

Toward a framework on the technology affordances for HRM of gig workers

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ABSTRACT,

Since a few years, more and more people work in the so-called gig economy where workers are hired and get paid per task. Due to their independent contractor status, they are differently managed and are not entitled to social protection. Furthermore, the use of technology in the gig economy influences how gig workers are managed. The use of technology to manage gig workers and the consequences of using technology to manage gig workers have been examined from different academic disciplines, all related to HRM. Though these insights have not been connected and therefore this study aims to derive a common framework, from the literature, on how technology is used to manage gig workers.

To derive a common framework of the different technologies used, also called technology affordances, a structured literature review was performed. This gave different insights into how technology was used and the themes described and analysed about the gig economy.

It appeared that all the HRM-activities in the gig economy use technology, except for training and development. Activities that technology affords are surge pricing, automated payment, automatic recording and monitoring of conversations, support, performing tasks on a mobile device, warning platforms, navigating workers, task assignment, objective monitoring by platforms, subjective evaluation by clients, and selecting and matching.

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Keywords

Gig economy, Human resource management, HRM-activities, Technology affordances, Academic disciplines, Framework

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1. INTRODUCTION

Over the last few years, a new way of working has arisen in which the traditional way of working where employees are hired by the company and have all sort of social protection rules is replaced by a way of working where people work in the so-called gig economy. In this economy, people are being hired under flexible arrangements working only to complete a particular task or for a defined time (Friedman, 2014). Workers will support themselves as flexible, free independent suppliers, moving seamlessly from one job (or 'gig') to another, utilising digital technology to connect with purchasers of their services (Stanford, 2017).

The gig economy, gig work and gig workers are examined from different academic disciplines. From a socio-political perspective, for example, research elaborated on the implications of gig work for society and from this, starting points for taking political measures have been given (Schmidt, 2017). Currently, gig workers often earn below minimum wage and are not entitled to social benefits, due to the fact that technology determines prices and wages. Depending on demand, prices are being raised or decreased by an algorithm (Kenney & Zysman, 2016). Gig workers income thus depends on technology and as a consequence, workers are often underpaid. Therefore, researchers propose social measures such as minimum wage and other social benefits as pension and health insurance. Lawyers look at the lack of social protection from a different perspective and examine whether platforms are allowed to pay below minimum wage. Furthermore, they propose measures to improve gig workers protection against platforms (De Stefano, 2016). Health researchers take a totally different look at the gig economy and examine the consequences of gig work on workers' health, stress level, emotional well-being and safety. Platforms' rating systems, for example, implies that clients give ratings via a mobile application and based on this, workers with the highest ratings receive more jobs and better-paying jobs. Furthermore, a lack of communication with both other gig workers and the platform makes that workers can feel socially isolated. As a consequence, workers perceive greater levels of stress (Broughton et al., 2018; Forde et al., 2017; A. J. Wood, Lehdonvirta, & Graham, 2018).

When looking at the academic disciplines mentioned above, there can be concluded that they have something in common. All talk about and relate to HRM, however, researchers themselves do not see that they talk about HRM-activities and look only within their own field. To illustrate, minimum wage and social benefits relate to the HRM-activity compensation and benefits and health consequences relate to job design, performance management and involvement.

The HRM-activities discussed are influenced by technology. To return to compensation and benefits, performance management and job design. Technology influences income and affects gig workers' well-being.

Because researchers currently do not know that they talk about HRM and because HRM is largely influenced by technology in the gig economy, it is important to have a common basis of the definition of HRM afforded by technology and the consequences for gig workers. A framework can give a clear overview of HRM-activities afforded by technology discussed by different academic disciplines, after which it is clear what information already exists and which aspects need further research. Therefore, this research aims to:

Derive a framework, from the literature on gig work, on how technology is used to manage gig workers by means of HRM-activities.

The first section of this paper is a theoretical framework where gig workers will be defined and where a deeper look will be taken at the different HRM-areas afforded by technology. Then the methodology section will follow, in which there will be elaborated on the structured literature review performed. In the end, a structured framework will follow in which the different HRM-activities afforded by technology will be discussed, followed by a discussion and conclusion.

2. THEORETICAL FRAMEWORK

In this section, the term gig worker and the characteristics of gig workers will be defined. Then there will be elaborated on the different HRM-areas in the gig economy afforded by technology.

2.1 Defining gig workers

A gig worker can be defined as a worker with the following characteristics:

- Gets paid per task;
- Has a freelance status;
- Works via an online labour platform.

Workers in the gig economy get paid per task, which stems from their freelance status. They namely do not work for an employment agency but work via a platform that brings organizations, businesses and individuals into contact through the internet. To get access to jobs, gig workers sign up on a platform that gives workers access to different jobs (De Stefano, 2016). When workers have successfully completed the task, they receive money (Deng & Joshi, 2016). This implies that gig workers need to be managed.

2.2 Role of technology in implementing HRM-activities

To manage gig workers, online labour platforms make use of what is traditionally defined as HRM-activities. In the gig economy, this is enabled by technology. In the literature, this is called technology affordances, which means focussing on the strengths and weaknesses of technologies with respect to the possibilities they offer the people that might use them (Gaver, 1991). The following section will elaborate on HRM-activities in the gig economy and their technology affordances. Six HRM-activities have been chosen that stem from Lepak and Gowan (Lepak & Gowan, 2015).

2.2.1 Compensation and benefits

Compensation for gig workers varies per platform. Uber's payment, for example, consists of the price for a ride, cancellation costs, promotions (if applicable), introduction rewards (if applicable), and tolls. The Uber-Fee, device costs, and lease costs should be diminished from this (Inc, 2019). Amazon Mechanical Turk (AMT) pays its workers via a Human Intelligence Task (HIT) system. Beforehand, workers are presented a list of 'requests', which contains the title of the job, the reward being offered per HIT, and the number of HITs available for that request, after which they can choose whether to take the request. Compensation per HIT varies between \$0.01 and \$0.10 and reflects the difficulty of the task (Crowston, 2012; Mason & Watts, 2009). Another example, a survey held around crowd workers found that the mean hourly pay is \$1.77 for Crowdfunder, \$5.55 for AMT USA and \$3.17 for AMT India, while the minimum wage in the US is \$7.25. Therefore it is not surprising that workers complain about low compensation for their work (Berg, 2016; Labor, 2019).

The above-mentioned wages are determined by technology. Compensation is dependent on the dynamic pricing mechanisms, which allows the platform to adjust prices in response to demand, time of sale, demand information and supply availability

(Cachon, Daniels, & Lobel, 2017; Elmaghraby & Keskinocak, 2003). Uber, for example, uses dynamic pricing to raise the price of a trip when demand outstrips supply within a fixed geographic area (Chen & Sheldon, 2016). However, this dynamic pricing mechanism causes underpayment and therefore lawyers ask whether this is legally possible and social-political researchers propose a minimum wage for gig workers.

2.2.2 Involvement

Employee involvement is used to describe communications with employees, employee commitment and employees contribution to the organization (Marchington, Goodman, Wilkinson, & Ackers, 1992). When focussing on communication, there can be seen that communication in the gig economy takes place via the platform, where the platform communicates the goods and services offered to the customer (Busch, Schulte-Nölke, Wiewiórowska-Domagalska, & Zoll, 2016). Besides, the mobile applications of platforms have a messaging feature which allows communication between gig worker, client and the platform (Broughton et al., 2018). Though, this makes that workers never meet anyone holding the title of ‘employer’ and therefore there is no employee-employer involvement (Moazami, 2017). Because there are many problems with communication in the gig economy, researchers in the computer science and information systems disciplines offer solutions for better communication systems (Abhinav et al., 2018; Salehi, Teevan, Iqbal, & Kamar, 2017).

2.2.3 Job design

When looking at the job characteristics model, it can be seen that job dimensions consist of skill variety, task identity, task significance, autonomy and feedback (Hackman & Oldham, 1976). First, skill variety. Many skills are needed for doing gig work and they differ per platform, however, the most important skill needed is communication. This is because communication affects ratings given by clients (Akgüç, Beblavý, Cirule, & Kilhoffer, 2018). And when looking at task variety, it appears that workers prefer doing repeatable tasks over doing one-off tasks, this while algorithmic management techniques are used to offer workers both a high level of autonomy and also a high level of task variety (Kässi, Lehdonvirta, & Dalle, 2019; A. J. Wood, Graham, Lehdonvirta, & Hjorth, 2019a). Furthermore, feedback in the gig economy takes place via rating systems. On the one hand, workers are reviewed by clients and on the other hand, workers are monitored by the platform (Prassl & Risak, 2015).

From a health discipline, researchers look at the consequences of job design for people’s health and they found that those working from home perceive less health and safety risks than those working outside the home (Broughton et al., 2018).

2.2.4 Performance management

Performance management is about establishing performance goals for employees, assessing performance, and providing feedback (Gruman & Saks, 2011). Platforms have added so-called digital reputation mechanisms or evaluating and rewarding mechanisms, in order to assess performance and provide feedback (Prassl & Risak, 2015). Ratings on these mechanisms are combined with work history (number of completed jobs, hours worked and total earnings) and test scores in order to rank workers. The influence is huge, those higher ranked have a higher likelihood of receiving more work (Graham, Lehdonvirta, et al., 2017) and Uber drivers, for example, can lose access to the platform when the threshold rating is below 4.6 out of 5.0 (Aloisi, 2015). But monitoring not only happens through ratings but also through GPS and how workers communicate with clients (Gibbs, 2017).

From a law perspective, researchers are proposing for portable ratings which makes it easier for gig workers to move to another platform and they doom the control that platforms have due to rating systems (Choudary, 2018; McHugh, 2017).

2.2.5 Recruitment and selection

How recruitment and selection are done in the gig economy varies per platform. On Nubelo, for example, short-term jobs are posted on the platform and workers can bid for those jobs on the platform. Technology allows that workers are then selected based on their bid and their profile (Galperin & Greppi, 2017). On AMT, workers can select a job. Upfront, they can see a description of the task and then they can decide whether to accept the job (Mason & Watts, 2009).

Matching also belongs to recruitment and selection. There are four ways in which platforms match clients with workers: gig workers making bids to customers; individuals who were located nearest; customers approaching workers; and contests (Broughton et al., 2018). However, platforms do not say they match clients and workers but claim that they only facilitate workers and clients with tools needed to efficiently match and let them free in determining the terms and conditions. And in case they do determine the terms and conditions they say they do this on behalf of the client and worker. This to convince courts that workers are independent contractors (Wouters, 2018).

2.2.6 Training and development

In the gig economy, workers are hired per task and therefore there is minimal or no on-the-job training. The platforms have no incentive to provide training because they are not guaranteed that workers work long enough for the platform to earn a return on their investment (Friedman, 2014). Parigi and Ma, therefore, propose to policymakers to make training mandatory. Either given by the platform or by private companies (Parigi & Ma, 2016).

Summarizing, there can be seen that HRM does play a big role in the gig economy and that many of the HRM-activities are afforded by technology. To have a better view of the technology affordances, a structured literature review will be performed. The following section will elaborate on the methods used to perform a literature review.

3. METHODOLOGY

In order to address the aforementioned research goal, this study applies a systematic literature review, which, according to Webster and Watson, consist of two types. The first type of literature review analyses and synthesises an accumulated body of existing research, whereas the second type tackles an emerging issue that would benefit from exposure to potential theoretical foundations (Webster & Watson, 2002). This systematic literature review is about the first type, a thorough literature review was conducted and then a framework will be proposed which extends existing research.

For this literature review, the systematic and rigorous approach of Wolfswinkel et al. to carrying out a literature review was used. The steps they advised to take and which will be elaborated on in the following section are: (Wolfswinkel, Furtmueller, & Wilderom, 2013)

1. Define
2. Search
3. Select
4. Analyse
5. Present

3.1 Define

The first step is the define step where first the criteria for inclusion/exclusion were determined, followed by fields of

research, appropriate sources and specific search terms (Wolfswinkel et al., 2013).

3.1.1 Define the criteria for inclusion/exclusion

This review covers the HRM-activities that platforms use to manage their gig workers and how technology affords HRM-activities. This in order to derive a common framework.

In table 1 and 2, the inclusion and exclusion criteria are set and these criteria were used based on title, abstract and keywords. How I tackled these criteria will be elaborated in section 3.2.

