

A REVIEW OF ONLINE CROWDSOURCING PLATFORMS

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Abstract

Over the years a great number of different websites have emerged that offer crowdsourcing services, which aim at taking advantage of the vast number of anonymous workers globally available to complete tasks. In this paper we review and analyze existing websites providing crowdsourcing services in an attempt to establish a framework that will allow systematic discussion, comparison and assessment of existing crowdsourcing platforms.

JEL Classification: A19, C14, J49, L15

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1. Introduction

The volume of knowledge sharing online via the World Wide Web (WWW) is exponentially increasing. In today's WWW environment, users exchange knowledge and opinions by using discussion fora, social networks, as well as a variety of collaboration support systems. The ubiquity of such WWW and users' large-scale interaction make it possible to characterise these environments as exhibiting "collective intelligence" (*Malone, 2009*), defined as "a universally distributed intelligence, constantly enhanced, coordinated in real time, and resulting in the effective mobilization of skills" (*Levy, 1997*).

While in the abovementioned environments collective intelligence emerges rather implicitly, there are attempts to explicitly harness and exploit such collective intelligence in today's WWW settings. One such example is websites supporting "crowdsourcing", which rely on the motto "Everyone Knows Something" (*Adamic et al. 2008*). Crowdsourcing is the practice of obtaining services, ideas or content needed and solutions to problems in general by soliciting contributions from a large group of people, and, in particular, from an online community, rather than from traditional employees or suppliers (*Zhao, Zhu 2012*). This process is often used to subdivide tedious work or to fund-raise start-up companies and charities, and may also occur offline. Crowdsourcing combines the efforts of numerous self-defined volunteers or part-time workers, where each contributor of their own initiative adds a small portion to the greater result. Practically, during crowdsourcing, a user (called the "requester") requests an amount of work – which can be associated with some form of payment - from an open, undisclosed set of contributors (called "workers"). Workers can browse through existing tasks and complete them for a monetary payment set by the requester who can ask that workers fulfil certain qualifications before engaging in the task at hand. They may also set up a test in order to verify workers' qualifications. Requesters can also accept or reject the 'product' sent by a worker, which reflects on the worker's reputation. Crowdsourcing has proven to be well-suited for accomplishing certain kinds of tasks. (*Mason & Duncan 2009*)

Over the years a great number of different websites have emerged (e.g. Amazon Mechanical Turk, Crowdfunder, Microworkers) that offer crowdsourcing services which focus on specific tasks, which range from general purpose simple chores to research and development assignments. As the number of crowdsourcing websites is today rapidly increasing, research efforts concentrate on examining and analysing this new way of providing labour, while, at the same time, addressing problems that may arise. No attempt has been made so far to group and classify existing crowdsourcing websites in order to discuss and reflect on them in a systematic manner (*Howe 2008*). The overall purpose of our research, recently conducted at the Department of Economics of the University of Patras, is to investigate various economic aspects of this new form of work currently becoming all the more important. As a first step, our

aim is to review and analyse existing websites providing crowdsourcing services in an attempt to establish a framework that will allow systematic discussion, comparison and assessment of existing crowdsourcing platforms. The framework also aims at helping potential requesters in their efforts to choose a suitable platform. Our approach reviews a number of popular crowdsourcing websites and assesses them, drawing qualitative conclusions concerning their aims and purposes. Our approach focuses, in particular, on the scope, the services provided and the quality assurance techniques of existing websites offering crowdsourcing services. When using these results, we aim to outline a framework to serve as a first footing in facilitating discussion on the provision of this new kind of labour (*Bradham 2009*).

