1. Introduction

Despite the forward-looking nature of debating the impact that Artificial Intelligence (AI) has on human labor, this thesis begins with a glance back into the past: In an essay from 1986, the social and occupational psychologist Marie Jahoda first addressed AI. Her analysis reflects tensions in the relationship between AI and humans that still apply today and are transferable to the world of work. Three quotations from this essay are intended to provide an opening explanation of some core ideas and the research focus of this thesis:

> ARTIFICIAL INTELLIGENCE (AI) demonstrates the habitual state of every science – uncertainty and controversy – almost to the extreme. Few things are certain in this young and rapidly growing field and controversy within and without the AI community is sharp on major issues. (Jahoda, 1986, p. 333)

AI research is no longer considered young, as the term was first mentioned in a scientific context at the famous Dartmouth Conference in 1956. Regarding the discussion of work and AI within the social sciences, uncertainty and controversy are what remain; controversy, particularly with respect to the discourse on the opportunities and risks of AI for the economy and the working world, in which many public debates hardly go beyond superficial discussions. Expectations of the potential of AI are often high, while the actual risks for society and individuals are difficult to grasp. From workers' perspective, the key questions in dealing with AI must be to what extent (we are clearly beyond *whether*) this changed relation to technology leads to a shift in power towards employers. In what contexts can AI be a driver of inequality? Will AI be utilized to support workers, set the pace, or even take over certain tasks entirely? Are AI systems even capable of fulfilling these diverse expectations?

> The crucial turning point was the realisation that computers were capable of more than 'number crunching': they were also competent manipulators of concepts and meaning. (Jahoda, 1986, p. 334)

There is no question that the research successes and applicability of AI in everyday life have seen enormous advances in recent years. The reasons for this include the availability of large amounts of data and lower costs for high computer performance. Today, digital and AI-based

systems are capable of more than simple data processing. In addition to fulfilling work routines in standardized settings, they are no longer just approaching intervention in cognitive and creative activities. They are already performing them. As a result, technical systems are potentially intervening in more areas of employees' work. The new capabilities of AI are the first reason to specifically address their influence on work situations. It is not only routine, easily formalized tasks or cognitive-creative work that is under pressure to change.

AI systems are also increasingly gaining access to the interaction components of work, be it in retail, finance, education, or healthcare – thus, in many work situations in which human skills have long retained sovereignty over work. The intervention in work action must be rethought as far as not only rule-guided, formalizable action but possibly also situation-related, experience-based action can be automated by an AI system. Will the new and rapidly changing capabilities of AI systems be reflected as a means of compressing and intensifying work if they can intervene in even more processes, or will workers establish new ways of retaining their self-determination?

> Hopefully major decisions will never rely entirely on expert systems and they will remain tools not become masters. (Jahoda, 1986, p. 333)

Jahoda is only referring to the expert systems that were common at the time, i.e., strongly rule-based concepts, and not the approaches to learning AI that are widespread today. The impression that AI systems have already become the masters of work can already be derived from studying work models in which AI systems completely take over the planning and control, such as platform work or in logistics companies. In these examples, AI systems exert a massive influence on work processes by controlling, specifying, and evaluating them. Workers are sometimes only left with the role of an executing force. The question of AI impacting work is therefore also one of negotiating autonomy at work.

Ultimately, nothing less than the role of humans in work processes – and therefore also questions about the quality of work and the scope for action granted – is up for debate when using AI in the workplace. In particular, the change in job autonomy as a work resource reflects a central means of coping with work requirements and thus influences the well-being, creativity, and productivity of workers. Job autonomy and quality of work are directly linked in this context. Jahoda (1983, p. 141) emphasizes the priority of a "work situation in which the individual has a certain amount of control over the nature and speed of his [or

her] work, in which he [or she] understands the reasons for rules and orders"[1]. Hence, it is the self-determined moments at work that make for positive experiences. They even facilitate the acceptance of difficult working conditions.

With little scope for action, work increasingly resembles dehumanized, monotonous work. In this sense, a lack of job autonomy with regard to work content and tasks can be a key driver of alienation (Jahoda, 1983, p. 129). If job autonomy is granted, by contrast, workers run the risk of being exposed to marketization as well as economization processes while no longer being able to escape them when management strategies are exploited accordingly.

Undoubtedly, a central difficulty in describing the relationship between AI and job autonomy is the extent to which work, its execution, and context, are permeated by autonomous and heteronomous moments. Jahoda (1983, pp. 69–70) emphasizes the distinction between voluntary and involuntary actions in working environments. Dependent employees in particular cannot escape heteronomous boundaries within the prevailing economic system (Jahoda, 1983, p. 116). The feeling of self-determined work can therefore only come to fruition within the relationship between autonomy and heteronomy in the workplace. It is crucial that the direct organization of an individual's work can be co-determined (Jahoda, 1983, p. 117), more so if technical and organizational interventions are undertaken in work processes.

This thesis "Algorithmic Decision-Making in Service Work. An Analysis of Changing Job Autonomy" examines the complex relationship between job autonomy and using novel AI systems. The main question is: What impact does using ADM systems, as a specification of AI systems, have on the job autonomy of employees in the service sector? In this way, this thesis also aims to clarify the conditions under which positive experiences of job autonomy can be created.

The concept of job autonomy used has a direct reference to action. This includes the understanding of job autonomy as autonomy at work, i.e., *the possibility of determining the courses of action in relation to an individual's own work processes*. This concept of job autonomy is extended by selected dimensions relating to work tasks, methods, objectives, scheduling, working time and place, and interaction.

1 Own translation of "Arbeitssituation, in der der einzelne eine gewisse Kontrolle über Art und Geschwindigkeit seiner Tätigkeit hat, in der er die Gründe für Regeln und Anordnungen versteht" (Jahoda, 1983, p. 141).

Job autonomy is anchored in the sociological research on work as it represents an essential workplace resource and, in this role, can be utilized as an adjusting screw for motivating or stress-reducing developments. The positive influence of autonomy in the workplace has been proven for several motivational factors: organizational commitment (e.g., Park & Searcy, 2012), work engagement (e.g., Spiegelaere et al., 2016), creativity (e.g., Sia & Appu, 2015), job satisfaction (e.g., Wheatley, 2017), and performance (e.g., Langfred & Moye, 2004), among others. Job autonomy also has a strengthening effect on well-being in that it can have a mitigating effect on strain (e.g., Bakker & Demerouti, 2007), work pressure (e.g., Carayon, 2006), or delimitation (e.g., Voydanoff, 2004).

In this thesis, job autonomy explicitly includes an interactional component that reflects the dependence on third parties at work. A high proportion and intensity of interaction at work is considered to be the core element of service work, although there is no consensus on the definition of both terms, service and interaction work, due to their wide variety and interpretations. Interaction work plays a particularly key role in the service sector, as working on and with people creates meaningful and motivating resources on the one hand but also demanding work situations on the other. It is true that interaction work has not always been given the appropriate attention and importance. However, Arlie Hochschild's reflections on "The Managed Heart" (1983) were the most significant to break through this view and reframe the understanding regarding the impact of interaction work in work processes (Korczynski, 2013, p. 2).

The inclusion of using AI in the workplace in the topic of job autonomy in the service sector is likewise hampered by definitional ambiguities. This is why some types of data analysis are misused for marketing purposes and falsely labeled as AI. However, as soon as regulatory measures on AI take effect, it is also possible that AI will be *argued out* of technical systems. What is more evident in the current use of language is predominantly the attempt to emphasize the supposedly (super)human capabilities of AI systems (language of anthropomorphism, Wajcman, 2017, pp. 121–122). Put similarly: "The result [of massive media exposure and commentary] has been a sometimes incomprehensible mixture of careful, evidence-based analysis, together with hype, speculation and what might be characterized as outright fear-mongering" (Ford, 2018, p. 2).

