

The future of work: Effects of digital platform systems on the workforce from an interdisciplinary perspective

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1. Introduction

Digitization is ubiquitous and has influenced the social fabric to a high extent. It is enabled and supported by new socio-technical systems. The output of these systems leads to new innovative ideas and more efficient socio-technical implementations. Technological progress also gives rise to new ways of communication. At the same time, digitalization leads to new challenges. Social environments change faster than before due to new technologies (Zweck 2013, 128). Previous generations have not experienced anything alike. As a result, digitization is one of the most discussed phenomena of the 21st century. One area in which the effects of digitization are particularly noticeable is the working environment (Timonen and Vuori 2018; Carstensen 2015, 188). The emergence of new technologies is not only changing traditional employment, it is creating professions (Baxter and Sommerville 2011, 4; Mrass and Peters & Leimeister, 2018, 2). An example is online work. It is a collective term for various intermediary services made possible by technologies such as smartphones, computers and tablet PC's. With these terminals, orders are offered on platforms such as Clickworker (<https://www.clickworker.de/>). Platforms are Internet-based portals, based on complex algorithms that offer a stage for interaction (Leimeister 2015). The differentiation of the field of online work – at least in Germany – is still in its very beginning, as current research shows (Diewald et al. 2017; Leimeister et al. 2015). One problematic aspect in this context is the fact that this form of work currently offers a legal vacuum, which is used by companies and clients to obtain favourable output to the disadvantage of platform employees (Däubler 2015). Relevant actors focus on technical necessities, economic necessities and employment policy opportunities (Tiemann 2016, 1). Self-determination, work-life balance, flexibility and the income of online workers are just a few examples for problems in the area of platform-based online work (Leimeister & Zogaj 2014, 212). However, due to these difficulties the creation of ergonomic, ethical, social and legal conditions is important for the people working on platforms, in order to establish online work as a meaningful alternative to institutionalized concepts of work. It is important thereby to take the platforms and their current regulations into account. Especially in today's dynamic world, dealing with questions of the future is urgent, since the present is quite different from the past and at the same time it is increasingly influenced by visions of the distant future.

An attempt is made in the following to create an interdisciplinary interpretation of the phenomenon of online work. The chosen methodology combines elements from *Industrial Engineering* and sociology. According to Schlick et al (2010), the discipline of *Industrial Engineering* offers concrete methods and theories to view the phenomenon of work from different perspectives. As an interdisciplinary scientific discipline shaped by the industrial context and engineering science, it deals with work-related activities of individuals and groups and the consequences of work (Sydow & Helfen 2015, 225). It could be particularly useful in the analysis of potential risks

that may emerge in the newly differentiated field. This is supported by *Future and Innovation Research* anchored in sociology in the terms of Zweck (2003). One of the aims of *Future and Innovation Research* is to precisely record the current situation of certain phenomena in order to be able to assess possible, likely or desirable future developments. As a relatively new science in Germany, *Future and Innovation Research* aims for a professional development of a suitable set of instruments for systematic research of the future. For this purpose, it adopts instruments of innovation research. The authors of this article base their assumptions primarily on Luhmann's systems theory (1982) and on Münch's theory of action (1985) in order to enable a targeted assessment of the phenomenon platform-based work. It describes society as a social system that includes all other social systems (Luhmann 1997, 78).

The aim of the paper is to present the possibilities at the intersection of *Industrial Engineering* and *Future and Innovation Research*. The newly differentiated field of platform-based work will be examined with respect to the problems mentioned above of its current development phase. On the one hand, this could assist politics, law and business to create suitable regulations and measures for regulating and improving the new work forms. On the other hand, a methodological approach will be further developed in order to be used during e.g. case studies.

2. Theoretical Background

In order to understand the approach used in this paper, it is necessary to explain the basics of the underlying theories. Luhmann's *system theory* and Münch's *theory of action* are the superordinate analysis tools, with which the field of *Future and Innovation Research*, *Industrial Engineering and Ergonomics* and the field of online work are examined. *Future and Innovation Research* is supposed to sketch possible developments in the field, while, *Industrial Engineering* is supposed to deliver the needed picture of the current state of the art in the field of platform-based work.

