Tampere University of Applied Sciences

Inventory methods applicable for crowdsourcing

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BACHELOR'S THESIS
April 2021

Degree Programme in International Business

ABSTRACT

Tampereen ammattikorkeakoulu
Tampere University of Applied Sciences
Degree Programme in International Business

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Inventory methods applicable for crowdsourcing

Bachelor's thesis 60 pages, appendices 5 pages
April 2021

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Crowdsourcing is becoming more widely used across the globe in different business operations. This trend opens an opportunity to service provider companies to leverage from the demand to run crowd-based projects. More businesses each year are looking for service providers who have access to crowd contributors and can help them to execute crowd-based projects. The key to success for service providers is to have access to large pools of crowd contributors via internal databases.

When talking about crowdsourcing and crowdsourcing databases, the discussion is about big volume data. The numbers of resources in the databases are in hundreds of thousands. To be efficient and achieve best possible outcome when executing crowd-based projects, databases need to be managed and inventories of resources (crowd contributors) to be maintained. The object of this research is to understand which one of standard inventory methods can be applicable to maintain crowdsourcing databases.

This research presents why inventories of crowdsourcing databases are important and where that knowledge can be used in practice when working on crowd-based project. The research examines how that knowledge impacts everyday tasks and decision making by sourcing team leads, who oversee, maintain, and manage pools of crowd contributors. The analyses are carried out for what type of data is needed from the inventory and what sourcing leads` tasks can be completed by using that data.

Focus group discussions and structured interviews were used to answer research questions. Research participants were sourcing team leads who have the most knowledge of the processes on how crowdsourcing works and how crowd contributors get engaged in the projects. All research findings where organised and analysed. Where applicable results were organised in charts and tables for visual presentation.

As conclusion it was presented that based on the research finding perpetual inventory method was found to be most suitable for crowdsourcing databases. To understand the full benefits of implementing perpetual inventory method to maintain crowdsourcing databases it was suggested to conduct further research to examine financial impact for the business.

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Key words: crowdsourcing, crowdsourcing platforms, crowdsourcing databases, crowd contributors, artificial intelligence, inventory management

CONTENTS

ABBREVIATIONS AND TERMS

AI	Artificial Intelligence
GDPR	General Data Protection Regulation
HRM	Human Resource Management
HR	Human Resources
ETA	Estimated Time of Arrival
FIFO	First In First Out
LIFO	Last In First Out
IFRS	International Financial Reporting Standards

1 INTRODUCTION

In past years due to Globalisation and technological development the new way how organisations can find solutions to simple or complex problems has emerged called crowdsourcing. Crowdsourcing is a practice on how to obtain and utilize the knowledge and expertise from large group of people. The term crowdsourcing was first introduced by Jeff Howe in 2006 (White 2019).

There are different ways how crowdsourcing is used, including crowdfunding, however this research will focus on crowdsourcing as part of business operations. The most discussed reason for businesses to use crowdsourcing is to save the costs and time and as a result become more efficient. However, this is not the only reason why crowdsourcing is becoming more popular lately and how it is used.

Crowdsourcing is contributing to the technological progress, the one our society is currently living through, especially related to AI - artificial intelligence. Many AI technologies are developed based on the human data. That data needs to be collected from humans and/or processed by humans. Crowdsourcing allows that to happen. Large data collection projects involving thousands of people can be done in relatively short time span. Large amount of data can be processed within weeks by hundreds of people at the same time.

The companies need to have access to crowd contributors to be able to engage them in their projects. They can do it by creating their own databases or by engaging people from open marketplaces such as UpWork, Work Market and similar online websites where people sign up looking for gig type of work. Second option is to reach out to vendors – companies that provide crowdsourcing services. This creates an opportunity for companies who specialise in crowdsourcing. These types of companies will have their own databases with crowd contributors to be able to execute any crowdsourcing related project.

For companies that are service providers specialised in crowdsourcing crowd contributors are main resources. They are the foundation of the business operations. As in any business resources need to be managed and there should be clear understanding of the inventory of stock the company has. Crowd contributors, even considered as resources do not belong to the company, nor they are employees, however they do show the interest in cooperation by registering in the databases and therefore they are considerate resources.

For a business to operate as a service provider the knowledge about their resources is a must to have. The aim of this research is to explore which standard inventory method can be applied for crowdsourcing databases to manage crowd contributors.

1.1 Background information

This research is conducted for the company Lionbridge AI. Lionbridge AI was established as a unite of the company Lionbridge Technologies, localization and translation company. Recently Lionbridge AI has been purchased by the company TELUS International.

Lionbridge AI is a service provided for companies operating in Artificial Intelligence field. Lionbridge AI mainly provides data collection and data processing services. Company operates with high volumes of data obtained through crowdsourcing. To satisfy the demand data is collected and processed by crowd contributors, internally called community. Lionbridge AI is a second biggest crowd sourcing service provide in the world. In year 2020 named as a Global leader for providing work from home by Forbes. (Rose, 2020)

Lionbridge AI has been operating in crowdsourcing business and building relationships with crowd contributors for past six years. During that time Lionbridge AI Global community has grown to one million plus contributors. Lionbridge AI community has contributors from around the Globe. Dedicated Community Management team daily engages with thousands of crowd contributors from Lionbridge AI community and outside audiences.

The author is currently working at Lionbridge AI as Global Community Sourcing Manager. The daily tasks of Sourcing Manager in the company that works in crowdsourcing field and engages crowd contributors in their projects varies from classical understanding of Sourcing Manager tasks working in supply chain management, however the main responsibility still remains similar – being in charge of resources used or needed to produce final product or service.

Sourcing Manager is responsible of delivering the resources – crowd contributors to the projects` teams who then will share the projects/tasks with the contributors to work on. To provide needed resources Sourcing Manager leads sourcing team who reach out directly to the crowd contributors within the community or outside that offering the opportunities to work on.

To be able to provide right contributors to the project some specific information needs be obtained beforehand, such as - what skills contributors must have, do they need to be native speakers of specific language or located in particular country, previous experience, any specific demographic split by age or gender etc. All this information is obtained by Sourcing Manger during the close cooperation with projects` teams. When project needs are defined Sourcing Manager sets up souring strategy, defines qualification path for crowd contributors and assess the risks before the project can start.

Close cooperation with projects` teams continues through the project to monitor the progress and to continue supplying the resources until the project is completed.

Other significant task for Sourcing Manager is forecasting. Estimating and budgeting sourcing efforts to run the project. Estimations are based on historical data and good understating of what capacity community has – meaning what types of crowd workers are there as a community members, how many are active, how many have worked on similar tasks previously already, what skills sets they have.

Lionbridge AI provides services for companies mostly developing AI technologies. AI technologies are developed by using human data. The data is mainly used to train or test the technologies. To succeed the amount of data needs to be significant and be of a wide variety. Crowdsourcing projects related to AI are mostly data collection and data processing. There are no specific profiles of resources who can take part in these projects as crowd contributors. Projects are divers and on demand, so any person with any profile and skill sets could be needed. Lionbridge AI as a service provided does not have visibility or ability to predict what type of resources will be needed in the next project. The resource profiles do get clarified only when the project is offered by the client to the company. This is a significant challenge as company needs to maintain a large and diverse database of crowd contributors. Company does have statistics and historical data available that can provide the understanding about resources needed by the type of the project, however in many scenarios when new projects arrive there are new demands added regarding type of resources.

The research topic emerged from the needs described above - to be able to manage and understand the inventory of resources used by the company.
In crowdsourcing a company does not own the resources as opposite of manufacturing or retail for example, where company would buy needed raw materials or goods to produce the final product or resell it.
In crowdsourcing resources are fluid, people sign up for the projects, they might do it once and never be willing to engage in any other projects or might be very active and work on all the projects offered to them.

1.2 Research questions

The aim of these thesis is to explore which standard inventory method can be used in crowdsourcing when working with large databases. The research is done for company Lionbridge AI, specifically for Lionbridge AI Global Sourcing team. Focus group taking part in this research consists of three Global Community Sourcing managers and Global Community Sourcing Director. The aim of the research questions is to explore in detail what data/information about crowd contributors is needed by souring team leads and how it can be collected and

maintained. Research questions are interconnected and must be answered in chronological order. The first question contains three sub-questions, they need to be answered first to be able to start exploring second question and after moving to the third, final question.

Research questions with respected sub-questions are as following:

1. What data (information) sourcing team leads need to know and have access to on the daily bases about crowd contributors in their database to be able to perform their daily tasks?

Sub-questions of question one:

- What are these daily tasks?
- Does each task need different type of data or can same data be used for different tasks?
- Can data/ information needed be prioritised, meaning is there more important type of information that is a must to have and is there information that is good to have, but not mandatory?

2. What data (information) can be collected by using standard inventory method?

3. Which standard inventory method can be applicable for crowdsourcing database maintenance?

1.3 Research approach

For this thesis qualitative research approach was used. Qualitative research method allows to explore the experience, ideas, knowledge, opinions, emotions of research participants in detail. For this research it is crucial to understand the needs of sourcing team leads based on their knowledge and day to day work experience, to be able to provide an accurate finding and conclusions. Based on that qualitative research method was selected as it suits best to the needs of the research.

Empirical part of the thesis started by identifying research participants who will contribute their knowledge and experience during data collection part of the research. Data collection was done in two parts. First focus group discussions were organised and later followed by structured interviews.

Focus group was organised from sourcing team leads and the goal of the discussions was to answer the first research question. During the discussions sub questions were identified. To answer sub-questions structured interviews were held with each research participant individually.

The obtained data was organised and analysed. Data was compared and, in some cases, mapped against exiting theories to gain answers for questions two and three and reach final conclusion.

Data analyses and finding are presented in forms of charts and tables for visualisation purposes. Conclusions are provided in the form of written report.

1.4   Structure of the thesis

The first chapter introduces the research topic together with the research questions. It provides and overview of the company the research is carried out for as well as presents the structure of the thesis.

Overview about crowdsourcing and its` aspects is provided in chapter two as a part of theoretical framework. Theoretical framework also covers human resource management in the relation to crowdsourcing and inventory management together with the inventory methods.

Chapter three presents methodology used in this research. It describes in detail why focus group discussions and structured interviews were selected as data collection methods. It is presented in chapter three how focus group discussion and interviews were carried out. This research was carried out by using qualitative research method. Chapter three also presents how data analyses will be done.

Empirical part of the research is laid out in chapter four. The findings of both parts of the data collection are presented and examined in chapter four. Chapter four

is outlined to present all finding of the research and chapter five offers the discussion about the findings.

2 LITERATURE REVIEW

This chapter will offer and overview on what is crowdsourcing, where it is used and what benefits it offers to the businesses. It will also discuss human resource management relations with crowdsourcing and review the theories of standard inventory methods currently in use to cover all the bases of theoretical framework needed for this research.

2.1 What is Crowdsourcing

The businesses always are looking for the ways on how to save and optimize labour costs without compromising productivity. As Globalization era emerged outsourcing has become a key strategy in cost saving during the last few decades since Global economies allow to set up production sides overseas to reach and leverage from cheaper labour outside home country. However as so-called internet age companies that are designed to utilize all advantages that internet and technologies can provide are manifesting across the Globe they have turned to the crowd and outsourcing from the crowd. (Howe, 2006)

Crowdsourcing is a practice on how to obtain and utilize the knowledge and expertise from large group of people. The term crowdsourcing was first introduced by Jeff Howe in 2006 (White, 2019).

Crowdsourcing has become more accessible in the resent years to the companies and contributors as connectivity has increased across the Globe. In crowd sourcing it does not matter where the person is located as long as they have internet they can contribute and be engaged in any project.

