Digital Surveillance and Algorithmic Management in the Metal Industry

Workers' Experiences, Perceptions and Trade Union Policies

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Survey of 665 metalworkers in 109 workplaces across ten union branches

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Foreword

This report presents the findings of the field study conducted by the United Metalworkers' Union in order to examine the effects of digital surveillance, algorithmic management and digital monitoring systems upon working conditions in the metal industry. The research covers the experience of metalworkers employed in workplaces organised under ten of our branches, their perceptions of these digital systems and their expectations of the union. The study was conducted and written up by Prof. Dr. Ferit Serkan Öngel.

Tablet- and screen-based work order systems, camera monitoring, turnstiles and access control, personnel time-and-attendance systems and performance scoring are today in widespread use in metal factories. Some of these instruments have been present in workplaces for a long time. What has changed in recent years is not the entry of these instruments into the workplace but the character of the data they produce: records are now stored digitally, linked to one another and rendered usable in the individual assessment of the worker. These systems are for the most part introduced into workplaces on the grounds of productivity, quality and occupational safety. Our union placed the risks that this subject carries from the standpoint of labour on the agenda even before these technologies became widespread. In its 2018 policy document on the Acceptable Workload, it drew attention to the fact that the measurability of production may be turned into an instrument of pressure upon the worker, and to the union's right to object to that measure. Our position in 2020 towards the wearable location-tracking devices that were to be introduced into workplaces on pandemic grounds rested upon the same principled framework.

This research constitutes an evidence-based continuation of that approach. Our aim is to address digital transformation not as an abstract debate but through the everyday working experience of the worker, on the basis of field data. The study forms part of our union's institutional activity in the field of labour research, and our research in this area will continue. Sharing the findings with the public and with the scholarly community is one of the fundamental purposes of this work.

The Aim and Approach of the Research

The impact of digital technologies upon the workplace is for the most part assessed by means of productivity criteria. This research addresses the subject from the standpoint of the worker's experience and perception, and is structured around four fundamental questions:

- Which digital monitoring systems do metalworkers work with in their workplaces, and how widespread are these systems?
- How do workers experience these systems; which systems are more strongly associated with work pace and the perception of pressure?
- How are the digital systems installed on occupational safety grounds interpreted by workers?
- What is the relationship between workers' perception of digital surveillance and their trade union orientations?

The research treats digital transformation as a matter of labour rather than as a technical matter. The meaning that a technology carries for the worker is determined less by the technology itself than by the working relations within which it is embedded. For this reason, what stands at the

focus of the research is not the technical properties of the systems but the relationship that the worker establishes with them.

In order to name this experience, we use the concept of digital Taylorism throughout the report. The scientific management approach developed by Frederick Taylor at the beginning of the twentieth century aimed to measure work by dividing it into its smallest units, to determine the worker's pace from above, to sever planning from execution, and thereby to devalue the worker's occupational knowledge. Digital Taylorism is this same logic reconstituted by means of sensors, tablets, software and algorithms: work is measured continuously and in real time, the pace is imposed by the system, and the worker is monitored without interruption. The most decisive feature of this new stage is that the decision-making function, which under classical Taylorism lay in the hands of a human manager, is increasingly transferred to software and to artificial intelligence systems: managerial decisions such as the allocation of work, the scoring of performance, the issuing of warnings and even dismissal now rest, in most cases, not upon a supervisor but upon the outputs produced by an algorithm. In this way not only the worker's craft skill but also the judgement that governs work passes from the human being to the machine. In this report we address digital surveillance not as the problem of a single technology but as this reorganisation of the labour process.

One point must be stated at the outset with respect to method: the research measures not an objective inventory of the technology installed in the workplaces but workers' experience and perception of these technologies. The findings therefore reflect a picture as seen through the workers' own eyes. This is not a limitation of the study but a deliberate choice, since what a monitoring system means in a workplace depends to a large extent upon how the worker who works with it experiences it.

The Scope of the Research and the Participants

665 metalworkers employed in 109 workplaces organised under ten branches of our union took part in the research. The participants are employed across the different sectors of the industry: basic metals (iron and steel, foundry), the automotive and supplier industry, white goods and electronics, metal goods, and energy and related fields. This sectoral distribution indicates that the findings relate not to a single form of production but to the metal industry as a whole.

The great majority of the participants consists of workers employed directly within the production process, on production and assembly lines, in machine operation and heavy manufacturing, in quality control, and in warehousing and logistics. The sample covers different levels of seniority and different shift arrangements, and thus encompasses the experience both of workers who have only recently begun work and of those who have worked in the industry for a long time.