In this respect, it is necessary to depart early from the term "AI", not only because no (interdisciplinary) definition of AI has yet been established or because the concept of intelligence has proved to be debatable. This thesis deals with technical systems that are already being used in

the working world. These can be limited to *algorithmic decision-making (ADM), i.e., rule-based or learning technical systems that have an algorithm at their core as a decision-maker*. This conceptual limitation already offers a less complex approach to understanding the influence of novel technical systems on work.

The aim of this thesis is to analyze the impact of ADM systems on job autonomy. The focus lies on the service sector, which partly adapts recent technologies with a certain time lag compared to manufacturing but which seems particularly attractive for such an analysis due to its professional diversity, employment strength, and the wide range of different forms of organization and task profiles. As a prerequisite for the empirical analysis, the concept of job autonomy and related dimensions are analyzed in depth in the context of modern working environments.

The methodical approach taken to address this complex of issues is a multi-method concept consisting of quantitative and qualitative elements. Building on the attempt to quantify job autonomy using a representative survey of workers, two company case studies (outpatient care and banking services) are presented to describe the influence of currently deployed ADM systems on job autonomy. This approach asks strictly about the *subjective experience of job autonomy* in the performance of work. The perceived autonomy at work results from the specific combination of demands and resources and ultimately also the psychological predisposition of the individual (Self-Determination Theory, Ryan & Deci, 2000).

The number of studies that show a connection between job autonomy and digitalization, let alone AI, is still limited. What is visible is that the current discourse on the impact of AI on working environments and conditions is increasingly focused on the change in job autonomy (e.g., Butollo, Jürgens, & Krzywdzinski, 2018; Gensler & Abendroth, 2021; Giering & Kirchner, 2021; Kirchner et al., 2020; S.-C. Meyer et al., 2019; Nies, 2021). Pessimistic voices assume a massive expansion of control mechanisms at the workplace and, in the worst case, assign workers no role or only an assistive one in AI-dominated environments; in the better case, they are equal to AI systems and work together with their new "AI colleague" (e.g., Gröner & Heinecke, 2019). More optimistic voices further support the narrative of emerging freedoms for workers, relieving them from tedious work tasks, releasing potential for productivity and creativity, and helping workers to achieve a new sense of self-determination that translates into less work (e.g., Kirchner et al., 2020).

These excerpts from the AI discourse not only illustrate that extremely conflicting views on the impact of AI in the world of work

prevail. They also suggest that new polarizations and inequalities are emerging from these areas of tension, in which some workers are gaining in terms of new self-determination and others might (further) lose opportunities for action. This thesis aims to provide an empirically based contribution to clarifying this area of uncertainty.

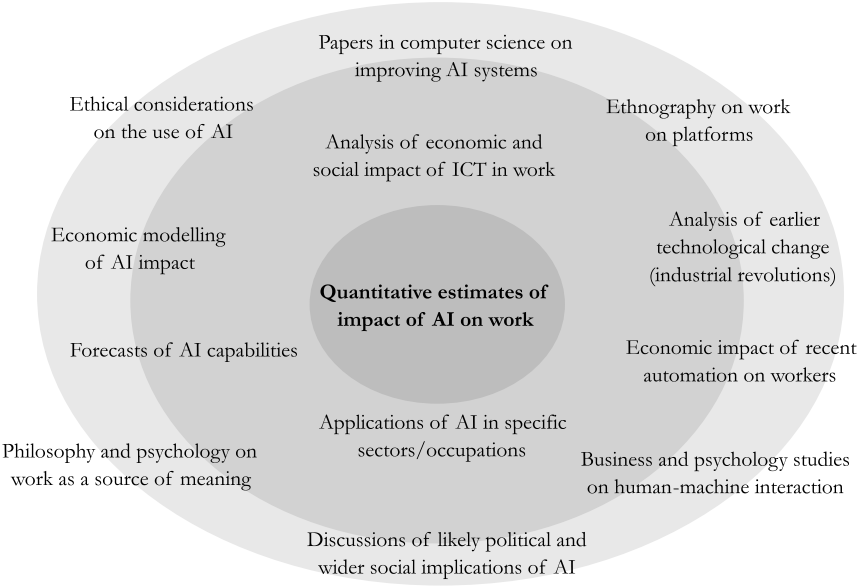
To systematically examine the relationship between job autonomy and AI, this thesis offers four parts that build on each other: Part I forms the theoretical-conceptual basis, sharpens central terms, and provides an interpretative framework for the corporate utilization of job autonomy. Part II, as a first empirical approach, quantifies job autonomy in the service sector, thus establishing comparability and attempting to isolate the first potential links to AI. Part III is the main empirical contribution within two company case studies, in which current AI systems applied in the service sector are examined for their influence on job autonomy. Part IV concludes the analysis of this thesis, deriving the core impacts of AI on job autonomy for service work and thus opening courses of action for social, economic, and political decision-makers. Chap. 1 initially forms the thematic introduction to this main section and, in particular, sets out the relevance and embedding of job autonomy in organizations and work processes. A detailed formulation of the research objectives and structure is provided in Chap. 2.

Whether and to what extent AI brings about radical changes in relation to work remains to be seen – and is analyzed in this thesis. What is clear is that the transformative nature of AI is not fundamentally "inevitable, necessary or historically unprecedented" (Boyd & Holton, 2018, p. 334). Ultimately, the influence of AI on work must also be viewed as a socio-technical project of change (Hirsch-Kreinsen, 2023, p. 330) that allows for, indeed absolutely requires, social and political influence. This thesis contributes to this formative process.

1.1. The necessity of a sociological lens on AI

While research on the effects of AI on work, although still limited in quantity, has its roots primarily in computer science, economics, and social sciences, many attempts at considering the interplay of AI and work are limited to a handful of indicators of employment and productivity development or human-machine interaction (Figure 1). In the public discourse, economic issues in particular are present in the discussion of AI (Fischer & Puschmann, 2021, p. 18). A comprehensive, empirically based assessment of the effects of using AI in the workplace is still pending (Deutscher Bundestag, 2020, p. 282). In absolute terms, quantitative es-

Figure 1: Dominating research attempts regarding AI and work



Source: Frontier Economics (2018, p. 13).

timates of AI impacting employment (e.g., Bonin et al., 2015; Felten et al., 2019; C. B. Frey & Osborne, 2017), qualification needs (e.g., André et al., 2021; Rammer, 2022; Squicciarini & Nachtigall, 2021; Susskind & Susskind, 2015), or the future economic capabilities of AI applications (e.g., Aghion et al., 2017; Agrawal et al., 2018; Brynjolfsson & McAfee, 2014; Daugherty & Wilson, 2018) have dominated so far. Attempts to transfer knowledge from earlier phases of automation waves are contributing (e.g., Acemoglu & Restrepo, 2018, 2019; Bessen, 2019; Nedelkoska & Quintini, 2018), as are ethical considerations regarding the application of AI systems in society (e.g., Ada Lovelace Institute, 2022; Liao, 2020; Munn, 2023). Comprehensive studies from the social sciences that deal with the concrete effects of using AI on workers and working environments are limited in number and depth.

Some reasons for this research gap are grounded both in the small spread of AI-based systems to date and in the time necessary for reliable studies to be conducted. However, the current scientific discourse on AI appears to be reminiscent of technological determinism in research. The economic and technical perspectives dominate. A sociological voice re-

ceives little public attention – even though it obviously exists. To fill this research gap with even more life from the perspective of the sociology of work is a designated goal of this thesis.