2. Motivation and Related Work

In recent years crowdsourcing has attracted the interest of researchers from various fields, who aspire to survey, analyze, comprehend or, even, improve this new form of labour. Research has focused on how platforms offering crowdsourcing services recruit and retain users as workers to enhance their smooth operation (*Doan et al. 2011*). Other research investigates models of workers supplying labour to paid crowdsourcing projects in an attempt to estimate worker's reservation wage (*Horton et al. 2010*). Discussions also revolve around workers' incentives when they participate in crowdsourcing platforms (*Kaufmann & Schulze 2011*), as well as around the relationship workers have with their own performance (*Winter & Duncan 2009*). Moreover, many surveys have been conducted to investigate the demographics of both requesters and workers who interact in the context of crowdsourcing (*Ipeirotis 2010*). The methodology employed by the research reported above includes conducting experiments and surveys by using the services of crowdsourcing platforms such as Amazon Mechanical Turk and Clickworkers (*Paolacci et al. 2010*).

While existing research focuses mainly on examining issues related to workers and requesters, the websites offering crowdsourcing services and their impact on all participants have not received due attention. Mapping services provided and the ways of WWW crowdsourcing may prove beneficial in establishing a framework for systematic discussion, comparison and assessment of such methods. Moreover, it may also facilitate interpreting some of the results reported in relevant literature.

3. Methodology

We selected a number of popular websites offering crowdsourcing services for review. In selecting these websites, we were guided by the following criteria:

- a) Language: All crowdsourcing websites reviewed had to present their services in English. This facilitated the work of assessing services provided and comprehending their use.

- b) Presentation of services provided: Websites had to provide the information required in order to facilitate their review.
- c) Information needed for completing the review had to be offered. Many websites do not disclose all information required and such websites were excluded from our analysis.

Based on the criteria above, 98 websites were selected for analysis. Top websites were selected based on their Alexa ratings on 15/01/2014 (*Alexa, 2014*). The full list of websites reviewed is presented in the Appendix.

3.1 Website criteria

The websites selected were assessed against a number of criteria, which aim to capture various aspects of the services offered. These criteria cover technical as well as operational features of the websites reviewed. Below we present the criteria in greater detail:

- i. *Type of service provided.* Services provided by websites were grouped into the following ten categories (*Shenk, Guittard 2011*)
 - a. Microworks/Simple tasks, which are considered the smallest unit of work in a virtual assembly line, e.g. categorisation, tagging, Web research, transcription, etc.
 - b. Crowdfunding, which is the collection of finance from backers (the crowd) to fund an initiative (project). Crowdfunding has its origins in the concept of crowdsourcing, which is the broader concept of an individual reaching a goal by receiving and leveraging small contributions from many parties. Crowdfunding is the application of this concept to collect funds through small contributions by many parties in order to finance a particular project or venture.
 - c. Mobile crowdsourcing services, which are applications for mobile phones based on the “crowd”.
 - d. Content Generation services, in which content is generated by the crowd. This method is becoming increasingly popular because it offers an alternative to content creation and content curation.
 - e. Data Entry services, which are projects using many different *modi operandi*, e.g. Excel, Word, electronic data processing, typing, coding and clerical assignments.
 - f. High knowledge intensity services, which are specialised services in particular fields, e.g. health, law, insurance, consultancies, data management, market research and cloud applications.
 - g. Program developing services, which focus on having software implemented by the crowd.
 - h. Web and graphic design services, which use the crowd contribution in the creation of artistic projects.