The survey was administered on a voluntary basis and the identifying information of the participants was kept confidential. The questions covered the digital systems that workers encounter in the workplace, their perceptions of these systems, their experience of work pace and pressure, their assessments of occupational safety, their views concerning their occupational future, and their expectations of the union.

Table 1. Demographic characteristics of the participants (N = 665)

Characteristic	Number	Share
Gender		
Male	593	89%
Female	72	11%
Age (as at the survey period: March 2026)		
30 and under	174	26%
31–40	240	36%
41–50	211	32%
51 and over	40	6%
Level of education		
Primary school and below	27	4%
Lower secondary / basic education	85	13%
Vocational high school	223	34%
High school (other)	181	27%
Vocational college (associate degree)	124	19%
Bachelor's degree	25	4%
Seniority in the workplace		
0–2 years	143	22%
3–5 years	158	24%
6–10 years	147	22%
11–15 years	107	16%
16 years and over	110	17%
Working arrangement		
Single shift (daytime)	218	33%
Two shifts	152	23%
Three shifts	269	40%
Irregular	26	4%
Sector		
Basic metals (iron and steel, foundry)	231	35%
Automotive and supplier industry	231	35%
White goods and electronics	102	15%
Metal goods	52	8%
Energy and related fields	47	7%
Other (not coded)	2	0%
Job		
Production / assembly line	309	46%

Characteristic	Number	Share
Machine operation / heavy manufacturing	102	15%
Warehouse / logistics	66	10%
Quality control	52	8%
Maintenance / repair	19	3%
Technician / technical service	18	3%
Crane operator	6	1%
Forklift operator	4	1%
Production planning / engineering	4	1%
Other	85	13%

Note: Shares are given with reference to the whole sample (N = 665); minor discrepancies due to rounding may occur. Two records under the sector heading fell outside the classification because an ISIC code was entered in the sector field during data entry; both are automotive supplier workplaces.

Which Digital Systems Do Workers Work With?

The first finding of the research is that digital monitoring in metal workplaces operates not as a single technology but as a multi-layered totality of systems. When we asked workers which instruments and systems monitor them, the systems most frequently marked were those resting upon entry-and-exit infrastructure. Approximately half of the participants (49 per cent) reported that they work with turnstiles, card readers or entry-exit readers; more than a third (35 per cent) with the screens and counters mounted on workstations and machines; and approximately a third (31 per cent) with a personnel time-and-attendance system (PDKS).

Alongside these, the systems that assess the worker directly and individually were marked by a more limited group: systems tracking work orders and durations by means of a tablet or screen were reported at 15 per cent, camera monitoring at 17 per cent, and performance and productivity scoring systems at 14 per cent. As we shall see in the sections that follow, the weight of these less widespread systems upon the worker's experience is not proportionate to their prevalence.

A worker reports being monitored by an average of two systems (median two). While approximately a third of the participants (32 per cent) marked three or more systems simultaneously, 12 per cent marked no system at all. Separately from these, 13 per cent of the participants explicitly marked the “none or do not know” option in the list; the two groups do not overlap exactly. This picture may point less to the absence of digital systems than to the worker's being unaware of the presence of these systems. Indeed, that workers employed in the same workplace give differing answers on this matter is one of the striking findings of the research, and is addressed further below.

One point must be underlined here: these proportions reflect not an objective count of the technology installed in the workplaces but workers' perception of what it is that monitors them. In other words, the picture shows not the technical inventory of the systems but the extent to which these systems are visible within the worker's everyday experience.

Table 2. Digital systems that monitor workers (number and share of those marking each item, N = 665)

System / response	Number of workers	Share
Turnstile / card / entry–exit reader	327	49%
Workstation and machine screens and counters	232	35%
Time-and-attendance system (PDKS)	204	31%
Handheld terminal / barcode / tablet	118	18%
Camera monitoring	110	17%
Work orders and time tracking via tablet or screen	102	15%
Performance / productivity scoring	95	14%
Computer login / screen monitoring	91	14%
None / do not know	89	13%
Movement tracking between units	30	5%
Break / toilet time tracking	28	4%
Handheld computer for warehouse entry–exit	27	4%
Vehicle / smartwatch / sensor-equipped vest	24	4%
Weighbridge application	16	2%

