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Analyzing the critical success factors of countries hosting crowdsourcing initiatives

Master's Thesis

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Analyzing The Critical Success Factors Of Countries Hosting Crowdsourcing Activities

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Abstract

Given the imperatives companies have had to live in the early years of the XXI century: economic uncertainty, tight budgets, interconnectivity, optimization of processes and shorter decision periods, crowdsourcing seems to be the answer for this decade's challenge. This new model is defined by the outsourcing process of a company's activities and tasks to the crowd through an open call (Howe 2006).

However the crowdsourcing process is more complex than having a company with a problem finding the right worker to solve it. (Malone, et al., 2010) In this sense, crowdsourcing has been recently discussed as an emergent organizational paradigm (Villarroel et al, 2011a, 2011b), in the context of a globally interconnected economy. Many factors could explain that in a given country more crowdsourcing initiatives are performed than in others.

This thesis focuses on developing a theoretical model exploring how different country-level characteristics explain different levels of crowdsourcing activity. Two key success factors have been identified in nations with a greater amount of crowdsourcing initiatives: (1) the development of the information and communications technology, and (2) the nature and training of the working age population.

This topic is of relevance for managers and academics since it is, to the best of our knowledge, the first empirical measurement studying the core country-characteristics driving the workflows of this emergent organizational model. Crowdsourcing platforms could use this insight to decide on their marketing efforts put into a specific country. The results offer them insight whether the country has the necessary critical factors for crowdsourcing to be effective.

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To my advisor, Professor Andrei Villarroel, who has challenged me to work on this topic and guided me during these past four months, always encouraging me to go further. Without whom I would not have been able to successfully conclude this research.

To my parents and family that have been so supportive throughout this process and have always believed and encouraged me to continue.

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II. Introduction

1. Crowdsourcing

Crowdsourcing emerges as a new paradigm of organization used by companies to reach out to distributed talent in the context of a globally interconnected society (Villarroel et al 2007, 2011a, 2011b). Although the term "crowdsourcing" is relatively new (Howe 2006), and it has only received theoretical attention by management academics in recent years (Geerts, 2009) (Malone, et al., 2010), crowdsourcing initiatives led by companies have over two decades of existence, finding roots in the software industry (von Hippel & von Krog, 2003).

Crowdsourcing offers a new business model that allows companies to gather faster and at a lower cost, the knowledge distributed among the population, specific to each one of us, the knowledge of time and place. (Hayek, 1945) (Schenk & Guittard, 2011)(Villarroel 2008, 2011c; Villarroel & Taylor 2007). (Malone, et al., 2010)

Even though crowdsourcing is emerging recently to the understanding of a wider audience, it has caught the attention of some academics as early as 1998, when Thomas Malone and Robert Laubacher, observed the organizational changes in motion and predicted future consequences (Malone & Laubacher, 1998). The Linux case has highlighted these new flexible organizations that are assembled for the duration of the projects and then are dissolved once the project is finished so workers can then search for future projects to work on. (Malone & Laubacher, 1998) This new model revolutionizes the organizational structure that we are used to: the economy becomes centered in the individual instead of in the company.

The organizational behavior of firms has evolved throughout the centuries, and crowdsourcing is yet another major change in the behavior of firms. The word crowdsourcing derives from the contraction of **Outsourcing**, phenomenon that has been

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observed in our society for the last decades as a result of the cost pressure every company is facing, and **Crowd,** the talented workforce spread throughout the world linked by a network.

The term was already used in the internet, by companies such as Eli Lilly with the platform Innocentive (2001) and Wikipedia (2001), before Jeff Howe introduced what became the mainstream definition in the 2006 issue of Wired Magazine:

"*Crowdsourcing represents the act of a company or an institution taking a function once performed by employees and outsourcing it to an undefined (and generally large) network of people in the form of an open call. The crucial prerequisite is the use of the open call format and the wide network of potential laborers"* (Howe, 2006)

From this definition we put forward three main characteristics of activities involving crowdsourcing:

1) Function that was performed inside the scope of the company;
2) Outsourced to a large and, most of times, undefined crowd
3) Through an open call.

As we known, with the current economic conjecture, companies face the imperative of reducing costs at all expense in order to become more flexible. But unfortunately this is not a recent challenge for companies and the mainstream solution to this challenge has been laying off company workers and hiring outsourcing firms, preferably in locations with low-wages, to perform the work previously done inside the boundaries of the firm. With the technological developments in information and communications technology (ICT), that allow the instant and costless share of information throughout the world, companies and individuals can now outsource some tasks to the crowd, at a much cheaper cost.

One of the perks and the added value of the internet is the wide range of people using it and communicating through it, creating its network.

In this sense, the internet represents a great potential to all of those that want to conduct their business or part of their operations through this vehicle, since in 2011 35% of the world population is using the Internet, which represents a 94% increase versus the total

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number of users in 2006. (ITU, 2011) More than half of these users are from the developing countries (65%), from which 37% are Chinese.

The wide pool of talent available to the crowdsourcing initiatives of companies derives from all these people connected to this network that are willing to work. The total size of the network of people is crucial to the crowdsourcing initiatives, since reaching its critical mass is a key success factor in this organizational model. (Busarovs, 2011)

The crowdsourcing initiatives are, according to Howe, released as an open call to the community. The various examples of crowdsourcing initiatives show that for big projects in which companies or individuals are specifically searching for the best or fastest solution, doing an open call assures a high volume of answers that can be a determinant factor in finding it. As it is the case of all initiatives posted in Innocentive and the Linux case in 1991.

In crowdsourcing there are two agents that are essential to any activity: the work giver company and the contributors. A third agent may appear, so the work giver and the crowd can more easily meet: an intermediary. This intermediary can take different forms: it can be the platform where the other agents meet; it can be a contact center that works as a training facility and provides the infrastructure to the workers that cannot have access to it otherwise.

The cases in which we are focusing in this research are online marketplaces, the perfect example of these new temporary business arrangements, where companies, from now on referred to as work givers, meet the workers for their next projects.

In these platforms, work givers first have to register so then they can post the work they want to see done in the platform: they define the category, duration and remuneration, among other variables and wait for workers to apply for their jobs. Once they receive applications they can evaluate the curriculums of the workers, and the performance metrics made available by the platform and choose who they want to work on their project. Very

much like a real recruiting process that we live nowadays, but faster and with fewer costs. Once the project is assigned to the workers, the work givers can monitor their progress, depending on the tools provided by the platform, and at the end of the project, the work giver reviews the quality of the work and pays the agreed amount. The process can be seen in the chart below:

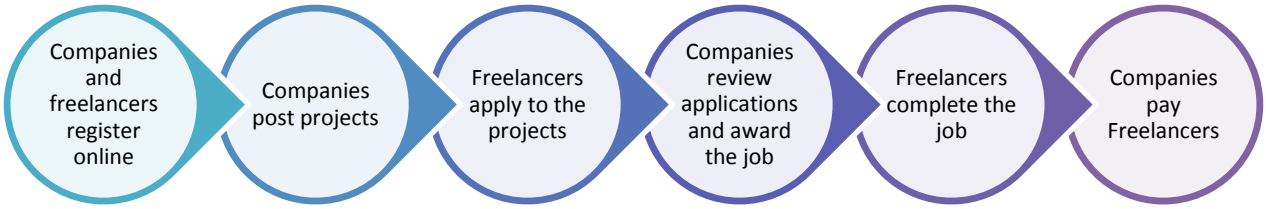

Figure 1: Process of online marketplaces

Online work continues to grow exponentially, despite the economic recession that has been put pressure both on companies and on countries. In 2011 this market reached $1 billion. (Elance, 2011).

As we have seen above, a critical success factor is size of the potential workforce. In order to overcome this challenge companies can take advantage of online marketplace such as Elance, oDesk, Freelancer and People per hour, that provide a meeting point for workers and work givers.

These companies are made up of individual contributors that register in the platform, expecting to be hired for a paid job. They fill in resumes, take tests and wait to be hired.

The greater the talent pool the better, since it represents a much wider group of potential workers, which companies are very interested in, so they can be almost certain that they can find the best candidate to perform the job among the candidates. Knowing that the

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probability of this happening increases with the size of the supply of work, they will always be searching for the platforms with higher number of registered users.

Nevertheless, the number of potential workers isn't the only aspect in the decision-making process of companies; they want to have a reliable monitoring model, where they can follow the progress of the worker, or of the team of workers, as if they were working indoors.

a. What can be crowdsourced and why?

It is also interesting to understand which tasks can be outsourced to the crowd and what have been the most common models used in each type of tasks.

The crowdsourcing tasks can be divided into three types of tasks: simple, routine tasks; creative tasks and complex tasks. (Busarovs, 2011) (Schenk & Guittard, 2011).

Simple tasks include market research, translations, image tagging, word recognitions that can be paid or not, and will reach a large number of participants. The main advantages of this type of task are the low costs of its implementation and the potential reach for participants and the amount of data collected, since it doesn't need specific training or knowledge it can be done by anyone with an internet connection. This type of crowdsourcing is known as *Integrative crowdsourcing*, when the added value of these initiatives comes from the total amount of information gathered (Schenk & Guittard, 2011). In this model, the remuneration is usually low to guarantee the low-cost advantage provided by the solution and because the solutions aren't knowledge intensive.

A crowdsourcing intermediary known as TxtEagle, is a good example of this type of crowdsourcing. TxtEagle offers market research services and translation services in Kenya to big companies from the industrialized world. It service is offered using the population' mobiles and enables answers of short surveys and translation of words or sentences by anyone with a mobile service. This model guarantees a large scale of contributors.

Almost all of us have already completed the other type of simple task in crowdsourcing that will be explained in this next section. When we are registering in a new

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website, there is always a verification process performed to detect whether we are an automatic procedure or not, and so we are asked to type the letters that appear in a small box in our browser, like the one shown below:

Figure 2: Example ReCaptcha

This system is called Captcha, it was invented by Luis von Ahn to avoid spammers in websites. Nevertheless the technology has evolved and now we are talking about ReCaptcha, the user is now asked to type two words, instead of one. What most users don't know is that the first word that all persons can so clearly see in the box, is a word taken from a digitized book, that the computer cannot recognize. Therefore this word is entered into the system and will be appearing to users all over the world, controlling the right answer with the volume of answers received. Nevertheless, this procedure is a somewhat dubious in terms of ethical behavior, since most of times people are unaware of their participation.

More complex activities can involve innovation of new products or services, as well as complex problem solving; therefore the usual remuneration is high. After analyzing the internal resources of the firm, managers can conclude than no one has the specific knowledge needed to solve the problem at hand, therefore they can decide to crowdsource their projects. This process has many advantages since now the company will only pay for completed projects with proven results. Traditionally the companies have employees that may or may not find the best solution and are paid their monthly wage, whereas when the project is crowdsourced the company will pay only for the solution. (Busarovs, 2011) This type of crowdsourcing initiative is known as *Selective crowdsourcing* when a company choses the best solution from a wide range of alternatives (Schenk & Guittard, 2011). Nevertheless this solution is not without risks, as most complex projects require much confidential information that companies must carefully disclose in order not to lose their competitive advantage.

Innocentive is a crowdsourcing platform launched in 2001 by former managers of the Eli Lilly Company, where companies post their most complex problems that the most brilliant "indoor" scientific professionals cannot solve, and companies have little hope to see them

solved. In exchange for a solution, companies pay a high fixed prize to the best solution in a "winner-takes-it-all mechanism" (Schenk & Guittard, 2011), that most of times the prize amount is much smaller than the cost of any solution developed internally. The community of solvers of Innocentive gathers more than 200 000 individuals with different scientific backgrounds, from 170 countries, what may explain the variety and number of solutions submitted. (Lehrer, 2012) Since these projects are so specific and complex it is important to carefully select the crowd working on them, as opposed to the *Integrative crowdsourcing* we are talking about quality of the crowd instead of quantity. (Schenk & Guittard, 2011).

Finally, creative tasks represent a call for innovative and creative solutions by a large pool of participants, the crowd. In this type of crowdsourcing we can find both *integrative* and *selective crowdsourcing*. If the company groups all the ideas generated by the crowd and keeps them all we are talking about the integrative crowdsourcing, if the company is only interested in the best solution we are talking about selective crowdsourcing. One of the most known cases of creative tasks that Jeff Howe talks about in his article in the Wired Magazine, is the case of iStockphoto (Howe, 2006). This is a platform where professionals and amateurs can share their own photos so companies and individuals can purchase them for a few dollars. iStockphoto has revolutionized the photography industry, where professional photographs used to sell their pictures at more than 100$ each. (Howe, 2006). Another aspect that has contributed to the success of iStockphoto is the ability instantaneously share the content to anyone in the network, which is enabled by the internet; people from all over the world can contribute to the photo stock of the platform and can instantaneously be connected with a potential buyer. In this model, the rewards are variable: they can range from as small as a few cents to very high when we are talking about creative projects for big companies like Airbus in creating new business models, for example.