- i. Translation services, which aim at translating content from a source language into a target language.
 - j. Product reviews and testing, in which such tasks are conducted by the crowd
- ii. *Open Call*. This reflects whether the task a requester submits solicits contribution from anyone. (*Brabham 2008*)
 - iii. *Quality & Reliability*. This variable is used to report which techniques the website employs to ensure the quality of results provided by workers. It also includes the techniques the platform provides in order to ensure workers' reliability. (*Wang et al. 2013*)
 - iv. *Provision of APIs (Application Programming Interfaces)*. This investigates whether the platform provides an API or not. In general, APIs allow services provided through the website to be integrated in third-party applications and facilitate interaction with the website to programs rather than only humans. (*Linares-Vásquez et al. 2014*)
 - v. *Country*. Indicates the country of origin the platform is operating in. (*Ross et al. 2010*)
 - vi. *Monetary reward*. Indicates whether the website allows monetary rewards for tasks completed by workers. (*Acar & Ende 2011*)
 - vii. *Free Trial*. Indicates whether the platform provides a demo use of its services or not. (*Chiou et al. 2010*)
 - viii. *Online help*. This variable examines the means a crowdsourcing platform offers in order to help users (both requesters and workers) better understand how the platform works and to engage new users. (*Zhou et al. 2009*)
 - ix. *Case studies*. This variable helps examine whether the platform reports success stories as a proof of the usefulness and trustworthiness of its services. (*Thies et al. 2011*)
 - x. *Job Openings*. This variable examines whether the website is currently offering job openings or not. (*Taylor 2015*)
 - xi. *Social Sites*. This variable reflects the social network profile each platform uses as a tool of marketing. (*Thackeray et al. 2008*)
 - xii. *Task visibility*. This variable indicates whether it is possible for visitors/guests to the platform to see all tasks offered by requestors or not. (*Eickhoff & Vries 2013*)

4. Results

We have reviewed and analysed the 98 crowdsourcing platforms selected on the basis of the factors outlined in the previous section. Each website was visited and both worker and requestor accounts were opened in order to assess the necessary variables. Furthermore, relevant information was also gathered from the presentation of services provided on the websites and from relevant literature research.

We reviewed each of the 98 crowdsourcing platforms selected and have derived some descriptive statistics in order to get an initial high-level view of the current state of the provision of such services. In the next section, we present some findings of this analysis related to the following aspects:

- Distribution of crowdsourcing services in a range of countries
- Distribution of services provided by platforms reviewed
- Quality assurance and reliability techniques currently deployed by crowdsourcing platforms.

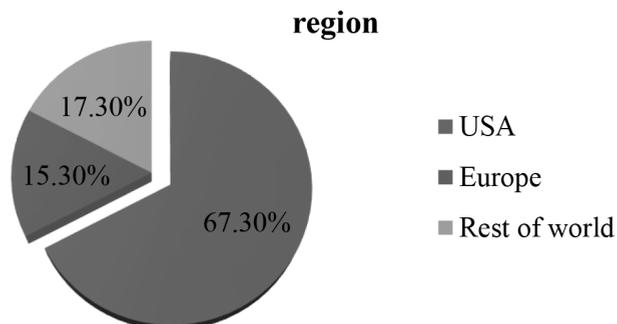
4.1 Country

Table 1 and Figure 1 show the percentage of websites reviewed operating in different geographic regions and specific countries.

Table 1. Percentage of websites reviewed that operate in each country

		Frequency	Percentage
Valid	USA	66	67.3
	Germany	6	6.1
	England	5	5.1
	Canada	2	2.0
	India	1	1.0
	Switzerland	4	4.1
	Australia	2	2.0
	Hong Kong	2	2.0
	Other	10	10.2
	TOTAL	98	100.0

Figure 1. Percentage of websites reviewed in each region



The majority of platforms (6.3%) currently operate in the USA, while the number of websites operating in Europe is lagging behind (15%). Most European sites in operation are located in Germany (6.1%).

4.2 Services provided

This sub-chapter presents the kind of services provided by the websites reviewed (Yang *et al.* 2008). Table 2 summarises findings, showing the percentage of websites for each service category. Below is a simple frequency table indicating how services are distributed depending on the number of platforms providing them.

Table 2. Percentage of each kind of services provided by websites reviewed

	Services Provided									
	mwk	crf	mcw	cntg	dte	hts	pdvp	dsns	trs	rtp
Frequency	27	31	4	11	15	16	9	14	5	10
Percentage (%)	27.6	31.6	4.1	11.2	15.3	16.3	9.2	14.3	5.1	10.2

Note: (mwk=microworks/simple tasks, crf=crowdfunding, mcw=mobile crowdsourcing, cntg=content generation, dte=data entry, hts=high knowledge intensity, pdvp=program developing, dsns= web and graphic design, trs=translation, rtp=product review and testing).