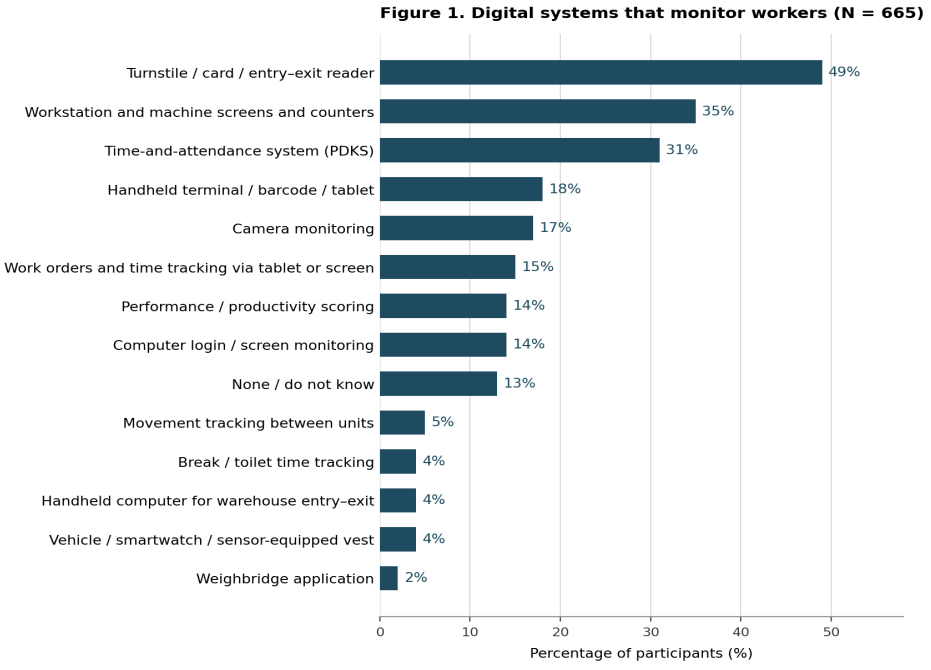

Figure 1. Digital systems that monitor workers.

What Information Do the Systems Collect?

When we asked workers which of their information these systems most collect in the workplace, the response that stood out by a wide margin was production and work pace: approximately two thirds of the participants (65 per cent) stated that the systems measure daily production volume and work pace. This was followed by machine stoppages and break durations (37 per cent), the

quantity of defective parts (23 per cent), performance scores and rates of target attainment (22 per cent), and location information within the factory (22 per cent).

An important finding at this point is the prevalence of a lack of information. Approximately one worker in every four (23 per cent) stated that they do not know which of their data are collected, or that this has not been clearly explained to them. This picture also coincides with the assessment of transparency that we asked about in a separate question: whereas only 26 per cent of workers stated that they know exactly how the systems that assess them reach their decisions, 56 per cent stated that they do not know this. This lack of transparency concerning the operation of digital systems confronts us, in the later sections of the report, as a central heading both for the worker's experience and for trade union demands.

Table 3. Information believed to be collected by the systems (N = 665)

Type of information	Number of workers	Share
Production volume and work pace	435	65%
Stoppage / breakdown / break duration	243	37%
Defective parts (scrap) quantity	154	23%
Do not know / was not told	151	23%
Performance score / target attainment	148	22%
Location within the factory	145	22%
Audio and video	27	4%

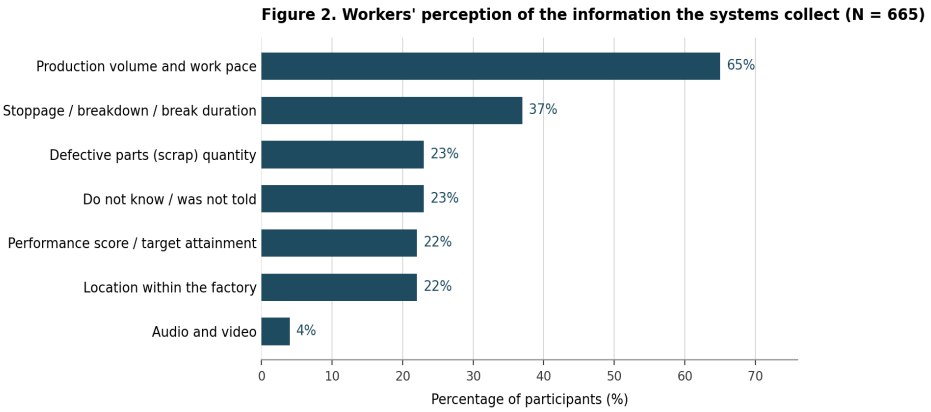

Figure 2. Workers' perception of which of their information the systems most collect.

Table 4. Agreement with the statement "I know exactly how the systems that assess me reach their decisions" and the level of digital Taylorism (N = 665)

Response	Number of workers	Share	Mean digital Taylorism
Strongly disagree	166	25%	2.04
Disagree	209	31%	2.19
Undecided	115	17%	2.76
Agree	110	17%	2.95
Strongly agree	65	10%	3.23

Response	Number of workers	Share	Mean digital Taylorism
Total	**665**	**100%**	**2.48**

Note: Means are calculated on a five-point scale. Those who say that they know how the system operates (agree and strongly agree) constitute 26 per cent of the participants, while those who say that they do not know constitute 56 per cent.