Table 1: Inclusions	
Criteria	Reason for inclusion
Papers about the gig economy, crowd work economy, crowd economy, platform economy, online platform economy, online labour platform economy, on-demand economy, eLancing	All talk about the same phenomena.
Keywords that can be found in the papers: Crowd work(er); Crowd work economy; Gig; Gig work(er); Gig economy; Platform; Platform work(er); Platform economy; Online labour platform; On-demand economy; eLancing; Independent contractor; Freelancer; Uber; Amazon Mechanical Turk; Deliveroo; Task Rabbit; Crowdfunder; Recruitment; Selection; Compensation; Benefits; Payment; Training; Development; Performance management; Rewarding; Evaluation; Feedback; Communication; Job design; Involvement; Matching.	The research goal is to derive a common framework about HRM-activities afforded by technology in the gig economy. Therefore, definitions for the gig economy, as well as the different HRM-activities have to be included. Hereby I also include the largest platforms to distinguish how platforms perform HRM-activities.
Papers discussing the role of technology in managing gig workers.	To contribute to the research goal of how technology is used to manage gig workers.
Papers published including and after the year 2000.	This is the time around which the gig economy started.

Table 2: Exclusions	
Criteria	Reason for exclusion
Papers that do not include an online labour platform.	The literature review is about the role of technology on online labour platforms.
Papers about the sharing economy	This paper focuses on workers who are getting paid by finishing a task and not on people getting paid for sharing a good.
Papers that do not include HRM-activities.	The common framework will be made from an HRM perspective. Therefore, papers from another discipline that discuss or

	offer a solution for HRM practices will be included and those not discussing or offering a solution for HRM practices will be excluded.
Papers published in another language than English or Dutch.	To prevent misunderstanding.
Duplicated studies	For the research, only one version of a given article is needed.

3.1.2 Identify the fields of research

Many research fields have done research on the gig-economy. For example, Information Systems, Law, Computer Science, Socio-political, Health etc. All these perspectives have issues related to HRM, so therefore the overall framework will be made from an HRM perspective.

Important to mention is when I did the research and encountered an interesting perspective, they were all encountered based on whether they discussed HRM practices.

3.1.3 Determine the appropriate sources

In order to gain all the necessary data to meet the aforementioned research goal, the following electronic databases were used: Google Scholar and Scopus. These databases were chosen due to their access to many articles related to the gig economy. Via Scopus, it is also possible to analyse the search results based on criteria such as title and abstract, which made it easier in a later stadium to include and exclude certain papers. Therefore, Scopus was used as the first database to select the papers. Google Scholar was used as a second check to add papers who were not found on Scopus. In addition to this, papers presented on three conferences in 2017 and 2018 were added to the selection to make sure that papers who are not yet published will be included in the literature review. The three conferences who were included are Annual Meeting Proceedings, International Conference on Information Systems and Reshaping Work Conference.

3.1.4 Decide on the specific search terms

On Scopus the following search terms were used within the advanced search options: Gig work; Gig economy; Crowd work; Crowd economy; On-demand work; On-demand economy; eLancing; Online platform economy; and Platform economy. These were used within the OR option, which will also count for the following terms: Recruitment; Selection; Compensation; Benefits; Dynamic pricing; Surge pricing; Training; Development; Performance management; Evaluating; Rewarding; Job design; Involvement; and Communication. I only used papers that talk about HRM-activities in the gig economy, so, therefore, both search combinations will be used within the AND option. Furthermore, all search terms were based on title, abstract and keywords.

In Google Scholar the following search terms were applied: Gig work; Gig economy; Crowd work; Crowd economy; On-demand work; On-demand economy; eLancing; Online platform economy; and Platform economy. These were not combined with the HRM-activities, because such advanced options are not possible in Google Scholar. Therefore, papers that do not talk about HRM-activities were excluded in a later stadium.

In both the International Conference of Information Systems, the Annual Meeting Proceedings and the Reshaping Work Conference, the following terms were used: Gig work; Gig economy; Crowd work; Crowd economy; On-demand work; On-demand economy; eLancing; Online platform economy; and

Platform economy. Both were based on the years 2017 and 2018, title, abstract, and subject or keywords.

3.2 Search and Select

In this section, the second and third step, illustrated in Appendix 1, were executed (Wolfswinkel et al., 2013). First, the actual search through the identified databases of the define stage was executed. The search process led to a result of 8163 papers.

Then the third step took place where I selected the actual sample. According to Wolfswinkel et al. the doubles should have been filtered out here. However, I did this in the previous step. Then, in accordance with Wolfswinkel et al., I refined the sample based on title, abstract and keywords, taking into consideration the inclusion and exclusion criteria in table 1 and 2 (Wolfswinkel et al., 2013).

When articles did not talk about the gig economy they were excluded and when they talked about managing gig workers or about a specific discipline they were included. This led to 336 results, who went through a full-text analysis. The exclusion of 7827 articles had mainly to do with that many articles talked about the sharing economy or crowd behaviour. Both do not relate to this study, because it is about the gig economy and how gig workers are managed.

In the full-text analysis I specifically looked at whether articles talked about HRM-activities or whether another academic discipline discussed or offered a solution for HRM-practices in the gig economy. These articles were included and this led to a final sample of 110 articles.

3.3 Analyse

The fourth step is the analyse step. All 110 articles were read and interesting findings and relevant insights were highlighted. I coded them in ATLAS.ti. based on HRM-activity, country, platform, academic discipline, discussed theme and technology used (Wolfswinkel et al., 2013). This allowed me to have a clear overview of the technologies used and technology affordances per HRM-activity and to have a clear overview of the themes described per HRM-activity. These findings will be shown in the following section.

4. RESULTS

This section will discuss the fifth step of the approach by Wolfswinkel et al. and entails the common framework of how technology is used to manage gig workers, which can be seen in figure 3 and Appendix 11 (Wolfswinkel et al., 2013). This will be extended with research themes in the different HRM disciplines and other academic disciplines that describe the gig economy.

4.1 Overview of the field

This section entails an overview of the included literature.

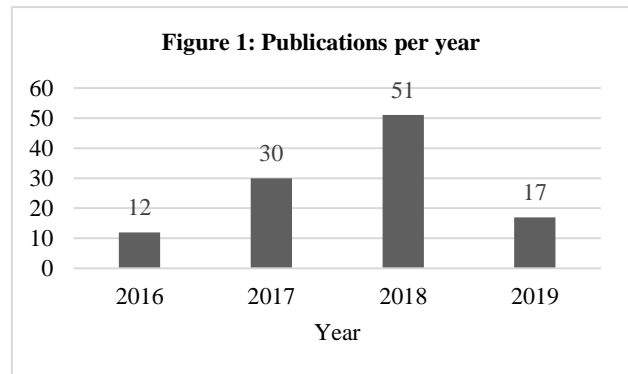
4.1.1 Publications per year

As can be seen in Figure 1, most publications were in 2018. This is in all probability due to the increased use of platform work and the increased growing of the gig economy.

4.1.2 Platforms where data have been collected

As can be seen in Appendix 2, Uber, AMT and Upwork are the most examined platforms. For AMT and Upwork this is probably due to that researchers can easily set up their own tasks and based on this perform their own research. For Uber, this is not the case, but because Uber is one of the largest platforms worldwide it perceives great interest.

Platforms that lack attention are mostly the smaller platforms, however, there are also some bigger ones such as Fiverr, TaskRabbit, Clickworker, Foodora and Topcoder. Strikingly,



there are also a view that allow setting up your own tasks. For other platforms, the reason behind a lack of research can be due to their specific services.

4.1.3 Countries and regions where data is collected

When looking at countries that have been described in the literature (Appendix 3), there can be seen that the UK, the US and Germany are the most investigated countries. This is probably due to their size and in the UK and US in particular, many lawsuits took place which was described in the literature.

4.2 Compensation and benefits

Compensation and benefits are different in the gig economy. Technology determines prices and wages and facilitates automated payment. How this takes place and what the consequences are will be described below.

4.2.1 Technology affordances

Surge pricing. Surge pricing is an algorithmically controlled pricing system – usually available for a few minutes where workers receive more compensation – being applied on online labour platforms during high demand periods. It is used to increase supply, which is contradicting as platforms defend their mechanisms as a self-managing market (Choudary, 2018; Lin & Zhou, 2018). To illustrate, Uber's algorithm increases prices in specific, high-demand areas to attract additional drivers while prioritising those riders willing to pay an additional charge to control customer demand. This mainly happens when the utilisation level is below 60% or 80%. Critics to this algorithm are that Uber uses them to have enough supply on the road, that the surge is gone once drivers arrive and that the surge does not count when the driver is in the surge zone but picks up a passenger outside the zone (Hansen Henten & Maria Windekilde, 2016; Khreiche, 2018; Ma, Yuan, Ghafurian, & Hanrahan, 2018).

Originally, the idea behind surge pricing was that both workers and clients can benefit, however, in practice mainly clients profit from low prices and workers are the victim and receive low compensation (Meijerink & Keegan, in press). Furthermore, some platforms subsidise the non-surge hours by pricing at a much lower level which they do to discourage drivers to work (Choudary, 2018).

Automated payment. Automated payment takes place via the mobile application that ensures that the intermediary platform captures a part of the fee paid by the requesters (Meijerink & Keegan, in press). However, some workers do not agree with the platform's fee and try to circumvent this algorithmic system by replacing the payment to another platform or they ask a higher price per hour and work more hours on the task than arranged to have a higher rate on their profile and thus receive higher rates on future projects (Jarrahi & Sutherland, 2019).

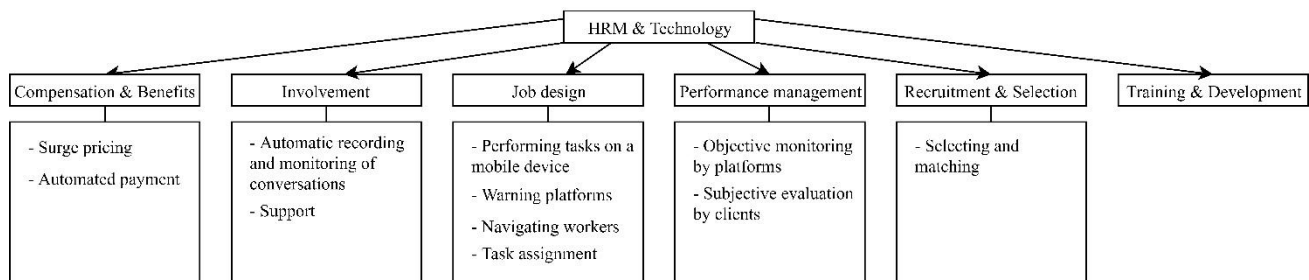


Figure 3 - Framework

The automated payment is facilitated via an escrow system, which automatically charges a percentage fee. Respondents do not have to chase clients for the payment and they are assured that they receive the payment (Broughton et al., 2018). The system namely puts the agreed price into the escrow and once the escrow payment has been collected by the platform, the workers begin the job (Taylor & Joshi, 2018). Advantageous and safe for both workers and clients, though fees captured by platforms can be high in proportion to the overall compensation.

4.2.2 Research themes and consequences

There are two main themes of compensation and benefits which are discussed in the literature. The first is variation in wages and the second is social protection. Both will be discussed below.

Variation in wages. The first reason for variation in wages is different pricing policies. Platforms can use either a fixed payment or a piece-based remuneration. Whereas most gig workers prefer the first, the latter is most applicable in the gig economy and most described in the literature (de Swart, 2018). Part of this piece-based remuneration is surge pricing or also called dynamic pricing. Workers who work during the surge receive higher compensation. However, increased competition between full-time gig workers and part-time gig workers, particularly during peak hours, leads to a decreased surge price (Kenney & Zysman, 2018). Shouldn't workers instead of competing against each other aim and strive together for better compensation and social protection? Another drawback, particularly applicable in the ride-hailing sector, is that workers who work during surge hours perceive more risks of working at night when the surge hours are often applicable (Berg & Johnston, 2019).

Secondly, wages vary due to the degree to which workers are financially dependent on the platform. In this regard, a survey from 2015 found that 33% of the Uber drivers are fully dependent on Uber, 14% has a part-time job in addition to driving for Uber, and 52% have a full-time job in addition to driving for Uber (Hall & Krueger, 2018). Also, other studies show that for the majority it is a supplemental income (Balaram, Warden, & Wallace-Stephens, 2017; Huws, Spencer, Syrdal, & Holts, 2017; Huws, Spencer, & Syrdal, 2018). Imaginable, the more dependent workers are on the platform, the more they will work for the platform and thus receive a higher income from gig work. More information about gig workers' average income, varying between platforms and countries, can be found in Appendix 4.