Most top crowdsourcing websites (31.6%) focus on providing crowdfunding services while only a small percentage offers mobile crowdsourcing services (4.1%).

Examining the type of services provided by websites in relation to their geographic location reveals some interesting results. Table 3 presents this information.

Table 3. Percentage of each kind of services provided in each region

	Percent Table (%)									
	mwk	crf	mcw	cntg	dte	hts	pdvp	dsns	trs	rtp
USA	30.3	28.8	4.5	12.1	18.2	18.2	7.6	12.1	4.5	12.1
Europe	26.7	26.7	6.7	20	13.3	26.7	0	6.7	6.7	13.3
Rest of the world	17.6	47.1	0	0	5.9	0	23.5	29.4	5.9	0

Note: (mwk=microworks/simple tasks, crf=crowdfunding, mcw=mobile crowdsourcing, cntg=content generation, dte=data entry, hts=high knowledge intensity, pdvp=program developing, dsns= web and graphic design, trs=translation, rtp=product review and testing).

The results in Table 3 indicate that different regions focus on different services. While in the USA and Europe the prevailing service is supporting microwork (USA 30.3% and Europe 26.7%) followed by crowdfunding services (USA 28.8% and Europe 26.7%), the Rest of the world websites appear to focus their attention on supporting

crowdfunding (47.1%) followed by web & graphic design (29.4%) services. Furthermore, some services are supported only by websites operating in certain geographic areas, as is the case with content generation services (cntg). Content generation services are provided only by sites operating in the USA (12.1%) and Europe (20%), while websites in the rest of the world do not seem to support such activities at all.

In general, crowdsourcing websites do not focus on providing exclusively only one kind of service. Many platforms provide more than one service (30.61% of the total number of platforms reviewed).

4.3 Quality and Reliability

A critical factor of any crowdsourcing platform is the mechanisms in place for ensuring the quality of work provided by workers, particularly when they are operating in an open participation model. We surveyed the sites selected with respect to the mechanisms they implement to ensure the quality of work undertaken.

To this end we enumerated and categorised all existing quality assurance mechanisms, as presented in the table below (Table 4).

Table 4. Categorisation of all existing quality assurance mechanisms

qr1	Not providing any information with respect to quality assurance
qr2	Support for reviews and ratings of jobs carried out by workers
qr3	Workers' Profiles indicating their skills and ratings
qr4	Skill tests and/or practice tests for workers so that the most suitable worker for a task may be selected
qr5	Mechanisms to detect spamming and plagiarism

We assessed each website selected against these five categories. Surveys showed that half of the platforms examined (49 platforms) do not provide any mechanism to assess the quality of workers' jobs. Moreover, when some form of quality assurance is provided, only 4.1% of websites reviewed offer more than one quality and reliability mechanism in order to assess the quality of a worker's results on a task.

Table 5. Percentage of all existing quality assurance mechanisms

	Quality & Reliability				
	qr1	qr2	qr3	qr4	qr5
Frequency	49	20	16	9	17
Percentage (%)	50	20.4	16.3	9.2	17.3

In addition, we also examined the provision of quality assurance mechanisms across geographic regions. While websites operating in the USA offer all five categories of quality control mechanisms, they seem to favour spam and plagiarism detection techniques (Table 6, qr5), as opposed to European websites, which favour workers' profiles. Furthermore, some quality assurance mechanisms can be found only in specific geographic areas, such as Skill tests (qr4), which seem to be popular in the USA and Europe, but do not appear in crowdsourcing platforms operating in other areas.

