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GHOST WORKERS – THE ESSENCE AND IMPORTANCE FOR CREATING SCIENTIFIC KNOWLEDGE

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Purpose: The gig economy involves short-term employment of staff via online platforms to complete specific tasks. These workers are referred to as "giggers" or "ghost workers". While the publications to date focus on the specificity of work or the motivation of giggers, the issue of their importance in the context of creating scientific knowledge remains insufficiently recognized. More and more often it is postulated that the inclusion of various stakeholders in research becomes some obligation, which is part of the democratization of science, its openness and inclusiveness. The purpose of this article is to identify the importance of ghost workers in the creation of scientific knowledge.
Design/methodology/approach: The publication is based on a systematic analysis of the literature on the subject published in the years 2006-2022. The following databases were used to collect the publications in question: Web of Science and Scopus.
Findings: The results of the systematic literature review indicate that it is possible to include a gig worker at every stage of the research process: identifying the general study area, selecting topic and developing a focus, deciding the approach, formulating a plan, collecting information, analysing, and presenting of findings.
Originality/value: The publication contributes to the development of research on the emerging issues of gig work in the context of creating scientific knowledge using crowdsourcing platforms.

Keywords: gig workers, ghost workers, crowdsourcing in science, scientific knowledge creation.

Category of the paper: Literature review.

1. Introduction

In response to the development of new technologies (Van Doorn et al., 2020), but also as a result of the financial crisis noted in 2007-2008 – the term "gig economy" appeared (Myhill et al., 2020). The very term reflects the situation on the labour market, where the rise in unemployment and the recession forced many employees to take up occasional, informal and temporary work. Since then, the concept of "gig economy" has evolved in the literature (Heeks

et al., 2021). In turn, the practice has experienced an increase in digital platforms enabling such work (Graham et al., 2017). Good examples may be provided by the following: Amazon Mechanical Turk, Task Rabbit, Deliveroo, Upwork, TopCoder, CrowdFlower and Clickworker. According to the data of the American agency Bureau of Labour Statistics, people working that way make up 34% of all employees in the United States. In 2016, the EY Global Contingent Workforce Study report even included the name of a group of people who work like that as communities – "giggers". It is expected that by 2055 over 60% of all works will have been carried out by the so-called "giggers" (Gol et al., 2019).

Bearing in mind the above, the rapid development of technology has become not only a catalyst for remodelling the way of scientific work, in particular in the context of accelerating the creation of scientific knowledge, ensuring increased productivity, opportunities for scientists to cooperate, information exchange and matching people with demand for a given service with people ready to perform it, and disseminating scientific knowledge. Moreover, technologies have created new opportunities and provided scientists with the potential to engage a wider audience, motivate volunteers, improve data collection, control data quality or increasing the speed of decision-making in research (Uhlmann et al., 2019).

Despite the growing interest of researchers in the issues of gig workers, literature lacks publications devoted to the essence and importance of ghost workers for the creation of scientific knowledge. Understanding this is important as there is some growing interest among researchers in the involvement of ghost workers in the creation of scientific knowledge, in particular with the use of scientific crowdsourcing platforms. As indicated by Aguisin et al. (2021, p. 1) "in some areas this increase was noticeable; one recent report shows an increase of 2,117% in management research using MTurk[1] from 2012 to 2019 (...). Moreover, it is possible that the COVID-19 pandemic could increase interest in online research platforms such as MTurk as academics are more likely to work remotely (Fan, Moen, 2021). That situation seems to be confirmed by the increase in the number of publications in which the authors used various crowdsourcing platforms: Keith et al. (2017), in 2012, recorded 7 such publications in 11 management journals. Three years later, in 2015 - 63 such publications. In turn, the author of this publication in 2022 identified 99 publications in which researchers used crowdsourcing. Those articles were published in prestigious journals, including Psychology & Marketing, Journal of Organizational Behaviour, Management Decision, Information Systems Research, Management Science, Personnel Review, Leadership Quarterly, Academy of Management and Journal of Business Research. Moreover, the gig economy is seen as an example of a broader trend of job platformization, with forecasts that by 2025 platforms will have participated in one third of all employee transactions (Kenney et al., 2019).