Performance Scoring

24 per cent of the participants stated that they are assigned a performance score or productivity mark in the workplace. Against this, 43 per cent stated that no such score exists, while 33 per cent stated that they have no information on the matter. The size of this third group is striking in its own right: one worker in every three does not even know whether a performance score is assigned to them. This is one of the first indications of the transparency heading that we shall address in the later sections of the report.

The majority (101) of the 158 workers who stated that they have a performance score reported that these scores affect their wage, their bonus or their continued employment at least in part. This proportion corresponds to approximately two workers in every three in the workplaces where scoring is applied. Performance measurement therefore operates, in the places where it is applied, not merely as a record but as an instrument of assessment with direct consequences.

Table 5. The application of performance scoring and the consequences of the score

Response	Number of workers	Share	Base
Yes, I have a performance score	158	24%	N = 665
No, I do not	288	43%	N = 665
Do not know	219	33%	N = 665
— The score strongly affects wage/bonus	50	32%	n = 158
— It affects them in part	51	32%	n = 158
— It does not affect them; it is on paper only	24	15%	n = 158
— Do not know	33	21%	n = 158

Note: The final four rows were put only to the 158 workers who stated that they have a performance score; the shares are calculated on that base.

What Do Workers Experience Together with These Systems?

At the centre of the research stands the question of how workers experience these systems. We asked workers whether or not they agreed with a series of statements concerning work pace, being monitored, occupational safety and their occupational future.

The most widely shared experience was mental fatigue: a third of the participants (34 per cent) stated that the existing pace and the digital monitoring systems produce in them an excessive mental fatigue by the end of the day. A striking picture emerged under the heading of occupational safety: a third of the workers (33 per cent) stated that they are at times compelled to breach occupational health and safety rules because of pressure on speed; 23 per cent stated that being monitored constantly distracts their attention and thereby increases the risk of accident;

and 21 per cent stated that what is in fact being monitored under the name of “occupational safety” is how much they work. That systems installed on occupational safety grounds are experienced by a section of workers not as safety but as control is one of the most original findings of this report.

There is a further question that completes this picture. It concerns whether digital measures and monitoring are effective in preventing accidents, and we put it under the occupational safety heading. This question tests directly the grounds on which these systems are presented to workplaces. The majority of workers do not accept those grounds. Of the 644 workers who gave a valid response, 54 per cent stated that they disagreed with the statement and 26 per cent that they agreed, while 20 per cent remained undecided (a mean of 2.58 on the five-point scale). In other words, the most frequently voiced justification for digital surveillance finds an echo in no more than a quarter of metalworkers.

We did not include this statement in any of the three dimensions, because, contrary to what might be expected, it does not behave as a simple reverse-coded item. Workers who experience digital pressure intensely agree with this statement somewhat more rather than less. The mean is 2.36 in the low-level group, whereas it is 2.79 and 2.82 in the medium- and high-level groups respectively. The item's association with the general level of digital Taylorism is weak and positive ($r = 0.20$); its strongest association is with the level of knowledge of how the system reaches its decisions ($r = 0.21$). This pattern is consistent with the findings to be addressed in the later sections of the report. Workers who are in more intensive contact with the systems, and who know them more closely, express more definite opinions about these systems in every direction. We therefore read this item not as an indicator of digital pressure but as an independent measure of workers' response to the discourse of legitimation.

The significance of the finding from a trade union standpoint is nevertheless clear. The occupational safety justification is not found convincing by the majority of workers. Read together with the statement conveyed above — that under the name of occupational safety it is how much we work that is monitored — this result shows that there is a marked gap between the grounds on which the systems are presented and the manner in which they are experienced in the workplace.

The pressure relating to work pace and to being monitored is also at a considerable level. 29 per cent of workers stated that feeling constantly monitored puts them under stress, and 18 per cent that keeping up with the pace determined by the software is very difficult and not humane. As regards the occupational future and autonomy, 22 per cent of workers stated that the craft skill that once mattered has given way to instructions on a screen, while approximately one in six spoke of being unable to object to the unjust decisions of the system (18 per cent) and of being unable to draw on their experience at the moment a problem arises (17 per cent). The proportions of those stating that their risk of dismissal has increased (14 per cent) and that they carry a fear of losing their work to software (15 per cent) remained comparatively lower.

These proportions show that digital pressure does not affect all workers to the same degree, but that for a section by no means to be underestimated it is a concrete and everyday reality.