Thirdly, wages vary also between platforms and between traditional workers and gig workers. To show the differences, researchers investigated gig workers' compensation. Comparing different platforms, there can be concluded that compensation decreased compared to a few years ago. And while there are some platforms that offer a guaranteed compensation, most platforms do not. Furthermore, it is possible to earn a decent income with gig work, however, this depends on the performance. The best performing workers are offered the best paying jobs. More detailed information about compensation per platform can be found in Appendix 5.

In line with the aforementioned, what are gig workers' motivations to join the gig economy while it is hard to earn a decent income? Perhaps contradictory, but perceived benefits are the most important motivator (Lee, Chan, Balaji, & Chong, 2018; Martin et al., 2017). Another motivation is the flexibility that gig work pretends to offer. Workers equate namely flexibility with a financial compensation of \$2.32 per hour (Yin, Suri, & Gray, 2018). Thus, workers are willing to give up \$2.32 per hour to have more flexibility in their work life. So, the more they tend to flexibility, the lower their wages are. Also when workers are hedonically motivated, they are willing to sacrifice financial benefits in favour of a pleasant experience during their gig work (Ihl, Strunk, & Fiedler, 2018).

Fifthly, costs influence wages. Besides the fee, which are often between 10 and 20%, there are also some costs which depend on the platform. Uber drivers, for example, have to pay gas, car maintenance, tolls, taxes (of 15.3%), local fees, car depreciation and then the suggested basics and optional items are not even mentioned (Berg & Johnston, 2019; Ma et al., 2018; A. Wood & Lehdonvirta, 2019).

Also, taxes should be paid by gig workers and vary per country. In Belgium, the parliament implemented a new tax regime which gives platforms the opportunity to apply for accreditation and gives workers the right to benefit from a favourable tax regime (Askitas, Bosc, et al., 2018; Lenaerts, 2018).

Sixthly, gender influences wages. Whereas gender differences in the traditional employer-employee relationship are common sense, this also happens in the more anonymous gig economy. Female do earn substantially less than their male colleagues do, which is attributable to gender differentials in length of experience, preferences over where and when to work and driving speed (Barzilay & Ben-David, 2016; Hunt & Samman, 2019). To overcome this problem, female should use a unisex or unidentifiable name to increase wages per hour with an average of \$2.26 (Barzilay & Ben-David, 2016; Foong, Vincent, Hecht, & Gerber, 2018). However, women can also blame themselves for this, as their behaviour tends more to monitoring avoiding. They are willing to pay \$1.779 for the avoidance of monitoring compared to \$1.276 that men are willing to pay for it (Liang, Hong, Gu, & Peng, 2018). So, next to using an unidentifiable name, women should also be willing to give up their freedom and be monitored. Though, this does not alter the fact that there are no good reasons for this income difference.

Lastly, an interesting finding is that within the ride-hailing sector, platforms like Uber and Lyft also influence the wages of employed taxi drivers. In New York, for example, the wages of employed taxi drivers decreased substantially after the introduction of Uber. However, at the same time, it allows other drivers to enter the market and earn an income (Berger, Chen, & Frey, 2018; Kenney & Zysman, 2018). Though this income is still 70.6% less than comparable workers (Cantarella & Strozzi, 2018).

Social protection. A lack of social protection in the gig economy is due to employee status. Workers are considered as independent contractors because they are compensated per job (Melián-González & Bulchand-Gidumal, 2018). However, in the UK and in Switzerland, the court said that Uber drivers are employees and that they are entitled to various worker's right. This is due to that drivers cannot set their own price and Uber determines the terms and conditions (Windekilde & Henten, 2018; Zwick, 2017). Uber contradicts this and claims that they are simply a platform that offers the software that matches drivers with customers (Collier, Dubal, & Carter, 2017).

A lack of social protection and poor compensation makes gig workers vulnerable to working excessive hours only because it is impossible for them to earn a decent income (Moore, 2018). Besides, the high cost of private pension funds makes it that gig workers often do not have a pension and that the government has to deal with older gig workers with low or no pension (Hall & Krueger, 2018). Furthermore, most gig workers also have no insurance, which is against their preferences (de Swart, 2018). And workers who are eligible for insurance do often not know that they are insured and for what they are insured (Lenaerts, 2018). This is quite problematic because society is being confronted with the problems that underinsured workers cause.

Mechanisms that can steer the evolution of social security are universality of coverage, formality of e-lancing, amount of e-lancers, complementarity of e-lancing and labour organizations of e-lancing (Cepa et al., 2016). How other platforms and countries deal with these issues around social protection can be found in Appendix 6.

When proposing for social protection of gig workers, economic dependency should be a determinant factor (Nadler, 2017; Potocka-Sionek, 2018). And for the future, it is important to set new legislation to prevent decreasing wages and further polarisation between secure and precarious work (Bock, Bontoux, Nascimento, & Szczepanikova, 2016).

Concluding remarks. Different reasons for variation in wages could be found in the literature. Whereas some are due to the technical features of the platform, others are due to workers own preferences and behaviour. Furthermore, workers lack social protection due to their independent contractor status and when workers are eligible for social protection are often not aware of it. In order to overcome both problems, workers should be better informed about their rights and why others receive more compensation.

4.3 Involvement

Involvement in the gig economy is different. Whereas in the traditional economy workers have face-to-face contact with their employer and co-workers, gig workers only communicate through the platform.

4.3.1 Technology affordances

Automatic recording and monitoring of conversations. Algorithms afford Upwork to automatic record and monitor conversations that take place and the algorithm reacts to specific terms used in the messaging application. Though, workers switch often to other communication channels such as e-mail (Jarrahi & Sutherland, 2019).

Support. Abhinav et al. came up with a CrowdAssistant which supports workers throughout their career journey. This buddy acts similarly as a profile assistant, task assistant, career assistant and marketplace assistant. Therefore, this buddy should give workers the feeling that someone is involved in the work they do (Abhinav et al., 2018). Though, I doubt whether this can replace human contact.

4.3.2 Research themes and consequences

There are two main themes that are described in the literature and they are issues surrounding involvement and how this can be tackled.

Issues and problems. Issues around involvement come from a lack of communication, a lack of briefing, a knowledge gap, lack of trust, perceived privacy, power and control, and data (Bock et al., 2016; Broughton et al., 2018; Choudary, 2018; Feldman, Joldaschewa, & Bernstein, 2017; McHugh, 2017; Moore, 2018).

A lack of communication is particularly problematic when technical issues or queries arise. It is hard for workers to ask for help via the platform, especially when emergency issues arise (Broughton et al., 2018; Ma et al., 2018). Furthermore, also more general communication is lacking. 78% of the gig workers rarely or never speak face-to-face with other gig workers (A. J. Wood et al., 2018). Due to this, social isolation is on the lookout.

When looking at trust, it appears that familiarity and service reputation has a positive impact on trust in the platform. And the higher the level of trust users perceive, the more likely they are to use the platform (Gao, Jing, & Guo, 2017). Therefore, platforms should guard personal information and trust.

Then privacy, also related to trust, which is becoming a sensitive topic due to increasing personal information available on platforms (Bock et al., 2016). Therefore, platforms should agree on confidentiality, anonymity and traceability (Shu, Liu, Jia, Yang, & Deng, 2018).

Another form of involvement is power and control, which is huge in the gig economy. For example, platforms track the delivery of work to determine whether it was completed in compliance with the contract mediated through the platform (Choudary, 2018). And according to the court, platforms power even decreases the freedom of gig workers as platforms determine the terms and services. A side note, workers do have the freedom to also work for other platforms (McHugh, 2017). Implications for this will be described in section 4.4.

Improvements. Improvements can be classified into two categories. The first focuses on improvements found and proposed by researchers. The second focuses on improvements made by gig workers to handle the lack of involvement.

A first improvement proposed to improve communication is a chat function on the platform to get into contact with the platform and with other gig workers (Pustulka-Hunt, Telesko, & Hanne, 2018). A second improvement is design implications for effective communication mechanisms proposed by Salehi et al. (Salehi et al., 2017). Furthermore, researchers investigated CloudFactory and found that they encourage workers to communicate in Facebook groups and in weekly face-to-face meetings (Lehdonvirta, 2018).

Secondly, workers found ways to handle the lack of involvement. The first way is that they have a preferred employer list and prefer to do repeatable tasks over doing one-off tasks that pay more. This is due to the high searching costs and risks of having a bad client and therefore they are willing to give up a part of their benefits for having a preferred employer (Kässi et al., 2019). The second way is that gig workers communicate with co-workers via the Internet (A. J. Wood et al., 2018).

Concluding remarks. On the one hand, involvement is extremely present in the gig economy through algorithms which track exactly what workers do. On the other hand, they are not involved because technology takes over the human aspect. Improvements, therefore, focus on having a buddy and communication with co-workers. Whether this is arranged by the platform or by forums on the Internet.

4.4 Job design

Job and platform design are influenced by many technological features and it has been described from two main themes, which both will be discussed below.

4.4.1 Technology affordances

Performing tasks on a mobile device. Technology affords gig workers to perform gig work on a mobile device. However, at AMT for example, performing HITs on a mobile device takes longer, is less usable, less affordable and there are task and software constraints (Newlands, Working-paper). While nearly 60% of the Turkers and Microworkers performs their tasks on a computer, nearly 10% performs it on a tablet or phone (Martin et al., 2017). This while it offers many benefits such as that workers receive notifications on their mobile device when work is available (Huws et al., 2018).

Warning platforms. Uber profits from technology with their Greyball software, which identifies links with potential law enforcement and other unwelcome authorities. Anytime a user opens and closes the application, a warning is sent to Uber that the person is considered as a potential operative of the city government (Khreich, 2018). Uber thus already indicates that they skirt around the law.

Navigating gig workers. Platforms in the food-delivery sector collect location through GPS to navigate workers. However, workers do not have to follow the proposed route and are allowed to take other (safer or shorter) roads (Veen, Barratt, & Goods, 2019). This in turn also leads to expanded market access, because workers do not need to know beforehand the city's road network (Choudary, 2018). There are even Uber drivers who do not trust the in-built navigation and use Google Maps instead (Glöss, McGregor, & Brown, 2016).

Task assignment. Different researchers came up with features to assign tasks to workers. Some propose task assignment algorithms while others developed a CrowdAssistant that can amongst other things, help workers to find the most relevant tasks with the highest benefits (Abhinav et al., 2018; Mizuhara, Sakai, & Fukumoto, 2018; Tarable, Nordio, Leonardi, & Marsan, 2016).

4.4.2 Research themes and consequences

Three themes have mainly been discussed, which are job characteristics, flexibility and gender preferences in flexibility, and task and platform design with their related subthemes.

Job characteristics. First, I will discuss skill variety, which are the abilities needed to perform gig work. A study done by Akgüç et al. shows three important skills needed for doing platform work: communication, driving and software/programming. The importance of communication comes from the rating systems of platforms, as communication with the clients affects the rating (Akgüç et al., 2018). Other researchers also mentioned database, machine learning, IT, statistical and mathematical, domain knowledge, consulting and monitoring, logical thinking and reasoning, project management, and visualization as important skills (Feldman et al., 2017). Notable, many gig workers perform low-skilled tasks that do not even match their existing skill set (Graham, Hjorth, & Lehdonvirta, 2017).

When looking at task variety and autonomy, a study done by Graham et al. shows that 53% of the gig workers strongly agree that their job involves solving complex tasks, compared to just 13% who disagreed or strongly disagreed. Furthermore, their respondents mention the independence they perceive. They can choose when to work, what work they want to do and how they want to do it (Graham, Lehdonvirta, et al., 2017).

Lastly, when looking at feedback, it can be seen that this happens through the rating and reward systems of online labour platforms. Further explanation will be given in section 4.5.

Flexibility. Flexibility entails that workers can choose when to work, what type of work they do and how long they work. 72% of the gig workers also actually feel that they are able to choose and change the order of online tasks and 74% was actually able to choose or change their methods of work. (A. J. Wood et al., 2019a). Furthermore, flexibility offers workers the possibility to schedule their own time and be their own boss (de Swart, 2018; Hall & Krueger, 2018; Shafiei Gol, Stein, & Avital, 2018). However, this flexibility differs per type of platform work. Whereas online contestants and on-location worker-initiated workers do have much freedom and flexibility, on-location platform-determined workers have less choice over which tasks they perform, where, when and how (De Groen, Kilhoffer, Lenaerts, & Mandl, 2018).