Not only Internet age companies have turned to crowd sourcing but also more traditionally set up business more and more are using crowdsourcing and advantages it brings in their daily operations. (White, 2019)

Crowdsourcing is used as a tool by the companies to not only outsource the labour and save the costs but solve the specific problems and obtain R&D solutions. Crowd contributors can solve a very simple problem, work on a task like transcription or image labelling, but they also can provide expertise in almost any area, design products, develop and bring up new ideas.

The demand of the constant innovation, efficient problem solving, shorter turnaround time at lower costs brought by Globalization and fast developing technologies are creating a climate where business to survive must be flexible, react fast and be adaptive to changes. If ten or so years ago companies were able to hire experts, set up structured teams with a hierarchy and invest several months and even years in the projects or R&D to work on the solutions, now this model may not be sustainable or profitable to everyone as technologies are developed fast and demands in the industries change constantly. The expectations of the consumers are high, and competition rises every day. (Grewal-Carr & Bates, 2016) The current trend is showing that more and more companies are using crowdsourcing in their daily operations. Crowdsourcing market has grown by 37% between 2012 – 2017 in United States of America alone. Companies still might have in house experts to assure the quality however it is not so uncommon to outsource the whole project including experts as well. (Dilmegani, 2021)

By using crowdsourcing businesses operating in specific fields mostly related to technology, can solve the problems faster, obtain the information and expertise from outside, scale the projects and get direct feedback together with actual input from the consumers. (White, 2019)

Wikipedia is a good and simple example on how crowd contributing emerge from growing connectivity and engaging people across the Globe. Wikipedia is a free space online where anyone can contribute their knowledge about any topic. Wikipedia has grown rapidly since it was first launched in 2001. By now year 2021 it has more than 6.3 million of articles. (Wikipedia, 2021)

Amazon Mechanical Turk, also called as MTurk is another good example of how crowdsourcing works from the business perspective. Amazon launched MTurk

on 2005, it was created after company came across the challenge of deleting the duplicate goods form their website. First a group of engineers were asked to develop a software that could illuminate the duplicates, which at the time seemed like simple task. However, it soon was proven that the task is more complex because computer program cannot notice delicate difference or similarities in pictures and text.

The task actually required human intelligence. The engineers offered a solution of splitting the data that needs identification of duplicates into smaller batches and sending it over the internet to review to people who will be willing to do so. The task itself was simple and did not require any specific education or experience. To streamline the process the idea of platform was presented so the task can be shared in more efficient way with the contributors. (Schawartz, 2019)

In recent years crowd and crowd sourcing has been implemented as a part of operations by big tech companies such as Amazon, Google, Alibaba, LEGO, Deloitte etc. However, advantage of the crowd is also taken by smaller companies, even individuals. It is beneficial for anyone who needs to obtain or process data by larger group of people.

Figure 1 below shows different types of tasks that can be executed with crowdsourcing.
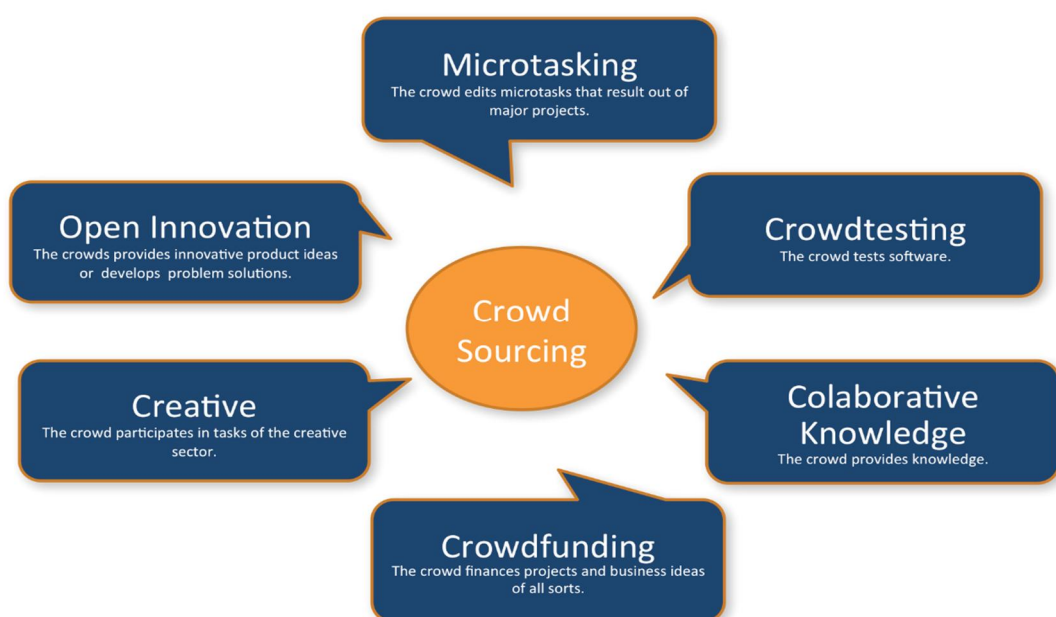

FIGURE 1. Different types of crowdsourcing (Clickworker, 2020)

2.2   How Crowdsourcing works

There are no limits on what type of tasks can be performed by crowd contributors as long as the task can be executed by the individuals either online or offline and the results delivered. Companies use crowdsourcing to work on big projects or just to solve smaller tasks.

There is no clear classification in diversity of crowdsourcing approaches. The most common ones are problem based, task based and/or platform based. (Grewal-Carr & Bates, 2016)

Table 1 below presents most offered tasks in crowdsourcing. In the table below it is explained what each type of task contains of and in what industry it can be use.

TABLE 1. Understanding the five types of crowdsourcing (Grier, 2013)

Usage	Features	Usage
Crowd contests	*Enable you to identify the best worker for you job *A single job description that asks for one item *Many people proposing or creating item *Only pay one person	*Graphic design *Answering questions *Testing software *Creating films *Other creative projects
Macrotasks	*Enable you to get a specific skill for a job or project *Hire worker from crowd for single task *Communicate over the Internet *Worker paid by task	*General business work *Web design and other forms of design *Assistance with writing and editing *Application development
Microtasks	*Enable you to use human intelligence on large, complicated jobs *Divide big jobs into small units *Put units on the Internet *Let members of crowd do tasks *All workers get paid	*Transcribe business cards, medical records and other documents *Tag photos and handle non-textual data *Find business information

Crowdfunding	*Engage social networks to raise money *Put a request for funds on an Internet platform *Create messages and videos to promote request *Recruit crowd to donate money *Offer crowd gift or benefit	*Support non-profit organisations *Raise funds for artistic endeavours *Get cash for companies by offering goods or services *Raise equity for company (under the right circumstances)
Self-organised crowds	*Post a challenge on the Internet *Recruit crowd to work on challenge *Crowd organises itself into a team *Teams compete to provide best answer for challenge *Winning team compensated *Team decides how to divide compensation	*Innovation – creating new products or services *Finding and collecting information *Processing information and offering judgement *Solving challenges

To start engaging crowd contributors a business must identify what is needed from the crowd - will workers be asked to solve a problem or execute a task. For larger projects, it is best if they are broken down into smaller tasks for the contributors to work on. It will allow for workers to focus on assigned tasks and complete them most effectively.

Even as simple as crowdsourcing idea is, it does become more complex as the demand in the industry rises. The complexity starts with the type of tasks offered to the crowd contributors. At the beginning tasks were more related to data collection, simple data processing such as transcription and basic annotation and online product testing. Recently tasks have become more complex and require specific knowledge and people with certain skill sets are needed. Such as specific knowledge in IT, medicine, law etc. Industries where crowdsourcing is on demand are changing as well. Before IT and Tech industry were main players, however nowadays such as human resources, retail, fashion, marketing and others. For many projects crowd contributors need to be vetted and high numbers of crowd contributors must be engaged in one single project. (Hobbs, 2018)

Crowdsourcing vendor companies allows businesses to save the costs from building their own crowd capital, assures quality of the end product. They also

take care of protecting intellectual property and follow all GDPR – General Data protection rules statues.

The key factor of crowdsourcing is for the tasks to be accessible to the large group of people – the groups might be pre-selected based on the certain criteria or tasks can just open to anyone depending on the requirements. Crowd workers do not have to have a specific education background or work experience. (Diamantapoulou, Androutsopoulou, Gritzalis & Charalabidis, 2018)

The most common tasks performed by crowd are transcription, annotation, data labelling, data collection. In many instances crowd is also used to execute more specific tasks related to R&D, as there is no limitation in terms of what type of tasks crowd contributors can work on or provide their expertise in the problem solving.

2.3   Crowdsourcing platforms

Since main idea of crowdsourcing is to leverage from the skills, ideas, knowledge, judgments etc. of large groups of people despite of their physical location, crowdsourcing tasks are done online. For the tasks to be available to the crowd contributors an online platform is needed. By eYeka report in 2015 84% of the biggest Global companies such as SAP, Google, Dell, Fiat, Amazon, General Electric, and many more have built their own crowdsourcing platforms. (Blohm, Zagoj, Bestchenider& Lemester 2020)

The idea of crowdsourcing platform is fairly simple and straight forward. An online website where business can publish the task/problem that needs to be solved. Crowd contributors - people who would like to earn extra income or who are interested in technologic development and would like to contribute their knowledge can sign up, create their profile, and list skills they have.

By signing up crowd contributors will have an instant access to the tasks published in the platform and businesses will have an overview of contributors' skill sets and expertise. If the business would like crowd contributors to work on

confidential projects as an option is to reach out to a vendor who will run the project and engage crowd contributors in a way that confidentiality is secured. Some businesses have their own platforms where they can invite crowd contributors to work on the tasks. Crowd contributors might be asked to sign a Non-disclosure agreement as it is common confidentially protection process.

However, crowdsourcing tasks are very diverse and have unique technical specifications when it comes to the execution. When it comes to the variety and complexity of the tasks, for many of them one platform cannot accommodate all the needs.

There are four types of crowdsourcing platforms based on the complexity of the tasks as presented in figure 3. The types of platforms are based on the tasks they are designed to carry out and how contributors will interact with each other within these platforms. There is micro tasking when each contributor submits their own results. This is the simplest task type. Microtask should be designed to not take much time to complete. For example, simple data classification, audio transcription and similar. Broadcast search is asking each contributor to offer their own ideas/problem solving solutions for the same problem. The most suitable ones will be selected. Broadcast search is used when there is an objective to a problem and solution can be proved. These two types fall under umbrella type - selective contribution where results are collected from individual contributors.