In the table below we can find a short summary of the characteristics of these three types of crowdsourcing activities:

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Type	Activities	Knowledge intensity	Benefits	Reward	Examples
Simple, routine tasks	Market research, translation, image tagging	Low	Scale, low cost	Micro	TxtEagle, Amazon Mechanical Turk
Complex tasks	New product and services development, problem solving	Extremely High	Variety	From micro to dollars reward	Threadless, Innocentive, Netflix contest[1]
Creative tasks	Innovation, new content	High	Variety	From micro to millionaire reward	iStockphoto, "Fly your idea" by Airbus[2]

Table 1: Types and characteristics of crowdsourcing activities

b. Benefits and risks of crowdsourcing initiatives

Crowdsourcing presents many advantages in comparison to traditional organizational models of companies, namely:

[1] Netflix is a DVD rental website that provides users with movies recommendations from previous customers. In 2006 it launched a contest with a 1$million prize for those who could achieve a 10% improvement in their recommendation system. About than 6 months later, a leading team in the contest was able to get a 7% improvement. (Segaran, 2007)(Villarroel & Taylor 2007)

[2] Contest launched by Airbus to all group of students to find the best idea to improve eco-efficiency for the aeronautics industry. (Busarovs, 2011)

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- **market or scale advantage**: as employers and employees no longer need to be in the same geographical location, any person with a problem can be connected with someone with a solution, around the world via internet or mobile telephone connection;
- **quality advantage**: a large range of contributors reflects in a wide range of possible solutions, there are very poor solutions but also very high quality solutions. As it was showed with Wikipedia in a study done by *Nature* magazine, that the quality of the articles published in Wikipedia was similar to the ones published in Britannica long regarded as "the gold standard of human knowledge" (Villarroel, 2011) (Giles, 2005);
- **speed advantage**: since a wide potential for contributors are connected from all over the world the speed at which one can obtain answers is higher than any other kind of collaborations, like in the case of Wikipedia where anyone can edit the content and it has been observed by a study of *Nature* magazine that all errors that were present in Wikipedia' articles were corrected in a short time span (Giles, 2005);
- **cost advantage**: in opposition to traditional work, through crowdsourcing companies or individuals can get the work done for less money as compared to the work performed in traditional companies since they aren't liked to single provider and there is a strong competition among potential service providers that cannot collude when setting the prices leading to perfect competition in setting prices. (Villarroel, 2011)
- **network externalities**: the individual contributions in a crowdsourcing initiative make other contributors want to participate and help build a project together. This is the case in the development of applications for operating systems;

Nevertheless, like in all models crowdsourcing presents some drawbacks:

- **quality issues**: as crowdsourcing initiatives are performed with none or less control from a management team, and most of the times are a result of scattered participations, quality is a very big issue for the industry. Many platforms working in this industry try to overcome this problem with various systems: TxtEagle has many respondents for the same project in order to control the solutions, the chosen one is the one that most of the respondents picked; Wikipedia relies on its community of contributors as the quality management process; Ushaidi also relies on the community of participants to denounce false news.
- **Absence of legal agreement**: in most of the crowdsourcing initiatives no agreement is signed between the two parties of a crowdsourcing project. When there is an agreement, most of the times it offers better protection for the work giver than for the worker, which can cause many abuses in the relationship. (Busarovs, 2011)
- **Manipulation issues**: in contests initiatives, participants can more easily fraud the activity by using the same URL to vote more than once. Additionally in these contests, people with larger networks have an advantage over others that don't.
- **Few contributors**: as we have seen, the number of contributors is a critical success factor for any crowdsourcing initiative. Nevertheless for beginners, it can be a challenge to find the needed amount of contributors to their projects. For these reasons it is intermediate platforms are very important, as they provide a very large pool of talent. (Schenk & Guittard, 2011)

c. Motivational factors in crowdsourcing participation

Intrinsic values such as fun, social commitment, moral, values have mixed influences in the participation in crowdsourcing activities (Villarroel 2008) (Villarroel & Tucci, 2009)

Different types of initiatives many require different type of incentives. (Borst, 2010)

In disaster relief initiatives, such as the big crowdsourcing call in Haiti's earthquake in 2010, people would use blogs and mobile messages to effectively direct the rescue teams to the more distressed areas. In this case, we can see that incentives such as social commitment and values were guiding the population. Another crowdsourcing activity guided by the same incentives is "Blue Servo", an initiative that allows anyone to help

patrolling the United States- Mexican border by looking at live transmitted images of focus points in the border. The participants don't get any monetary incentives, knowing that they are working for a greater good and to help their home nation is enough. (Blue Servo, 2007-2012)

In the development of the Lynux software, many programmers participated in the initiative as for the social recognition by other professionals. Additionally, another very important aspect in the freelancing industry is the referral process, many freelancers state that they the most important factor for finding new clients are word of mouth and referrals (Gandia, 2011), therefore it is very important to create a strong contact network, which can be obtain by participating in various projects. (Schevchuk & Strebkov, 2012)

As in many other professions extrinsic factors such as money are important incentives for crowdlabor participation in initiatives sponsored by firms and individuals (Villarroel 2008) (Villarroel & Tucci, 2009). (Schenk & Guittard, 2011)

2. Research Problem and Managerial relevance

As we have seen, crowdsourcing is present in our everyday lives, even though currently its potential is not yet fully explored by companies and countries' governments. Crowdsourcing as we know it, is a relatively new paradigm that promises to change the way companies, and in a broader sense, society are organized.

Recently, there has been a multiplication of reports and research articles treating crowdsourcing, defining, explaining and illustrating it. There has been none, or few, attempts to understand the flows in the crowd labor industry, in which country the work originates and where it is completed. Unfortunately, due to lack of information from companies, it is not possible to establish such flows. Nevertheless with an in-depth research process and understanding it is possible to see where the work is perform and try to understand which are the country-level characteristics that can be seen as critical factors for attracting crowdsourcing initiatives.

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Analyzing The Critical Success Factors Of Countries Hosting Crowdsourcing Activities

This research strives to understand the characteristics of the countries where crowdsourcing activities are performed that can help predict a high level of participation in crowdsourcing initiatives.

As we will see below, literature suggests that there are two key critical factors in countries hosting crowdsourcing initiatives: People and Technology.

This brings us to our two research questions:

RQ 1: How is the information and communication technology infrastructure related with crowdsourcing activity?

RQ 2: How is human capital related to crowdsourcing levels in different countries?

The findings of the research should be important to governments both in emergent economies where the population has very scarce employment opportunities and cannot easily find jobs that can provide a comfortable living for the workers and their families; as well in the industrialized countries. These governments need to understand what companies giving work through crowdsourcing are looking for in the workers, so they can better prepare them, through training and others, and can also assure that they have the adequate infrastructure to perform the work.

For work giver companies it is relevant to understand which platforms they should choose that have workers in countries with highly developed Human Capital and ICT infrastructure and thus is are more prone to have higher levels of crowdsourcing activity.

For crowdsourcing platforms, it is relevant to understand which characteristics can indicate a country's high potential for crowdsourcing activities, when considering extending their operations to new countries.

III. Literature Review

In this research, we will study the four major online platforms for crowdlabor in annual revenues in 2010 according to the WhichLance report. (Morgan, 2010) After a brief explanation of each platform, a more detailed analysis of their business models is performed to get a better understand of this industry.

Afterwards, a deep analysis of the factors that compose the Human Capital and ICT infrastructure is conducted through a review of the main literature.

1. Online Freelance economy

a. Four Major Players

oDesk, is an online job platform created in 2003 by Odysseas Tsatalos and Stratis Karamanlakis with the aim of being an intermediary between companies with problems and workers. Companies register in the oDesk platform and create their profile, after which they can post jobs and start searching for workers.

The jobs posted can fall into 9 categories: web development, software development, networking and information systems, writing and translation, administrative support, design and multimedia, customer service, sales & marketing and business services. oDesk states that all work that can be done remotely can be done in oDesk. As we can see, the types of jobs performed are not only IT related, but also administrative work, creative tasks and strategic tasks such as marketing and consulting.

In 2010, according to WhichLance the company billed 115 million dollars for that year. In the graph below we can see the evolution of the billings and number of workers of this platform.

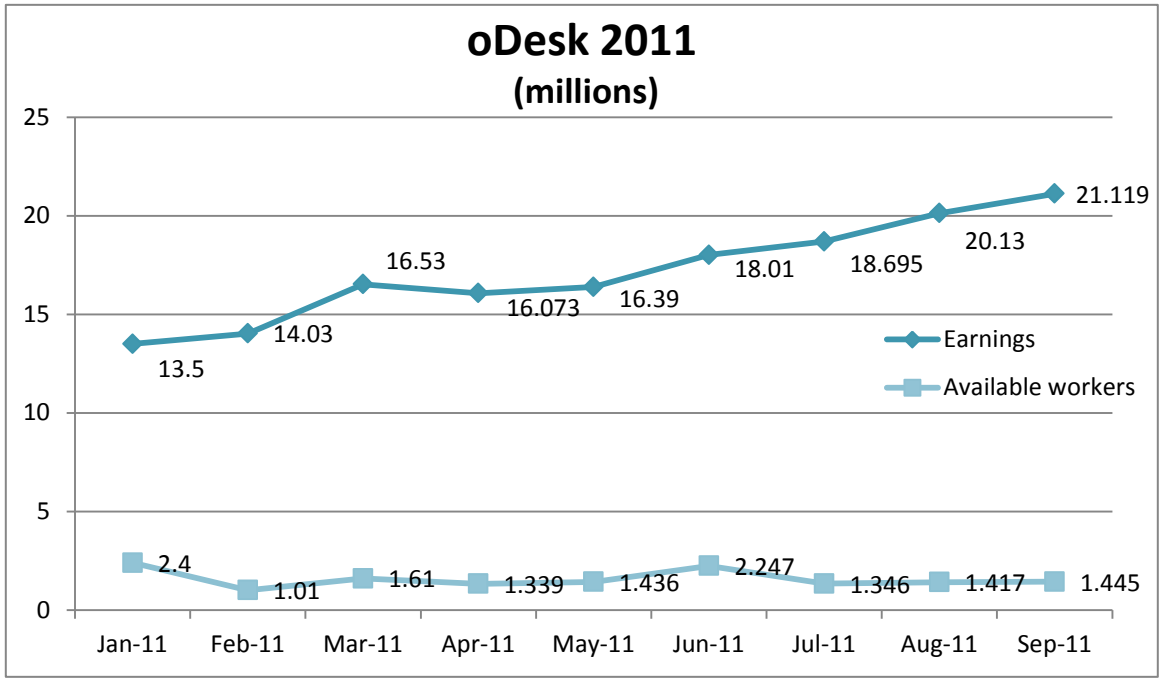

Figure 3 oDesk billings and workforce[3]

Elance is another, privately-held, major online crowdlabor marketplace, the oldest one created, short after the article from Thomas Malone and Robert Laubacher in 1998 about the "Dawn of the E-Lance economy". Over the years the platform has built its reputation, along with the number of workers, usually referred to as contractors. It is very similar to the other online platforms: the clients post jobs, carefully specifying the needed details and receive bids from independent candidate workers and from which they need to choose from.

The platform earned more than $560 million since its starting date, back in 1999, from which $156 million were earned in 2011, which clearly shows the recent exponential growth in the earnings. (Elance, 2011)

[3] https://www.odesk.com/oconomy/report/

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The number of active contractors clients reached 550 000 completing 650 000 jobs for 130 000 contractors. In the first quarter of 2012, the number of projects posted reached 193 000 with 80 000 new clients, 180 000 new contractors and $43 million[4] earn by contractors, which have been growing at a compounded annual growth rate of 42%

Over the last year, the split of earnings by category as been stable with IT being the category with most dollars paid, followed by Creative, Marketing and Operations. The most demanded skill is creativity (42%) of total jobs, followed by IT (39%), Marketing (9%) and Operations (7%).In the last year, the total number of registered contractors has outgrown the number of registered clients. The top 4 hiring countries in the first quarter of the year are all English speaking countries in the developed world. The countries with most contractors are mostly located in developing countries.

Below we can see the evolution of billings and number of workers of Elance:

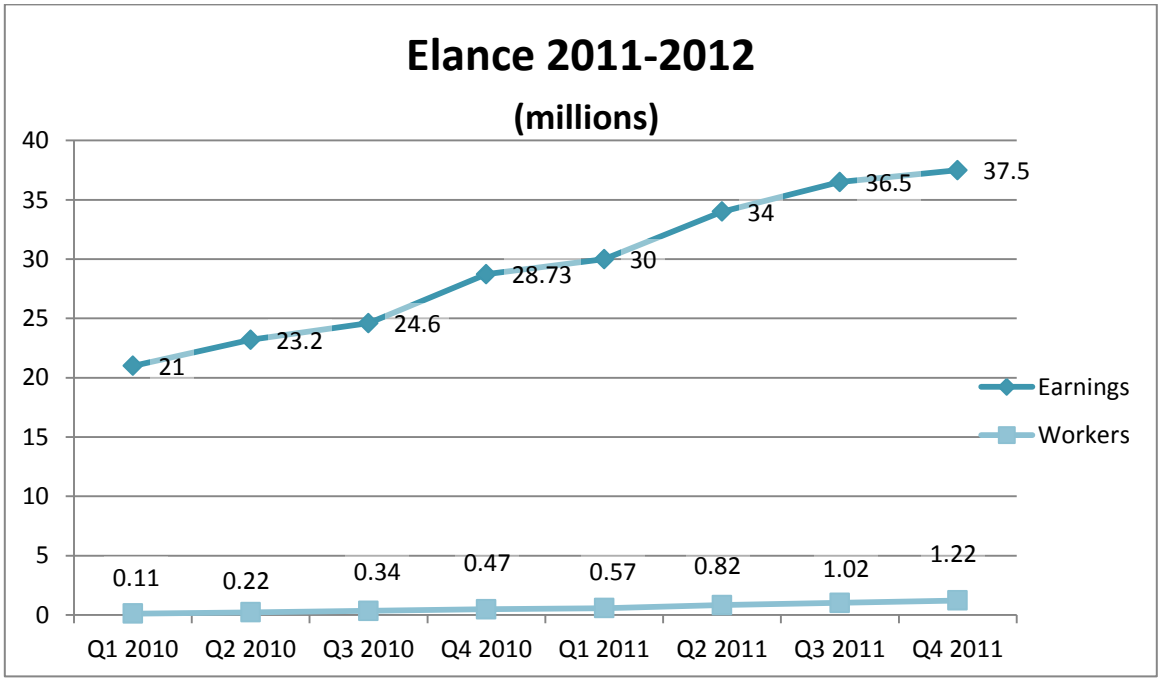

Figure 4: Elance: billings and workforce[5]

Freelancer is the third platform studied, an online marketplace focused on solutions for small companies and entrepreneurs that cannot pay thousands of dollars per project but

[4] https://www.elance.com/q/online-employment-report
[5] https://www.elance.com/q/online-employment-report

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are still interested in crowdsourcing projects. This platform was created in 2009 as the results of a merger from various online freelancing platforms: GetAFreelancer, Freelancer.co.ok among other in Australia. The platform has over 3 million registered workers than can bid for one of the over 1, 3 million jobs posted. Is operates very much like the platforms previously seen: companies or entrepreneurs post jobs and receive bids from potential workers. Each one of these projects can fall into one of the following categories: Website, IT and Software, Mobile Phones and Computing, Writing and Content, Design, Media and Architecture, Data entry, Sales and Marketing, among others.