Another aspect of flexibility which is discussed is in-task flexibility. More in-task flexibility gives workers more control over when they work, they take fewer breakers and they take their breaks later (Yin et al., 2018). Whereas workers thus not always perceive flexibility, amongst others by surge pricing, platforms should preserve their flexibility to let more tasks being fulfilled.

Lastly, a gender difference in flexibility could be found. Females more highlight the need for flexibility (Hall & Krueger, 2018). And the flexibility that gig work offers them makes it easier to schedule around their existing activities (Barzilay & Ben-David, 2016).

Task and platform design. First of all, task design differs per platform and per sector. Also, the requirement that platforms state on how gig workers should behave differs per platform. Further details of both can be found in Appendix 8.

Second, tasks and platforms are differently designed to motivate workers to participate. Autonomy and independence, entrepreneurial creativity, lifestyle integration, problem-solving, security and stability, technical skill development, and employment access are important values that motivate participation (Taylor & Joshi, 2019). Motivations as autonomy, flexibility and work-family life even outrank other motivations, and thus platforms and tasks should be designed such that they suit these factors (Abubakar & Shneikat, 2017). Taylor and Joshi even distinguish between the stay-at-home dad, the former teacher, the workforce survivor, the five-star mom and the prison trained and their motives for joining the gig economy (Taylor & Joshi, 2018).

Furthermore, task design is influenced by algorithmic control, which causes increased intensity of work due to the high speed of working, tight deadlines and a high level of competition. Furthermore, the algorithm also determines pricing and access to work and therefore workers are unable to negotiate about working conditions (Bajwa, Gastaldo, Di Ruggiero, & Knorr, 2018; Birgillito & Birgillito, 2018). How specific platforms use algorithms can be found in Appendix 7.

Fourthly, risks that come from task and platform design have been described in the literature. Gig workers are being exposed to different vulnerabilities: (1) occupational vulnerabilities; related to the type of work, (2) precarity; related to the short-term character of gig work and the social and economic demands of the platform, and (3) platform-based vulnerabilities; affected by how the platform is designed (Bajwa et al., 2018). Other risks relate to tight deadlines, discriminatory practices and the high chance of forced labour. These risks are reinforced by platform's applications which are driven by algorithms, and also reduces drivers ability to make choices about work based on personal

fatigue or concern for safety (Moore, 2018). Lastly, there are also risks related to inappropriate behaving clients (Glöss et al., 2016).

However, gig work is not only risky but also creates opportunities for those that cannot do regular work. People with physical and mental health issues were attracted because gig work can be performed from home and others even said that it was helping them return to the regular labour market (Broughton et al., 2018; Hall & Krueger, 2018).

Concluding remarks. Job design is a broad concept and relates to all facets of gig work. It ranges from how tasks should be carried out till the risks related to the tasks. And next to criticism on gig work, it also creates an opportunity for people not fitting in the regular labour market.

4.5 Performance management

Performance management in the gig economy is particularly about monitoring and evaluating of workers through rating systems. Clients give reviews about workers and this influences future work. Further elaboration about this can be found below.

4.5.1 Technology affordances

Objective monitoring by platforms. The platform can monitor workers through different technologies. The first is a combination of a mobile application and GPS through which the platform knows when and how long works are logged in, their location and their performance (Bajwa et al., 2018). In the food-delivery sector in particular, platforms track the progress of deliveries and the location of workers. From this, the platform generates data from which they calculate for example average speed and deliveries per hour (De Groen et al., 2018). Deliveroo workers, for instance, receive monthly performance reports showing their average delivery time metrics compared to the algorithm's calculation of how quickly they should have been able to complete orders. Another example, Upwork electronically monitors its workers through screenshots which are taken periodically and then rates its workers (Kuhn & Maleki, 2017). Besides, workers are also being monitored through algorithms (Kenney & Zysman, 2018). After the client gives feedback, algorithms improve this via the number of tasks a worker accepts and completes, and on the quality of customer ratings (Moore, 2018). This improvement increases objectivity of the feedback, as it is not only dependent anymore on a client's rating. However, ratings are still partly biased by clients.

Subjective evaluation by clients. Ratings are not always objective, because clients and workers can agree to give high ratings to ensure future high-performance riders (Meijerink & Keegan, in press). Furthermore, in the ride-hailing sector, it seems that most rides are routine and thus clients give the drivers a routine score of 5 and the platform even automatically fills out the next ride as five stars (Cameron, 2019).

4.5.2 Research themes and consequences

Performance management and the rating mechanisms differs per platform and this can be found in Appendix 9. There are several drawbacks of rating mechanisms, which will be described below

Disadvantages of the rating mechanisms. A first drawback is gamification, which allows that work flows to active workers with high and good reviews and that those workers receive better-paying tasks. As a consequence, those workers are overloaded with work and to maintain the good reputation they have to accept the tasks. Therefore, workers re-outsource their tasks to close family and friends (Gomez-Herrera, Martens, & Mueller-Langer, 2017; Hannák et al., 2017; Ihl et al., 2018; Schmidt, 2017; A. J. Wood, Graham, Lehdonvirta, & Hjorth, 2019b). However, this puts the reliability of the platform into question

because they cannot guarantee that the relatives of the gig worker are as good as the worker themselves.

The second drawback is the multihoming costs and the level of control that platforms have through the rating system. Multihoming costs contain that workers should give up their high ratings when they move to another platform (Choudary, 2018; Gomez-Herrera et al., 2017). This increases the level of control that platforms have over workers, as workers are often not willing to give up their ratings.

Another drawback of the rating systems is that it creates pressure amongst gig workers, due to the fact that they can be deactivated when their performance is under average. Furthermore, it can be stressful and exhausting for workers to perform emotional labour to please customers (Bajwa et al., 2018; Moore, 2018).

Furthermore, gender differences were found. It appeared that women receive fewer reviews than males, though, they found no significant correlation in the case of gender (Hannák et al., 2017). However, researchers are not in agreement. Greenwood et al. found no bias by gender in the rating mechanism when there was a high-quality experience. Though, they did find this in a low-quality experience (Greenwood, Adjerid, & Angst, 2017). Also, Barzilay et al. and Thebault-Spieker et al. found that the feedback score of females and males is equally distributed (Barzilay & Ben-David, 2016; Thebault-Spieker et al., 2017). Because researchers find no overall agreement whether there are gender differences when it comes to performance management, further research is needed.

Concluding remarks. Performance management in the gig economy largely takes place via the rating mechanisms. However, these rating mechanisms also cause that workers are depending on reviews to receive jobs. This can create pressure and therefore it can be important for platforms to investigate how this pressure can be decreased.

4.6 Recruitment and selection

Most platforms have no much difficulty in attracting workers due to the fact that there is a lack of traditional jobs offering decent work (Bellace, 2018). And recruitment that takes place happens largely through the interpersonal network of gig workers. Gig workers introduce their job relatives and teach them how to successfully perform on the platform (A. J. Wood et al., 2019b). However, there are still some technical features that help in recruitment and selection, which will be discussed in this section.

4.6.1 Technology affordances

Selecting and matching gig workers. Technology affords platforms to match and select workers based on, amongst others, location, performance and skills.

First, location. Uber drivers, for example, have to share their location through GPS and clients have to specify the pickup location. Once drivers Go Online in the Uber Application, they are being available for customers and can be selected by them (Birgillito & Birgillito, 2018). Ali et al. went a step further and presented an effected tool in selecting gig workers from a large pool. The algorithm divides the pool into two segments that parallel checks and selects the participants. If the participants are available in the location, they will be selected to participate in the user pool. Otherwise, they will not be selected (Ali et al., 2018).

Second, performance and skills. Algorithms match clients and workers based on their skills and previous performance and the requirements for the job (Drahokoupil & Piasna, 2017; Ellmer & Reichel, 2018). An example of this is TaskRabbit, their algorithm matches based on Tasker's skills and experiences and the client's request and budget. However, Taskers need to be immediately available and respond in 30 minutes (Shade, 2018). Thought this

shrinks into insignificance compared to Uber where workers have to decide within 10 seconds (Veen et al., 2019).

4.6.2 Research themes and consequences

There are two main themes: how gig workers attract clients and how workers and clients are being matched. Again, this differs per platform and information about individual platforms can be found in Appendix 10.

Gig workers attracting clients. To attract more clients, workers should describe their professional skills and certificates on their profile (Almuhrij & Alhamed, 2018). And a problem of attracting clients is that not all clients are equally reliable. To anticipate this, workers incur higher marginal costs when applying to jobs posted by inexperienced clients (Pelletier & Thomas, 2018).

Matching. When we talk about matching, there are different ways in which workers and clients are being matched: (1) gig workers making bids to customers; (2) individuals who were located nearest; (3) customers approaching workers; (4) contests; (5) as an automatic matching operated by the internal algorithm on the basis of the specification of the service required and the worker's profiles; (6) the worker may spontaneously apply for the fulfilment of the task; (7) and other employers experiences (Broughton et al., 2018; De Stefano & Aloisi, 2018; Farrell & Corbel, 2017; Pelletier & Thomas, 2018).

However, sometimes platforms miss information and cannot accurately recruit and select workers. Pelletier and Thomas offer two solutions for this. First, employers restrict the nature of the work done to work where the two problems of coordination and selection are minimized. Second, platform technologies can be improved to make it as easy to use as possible for employers (Pelletier & Thomas, 2018). The addition of a self-assessment in the pre-screening method, compared to traditional pre-screening, makes the recruitment and selection process even more reliable resulting in workers who are performing with higher accuracy (Gadiraju, Fetahu, Kawase, Siehndel, & Dietze, 2017).

A side note, to keep the independent contractor status, platforms say they only facilitate workers and clients with tools needed to efficiently match and let them free in determining the terms and conditions. And in case they do determine the terms and conditions they say they do this on behalf of the client and worker (Wouters, 2018). Though, for some platforms this is very doubtful.

Concluding remarks. When looking at recruitment and selection, technology is mainly used to select and match workers with clients. Matching mainly happens based on skills, experience and performance. Hereby, matching based on skills and experience is more reliable due to the sensitivity of rating systems.

4.7 Training and development

Training and development in the gig economy is not frequently discussed. Researchers that do focus on it elaborate on skills needed for doing gig work and how to acquire them and not on how workers are being taught those skills. This is also due to that platforms often do not offer training possibilities to gig workers.

4.7.1 Research themes and consequences

Developing skills. Gig workers are eager to develop their skills, and in particular, disabled people seek opportunities in developing new skills to stay competitive in the online workforce (Abubakar & Shneikat, 2017; Ding, Shih, & Gu, 2017). Skills that they do develop during their work are mostly self-taught using online resources (A. J. Wood et al., 2019b). Therefore, it can be seen that training and development are transferred to gig workers themselves (Ellmer & Reichel, 2018). Furthermore, it seemed that hedonic motivated are less willing to invest effort

into skills development since they focus on fulfilling hedonic desires (Ihl et al., 2018). Workers who do invest in training and skill development have a competitive advantage and thus could attract better-paying tasks (Broughton et al., 2018). Kässi shows that signalling in the form of taking computer-based tests that award digital skill certificates increases worker earnings in the gig economy, and this is particularly helpful for new gig workers who have no ratings yet (Kässi & Lehdonvirta, 2019).

Training. Many platforms do not offer training to workers and platforms that do offer it focus on learning workers to use their app or platform, safety procedures and how they should correctly complete tasks instead of developing new skills and capabilities. Furthermore, many formal training opportunities that can be useful are offered during typical working hours (Askitas, Bosc, et al., 2018; Broughton et al., 2018; De Groen et al., 2018; Robinson, 2017). Gig workers, therefore, share their tips and tricks on blogs and learn from family and friends how to perform on the platform (Farrell & Corbel, 2017; Martin et al., 2017). And when workers do not have the necessary skills, they sometimes subcontract sub-tasks (Morris et al., 2017).

5. DISCUSSION

This study investigated how technology is used to manage gig workers. The goal was to derive a common framework, to show overlap and make connections between different academic disciplines. Therefore, I looked at six different HRM-activities.

Training and development. It appeared that all activities are afforded by technology, except for training and development. It even appeared that training and development do not occur in the gig economy. Gig workers currently have to and do invest in themselves using online resources (A. J. Wood et al., 2019b). Therefore, there can be said that future research should not focus on further examination of training and development in the gig economy or research should focus on whether technology can be used to afford training and development. This because workers who invest in developing their capabilities attract better-paying jobs (Broughton et al., 2018).