Second umbrella type is integrative contribution – there the results are collected from input of all contributors together. There are two types or tasks – information pooling and open collaboration. Information pooling is collecting and integrating divers' opinions about the problem. Open collaboration – limited number of contributors cooperate to solve a problem and share their ideas with each other, working as team. (Blohm, Zagoj, Bestchenider& Lemester, 2020)

Aggregation of Contributions

Selective contributions
the value is derived from individual contributions

Integrative contributions
the value is derived from the entirety of all contributions

Diversity of contributions

Homogenous contributions — contributions have the same characteristics

Microtasking
> Highly pre-determined and qualitatively identical contributions as result of simplistic tasks
> **Goal:** Scalable and time-efficient batch processing of tasks
> **Examples:** Facebook Translations; Amazon Mechanical Turk; GalaxyZoo; Clickworker

Information Pooling
> Additive aggregation of distributed information
> **Goal:** Integration of diverse opinions, assessments, predictions, or other information of contributors
> **Examples:** Mountain Dew Dub the Dew; Hollywood Stock Exchange; AT&T Mark the Spot; Google Maps

Heterogeneous contributions — contributions differ in nature and quality

Broadcast Search
> Contributions reflect alternative solutions to the same problem of which the most promising ones are going to be selected
> **Goal:** Gaining alternative insights and solutions to problems from "outsiders"
> **Examples:** General Electric Ecomagination Challenge; Netflix; Prize; Applause; InnoCentive

Open Collaboration
> Contributions of limited individual value are aggregated to an entire whole by means of collaboration among contributors
> **Goal:** Creation of complex artifacts that require the integration of distributed knowledge and skills
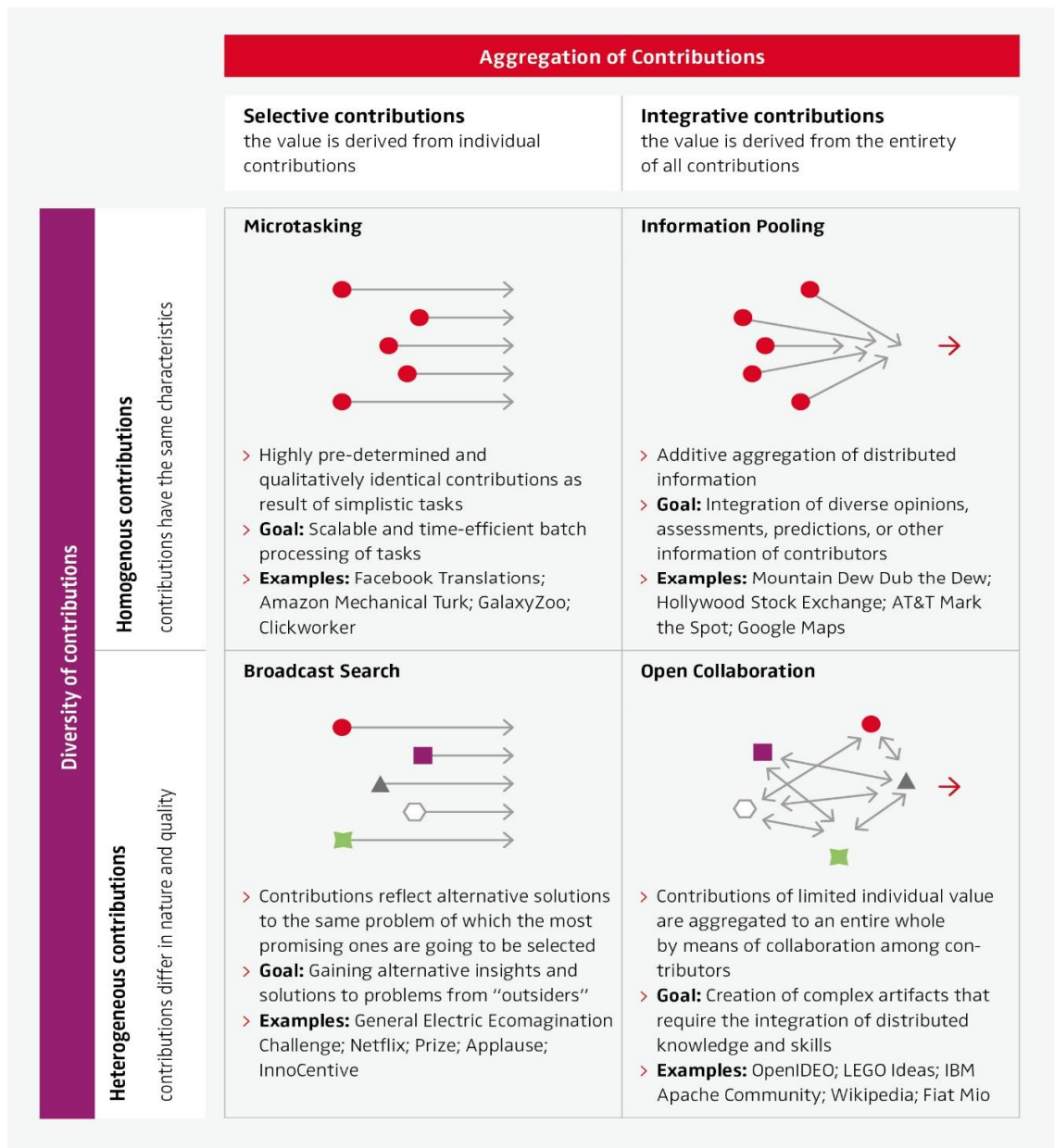> **Examples:** OpenIDEO; LEGO Ideas; IBM Apache Community; Wikipedia; Fiat Mio

FIGURE 3. Different types of crowdsourcing platforms (Blohm, Zagoj, Bestchenider& Lemester, 2020)

Despite the differences in task types and technical abilities of platforms there are key elements every platform should have to assure successful collaboration between businesses and crowd contributors.

To achieve the desired goal, same as any other projects also crowdsourcing tasks need to be managed. The host/owner of the platform should have process in place that allows communicate the task requirements and details together with the guidelines and clear instructions on how the final results should be delivered to the crowd contributors. Crowd contributors should be able to access the task

simultaneously or just individual distributed batches based on the needs. Many platform host/owners solve this by implementing structured templates to be filled in, so it is easier for the company to publish the task.

Quality assurance is another challenge that hosts/owners of crowdsourcing platforms face. It is suggested that quality assurance process should be automated as much as possible, however automation might not work for all the types of the tasks and human intelligence is still needed to check the quality. Manual quality checks are left to the business who owns the project, platforms/platforms owners do not offer manual quality checks.

Crowd contributors are getting compensated for the work they have performed. Crowdsourcing platforms must have a payment method options implemented so each worker can select one based on their preference. The most popular methods on how compensation is transferred is via online payment systems such as PayPal, Pioneer, and various online wallets.

In addition to all listed above an effective crowdsourcing platform should provide an overview to the crowd contributors' profiles, their skills, experience, level of expertise. Not all crowdsourcing tasks can be done by everyone, some of them are more specific than others and by having an overview on contributors` profiles business can leverage from an option to be able to choose crowd contributors with needed skill sets. (Blohm, Zagoj, Bestchenider & Lemester, 2020)

Not every business who wants to engage crowd contributors in their operations needs to build their own crowdsourcing platform. As an alternative they can use so called Crowd Labor Markets. These are crowdsourcing platforms hosted/ owned by 3rd parties who offer to match businesses with crowd contributors. They operate on same principles as crowdsourcing platforms. (Boudreau & Lakhani, 2013)

2.4 Crowd as capital

There are many success cases that prove that businesses do successfully leverage from crowd in terms of innovation and cost saving, however, to introduce crowd contributors/ crowdsourcing as part of the business operations does require the strategy and investment.

To successfully operate crowdsourcing business needs to build crowd capital – resources obtained through crowdsourcing that can be partially or fully re-used in business operation. As a rule, business do not have ready and pre-existing crowd capital, it needs to be gained, developed, and maintained.

There are three steps to follow to start building crowd capital - constructing a crowd, developing crowd capabilities and harnessing the crowd (Prpic, Shukla, Kietzmann & McCarthy, n.d)

2.4.1 Constructing a crowd

To start constructing the crowd DBAS framework can be used as shown below in Figure 4. DBAS stand for Define, Broadcast, Attract, Select. This is the framework that is easy to follow and is based on the logic on how any traditional recruitment works.

To start a company needs to define and understand what is needed. The problem or what needs to be solved must be clearly defined. It will lead to understanding of what type of task will be offered to crowd contributors - will it be simple micro task or something more complex. From there the conclusion can be made about what type of crowd contributors are needed. What skill sets crowd contributors must have to solve the problem and to contribute to the solution.

When problem is defined and crowd contributors' profiles are clear, the company must start to broadcast the opportunity by creating call for action. There are several ways how to broadcast the call for action and where to do so.

Nowadays social media platforms are very popular and offer different ways how to reach large audiences. It is important to define where the opportunity will be advertised to gain the interest of needed crowd contributors.

The goal of broadcasting is to attract the needed crowd contributors and later on engage them in the work. Adequate and appealing compensation amount or incentives for the work done is a good way how to attract needed contributors. If good compensation is stated during broadcasting it will help to attract people.

Final task is to select correct contributors. Clear selection path must pre-defined based on needed skill sets and profiles of crowd contributors. If selection path is more complex and involves tests or screening of candidates it must be communication beforehand to the contributors, preferably during the broadcasting step.

Crowd capital needs to be stored somewhere. After contributors are attracted and have shown the interest there must be an online place ready for them to sign up. Usually it is databases owned by the business or third-party crowdsourcing platform. (Dahlander & Piezunka, 2020)
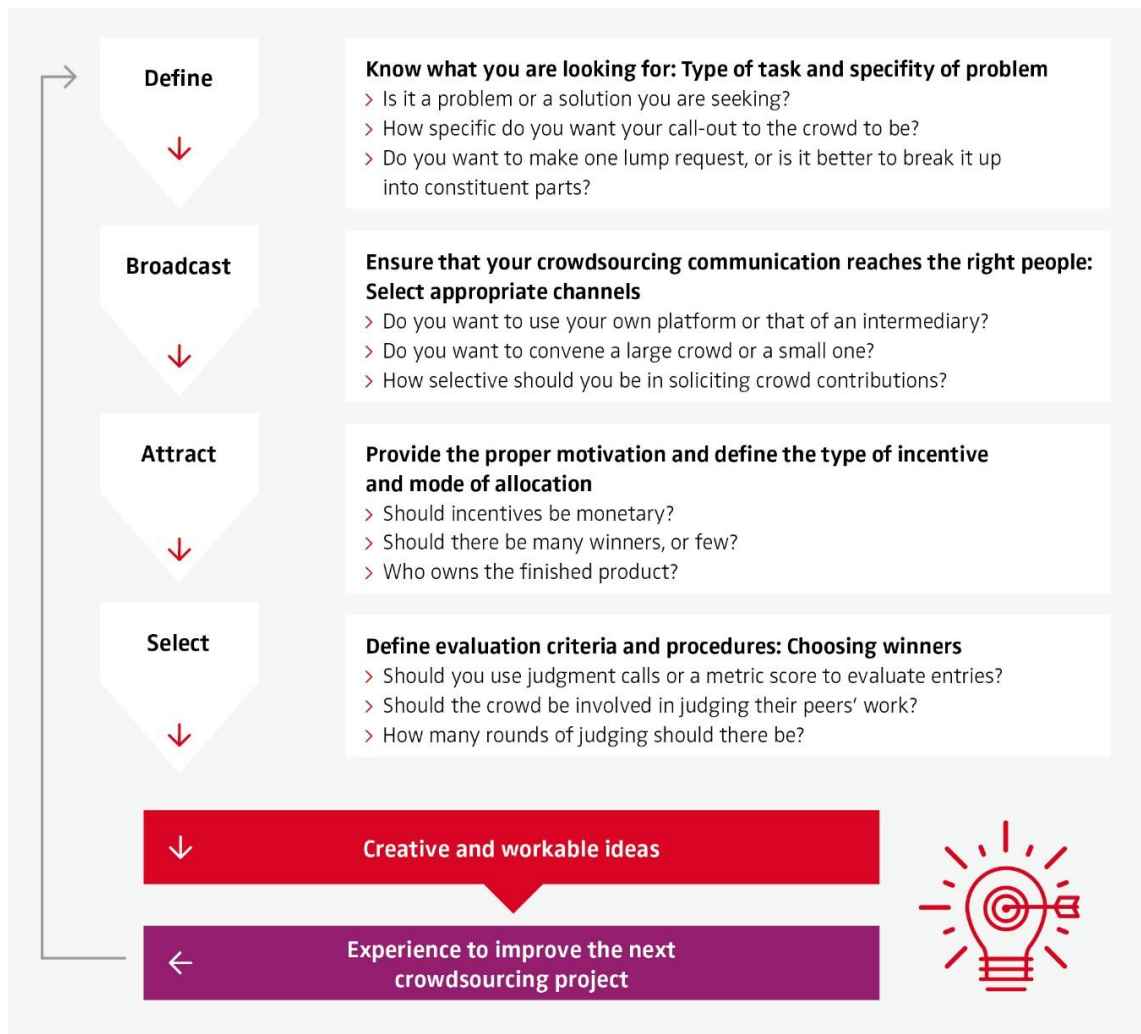
FIGURE 4. DBAS crowdsourcing framework (Dahlander & Piezunka, 2020)

2.4.2 Developing crowd capital

Developing and maintaining the crowd capital is the most important step in crowd capital to achieve the desired goal when using crowdsourcing. If proper actions are taken it will not only help to achieve the goals, but also will pay off financially. Even, if simply put, there are millions of people available and they all can be reached through internet, attracting them costs money for any business.