This website differs from the ones we have seen by focusing in a niche market: small size projects which average cost is less than 200$. Additionally it tries to overcome the initial mistrust of this new business solution: not knowing your team, not being able to meet with the workers performing your job, which inevitably leads distrust in the possible final result. In order to try to solve this issue, Freelancer clearly explains the main flows involved in the projects and assures that no money is paid to the workers unless the client is fully satisfied with the final outcome. Even though this model doesn't result in higher sales than the two previous platform it definitely increases the number of work givers that work with the platform.

Moreover this platform has different country websites and in the future it is expected that the platform will be translated into several languages to reach a broader audience. This strategy makes Freelancer the platform with the larger freelancers 'community.

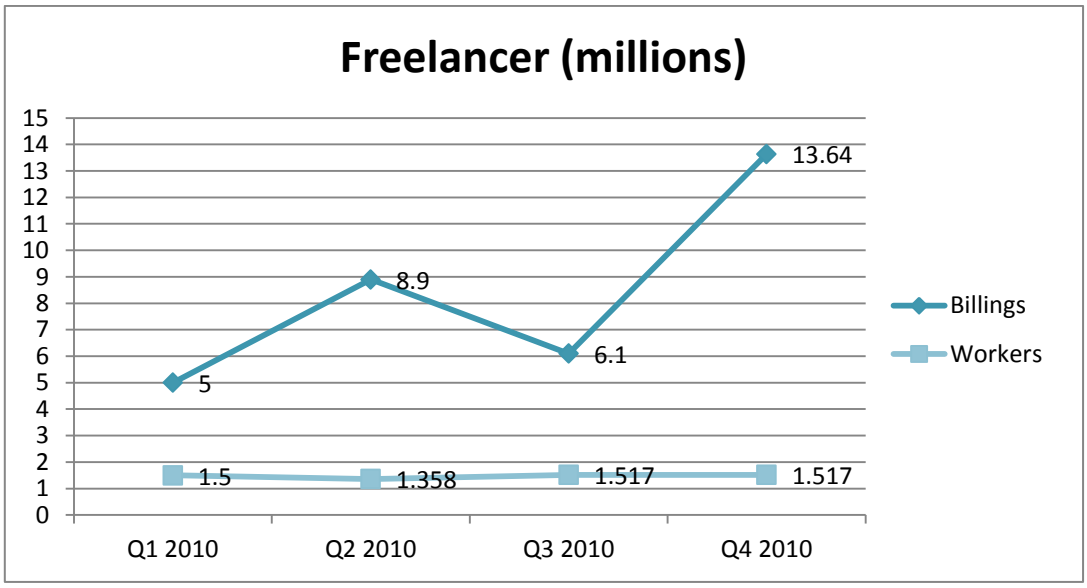

Figure 5: Freelancer billings and workforce

PeoplePerHour is another online marketplace where freelancers and companies can meet to undertake projects, founded in 2006 by a Greek entrepreneur Xenios Thrasyvoulou. Similarly to Freelancer this platform also focus in small businesses, 70% of the clients have less than 4 employees. In 2012, the website has nearly 206 500 workers from 150 countries and 76 500 clients mainly from United Kingdom, United States and India. The clients who post jobs in this platform are mainly from the information and technology sector but also from very diverse sectors such as Media and Retail.

Below we can see the billings and the number of workers of PeoplePerHour:

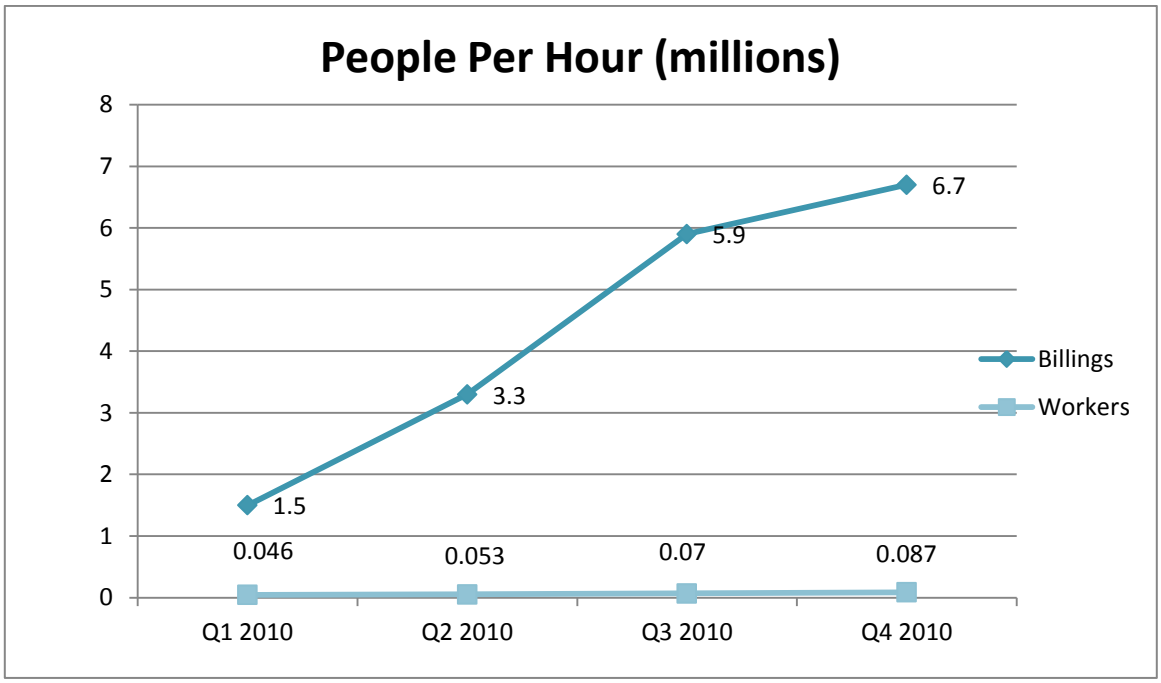

Figure 6: PeoplePerHour billings and workforce

In the table below we can see the main components of each company's business model, knowing that in some cases the characteristics are common to all four companies, especially those linked with the market.

Table 2: Business models of the four major players in crowdlabor

	ELANCE	ODESK	FREELANCER	PEOPLE PER HOUR
Value Proposition	Virtual platform where work givers and workers can meet and work together. It allows cost reduction, time gain and the ability to tap a much wider market. It allows the facilitation of the control of remote work.			
Revenue Model (% billings)	6,75% > $10 000 8,75% < $10 000	10%	$3 or 3% for employers	4,5%-10%

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			$3-$5 or 3%-10% for workers	
Market opportunity	According to the Elance, the Online Employment Industry is a $1 billion industry and with double digit growth.			
Competitive environment	We have presented here the four major players in the online freelancing industry. Nevertheless it is believed to be over 110 similar but smaller platforms			
Competitive advantage	Reliable progress tracking method Availability of complementary applications	Reliable progress tracking method Number of workers	Low average price per project and no need to make an up-front payment High number of workers	Low average price per project
Market Strategy	Building a large workforce and strong relations with big companies		Focus on niche market: small companies	For small companies based in UK and US
Management Team	Thomas Layton, Executive chairman, former consultant at Boston Consulting	Fabio Rosati, Former Capgemini consultant and CEO of Italian subsidiary	Matt Barrie, CEO, founder of high technology companies, specialist in rasing venture capital	Xenios Thrasyvoulou, founder

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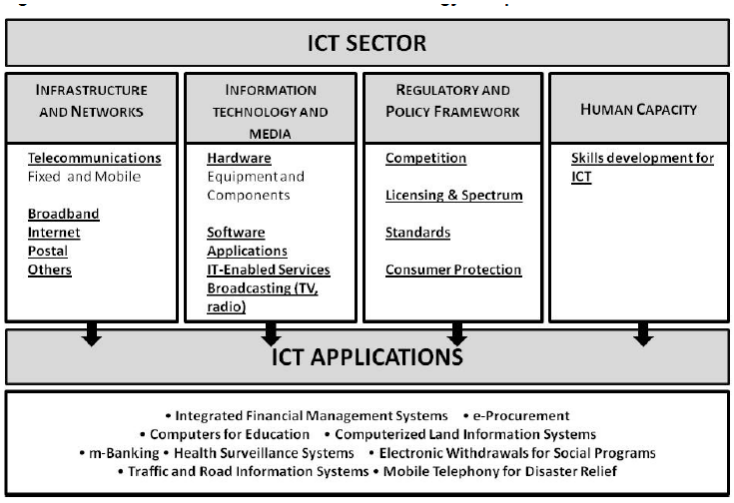
Group, former CEO of Open Table and of Metaweb		(over $40M)

2. ICT infrastructure a critical success tool for crowdsourcing

The World Bank defines the ICT infrastructure as all the supporting tools for communications such as fixed telecommunications as well as the internet, as shown in the table below.



Sources: World Bank ICT Strategy (World Bank 2002), IEG.

Figure 7: ICT Scope and definition (Independent Evaluation Group, 2011)

In the case of crowdsourcing, ICT is more than a tool for product information and an enhancer of productivity; it is the backbone of this industry, it is the network that enables companies and individuals to tap a pool of talent worldwide.

a. Internet infrastructure and usage

Information and Communications Technology has enabled sharing real time information across countries and continents, which allow connecting people all over the world in order to establish business ties, among others. (Malone & Laubacher, 1998). It is the ICT

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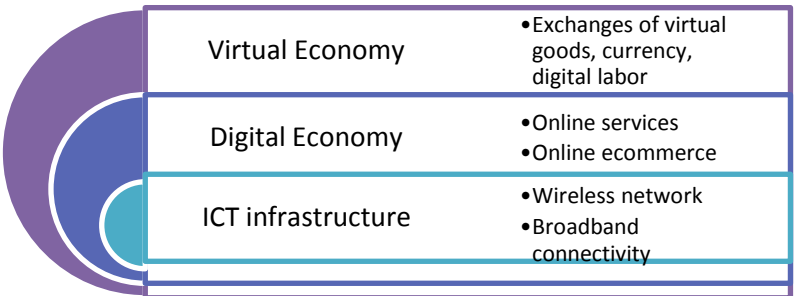

Figure 8: Three -layer model of the ICT and digital economy

infrastructure that provides the supporting structure for the Virtual Economy of crowdlabor since it offers the meeting point for workers and clients (Lehdonvirta & Ernkvist, 2011).

Crowdsourcing implies tapping into a wide crowd of available and willing to work workforce. In the definition provided by the Smartsheet' Report "Paid Crowdsourcing" crowdsourcing is as the "act of outsourcing paid work (…) using a technology intermediary" (Smartsheet, 2009), where the technology intermediary can be a hub or a mobile phone that ultimately connects workers or intermediaries to work givers through an internet connection. Therefore all that is needed is that workers are connected to the network regardless of their location (Howe, 2006).

In emergent countries, the crowdsourcing initiatives assume many forms. Since the internet infrastructure isn't as developed as in industrialized countries, the population and companies have to understand what the best structures to overcome the digital gap are. Whether the crowdsourcing initiatives are done through an intermediary and a contact center, where the worker has access to training and to an internet connection; or whether they are done in an internet café, the population' access to these activities is limited by the "digital infrastructure" of the country and more explicitly to their city or village. (Lehdonvirta, 2012).

Samasource, one of the most well-known crowdsourcing intermediaries operating in the emerging countries, clearly states that it enables people leaving in poverty with work opportunities "via the Internet" (Samasource, 2011).

Another example of how the internet is the supporting tool for crowdsourcing activities is the Ushaidi tool. Ushaidi is a website created in 2008 which relies on crowdsourcing inputs to help bring disaster relief to populations and to denounce situations where human rights are violated. It started in 2007 in Kenya, during an election where the authorities were controlling the media and the founder, Ory Okolloh, called for independent, truthful

information about the violent outburst across the country that were posted through its blog. The initiative was a success and it allowed the author of the blog to map the conflicts in the country in a much more reliable way than the available media in the country. (Okolloh, 2009).

Therefore understanding the ICT access and usage in the countries where crowdsourcing is performed is to understand their ICT readiness. (Shwab, 2011-2012)

This presents a very high opportunity for companies and for the freelancers spread all over the world since 90% of the world population has 2G coverage, 45% has 3G coverage in 2011 and the prices of fixed broadband connections have decreased by 50% in the last two years (ITU, 2011).