Performance management & training and development. Platforms do not offer training and development opportunities to gig workers because they are scared that workers will leave after a short period of time. In their opinion, the costs of training and development are not worth it. However, workers are locked-in by platforms through their rating systems, which implies that ratings are not portable (Choudary, 2018; Gomez-Herrera et al., 2017). Therefore, platforms' argument to not invest in training and development because of the risk that workers will leave after a short period is not substantiated and thus platforms should be willing to invest. Also, because it increases workers' performance.

Performance management & recruitment and selection. Besides, from the framework there can also be concluded that recruitment and selection and performance management are related. Performances are used to monitor workers' skills and based on this, workers and clients are being matched (Drahokoupil & Piasna, 2017; Ellmer & Reichel, 2018; Shade, 2018). Therefore, in the future researchers should not specifically examine performance management or recruitment and selection but combine both HRM-activities and see how they influence the other activity.

Job design & recruitment and selection. Furthermore, there are also connections between recruitment and selection and job design. Mainly from the Information Systems and Computer Science discipline, researchers come up with solutions to improve task assignment (Abhinav et al., 2018; Mizuhara et al., 2018; Tarable et al., 2016). These solutions can be used to

improve job design but also to improve the matching process between clients and workers. Therefore, platforms should consider implementing the solutions proposed by researchers. Furthermore, consultation between the HRM-activity job design and recruitment and selection can lead to even better task assignment. Therefore, researchers should consider the offered solutions not for solely one HRM-activity, but for more. Besides, many platforms have not considered using task assignment algorithms, while this can lead to more efficient matching of clients and workers.

Involvement & job design. Abhinav et al. developed a CrowdAssistant. This assistant acts as a virtual buddy and should help workers to overcome the challenges they face. On the one hand, workers should feel that someone is involved, while on the other hand, it can help workers to find the most relevant tasks with the highest benefits (Abhinav et al., 2018). However, I think we must ask ourselves whether this is what we want. Do we want to replace human contact with robotic contact allowed by technology? This is a good solution for a while, though researchers should come up with a solution that includes human contact.

Job design. One finding was that Uber drivers do not trust the in-built navigation and use Google Maps instead (Glöss et al., 2016). What are the reasons behind this? This is not known yet and therefore researchers should examine why Uber drivers do not use the in-built navigation and how this navigation should be improved.

Performance management. Ratings about performance are given by clients which do not always give an objective evaluation. Research should therefore see whether and how the objectivity of rating systems can be improved. Furthermore, platforms should consider whether future work should always be dependent on subjective ratings given by clients.

Compensation and benefits. Compensation in the gig economy has been decreased over the last couple of years (Lenaerts, 2018). Strikingly, the economy has grown over the last years and therefore one would expect wages to be growing as well. Research should therefore stay up-to-date about the evolution of wages and when they keep decreasing researchers intervene and advice to politicians to introduce a minimum wage. If this is not already needed anyway.

5.1 Limitations

The goal of this study was to give a complete overview of how technology is used to manage gig workers. This is also the first limitation. Many articles were not publicly accessible. Therefore, I contacted those researchers, however, still many researchers did not answer and therefore many articles are not included in this study which would be otherwise. Second, due to lack of time and limitation in length of this thesis, articles from 2015 and earlier, about 50 articles, could not be included. The conscious decision has been taken to exclude earlier articles and to include the latest insights. Third, I wished to include more articles from the Reshaping Work Conference of 2018 and 2017. This conference discussed many interesting findings, though many articles were not published or finished yet and could therefore not be included. The fourth implication is about articles not published in Dutch and English. Those articles were excluded due to time restrictions in translating the articles. However, for a complete overview those should be included.

5.2 Future research

Future research should focus and include four things: (1) local, smaller and less known platforms; (2) countries other than the UK and the US and more focus on countries outside Europe; (3)

gender differences on different platforms; (4) gender differences in ratings.

The three most discussed platforms currently are Uber, AMT and Upwork. Many is known from these platforms, how they influence their workers and how workers feel about working for these platforms. However, smaller platforms are often skipped, while those can deliver interesting findings. We do know that performance management is very big on the largest platforms, but how do smaller platforms act to their workers? Are their ratings also very subjective or do they have mechanisms to make performance as objective as possible? Furthermore, it has been shown that smaller platforms often pay better. How about the smallest platform? Is it possible to earn a decent income? Do they offer social protections? To answer these questions, researchers should investigate them.

The same counts also for countries outside Europe. The US and UK are very big, however, it appeared that a small country as Belgium offers a favourable tax regime to gig workers. It could be that also other countries offer favourable protections to gig workers, which can give a different picture of the gig economy. Furthermore, it would be interesting to see what the implications of using in technology in managing gig workers are in non-European countries. Therefore, also other countries should be examined.

Next to this, there are still gender differences in the more anonymous gig economy. Though, researchers mainly hereby focused on platforms as AMT, Upwork and Freelancer.com, where clients can post jobs and pick a client. On these platforms, jobs differ, whereas on platforms such as Uber, Deliveroo, Lyft and Foodora the tasks are always the same. On these platforms, clients are less sensitive for skills and performance, but does this also decrease gender differences in compensation? For future research it is very interesting to see whether there are changes between platforms.

Till so far, researchers cannot agree whether there takes place gender discrimination in reviews. Some say this does take place, some only when there was a low-quality experience and others say it does not take place. Therefore, it is important that further research will be examined.

6. CONCLUSION

In this paper I derived a common framework from the literature on how technology is used to manage gig workers by means of HRM-activities. Eleven affordances were found: (1) surge pricing; (2) automated payment; (3) automatic recording and monitoring of conversations; (4) support; (5) performing tasks on a mobile device; (6) warning platforms; (7) navigating workers; (8) task assignment; (9) objective monitoring by platforms; (10); subjective evaluation by clients; (11) selecting and matching. They exist in the HRM-activities compensation and benefits, involvement, job design, performance management, and recruitment and selection. Thus technology affordances exist in all HRM-activities except for training and development.

I hope that this research contributes to the understanding of the gig economy and that researchers are aware that activities that take place to manage gig workers all relate to HRM. For future research, researchers from different disciplines should focus on the HRM-activities present in their field and communicate their findings and solutions to other fields.

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8. REFERENCES

- Abhinav, K., Dubey, A., Jain, S., Bhatia, G. K., McCartin, B., & Bhardwaj, N. (2018). *Crowdassistant: A virtual buddy for crowd worker*. Paper presented at the Proceedings of the 5th International Workshop on Crowd Sourcing in Software Engineering.
- Abhinav, K., Dubey, A., Virdi, G., & Kass, A. (2016). *Analyzing on-boarding time in context of crowdsourcing*. Paper presented at the Proceedings of the 2nd International Workshop on Software Analytics.
- Abubakar, A. M., & Shneikat, B. H. T. (2017). eLancing motivations. *Online Information Review*, 41(1), 53-69.
- Akgüç, M. (2018). Industrial Relations and Social Dialogue in the Age of Collaborative Economy (IRSDACE). National Report France. 21 December 2018.
- Akgüç, M., Beblavý, M., Cirule, E., & Kilhoffer, Z. (2018). Industrial Relations and Social Dialogue in the Age of Collaborative Economy (IRSDACE).
- Ali, T., Draz, U., Yasin, S., Noureen, J., Shaf, A., & Ali, M. (2018). An Efficient Participant's Selection Algorithm for Crowdsensing. *INTERNATIONAL JOURNAL OF ADVANCED COMPUTER SCIENCE AND APPLICATIONS*, 9(1), 399-404.
- Almuhrij, M. A., & Alhamed, A. A. (2018). *Manfaa Freelancer Application*. Paper presented at the 2018 21st Saudi Computer Society National Computer Conference (NCC).
- Aloisi, A. (2015). Commoditized workers: Case study research on labor law issues arising from a set of on-demand/gig economy platforms. *Comparative labour law & policy journal*.
- Aloisi, A. (2018). The Role of European Institutions in Promoting Decent Work in the "Collaborative Economy". In *Multidisciplinary Design of Sharing Services* (pp. 161-182): Springer.
- Askatas, N., Bosc, R., de Groen, W. P., Eichhorst, W., Kilhoffer, Z., Lenaerts, K., . . . Salez, N. (2018). Online Talent Platforms, Labour Market Intermediaries and the Changing World of Work. Independent study prepared by CEPS and IZA for the World Employment Confederation-Europe and UNI Europa May 2018.
- Askatas, N., Eichhorst, W., Fahrenholtz, B., Meys, N., & Ody, M. (2018). *Industrial Relations and Social Dialogue in the Age of Collaborative Economy (IRSDACE)*. Retrieved from
- Bajwa, U., Gastaldo, D., Di Ruggiero, E., & Knorr, L. (2018). The health of workers in the global gig economy. *Globalization and health*, 14(1), 124.
- Balaram, B., Warden, J., & Wallace-Stephens, F. (2017). Good gigs. *A fairer future for the UK's gig economy. Report, RSA Action and Research Center*.
- Barzilai, A. R., & Ben-David, A. (2016). Platform inequality: gender in the gig-economy. *Seton Hall L. Rev.*, 47, 393.
- Bellace, J. R. (2018). Back to the future: workplace relations and labour law in the 21st century in the Asia Pacific context. *Asia Pacific Journal of Human Resources*, 56(4), 433-449.
- Berg, J. (2016). Income security in the on-demand economy: Findings and policy lessons from a survey of crowdworkers. *Comparative Labor Law and Policy Journal*, 27.
- Berg, J., & Johnston, H. (2019). Too Good to Be True? A Comment on Hall and Krueger's Analysis of the Labor Market for Uber's Driver-Partners. *ILR Review*, 72(1), 39-68.
- Berger, T., Chen, C., & Frey, C. B. (2018). Drivers of disruption? Estimating the Uber effect. *European Economic Review*, 110, 197-210.
- Birgillito, G., & Birgillito, M. (2018). Algorithms and ratings: tools to manage labour relations. Proposals to renegotiate labour conditions for platform drivers. *Labour & Law Issues*, 4(2), 25-50.
- Bock, A., Bontoux, L., Nascimento, S., & Szczepanikova, A. (2016). The future of the EU collaborative economy. *JRC Science for Policy report*.
- Borghi, P., Mori, A., & Semenza, R. (2018). Self-employed professionals in the European labour market. A comparison between Italy, Germany and the UK. *Transfer: European Review of Labour and Research*, 24(4), 405-419.
- Broughton, A., Gloster, R., Marvell, R., Green, M., Langley, J., & Martin, A. (2018). *The experiences of individuals in the gig economy*.
- Busch, C., Schulte-Nölke, H., Wiewiórowska-Domagalska, A., & Zoll, F. (2016). The Rise of the Platform Economy: A New Challenge for EU Consumer Law? *Journal of European Consumer and Market Law*, 5, 6.
- Cachon, G. P., Daniels, K. M., & Lobel, R. (2017). The role of surge pricing on a service platform with self-scheduling capacity. *Manufacturing & Service Operations Management*, 19(3), 368-384.
- Cameron, L. D. (2019). Who Made the Stars?: Ratings Control, Construction, and Consequence in Platform-Mediated Labor Markets. 8.
- Cantarella, M., & Strozzi, C. (2018). Labour market effects of crowdwork in US and EU: an empirical investigation.
- Cepa, K., Mc Caffrey, C., Noorizadeh, A., Öhman, M., Töyrylä, P., Neuvo, Y., . . . Kuikka, M. (2016). Is Digitization Making Work Precarious? Implications of the Global e-Lancer Economy. *Digitalization*, 11.
- Chen, M. K., & Sheldon, M. (2016). *Dynamic Pricing in a Labor Market: Surge Pricing and Flexible Work on the Uber Platform*. Paper presented at the Ec.
- Choudary, S. P. (2018). The architecture of digital labour platforms: Policy recommendations on platform design for worker well-being. *ILO Future of Work Research Paper Series*(3).
- Claussen, J., Khashabi, P., Kretschmer, T., & Seifried, M. (2018). Knowledge Work in the Sharing Economy: What Drives Project Success in Online Labor Markets? Available at SSRN 3102865.
- Collier, R. B., Dubal, V., & Carter, C. (2017). Labor platforms and gig work: the failure to regulate.
- Crowston, K. (2012). Amazon mechanical turk: A research tool for organizations and information systems scholars. In *Shaping the Future of ICT Research. Methods and Approaches* (pp. 210-221): Springer.
- De Groen, W. P., Kilhoffer, Z., Lenaerts, K., & Mandl, I. (2018). Employment and working conditions of selected types of platform work.
- De Stefano, V. (2016). The rise of the just-in-time workforce: On-demand work, crowdwork, and labor protection in the gig-economy. *Comp. Lab. L. & Pol'y J.*, 37, 471.
- De Stefano, V., & Aloisi, A. (2018). *European Legal framework for digital labour platforms* (9279941313). Retrieved from
- de Swart, J. (2018). *Delivering Food in the Gig Economy*.
- Deng, X. N., & Joshi, K. D. (2016). Why individuals participate in micro-task crowdsourcing work environment:

- Revealing crowdworkers' perceptions. *Journal of the Association for Information Systems*, 17(10), 648.
- Dijkstra, S. (2017). *Upwork at work: Labor as a service*.
- Ding, X., Shih, P. C., & Gu, N. (2017). *Socially embedded work: A study of wheelchair users performing online crowd work in china*. Paper presented at the Proceedings of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing.
- Drahokoupil, J., & Piasna, A. (2017). Work in the platform economy: beyond lower transaction costs. *Intereconomics*, 52(6), 335-340.
- Dubey, A., Abhinav, K., Taneja, S., Virdi, G., Dwarakanath, A., Kass, A., & Kuriakose, M. S. (2016). *Dynamics of software development crowdsourcing*. Paper presented at the 2016 IEEE 11th International Conference on Global Software Engineering (ICGSE).
- Ellmer, M., & Reichel, A. (2018). *Crowdwork from an HRM perspective—integrating organizational performance and employee welfare*. Retrieved from
- Elmaghraby, W., & Keskinocak, P. (2003). Dynamic pricing in the presence of inventory considerations: Research overview, current practices, and future directions. *Management science*, 49(10), 1287-1309.
- Farrell, L., & Corbel, C. (2017). The Literacy 4.0 Project-Working Paper 1: Literacy Practices in the Gig Economy. In: Melbourne: Melbourne Graduate School of Education, The University of Melbourne.
- Feldman, M., Jaldaschewa, F., & Bernstein, A. (2017). Data Analytics on Online Labor Markets: Opportunities and Challenges. *arXiv preprint arXiv:1707.01790*.
- Finck, M. (2017). Digital co-regulation: designing a supranational legal framework for the platform economy.
- Foong, E., Vincent, N., Hecht, B., & Gerber, E. M. (2018). Women (Still) Ask For Less: Gender Differences in Hourly Rate in an Online Labor Marketplace. *Proceedings of the ACM on Human-Computer Interaction*, 2(CSCW), 53.
- Forde, C., Stuart, M., Joyce, S., Oliver, L., Valizade, D., Alberti, G., . . . Carson, C. (2017). The social protection of workers in the platform economy. *DIRECTORATE GENERAL FOR INTERNAL POLICIES POLICY DEPARTMENT A: ECONOMIC AND SCIENTIFIC POLICY*.
- Frenken, K., van Waes, A., Smink, M., & van Est, R. (2017). A fair share: safeguarding public interests in the sharing and gig economy. In: Rathenau Instituut.
- Friedman, G. (2014). Workers without employers: shadow corporations and the rise of the gig economy. *Review of Keynesian Economics*, 2(2), 171-188.
- Gadiraju, U., Fetahu, B., Kawase, R., Siehdell, P., & Dietze, S. (2017). Using worker self-assessments for competence-based pre-selection in crowdsourcing microtasks. *ACM Transactions on Computer-Human Interaction (TOCHI)*, 24(4), 30.
- Galperin, H., & Greppi, C. (2017). Geographical discrimination in the gig economy.
- Gandini, A. (2019). Labour process theory and the gig economy. *Human Relations*, 72(6), 1039-1056.
- Gao, S., Jing, J., & Guo, H. (2017). *The Role of Trust with Car-Sharing Services in the Sharing Economy in China: From the Consumers' Perspective*. Paper presented at the International Conference on Cross-Cultural Design.
- Gaver, W. W. (1991). *Technology affordances*. Paper presented at the Proceedings of the SIGCHI conference on Human factors in computing systems.
- Gibbs, M. (2017). How is new technology changing job design? *IZA World of Labor*.
- Glöss, M., McGregor, M., & Brown, B. (2016). *Designing for labour: uber and the on-demand mobile workforce*. Paper presented at the Proceedings of the 2016 CHI conference on human factors in computing systems.
- Gomez-Herrera, E., Martens, B., & Mueller-Langer, F. (2017). *Trade, competition and welfare in global online labour markets: A "gig economy" case study*. Retrieved from
- Graham, M., Hjorth, I., & Lehdonvirta, V. (2017). Digital labour and development: impacts of global digital labour platforms and the gig economy on worker livelihoods. *Transfer: European Review of Labour and Research*, 23(2), 135-162.
- Graham, M., Lehdonvirta, V., Wood, A., Barnard, H., Hjorth, I., & D Simon, P. (2017). The risks and rewards of online gig work at the global margins.
- Greenwood, B. N., Adjerid, I., & Angst, C. M. (2017). How Unbecoming of You: Gender Biases in Perceptions of Ridesharing Performance.
- Gruman, J. A., & Saks, A. M. (2011). Performance management and employee engagement. *Human Resource Management Review*, 21(2), 14.
- Hackman, J. R., & Oldham, G. R. (1976). Motivation through the design of work: Test of a theory. *Organizational behavior and human performance*, 16(2), 250-279.
- Hall, J. V., & Krueger, A. B. (2018). An analysis of the labor market for Uber's driver-partners in the United States. *ILR Review*, 71(3), 705-732.
- Hannák, A., Wagner, C., Garcia, D., Mislove, A., Strohmaier, M., & Wilson, C. (2017). *Bias in online freelance marketplaces: Evidence from taskrabbit and fiverr*. Paper presented at the Proceedings of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing.
- Hansen Henten, A., & Maria Windekilde, I. (2016). Transaction costs and the sharing economy. *info*, 18(1), 1-15.
- Harmon, E., & Silberman, M. S. (2018). Rating working conditions on digital labor platforms. *Computer Supported Cooperative Work (CSCW)*, 27(3-6), 1275-1324.
- Hunt, A., & Samman, E. (2019). Gender and the gig economy.
- Huws, U., Spencer, N., Syrdal, D. S., & Holts, K. (2017). Work in the European gig economy: research results from the UK, Sweden, Germany, Austria, The Netherlands, Switzerland and Italy.
- Huws, U., Spencer, N. H., & Syrdal, D. S. (2018). Online, on call: The spread of digitally organised just-in-time working and its implications for standard employment models. *New Technology, Work and Employment*, 33(2), 113-129.
- Ihl, A., Strunk, K. S., & Fiedler, M. (2018). The Influence of Utilitarian and Hedonic Motivation on Success in Crowd Work.
- Inc, U. T. (2019). Hoe wordt mijn betaling berekend?
- Jarrahi, M. H., & Sutherland, W. (2019). *Algorithmic Management and Algorithmic Competencies: Understanding and Appropriating Algorithms in Gig Work*. Paper presented at the International Conference on Information.
- Kässi, O., & Lehdonvirta, V. (2019). Do digital skill certificates help new workers enter the market?

- Kässi, O., Lehdonvirta, V., & Dalle, J.-M. (2019). Workers' task choice heuristics as a source of emergent structure in digital microwork.
- Kenney, M., & Zysman, J. (2016). The rise of the platform economy. *Issues in Science and Technology*, 32(3), 61.
- Kenney, M., & Zysman, J. (2018). Work and Value Creation in the Platform Economy. *Forthcoming, Research in the Sociology of Work edited by Anne Kovalainen and Steven Vallas*.
- Khreiche, M. (2018). *Milieus in the Gig Economy*. Virginia Tech,
- Kuhn, K. M., & Maleki, A. (2017). Micro-entrepreneurs, dependent contractors, and instasferfs: Understanding online labor platform workforces. *Academy of Management Perspectives*, 31(3), 183-200.
- Labor, U. S. D. o. (2019, 29 March 2019). Minimum Wage Laws in the States.
- Lee, Z. W., Chan, T. K., Balaji, M., & Chong, A. Y.-L. (2018). Why people participate in the sharing economy: an empirical investigation of Uber. *Internet Research*, 28(3), 829-850.
- Lehdonvirta, V. (2018). Flexibility in the gig economy: managing time on three online piecework platforms. *New Technology, Work and Employment*, 33(1), 13-29.
- Lenaerts, K. (2018). Industrial Relations and Social Dialogue in the Age of Collaborative Economy IRSDACE: Ntional Report Belgium. CEPS Special Report.
- Lepak, & Gowan. (2015). *Human Resource Management: Managing Employees for Competitive Advantage*: Chicago Business Press.
- Liang, C., Hong, Y., Gu, B., & Peng, J. (2018). Gender wage gap in online gig economy and gender differences in job preferences. *Available at SSRN 3266249*.
- Lin, X., & Zhou, Y.-W. (2018). Pricing policy selection for a platform providing vertically differentiated services with self-scheduling capacity. *Journal of the Operational Research Society*, 1-16.
- Ma, N. F., Yuan, C. W., Ghafurian, M., & Hanrahan, B. V. (2018). *Using Stakeholder Theory to Examine Drivers' Stake in Uber*. Paper presented at the Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems.
- Marchington, M., Goodman, J., Wilkinson, A., & Ackers, P. (1992). New developments in employee involvement.
- Martin, D., Carpendale, S., Gupta, N., Hoßfeld, T., Naderi, B., Redi, J., . . . Wechsung, I. (2017). Understanding the crowd: ethical and practical matters in the academic use of crowdsourcing. In *Evaluation in the crowd. crowdsourcing and human-centered experiments* (pp. 27-69): Springer.
- Mason, W., & Watts, D. J. (2009). Financial Incentives and the "Performance of Crowds". *Proceedings of the ACM SIGKDD workshop on human computation*, 99.
- McHugh, J. W. (2017). Looking Through the (Mis) Classifieds: Why TaskRabbit is Better Suited than Uber and Lyft to Succeed Against a Worker Misclassification Claim. *Clev. St. L. Rev.*, 66, 649.
- Meijerink, J., & Keegan, A. (in press). Conceptualizing human resource management in the gig economy: Toward a platform ecosystem perspective.
- Melián-González, S., & Bulchand-Gidumal, J. (2018). What type of labor lies behind the on-demand economy? New research based on workers' data. *Journal of Management & Organization*, 1-17.
- Mizuhara, R., Sakai, K., & Fukumoto, S. (2018). *A Collaborative-Task Assignment Algorithm for Mobile Crowdsourcing in Opportunistic Networks*. Paper presented at the 2018 IEEE International Conference on Communications (ICC).
- Moazami, Y. (2017). UBER in the U.S. and Canada: Is the Gig-Economy Exploiting or Exploring Labor and Employment Laws by Going Beyond the Dichotomous Workers Classification? In. Miami: University of Miami School of Law Institutional Repository.
- Moore, P. V. (2018). The threat of physical and psychosocial violence and harassment in digitalized work. *ILO*.
- Morris, M. R., Bigham, J. P., Brewer, R., Bragg, J., Kulkarni, A., Li, J., & Savage, S. (2017). *Subcontracting microwork*. Paper presented at the Proceedings of the 2017 CHI conference on human factors in computing systems.
- Nadler, M. L. (2017). Independent employees: A new category of workers for the gig economy. *NCJL & Tech.*, 19, 443.
- Newlands, G. (Working-paper). Crowdwork and the mobile underclass: Mobile connectivity on Amazon Mechanical Turk.
- Parigi, P., & Ma, X. (2016). The gig economy. *XRDS: Crossroads, The ACM Magazine for Students*, 23(2), 38-41.
- Pelletier, A., & Thomas, C. (2018). Information in online labour markets. *Oxford Review of Economic Policy*, 34(3), 376-392.
- Potocka-Sionek, N. (2018). Facing digital precariousness in the platform economy: on the way towards a more sustainable future of work. *Economia & lavoro*, 52, 27-42.
- Prassl, J., & Risak, M. (2015). Uber, taskrabbit, and co.: Platforms as employers-rethinking the legal analysis of crowdwork. *Comp. Lab. L. & Pol'y J.*, 37, 619.
- Pustulka-Hunt, E., Telesko, R., & Hanne, T. (2018). *Gig Work Business Process Improvement*. Paper presented at the 2018 6th International Symposium on Computational and Business Intelligence (ISCBI).
- Robinson, H. C. (2017). *Making a digital working class: Uber drivers in Boston, 2016-2017*. Massachusetts Institute of Technology,
- Salehi, N., Teevan, J., Iqbal, S., & Kamar, E. (2017). *Communicating context to the crowd for complex writing tasks*. Paper presented at the Proceedings of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing.
- Schmidt, F. A. (2017). Digital labour markets in the platform economy. *Friedrich-Ebert Stiftung. Sokoler, Alexander (2016): 'Tegn på lovbrud: Personer udlejer adskillige lejligheder på Airbnb'*. *Fagbladet F*, 3.
- Shade, L. R. (2018). Hop to it in the gig economy: The sharing economy and neo-liberal feminism. *International Journal of Media & Cultural Politics*, 14(1), 35-54.
- Shafiei Gol, E., Stein, M.-K., & Avital, M. (2018). Why take the risk? motivations of highly skilled workers to participate in crowdworking platforms.
- Shu, J., Liu, X., Jia, X., Yang, K., & Deng, R. H. (2018). Anonymous privacy-preserving task matching in crowdsourcing. *IEEE Internet of Things Journal*, 5(4), 3068-3078.
- Stanford, J. (2017). The resurgence of gig work: Historical and theoretical perspectives. *The Economic and Labour Relations Review*, 28(3), 382-401.