The main aspect of developing the crowd capital is the relationships between the business and crowd contributors. To establish good relationships that serves both parties it is essential to understand what type of interactions, also known as crowd engagement, will be needed and where they will take place.

Commonly there are two types of interactions – one-time independent encounters that might be or might not be repeated or a long-term engagement where both parties – the busines and crowd contributors expect continues collaboration.

For interactions to happen an appropriate IT structure – crowdsourcing platform, must be selected. A business can decide if they want to develop their own platform, outsource from 3rd parties, or use Crowd Labor markets. The platform should be able to serve the needs of business and crowd contributors.

Incentives and bonus for successfully completing the tasks work as a good motivator for crowd contributors. Well thought thru reward model will add extra value during the crowd capital development stage. (Prpic, Shukla, Kietzmann & McCarthy, n.d)

When building long term relationships with crowd contributors it is good to keep in mind that not every crowd contributor can be engaged in all the ongoing projects at all times, however a certain percentage can be engaged in several projects or might contribute to finding and bringing into the project new contributors. However, some people might never work on any projects and there is no possibility to motivate them to stay in the databases. This type of attrition is expected in crowd sourcing; therefore, it is important to manage the crowd databases.

2.4.3 Harnessing crowd capital

Crowd contributors are individuals/people who do have their own understanding and take on thing no matter their expertise and skill sets. To get the best possible outcome from crowd capital business should invest the same amount of energy and intelligence in crowdsourcing as in the internal processes and employees. It has been proven useful to use several sets of tools such as dedicated crowdsourcing platforms, adapt pipeline management techniques, constant data analyses and risk management, good and open communication channels to successfully manage crowd projects which would allow crowd contributors easily switch from one task to another, provide the feedback and share the knowledge.

No matter what type of relationship business would like to have with the crowd contributors, communication and trust are important key points that should not be left outside. Businesses need to listen to the crowd contributors to be able to build the trust. Relationships never work one way; communication channels should work both ways. Crowd contributors should have an option to reach out to the business. Communication options can be implemented as a part of crowdsourcing platform or can be directed via e-mails or other online communication tools.

By obtaining and analysing the feedback from the crowd contributors' will allow businesses to adjust and improve their crowd management processes, understand the expectations and abilities of their crowd contributors, and keep developing their crowd capital. (Prpic, Shukla, Kietzmann & McCarthy, n.d)

2.5   Human Resource management and Crowdsourcing

When talking about crowdsourcing and crowd contributors we talk about humans – people who sign up for different tasks online. In the traditional business models' humans who work for the company are employees – human resources.

In any organisation human resources are managed to assure best possible performance. Human resources management is a part of an organisation dedicated to managing and supporting employee's performance based on the needs of an organisation. (Buettner, 2015)

It is logical that question about what role HRM – human resource management has in crowdsourcing is raised. Crowd contributors even being human resources are not companies' employees. The idea of crowdsourcing is to expand organisations capacities by engage in their projects thousands of people all around the Globe without employing them directly. If crowd contributors would be employees crowd sourcing would not work as it is designed, many projects would not be possible to execute. (Cabanillas, n.d.)

There are eight focus processes in traditional HRM. Recruitment process when a job opportunity is advertised and offered to potential candidates, selection process also called as screening when potential candidates are selected and interviewed based on their experiences and skills to fit for a job. Then it is followed by training process. Trainings are provided to all new employees when they start, as well as to all existing employees during their employment based on the development of the organisation.

To keep employees engaged and motivated there is performance management process, incentives, involvement process and job design. Performance reviews as a part of performance management allows employees to receive structured feedback on their performance, follow companies' goals and set up individual goals or create development plan. Incentives are used to motivate employees.

Job involvement and job design are processes that complement each other. They are both designed to encourage employees to use their knowledge obtained during working experience to suggest innovations and improvements and be able to present them to their direct supervisors. (Jiang, Lepak, Hu & Baer, 2012)

Pipeline management in human resources is another aspect that is discussed in relation to crowdsourcing. Pipeline management assures that there are talents in the pipeline who are qualified and ready to fill in vacancies as soon as there is job opening. Pipeline management helps to save recruitment costs for the companies and fill the positions the soonest which saves production costs at the end. (Nyberg, Abdulsalam & Weller, 2019)

Crowdsourcing process by its design is similar to pipeline management process in HR. For the companies who work with crowdsourcing projects and must have large databases of crowd contributors to execute the projects it is mandatory to maintain the databases in a similar way as it is done in HR using pipeline management.

Lately crowdsourcing is becoming a part of pipeline management in HR. Crowdsourcing offers an opportunity for HR to recruit form larger networks and attract more candidates at the same time. People are reluctant to trust recruiters

or headhunting agencies. People will trust a friend more who recommends a position or a company. Crowdsourcing offers possibilities to explore the connections within communities. (Ecceleston, 2018)

HR department is not directly involved with crowd contributors even if they are considered human resources. Crowd contributors are usually managed by sourcing managers, community managers, resource engagement managers, recruitment managers, production leads, project managers etc. depending on organisation`s structure, but they are not managed by HR professionals.

Standard human resource management is not applicable for crowdsourcing when dealing with crowd contributors, however the HR processes and practise are applied to crowd contributor management. There are no defined set of processes that are applied from HRM to crowdsourcing management, however, most comply used ones are trainings and motivations, especially incentives. (Becking, 2018)

2.6   Inventory management

Inventories are all around us and people encounter them every day. Inventories can be as simple as a household having a groceries in the fridge for the week to feed the family or having a list of groceries that need to be purchased as an addition to the existing ones to cook big family Christmas dinner. We get our groceries form bigger or smaller stores that also have inventories of the goods they sell. The goods are bought from manufactures/produces that will have inventories of raw materials, machinery, ingredients etc. needed to produce these goods.

Quick trip to the store down the street can be a challenge in winter is the city government is not owning enough of snow shuffles to clean the streets is an inventory problem too. Last year there was no snow, no one ordered new snow shuffles. This year it is snowing constantly, the demand for snow shuffles rises and creates shortage of the goods in the market.

Inventories are dependent, they depend on the variety of outside processes and factors. Most understood one is a demand and supply, there is certain demand for goods in the market so business must provide the supply. To supply the goods and react to changes in the demand - increasing or decreasing, a good meticulous inventory process must be in place. Weather changes, political climate changes in the region are just a few to name amongst other factors that will influence inventory. (Muckstad & Sapra, 2010)

Each organization or business keeps inventory. The definition of inventory can slightly change based on the industry in what business or organization is operating, but the bases of every inventory are business possessions that are used to produce goods or services to sell such as raw materials, unsold ready goods, goods in process to be completed and supplies used in the production process. (Muller, 2019)

For business to be successful it must have ability to provide goods or services to their customers and sustain financial health. To achieve that business must have set up operations that will guaranty constant supply of goods to the customer with competitive price and in a timely manner.

Part of these operations is inventory and inventory management. Inventory management is the process that assures the availability of goods. To sell the goods they need to be purchased first or raw materials form which goods are made need to be purchased first. To satisfy the demand a stock of the goods or raw materials must be kept. Having stocks will help business to manage lead time in which goods will be ready and can be sold to the consumers. As stated before inventory is dependent and having controlled stock can help to mitigate the risks of unforeseen factors that can impact the delivery, manufacturing, shipping, purchase of the goods or raw materials and as a result impact the business operation in whole. (Wild, 2018)

To have an understanding on the supply capacities an inventory must be carried out on stock. The purchase value together with sales value of each item in stock must be recorded Each item in stock carries a value – cost of the item purchased and sell value.

That information not only helps to have clear understanding on current value of the stock what business, but also is used when forecasting future sales and turnaround.

There are four most commonly used inventory methods – perpetual, periodic counts, fist in first out and last in last out.

2.6.1 Perpetual vs Periodic inventory methods

In perpetual inventory method every purchase or good sold are tracked and updated after each transaction (Haber, 2003). Until recently there were significant challenges to use this method to monitor large inventories and track data manually. Nowadays technological development allows to do so by using software and scanners that allows to track and update information on goods sold and purchased in real-time. Perpetual inventory method helps management to know and follow actual inventory of the stock at any given time. (Corporate Finance Institute n.d)

Periodic method is a manual counting of the goods that is done periodically. It is widely used by small and medium businesses, however in between the "counts" the stock inventory might not be accurately up to date that might lead management to make mistakes when creating a forecast. Perpetual and periodical inventory methods are two opposite systems. Each of them having pros and cons.

Main plus to use perpetual method is that stock inventory will be update in real time, however to implement the system can be too costly for small and medium size businesses as they will need to acquire software, barcoding tools, scanners and have additional personnel.

Periodic method is more suitable for small and medium size business with slower turnaround. (Corporate Finance Institute n.d)

2.6.2 First In Firs Out vs Last In First Out inventory methods

Fist in First Out also called FIFO is an inventory method used in accounting to understand the value of the stock left and goods sold. FIFO works on the assumption that inventory stock items/good bought first are sold first. It is commonly used in manufacturing where inventory consists of raw materials used to produce the final product. However, it does not reflect stock actuals and is mainly used to understand the expectations of the cost flow.

Substitute of FIFO is LIFO – Last in First out. LIFO is an accounting method that assume the last good manufactured/both is the first to be solved. It is used only in USA and IFRS forbids to use LIFO method. (Corporate Finance Institute n.d)

IFRS stands for International Financial Reporting Standards and it is a non-profit organisation set up to develop accounting standards that would be transparent, clear and understandable globally. IFRS are currently accepted in 140 countries. (IFRS Foundation, 2021)

3   METHODOLOGY

This chapter describes what methodological approach was used in this research. It talks about what methods were used to collect the data and why they were chosen. This chapter also describes how the collected data is analysed.

3.1   Methodological approach

The purpose of the research is to explore what data sourcing team leads need to have daily access to about crowd contributors and understand if any of standard inventory methods can be used when working with crowdsourcing databases. To answer research questions practical knowledge must be obtained from the research participants – sourcing team leads. Sourcing team leads do know the best from their day to day work experience what are the needs, meaning what data (information) will help them with their everyday tasks. Research participants are able to identify the tasks they need the data for and map how the data can be used in these tasks. Based on the aim of the research qualitative research method was selected.