System Theory

The systems theory is a sociological theory, which describes society as a social system that includes all other social systems (Luhmann 1997, 78). Modern societies are not viewed in an individual-centred manner, but in a system-oriented manner. Social (sub)systems, such as the economy, follow their own logic and thereby develop their own momentum (Zweck 2006, 205; Luhmann 1984, 312; Münch 1994, 389). Social (sub)systems differentiate themselves from an environment and are constituted only through this (Luhmann 2011, 4-14; Kneer 2001, 417). The difference between systems and the environment is about reducing the complexity of the world (Münch 1974, 169). The operating method through which the difference between system and environment is created is communication (Kneer 2001, 413). New subsystems can differentiate from existing systems, which contain new elements as well as those formerly belonging to the old system (Kneer 2001, 412). Differentiation is a characteristic feature of dynamic and pluralistic societies (Zweck 2006, 205). The recursively referring, communicative operations form systems that, despite their interdependence, cannot communicate across their borders (Zweck 2009, 195; Kneer 2001, 409-413). Society in the Luhmannian sense is always a communication system that includes actions (Kneer 2001, 408; Bohnen 1994, 299). Actions lead to other actions, whereby a self-conditionedness of the actions as well as a self-reproduction, in the language of *system theory* an "autopoiesis", is given (Bohnen 1994, 299; Luhmann 1984, 311;

Kneer 2001, 416). Events are bound to the present and are already on the line to the past (Luhmann 1982, 369). Systems are bound to the double contingency in which mutual expectations are raised up (Kneer 2001, 418). The mutual exchange of subsystems is called "interpenetration" (Münch 1994, 288; Bohnen 1994, 300). Münch pointed out the interpenetration of systems as an important criterion and therefore the mechanisms of mutual influence (Zweck 2012, 64). As a result, the focus changes from the inherent dynamics of the subsystems to the consideration of transitions and boundaries and becomes the link between opposing systems (Münch 1994, 388; Zweck 2009, 196). Münch sees interpenetration as an opportunity for systems to achieve a higher level of self-development (Aretz & Lahusen 2005, 16).

Future and Innovation Research

As a relatively new science in Germany, *Future and Innovation Research* aims to develop a suitable set of instruments for systematic research of the future. The aim is to allow future-related statements to be made about circumstances and framework conditions that are as precisely defined as possible (Zweck 2012, 61). In contrast to other sub-areas of social science, scientists in *Future and Innovation Research* have a professional and scientific interest in the future (Schüll 2009, 223; Steinmüller 2012, 7). The scientific system has a special role to play here, because statements about the future can be made within a limited scope through the generation of specific knowledge and knowledge gain, the identification of comprehensible connections and the dissemination of (scientific) results (Grunwald 2013, 22; Zweck 2010, 52). Academic *Future and Innovation Research* uses this fact by taking up findings from various disciplines and bringing them together with a focus on findings relating to specific future issues (Zweck 2010, 53; Graf 2003, 357). This leads Zweck (2010) to the assumption that the present and current state of various fields and disciplines is decisive for the conduct of *Future and Innovation Research*. In other words: "Whoever wants to talk about the future must know about the present" (Zweck 2010, 53). Both the interdisciplinary aspect within *Future and Innovation Research* and an exact research of past and present leads Zweck to his second thesis: Future research must always create a starting point before it answers future-relevant questions, and thus bears a double burden (Zweck 2012, 72). The identification of essential issues, relevant influencing factors and the design of a present image form the starting point for future research activities (Zweck 2010, 53; 2014, 19). In the approach of this paper this present image should be established by methods of the *Industrial Engineering* discipline, as explained later. Relevant questions beyond the scientific disciplines arise primarily from economy and politics, and from society itself. Due to the fact that *Future and Innovation Research* is still at the beginning of becoming a discipline (Zweck 2012, 65), the process of differentiation from other disciplines, characterized by specific needs from the community system – the political and economic system – is not yet complete (Zweck 2012, 65). The aim of *Future and Innovation Research* is therefore to develop a set of instruments, which can be used to capture defined facts and framework conditions of future-related questions as precisely as possible (Zweck 2012, 61). In this context, Zweck suggests a classification into a theory of innovation-accompanying measures. The triad consisting of technology forecasting, foresight and technology assessment is to be mentioned here (Zweck 2012, 63, 2013). This creates a starting point for future research as the sum of toolboxes that are already institutionalised and proven in practice (ibid.). At the same time, questions are made concrete that limit the variety of possible subjects of

investigation (Zweck 2010, 51). The three toolboxes offer different focus aspects of the analysis, although they are always linked to each other (Zweck 2003, 17; 2009, 197; 2012, 73; 2014, 21).