H1: Internet infrastructure is positively associated with the amount of crowdsourcing activity.

3. Human capital as a key success factor of crowdsourcing

a. Brain Drain and economic development

The outflow of talented professionals from emerging countries to wealthier nations, also known as "Brain Drain", has long been seen as a cause of further impoverishment of the less developed countries. Among economists and even in the public opinion, brain drain is seen as a phenomenon that must be stopped, mostly with the direct intervention of the government (Hale, 2007). This migration of talented professionals was due to the restricted opportunities that they would find in their home country, in terms of quantity and quality. With the advancements of technology and the decrease in transportation costs it is now possible, and has been for the past few years, for professionals to collaborate across long distances in real time. Recently, academics have been studying the long term effects of Brain Drain enabled by these effects. Even if, at first we can talk about an outflow of highly-skilled professionals, it has been observed that they tend to come back and/or establish strong economic relationships with their home countries, what can be characterized as "Brain circulation" (Saxenian, 2011) (Hale, 2007) (Massey, et al., 1993).

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A study from 2007 conducted by the Duke University has concluded that 25.3% of companies US based in the technology and engineering industries were created by foreign-born entrepreneurs, among which Hotmail, Yahoo and Webex.

These entrepreneurs that have left their country in search for better professional opportunities can re-establish their connections with their home countries through two processes: they can continue working in the foreign countries but use their connections and language knowledge to outsource some activities to their country and take advantage of lower-wages; or they can return to their home country to start their own companies while still maintaining the partners and customers in wealthier economies where they came from.

In the first case, these professionals have the "cultural and linguistic know-how (Saxenian, 2011)" to overcome cultural barriers and establish the efficient relations between the two countries. In the second case, they import the knowledge and the technologies into their home countries which make them in the best position to identify and will, directly or indirectly, influence the public policies (Saxenian, 2011) of their countries.

In both cases their influence in local and regional economies fosters the development of entrepreneurial initiatives and boost local and regional economic growth.

With the brain circulation, we can see that both countries are winning, and that the unbalance that once raised so much critics to brain drain, is now a two-flow process. (Hale, 2007)

Nevertheless these models can only work if the nations have invested significantly in education and technology and if there is political stability, so the country would be attractive enough so professionals would consider returning again.

H2a: Brain-drain predicts the level of crowdsourcing activity

b. Local training as a critical factor for crowdsourcing development

In every crowdsourcing activity, workers are asked to perform a given task. The more complex the task, the higher the monetary compensation paid by companies. Therefore

when studying the ability for crowdsourcing to provide economic growth, as it has been doing, we must focus on the types of tasks that can provide higher pay, the more complex ones.

One of the many advantages of crowdsourcing is the ability to provide human and economic development in areas that are isolated or unattractive to economic activity (Nyoro, 2011). Less wealthy countries that are interested in attracting crowdsourcing initiatives, mostly in form of BPO services, are interested in developing "higher-value services", like the ones performed by contact centers, which need more skilled professionals and more educated, as opposed to micro-work employees. (Nyoro, 2011).

Moreover, the speed at which our environment changes makes it crucial to foster highly-educated professionals so they can follow the fast pace of changes. (Shwab, 2011-2012) Countries, like Kenya and South Africa, have been investing in training programs to prepare the population to BPO high-value services, such as voice, and are willing to spend up to $3 450 in 10-months training programs (Nyoro, 2011). It is important to note that ensuring high levels of education doesn't exclude the need for continuous training, especially when dealing with Information and Communication Technologies that are subject to constant improvements (Shwab, 2011-2012).

As seen above, quality and risk level are the main issues in the crowdsourcing industry; it is addressed by all companies working in this industry and most of the related papers. Education levels are a solution for both problems; if the workforce is more educated it with certainly perform better in the tasks performed than workers with less education, thus increasing the quality of the work performed. Following the same reasoning, if the levels of quality are increased then the levels of risk perceived by the work givers decreases. (Nyoro, 2011). "Training capabilities (…) may be a future selling point" (Nyoro, 2011).

H2b: The availability and extent of local training in a given country is a good predictor of the crowdsourcing levels

In light of these two sub- hypotheses we can build the overall hypothesis combining both the training and the brain drain into what we may call the Intellectual Human Capital:

H2: Availability of human capital is associated with higher levels of crowdsourcing activity.

As we have seen through the analysis of the theoretical literature we have two main factors affecting crowdsourcing: Intellectual Human Capital and ICT infrastructure. On one hand, Intellectual human capital can be explained by the presence of brain drain flows in a given country that allows the circulation of knowledge among the population and other knowledge centers; and the availability of local training services to make sure the population has the tools to promptly answer the challenges of their environment.

These relations are explained in the graph below, with indication of the concern literature:

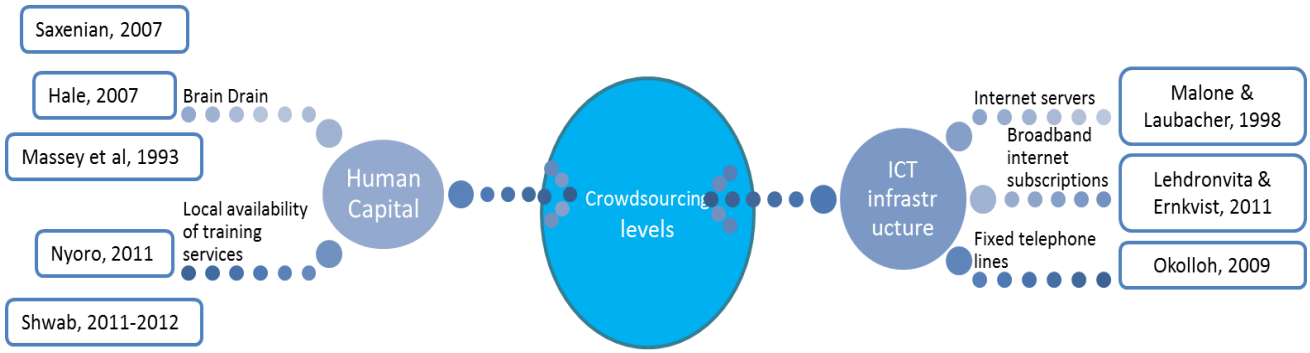

Figure 9: Conceptual model for crowdsourcing activity

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IV. Method and Data

We collected data to measure the conceptual constructs described in our theoretical model (Fig. 9). A statistical analysis was then performed using Structural Equations Modeling (SPSS AMOS version 20).

1. Methodology

The crowdsourcing level was estimated using the information available in the Alexa website about the number of visitors per year in each of the four major platforms studied above. Alexa is an Amazon's subsidiary that provides traffic information for virtually all websites. Here we have access to information about the audience of each studied website namely the country of origin of visitors and the number of unique visitors per day. As the Alexa website provides us with percentages of the total visits for each country, this information was then multiplied by the number of unique page viewers per day, computed by Alexa as a three month average. This way we had the total number of visitors per day from each country. Then we multiplied it by 365 days in order to have the global scenario for one year of visits. After this analysis we had a set of 43 countries with crowdsourcing activity in the last year.[6]

To make sure that the number of visitors per country per year computed with the methodology above can be a good proxy for the total earnings from the platforms for each country, we correlated the number of visitors per country obtained only for the Elance platform, with the total earnings per country available in the Elance website.

Note that Elance is the only company that fully discloses the total earnings billed in the top 43 contractors' home countries, therefore it was only possible to computed the correlation between the variables for this platform. The total earnings made by each country provided by this platform weren't used as it would provide us a very narrow perspective in two aspects: the small number of countries and being restricted to one platform.

[6] Alexa website access on 19/05/2012

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For this purpose we ran a correlation between the following variables: total number of visitors per country for the Elance website and the total earnings of Elance platform per country. The correlation coefficient was 0,95 which is very near 1, situation where the two variables would be identical; as well as statistically significant as we can see below:

Correlations

		total earnings	total visitors per year
total earnings	Pearson Correlation	1	,950**
	Sig. (2-tailed)		,000
	N	17	17
total visitor per year	Pearson Correlation	,950**	1
	Sig. (2-tailed)	,000	
	N	17	30

**. Correlation is significant at the 0.01 level (2-tailed).

Table 3: Correlation matrix between number of visitors and total earning of the Elance platform

Therefore it is safe to assume that the number of total earnings in a given country can be well represented by the number of visits per year from that same country

After proceeding to the same calculations for each one of the three other platforms we added up these numbers as to obtain the total number of visitors to crowdsourcing platforms per country, which is what we will now assume as the crowdsourcing activity level. This determines the set of "crowsourcing countries".

Then, we matched the crowdsourcing countries set to the country characteristics gathered for this study.

Finally, the conceptual model created based on the literature was further analyzed using structural equations modeling. In this statistical model we assess causal relations between qualitative hypotheses and observed values. Therefore, after determining the theoretical hypotheses, we needed to confirm if such relations were definite.

As it was seen in the conceptual model, there are two main factors that are believed to explain the level of crowdsourcing in each country: ICT infrastructure and Intellectual Human Capital. In the structural equation model these factors are defined as the latent

variables which the influence the crowdsourcing activity in countries will be studied. The reason why these variables are determined as latent variables is because they cannot measured, they can only inferred by the observed variables that compose them.

In the Computing Infrastructure variable, we have the information concerning the information and communication technology infrastructure for each country. As the platforms that were studied function only through the internet, it was important to capture all the internet connections: fixed broadband connections, fixed telephone connections, as some countries still have dial-up internet connections, and the number of secure servers.

As in the conceptual model, the Intellectual Human Capital variable is explained by the following variables: brain drain and availability of training.

Additionally two other variables were introduced to capture the nature of the workers performing crowdsourcing: the total number of Facebook users and the number of unemployed in each given country. Each one of these variables aims at understanding if a country with higher number of unemployed workers has more crowdsourcing activity and similarly if a country with more Facebook users has more crowdsourcing activity.

In light of the newly introduced number of unemployed workers it makes sense to make a conceptual split between regular Human Capital and Intellectual Human Capital, where the first one controls for the nature of the active population in the countries and receives as input the number of unemployed workers.

The Facebook users introduce the control variable in the model, which allows us to understand if there is some migration between users of crowdlabor platforms and users of Facebook.

The SEM model is presented below:

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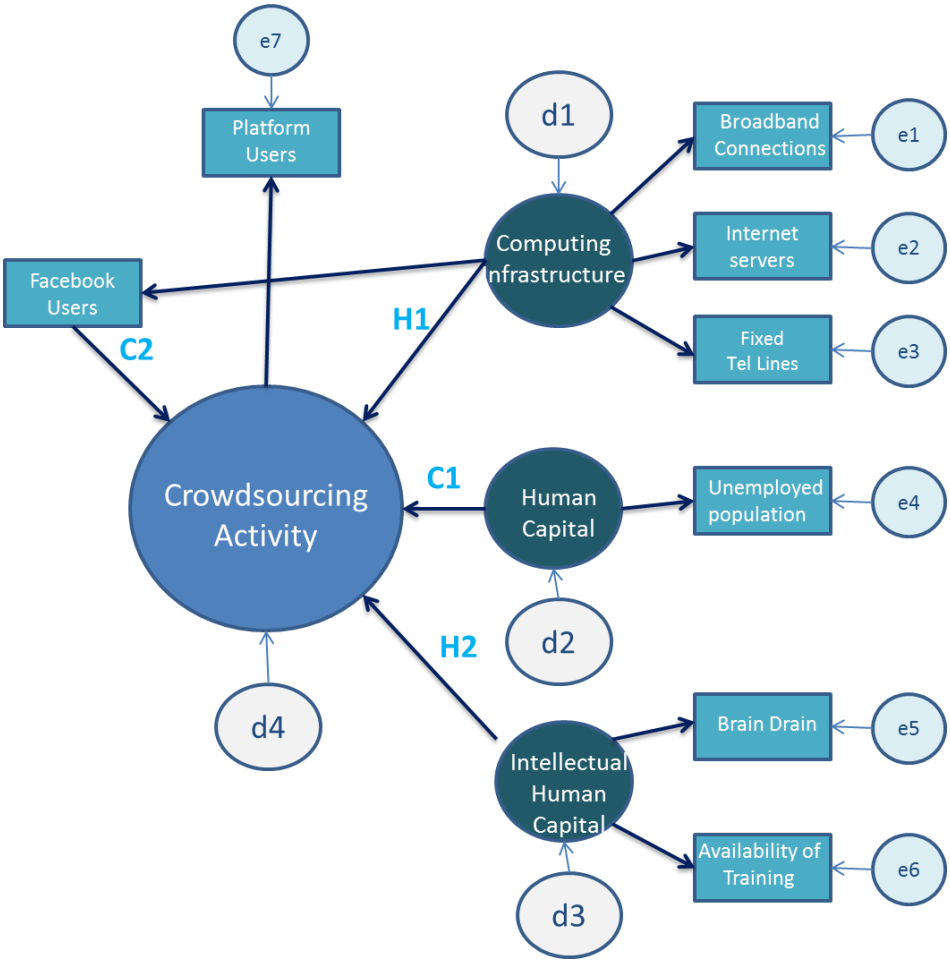

Figure 10: Crowdsourcing activity explanatory model

In order to eliminate any country that would have a missing value in any of the variables of the country characteristics we had to cross the information for the various databases of the country characteristics, since it may cause many problems for running the Structural Equation model. The most restricting database was the one in the Global Competitiveness Report that studies 142 countries, which after we exclude those that have missing that in any of the other variables, we were down to 113 countries.