From a historical point of view, waves of technological innovation are often characterized by both visionary and skeptical expectations of its effects on society, business, or specific social formations. In the case of AI, the existing conceptual indeterminacy and ambiguity add difficulties to the precise analysis of AI. The absence of a consensual definition of AI is also due to the fact that "There is basically no consensus on the place, function, and operating mode of natural intelligence"[2] (Rammert, 1995, p. 9). Some popular AI definitions will be taken up in later chapters. At their core, these will cover ADM systems, i.e., rule-based or learning technical systems that have an algorithm at their core as a decision-maker.

However, whether technology qualifies as intelligent is not the subject of discussion in this thesis.[3] Suffice it to say that "Computers are intelligent precisely when we think they are. [...] On the basis of which processes and in which social contexts is intelligence attributed to them?"[4] (Heintz, 1995, p. 49). Heintz (1995, p. 51) shifts the focus of debating AI from the questions of what machine intelligence is and whether it is comparable to human intelligence to the social embedding of AI applications. R. D. Schwartz (1989, p. 187) adds that sociology can provide new perspectives on AI and assumes that AI applications act in social situations and thus intervene in them.

Since the beginning of research on the concept of AI, the social sciences and humanities, predominantly philosophy and psychology (Heintz, 1995, p. 48), have only been marginally involved in its further development and discussion. If there was any mention of a sociological approach to AI at all, it was in the form of asking how AI relates to society (e.g., acceptance of and expectations towards AI), but not its genesis (Heintz, 1995, p. 48; Woolgar, 1985, p. 558). The status quo seems to have changed only slightly, as Rezaev et al. (2018, p. 368) pointedly state: "What is most striking about sociological literature on AI is how small it is".

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2 Own translation of "Über den Ort, die Funktion und die Operationsweise der 'natürlichen Intelligenz' besteht im Grunde keine Einigkeit" (Rammert, 1995, p. 9).

3 Joseph Weizenbaum (1976) already assumed that the type of intelligence that can be transferred to a computer is limited and that a comparison with human intelligence is inappropriate. This takes up the still valid theory that AI systems are only functional and adaptive to a limited extent in closed, predefined situations and domains.

4 Own translation of "Computer sind genau dann intelligent, wenn wir der Meinung sind, sie seien es. [...] Aufgrund welcher Prozesse und in welchen sozialen Kontexten wird ihnen Intelligenz zugeschrieben?" (Heintz, 1995, p. 49).

Overall, sociology's engagement with AI is extremely patchy (Mlynář et al., 2018, pp. 130–134). Some contributions also deal with AI as a methodological tool or as an aid for theory development in sociology; exemplary is the contribution of Malsch et al. (1996) to Socionics, who moved into the border area between computer science and sociology, discussing the potentials of collaboration between the two disciplines. However, from a long-term perspective, sociology has played only a minor role in research on AI.

The new dimension of AI abilities, i.e., learning from vast amounts of data and autonomous decision-making, defines the most substantial difference from previous transformations of work environments. For the time being, the question remains open as to what *bounty* (Brynjolfsson & McAfee, 2014, p. 11), i.e., what social and economic benefits, will result from this change (and for whom). Certainly, there is a risk of further polarization of *lousy and lovely* jobs (Goos & Manning, 2007), which also threatens to intensify social inequality.

Hence, the sociology of work naturally has a great interest in the question of the embedding and impact of AI applications in work environments. In fact, the sociology of work *needs* to address the AI issue because it implies a question of both economic distribution and inequality that must be determined in a process of social negotiation. Regarding the possibilities, consequences, and conditions of AI and work, the focus of a sociological discussion of work should not only lie on the consequences of using AI for workers but also on the organizational conditions under which these possible effects might come to fruition.

Thus, questions about the change in work processes are just as central as the embedding of AI in organizational constellations and dealing with uncertainties. It is important to analyze how the use of AI manifests and expresses itself on a task, organizational, and social level. From the perspective of workers, these questions become concrete in the description of changes in the tasks and processes they perform, the work environments and situations in which they operate, the organizational and company structures they are given, and their positioning and status in society.

Job autonomy – as the object of interest in this thesis – can be considered on a wide variety of these levels. The change in job autonomy describes the change in the position of employees in the organizational and technological structure of work environments. It can characterize the relationship and division of tasks between workers and machines, be used as a motivational but also a control instrument by companies, and thus serve as an important indicator for the change in working relationships among entire groups of employees.

Using AI in the workplace is likewise a question of job quality. It is essentially a sociological one, since at the macro level it asks about changes in the conditions of work. Ultimately, altering the relationship between people and technology in the workplace also implies a change in the relationship between work and capital and thus in working conditions, which not only affects people's social position but also their private sphere of life, well-being, health, and contentment.

The intervention of AI in work can thus be understood as a question of social equality and distribution. After all, AI-based systems are embedded in prevailing social, economic, political, and cultural structures (Crawford, 2021, p. 211). For this thesis, the main question is how using AI systems might affect the job autonomy of service workers, which implies questioning the role of employees in the work process. As will be shown later, the use of AI is reflected very differently in work processes depending on the depth of the intervention.

With a view to the macroeconomic perspective and the deepening of social inequality structures, it is striking that a number of renowned economists have been warning of increasing inequality through the use of AI for some time. Acemoglu (2021), for example, describes that the unregulated use of these systems in particular harbors a number of social, economic, and political dangers, which are expressed essentially through increasing income inequality, or rather, the potential lowering of wages. Acemoglu (2021, p. 4) emphasizes the potentially altered power structures and downward tendencies of unregulated AI: "Put differently, AI's harms are harms of unregulated AI". Agrawal et al. (2018, pp. 223–224) go on to state that AI use at the societal level is always expressed as a trade-off problem: intensification of competition between employees and (skill-biased) polarizations in the labor market (productivity vs. distribution) or monopolization tendencies in data and technology (innovation vs. competition). The danger of increasing income inequality (e.g., also Felten et al., 2019) plays a central role in these considerations.

M. Lane and Saint-Martin (2021, p. 27) note that even if AI were to increase productivity, which is not visible at present, it is not synonymous with a fair distribution of these gains. Classic productivity effects on labor demand and wages can be overshadowed by displacement effects and vice versa (e.g., Acemoglu & Restrepo, 2018, pp. 6–8). In general, economists disagree on the direction of the impact of AI on employment and wages due to several overlapping effects (overview in Menzel & Winkler, 2018). M. Lane and Saint-Martin (2021, p. 32) aptly summarize that "the impacts on inequality should not be underestimated as there is no reason to believe that the displacement effects, productivity effects and emergence of new labor-intensive jobs will be distributed

evenly across industries, regions, and socio-demographic groups". What is agreed, however, is that a broad welfare gain is hardly possible without redistribution (Korinek & Stiglitz, 2017, pp. 38–39).

The scientific and political debate on the potential of AI emphasizes its primarily economic direction of thought (e.g., Büchel et al., 2021). These possibilities translate into growth and productivity opportunities. To what extent working conditions could potentially change in this process remains (as so often) largely unnoticed. Not surprisingly, many workers' councils consider using AI in a professional context to be untrustworthy (Deutscher Gewerkschaftsbund [DGB] & Hans-Böckler-Stiftung [HBS], 2022, p. 44). This assessment may be influenced by the fact that there is sometimes little knowledge about the functioning of AI systems. However, the doubt about the benefits of these systems for employees is justified as long as the goals of AI use (or the use of other assistance systems) are not always clearly communicated, which in any case only raises questions of co-determination for employees in whose companies it is permitted. In the service sector, in particular, many employees have little or no influence on the way digital technology is used in the workplace (Institut DGB-Index Gute Arbeit [DGB-Index], 2022b, p. 34). In this respect, too, the use of recent technologies is likely to affect job autonomy.