Qualitative research is approach that offers possibility to explore in more depths and details the opinions and points of view of the research participants. It allows to gain knowledge and insights of participant experiences regarding the specific subject. (Hennrik, Hutter & Bailey, 2020 p.10)

There are different techniques on how to carry out the qualitative research such as interviews, focus group discussions, content analysis, observations, visual methods and biographies/historical life documentation. (Hennrik, Hutter & Bailey, 2020 p.10)

Several techniques can be used simultaneously during the same research since they all offer different values. By using interviews researcher can learn in depth personal experiences and detailed opinions from research participants based on their experience in the field in question. The hypothesis of the research questions

and structure as well as focus area can be better understood and streamlined through group discussions (Creswell & Poth, 2017, p. 60 – 70). Observation technique allows researcher to see what research participants are actually doing and what is the progress or consequences of actions. The actions can also be documented photographically. Content analysis can bring in clarity on communication style, tone, examine if written text as bias or not. Documents, books, articles, pictures or any other written texts are considered content. Qualitative research findings are reported differently than quantitative research findings where data is presented in numbers, can be calculated and measured in any other mathematical expressions. Qualitative research findings are mostly presented as analyses and conclusions (Patton, 2015)

The goal of any research is to create new or test existing theories. Research results should tell in detail how the existing theories work and what are they flaws and benefits or should they be challenged. Qualitative research method is applicable when research needs to answer the questions "why" and "how", to research new ideas/topics, explore challenging issues or find ground theory. Qualitative research method is all about field work - collecting information, observing behaviours of research participants, gaining in depth knowledge through interview process from research participants who are at the same time stakeholders and are involved in the case study, therefore can share their practical experiences, thoughts, ideas and even emotional components. (Patton, 2015)

3.2   Data acquisition methods

It is important to identify the most suitable data acquisition method to guide the research participants on how to share their knowledge and expertise. For this research two data acquisition methods were used - focus group discussions and structured interviews.

In this research there are four research participants, all currently working at Lionbridge AI and being part of Lionbridge AI Sourcing team. Three of research participants are Global Community Sourcing Managers and one is Global

Community Sourcing Director. All four participants took part in focus group discussions and later answered interview questions. Research participants will be referred as sourcing team leads or just research participants.

All of the research participants work with crowd community on the daily bases, in fact their main tasks are - to manage crowd community, by offering to existent crowd contributors' new projects/task, bringing in new contributors into the community and use their knowledge to plan sourcing team`s capacities and provide estimates for the new prospects.

The first part of data collection was focus group discussions. Focus group is designed to discuss the topic in question to obtain the detailed information, ideas, experiences and points of view from research participants. (Cornwall & Jewkes, 1995)

All four research participants took part in the discussions. Discussions were organised as online meeting through online communication platform Teams. Notes were taken during the discussions and main findings have been recorded in written. Due to the current Covid – 19 restrictions, it was not possible to have physical meeting on the premises.

First discussion question was to better understand the needs of sourcing managers regarding of what type of data should be accessible about the community contributors to sourcing managers at any given point.
Second discussion point was to gain the understanding about for what tasks each souring manager is using the data.

During the focus group discussions additional questions surfaced and it was decided by the researcher to continue collecting the data and have second round of data collection.

Second round of data collection was carried out in form of structured interviews. When conducting qualitative research, it is important to select correct interview method that will suite the goal of the research. The correct interview method will allow to collect data in most precise manner.

In qualitative research are three main types of research interviews used – conversely or unstructured interviews, semi structured interviews and structured interviews.

Unstructured interviews are carried out with very little or no preparation at all. They do not have pre-defined questions. The research participant is asked open end question to share their experience or thoughts/ideas on the subject and from there the interview evolves. Unstructured interviews are conducted when there is very little information or no information at all about the research subject or when in depth understanding or research participant experiences are needed.

Semi-structured interviews have few pre-defined questions to guide the researcher participants. Similar as with unstructured interviews this approach allows to explore research subject/questions in depths.

Structured interviews are designed as questioners and are asked form research participants. Structured interviews have sets of pre-defined questions, that in most cases do not lead to follow up questions or too elaborate answers. Structured interviews are conducted when precise, factual information is needed to have a conclusion on the research subject/questions. (Gill, Stewart, Treasure & Chadwick, 2008)

Structured interviews were selected as data collection method because this research is not focusing on personal emotional experience or asking for opinions or ideas. As opposite it has defined and formulated questions that need to be answered with the facts. However, the facts can be provided only by research participants based on their daily work experience, therefore the structured interviews are important data collection method in this research.
All four research participants have been interviewed online and interviews have been transcribed.

Structured interviews had nineteen questions in total. All of them but one, were designed in the form of questioners where research participants were asked to grade the importance of the data in question and map it together with the task. One question was left as open question to obtain any additional knowledge.

3.3   Data analyses methods

When using Qualitative research method there is no one defined technique how to analyse the collected data. To be able to analyse the data researcher needs fully understand it, look for repeated patterns or absence of them, find how data collected from different sources is related and where/if it overlaps. (Kawulich, 2004)

During the process of data analyses the data should be reduced, organised, categorised and summarised. All patterns in the data should be identified and linked to each other. As a result, that should lead to the final stage of the research where findings can be obtained, and conclusions made. (Patton & Herman, 1987)

There are several techniques that can help to analyse data in qualitative research, however all analyses in qualitative research must be done with critical, analytical and logical thinking of the researcher.

For this research analyses of the data will be performed by exploring the actuals obtained through the interviews and focus group discussions together with the proven theories of inventory management described in section 2.6 .The data will be organised and presented in the form of charts and tables when possible for visualisation.

There are three main questions that need to be answered to obtain the conclusion of the research. The research questions are interconnected and need to be answered in chronological order therefore the research analysis will be done in three parts, in each part verifying that the respected question is answered.

Figure 5 shows the flow of the research based on the question hierarchy. First question should be answered during the focus group discussions. Answers to sub-questions will be obtained through interviews. The answers to the remaining two questions will be concluded based on the analyses of interview answers and existing theories. The clearly identified data types must be the result of the discussion between research participants.

Second question is analysed based on existing practices. Use and practises of standard inventory methods will be examined to find a conclusion. Findings of the third question will come from first and second questions.
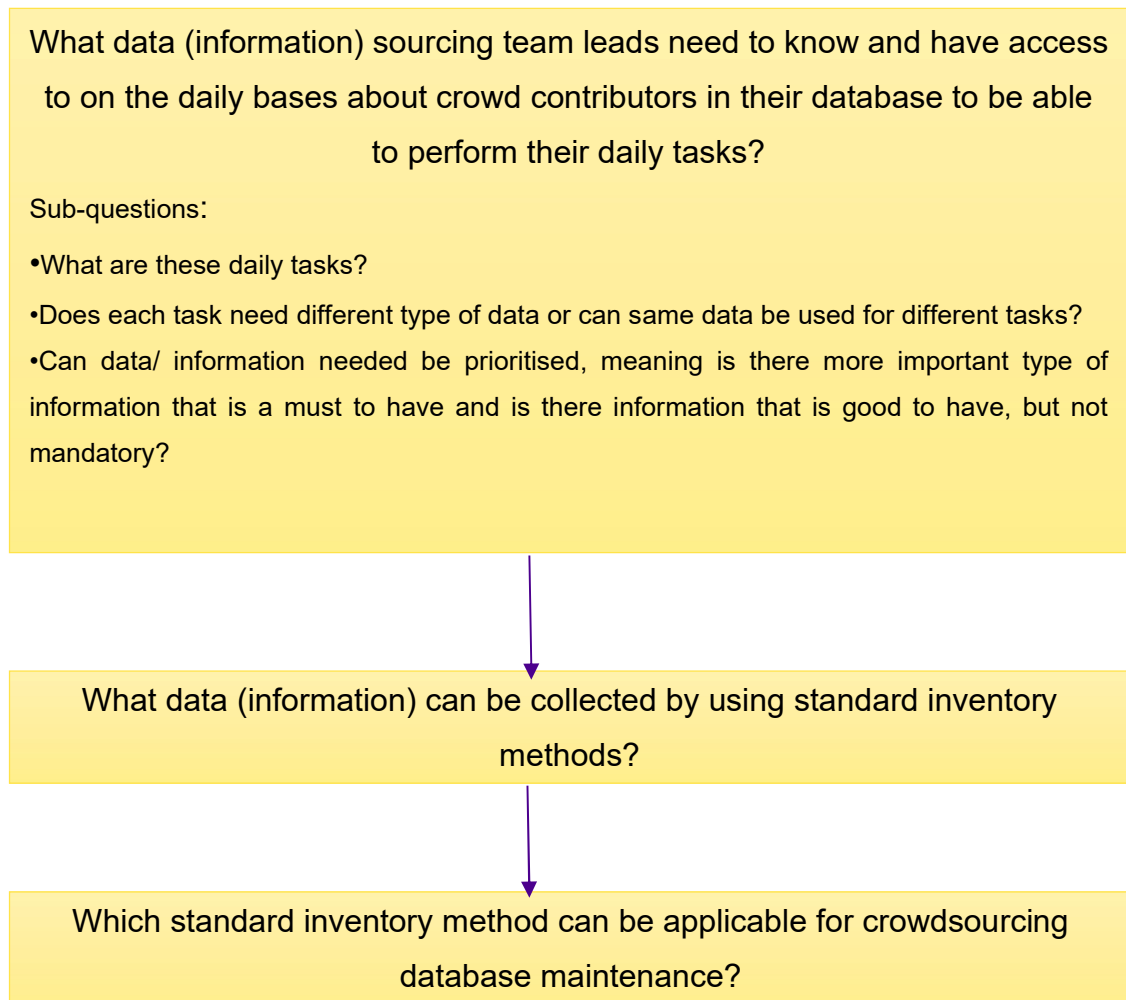
What data (information) sourcing team leads need to know and have access to on the daily bases about crowd contributors in their database to be able to perform their daily tasks?

Sub-questions:

•What are these daily tasks?

•Does each task need different type of data or can same data be used for different tasks?

•Can data/ information needed be prioritised, meaning is there more important type of information that is a must to have and is there information that is good to have, but not mandatory?

What data (information) can be collected by using standard inventory methods?

Which standard inventory method can be applicable for crowdsourcing database maintenance?

FIGURE 5. Flow of the research

Any additional questions that might surface during the focus group discussions or interviews will be analysed respectively.

4   DATA NEEDS AND INVENTORY METHODS` ANALYSES

The aim of this study is to understand which of standard inventory method would be best suited for crowdsourcing when maintaining large numbers of resources (crowd contributors) in the databases.

The chapter below will present discovered findings during the research process. As described in chapter three qualitative research method was used to conduct this study. In practice the research started with building theoretical framework and continued by obtaining the data from focus group – sourcing team leads, who are directly involved in crowdsourcing.

There are three questions to be answered during this research to be able to conclude the results.
The first question, including sub – questions, is designed to be examined and answered by research participants. Second and third questions are examined by the researcher based on the existing theories and analyses obtained from answers provided by research participant to the first question and sub – questions.

The question about total number of resources available in database is not included in this research, because it is assumed that that information should be available by default.

4.1   Data that must be accessible to sourcing team lead daily

To answer this question, focus group discussions were organised. Discussion topics are presented in Appendix 1. During the discussions it crystallised that there are specific tasks sourcing managers need to do on the daily bases where they do need the updated data regarding the resources they currently have in the databases. From there a conclusion was drown that first step should be to list the tasks that do require the data about resources. It would help to steer the discussion towards practical side of this research – to have clearly identified

needs that can later be used to determine what inventory method can be applicable for crowdsourcing.