Table 6. Percentage of all existing quality assurance mechanisms for each region

Percentage Table (%)				
	qr2	qr3	qr4	qr5
USA	37.1	25.7	20	40
Europe	37.5	62.5	25	25
Rest of the world	66.7	33.3	0	16.7

Finally, we examined the provision of quality assurance mechanisms with respect to the services provided by the websites selected. These results are presented in Table 7 and indicate that platforms providing “program development” (pdvp) or “web & graphic design” (dsns) services prefer quality assurance mechanisms in the form of reviews and ratings of the job done (71.4% and 71.4%, respectively). Furthermore, some quality assurance mechanisms are not used in certain service categories. For example, platforms that support “program development” or “web & graphic design” services do not offer Skill tests to assess workers, while platforms that provide translation services do not provide review and rating mechanisms to assess the work of workers.

Table 7. Percentage of all existing quality assurance mechanisms with respect to kind of services

Percentage Table (%)										
	mwk	crf	mcw	cntg	dte	hts	pdvp	dsns	trs	rtp
qr2	42.1	16.7	50	55.6	50	33.3	71.4	71.4	0	33.3
qr3	26.3	33.3	25	22.2	25	66.7	14.3	42.9	33.3	16.7
qr4	31.6	0	50	33.3	41.7	11.1	0	0	33.3	33.3
qr5	47.4	50	50	55.6	58.3	0	28.6	14.3	33.3	50

4.4 Associations of services provided

The review of existing crowdsourcing websites reveals that more than 30% of sites surveyed offer more than one type of service. When investigating how services provided are associated in the context of platforms, the patterns of co-appearances in the set of types of services supported can provide useful insights into how platforms specialise their activities and gain further understanding to support categorisation efforts.

To this end, we analysed the dataset collected using the Apriori algorithm. The Apriori algorithm (*Agrawal & Srikant, 1994*) is a well-known and widely used data mining algorithm for discovering association rules in large datasets. Association rules are implications of the form $X \rightarrow Y$ where X (called the antecedent) and Y (called the consequent) are disjoint sets of attributes indicating that whenever a set of attributes X are present in an observation, then the same observation is highly likely to will also contain Y . An association rule does not imply causality; it simply indicates a highly probable co-occurrence of attribute X and Y sets. Strong rules are based on two metrics, namely the support and the confidence of a rule. Support of the rule $X \rightarrow Y$ is defined as the percentage of observations that contain the attribute set $X \cup Y$, i.e. both attribute sets, while the confidence of a rule is defined as the percentage of observations containing the attribute set in the set of observations containing X and can be perceived as the conditional probability $P(Y|X)$. Desirable thresholds for support and confidence are entered as an input to the Apriori algorithm. Furthermore, among strong association rules, the lift (or interest) of a rule (*Brin et al, 1997*) is a metric to assess a rule's interestingness i.e. how interesting a rule is; this is calculated as the ratio of the rule's confidence to the expected confidence, considering the antecedent and the consequent of the rule independent. The lift of a rule indicates how many times more likely it is that the attributes in the rule would occur together than these attributes occurring separately in the dataset or together at random. A lift value greater than 1.0 implies that the relationship between the antecedent and the consequent in the rule is more significant than would be expected if the two attribute sets were independent. In general, the larger the lift ratio, the more significant the association of the two attribute sets. The Apriori algorithm was applied to websites surveyed examining only variables capturing the type of service provided. The algorithm was executed with a support value of 0.2 (support=0.2) and a confidence of 1. Table 8 shows the association rules discovered that meet the support and confidence threshold with a lift greater than 1, after redundant rules had been pruned.

Table 8. Strong and interesting association rules mined from the websites surveyed. Support, confidence and lift for each rule are presented