1.2. Avoiding confusion: workers' autonomy and machine automation

The term "autonomy" derives from the ancient Greek autós (self) and nómos (law) and translates to self-legislation, or alternatively, self-determination. Applied to the world of work, this thesis understands job autonomy as *autonomy at work, i.e., the possibility of determining the courses of action in relation to an individual's own work processes*. The heteronomous moments lie in the embedding of work in the network of market supply and demand, organizational structures in the company, cooperation and relationships with other workers, the interplay between the private and the professional working world, and much more. Looking back at the historical changes in the organization of work, it is important to note that work today is more autonomous – for example, in terms of flexible work content, time, and place. According to M. Frey (2009, p. 26), autonomy forms the counter-concept to heteronomy, i.e., variations of organization that are characterized by a high degree of planned work and a low degree of subjective influence on the part of the worker. In this context, job autonomy is considered a prerequisite for bringing subjectivity into work.

The idea of establishing a higher degree of job autonomy is fundamentally a counter-draft to Tayloristically influenced ways of working during the *humanization of the world of work* approach in the 1970s and 1980s (Bundeszentrale für politische Bildung [bpb], 2011; Georg & Guhlemann, 2020). Ever since, job autonomy has gained importance in the context of self-determination and self-organization in modern work. Job autonomy, as defined in this thesis, is never viewed as a standalone characteristic of work but as a construct that reflects the relationship and dependencies between workers and their environment.

The situation of ideal job autonomy is difficult to imagine – it is probably non-existent. The term "dependent employment" already implies a form of heteronomy. Even self-employed persons are not free from external constraints but are dependent on the cooperation with third parties, such as clients. In this sense, Sichler (2005, p. 106) concludes that autonomy does not describe the possibility of being able to act freely without any external or internal restrictions.

As these reflections indicate, the overall scientific debate on job autonomy is extremely diverse. There is no single mutually agreed-upon definition. Peters (2001, p. 20) highlights that the concept of autonomy has different meanings and that when autonomy is mentioned in work, often very different ideas about the term apply. Common research approaches mostly originate from the fields of sociology, economics, psychology, and philosophy. Depending on the field, job autonomy can have different dimensions and meanings. Therefore, the terms used to describe aspects of job autonomy vary depending on perspective and discipline. Following Warr (1994, p. 87), these may include: discretion, decision latitude, independence, job control, self-determination, personal control, absence of close supervision, or participation in decision-making. Although these terms are not to be understood as synonyms, they are all considered to conceptualize aspects of job autonomy to obtain a holistic picture of its dimensions and characteristics (Chap. 4).

In the German-speaking world, variations of the terms *scope of task* (Tätigkeitsspielraum), *scope of action* (Handlungsspielraum), *scope of design* (Gestaltungsspielraum), and *scope of decision-making* (Entscheidungsspielraum), originating from the field of occupational psychology, are often used interchangeably to describe job autonomy. According to Ulich (1988, as cited in Ulich, 2001, p. 175), all scopes fall under the umbrella term scope of task (also Chap. 4.1). In the following[5], the term

5 Since the term *scope for action* is more common in English-speaking literature as an alternative description for job autonomy, it is applied in the following to comply with a certain linguistic variation.

"job autonomy" is used whenever appropriate to describe autonomy at work, i.e., the possibility of determining the courses of action in relation to an individual's own work processes.

While the synonymous use of various terms intended to address job autonomy in sociology, psychology, or economics essentially addresses comparable concepts, this does not apply to computer science and other technology-related domains. In particular, the synonymous use of the term in relation to the scope of action for humans and the functions of machines in socio-technical systems proves problematic for the analysis envisaged in this thesis. More precisely, it is the use of the term autonomy to describe the degree of automation of machines that must be distinguished, because autonomy as a term for self-legislation as described above is by definition to be attributed only to humans.

A description of autonomy from political science adequately presents the special features of human decision-making and allows a transfer to the discussion conducted. According to Müller-Mall (2020, p. 30), human autonomy essentially consists of the possibility to think and act in a self-determined way:

> This includes the possibility of always deciding anew and differently, to act irrationally or not at all. And it includes being able to orient oneself in one's decisions and actions to personal standards. At the same time, autonomy understood in this way also provides the condition for being able to take responsibility for one's own actions.[6]

These considerations highlight the essential difference between humans and machines in terms of autonomy and decision-making at the workplace. Autonomous decision-making can follow an irrational, non-rule-bound principle for workers, while a machine is necessarily bound by its somewhat rule-bound nature. Novel systems of AI are somewhat liberated from this rule-boundness.

The use of the term "autonomy", however, is not applied to machine capabilities in the following. According to Rammert (2003, p. 6), humans and machines stand in a dichotomous relationship with each other. If autonomy implies self-determination, the concept of autonomy can only

6 Own translation of "Dies schließt die Möglichkeit ein, sich immer wieder neu und anders zu entscheiden, irrational oder auch überhaupt nicht zu handeln. Und es schließt ein, sich in seinen Entscheidungen und Handlungen an eigenen Maßstäben orientieren zu können. Gleichzeitig liefert eine so verstandene Autonomie auch die Bedingung dafür, für sein eigenes Tun Verantwortung übernehmen zu können" (Müller-Mall, 2020, p. 30).

be applied to humans and rarely to machines. The use of the term "autonomous machines" is sufficiently misleading. Autonomous machines signify machines that have achieved a certain degree of automation and give the impression of independent action.

The strengths of AI systems in the work context have so far been within relatively static environments and clearly determined situations in which probability-based decisions can be made or decision recommendations provided. In contrast, the strengths of workers' action come to the fore, especially in their ability to act autonomously in dynamic situations, which, for example, require a certain capacity for abstraction, flexibility, and intuition. Brödner (2019, p. 89) emphasizes that humans are assumed to have a certain intentionality in their actions with regard to the fulfillment of a certain objective, whereas machines act in a strictly pre-determined manner. Brödner (2019, pp. 90–92) further summarizes the limitations of these machines and systems by pointing out that so-called autonomous systems do not determine their tasks and actions themselves and therefore cannot be described as autonomous. This statement, however, should not be confused with the fact that automated systems are not being granted increasingly greater degrees of freedom (Papsdorf, 2019, p. 51). These new degrees of freedom define the extent to which machines can intervene in human work systems and processes (Chap. 3).

1.3. Framing job autonomy in the organization of work

Back in the 1970s, during the transformational movements of labor, Cummings and Molloy (1977, p. 6) described job autonomy as "the most frequently changed of all organizational variables". However, "Conceptualizations of autonomy reflect the historical and economic environment of organizations. For instance, in the 1970s most developed economies were predominantly based on manufacturing with employees working on traditional assembly lines" (Gagné & Bhave, 2011, p. 164). In fact, the analysis of job autonomy has been particularly popular since the 1970s in the context of research on job redesign[7] which identifies job autonomy as a key driver for motivating employees and enabling

7 Early approaches to reorganize cooperation and division of labor include, for example, the quantitative increase of work diversity (e.g., job rotation, job enlargement) or the qualitative expansion of work content (e.g., job enrichment, semi-autonomous work in groups).

performance gains within organizations. Job redesign refers to the attempt to restructure workplaces, which, due to their orientation towards Tayloristic work systems, led to alienation from work (e.g., Sims et al., 1976) and a decrease in the motivation and performance of employees (e.g., Hackman & Oldham, 1975). The three model approaches outlined in the following are intended to exemplify the organizational embedding of job autonomy from this research perspective:

- The Job Diagnostic Survey (JDS), more commonly known as the "Job Characteristics Model" by Hackman and Oldham (1975), emphasizes the importance of autonomy for employee performance, satisfaction at work, and job involvement. Without the presence of job autonomy, no work motivation can arise. Hackman and Oldham (1975, p. 162) characterize job autonomy as "The degree to which the job provides substantial freedom, independence, and discretion to the individual in scheduling the work and in determining the procedures to be used in carrying it out". The authors name five dimensions of job characteristics that enable so-called critical psychological states of employees (e.g., perceived meaningfulness of work) – one of which is autonomy. Accordingly, autonomy is positively related to the experienced responsibility for outcomes of the work, i.e., "The degree to which the employee feels personally accountable and responsible for the results of the work he or she does" (Hackman & Oldham, 1975, p. 162).
- With the Job Characteristic Inventory (JCI), Sims et al. (1976) intend to evaluate how selected characteristics of a job, such as autonomy, influence productivity, motivation, and overall job satisfaction. Their definition of autonomy is derived from Hackman and Lawler (1971, p. 265) and describes "The extent to which employees have a major say in scheduling their work, selecting the equipment they will use, and deciding on procedures to be followed" (Sims et al., 1976, p. 197). In this model, the time- and method-related elements of job autonomy are emphasized. Additionally, the choice of work equipment is included.
- The conceptualization of job autonomy by Breaugh (1985) differs from JDS and JCI in that it makes a distinction between three concrete autonomy dimensions: Breaugh's attempt to measure job autonomy approaches work method autonomy, work scheduling autonomy, and work criteria autonomy. Work method autonomy refers to the scope of personal discretion while choosing work methods. Work scheduling autonomy is defined as the ability to independently sequence tasks. Work criteria autonomy describes the opportunity

to individually choose work performance criteria (Breaugh, 1985, p. 556). The distinctive feature of Breaugh's approach is that he not only defines three applicable autonomy dimensions but also specifically operationalizes them (also Chap. 7.1).

Reviewing the selected definitions of job autonomy originating in job redesign research from the 1970s and 1980s, it becomes apparent that a limited understanding of job autonomy was predominant. Its justification in typical Tayloristic work systems becomes as clear as its essential limitation to Breaugh's (1985) three dimensions of job autonomy. Nevertheless, the above-mentioned dimensions have not lost their significance today. Rather, they must be supplemented by other elements that reflect today's working world.

The 1970s also saw the emergence of research into the tensions between work demands and work resources, that is, the demands that workers must meet and the resources that they have at their disposal to cope with these demands. The following two model approaches show their mutual relationship and thus allow conclusions to be drawn about the embedding of job autonomy in the interplay of demands and resources:

- The Job Demand-Control Model (JDC), also known as the "Job Strain Model" following Karasek (1979), aims to analyze stress factors for employees in order to derive health-promoting measures. Karasek (1979, pp. 287–290) compares job demands with given job decision latitude (i.e., job autonomy) and defines the latter as "the constraint which modulates the release or transformation of 'stress' (potential energy) into the energy of action. [...] Job decision latitude is defined as the working individual's potential control over his tasks and his conduct during the working day". High work demands lead to high stress for employees when the existing job decision latitude is low. If both high demands and high job decision latitude are present, a motivational push occurs (Karasek, 1979, pp. 287–289).
  Karasek's assumptions implied that high work demands do not necessarily have to be accompanied by high strain, but that the outcomes depend on the extent of job autonomy.
- The JDC is extended by Demerouti et al. (2001) with the Job Demands-Resources Model (JD-R), which relates job demands to job resources, taking into account individual, social, and organizational variables that may have positive or negative effects on employees. Job strains result from an imbalance between demands and resources. According to Demerouti et al. (2001, p. 501), job demands "refer to those physical, social or organizational aspects of the job that require

sustained physical or mental effort and are therefore associated with certain physiological and psychological costs". In contrast, job resources, which include job autonomy, are considered "physical, psychological, social, or organizational aspects of the job that may do any of the following: (a) be functional in achieving work goals; (b) reduce job demands at the associated physiological and psychological costs; (c) stimulate personal growth and development". According to Bakker and Demerouti (2007, pp. 312–314), job resources may act as a counterbalance to job demands.

These conceptual embeddings of job autonomy in work organizations assign distinct roles, functions, and dimensions to job autonomy. They all set their own definitions of job autonomy and, in some cases, even named specific dimensions of the concept. Thereby, they form the starting point for the conceptual reformulation of autonomy that meets the demands of work today (Chap. 4).

1.4. Relevance and extent of job autonomy

The effects of changes in job autonomy can be manifold for both workers and companies. Selected frameworks that cover research on the organization of work identify job autonomy as a key enabling factor for positive personal (such as motivation or strain reduction, e.g., Demerouti et al., 2001) or organizational outcomes (such as productivity, e.g., Hackman & Oldham, 1975; Sims et al., 1976). Its ascribed resource quality assigns job autonomy a possible role in reducing work tensions, i.e., an imbalance between work demands and resources.

To illustrate the relevance of job autonomy, it is particularly useful to consider job autonomy as a job resource. Following the logic of the JD-R model, high job resources may have positive effects on personal and organizational outcomes as well as a mitigating effect on strain and its negative consequences. According to a comprehensive literature study by Spector (1986, p. 1011), positive relations between job autonomy are found for job satisfaction, commitment, job involvement, performance, and motivation. In contrast, mitigating effects are found for physical symptoms, emotional distress, turnover rate, and absenteeism. Likewise, interdependencies between job autonomy and other job resources such as self-efficacy, learning opportunities, and role breath have been empirically proven (e.g., Den Hartog & Belschak, 2012, pp. 197–199; Morgeson et al., 2005, p. 402; Sousa et al., 2012, pp. 165–167; Wielenga-Meijer et al., 2012, pp. 16–17).

The following paragraphs summarize selected studies that elaborate on the importance of job autonomy in relation to stress, motivation, and personal and organizational outcomes:

Relation to job strain

- According to Karasek (1979) and Demerouti et al. (2001), job resources mitigate the negative effects of job demands. This assumption may also apply to the relationship between job autonomy and job strain. The combination of low job autonomy and high job demands leads to mental strain. Carayon and Zijlstra (1999, pp. 40–43) further differentiate between workers' control over work tasks and resources, which, if present, also have a mitigating effect on work pressure. Furthermore, based on a low to medium level of autonomy among workers, it is assumed that in the case of an autonomy expansion, the risk of burnout decreases (Gerich, 2019, p. 95).
- With respect to a specific driver of stress for workers, the increasing blurring of the boundaries between private and professional life, i.e., delimitation, it is assumed that job autonomy helps to avoid conflicts between work and private life (e.g., Gerich, 2019, p. 88; Voydanoff, 2004, p. 283). Whether this positive effect of job autonomy on the reconciliation of work and private life comes to fruition depends on the extent of job autonomy. In contrast, higher autonomy may also have the opposite effect of neglecting private needs, for example, by working more or at untypical times to achieve work goals.

Relation to job motivation

- Job resources are generally associated with positive effects on work motivation. This motivation can manifest itself in a variety of ways – for example, through higher commitment to the organization, engagement, or job involvement. It is these aspects that usually have a positive effect on organizational outcomes. Bakker et al. (2003, p. 352) find that job resources are "unique predictors of organizational commitment". Spiegelaere et al. (2016, pp. 522–524) specify that method-related autonomy has a significant influence on work engagement.
- Creativity is counted as a phenomenon of high motivation since it is assumed that job resources can create free capacity for creative work. Sia and Appu (2015, pp. 779–780) refer to the three autonomy dimensions according to Breaugh (1985) and find that all dimensions enable positive effects on creativity at the workplace. Chang et al.

(2012, p. 719), however, note that task autonomy can limit the creative performance of employees if no specific, task-related knowledge was previously available on the part of the employees.