Some discussions of the ghost workers are focused on the specifics and work ethics of "giggers", their motivations, potential benefits, types of crowdsourcing platforms (Josserand,

[1] MTurk (full name Amazon Mechanical Turk) is one of the available gig economy platforms dedicated to science: https://www.mturk.com.

Kaine, 2019). The literature shows that "giggers" are a new type of knowledge workers (Hasija et al., 2020). Despite the growing interest of researchers in the specificity of ghost workers' work, it is postulated to conduct research on their significance for the creation of scientific knowledge (Beck et al., 2022), where the creation of knowledge comes down to "generating new knowledge, usually in the form of ideas, practices, scientific and technical studies, inventions or products" (Phelps et al., 2012, p. 1119).

This article contributes to filling the cognitive gap signalled and it provides evidence on the importance of ghost workers in the production of scientific knowledge. To achieve this research goal, a systematic approach to literature review was used (Tranfield et al., 2003; Lenart-Gansiniec, 2021). The choice of a systematic literature review is supported by the fact that such a review shows the path of previous research, integrates and summarizes what is known in a given area and it can stimulate new ideas. The review also helps identify gaps in the literature that provide space for developing or testing new ideas. By using clear and systematic methods when reviewing articles and all available evidence, errors can be minimized, thus providing reliable results from which conclusions can be drawn and decisions made (Lenart-Gansiniec, 2021). Moreover, a systematic review of literature "is a review of an existing body of literature that follows a transparent and reproducible methodology in searching, assessing its quality and synthesizing it, with a high level of objectivity" (Kraus et al., 2020, p. 1026).

Our publication provides several contributions to the literature devoted to gig workers and the creation of scientific knowledge with their help. Firstly, the research so far has focused on crowdsourcing in science: "the novelty of this research technique has not yet created routine and best practices, and more importantly, there is no consensus – especially between disciplines – as to what this" method "is, how to use it, and even why use it" (Eklund et al., 2019, p. 1). On the other hand, many publications deal with the issue of gig workers, but ignore the issue of their importance for the creation of scientific knowledge. It seems important to understand this. For example, the European Commission "has sought to advance open science policy from its inception in a holistic and integrated way, covering all aspects of the research cycle from scientific discovery and review to sharing knowledge, publishing, and outreach" (Burgelman et al., 2019, p. 1) and urges academics to use crowdsourcing platforms to conduct research. This article aims to contribute to filling this gap by looking for a systematic order in the current literature (Beck et al., 2022). In this context, a systematic review of the literature provides the basis for the development of knowledge, theory and discovers new research areas (Webster, Watson, 2002). Moreover, it is a kind of map of knowledge, as it allows to analyse and synthesize the available literature (Fisch, Block, 2018). Moreover, "crowdsourcing is a nascent tool for streamlining the process of gathering, processing and analysing research data in many fields. Tasks that were previously conducted by a small team of researchers can now be parallelized and processed by millions of volunteers over the Web, making questions that seemed previously impossible now tractable" (Law et al., 2017, p. 1).

2. Theoretical background

2.1. Gig economy and ghost workers

Gig economy is referred to in the literature as "sharing economy", "collaborative economy" or "creative economy" (Kuek et al., 2015), following the report "Department for Business, Energy & Industrial Strategy" (2018, p. 12): "the gig economy involves exchange of labour for money between individuals or companies via digital platforms that actively facilitate matching between providers and customers, on a short-term and payment by task basis". The gig economy is therefore a type of economy in which the initiators (organizations or private persons) invite employees (referred to as "ghost workers", "gig workers", "giggers", "1099", "modern precariat"; Block, Hennessy, 2017) to complete a specific task.

The activity of ghost employees takes place on a digital platform, which allows, among others for transferring job description, requirements, and expectations, for coordinating work, for motivating, and for involving employees and connecting teams around short-term tasks (Meijerink, Keegan, 2019). These platforms are called "markets" or "trading platforms" and their role is to mediate between employees and initiators. On the other hand, the work performed by ghost workers is defined as "platform-based employment which uses digital technology to mediate the process of commissioning, supervising, delivery and compensating work performed by workers on a contingent, piece-work basis" (Flanagan, 2017, p. 2).