After having the database ready we ran the model three different with three different subsets of data.

The first model (Model 1) was run with the information for the 113 countries, with all the variables explained above. The level of crowdsourcing activity in the countries where there is no crowdsourcing is equal to 0 in the model.

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After running this model, we wanted to understand if some estimates change their weight or their statistical significance if we would limit the database only to countries with crowdsourcing activity (Model 2) and then, only to industrialized countries with crowdsourcing activities (Model 3).

2. Variables description

The model shown above, aims to explain the crowdsourcing activity through eight observed variables:

- Platform users: number of platform users is the total amount of visitors from a given country to the four platforms per year
- Number of Broadband connections: is the number of fixed broadband connections available in a given country
- Number of internet servers: is the number of secured internet servers that use encryption technology in all transactions over the internet.
- Number of Fixed Telephony subscriptions: is the total number of fixed telephone subscriptions per country
- Number of unemployed workers: Unemployed population per country
- Brain drain is measured by a qualitative assessment made by the Global Competitiveness Report in a scale from 1- 7. Where 1 is when the best and brightest leave to pursue opportunities in other countries to 7: there are many opportunities for talented people within the country,
- Availability of training: measures the availability of specialized research and training services with a qualitative method in the Global Competitiveness Report in a scale from 1-7. In this context 1 is when they are not available at all and 7-when they are widely available.
- Facebook users: number of Facebook users per country according to the Social Bakers website that provides traffic statistics on the major websites. (SocialBakers, 2012)

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- The Computing infrastructure which is a latent variable in the Structural Equation Model, which reflects the ICT infrastructure in a given country.
- The Human Capital variable is explain by the unemployed population in each country
- The Intellectual Human Capital which is the final latent variable in this model which is composed by the variables representing intellectual capabilities of the population.

3. Data collection description

In this study we have considered two levels of analysis:

- The country-level analysis, where we gathered characteristics of a selected number of countries;
- The crowdsourcing level analysis that was collected through the Alexa website on the four main platforms explained above.

Firstly it was essential to determine each country's level of crowdsourcing activity: it is the sum of number of yearly visitors to each platform from each country. This information was collected from the Alexa website in the 19/05/2012

The variables measuring country characteristics were collected from the World Bank Database, the International Telecommunications Union, the CIA Factbook and from the Global Competitiveness Report 2011-2012 elaborated by the World Economic Forum.

The World Bank is a financial and pro-development institution focused on the poorest countries. It loans money and provides country assistance to help reduce poverty in these countries. In its website the World Bank has available a large database for over 331 indicators from the World Development Indicators (economic, demographic, infrastructures,…) about countries worldwide. Data available in the World Bank' database is collected through internationally recognized sources for each country, whenever it is possible. Data for the purpose of this research has been collected between March and May 2012.

The Central Intelligence Agency of the United States of America issues a yearly World Factbook with economic, demographic, governmental information about 267 countries and other entities. The data is prepared to be used by national institutions, among which the

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American government, which is a good indicator of its reliability. Since 2010, the World Factbook has updated its data weekly.

The World Competitiveness Report is a publication of the World Economic Forum that studies the competitiveness of nations in their ability to provide high standards of living to their citizens. It analysis both the macro and the micro-economic environment of countries and sums up all the 13 pillars studied into one competitiveness index. Data was collected from the 2011-2012 report that contains data that refers to 2010 for most indicators.

The International Telecommunications Union makes comprehensive studies about the ICT infrastructure status all over the world, that then are combined in several reports.

V. Results

1. Model 1: All countries

As we have seen above, the structural equation model was run a first time for the data set containing 113 countries, the largest sample we could obtain.

The results obtain are shown below:

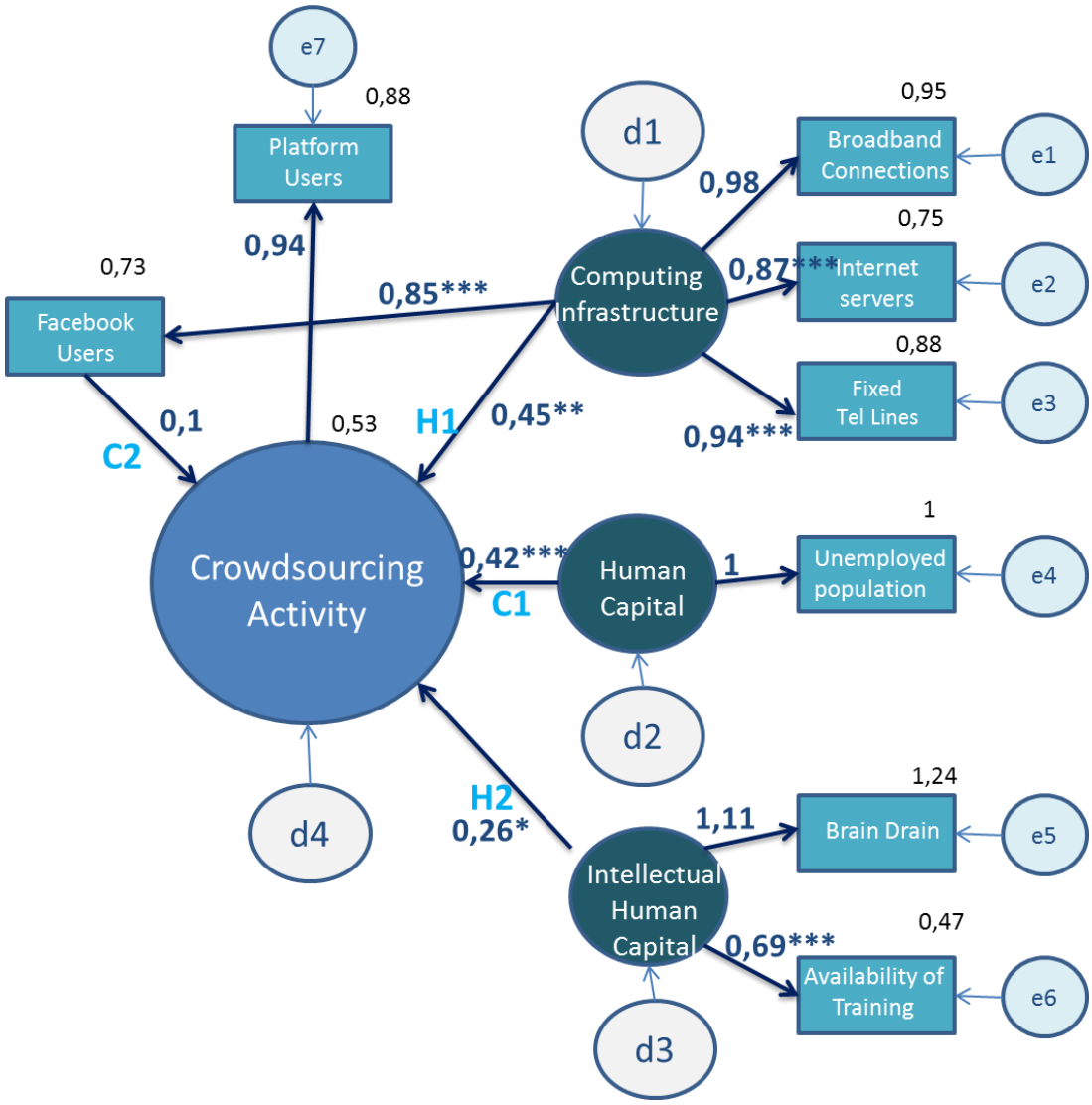

Figure 11: Standardized estimates for model with all the countries (N = 113)

Model	Chi-Square	Degrees of freedom	Chi-square/ DF	P	CFI	RMSEA
All countries	273,5	18	15,2	0,000	0,725	0,356

Table 4: Model Fit for model with all the countries

In order to assess the goodness of the model, we will look at two tests: the test of absolute fit with the Chi-square test; and the test of relative fit with the Comparative Fit Index (CFI) and the Root Mean Square of Error of Approximation (RMSEA).

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The Chi-square test measures whether the difference between the expected and the observed frequencies in one or more categories is significant. The null hypothesis for this test states that the differences between the expected and observed frequencies are not significant. In this situation we can see that the test is smaller than 0,05 (p=0,000) so we have to reject the null hypothesis, thus concluding that it is not possible to determine whether the deviations in the model are just a result of chance. Nevertheless, this test is very sensitive to the sample size, so we will now analyze the relative fit of the model, arguing that the model could outperform the independent mode, where all relationships between the observed variables are zero.

For this purpose we will analyze the Comparative Fit Index that is comparing the absolute fit of the model to the absolute fit of the baseline model (independence model). We would expect that the CFI would be greater than 0,9, meaning that the there is a significant difference between the overall fit of both models. In this model, we can see that the CFI is only 0,725 which isn't very high and could indicate that the average correlation between the variables is not very high.

The Root Mean Square Error of Approximation is this model is 0,356 but it had to be lower than 0,06 (Hu & Bentler, 1998) to be significant. However, we must be aware that the RMSEA tends to over discard the hypothesis when the sample size is smaller than 250 observations, as it is the case for this model.

Even though the indexes studied above show us that the model created does not fit exactly the observations in the database, we can observe that some most regression coefficients are statistically significant.

We can see that the three hypotheses are supported by the model, all with a high degree of significance:

H1: the computing infrastructure greatly affects the crowdsourcing activity, its standardized regression weight is 0,45 and it is statistically significant (p=0,002);

H2: the intellectual aspect if the Human Capital is still supported by the model, at a 0,02 significance level, with a standardized estimate of 0,26.

C1: the human capital is also highly correlated with the levels of crowdsourcing activity; its standardized estimate is 0,42 and statistically significant at a 0,00 level;

C2:The effect of the number of Facebook users in the level of crowdsourcing activity isn't supported by the model.

The latent variables explain 53% of the variance of the crowdsourcing activity.

As the statistical model has shown, the level of crowdsourcing activity in each given country the internet infrastructure in a given country is a good predictor of the level of crowdsourcing activity that can be performer in that country. As Lehdonvirta and Ernkvist pointed out in the Digital Economy report, the infrastructure made of the ICT technologies is the basis for the Virtual Economy (Lehdonvirta & Ernkvist, 2011). Especially when we are considering crowdlabor performed over the Internet it is essential to have a good internet infrastructure that would allow the worker of these platforms to easily access the websites. When looking more carefully at the variables that constitute this latent construct, we have the number of fixed broadband connections and the number of fixed telephone lines. As we have seen both indicators are a good estimate of the internet connections that may be available in a given country, because even though we would think about dial-up internet as a process that isn't used in over a decade in most industrialized countries, some emergent economies still have this as their only technology to connect to the internet. Therefore accessing the level of accessibility to internet connections is determining the level of accessibility of the people working in crowlabor platforms to their work place, which seems to be one of the most critical factors when performing a job: if you cannot access your workplace you cannot work. Additionally, as we have seen with the Ushaidi example, internet connections are determinant not only in defining the access of a worker to its workstation, but also it the network in which crowdsourcing activities take place. (Malone & Laubacher, 1998) Therefore if there isn't the appropriate infrastructure connecting people and information then the links cannot be established, which completely destroys the crowdsourcing model.

The other variable that constitutes the computing infrastructure is the number of secured internet servers, the number of servers in a country that used encrypted technology

to protect the information that is stored and that transmitted through the website. In the crowdsourcing platforms, projects may deal with sensitive information concerning the confidential information about business processes. Additionally other type of information that is very sensitive is the bank accounts of both clients and workers, since if this information could easily be accessed by anyone in the internet it would most certainly compromise the entire system.

Therefore as it is presented in the Global Competitiveness report, the ICT infrastructure reflects the ICT readiness in a given country, which in this case is the essential to the crowdsourcing activities. (Shwab, 2011-2012)

On the other hand we have the Intellectual Human Capital hypothesis that is also confirmed by the model. This hypothesis concludes that the availability of Human Capital is associated with higher levels of crowdsourcing activity.

The intellectual human capital is analyzing the measures the quality of the workforce that is available for the crowdsourcing activities, as well as for any other economic activity. Therefore the availability of intellectual human capital will determine the quality of the outcome of the work performed in crowdsourcing activities, which is a critical factor for the sustainability of crowdsourcing as it is for any business process. If the work created by the workers has no quality then they won't be chosen again for future works because they failed to produce good work.

Thus the availability of local training is very important when determining the level of crowdsourcing activities since it allows for the qualification of the workforce. (Nyoro, 2011) This is both valid for specialized work, as for more general tasks.

Moreover, brain drain is essential in building the human capital of a country. As it was showed in the literature the negative effect (Hale, 2007) that was always associated with brain drain has been replaced by a two way beneficial relationship between those who leave the country in pursuit of better job opportunities and those who stay in that country. (Hale, 2007) Those who left may come back and import their knowledge or they may establish preferred business relationships with their home countries in the

internationalization process. (Saxenian, 2011). This effect affects strongly the qualification of human capital since it brings knowledge and best practices for the most advanced countries into poorer countries. Returning brain-drainers will want to develop their home-country economy and for this they first need to develop the workforce of the country.

Additionally, as it has been showed by the literature the effect of international migration, from which brain drain is an integrative part, also increases the levels of investments in education. The population, with the expectation of migrating to wealthier countries, will strive to get the better education possible in order to be sure that it has the needed qualifications and knowledge to be successful in the destination country. (Drinkwater, et al., 2003) (Kapur, 2007).