Table 6. Workers' reported experience — share agreeing with each statement (“agree” + “strongly agree”)

Statement	Agreeing	Valid responses	Share
Digital monitoring and the pace create excessive mental fatigue	226	665	34%
I breach OHS rules because of pressure on speed	211	649	33%
Feeling constantly monitored puts me under stress	195	665	29%
Constant monitoring distracts attention and raises accident risk	148	634	23%
My craft skill has been devalued; I now follow on-screen instructions	147	665	22%
Under the name of “occupational safety”, how much we work is monitored	138	647	21%
It is very difficult to keep up with the pace set by the software	122	665	18%
I have no chance to object to or correct an unjust decision of the system	117	665	18%
I cannot draw on my experience when a problem arises	111	665	17%
The pressure on me has increased because of the tablet / system	115	665	17%
My toilet / break times are monitored	98	665	15%
I fear losing my work to a robot or to software	98	665	15%
My risk of dismissal has increased	90	665	14%

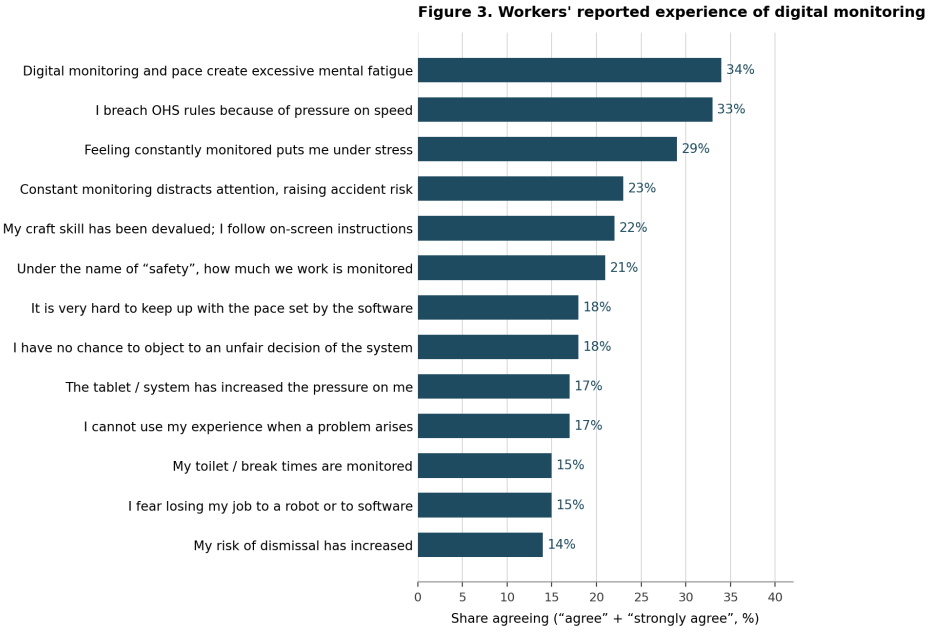

Figure 3. Workers' reported experience. Shares are calculated on those giving a valid response.

The Three Dimensions of the Digital Taylorism Experience

When the experiences conveyed in the previous section are examined not one by one but as a whole, it becomes apparent that they are not disconnected complaints but cluster coherently around particular headings. The analysis we conducted on workers' responses reveals that the experience of digital monitoring gathers into three fundamental dimensions. In the assessments below, workers' agreement with the relevant statements is given as a mean on a scale where 1 signifies “strongly disagree” and 5 “strongly agree”. Values above 3 indicate that the average worker tends to share that experience.

We defined the first dimension as algorithmic discipline. This dimension brings together experiences relating to the system's pressing in upon the worker, determining their pace and monitoring them continuously: pressure originating in the tablet and the system, a pace that is difficult to keep up with, the stress produced by being constantly monitored, the control of break times, and anxiety about dismissal. In short, this dimension expresses the experience of digital systems as an apparatus of discipline and of speed.

The second dimension focuses upon the transformation of occupational safety into control, and upon the rise in the risk of occupational accidents alongside the rise in productivity. This dimension encompasses the experience of systems installed on the grounds of "occupational safety" not as an instrument of safety but as an instrument of control. These are: the breaching of safety rules because of pressure on speed; the monitoring, under the name of "occupational safety", of how much work is in fact being done; the distraction of attention by constant monitoring and the consequent increase in accident risk; and the mental fatigue that these produce. This is the dimension on which workers show the highest level of agreement among the three. This perception — that occupational health and safety can be turned by capital into a justification for control — confirms, in the everyday experience of workers, a concern that our union has voiced for years.

We named the third dimension algorithmic deskilling. This dimension covers experiences relating to the devaluation of the worker's occupational knowledge, craft skill and autonomy of decision: the giving way of craft skill to instructions on a screen, the fear of losing one's work to software, the inability to object to the unjust decisions of the system, and the inability to draw on one's experience at the moment a problem arises. This dimension shows that digitalisation is not solely a matter of speed and surveillance but is at the same time a matter that touches upon the quality of the worker's labour and upon their occupational dignity.