Typically, assignments targeting virtual communities are structured around three categories, such as: (1) working on an equity platform where individuals sell or rent assets via a digital platform; (2) crowdwork where digitization work is done remotely; and (3) work with applications where the work is organized via a digital platform. Additionally, within the crowdwork framework, the following can be indicated:

- online task crowdwork – refers to micro tasks that are modular in nature. They are simple tasks that do not require the involvement of many people and can be performed without the need for many people to cooperate. Examples of platforms can be provided by Amazon Mechanical Turk, UpWork, Fiverr, CloudFactory, CrowdComputing Systems or InCloudCounsel;
- 'playbour' crowdwork – refers to performing tasks oriented at introducing innovations or solving problems. These tasks require involvement of a larger group of people who work together. Often those tasks use a gamification mechanism. Examples of platforms include but are not limited to InnoCentive.com or Threadless.com;
- asset-based services – refers to the exchange of resources (e.g., cars, bikes, vacant rooms, DIY tools and many other things) owned by people logged in to platforms, e.g., Airbnb, Uber or TaskRabbit.

- profession-based freelance crowdwork – refers to the inclusion of virtual communities in tasks requiring a specialized level of professional knowledge and competences. Such tasks may include designing products or services. Examples of platforms: Apple, Google or iStockphoto.

As previously mentioned, in gig economy, tasks are performed by members of the virtual community, often referred to as "gig employees" or "ghost employees". They are mostly freelance contractors or freelancers who typically perform short-term work for multiple clients simultaneously. Their work is project-based, part-time and temporary in nature. Generally, these employees are flexible and autonomous (Berger et al., 2019), and the work performed by them is characterized by piecework or agency work with uncertain wage conditions and irregular orders (Duggan et al., 2020). Some researchers compare such work to "digital shops" (Zittrain, 2009).

2.2. Crowdsourcing in science

The basic component of gig economy is crowdsourcing *per se* (De Stefano, 2015). Growing interest in crowdsourcing among researchers was initiated in 2006 by Howe, the publisher of Wired magazine. In his article entitled "The Rise of Crowdsourcing" he described organizations that use crowdsourcing to source ideas from a virtual community. Two years later, in 2008, Howe in the introduction to his book "Crowdsourcing. Why crowd power drives the future of business", wrote, among others: "I had often said that crowdsourcing could be applied to anything reducible to bits and bytes, but not products measured in pounds and ounces. But […] I changed my maxim. Crowdsourcing's limits are determined by people's passion and imagination, which is to say, there aren't any limits at all" (Howe, 2008, p. IX). Howe (2006, p. 1) argued that ""act of a company or institution taking a function once performed by employees and outsourcing it to an undefined (and generally large) network of people in the form of an open call" had limitless application possibilities.

Crowdsourcing in science is a response to the postulates of open science (Beck et al., 2022), collaborative science (Correia et al., 2018), academic commitment (Perkmann et al., 2021) and public participation in science (Strasser et al., 2019). Moreover, crowdsourcing in science is a response to the development of information and communication technologies, Web 2.0 technologies, the democratization of science, the need for academic teachers to be open to access to research by all interested parties, and the growing interest in public participation in scientific research (Uhlmann et al., 2019).

As indicated by Bücheler et al. (2010), crowdsourcing in science is combined with research collaboration, and it changes the way researchers interact with the general public. At the same time, the literature indicates that crowdsourcing in science does not lead to maximization of value or creation of innovation, as in the case of crowdsourcing used by organizations. Crowdsourcing in science is defined as an online collaborative process in which researchers engage a group of individuals of their choice with different and diverse knowledge and skills,

through open invitation via the Internet and/or online platforms, to undertake a specific research task or set of tasks. The process involves dynamic interactions between members participating in the crowdsourcing initiative, workflow, assets, and performance. They all take place on crowdsourcing platforms including, inter alia, Abstrackr, Amazon Mechanical Turk, Cochrane Crowd, CrowdFlower, CrowdScreen SR, DistillerSR, EPPI-Reviewer, Mark2Cure, RobotSearch, Systematic Review Data Repository, Upwork and Weka.