- Tarable, A., Nordio, A., Leonardi, E., & Marsan, M. A. (2016). The importance of worker reputation information in microtask-based crowd work systems. *IEEE Transactions on Parallel and Distributed Systems*, 28(2), 558-571.
- Taylor, J., & Joshi, K. (2018). How IT Leaders Can Benefit from the Digital Crowdsourcing Workforce. *MIS Quarterly Executive*, 17(4).
- Taylor, J., & Joshi, K. D. (2019). Joining the crowd: The career anchors of information technology workers participating in crowdsourcing. *Information Systems Journal*, 29(3), 641-673.
- Thebault-Spieker, J., Kluver, D., Klein, M. A., Halfaker, A., Hecht, B., Terveen, L., & Konstan, J. A. (2017). Simulation Experiments on (the Absence of) Ratings Bias in Reputation Systems. *Proceedings of the ACM on Human-Computer Interaction*, 1(CSCW), 101.
- Veen, A., Barratt, T., & Goods, C. (2019). Platform-Capital's 'App-etite' for Control: A Labour Process Analysis of Food-Delivery Work in Australia. *Work, Employment and Society*, 0950017019836911.
- Verbiest, S., Tooren, M., Torre, W., & van de Ven, H. (2019). *De kwaliteit van arbeid van platformwerkers: een eerste verkenning: een onderzoek uitgevoerd binnen het Kennisinvesteringsprogramma Future of Work 2018*. Retrieved from
- Webster, J., & Watson, R. T. (2002). Analyzing the past to prepare for the future: Writing a literature review. *MIS quarterly*, xiii-xxiii.
- Windekilde, I. M., & Henten, A. (2018). Implications of ICT-based platforms on labor markets—the case of Uber. *Economic Problems of Services, Scientific Journal of the University of Szczecin*, 2(2/2018), 75-96.
- Wolfswinkel, J. F., Furtmueller, E., & Wilderom, C. P. (2013). Using grounded theory as a method for rigorously reviewing literature. *European journal of information systems*, 22(1), 45-55.
- Wood, A., & Lehdonvirta, V. (2019). Platform Labour and Structured Antagonism: Understanding the Origins of Protest in the Gig Economy. *Available at SSRN* 3357804.
- Wood, A. J., Graham, M., Lehdonvirta, V., & Hjorth, I. (2019a). Good gig, bad gig: autonomy and algorithmic control in the global gig economy. *Work, Employment and Society*, 33(1), 56-75.
- Wood, A. J., Graham, M., Lehdonvirta, V., & Hjorth, I. (2019b). Networked but Commodified: The (Dis) Embeddedness of Digital Labour in the Gig Economy. *Sociology*, 0038038519828906.
- Wood, A. J., Lehdonvirta, V., & Graham, M. (2018). Workers of the Internet unite? Online freelancer organisation among remote gig economy workers in six Asian and African countries. *New Technology, Work and Employment*, 33(2), 95-112.
- Wouters, M. (2018). *Directing labour market outcomes: why are digital labour platforms not deemed private employment agencies?* Paper presented at the XII ISLSSL World Congress Torino 2018, Location: International Training Centre of the ILO: Viale Maestri del Lavoro, 10–10127 Turin, Italy.
- Yin, M., Suri, S., & Gray, M. L. (2018). *Running Out of Time: The Impact and Value of Flexibility in On-Demand Crowdwork*. Paper presented at the Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems.
- Zwick, a. (2017). Welcome to the Gig Economy: neoliberal industrial relations and the case of Uber. *GeoJournal*.

9. APPENDIX 1 – SEARCH AND SELECTION PROCESS

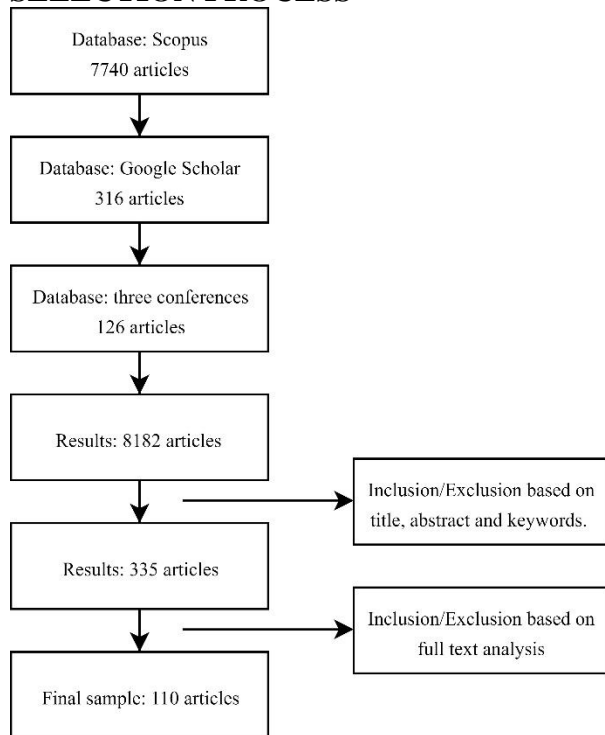
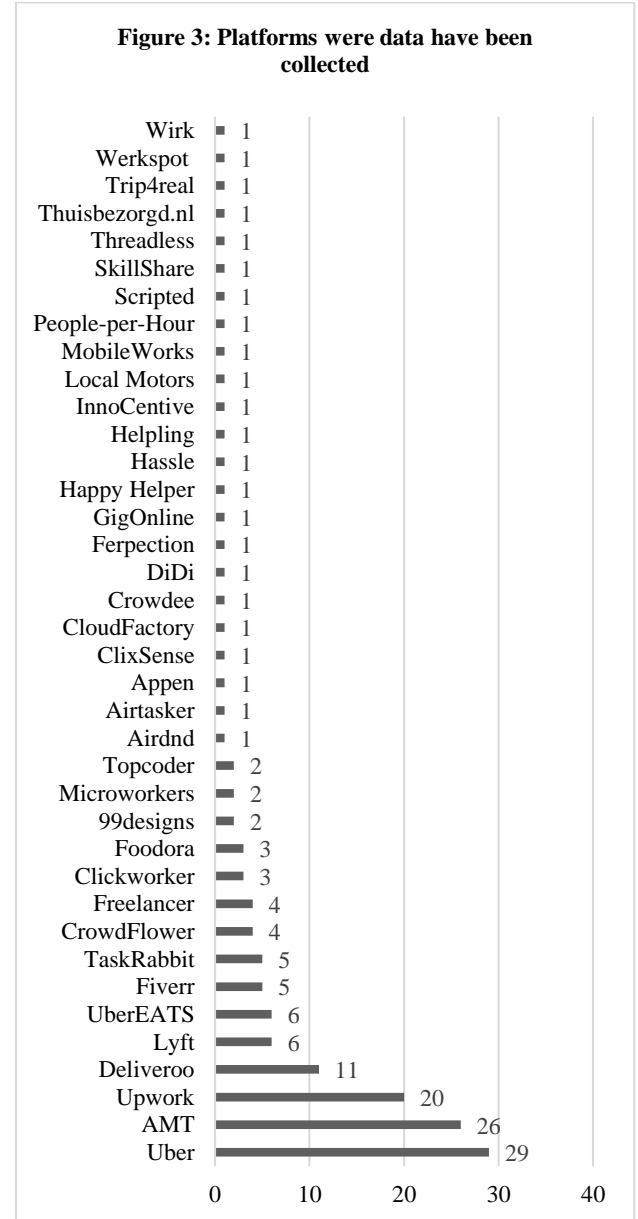
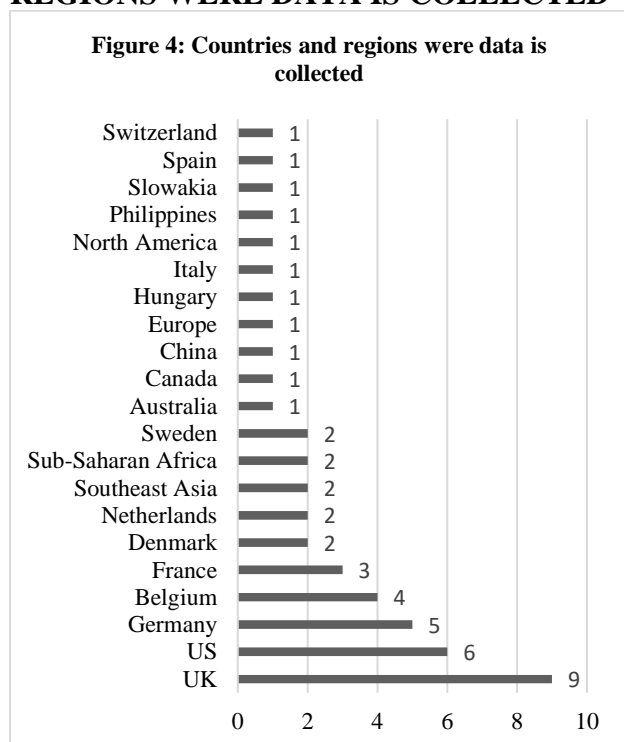


Figure 4: Search and selection process

10. APPENDIX 2 – PLATFORMS WHERE DATA HAVE BEEN COLLECTED



11. APPENDIX 3 – COUNTRIES AND REGIONS WHERE DATA IS COLLECTED



12. APPENDIX 4 – GIG WORKERS' INCOME

Income in the gig economy depends on the platform but also whether it is a part-time or full-time job. US gig workers have a mean weekly income of \$165, while those lacking a strong reputation earned \$58 a month (A. J. Wood et al., 2019a). And around two-thirds of the US Turkers have a yearly income below \$60,000 and more than 90% of the Indian Turkers has a yearly income below \$60,000. Half of the Microworkers earn less than \$10,000 per year (Martin et al., 2017). German gig workers income ranged from €144 to €663 a month (Askatas, Eichhorst, Fahrenholtz, Meys, & Ody, 2018). Another study found that two third of the workers earned up to €1000 a month and that even 10% earned more than €2000 a month (Akgüç et al., 2018). And when distinguishing between types of platform, there can be estimated that on-location platform-determined workers earn between €4 and €13 per hour, while on-location worker-initiated worker earnings vary between €11.98 and €14 in the cleaning business (De Groen et al., 2018).