No	Association rule	Support	Confidence	Lift
1	{mwk=Yes} => {crf=No}	0.27	1	1.46
2	{crf=Yes} => {mwk=No}	0.31	1	1.38
3	{crf=Yes} => {cntg=No}	0.31	1	1.12
4	{mwk=Yes} => {pdvp=No}	0.27	1	1.10
5	{mwk=Yes} => {hts=No}	0.27	1	1.19
6	{crf=Yes} => {hts=No}	0.31	1	1.19
7	{mwk=Yes} => {dsns=No}	0.27	1	1.16
8	{mwk=Yes} => {trs=No}	0.27	1	1.05
9	{crf=Yes} => {trs=No}	0.31	1	1.05
10	{crf=Yes} => {rtp=No}	0.31	1	1.11
11	{crf=Yes} => {dte=No}	0.31	1	1.18
12	{crf=Yes} => {mcw=No}	0.31	1	1.04
13	{mwk=Yes,cntg=No} => {mcw=No}	0.23	1	1.04
14	{mwk=No,cntg=No,pdvp=No} => {dte=No}	0.57	1	1.18
15	{mwk=No,mcw=No,cntg=No,hts=No,pdvp=No,dsns=No,trs=No,rtp=No} => {crf=Yes}	0.25	1	3.16
16	{crf=No,mcw=No,cntg=No,hts=No,pdvp=No,dsns=No,trs=No,rtp=No} => {mwk=Yes}	0.21	1	3.62

The association rules discovered indicate that, for example, websites that support Microwork ({mwk=yes}) with high probability do not support crowdfunding ({crf=No}) (rule 1). A general pattern that emerges from the association rules in Table 8 is that websites that support microwork and crowdfunding are strongly associated (high lift ratio) with not supporting any other type of service (rules 15 and 16). This indicates that platforms supporting microwork and crowdfunding are highly specialised and focus their efforts only on such activities. Hence, such platforms form a distinct class that differs considerably in focus and range from services provided on other sites.

4.5 Issues Encountered

Some important information of crowdsourcing platforms reviewed online was not readily available, which impacted the extent of this research.

In particular, existing crowdsourcing platforms did not provide quantitative data related to, for example, the total number of workers registered, the average number and volume of tasks completed per worker per day, the completion rate of tasks, etc. In order to gain insights into such aspects, a survey was conducted in the form of a questionnaire, which was sent to all websites reviewed. The questionnaire asked providers to answer questions related to various aspects of their website, such as their workforce, tasks completed and revenue earned. Fewer than 10% of websites surveyed responded to this request and completed the questionnaire. This made it impossible to include such data in the review.

5. Conclusions and Future Work

It is certain that the power of the crowd will drive the future of businesses, because paid crowd work offers remarkable opportunities for improving productivity (*Vukovic 2009*). Moreover, with such labour force arrangements, the global economy can complete complex tasks on demand and at a large scale with no geographic boundaries (*Schneider 2012*).

Research in this field is currently undertaken so as to investigate, understand and facilitate this new form of supplying and demanding labour. In this context, we have presented an initial attempt to review contemporary crowdsourcing websites considering how they offer their services. We reviewed 98 top websites, as ranked by Alexa, which offer crowdsourcing services and have presented descriptive statistics related to their country of operation, the kind of services provided and the mechanisms used to ensure the quality of work performed.

Review results indicate that the majority of websites are located in the US, while Europe and the rest of the world are lagging behind. Most websites provide microwork and crowdfunding services, while other kinds of services are rather under-represented. Moreover, sites offering without supporting any other type of service. Finally, while only half of the sites surveyed offer some form of quality control of work undertaken, only a very small number offers two or more such mechanisms.

The survey presented here is a first attempt at laying down a framework for discussing and analysing the kind of services that are becoming increasingly widespread. Future work includes laying down a conceptual framework for systematic evaluation and assessment of such service providers, as well as for designing some form of taxonomy of such kinds of services. Furthermore, we will also examine issues related to workers' incentives/motivation and issues related to quality control and efficiency (*Kittur et al. 2013*). To this end, we are currently conducting experiments in various environments (controlled laboratory settings, as well as social networking sites, such as Facebook) in order to correlate workers' incentives/motivation and quality of work (*Wang et al. 2011*).

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Appendix

1.	https://www.mturk.com/mturk/
2.	http://www.clickworker.com/
3.	https://microworkers.com
4.	http://www.mykindacrowd.com/
5.	http://www.kickstarter.com/
6.	http://www.indiegogo.com/
7.	https://www.crowdfunder.com/
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