3. Research methodology

A systematic literature review was carried out to identify the importance of ghost workers for the generation of scientific knowledge (Moher, 2009). The literature review was limited to scientific articles in 2006-2022, which is due to the fact that the concept of crowdsourcing was introduced in 2006. The literature on the subject was selected based on the search of two foreign databases (Scopus and Web of Science). This approach stems from several reasons. Scopus is a multi-domain database and covers a wide range of publications, offers quick basic and advanced searches (Falagas et al., 2008). On the other hand, Web of Science, compared to other databases, such as ProQuest or Emerald, is recommended for its robustness, convenient interface and the presence of various sorting functions. To ensure the continuity of the research (Tranfield et al., 2003), initial database searches were performed first. The filter criterion included the following keywords: "gig worker* OR ghost worker* OR crowdsourcing in science* AND scientific knowledge creation*". This initial search yielded 551 hits (Scopus: 470; Web of Science: 81). The following restrictions were imposed on the identified articles:

1) full-text, peer-reviewed scientific articles (books, book chapters, conference materials, reviews, and editorial introductions have been excluded),
2) the keywords "gig worker* OR ghost worker AND scientific knowledge creation*" in the title, summary,
3) category "business, economy, management".

Then, the abstracts were reviewed and verified, which allowed the publication base to be narrowed down to those focused strictly on gig workers from the perspective of management and quality sciences. Hence, 62 publications selected on the basis of foreign databases were included in the further analysis.

4. Systematic literature review results

According to Uhlmann et al. (2019, p. 727) "crowdsourcing is the next step in science's progression from individual scholars to increasingly larger teams and now massive globally distributed collaborations (...) it seeks to complement this standard approach to provide more options for accelerating scientific discovery". A literature review revealed the importance of ghost workers for the scientific knowledge creation. This importance was demonstrated in accordance with the stages of the research process (see Table 1).

Table 1.
Ghost workers and scientific knowledge creation

Criteria	Task type
Identifying the general study area	Sharing resources
	Providing valuable knowledge and resources to elaborate complex scientific questions
	Gathering information in design research
	Identifying gaps in terms of possible variables and relationships
	Finding problems
	Making a systematic literature review
	Assembling resources
	Creating new ideas, designs, algorithms
Selecting topic and developing a focus	Conducting research into scientific questions
	Acquiring new knowledge
	Defined goals or hypotheses
	Generating novel research ideas and solutions to problems
Deciding the approach	Managing data
	Correcting/modifying content
	Improving existing research paradigms and interventions
Formulating a plan	Improving optimization processes
	Clearing experimental protocols
	Designing a study
	Designing a survey
	Generating data
	Recruiting participants for surveys
	Collecting validity evidence for new measurement instruments
	Sampling
Collecting information	Generating data
	Collecting data
	Sampling for conducting experiments
	Monitoring
	Refining measurement of latent constructs
	Testing evidence
	Tagging collaboratively

Cont. table 1.

Analysing	Analysing data
	Processing data
	Visualizing data, integrating data and providing analytic solutions
	Translating or annotating text as well as video and audio materials
	Analysing the content quantitatively
	Coding
	Gathering large volumes of data
	Validating data
	Transcribing
	Recording and creating content
	Commenting, providing critical responses and stating preferences
	Categorizing
	Cataloguing
	Contextualizing
	Mapping
	Georeferencing
	Translating
	Editing or proofreading
	Entering structured or semi-structured data
	Replicating findings before publication
Presenting of findings	Writing research reports
	Producing knowledge
	Distributing problem solving

Source: own study based on: Pan, Blevis (2011); Parrick, Chapman (2020); Wang, Yu (2019); Petersen (2013).