Relation to personal and organizational outcomes

- Ryff (1989, p. 1071) refers to autonomy as one of six central criteria for the psychological *well-being* of people. High autonomy is understood as the independence and self-determination of a person who can act in a certain way to regulate social pressure situations. Especially within the JD-R model (Bakker & Demerouti, 2007; Demerouti et al., 2001), well-being is treated as a central target dimension that can be positively influenced by job resources. The dichotomy between positive or negative effects of job autonomy and *health*, which is assumed to be closely linked to well-being, is described by the autonomy paradox (see below). Exemplary, Gerich (2019, p. 88) describes how flexible working hours do not contribute to a better reconciliation of family and work but can take on self-exploitative tendencies that may lead to a deterioration in health.
- Regarding *job satisfaction*, numerous studies refer to the positive influence of job autonomy. For example, Wheatley (2017, pp. 18–19) confirms that control over one's own tasks and the pace of work increase job satisfaction. Lopes et al. (2014, pp. 317–320) add that job satisfaction is reduced by increased workloads if they are not accompanied by higher autonomy. Additionally, Nguyen et al. (2003, pp. 8–10) approve a significant positive influence of autonomy on five dimensions of job satisfaction (pay, other benefits, prospects for promotion, job security, and the importance or challenge of work for employees).
- Research on job redesign (Hackman & Oldham, 1975; Sims et al., 1976) is followed by empirical evidence that job autonomy can have a positive impact on employee *performance*. These findings are especially related to the redesign of workplaces. Other contributions (e.g., Claessens et al., 2004, pp. 944–946; Fuller et al., 2010, p. 45; Saragih, 2011, p. 211) also refer to the positive influence on performance. Langfred and Moye (2004, pp. 939–940) complement the approach of improving performance through task autonomy by exploiting motivational, informational, and structural mechanisms, such as the utilization of information asymmetries or the linking of work tasks and organizational structures.

These exemplary descriptions regarding the relevance of job autonomy initially led to the assumption that a high degree of autonomy *always* has a positive effect on the various possibilities for exerting influence as a job resource. Contrary to this perspective, there are also states of job autonomy that can lead to higher levels of strain. This idea implies that high degrees of freedom can have a negative impact on working conditions after reaching a certain saturation point. However, there are far fewer studies dealing with the negative effects of job autonomy on workers and their constitution than there is evidence that documents the positive effects.

The question of the extent of job autonomy is nonetheless addressed in the following because it provides a first indication of the different organizational roles that job autonomy may take. The focus lies explicitly on the organizational role that job autonomy fulfills while also acknowledging that, from a psychological perspective, individuals have different needs for autonomy.[8]

The concept of autonomy has long been treated in a normative way in relation to the negative consequences of restrictive working conditions in Taylorist work systems (M. Frey, 2009, p. 24). Even today, high autonomy is understood as fundamentally beneficial for workers, while low autonomy is associated with adverse effects. Although there is some verifiable truth in this view, a more nuanced perspective on the extent of job autonomy and possible consequences for employees is advisable.

First and foremost, the so-called Vitamin Model[9] according to Warr (1994), draws an analogy to the vitamin intake of humans: "The intake

8 Self-determination Theory following Ryan and Deci (2000) declares job autonomy one of three central psychological needs (along with the need for competence and relatedness) that must be met to ensure not only motivation and well-being but also, for example, employee performance (van den Broeck et al., 2016, p. 16). Accordingly, people have individual needs for autonomy (Kubicek et al., 2017, p. 53), which co-determines the individual's perceived job autonomy. In particular, degrees of freedom in terms of working time and location have a positive effect on employees with a high need for autonomy (van Yperen et al., 2014, pp. 2–3). In contrast, workers with a low need for job autonomy may perceive higher demands on their work tasks, conflicting relationships between their private and professional lives, or monitoring tendencies (Gagné et al., 2022, p. 386).

9 The Vitamin Model is of particular importance with regard to selected personal work outcomes such as job satisfaction and health. Gerich (2019, p. 87) states that job autonomy is usually considered a health-promoting work characteristic in occupational health research. Baltes et al. (2002, p. 11) confirm this relationship with regard to job satisfaction: starting from a low to medium level of job autonomy, job satisfaction increases, while it decreases above a certain level.

of vitamins is important for physical health up to, but not beyond, a certain level" (Warr, 1994, p. 88). In the transfer to job autonomy, he thus states the thesis that too much job autonomy is harmful for employees. Warr (1994, p. 89) justifies this thesis by explaining, "that at those levels an 'opportunity' becomes an 'unavoidable requirement', coercing rather than permitting action". Accordingly, excessive job autonomy is no longer expressed in new self-determination and more degrees of freedom but brings constraints such as the frequent assumption of personal responsibility or the accumulation of overtime. Kubicek et al. (2017, p. 50) summarize that a high degree of job autonomy is no longer perceived as a *nicety* but as a *necessity* by workers. Accordingly, it is reasonable to assume that high levels of job autonomy also go hand in hand with high levels of other job characteristics that have a negative impact on employees (e.g., time pressure) or low levels of desirable job characteristics (e.g., social support).

The reference to the so-called *autonomy paradox* (Mazmanian et al., 2013), which establishes a connection between high autonomy and the delimitation of private and professional life, has an explanatory effect: The more job autonomy workers are given, the more time they invest in their work to process more content. Correspondingly, companies also intervene in the private lives of their employees. The autonomy paradox is particularly visible regarding the dimensions of job autonomy in terms of working time and place. In this context, Lott (2017, p. 19) notes that self-determination with regard to working time can lose its positive effects, so it is important to ensure that high time-related autonomy is not exploited to compensate for high work pressure or large workloads. Similarly, Hünefeld et al. (2019, p. 80) report a relationship between high time-related autonomy and the use of over time. In this context, Peters (2011) speaks of *interested self-endangerment* (interessierte Selbstgefährdung), e.g., employees willingly accepting to work longer hours in order to meet their work targets, whether due to a lack of time or personnel. Employers thus draw on employees' sense of responsibility for their own work.

The conditions under which job autonomy has positive or negative effects on personal outcomes have not yet been clearly established. Many studies show the positive benefits of job autonomy as a work resource. Few point out that, under certain circumstances, high autonomy has the opposite effect. This tendency refers in particular to high levels of autonomy in terms of working time and method. This distinction indicates that for most workers, the granting of medium degrees of autonomy is associated with positive effects on motivation, strain, and other aspects. However, there is a group of workers who have such high levels of au-

tonomy that the potentially positive effects are reversed in the form of self-exploitative tendencies. This insight is discussed in more detail in later chapters, as it contributes considerably to the understanding of how using AI is changing job autonomy in the service sector.

In any case, there is no doubt that not only do different dimensions of job autonomy emerge for workers, but that their extent can have ambivalent consequences depending on the organizational circumstances. The following excursus, therefore, provides an insight into some concrete aspects of work that are closely related to job autonomy. In doing so, the definitional narrowing of the object of investigation in this thesis – the service sector – is likewise pursued.

1.5. Excursus: How are you, service workers?

This brief excursus aims to outline the basic understanding of service work, labor market-related key figures, specific work-related burdens and needs, as well as first tendencies on the current state of job autonomy. In many ways, the analysis of the relationship between job autonomy and AI builds on these preliminary considerations. After all, not all services are the same; the content, requirements, and working conditions are so different that common features need to be identified, such as the high intensity of interaction work that all services have in common or the following distinction between particularly autonomous and less autonomous service branches.

A brief definition of service work

The simplest approach to a definition of service work is to note that it is not production work in the primary (extraction of raw materials) or secondary (manufacturing of goods) sector (Pongratz, 2012, p. 17). The social science perspective usually reveals their difference based on three distinctive features, which serve as a definitional basis (Haller & Wissing, 2020, pp. 9–15):

- A service is intangible at its core and hardly measurable or objectively comparable.
- A service follows the uno-actu principle, i.e., production and consumption of the service are hardly separated. The service is consumed during the production process.
- A service involves the service recipients and includes them in the work process. The service is dependent on the service recipient.