Industrial Engineering and Ergonomics

Industrial Engineering, as an interdisciplinary scientific discipline shaped by the industrial context and engineering science, deals with work-related activities of individuals and groups and the consequences of work (Sydow & Helfen 2015, 225). Both objective and subjective work aspects are considered (Schlick et al. 2010, 1). It follows the economic principle and has the goals of an optimal design of work tasks, work systems, workplaces, safety and health protection at the workplace. The analysis focuses on the human being and a general economic exploitation. Thus *Industrial Engineering* uses empirical methods as well as theoretical constructs to achieve this aim. In addition, *Industrial Engineering* makes use of other disciplines like psychology, economy, mathematics, statistics and their methods for research on work-related activities (Schlick et al. 2010). Important sociological sub-disciplines are sociology of work, industrial sociology, sociology of technology and industrial sociology (Schlick et al. 2010, 18). "ELSI" questions (Ethical, Legal and Social Aspects) have therefore gained importance in *Industrial Engineering*. Especially the research of ELSI consequences of technical innovations of an extended technology assessment are to be mentioned here (Bohn et al. 2004). In this way, *Industrial Engineering* and *Future and Innovation Research* use similar methods to advance research in the sense of self-referentiality and interpenetration of their system.

3. New Forms of Organization in a Digital Environment

This chapter is about defining and describing the field of online work and differentiate it from institutionalized work and highlighting the opportunities and risks for society. In the process, reference is made throughout to the theories outlined above. At the end of this chapter, the need for further scientific research in this field is outlined.

Online Work

The term online work refers to new phenomena that is made possible with the help of developed technologies such as smartphones, computers and tablet PCs. As a socio-technical system, it follows organizational, technical and social logics in the interpenetration process (Zweck 2014, 23). This creates a new innovative branch of work/occupation. These include intermediary services that provide affordable orders online via internet platforms. Platforms are Internet-based portals that offer a stage for interaction (Leimeister 2015). Using complex algorithms, they create a workspace (Kalkhake 2016). Leimeister (2016) proposes a subdivision into five groups: microtask-, marketplace-, design-, testing- and innovation-platforms. The platforms differ in the nature of the orders, as well as in the work forms. Criteria of differentiation are paid/unpaid work, online/offline, minor tasks/elaborate tasks, simple/complex economic/not economic, german/other languages. Established names for subgroups would be crowdwork or clickwork (Pongratz & Borman 2017, 160; Mrass et al. 2018, 2; Däubler 2015). Previous research in the field has shown that the extent of contract placement has been low and that only a few hundred thousand people use these platforms regularly. However, it is interesting to note that private persons in particular make use of it (Kalkhake 2016, 52). These persons usually earn only small sums of up to 500 euros per month, accordingly only a small part can live from their

earnings. The easy access to the platforms and a temporary usability effort makes this new market very attractive for specific group of people, such as, students and mothers. Apart from this, the anonymous competition, highly diverse qualified individuals, leads to a "price war", which is not regulated by an authority or legislation and as a result is equivalent to an undercutting competition (Pongratz & Borman 2017). The platforms are structured in anonymity between platform operators, companies and online workers (Kalkhake 2016, 52). Due to the fact that many forms of gainful employment offer the possibility of being outsourced digitally, it can be assumed that the phenomenon will spread in the future. This also involves aspects of new career opportunities, chances and risks (Kittur & Nickerson 2015, 174).

Risks of Working Online

Various aspects of the situation in Germany have already been discussed in previous research (Mrass Peter & Leimeister 2017; Ohnemus et al. 2016; Al-Ani & Stumpp 2015). The focus is on technical necessities, economic and employment policy opportunities (Tiemann 2016, 1). Self-determination, better work-life balance, flexibility and the possibility of increasing one's income are just a few examples for this (Leimeister & Zogaj 2014, 212). However, risks of online work should also being discussed, which include the following concrete problems:

- Potential refusal of payment without justification by the companies in case of performed work;
- Loss of rights of online workers when the completed work is handed over to the platform or company;
- Price dumping, as there are no recommended prices or minimum wages;
- An information imbalance, as platforms typically provide clients with significantly more information than online workers;
- The data protection, which typically favours the companies;
- Missing organisations, e.g. committee memberships;
- Monotonous work and additional burden to other responsibilities, such as the institutionalized workplace;
- Ergonomic aspects, such as the display size of the used device and workplace design of online workers (Leimeister & Zogaj 2014, 212; Carstensen 2015, 190; Pongratz & Borman 2017; Peinl, Lothar & Bildat 2017, 13).

Laws, ordinances, changes in collective agreements and works agreements in this field are visibly missing (Tiemann 2016, 4). However, target-oriented scientific research is needed to meet the needs of the people working in the platform-based field.