In conclusion we can see that both the infrastructure and the human capital are two critical factors in country hosting high levels of crowdsourcing activity. By the standardized regression estimates we can see that the computing infrastructure has a higher importance when determining levels of crowdsourcing since it provides the basic network in which crowdsourcing activities run. Even though availability of highly qualified human capital is essential for more complex tasks performed in online platforms, we may estimate that there is here an effect of those tasks that are more simple, and don't require much knowledge intensity.

In the two control variables that were introduced only the nature of the human capital is statistically significant. By this we may conclude that there is statistical evidence that countries with higher number of unemployed workers are the hosts of higher levels of crowdsourcing initiatives. This leads us to believe that a big part of the workers in these platforms are unemployed workers.

The number of Facebook users has no statistical significance in this model; therefore we may conclude that there is no migration of users between these different platforms.

Now that we have studied the structural equation model for all the countries for which we add data available, we will now analyze the two following set of countries: only the countries that had crowdsourcing activity in the last year, estimated by the Alexa traffic data; and the same study for countries with crowdsourcing activity belonging to the industrialized countries.

2. Model 2: Subset of countries with crowdsourcing activity

By taking only the subset of countries where crowdsourcing activity was performed last year we obtain the following results:

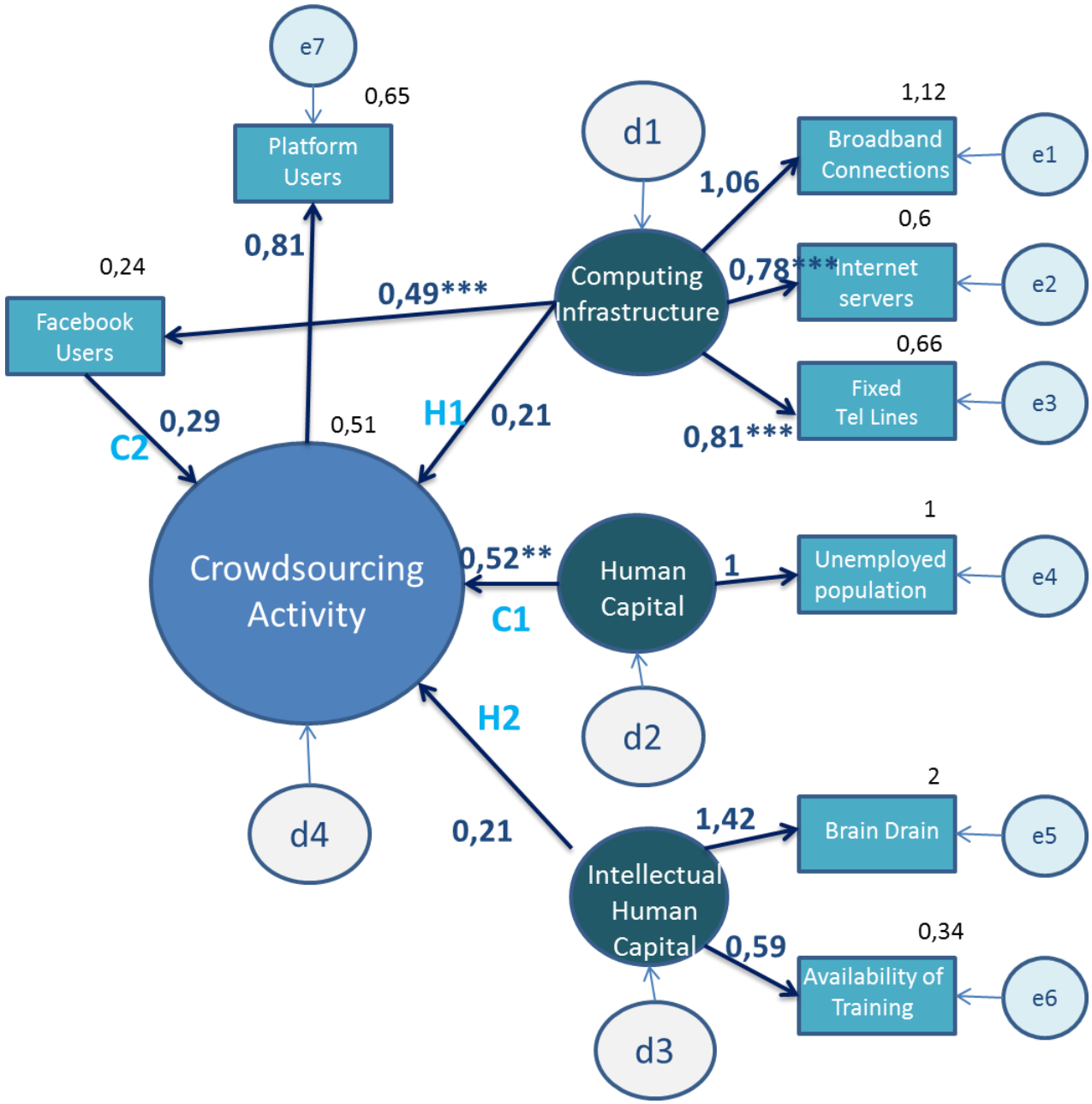

Figure 12: Standardized estimates for model with crowdsourcing countries (N=37)

Model	Chi-Square	Degrees of freedom	Chi-square/ DF	P	CFI	RMSEA
Countries with crowdsourcing activity	113,74	18	6,319	0,000	0,623	0,384

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Table 5: Model fit for model with crowdsourcing countries

As we may see by the measures in the table above the isn't a good fit for the dabatase provided, but now we are more interested in understanding if there are major changes in the confirmation of the hypotheses by changing the subset of countries, and which hypotheses are more affected by this change.

As we can see in the figure above, only C1 is still supported by this model at a 0,01 level (p=0,001), meaning that the Human Capital variable, explained by the unemployed population is a good predictor of the level of crowdsourcing activity across models.

We see that even though it is not statistically significant, the impact of Computing Infrastructure in the Crowdsourcing activity has dropped almost by half, as opposed to the Intellectual Human Capital that has maintained a stable standardized estimate.

As crowdsourcing activities are performed in all the countries in this database we can assume that these countries already have a significantly high level of computing infrastructure to provide sustainable levels of crowdsourcing. (Lehdonvirta & Ernkvist, 2011). Nevertheless we don't see the same happening with the intellectual human capital, as this is a factor that still allows us to clearly say that not all countries in the sample are alike. We have different countries, with different levels of human capital and thus having high levels of intellectual human capital is associated with high levels of crowdsourcing initiatives.

In this model, the latent variables explain 51% of the variance of the crowdsourcing activity, which is similar to the situation knowing that in this case only one control hypothesis is supported.

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3. Model 3: Industrialized countries

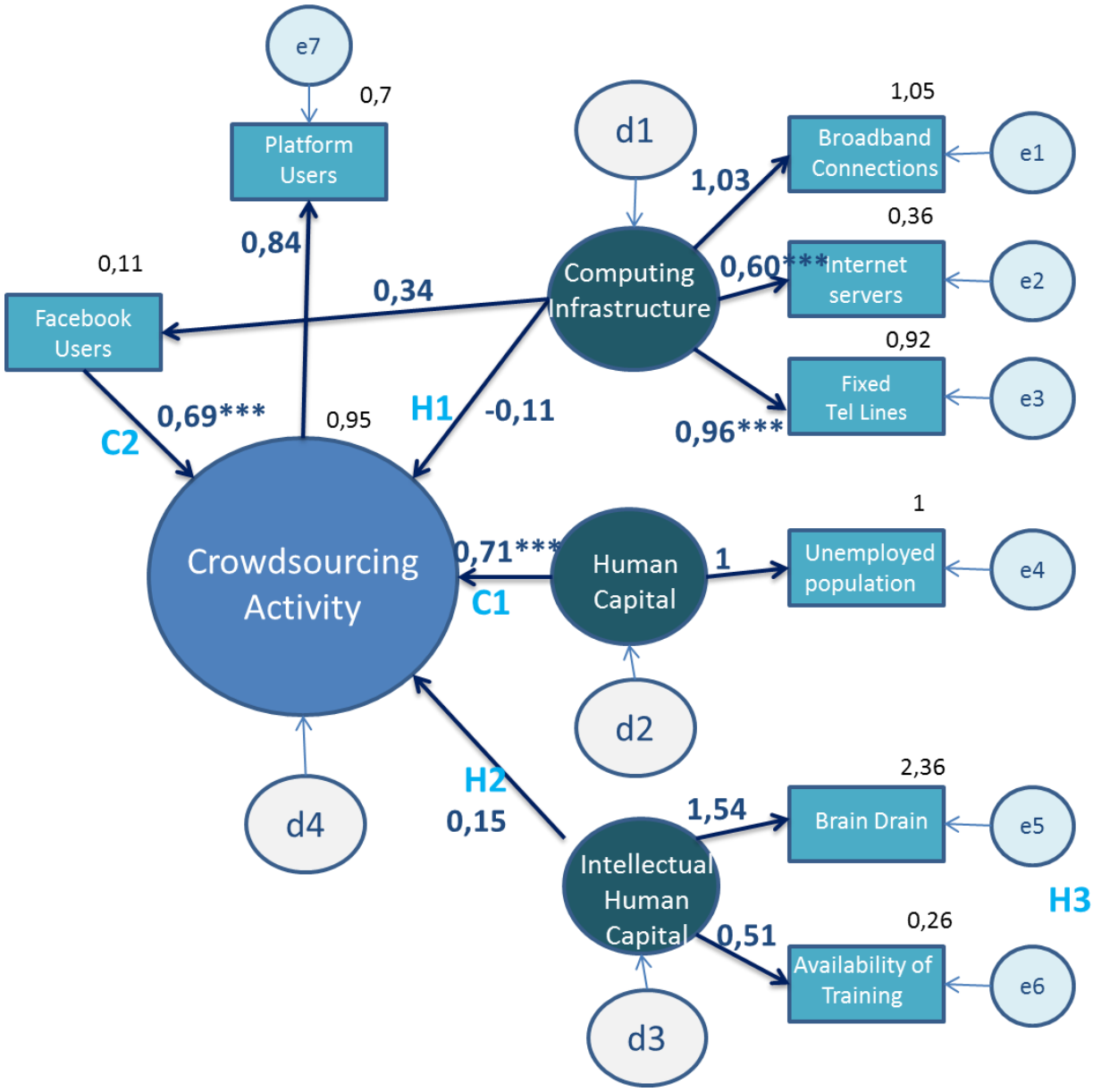

Figure 13: Standardized estimates for model with industrialized crowdsourcing countries (N= 22)

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Model	Chi-Square	Degrees of freedom	Chi-square/ DF	P	CFI	RMSEA
Industrialized Countries with crowdsourcing activity	102,01	18	5,671	0,000	0,599	0,472

Table 6: Model for model with industrialized crowdsourcing countries

As we can see when we narrow the number of countries in the analysis we see that the model worsens, we continue to reject the null hypothesis in the chi-square test, the CFI is well below 0,95 and the RSMEA is higher than 0,06. (Hu & Bentler, 1998)

In this model, only the control hypothesis, C2, is supported indicating the Human Capital is a good predictor of the crowdsourcing activity, countries with high levels of unemployment are the ones with levels of crowdsourcing initiatives being performed.

What is interesting to look at in this model, is that the standardized estimate between the Computing Infrastructure and the Crowdsourcing activity is now negative, even though it is not statistically significant. Since it isn't significant it is rather difficult to draw any conclusions. Still one qualitative assessment that can be made is the following: in this subset of countries we are analyzing we have only developed economies with high levels of computing infrastructure; therefore we cannot say that the computing infrastructure is the determinant factor of explaining high levels of crowdsourcing since all the countries have similar levels of infrastructure. This result may be an indicator that we should look further for other indicators that would explain different levels of crowdsourcing.

Additionally, another change between this model and the previous ones is that the Facebook users have a high, and statistically significant, standardized estimate over the crowdsourcing activity: 0,69. This may make us speculate if whether there is a big migration between the users of both platforms.

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4. Main limitations

One important limitation is the sample size of the database, it was estimated with 113 countries for the "All countries" (Model 1), 37 for the " Crowdsourcing countries" (Model 2) and 22 for the "Industrialized crowdsourcing model". This data could have gone up to 196 countries, but it wasn't possible to gather comparable country data for all of them. Not the least, as the number of countries is finite, this fact will always limit the sample size for the statistical analysis.

Another limitation is that, in the Structural Equation model it can be performed a group analysis, where the available database is split in two or more groups, so the model would run separate models for the groups. Nevertheless, given the number of parameters to estimate, it wasn't possible to compute these analyses due to the small sample size.

Finally, even though a wide range of sources were used in the data collection of the country characteristics, the accuracy of such data is directly linked with the reliability of the sources used by the institutions. Using these heterogeneous data simultaneously in the statistical analysis could lead could affect the overall results.

VI. Conclusions

Crowdsourcing has emerged over two decades ago, but it wasn't until a few years ago that it has caught public and academic attention (Howe 2006) (Villarroel, 2011a, 2011b) (Malone, et al., 2010) (Geerts, 2009)

This new paradigm for organizations is characterized by outsourcing a process to the crowd through an open call within a network, usually the internet.

Crowdsourcing provides a cheaper and faster solution for companies to capture the knowledge that is distributed worldwide, (Villarroel, 2008) mainly due to its ability to reach a large potential workforce in a short period of time, enabled by the ICT infrastructure. Nevertheless it can present some limitations like the quality of the output that is now produced independently with few or none management control.