The existing scientific achievements show that the work of gig workers in line with the idea of crowdsourcing "holds the potential to greatly expand the scale and impact of scientific research. It seeks to promote inclusion in science, maximize material and human resources, and make it possible to tackle problems that are orders of magnitude greater than what could be solved by individual minds working independently" (Uhlmann et al., 2019, p. 727). Comparing traditional methods of creating scientific knowledge with those based on new technologies, it can be seen that they are not only an alternative, but also a strategy for organizing the work of researchers, an alternative model of doing science (Uhlmann et al., 2019) and a research tool supporting scientific research (Law et al., 2017). All this makes scientific crowdsourcing crucial in the context of lowering the costs of conducting scientific research (Steelman et al., 2014), increasing the scale and impact of research, inclusiveness and democratization of science, and accelerating scientific discovery (Edgar et al., 2016). Moreover, scientific crowdsourcing responds to concerns related to traditional ways of generating scientific knowledge. Those ways used to be criticized for insufficient use of science to solve problems affecting members of society (Djenontin, Meadow, 2018).

5. Conclusion

The systematic literature review was aimed at identifying the importance of ghost workers for the creation of scientific knowledge. These analyses develop research on the emerging issues of gig work in the context of creating scientific knowledge using crowdsourcing platforms. The current state of knowledge allows us for claiming that ghost workers perform a variety of tasks directed by the initiator-researcher: from the simple to the creative. To conclude, those tasks may cover all stages of creating scientific knowledge: identifying the general study area, selecting topic and developing a focus, deciding the approach, formulating a plan, collecting information, analysing, and presenting of findings. As the results of the systematic literature review show that more and more researchers see the possibility of involving gig employees in performing various tasks. Inter alia, it is possible to involve gig workers in the following tasks: sharing resources, identifying gaps in terms of possible variables and relationships, finding problems, making a systematic literature review, designing a study or a survey, generating, analysing, processing, visualizing, integrating data, and more.

Literature shows that the said employees cannot only be the main source of new ideas and new knowledge. Their work is based on the so-called "wisdom of the crowd", where a group in the right conditions could potentially work out more than many specialists in a given field – which allows you for speeding up work, but also helps you reduce costs. And finally, tasks are performed by them practically all the time and 24/7, because gig employees come from different time zones.

Additionally, more and more employees are getting registered on various digital platforms. The increase in publications in which the authors used various digital-crowdsourcing platforms should be noted. Editorial offices of journals open up to this type of research, despite the resistance. It is suggested that ghost workers are beginning to play a significant role in creating scientific knowledge, in particular, in formulating research problems or hypotheses, ideas for research, filling out surveys or submitting reviews and opinions on working-papers. This change in the creation of scientific knowledge results mainly from the expectations posed to research workers, but also from the demands of inclusiveness, openness and democratization of science.

Despite numerous positive implications, there are threats and risks that result primarily from the specificity of virtual communities and the crowdsourcing mechanism. The following can be indicated: risk of idea theft, copyright infringement, phishing, spamming, stalking, malware and fraud. Additionally, community workers are often treated as "commodities" and their work becomes a commodity (Bergvall-Kåreborn, Howcrof, 2014). Jeff Bezos, creator of the Amazon Mechanical Turk platform in 2005, said: "You've heard of software as a service. Now this is human-as-a-service" (Cater, 2021). Admittedly, press reports (Cater, Heikkila, 2021) and those published on the website of the European Commission show that the European Union

recognized the need to regulate work that involves crowdsourcing platforms and started consultations on gig employees, but this does not solve the global issue of privacy and the introduction of global solutions. Therefore, despite the undisputed importance of ghost workers for the creation of scientific knowledge, it is important to pay attention to the negative implications as well. All this leads to demands to conduct research on the challenges faced by researchers who choose to involve ghost workers in the creation of scientific knowledge.

Please note that this publication is not free from limitations that may pave the way for future research. Despite the comprehensive nature of the systematic literature review, there is a risk that some publications could have been omitted. This may be due to the fact that the selection of publications was made on the basis of full-text publications available in English databases, which eliminated domestic literature and studies that were not available in the digital version. Additionally, the conducted systematic literature review takes into account only peer-reviewed scientific articles and omits post-conference materials or books. Therefore, in order to overcome potential limitations, it is suggested to extend the literature review to crowd science and crowd work magazines and consider the inclusion of conference materials and books.

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