The Need for Conducting Scientific Research in the Field of platform-based work

Already in 2015, the Federal Ministry of Labour and Social Affairs in Germany stated that there is a need for basic empirical research regarding living conditions, working conditions, remuneration and fairness standards in the area of platform-based services (Bundesministerium für Arbeit und Soziales, Abteilung Grundsatzfragen des Sozialstaats, der Arbeitswelt und der sozi- alen Marktwirtschaft 2015, 66). Even though research is already being undertaken in these topics, it usually focuses on the perspective of employers, such as platform operators, clients of companies or other actors. Examples of research can be found from Mrass, Peters & Leimeister (2017) and Ohnemus et al. (2016). However, little is known about the concrete organization of

work, as well as about the work load, self-determination, communication and development of online workers (Leimeister et al. 2015, 35).

In addition, the different forms of online work present new technological, organisational, ethical, legal, social and ergonomic challenges for industry and politics, which have also not yet been researched (Leimeister et al., 77; Adolph et al. 2017, 3). On top there is the difficulty that online workers as a group are hardly included in the current discourse (Pongratz & Borman 2017, 174). A goal-oriented discussion that addresses the needs and desires of online workers is difficult. Hence, there is hardly any scientific research in the area yet (Zink 2017, 98). Therefore, a concept for the investigation of the field on platform-based work is presented in the following.

4. Own Conception

Looking at the explanations made here from a theoretical point of view, it can be concluded that the area of online work is in the process of differentiating itself as an independent system. The socio-technical work in the area of virtual space created by digitization represents autopoietic and self-contained units. This new differentiating system is different from its environment insofar as it has its own logics and rules (e.g. general terms and conditions) of the corresponding subsystems (clickworker and crowdworker etc.). At the same time, it is in a reciprocal determinism with other systems such as economy, law, science and politics. According to this, it is possible to speak of interpenetration. The problem, however, is that these other systems discuss, do research and do business on the system of online work; in other words, communicate without including the system itself in the discourse (Pongratz & Borman 2017, 174). This leads to a false expectation towards the system of online work. In order to support a positive differentiation of the system, communication with the system as well as communication between the systems is important. In this context, the system of science can act as a link between online work and economy, law and politics. Science can translate its results from the field of online work into a generally understandable language and thereby support decision-makers in economics, law and politics.

It is precisely at this point that the integration of *Industrial Engineering* and *Future and Innovation Research* is proving to be effective. Existing instruments of *Industrial Engineering* will be used on the phenomena of online work in order to analyse current problems and risks in depth. In practice, the methods of *Industrial Engineering* are used to analyse the current state of online work. The analysis will be deepened by implementing the methods of *Industrial Engineering* in the toolboxes of *innovation and future research*. At the same time, assessments, for example in the form of scenarios relating to the future development of the field, will be sharpened. The approach provides a testing and application in the field in order to interact with the relevant actors. One goal is to use methods of *Industrial Engineering* and the toolboxes technology forecasting, foresight and technology assessment to investigate the need for action for law, politics and business. A second objective is of theoretical nature. An implementation and validation of the methods of *Industrial Engineering* in *Future and Innovation Research* is planned. A process of verification or falsification and modification of the theoretical constructs behind the methods accompany this. A preparation for further areas of application is planned. This approach should help *Future and Innovation Research* to strengthen itself as an independent science.

For a concrete identification of the needs of online workers in the context of platforms, a first preliminary study was carried out. The results of the study will be used to sharpen the theoretical basis. At the same time, they should point out potential risks of online work that have not yet been taken into account. It is planned to apply use tools that explore ELSI topics on various platforms, which will take into account the results of the preliminary study. In addition, other concrete methods, such as scenario development, will be selected to identify potential solutions for the risks and needs of online workers. The operators of platforms and online platform workers are to be involved in the research. This will ensure that the specific needs of these groups are taken into account in the research.

5. Outlook

In this paper, the theoretical background to an investigation into the field of online workers was outlined. This theoretical basis will be further developed as a research project and sharpened in future work. Among other things, it is planned to concretize the scientific risk analysis for specific application steps. Afterwards, this will be evaluated by *Future and Innovation Research* in the sense of technology assessment.

In addition, initial data were collected in a first pilot study with online workers of platforms. These will be analysed and evaluated in detail as the next step. The results serve as the basis for further studies in this area and will be analysed in consideration of the theoretical components listed in this paper. In addition, it is planned to exploit the results of applying the risk tool on platforms.

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