A further important property of these three dimensions is that they are strongly interconnected. A worker who experiences one dimension intensely in all likelihood experiences the others as well. This indicates that the three dimensions are different faces of the same underlying phenomenon, and that one may therefore also speak of a worker's general experience, or perception, of digital Taylorism. Looking at this general level, approximately a quarter of the participants (26 per cent) are found to have a mean above 3 on the five-point scale — that is, a level indicating that they distinctly experience, or perceive, digital Taylorism. This criterion differs from the cluster analysis addressed in the following section.

Table 7. The three dimensions of the digital Taylorism experience

Dimension	Experience covered	Reliability (α)	Mean (1–5)
Algorithmic discipline	Pressure, an inhumane pace, the stress of being monitored, control of breaks, anxiety about dismissal	.86	2.40
Occupational safety turned into control	The experience of "occupational safety" systems as an instrument of control and pressure	.76	2.66
Algorithmic deskilling	Devaluation of craft skill, loss of autonomy, inability to object to the system, fear of losing work to a robot	.83	2.36

Workers Divide into Three Types

When we examined how the experience of digital Taylorism is distributed among workers, we found that the participants form three distinct groups.

The first and largest group constitutes approximately half of the participants (48 per cent). These workers report low levels on all three dimensions (a mean below 2 on each of the three). For this group digital monitoring is either not a constricting part of the working experience or is not yet perceived in that way.

The second group constitutes somewhat more than a quarter of the participants (28 per cent) and has a striking profile. While these workers hold a medium-level perception on the matters of algorithmic discipline and deskilling (a mean of around 2.4), they hold a distinctly high perception on the matter of occupational safety being turned into control (a mean of 3.17). What defines this group, in other words, is not a general digital pressure but specifically a sharp perception that occupational safety systems have been turned into an instrument of control. This is significant in that it reflects the particular meaning that the occupational safety heading carries in the metal industry.

The third group constitutes approximately a quarter of the participants (23 per cent) and is the section that experiences digital Taylorism most intensely. These workers hold a high perception on all three dimensions (a mean of around 3.5 on each of the three). For them digital monitoring is a multi-dimensional and everyday reality that has penetrated every aspect of working life.

Table 8. Size and dimension profile of the three worker types (means, 1–5 scale)

Worker type	Share	Algorithmic discipline	Safety as control	Deskilling	General level
Low level	48%	1.76	1.88	1.75	1.80
Medium level	28%	2.43	3.17	2.42	2.67
High level	23%	3.60	3.66	3.47	3.58

Note: Cluster shares are calculated on the 649 participants who could be assigned to a cluster; 16 records were excluded owing to missing data.

Figure 4. Dimension profile of the three worker types

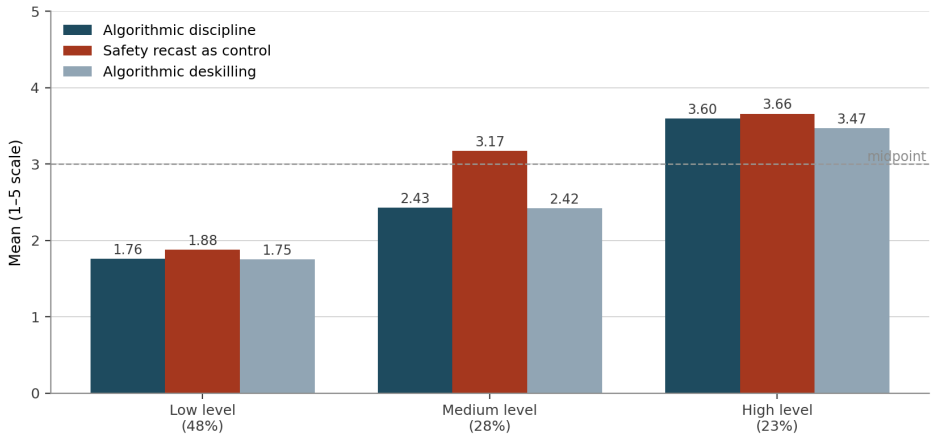

Figure 4. Dimension profile of the three worker types. Note that the medium group rises only on the dimension of occupational safety turned into control.

As the Experience Deepens, Expectations of the Union Become Clearer

When we examine the worker types together with their expectations of the union, we encounter a clear and meaningful pattern. As the experience of digital Taylorism deepens, workers' expectations of the union become more definite and more concrete.

