposed to crowdsourcing of routine activities and crowdsourcing of content (mostly information) where the crowd does not provide the firm with knowledge but with information, time and computing capacities [10].

In business and academic world the generation of the ideas outside the firm is also known with the terms of broadcast search [25] or innovation contest [8]. The success rate of real world stories and the results deriving from empirical studies, following the real-world comparison Poetz and Schreier, about the novelty of the ideas generated by the crowd [32] paint a positive picture and tempt the firms to implement the process of crowdsourcing for gathering ideas.

Geiger et al. [21] developed a taxonomic framework for crowdsourcing processes and identified four dimensions that describe how crowdsourcing processes can be configured, ranging from pre-selection of contributors, accessibility of contributors, and aggregation of contributors to remuneration for contribution.

The process of the generation of the ideas usually is supported by a platform with specific functions (integrative or selective [35]) and features. The proper matching between platform functions and task type can enhance the performance of crowdsourcing as in their empirical work Boudreau and Lakhani [7] suggested that, if a client firm wants to crowdsource a design task or creative project, a contest-oriented platform should be selected.

The platform can be of the property of the firm as Ideastorm, or of an intermediation company as Innocentive, NineSigma, Eyeka etc. that eases the connection between the firm and the crowd.

### **3.3 The Challenges of Technological Platform: from Enabler to Shaper that Optimizes Crowdsourcing**

Stankovic CEO of Hypios, a crowdsourcing intermediary, confirm that “simply posting a problem online is not enough to attract diverse and innovative solutions,” but platforms need to proactively identify potential solvers. The platform selection is a major issue who's importance has been recognized in the literature since various

papers affirm that crowdsourcing cannot be done effectively without a proper technological platform selection [7] but this dimension still needs to be investigated in an extensive way.

Various research streams of the Information Systems investigate on whether and how the technological tools or services can be used to enhance the crowd's productivity like use of collaboration tools [3], [27] to elicit the community's knowledge and/or skill sets and increase the quality of crowd's output.

In their empirical work, Kittur et al. [27] indicated that the perception of poor crowd work quality was caused, at least partly, by unclear instructions and insufficient feedback, and that contributors need more guidance to better understand what is expected. Crowdsourcing platforms can provide a wider array of communication channels between the client organization and contributors to support synchronous collaboration and real-time crowd work. Although their study refers to the task crowdsourcing the results are generalized with no mistakes in the other forms of crowdsourcing.

## **4 Linking the Two Phenomena: the Challenges of Using Recommendation Systems in Creative Crowdsourcing**

### **4.1 The Predictable Successful Match: the Task Recommendation on Crowdsourcing Work Platforms**

Why did the need to investigate the suitability of Recommendation Systems for task personalization, and consequently to help contributors dealing with information overload, in paid work platforms came into light?

Crowdsourcing has become a powerful mechanism for accomplishing work online and crowdsourcing platforms are changing the way people can work and earn money. The population of workers on crowdsourcing platforms already counts millions and keep growing. The pioneer in crowdsourcing and work distribution is Amazon Mechanical Turk (or MTurk) but a lot of other examples coexist like CrowdFlower, Taskcn, TopCoder etc. and the number of these type of crowdsourcing systems is increasing rapidly.

Originally, the researchers answered to the need of matching tasks to suitable contributors embracing the perspective of task assignment, which basis in the same idea like task recommendation but puts less emphasis on the self-identification principle. To this intent they described an approach to preselect the crowd of potential contributors to such tasks based on their capabilities [34] or develop approaches for the semi-automated assignment of contributors to processing tasks [22], [18].

Task Recommendation supporters on proposing their works take a slightly different perspective (help workers to find their right tasks faster), to a similar intent (help requesters to receive good quality output quicker).



Ambati et al. [2], Chilton et al.[14] Yuen et al. [40] [41] and so on propose recommendation engines because of the increase of difficulty for workers to find their preferred tasks.

In these systems, a worker has to select a task from more than ten thousands of tasks to work on in order to earn the tiny associated reward of such a few cents. Obviously, it is not efficient that the amount of time spent on selecting a task is comparable with that spent on working on a task. Their surveys show that the majority of workers spend more than 25% of their time on searching tasks to work on.