In this business model, there are two essential actors: companies and workers. Even though it may seem that crowdsourcing is a simple process, all that is needed is a company with a problem and workers and an internet connection, sometimes the links between the companies and workers fail to be established because they cannot find one another in an effective way in the network. This limitation puts forward the importance of intermediaries in the crowdsourcing model, as the four platforms that were studied. These platforms enable the connection between these two agents and allow for the flows of work to cross the world with almost no effort.

In this thesis, it was studied what were the country-level characteristics that explain that some countries host more crowdsourcing activities than others. The definition alone of crowdsourcing already provides us with what seem to be the critical success factors in any country hosting crowdsourcing activities: the nature of the crowd and of the network. Literature suggests the same critical factors: computing infrastructure is the support network in which the majority of crowdsourcing initiatives take place (Lehdonvirta & Ernkvist, 2011) both in industrialized as in emerging countries (Okolloh, 2009). Simultaneously nations need to ensure that the workforce available to take part in this $1 billion dollar industry is sufficiently qualified to be attractive (Nyoro, 2011). The training of the population can occur as a result of brain circulation, consequence of brain drain

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(Saxenian, 2011); or as a preparing process for later migration processes. (Drinkwater, et al., 2003)

A sample of 113 countries was collected in order to confirm if the two critical factors explained above are good predictors of crowdsourcing activity, where this later variable was computed as being the total number of visitors to the four major crowdsourcing platforms in a year.

Statistical evidence showed that computing infrastructure and intellectual human capital can be predictors of the level of crowdsourcing.

Theoretical contribution

This study shows that the statistical model (Model 1) supports the hypotheses we set forth as informed by the literature, highlighting more qualitative and intellectual characteristics of country-level characteristics that can determine high levels crowdsourcing, as well as the importance of basic infrastructure where the model runs in. Additionally is puts forward the importance of is the Human Capital control variable that studies that nature of the working population, implying that we should focus on understanding what may have been the changes in the characteristics of the population, any sudden increase in the unemployment rate that makes that people need to find alternative ways of working, and then turn to online working in crowdsourcing platforms.

As we seen in the first model the the hypotheses are supported. The computing infrastructure is the most important factor, as it the basis of the network of work givers and workers that make crowdsourcing work.

The Intellectual characteristic of human capital, is one of the most widely issues treated in the literature, and helps us distinguish between countries with different levels of development where there is crowdsourcing activity, where the computing infrastructure fails to show differences.

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Managerial implications

As we seen in the more complete model, the computing infrastructure, the nature and quality of the working population explain up to 53% of the variance of the levels of crowdsourcing activity in countries (Cf. section 5.1 Figure 10).

The platforms studied, as others similar to them, can understand better what to look for when they are considering expanding their businesses to other countries: countries with a strong Information Communications and Technology infrastructure characterized by the internet infrastructure, as well as highly qualified human capital.

Additionally, they can focus their advertising efforts in countries that have seen or are seeing a boom in the unemployment rate, since people will continue needing to work and by adding more workers to their workforce the platform is increasing its value to clients.

It has also been seen that countries with a high extent of brain drain can profit from this phenomena, and combining it with additional training of the workforce as well as an appropriate development of the infrastructure, can improve that wellbeing of its population by providing additional incentives so people can work through crowdsourcing, and be part of a $1 billion industry.

The critical success factors found are relevant since we are talking about measurable, fairly objective variables that are under the control of governments. If these governments want to make their country attractive enough for the crowdsourcing industry, they now know which the key aspects which they can improve are: ICT infrastructure and intellectual human capital.

For managers, these findings are relevant if they are thinking about extending their operations to new countries, or simple need to gain new insights about those other countries, they already know if for that destination crowdsourcing would a good way to obtained the wanted information. Additionally they also know how to access which are the

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best countries for higher crowdsourcing levels, thus this may help them make an informed assessment of which are the crowdsourcing platforms that have workers from those countries, thus increasing the chances of output quality.

Future Research

Crowdsourcing can have a major impact in the living standards of its workers, since it provides relatively equal job opportunities to people living in remote or isolated rural areas, in emerging countries. It could be a very interesting future research understanding the extent to which crowdsourcing has had a positive impact in such communities and what can be done to increase this outcome.

Appendixes

1. List of studied countries

All countries		
Argentina	Finland	Jamaica
Australia	Greece	Jordan
Bangladesh	Sri Lanka	Kazakhstan
Canada	Kenya	Kyrgyz Republic
China	Ukraine	Latvia
France	Albania	Lithuania
Germany	Algeria	Luxembourg
India	Armenia	Macedonia, FYR
Ireland	Austria	Mali
Israel	Azerbaijan	Malta
Italy	Belize	Mauritania
Japan	Bolivia	Mauritius
Mexico	Bosnia and Herzegovina	Moldova
Netherlands	Botswana	Mongolia
New Zealand	Bulgaria	Morocco
Nigeria	Burkina Faso	Mozambique
Norway	Cambodia	Namibia
Pakistan	Cameroon	Nepal
Philippines	Cape Verde	Nicaragua
Portugal	Chile	Panama
Romania	Colombia	Paraguay
Russian Federation	Costa Rica	Peru
South Africa	Croatia	Saudi Arabia
Korea, Rep.	Cyprus	Senegal
Spain	Czech Republic	Serbia
Switzerland	Dominican Republic	Singapore
Thailand	Ecuador	Slovak Republic
United Kingdom	Egypt, Arab Rep.	Slovenia
United States	El Salvador	Suriname
Brazil	Estonia	Swaziland
Indonesia	Georgia	Tajikistan
Poland	Ghana	Trinidad and Tobago
Malaysia	Guatemala	Tunisia
Sweden	Guyana	United Arab Emirates
Belgium	Honduras	Uruguay
Turkey	Hungary	Venezuela, RB
Denmark	Iceland	Vietnam
		Yemen, Rep.
		Zambia

Countries with crowdsourcing activity
Argentina
Australia
Canada
France
Germany
Ireland
Israel
Italy
Japan
Mexico
Netherlands
New Zealand
Nigeria
Norway
Pakistan
Philippines
Portugal
Romania
Russian Federation
South Africa
Korea, Rep.
Spain
Switzerland
United Kingdom
United States
Brazil
Indonesia
Poland
Malaysia
Sweden
Belgium
Turkey
Denmark
Finland
Greece
Sri Lanka
Ukraine

Industrialized countries with CS
Australia
Canada
China
France
Germany
Ireland
Italy
Japan
Netherlands
New Zealand
Norway
Portugal
Korea, Rep.
Spain
Switzerland
United Kingdom
United States
Sweden
Belgium
Denmark
Finland
Greece

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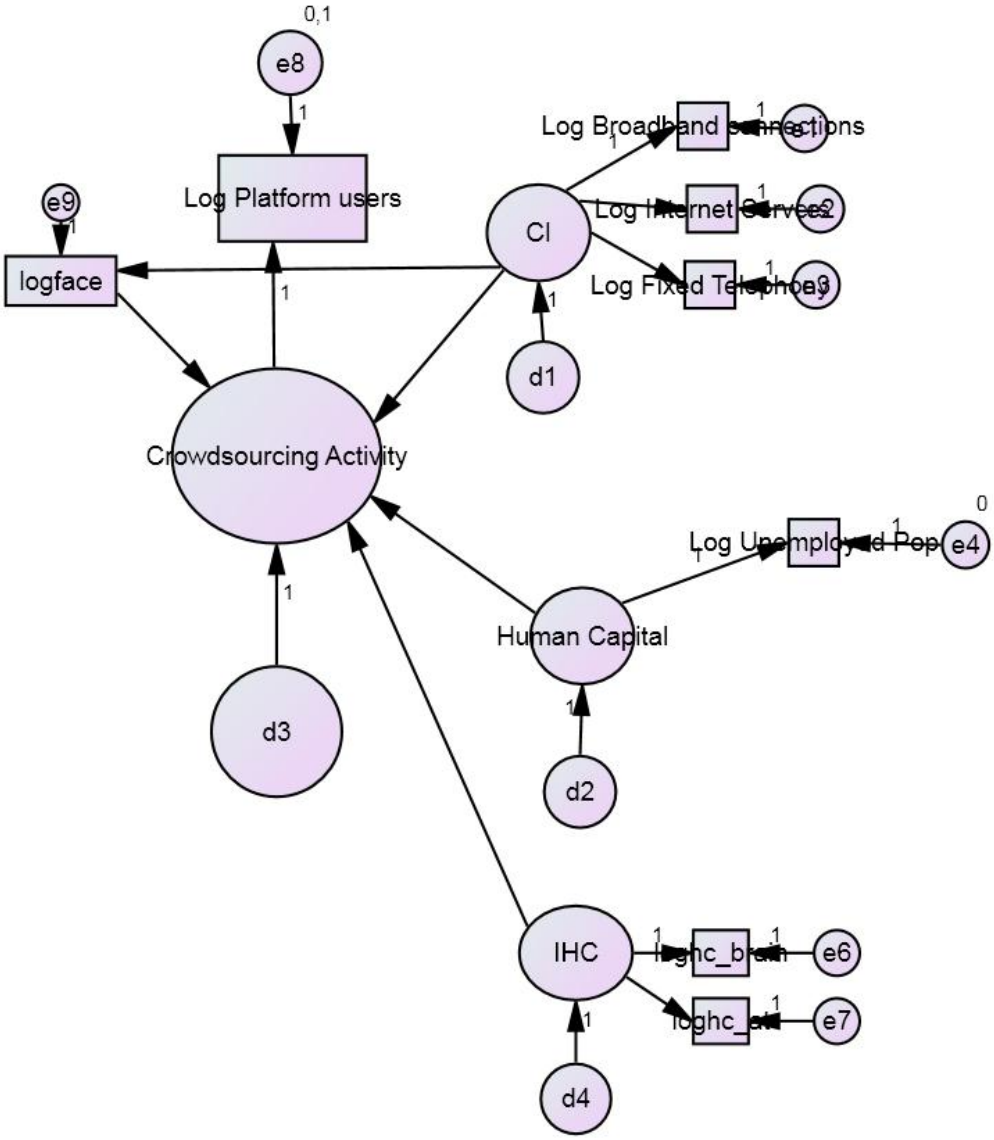
2. Statistical Model designed in AMOS



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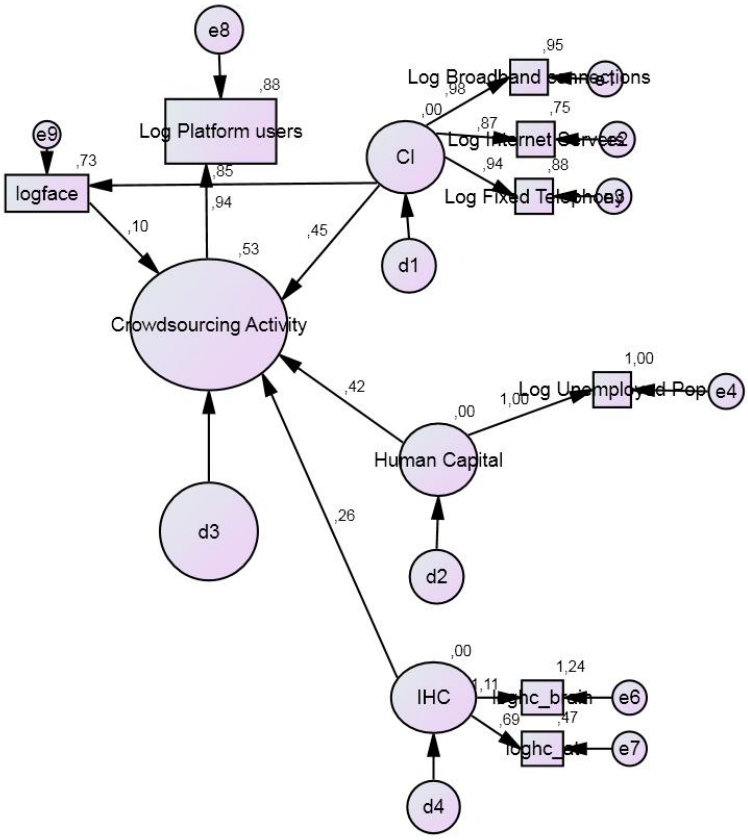
3. Statistical Results

a. All countries' model



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Scalar Estimates (Group number 1 - Default model)

Maximum Likelihood Estimates

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
logface	<---	CI	,616	,039	15,600	***	
CS	<---	CI	,378	,123	3,084	,002	
CS	<---	HC	,477	,082	5,810	***	
CS	<---	IHC	2,051	,841	2,440	,015	
CS	<---	logface	,111	,167	,668	,504	
logci_bb	<---	CI	1,000				
loginternet_servers	<---	CI	,918	,056	16,476	***	
logunempl	<---	HC	1,000				
logci_ft	<---	CI	,728	,032	23,007	***	
logplatusers	<---	CS	1,000				
loghc_brain	<---	IHC	1,000				
loghc_at	<---	IHC	,499	,143	3,476	***	

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
logface	<---	CI	,852
CS	<---	CI	,454
CS	<---	HC	,421
CS	<---	IHC	,259
CS	<---	logface	,097
logci_bb	<---	CI	,975
loginternet_servers	<---	CI	,866
logunempl	<---	HC	1,000
logci_ft	<---	CI	,940
logplatusers	<---	CS	,938
loghc_brain	<---	IHC	1,115
loghc_at	<---	IHC	,688

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
d1	1,060	,150	7,071	***	
d2	,573	,077	7,483	***	
e9	,152	,022	6,819	***	
d4	,012	,003	3,460	***	
d3	,342	,061	5,590	***	
e4	,000				
e8	,100				
e1	,055	,020	2,734	,006	
e2	,297	,044	6,728	***	
e3	,074	,014	5,198	***	
e6	-,002	,003	-,722	,470	
e7	,003	,001	3,619	***	