The most striking indicator of this pattern is the course taken by the “no view” response. Whereas in the group experiencing digital pressure at a low level one worker in every three (35 per cent) states that they have no view as to what the union should do, in the group experiencing digital pressure intensely the share of the “no view” response falls to 10 per cent. As the experience becomes concrete, so does the expectation. Similarly, the expectation that the union should secure a reduction in the pace doubles from the low group (17 per cent) to the high group (35 per cent); and the expectation that the use of data as grounds for dismissal should be prevented rises from 41 per cent to 58 per cent.

Notwithstanding all this differentiation, one expectation stands out by a wide margin in every group: what workers most frequently ask of the union is that it should establish which data are collected and explain this to them clearly. This expectation stands at 61 per cent even among those who experience digital pressure at a low level, and at 69 per cent among those who experience it intensely. Workers, in other words, whether greatly or little affected by these systems, demand transparency above all else. This finding is important for the trade union policies that we shall address in the following section of the report.

Key Findings

The most important contribution of this research lies, beyond the descriptive picture, in three fundamental findings concerning how digital Taylorism operates within the worker's experience. These findings show that digital surveillance works according to a logic different from that which is commonly assumed.

1. The number of systems does not explain the severity of the pressure; their type does

It is generally assumed that the more digital systems there are in a workplace, the greater the pressure upon the worker will be. Our data do not confirm this assumption. There is no appreciable relationship between the number of systems that a worker states to be monitoring them and the level of digital Taylorism that they experience. The experience levels of workers who state that they are monitored by a single system and of those who state that they are monitored by four or more systems are almost identical (2.40 and 2.56 respectively on the five-point scale). Nor is the relationship between the two variables statistically significant ($r = 0.07$; $p = 0.06$). The number of systems does not explain the severity of the pressure.

Table 9. Level of digital Taylorism by the number of monitoring systems (N = 665)

Number of systems marked	Number of workers	Share	Mean digital Taylorism
None	77	12%	2.48
1 system	243	37%	2.39
2 systems	130	20%	2.46
3 systems	87	13%	2.61
4 and above	128	19%	2.55

Note: The shares total 101 per cent owing to rounding. The relationship between the number of systems and the level of digital Taylorism is not significant (r = 0.07; p = 0.06).

What does explain it is the type of system. When we separate the systems into those that single out and assess the worker individually and those that constitute a shared infrastructure for everyone, we see that their effects upon experience are entirely different. Systems that target the worker individually — work order and time tracking via tablet, and camera monitoring — are distinctly associated with the pressure that the worker experiences. The general level of digital Taylorism among workers who state that they are monitored by tablet is visibly higher than among those who do not (2.72 against 2.43; d = 0.35; p = 0.002); a similar difference is observed in the case of cameras (2.67 against 2.44; d = 0.29; p = 0.010).

By contrast, instruments resting upon entry-and-exit infrastructure, such as turnstiles and the personnel time-and-attendance system, make no difference to the worker's experience (d = 0.04 for turnstiles; d = −0.05 for PDKS). These instruments register the worker at the threshold, that is, outside the labour process.

The screens mounted on workstations present a more complex case, and show the limit of the finding. These screens too produce data on pace that are specific to the individual. Indeed, 85 per cent of the workers who state that they work with a workstation screen say that production volume and work pace are measured; among those who do not, this proportion is 55 per cent. Despite this, the screens make no marked difference to experience, or to perception (d = 0.05).

Where the distinction is established becomes visible when one looks at the autonomy items. 33 per cent of the workers who state that they are monitored by tablet say that their craft skill has been devalued, and 26 per cent that they cannot object to the decision of the system. Among those who do not, these proportions are 20 per cent and 16 per cent. In the case of workstation screens there is no difference at all on these same two items (22 per cent against 22 per cent, and 18 per cent against 17 per cent). On anxiety about losing one's work to software, however, the two instruments behave similarly. The workstation screen, in other words, also produces the sense of being displaced by technology, but it does not touch upon the worker's authority to decide.

The difference between them arises from the fact that the screen displays the work whereas the tablet dictates the work individually. The screen is attached to the workstation, is shared between shifts, and the target it displays is common to everyone working at that station. The tablet, by contrast, is attached to the worker themselves, and notifies them of the work order, its sequence and its duration on an individual basis.

Camera monitoring is the third case in this picture, and it operates by a different route. The camera does not produce data concerning the pace of production. There is no significant difference in the perception that production speed is measured between those who state that they are monitored by camera and those who do not. The camera does, however, produce data of another kind about the worker, data that are by their nature personal. 44 per cent of the workers who state that they are monitored by camera say that their location within the factory is recorded, 56 per cent that stoppage and break durations are measured, and 14 per cent that their voice and image are collected. Among those who do not, these proportions are 17 per cent, 33 per cent and 2 per cent respectively. Where you are and how long you have stopped are pieces of information belonging directly to the person, not to the station.