While this ideal-typical definition clearly points to an essential feature of service work, which is a high degree of interaction work, it is certainly not applicable to all tasks that are fulfilled in the tertiary sector. The uno-actu principle, for example, is not viable for every service. The processes of service production and consumption are separate in the case of security services or cleaning activities, for instance. The degree of involvement of service recipients varies greatly, from passive participants to active cooperation partners (Pongratz, 2012, p. 19). The service character of a task is particularly high when the logic of production and consumption is closely intertwined (Pongratz, 2012, p. 18). Interaction work thus takes on the clearest form of a service. A distinctive feature of service work regarding job autonomy is the dependence on the service recipient.

Initially, interaction work is not limited to the service sector. However, the proportion of interaction work is generally higher in both quantitative and qualitative terms than in the primary or secondary sector, i.e., interaction work is performed more frequently and more intensively due to the close ties to service recipients. It is precisely the dependence on service recipients that makes interaction work so complex and demanding (Böhle & Weihrich, 2020, p. 9).

On average, service workers spend almost three-quarters of their working time on interaction work (manufacturing sector: 43 %, Holler & Dörflinger, 2021, p. 2). The difficulty for service workers arises from not working with inanimate objects but with living beings. Thus, the service process is often characterized by a continuous interplay of action and reaction. The two parties must clarify what the service consists of, ensure that the contractual partners also provide their service, and master possible conflicts (Böhle & Weihrich, 2020, p. 11). Interaction work is therefore hardly plannable, let alone entirely reducible to certain recurring patterns.

Although there is no uniform definition of interaction work (Holler & Dörflinger, 2021, pp. 1–2), the concept of Böhle and Weihrich (2020, pp. 15–19) has become established, which foresees four tasks for service workers: establishing a cooperative relationship with the service recipient (cooperation work), influencing and working with the feelings of the service recipient (sentimental work), coping with one's own feelings (emotional work [10]), coping with imponderabilities and non-plannable actions

10 The concept of emotional labor goes back to the American sociologist Arlie Hochschild (1983, p. 7), who ascribes the necessity of "the management of feeling to create a publicly observable facial and bodily display [...] for a wage" for service professions.

(subjectifying action). The concept of interaction work emphasizes the natural subjectivity of both the service recipient and the service worker and presents it as a criterion for the success of the service. Subjectivity is not declared a disruptive factor in the work process but is regarded as a prerequisite (Böhle & Weihrich, 2020, p. 15).

Within the service sector, there is a high degree of homogeneity regarding the frequency of interaction work. In most branches, two-thirds of employees state that they frequently or often work with customers or clients, for example, in finance and insurance (63 %). Only healthcare falls outside these statistics, with just under 90 % working with patients or those in need of care (DGB-Index, 2018b, p. 6). The incidence of interaction work possibly relates to poorer job quality. This applies in particular to the factors of working hours, emotional demands, and work intensity.

Exemplary, working outside of traditional working hours particularly affects branches that provide personal services or that serve basic social needs (DGB-Index, 2022a, pp. 40–43). Evening work is the most widespread. Considering the frequency of night work, it becomes clear which branches are particularly relevant: logistics and healthcare. They do not only suffer from little influence on the quantity of work and scheduling of working time (DGB-Index, 2022a, pp. 24–27), but also frequently work at variance with traditional working hours, which overall suggests particularly intensive work. What is additionally reflected is the low planning security regarding working time (e.g., on-call duty, work on demand).

With regard to emotional demands and intensity, one-fifth or more employees in healthcare and financial services report that they are very often or often confronted with negative, psychologically stressful situations when dealing with the persons concerned (DGB-Index, 2018b, pp. 9–10). However, it is precisely the interaction-typical forms of stress that are still inadequately recorded and to which too little importance has been attached in research and corporate practice to date.

Workers deliberately use their own emotional expressions to elicit a desired reaction from their counterparts. It is assumed that these emotionally demanding activities have a particularly psychologically stressful effect on employees due to the possible discrepancy between the emotions they really feel and the emotions they display (Schöllgen and Schulz, 2016, p. 10).

Employment situation

Around 25 million people are regularly employed in the German service sector (72 % of total, Table 15 | Appendix). Most of them are women (55 %). Almost two-thirds work full-time. In relation to total employment, by far the most women and almost all part-time employees work in services. Most service workers are employed in the wholesale and retail trade (19 %) as well as in healthcare and social work (21 %). The largest part of the service sector is thus made up of jobs that concern the (everyday) care of people. A similar picture emerges for marginally employed persons, who in Germany are almost exclusively concentrated in services.

Women make up the majority of employees in most service branches (Figure 18 | Appendix). These include, for example, healthcare and social work (77 %) and education (72 %). However, this fact does not apply to all branches, such as information and communication (34 %), transport and logistics (24 %). In some cases, close to or over 50 % of employees work part-time (e.g., education, healthcare and social services, accommodation, and food services). It is plausible that the combination of high physical and mental stress leads to part-time work or that there are fewer barriers to entry for part-time employees in these branches.

Regarding the qualification level of workers, the service sector is divided into branches with a great proportion of highly qualified employees and a below-average number of people without formal training, and those where the opposite is the case (Figure 19 | Appendix). Nevertheless, most workers have completed vocational training. Information and communication (48 %), professional, scientific, and technical services (44 %), and education (41 %) show above-average levels of qualification. Trade, transport and logistics, accommodation, and food services, as well as parts of healthcare and social services, employ an above-average number of people without formal training and relatively few with university degrees.

Between 2018 and 2022, employment in the service sector increased (Table 16 | Appendix). These gains are particularly marked in information and communication (20 %), real estate (13 %), professional and scientific services (11 %), and public administration (11 %). However, a closer look at employment growth reveals other structural findings: Part-time employment has grown more strongly than the full-time equivalent. The employment of highly qualified people has increased by more than 20 % on average. In some cases, however, the employment of people without formal training also increased considerably. Overall, both an increasing movement towards academization and a polarization of qualifications are visible.

Around a quarter of all employees in Germany work in the low-wage sector, many of them in services (Bäcker et al., 2020, p. 188). The reasons for this are, on the one hand, the weakness of trade unions and the privatization of state-owned companies, but also social policies in terms of low basic income levels and unemployment policies (Bäcker et al., 2020, p. 41). Trade, transport and logistics, and food services are clearly prime examples of low-wage branches. High part-time rates additionally precarize these branches. Moreover, work in low-wage branches is characterized by more stressful work situations. According to Dütsch and Bruttel (2021, p. 12), people in those branches are considerably more exposed to strain in terms of working hours. Overall, they work longer hours, overtime, and unpaid work. Their working time arrangements frequently fall outside traditional working hours, i.e., at weekends or in shifts, and they show generally more dependence on fluctuating labor demand, making work less predictable. Women, younger people, and the less qualified are more likely to work in low-wage service branches than their counterparts.

Who is (not) working autonomously?

Autonomous workers are highly qualified, male, and in supervisory positions. They work in business, scientific, or IT services and are less likely to perform interaction work. – Although these remarks are overstated and generalized, they do reflect statistically common characteristics of workers with particularly high degrees of freedom in the workplace. Building a bridge between the positive relationship between job quality aspects and job autonomy helps to establish an impression of the current state of autonomous work. Concepts of job quality[11] cover a wide range of autonomy dimensions, even though the term "autonomy" is not often explicitly used: work organizational aspects, work intensities, or working time situations. On the one hand, this wealth of information reinforces the approach of considering job autonomy as an essential element of job quality. On the other hand, it makes clear that the boundaries between job resources and job demands are blurred in that certain job demands also provide information about the degree of autonomy.

To approximate the levels of job autonomy in a very heterogeneous service sector, some selected job characteristics are evaluated to identify

11 In recent years, the attempt at qualitatively describing and empirically measuring job quality has grown in popularity in industrialized countries. The term *job quality* comprises a collection of multidimensional concepts whose definition or operationalization often differs. For an overview of job quality concepts, see Warhurst et al. (2017).

rough trend lines related to job autonomy: In which service branches or forms of interaction are there particularly pronounced or restricted autonomy situations? To what extent are there relations between job autonomy and management function, educational demands, and the sex of workers?