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	18	273,477	18	,000	15,193
Saturated model	36	,000	0		
Independence model	8	958,212	28	,000	34,222

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	,137	,691	,381	,345
Saturated model	,000	1,000		
Independence model	,380	,278	,072	,216

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	,715	,556	,728	,573	,725
Saturated model	1,000		1,000		1,000
Independence model	,000	,000	,000	,000	,000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	,643	,459	,466
Saturated model	,000	,000	,000
Independence model	1,000	,000	,000

NCP

Model	NCP	LO 90	HI 90
Default model	255,477	205,646	312,750
Saturated model	,000	,000	,000
Independence model	930,212	832,787	1035,037

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	2,442	2,281	1,836	2,792

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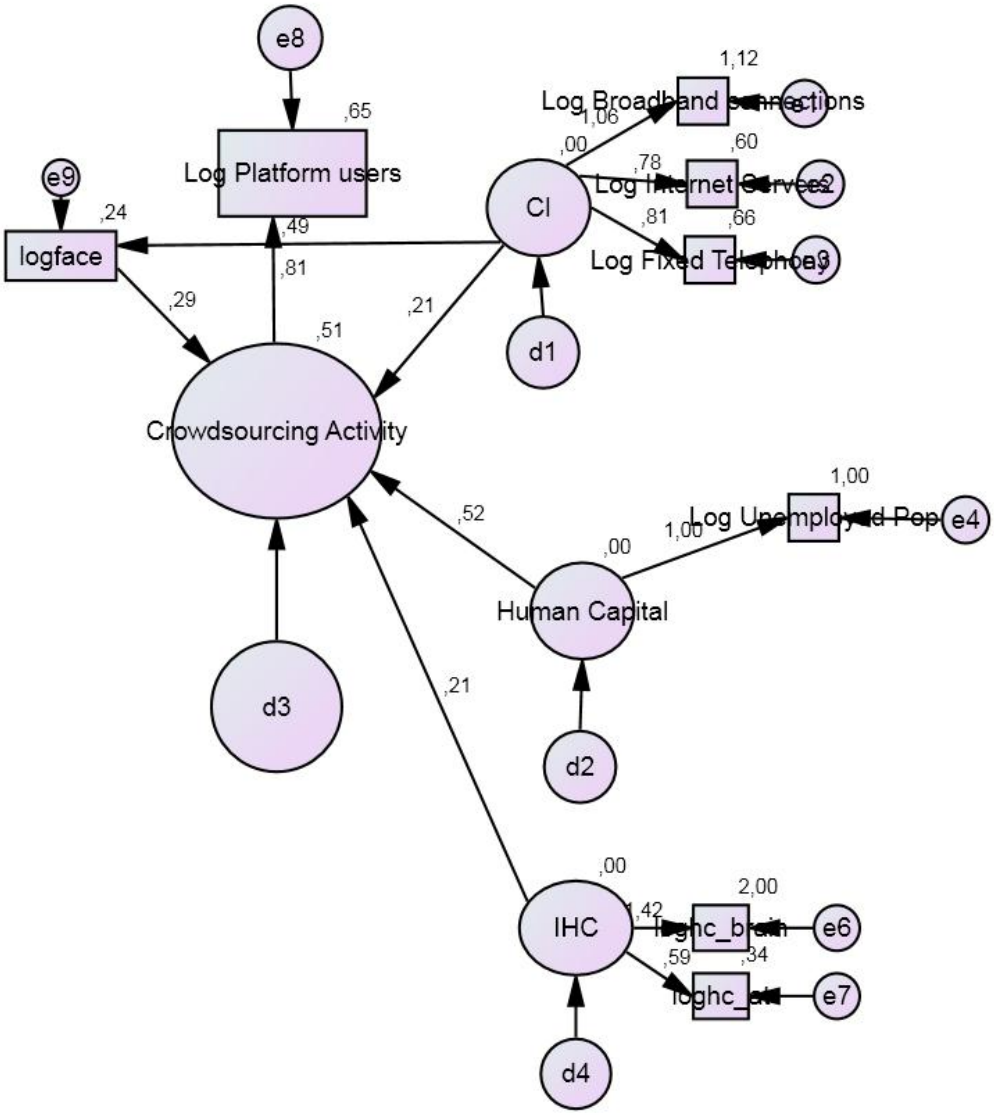
Model	FMIN	F0	LO 90	HI 90
Saturated model	,000	,000	,000	,000
Independence model	8,555	8,305	7,436	9,241

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	,356	,319	,394	,000
Independence model	,545	,515	,574	,000

b. Crowdsourcing countries



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Scalar Estimates (Group number 1 - Default model)

Maximum Likelihood Estimates

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
logface	<---	CI	,365	,104	3,510	***	
CS	<---	CI	,144	,111	1,296	,195	
CS	<---	HC	,376	,116	3,240	,001	
CS	<---	IHC	,702	,970	,724	,469	
CS	<---	logface	,261	,163	1,598	,110	
logci_bb	<---	CI	1,000				
loginternet_servers	<---	CI	,983	,138	7,137	***	
logunempl	<---	HC	1,000				
logci_ft	<---	CI	,654	,082	8,010	***	
logplatusers	<---	CS	1,000				
loghc_brain	<---	IHC	1,000				
loghc_at	<---	IHC	,270	,268	1,007	,314	

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Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
logface	<---	CI	,488
CS	<---	CI	,215
CS	<---	HC	,522
CS	<---	IHC	,207
CS	<---	logface	,289
logci_bb	<---	CI	1,059
loginternet_servers	<---	CI	,777
logunempl	<---	HC	1,000
logci_ft	<---	CI	,812
logplatusers	<---	CS	,805
loghc_brain	<---	IHC	1,415
loghc_at	<---	IHC	,585

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
d1	,408	,088	4,626	***	
d2	,357	,084	4,243	***	
e9	,173	,039	4,399	***	
d4	,016	,015	1,042	,297	
d3	,091	,045	2,011	,044	
e4	,000				
e8	,100				
e1	-,044	,026	-1,737	,082	
e2	,259	,063	4,127	***	
e3	,090	,023	3,967	***	
e6	-,008	,015	-,518	,604	
e7	,002	,001	1,810	,070	

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Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	18	113,744	18	,000	6,319
Saturated model	36	,000	0		
Independence model	8	281,792	28	,000	10,064

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	,055	,598	,197	,299
Saturated model	,000	1,000		
Independence model	,124	,377	,199	,293

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	,596	,372	,637	,413	,623
Saturated model	1,000		1,000		1,000
Independence model	,000	,000	,000	,000	,000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	,643	,383	,400
Saturated model	,000	,000	,000
Independence model	1,000	,000	,000

NCP

Model	NCP	LO 90	HI 90
Default model	95,744	65,750	133,240
Saturated model	,000	,000	,000
Independence model	253,792	203,639	311,409

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	3,160	2,660	1,826	3,701
Saturated model	,000	,000	,000	,000
Independence model	7,828	7,050	5,657	8,650

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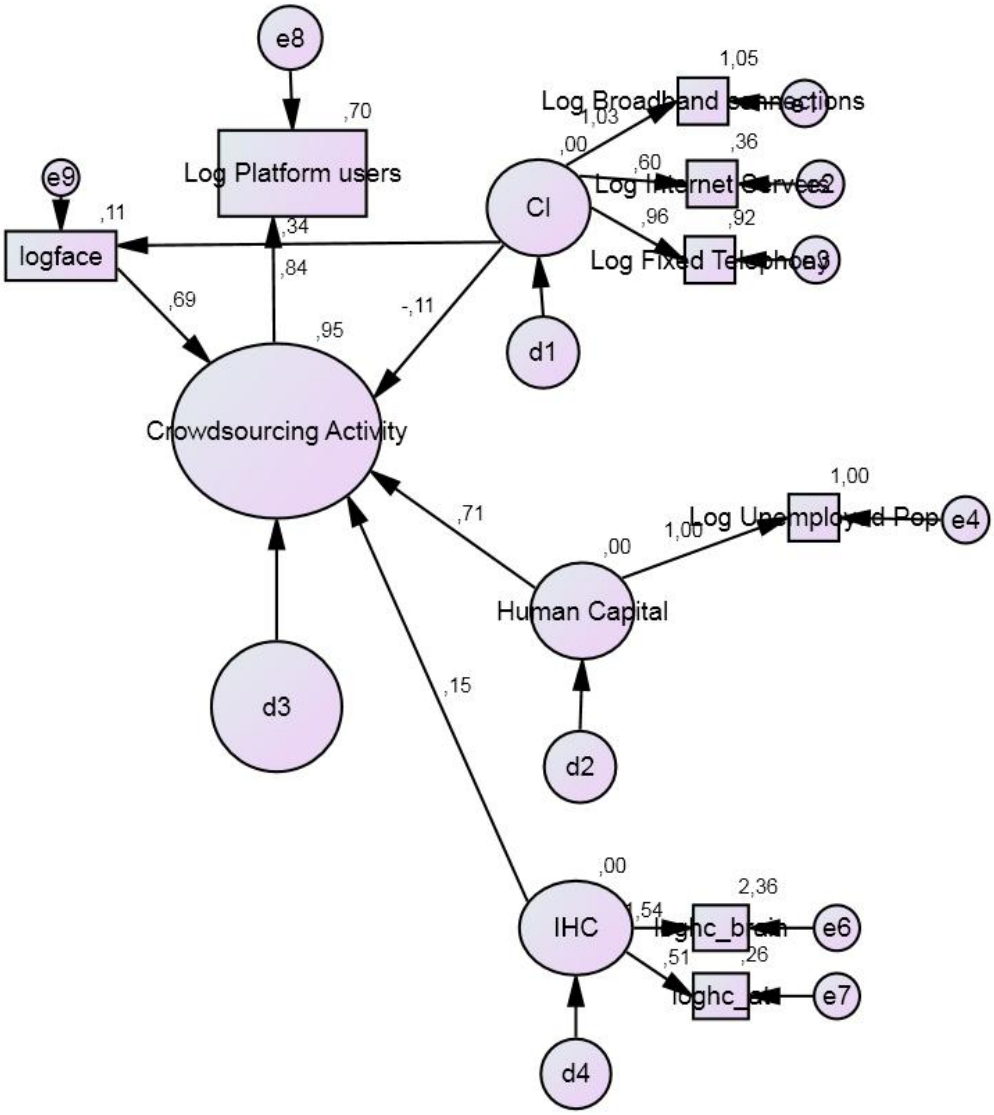
RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	,384	,319	,453	,000
Independence model	,502	,449	,556	,000

c.Industrialized countries



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Scalar Estimates (Group number 1 - Default model)

Maximum Likelihood Estimates

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
logface	<---	CI	,287	,168	1,706	,088	
CS	<---	CI	-,085	,111	-,762	,446	
CS	<---	HC	,505	,101	5,000	***	
CS	<---	IHC	,568	1,123	,506	,613	
CS	<---	logface	,634	,138	4,597	***	
logci_bb	<---	CI	1,000				
loginternet_servers	<---	CI	,598	,176	3,402	***	
logunempl	<---	HC	1,000				
logci_ft	<---	CI	,995	,062	15,970	***	
logplatusers	<---	CS	1,000				
loghc_brain	<---	IHC	1,000				
loghc_at	<---	IHC	,179	,283	,634	,526	

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
logface	<---	CI	,335
CS	<---	CI	-,107
CS	<---	HC	,707
CS	<---	IHC	,148
CS	<---	logface	,686
logci_bb	<---	CI	1,025
loginternet_servers	<---	CI	,598
logunempl	<---	HC	1,000
logci_ft	<---	CI	,961
logplatusers	<---	CS	,835
loghc_brain	<---	IHC	1,537
loghc_at	<---	IHC	,509

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
d1	,368	,109	3,369	***	
d2	,453	,140	3,240	,001	
e9	,240	,073	3,280	,001	
d4	,016	,024	,662	,508	
d3	,011	,035	,303	,762	
e4	,000				
e8	,100				
e1	-,018	,018	-1,013	,311	
e2	,236	,072	3,276	,001	
e3	,030	,019	1,610	,107	
e6	-,009	,024	-,378	,705	
e7	,001	,001	1,632	,103	

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Squared Multiple Correlations: (Group number 1 - Default model)

	Estimate
CI	,000
logface	,112
IHC	,000
HC	,000
CS	,954
loghc_at	,259
loghc_brain	2,363
logci_ft	,923
logplatusers	,698
logunempl	1,000
loginternet_servers	,357
logci_bb	1,051

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	18	102,082	18	,000	5,671
Saturated model	36	,000	0		
Independence model	8	237,510	28	,000	8,482

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	,118	,634	,269	,317
Saturated model	,000	1,000		
Independence model	,162	,331	,140	,258

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	,570	,331	,617	,376	,599
Saturated model	1,000		1,000		1,000
Independence model	,000	,000	,000	,000	,000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	,643	,367	,385
Saturated model	,000	,000	,000
Independence model	1,000	,000	,000

NCP

Model	NCP	LO 90	HI 90
Default model	84,082	56,019	119,659
Saturated model	,000	,000	,000
Independence model	209,510	164,011	262,484

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	4,861	4,004	2,668	5,698
Saturated model	,000	,000	,000	,000
Independence model	11,310	9,977	7,810	12,499

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RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	,472	,385	,563	,000
Independence model	,597	,528	,668	,000

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