Therefore the over mentioned authors state that task recommendation in crowdsourcing systems are necessary. The currently hot area in the IS research to explore on is how to support crowdsourcing platforms to recommend tasks more easily and effectively.

The survey results collected from (MTurk) show that workers' histories can reflect workers' preferences, and so these authors propose to add worker task searching history to the previously known techniques based on worker performance history. Other proposes for improved algorithms and juxtaposing these results with others from user interface studies gather daily.

#### **4.2 The Tensions on Recommendation Systems in Creative Crowdsourcing: technology Affordances and Constraints Theory (TACT)**

Creative Crowdsourcing is based on the “wisdom of crowds”, which basically states that, under the assumption that there do not exist perfect experts for a complicated problem, the crowd is on average more likely to correctly understand and solve a task than any given individual [37].

So among reasons that push the firm to adapt the crowdsourcing paradigm the most stressed out is that the quality of the outcome (task or idea) produced is often higher than in non-crowd based processes.

Majchrzak and Markus's **Technology Affordances and Constraints Theory (TACT)** framework is used increasingly to study how people and organizations use information systems and how the use of IS affects individuals, organizations, and their performance. The concept of *Technology Affordance* refers to “an action potential, that is, to what an individual or organization with a particular purpose can do with a technology or information system”; *Technology Constraint* refers to “ways in which an individual or organization can be held back from accomplishing a particular goal when using a technology or system”. Affordances and constraints are understood as relational concepts, that is, as potential interactions between people and

technology, rather than as properties of either people or technology [31]. The researchers argue that to establish the status of TACT as a lens to understand technology use and consequence, it is necessary to apply TACT to a specific context, generate some testable propositions and empirically test these developed proposition. Based on previous empirical work, we generate the following propositions about the implementation of RS in the creative crowdsourcing platforms:

***Tension 1: Similarity of the calls recommended restrains the genius***

Since a distinctive of crowdsourcing is based on the self-selection, the contributors tend submit in the areas they know they have knowledge and expertise. Further recommendation of the calls will vertically restrict the width of the areas of submission from contributors. In their work based on *Innocentive.com* Jeppesen and Lakhani showed non-experts accounted for over 50% of the winning solutions, in 166 broadcast searches conducted. They state that people who come from other areas have other perspectives and experiences and can see the problem in new ways and have access to solutions that the experts do not [25]. Crowdsourcing research shows this exclusivity of experts to be better able to resolve problems to be false and the need for excluding the non-experts to be not a smart move.

***Tension 2: What about the role of randomness?***

Franke et al.in an experimental paper compared 22 deterministic factors of crowdsourcing tournaments and the explanatory power of randomness and found that randomness outperformed by over 500%. Even if their result are not generalized to all the subforms of crowdsourcing, confirm that the success of tournaments rests on the number of participants [20].

***Tension 3: Recommended calls bring design fixation***

Bayus studying Dell's IdeaStorm community, found that serial inventors are unlikely to repeat their early success once their ideas are implemented. As inventors with past success attempt to again come up with ideas that will excite the organization, they instead end up proposing ideas similar to their ideas that were already implemented (i.e., they generate less diverse ideas)[5].

## **5 Conclusion and Future Work**

Because of the same embarrassed approach the distributed work crowdsourcing platforms and creative crowdsourcing platforms present similitudes but also a lot of differences. So the fact that using Recommendation Systems in the former may bring

benefits because of the technology affordances it may not be the same for the later. In the creative crowdsourcing case the implementation has to be carefully evaluated by firm management because it presents constraints. In this paper, adopting a TACT lens, we generated some propositions that need to be further empirically tested to generate theory. We can then rephrase Steve Jobs famous sentence “It doesn’t make sense to hire smart people and tell them what to do”; we hire smart people so they can tell us what to do in “It doesn’t make sense to use Recommendation Systems in creative crowdsourcing platforms and tell the crowd what to do, because we use the crowdsourcing to let the crowd tell us what to do”. In these platforms we need other sophisticated tools to deal with information overload.

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