Across all sectors in Germany (Table 1), many workers have little influence on the amount of work they do (63 %), their respective working time (55 %), or the scheduling of work (31 %). Many of them act under constant time pressure (50 %) or are disturbed and interrupted in the process (54 %). For a solid quarter, constant availability, evening and weekend work are a regular part of everyday working life (DGB-Index, 2022a, pp. 40–43). A variety of restrictions and constraints at work are therefore expressed in terms of work content, scheduling, and working time. Alarmingly, employees who frequently perform interaction work, in particular, report quality cutbacks in their work outcomes and regular conflicts with clients.

The analysis by *service branch* shows a broad range of autonomy-limiting factors at work. Well over half of the employees have little or no influence on the amount of work they do, with employees in transport and logistics (79 %) and healthcare (72 %) standing out. The ability to influence the working time situation and the possibility of planning or scheduling work independently are more differentiated. Poles are formed between more restricted branches (trade, logistics, accommodation, food services, education, healthcare, and social services) and rather flexible ones (information and communication, finance and insurance, professional, scientific, and technical services). This polarization continues in a comparable way regarding the possibility of contributing one's own ideas or the necessity of making quality restrictions on their work. Half of the employees tend to work under frequent time pressure, with the healthcare sector (68 %) again standing out.

The autonomy-related difference between workers who have very frequent or rather seldom *client interaction* is essentially reflected in the intensity of work and the organization of working time. The former are interrupted more often, experience intense time pressure, and report having to make quality cutbacks in their work more than average. Conflicts with clients are present in everyday work, and the need to be constantly available is also reflected in more frequent evening and weekend work. However, differences in job autonomy are not as pronounced as expected.

People in *management functions* have higher levels of autonomy in their work than others (also Breaugh, 1989, pp. 1046–1047). Unsurprisingly, there is extended scope for action in supervisory positions,

which are organizationally responsible for the performance and output of workers. Management function enables slightly more leeway in organizing work, while higher intensity in the form of time pressure, interruptions, and conflicting work demands counteracts.

The *level of demand for occupational tasks* reveals a highly polarized relationship between qualification and job autonomy. Job autonomy increases considerably with the level of qualification (also Esser & Olsen, 2012, p. 452). The possibility of contributing one's own ideas to work also follows a similar course. Workers with higher qualifications[12] are thus likely to be left to organize themselves, while those with lower qualifications must work in more predefined environments. In contrast, an examination of the intensity of work paints the opposite picture: It is the highly qualified who are particularly often under time pressure, disturbed at work, or confronted with contradictory work requirements.

So far, little attention has been paid to differences in job autonomy in relation to *sex* (Adler, 1993, p. 450; Esser & Olsen, 2012, p. 452). On average, men have higher levels of autonomy than women (Adler, 1993, p. 455). However, this is not only due to gender representation in specific organizational structures. In management or white-collar work, men systematically have higher degrees of autonomy than women (Adler, 1993, pp. 450–455). It is reasonable to assume that existing power structures and the relationship between professional and care work come into play. Women in particular have less influence on the amount of work they do but are less often under time pressure – at least when focused on the selected job quality characteristics.

This overview confirms the need for a differentiated view of job autonomy in services. The contours of two groups of workers are becoming visible: less autonomous services (LAS) and highly autonomous services (HAS). The first group is less likely to autonomously influence their working time, work quantity, and scheduling. It is also those workers who are particularly burdened by their working time situation, in that they must engage frequently at weekends, in the evening, or at night. This group includes trade, logistics, accommodation, and food services, as well as healthcare and social services. The description of LAS applies

12 The German Federal Employment Agency (2021, pp. 27–28) defines four demand levels that describe certain knowledge and skill levels required to perform an occupation. These four requirement levels are: helper and semi-skilled tasks, specialized tasks, complex specialist tasks, and highly complex tasks. They are roughly comparable with the qualification levels: no formal training, vocational training, further training, and higher education degree.

predominantly to person-related tasks and low- to medium-skilled workers who tend to have no management function.

HAS are characterized by constant interruptions at work and contradictory work requirements. The working-time situation of these employees is less demanding. Nevertheless, constant availability is problematic for some. Overall, workers are able to influence their working time and the planning of individual tasks more frequently. However, this freedom makes their work more conflictual. The group of HAS includes those in information and communication, finance and insurance, professional, scientific, and technical services, public administration, and, to some extent, education.

This rough distinction between LAS and HAS is taken up again, particularly in the context of the theoretical embedding of job autonomy in work organizational contexts (Chap. 5).

Table 1: Selected job quality measures, 2019–2022

	Influence on work quantity	Influence on working time	Schedule work independently	Bringing in own ideas	Rushed/ under time pressure	Disturbed/ interrupted	Quality cutbacks	Constant availability	Conflicts with clients
	Answers "Not at all/to a small extent"				*Answers "Very often/often"*				
Total	**63 %**	**55 %**	**31 %**	**31 %**	**50 %**	**54 %**	**23 %**	**23 %**	**13 %**
Service Sector									
Wholes., retail trade; rep. of vehic.	63 %	53 %	38 %	39 %	49 %	53 %	22 %	22 %	14 %
Transportation, storage	79 %	58 %	48 %	47 %	48 %	36 %	24 %	25 %	14 %
Accommodation, food service	59 %	47 %	51 %	33 %	53 %	39 %	15 %	33 %	17 %
Information, communication	57 %	25 %	19 %	22 %	51 %	58 %	20 %	24 %	11 %
Finance, insurance	67 %	27 %	21 %	25 %	55 %	65 %	19 %	17 %	15 %
Prof., scientific, technical services	56 %	23 %	16 %	26 %	56 %	63 %	20 %	22 %	8 %
Public admin., def., social sec.	68 %	30 %	22 %	36 %	49 %	63 %	23 %	18 %	24 %
Education	62 %	55 %	25 %	13 %	58 %	49 %	38 %	40 %	24 %
Health	72 %	57 %	42 %	32 %	68 %	63 %	34 %	26 %	19 %
Social Service	60 %	53 %	33 %	25 %	47 %	48 %	26 %	28 %	17 %
Client interaction									
Very often/often	63 %	48 %	33 %	29 %	56 %	56 %	25 %	29 %	17 %
Rarely/never	63 %	46 %	31 %	35 %	41 %	48 %	18 %	15 %	12 %
Management function									
With management function	55 %	38 %	20 %	16 %	61 %	70 %	24 %	36 %	17 %
W/o management function	66 %	50 %	37 %	37 %	47 %	47 %	22 %	19 %	12 %

Educational demand									
Helpers/semi-skilled workers	66 %	61 %	45 %	55 %	31 %	26 %	17 %	20 %	7 %
Professional tasks	66 %	55 %	40 %	36 %	48 %	50 %	21 %	20 %	12 %
Complex specialized tasks	63 %	35 %	22 %	25 %	55 %	65 %	24 %	25 %	16 %
Highly complex tasks	55 %	30 %	16 %	14 %	61 %	62 %	28 %	34 %	17 %
Sex									
Men	61 %	49 %	33 %	29 %	56 %	56 %	25 %	25 %	11 %
Women	65 %	46 %	32 %	34 %	41 %	48 %	18 %	21 %	16 %

Notes: Mean values from 2019 to 2022 for all branches. Relative frequency of employees whose answers to a particular question can be interpreted as restricting autonomy, e.g., having no/only little influence on the amount of work (left side) or being very often/often rushed or working under time pressure (right side).

Source: DGB-Index (2022a), Table 4, 5, 8, 9, 11.