During the focus group discussion three additional questions came into focus that would need to be answered to have accurate and precise as possible answer to the first research question.

List of all three questions that were identified during focus group discussion:

- What are these daily tasks?
- Does each task need different type of data or can same data be used for different tasks?
- Can data (information needed) be prioritised, meaning is there more important type of information that is a must to have and is there information that is good to have, but not mandatory?

The list of main tasks that would need data about resources where prepared during the discussion:

- to plan ETAs – estimated time of arrival – when resources can start working on the project;
- to plan sourcing team`s capacity;
- provide estimates – provide information to new project proposals to the client and prepare quotes;
- to plan sourcing strategy;
- to plan qualification path for resources;
- to plan sourcing budget

Sourcing leads daily plan and provide ETAs to the project team regarding how long it will take to source needed number of resources for specific projects. That allows project team to plan project timelines and deliveries to the customer. To be able to plan ETAs sourcing team leads do need to know resources already available in the databases and if possible, any other information about resource skills set, profile, experiences etc.

Planning teams` capacity is part of managing projects and internal teams. Sourcing team`s capacity is planned based on the number of project ongoing at the same time and complexity of the projects. Data about available resource is

often used as well, because if project is not complex and resources are already in the databases it means that team will spend less working hours and human power to source for the project.

To be able to provide estimates for new prospect request that come from clients sourcing team leads to need to have a good overview of what type of resource company currently have in their database. All sourcing team activities and budget are planned based on the actual numbers of existing resources. This is fairly similar when companies do forecast and plan any future purchases based on their inventories in stocks.

Sourcing strategy is important to plan and define when starting the project. It includes how the resources will be sourced, what advertisements channels will be used, how call of action will be broadcasted to the outside audiences and so on. If there are enough resources already in internal databases the call of action will not be sent out.

Qualification path for resources is a part of sourcing strategy. It defines if resources need to be tested for their skill sets or if they will be any additional screening of the resources needed. It is decided based on the project specifications and what type of resources can take part in the project.

Sourcing budget is planned in the estimation phase usually. It shows how many hours and at what costs sourcing team will spend to source specific resources requested.

Types of data (information needed) were identified during the focus group discussion as following:

- Date when a person signed up to Lionbridge AI database
- Responsiveness – number of projects a person signed up for
- Actual delivery - number of projects a person actually worked on and delivered the data/completed the task
- Feedback/grading on a person on their performance quality per project

- Activity track - date when person last time logged into Lionbridge AI database
- Activity track - date when person last time signed up for a project
- Language skills resources have
- Location of resources
- Previous experience resources have for AI related tasks such as annotation, transcription, rating etc.

To answer additional two questions that emerge from focus group discussion the individual structured interviews were arranged.

4.2   Data needed for each task and data prioritisation

As mentioned above to answer the questions that have surfaced during focus group discussion structured interviews were organised. The goal of structured interviews was to understand:

- Does each task need different type of data or can same data be used for different tasks?
- Can data (information needed) be prioritised, meaning is there more important type of information that is a must to have and is there information that is good to have, but not mandatory?

Interview questions can be found in Appendix 2.

During the interviews research participants were asked to map what type of data will help with what task. This will allow to better understand to carry out what tasks sourcing managers do need to have the access to the data the most. As a second step research participants were asked to evaluate how important the data is. Data evaluation is significant as in practice not all the data can be collected and when working with databases, even if they are designed to have sophisticated algorithms that can run any calculations and data reports, it is still important to have a priority system and focus on what is most important and what data is most needed, because in practice having too much data and shifting through countless data reports will not be productive. Task and data types have been identified during the focus group discussion and are presented in section 4.1.

4.2.1 Data used for each task type

This section will present results of analysis of each data type presented in section 4.1. Charts are included for visual presentation.

Figure 6 clearly shows that data about when person has signed up for Lionbridge AI platform will be used to provide estimates. It will be also used when planning ETAs – estimated times of arrival for the project and planning sourcing strategy based on specific project needs.
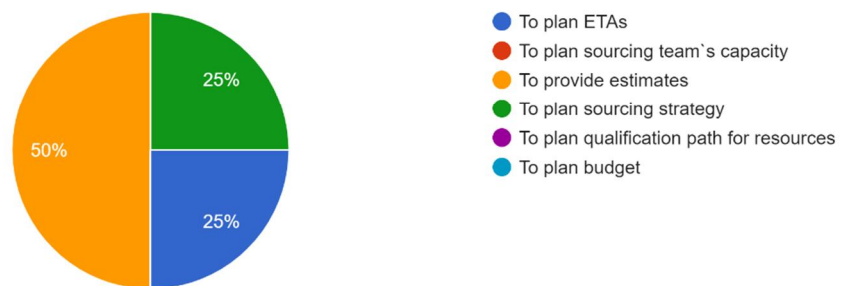
FIGURE 6. Knowledge of the data when a person signed up to Lionbridge AI platform

Figure 7 illustrates responses to a question regarding data about resource responsive – number of projects a person has signed up for. As seen in the results there is no one dominant task where this information will be used. Based on the responses of research participants – sourcing managers and director, this information can be used to plan ETAs, to plan sourcing strategy, to provide estimates, to plan qualification path for resources. This is a clear indication that this type of information is not crucial to have since it can be used differently and very individually by each sourcing manager and sourcing director.

Knowledge of responsiveness - number of projects person signed up for, will help me:
4 responses

- To plan ETAs
- To plan sourcing team`s capacity
- To provide estimates
- To plan sourcing strategy
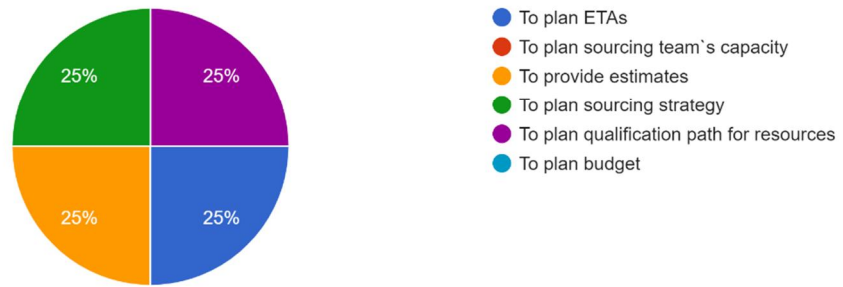- To plan qualification path for resources
- To plan budget

FIGURE 7. Knowledge of responsiveness - number of projects person signed up for

Figure 8 illustrates responses about data regarding number of projects the person actually worked on and delivered the results. The results clearly show that this type of information will be mainly used when providing estimates.

Knowledge of actual delivery - number of projects a person actually worked on and delivered the data/completed the task, will help me:
4 responses

- To plan ETAs
- To plan sourcing team`s capacity
- To provide estimates
- To plan sourcing strategy
- To plan qualification path for the resources
- To plan budget
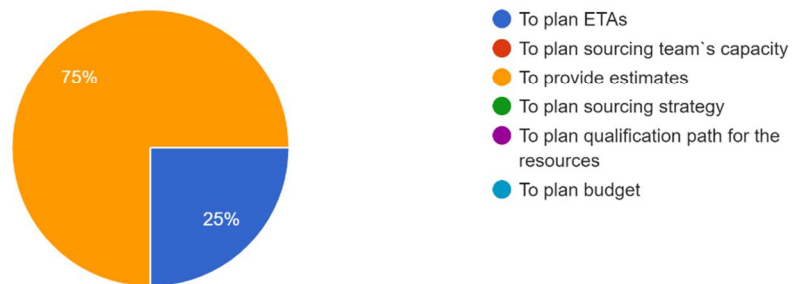
FIGURE 8. Knowledge of actual delivery – number of projects a person actually worked on and delivered the data/completed the task

Figure 9 illustrates responses about data regarding the feedback/grading on a person about their performance quality per project. Results clearly indicate that this data will be used to plan qualification path for resources.

Knowledge of the feedback/grading on a person on their performance quality per project, will help me:

4 responses

- To plan ETAs
- To plan sourcing team`s capacity
- To provide estimates
- To plan sourcing strategy
- To plan qualification path for the resources
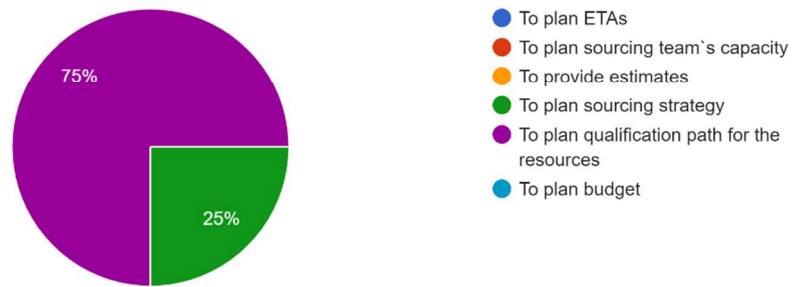- To plan budget

FIGURE 9. Knowledge of the feedback/grading on a person on heir performance quality per project

Figure 10 illustrates responses about data regarding the activity track – date when a person last time logged into Lionbridge AI database. The responses clearly show that this data can be used to plan ETAs and to provide estimates.

Knowledge of activity track - date when person last time logged into Lionbridge AI database, will help me:

4 responses

- To plan ETA`s
- To plan sourcing team`s capacity
- To provide estimates
- To plan sourcing strategy
- To plan qualification paths for resources
- To plan budget
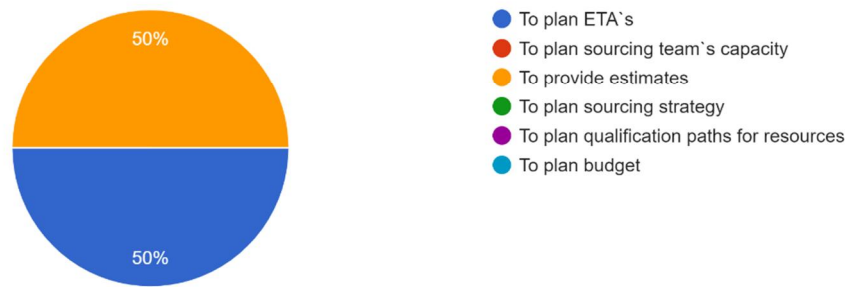
FIGURE 10. Knowledge of activity track – date when person last time logged into Lionbridge AI database

Figure 11 illustrates the responses about data regarding activity track – date when a person last time signed up for a project. Based on the responses provided this data will be used to provide estimates.

Knowledge of activity track - date when person last time signed up for a project, will help me:
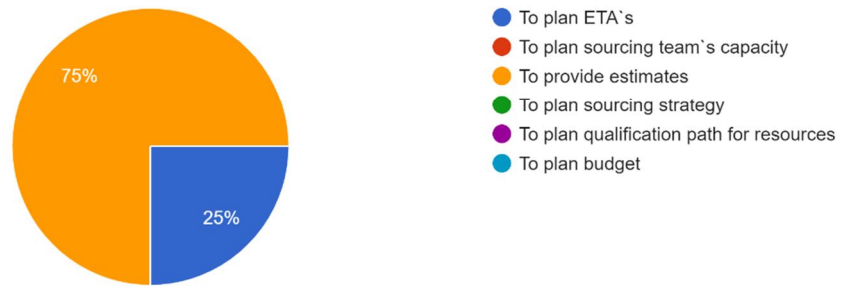4 responses

FIGURE 11. Knowledge of activity track – date when person last time signed up for a project

Figure 12 illustrates responses about data regarding languages skills resources have. The results show that this data will be mostly used for planning qualification path for resources. Sourcing managers would also use it to plan sourcing team`s capacity and to provide estimates.