13. APPENDIX 5 – COMPENSATION AND BENEFITS PER PLATFORM

Many researchers talk about the compensation gig workers receive for their work. Upwork has a guaranteed minimum wage of \$3 per hour and workers average hourly wage is ranging from €3.94 to €26.32 (Askatas, Bosc, et al., 2018). For further improvements, this minimum wage should be determined in collaboration with public authorities and other interest groups (Finck, 2017). Furthermore, they have a fee of 20%, 10% and 5%, depending on the income segment (Claussen, Khashabi, Kretschmer, & Seifried, 2018; Dijkstra, 2017). Deliveroo initially used guaranteed earnings (Veen et al., 2019). Within this system, workers could earn €9 per hour, while afterwards, they earned only a maximum of €5 per hour (Lenaerts, 2018). Uber EATS pays since it launches on a

variable piece-rate basis (Veen et al., 2019), which is €3.30 per delivery plus €1 per mile plus €5 trip reward subjected to 25% transaction cut (Glöss et al., 2016). Lyft adjusted its pricing mechanisms to competitor Uber and rewards the most active drivers (Choudary, 2018). Turkers on Amazon Mechanical Turk (AMT) receive usually between 1-2\$ per hour but this can peak till \$20. To receive a higher income, workers should fulfil more low-paying HITS resulting in higher classified HITS in the future and should aim for a Masters Qualification (Khreiche, 2018; Lehdonvirta, 2018). Biggest drawbacks of AMT are the relative high searching costs (Kässi et al., 2019), that they do little to prevent non-payment (Akgüç et al., 2018) and that they only pay out to American and Indian bank accounts (De Stefano & Aloisi, 2018). On Clickworker, workers earn on average €2 per hour and highly ranked workers can earn till €8 per hour (De Stefano & Aloisi, 2018). Crowdfunder even limits payment per task to \$5 and this can only be increased with the manual bonus feature. More extremely, sometimes workers receive points or other forms of non-currency-based payment (Harmon & Silberman, 2018). A CloudFactory worker earns between \$10 and \$20 a week, compared to a usual wage of \$25 in India. MobileWorks workers earn between \$60 and \$100 a week, which is usually in the Philippines (Lehdonvirta, 2018). Taskers of TaskRabbit have an average gross income of \$289.96 a week and have to pay a 30% fee (15% if the client has previously required the individual's services) (Melián-González & Bulchand-Gidumal, 2018). Others mention that TaskRabbit has a wage floor of \$12.80 per hour (Shade, 2018). eLance pays the gig worker once the task is completed successfully (Abubakar & Shneikat, 2017). People-Per-Hour (PPH) charges 20% fee a month and 5% after €520 and the average wage is €33.09 per hour with a minimum wage rate of €7 per hour (Gomez-Herrera et al., 2017). Helping cleaners earn between €11 and €12 per hour for a regular cleaning job (Frenken, van Waes, Smink, & van Est, 2017). The Dutch platform Werkspot uses a fee based on the scope of the job and chance of winning (Verbiest, Tooren, Torre, & van de Ven, 2019).

14. APPENDIX 6 – SOCIAL PROTECTION

Social protection varies between platforms and between countries. For health insurance, in 2015 38% of Uber drivers received employer-provided health insurance, however, this was either from their own employer at another job or from a family member's employer (Hall & Krueger, 2018). Therefore, in Germany, there is since 2006 a mandatory health insurance for all residents. However, this system does not cover paid maternity leave or invalidity and disability allowances (Borghi, Mori, & Semenza, 2018). Still, this is important, as gig workers prefer work arrangements including sick arrangements over work arrangement without them (de Swart, 2018). In French, gig workers do enjoy the French basic coverage but this excludes unemployment benefits (Akgüç, 2018). Furthermore, most platforms only compensate workers for the damage occurred during their work but not the damage they have after the accident (De Groen et al., 2018).

15. APPENDIX 7 – USE OF ALGORITHMS BY SPECIFIC PLATFORMS

In Sweden, the algorithm assigns shifts to workers (De Groen et al., 2018) and MobileWorks uses the algorithm to match tasks and workers based on their skills (Lehdonvirta, 2018). Upwork's algorithm is programmed to show new job offers at any time, depending on profile preferences, filters, and search

terms (Dijkstra, 2017). And Uber also uses its algorithm to improve driver satisfaction. When drivers need to be at a certain time at a certain place, their algorithm will drive them in the right direction (Khreiche, 2018).

16. APPENDIX 8 – TASK AND PLATFORM DESIGN

Task and platform design. Deliveroo workers have to register for the hours they would like to work and Deliveroo then designates workers to specific zones and requires them to ‘check in’ within these zones before the workers can receive orders. Workers have to decide within 10 seconds whether to accept or reject the job (same as Uber EATS) and workers with the best reviews get priority bookings (Akgüç, 2018; Veen et al., 2019). Uber EATS application offers the option to collect multiple deliveries from the same restaurant (Veen et al., 2019). Uber drivers are required to have a car, clean the car before a shift, to wear a uniform, to decide within 15 seconds whether to accept a ride (De Groen et al., 2018; Ma et al., 2018). Especially younger adults view the requirement of car ownership as a drawback and a more general drawback is that riders see the price of the drive once it is completed (Akgüç, 2018; Choudary, 2018; Khreiche, 2018). Furthermore, Uber drivers complain about the great level of perceived control (Ma et al., 2018). Upwork employers have to register by providing contact details and basic information and then they can post as many jobs as they like. Workers must register by also giving personal information and by setting up a profile page. And while many platforms do not allow negotiating, Upwork employers do have this option (Claussen et al., 2018). Once the hiring process has started, Upwork provides a messenger and time-tracking on mobile and desktop for communication and the exchange of documents between employer and gig worker (Dijkstra, 2017). Fiverr workers can post jobs they are willing to do on the platform including the fixed wage they want to receive. TaskRabbit clients can post a job on the platform and Taskers can bid for it (Kuhn & Maleki, 2017). On Topcoder it seems that task completion is driven by the capability/ratings of the gig worker, followed by task category, remunerations and prize money (Dubey et al., 2016). For AMT, Morris et al. mention the benefits for AMT when they design the platform in such a way that it supports collecting and using task labels (Morris et al., 2017).

Code of conduct. Job design is not only about how platforms and jobs are designed but is also about how workers should behave. Uber, for example, has a code of conduct which regulates the behaviour of its drivers (Finck, 2017). TaskRabbit provides its workers with a guide on Best Practices for Tasker Success, stating how Taskers should behave (McHugh, 2017). Both Uber and Lyft have a design mechanism which combats for the effect of low multihoming costs, in order to retain workers on their platform. Uber did this by introducing a new feature which allows drivers to accept the next ride before completing the current one (Choudary, 2018). On Upwork, users can report inappropriate behaviour and then Upwork notifies that person and proposes steps for a solution (Dijkstra, 2017). Werkspot made rules and when workers violated them twice they will be banded from the platform (Verbiest et al., 2019).

17. APPENDIX 9 – PERFORMANCE MANAGEMENT PER PLATFORM

Performance criteria that are used differ per platform. Uber EATS uses the following: (1) acceptance ratings, (2) cancellation ratings, and (3) customer satisfaction rating. Deliveroo uses a ‘service delivery standard assessment’ and a

performance reports mention drivers whether their performance met or fell below the required level (Choudary, 2018; Veen et al., 2019). Uber drivers are rated based on the last 500 rides and when they fall below a rate of 4.6 out of 5, they will be deactivated. Also when the ratings are high, but the cancellation rate is also high or the acceptance rate is low, drivers will be deactivated (Aloisi, 2018; Birgillito & Birgillito, 2018; De Stefano & Aloisi, 2018; Kuhn & Maleki, 2017). However, drivers who score a high proportion of five-star ratings are being rewarded by a bonus (Broughton et al., 2018). The easiest way for a driver to get five-star ratings is to drive in silence (Khreiche, 2018). Criticisms come from court, which mentioned that Uber’s rating system gives them a tremendous amount of control (McHugh, 2017). On Upwork, the employer can review the work, which happens when the task is fulfilled or when the task stops, based on the process and results of work (Dijkstra, 2017). With hourly contracts this happens through the Work Diary and with fixed-price contracts this happens through submitted milestones. Subsequently, the workers receive a score from 1 to 5 (Claussen et al., 2018; Ellmer & Reichel, 2018). AMT shows the number of completed tasks and the approval rate to hirers (Gandini, 2019). Taskers will not be terminated based on their rating, however, most employers filter out lower rated Taskers (Kuhn & Maleki, 2017). Taskers do receive feedback, 61% of the clients give feedback, and Taskers get a badge when they meet the performance criteria, however, TaskRabbit only terminated them when they breach its Terms of Service (Kuhn & Maleki, 2017; McHugh, 2017; Melián-González & Bulchand-Gidumal, 2018). Furthermore, the number of completed tasks, membership length and recent activity have a positive correlation with rank. For Fiverr, being active and having experience have a positive effect on the number of reviews and not having a profile image has a negative correlation with ratings (Hannák et al., 2017). It seems that for workers on Werkspot it is difficult to acquire new jobs when ratings fall below 4 out of 5. However, when bad ratings are given, Workshop mediates between both parties and when the rating is unfounded it will be deleted. Besides, new workers can add three reviews from previous jobs which will be checked by Werkspot (Verbiest et al., 2019). Deliveroo and Foodora have a policy which pays out bonuses only to the top 15% of riders, meaning that only those with the fastest routes and most deliveries recorded would be eligible for a bonus. As a consequence, workers ride faster regardless of external factors (Moore, 2018).

18. APPENDIX 10 – RECRUITMENT AND SELECTION PER PLATFORM

Many researchers investigate recruitment and selection on a specific platform. On Deliveroo, for example, the pool of active workers is restricted by having a selection process and waitlist for new entrants. This controls the supply of workers and provides basic safety and customer-training. On the other hand, Uber EATS has only a few restrictions and provides a direct pathway for new entrants into the sector (Veen et al., 2019). Uber drivers have to meet more requirements and have to pass a quick practical tests which includes a driving licence check, a standard vehicle with previously defined usage conditions, a proof of insurance (and in most cities, a car inspection) (Aloisi, 2018; Borghi et al., 2018; Khreiche, 2018; Robinson, 2017). Foodora requires workers to being 18 or older, have an iPhone 4s or a superior version with a tariff scheme including a data connection, willingness to work on the weekend, work permit, sense of responsibility. Clickworker workers have to submit samples or undergo a test before they can access the platform. After this recruitment method, they are rated and receive tasks that match their score (De Stefano & Aloisi, 2018). On

Upwork, the client should recruit the worker and give an explanation about the job, but before this can take place, both should register and build a profile online. And in order to make the right match, workers should update their profile frequently and give detailed information (Dijkstra, 2017; Harmon & Silberman, 2018). Another interesting finding is that on Upwork, 61% of the tasks take more than two days of onboarding while 28% of the tasks start the same day (Abhinav, Dubey, Viridi, & Kass, 2016). Furthermore, task completion is hugely influenced by the task poster's characteristics (Dubey et al., 2016). Also, clients on AMT have to recruit the Turkers by themselves. However, the platform has an option to make specific qualifications and filter out those who do not match based on for example performance or recent activity (Harmon & Silberman, 2018; Khreiche, 2018; Kuhn & Maleki, 2017). Taskers must first register and pass certain steps. Once completed, they are free to choose which task categories they are willing to perform when they are willing to perform then, and their expected hourly wage for each category (Hannák et al., 2017). However, it is still the algorithm that gives a selection of Taskers to the client (Kuhn & Maleki, 2017). On Fiverr, workers also fill out a user profile, but no background checks or preconditions are set. Once completed, they can post tasks in one of the predetermined categories (Hannák et al., 2017). Helping workers are being screened before they can join the platform. This procedure consists of an intake interview, CV, references, work experience and a test (Frenken et al., 2017).

19. APPENDIX 11 – FRAMEWORK

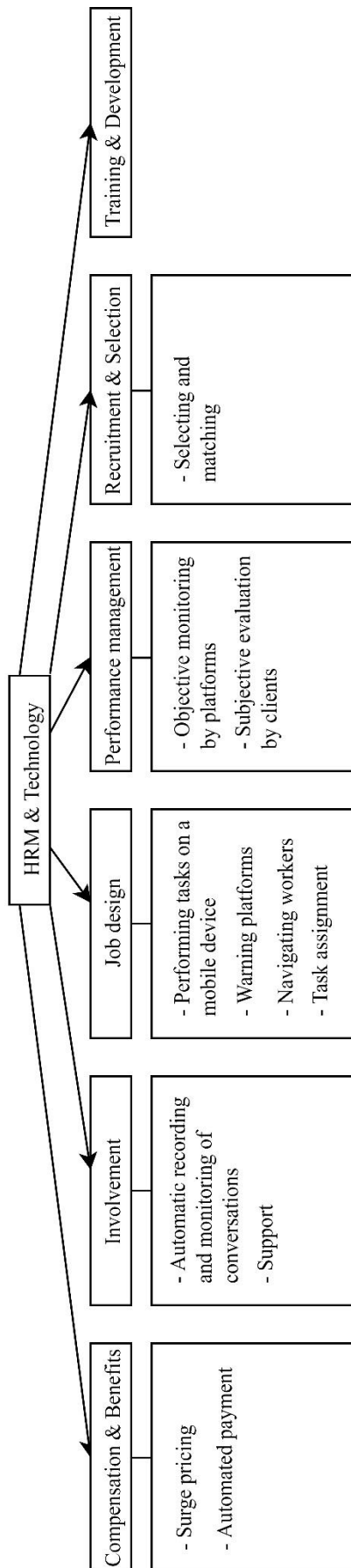


Figure 3 - Framework