Knowledge of language skills resources have, will help me:
4 responses
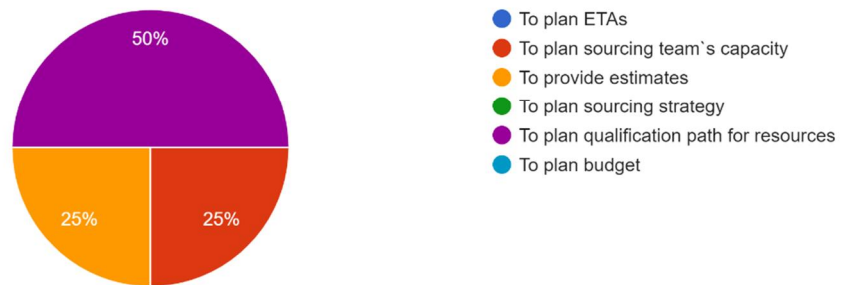
FIGURE 12. Knowledge of language skills resource have

Figure 13 illustrates responses about data regarding the location of the resources. It mainly will be used to plan sourcing strategy but is also useful when providing ETAs and planning sourcing team`s capacity.

Knowledge of location of the resources, will help me:
4 responses

- To plan ETA`s
- To plan sourcing team`s capacity
- To provide estimates
- To plan sourcing strategy
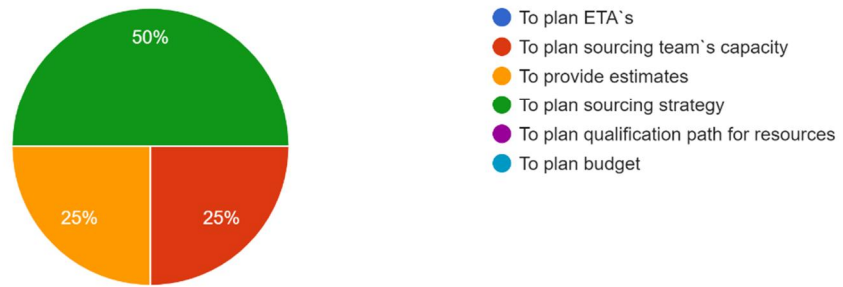- To plan qualification path for resources
- To plan budget

FIGURE 13. Knowledge of location of the resource

Figure 14 illustrates the responses about the data regarding what type of previous experience resources have in AI related task such annotation, transcription, rating. Based on the answers provided this information will be used mainly to plan qualification path for resources.

Knowledge of what type of previous experience resources have for AI related tasks such as annotation, transcription, rating etc. , will help me:
4 responses

- To plan ETAs
- To plan team`s capacity
- To provide estimates
- To plan sourcing strategy
- To plan qualification path for resources
- To plan budget
- Its easier to involve resources in similar or tougher task if this information is provided
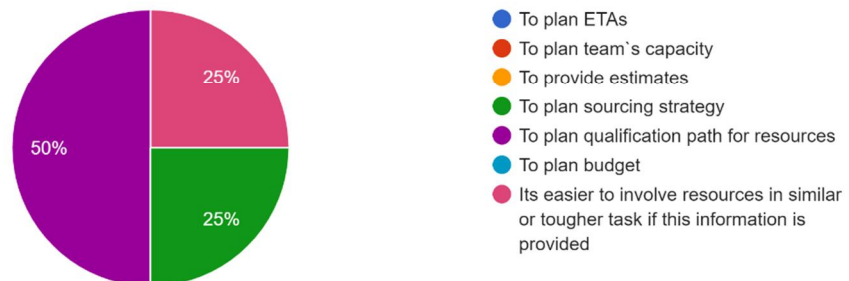
FIGURE 14. Knowledge of what type of previous experience resources have for AI related tasks such as annotation, transcription, rating

Based on the findings above it is safe to conclude that most of the data can be used to perform more than one task, however from the answers collected it is clear that there are some tasks where different type of data is needed. Therefore, more analyses were done to see preforming what tasks sourcing managers will need to have the data the most.

Figure 15 illustrates the findings of data needs per task. Findings conclude that when sourcing team leads are asked to provide estimates they need to have access to the variety of data to be able to do so.
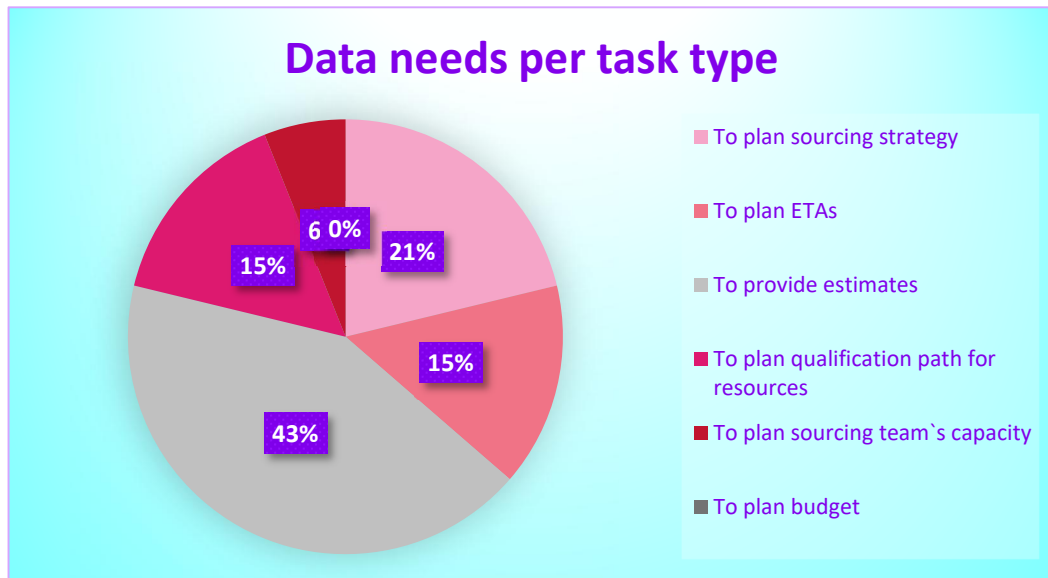

FIGURE 15. Data needs per task type

From all nine data types discussed above 43% would be used to provide estimates for new project prospect. Providing estimates would be the number one task where access to the data about crowd community is needed. It also indicates that to provide estimates without any data about crowd community for sourcing team leads will be highly challenging. Managers need to know the resources at hand and additional information about the resources to be able to provide accurate estimates for upcoming prospects/quotes to the customers.

The second task would be to plan sourcing strategy where knowledge of the data about crowd community is also needed. It rates at 21%. Third and fourth at 15% are to plan qualification path for resources and ETAs. Only 6% of data is used to plan sourcing team`s capacity, that indicates that for this specific task the knowledge of data of crowd community is not crucial. To plan budget is at 0% no data needed at all, however budget planning in most cases is done during the estimation phase.

There is no possibility to evaluate and classify the importance of the task, as in this research business is discussed and in daily business operations are task are equally important.

The answers to open ended questions as seen below in *Italic* suggest that more detailed data about what previous experience people have and their skill sets would be useful especially when planning qualification path for resources and providing estimates.

Answers to open end question:

Candidate's Gender and Age group very needed for both estimates and ETAs on projects with demographics; Previous working experience in a specific field: medical, education, marketing, IT etc. for estimates, ETAs and qualification path.
The devices the resources have access to, this can help us to plan ETAs.
Demographic profile and education level.
It`s very important to get more details of crowd contributors like their experience, expertise, skillset, rates and real location to estimate properly new projects, planning ETA, building qualification path and sourcing strategy.

Figure 16 illustrates that more precise data will help first of all to plan ETAs. Second would be to plan qualification path for resources and provide estimates for new project prospects.
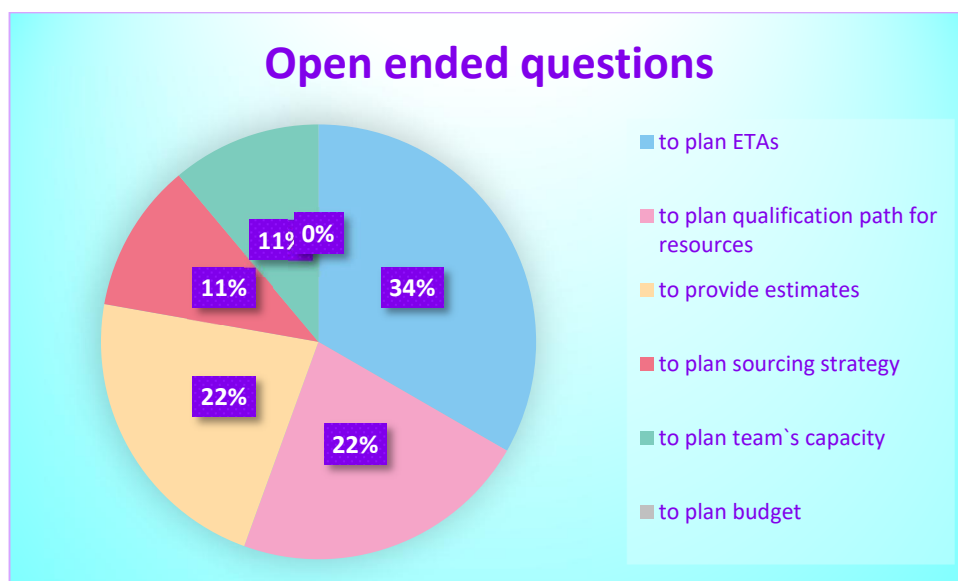

FIGURE 16. Answers to open ended questions.

Based on these findings there is second equally important task for sourcing team leads where data is needed – to plan ETAs the start date when crowd contributors are sourced and ready to start to work on the project.

4.2.2 Data prioritisation

In this section the findings about value of the data will be presented. Data is presented in the table for visualisation. The data types were graded by research participants on a scale from 1 to 5. 1 being Not Useful and 5 Most Needed.

The maximum gradings are for two types of data – languages skill resources have and location of the resources. This type of data is valuable when working on crowd sourcing projects. Most of the crowdsourcing projects need contributors who are physically located in specific region/city and who speak specific language. As shown in the figure 11 and 12 this type of data can be used to preform several tasks by sourcing team leads.

67% of the data, six data types, are graded with 4 and only one data type is grade with 3. No data type is graded with 1 or 2. It allows to conclude that all nine data types that where presented during the interviews and agreed upon during focus group discussions are valuable in everyday work performance for sourcing team leads.

Table 2 provides visual representation on how data was graded. It is designed by combining all gradings for each type of data based on individual response form research participants.

TABLE 2. Data grading

Data type	Grading
Language skills resources have	5
Location of resources	5
Date when a person signed up to Lionbridge AI platform	4
Actual delivery - number of projects a person actually worked on and delivered the data/completed the task	4
Feedback/grading on a person on their performance quality per project	4
Activity track - date when person last time logged into Lionbridge AI database	4
Activity track - date when person last time signed up for a project	4
Previous experience resources have for AI related task such as annotation, transcription, rating etc.	4
Responsiveness - number of projects person signed up for	3

4.3 Data collection in each standard inventory method

The purpose of inventory is to keep a record of information about the resources business have. Each inventory method has different process how data is recorded and what type of information is kept on the record.

When it comes to the crowdsourcing the discussion is about people – crowd contributors, however for business that operates in crowdsourcing field crowd contributors are resources, therefore inventory is important and knowledge of the resources available is essential in crowd sourcing business.

This chapter will explore how information is collected and recorded for each standard inventory method and if there are any limitations per inventory method regarding what information can be collected and recorded. Obtained information later will be used to explore which inventory method can be applicable in crowdsourcing.

4.3.1   Perpetual inventory method

Perpetual inventory method is mainly used for business with large inventories, big stocks such as manufacturing, retailers, distribution centres etc. Data is tracked by using automated system that contains of computer software that generates the swift codes for each item. Later when the items are scanned software will update the record of the item in the database automatically. Each time when items are touched – moved to different location, used in manufacturing or sold, they are scanned, and the records are updated. Perpetual inventory method allows to keep inventory up to date and have all information on the record and have it accessible on daily bases. (Ellison, 2020)

Swift codes are generated by the software and therefore any type of information can be recorded based on the business needs when using perpetual inventory method. The process is automated which helps to save on labour costs and time. (Ellison, 2020)

4.3.2   Periodic inventory method

Periodic method works as manual count of the goods the business has. The counts are carried out periodically based on each business individual needs. Information recorded during the periodic count is mainly regarding the amount of goods available and their value. Additional information such as weight of the item, colour, shape etc can be obtained when the manual counts are done. All the records are updated manually by a person physically checking previous records. This inventory method is labour and time consuming as the counts are done manually. It does not provide real time information on the inventory or stock. Since the counts are done periodically there is always a period of time when the data is not updated. (Gupta, 2020)

4.3.3 First In First Out inventory method

FIFO - First in First Out inventory method focuses on the assumption that goods/items first bough are sold first. FIFO method does provide the information about value of the stock and size. Other than that, the information obtained regarding items available in stock is very limited when using FIFO method. FIFO is used in accounting and is mainly used for financial reports, it is also used for forecasting and planning turnarounds and investments. (Najjar, n.d)

4.3.4 Last In First Out Inventory method

LIFO – Last in First Out inventory method focuses on assumption that last goods bought are first goods sold. It is used in account in USA only. It is not accepted by IFRS, therefore for this research LIFO method will not be taken into consideration.

4.4 Which standard inventory method can be used in Crowdsourcing

Table 3 below presents the summary of the finding of what data can be collected with what inventory method. These finding are based on the assumption that any data can be collected from resources during their sign up for Lionbridge AI database and any algorithm or software can be built as a part of Lionbridge AI database. The goal is to examine and conclude the most suitable inventory method that can be adapted to collect and manage the data from large databases used in crowdsourcing.

When examining the findings in section 4.2 it is concluded that two standard inventory methods allow to collect any data or information about the inventory items. These methods are perpetual inventory method and periodic inventory method. However, there is a significant difference of how and when the data is collected in each method. In periodic inventory method data will be collected by

certain periods and will be done so manually. In the crowdsourcing database it would mean to have manual checks done for each resource. This is not efficient and time consuming. It will also lead to the situation when data will be outdated or not accurate as the updates will not be recorded in real time when they happen.

Perpetual method does allow to record data in real time and all the recording is done automatically. When dealing with inventories for goods the scanner is used to record the information. It will not be possible in crowd sourcing database to use the scanner, but the principle of this inventory method suits the most to the needs of crowdsourcing business. It will allow to have access to all needed information on the record. Perpetual inventory method assures that information is updated in real time and data provided is accurate.

First in First Out method is mostly used in bookkeeping and it will not serve the needs for crowdsourcing database. The data that this method relies on is very limited. When using FIFO only data of registration could be used.

TABLE 3. Overview of what data can be collected by which inventory method.

Types of data needed	Inventory methods			
	Perpetual	Periodic	FIFO	LIFO
Date when a person signed up to Lionbridge AI database	X	X	X	N/A
Responsiveness – number of projects a person signed up for	X	X		N/A
Actual delivery - number of projects a person actually worked on and delivered the data/completed the task	X	X		N/A
Feedback/grading on a person on their performance quality per project	X	X		N/A
Activity track - date when person last time logged into Lionbridge AI database	X	X		N/A
Activity track - date when person last time signed up for a project	X	X		N/A
Language skills resources have	X	X		N/A
Location of resources	X	X		N/A
Previous experience resources have for AI related tasks such as annotation, transcription, rating etc.	X	X		N/A

4.5 Synthesis of the results

The focus group discussions and interviews have proven to be successful in answering research questions. Literature review provided theoretical base line for this work to reach the conclusions.

The research finding allow to conclude that most suitable inventory method to manage crowdsourcing databases is perpetual inventory method. This inventory method in principal allows to collect any needed data (information) in real time. When working with crowd contributors and managing large volume databases it is essential for souring team leads to have access to the data about the resources (crowd contributors) company have.

Inventory methods were examined to obtain a clear understanding of what type of data can be collected using each inventory method. The methods how data is collected were also reviewed. As a result, it was concluded that perpetual and periodic inventory methods have no limitation when it comes to collecting the data during the inventory. These two methods allow to collect customised data and both methods can be adapted to individual needs.

The research also presents what data is needed and must be accessible to sourcing team leads on the daily bases. The data is listed in chapter 4.1. Together with data a list of daily tasks has been defined. The tasks indicate where collected data will be used in daily operations. It has been concluded that not all the tasks need the data equally to be executed. Some tasks have higher need for data for sourcing team leads to be able to complete them. Providing ETAs – estimated time of arrival of resources when they are ready to start working on the project and providing estimates for new project prospects have been identified as two priority tasks for which data is needed the most.

Results of data prioritisation analyses show that the same is applicable for the data. The research showed that all data is useful for sourcing managers, however the data about persons` skill sets, language abilities and location is most needed for the daily tasks of souring team leads.

All nine data (information) types presented has been proven to be useful. There is no information in question that is irrelevant for sourcing team leads or will not bring any value. All data (information) is used to perform several tasks on the daily bases. There is no one type of data that will be useful only just for one task and will not be suitable for other tasks. Some tasks do need to have more data to be done than others as it is seen in the findings.

The objectives of this research have been reached and research questions answered. Research findings have been analysed respectively. Conclusion has been made and presented.

5 DISCUSSION

It has been proven that access to organised and updated data reports are needed when working with crowd databases. For souring team leads it is crucial for daily task performance to have clear visibility on the resources they have in the databases. Knowledge of that information provides options to increase teams` productivity, estimate project timelines and budgets more precisely and plan future efforts. Inventory of the resources available is the key on how to achieve that. As discussed in chapter 2 there are many crowdsourcing databases available and crowdsourcing marketplaces, however they all have limitations in terms of data (information) access. Crowdsourcing platforms are designed mostly to carry out specific project or as a place where crowd contributors can sign up to find companies who offer crowd related task, but they are not designed to carry out inventory management of the resources (or if some of them do, it is very limited).

For perpetual inventory method to work in practice a software needs to be developed for specific databases for the data that will be collected and kept on the record. To implement the bases of perpetual inventory method in the crowdsourcing database the types of data that will be collected and monitor must be very well defined.

Research results do show clearly an added value and benefits of customised databases for crowdsourcing companies. Having the detailed information about who, when, how, where etc. will not only benefit sourcing team directly involved with resourcing, but benefits will extend through all company operations. One of benefits can be that detailed data will provide overview for financial aspect. The cost analyses can be made from basic ones such as how much does it cost to source x amount of resources to the more complex ones as what type of resources are most expensive ones to source and maintain. In what type of projects are they utilised? Does it pay off to maintain them? Where else they can be utilised?

Another benefit for all operations – quality. Having control of data about how each resource performs, ability to analyse performance per each task, compare them and have this information updated instantly will add significant value to quality control.

As mentioned in the research the overall trend for businesses is to save the costs and increase efficiency. Outsourcing together with crowdsourcing are main processes though which this can be achieved. Companies who offer crowdsourcing services are not exception in this. They also want to save costs and be more efficient. Having a well-maintained database can bring benefits not only to the satisfying customer needs and running operation as such, but also to execute internal tasks. It gives the opportunity to crowdsource internally, identify best resources available and engage them in internal operations to save labour costs.

Creating software like that is an expensive project, but in a long run it will pay off as it will help to achieve efficiency of whole operation in general when running crowd sourcing projects. Further research would be needed to conclude the cost and benefits of such software. Further research could also carry out detailed examination of existing crowdsourcing platforms to better understand structure and abilities of each of them.

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APPENDICES

Appendix 1. Focus group discussions plan

	Discussion Topics	# of attendants
First round	Do we need inventory in crowdsourcing databases?	4
Second round	Where inventory data can be used (tasks)?	4
Third round	What data we would need to have access to?	4

Appendix 2. Structured interview questions

Email address *

Your email address

Date when a person signed up to Lionbridge AI platform *

Not Useful

1

2

3

4

5

Most Needed

Knowledge of the date when a person signed up to Lionbridge AI platform will

help me to: *

To plan ETAs

To plan sourcing team`s capacity

To provide estimates

To plan sourcing strategy

To plan qualification path for resources

To plan budget

Other:

Responsiveness - number of projects person signed up for *

Not Useful

1

2

3

4

5

Most Needed

Knowledge of responsiveness - number of projects person signed up for, will

help me: *

To plan ETAs

To plan sourcing team`s capacity

To provide estimates

To plan sourcing strategy

To plan qualification path for resources

To plan budget

Other:

Actual delivery - number of projects a person actually worked on and delivered

the data/completed the task *

Not Useful

1

2

3

4

5

Most Needed

Knowledge of actual delivery - number of projects a person actually worked on and delivered the data/completed the task, will help me: *

To plan ETAs
To plan sourcing team`s capacity
To provide estimates
To plan sourcing strategy
To plan qualification path for the resources
To plan budget
Other:

Feedback/grading on a person on their performance quality per project *

Not Useful

1
2
3
4
5

Most Needed

Knowledge of the feedback/grading on a person on their performance quality per project, will help me: *

To plan ETAs
To plan sourcing team`s capacity
To provide estimates
To plan sourcing strategy
To plan qualification path for the resources
To plan budget
Other:

Activity track - date when person last time logged into Lionbridge AI database *

Not Useful

1
2
3
4
5

Most Needed

Knowledge of activity track - date when person last time logged into Lionbridge AI database, will help me: *

To plan ETA`s
To plan sourcing team`s capacity
To provide estimates
To plan sourcing strategy
To plan qualification paths for resources
To plan budget
Other:

Activity track - date when person last time signed up for a project *

Not Useful

1

2
3
4
5

Most Needed

Knowledge of activity track - date when person last time signed up for a project, will help me: *
To plan ETA`s
To plan sourcing team`s capacity
To provide estimates
To plan sourcing strategy
To plan qualification path for resources
To plan budget
Other:

Language skills resources have *

Not Useful

1
2
3
4
5

Most Needed

Knowledge of language skills resources have, will help me: *
To plan ETAs
To plan sourcing team`s capacity
To provide estimates
To plan sourcing strategy
To plan qualification path for resources
To plan budget
Other:

Location of resources *

Not Useful

1
2
3
4
5

Most Needed

Knowledge of location of the resources, will help me: *
To plan ETA`s
To plan sourcing team`s capacity
To provide estimates
To plan sourcing strategy
To plan qualification path for resources
To plan budget
Other:

Previous experience resources have for AI related task such as annotation, transcription, rating etc. *

Not Useful

1

2

3

4

5

Most Needed

Knowledge of what type of previous experience resources have for AI related tasks such as annotation, transcription, rating etc. , will help me: *

To plan ETAs
To plan team`s capacity
To provide estimates
To plan sourcing strategy
To plan qualification path for resources
To plan budget
Other:

Please kindly state below any other information you would like to know and have access to about our resources in our databases that would help with your daily tasks. Please also state with what tasks it would help.