What distinguishes the camera is not only the type of these data but the continuity of the recording. The turnstile records the worker once at the beginning and once at the end of the shift. The personnel time-and-attendance system is likewise tied to particular moments. Indeed, the perception of location recording rises with both systems (27 per cent in the case of turnstiles, 31 per cent in the case of PDKS), yet this makes no difference whatsoever to the worker's experience. The camera, by contrast, looks without interruption throughout the shift. The difference between them lies not in whether personal data are produced but in whether that production is momentary or continuous. Uninterrupted monitoring converts the whole of the worker's working time into time under surveillance.

Accordingly, the camera produces a difference in pressure of almost the same strength as the tablet, but it does so by a different route. The tablet takes away the authority to decide by dictating the work; the camera renders surveillance uninterrupted by continuously recording the body and time.

Reading the three cases together, it becomes apparent that digital pressure does not arise from a single mechanism. On the one hand there is surveillance that continuously monitors the worker's body and location; on the other there is direction that takes away the worker's authority to decide. The tablet does both at once, the camera only the first, while the workstation screen and the turnstile do neither. What is common to them is that the instruments producing pressure are those attached to the worker personally. The tablet is in their hand; the camera watches their body. The workstation screen is attached to the machine, and the turnstile to the door. The source of digital pressure is less surveillance itself than the personalisation of surveillance.

Table 10. Level of digital Taylorism by type of instrument (N = 665)

System	Number of workers	System present	System absent	Difference (d)	p
Work orders via tablet	102	2.72	2.43	0.35	0.002
Camera monitoring	110	2.67	2.44	0.29	0.010
Performance scoring	95	2.58	2.46	0.15	0.235
Workstation / machine screen	232	2.50	2.46	0.05	0.551
Time-and-attendance system (PDKS)	204	2.45	2.49	−0.05	0.551
Turnstile / card reader	327	2.50	2.46	0.04	0.590

Note: Means are calculated on a five-point scale. The difference column reports Cohen's d effect size. Only the differences in the first two rows are statistically significant.

This last reading is not a result that the data show directly but an interpretation consistent with the findings. Since the research measures individual perception, the extent to which an instrument severs the worker from collective working relations cannot be measured directly. It should also be borne in mind that the three dimensions are strongly related to one another; the correlation between the surveillance dimension and the autonomy dimension is 0.64. The association of the instruments with different dimensions should be read not as independent channels but as different faces of a common experience of pressure.

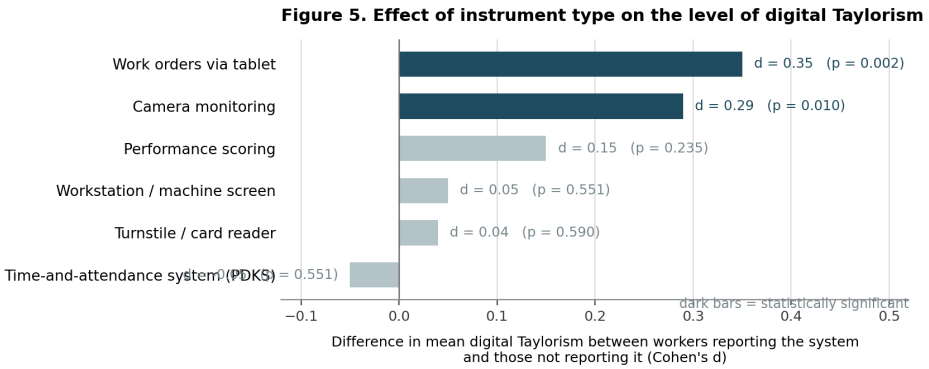

Figure 5. Instruments that target the worker individually (tablet, camera) produce a marked difference in experience, whereas collective infrastructure (turnstile, PDKS) does not.

2. Workers in the same workplace diverge as to what monitors them

Perhaps one of the most surprising findings of the research is that workers employed in the same workplace give largely differing answers as to which systems monitor them. Workers in the same factory, in the same production area, diverge widely on whether instruments such as turnstiles, the personnel time-and-attendance system and workstation screens monitor them or not.

This may at first sight appear contradictory. What we asked workers was not which technology is installed in the workplace but what it is that "monitors" them. Whether a worker sees the turnstile as an ordinary means of passage or as a monitoring system depends less upon physical reality than upon how they interpret that reality. "Being monitored", in other words, is to a large extent an experience that begins with the worker's noticing it and naming it.

It should also be stated that this differentiation does not arise solely from the fact that workers hold different jobs. This difference of interpretation is observed even among workers doing the same job. This shows that the rendering visible of digital surveillance is not a process that occurs of its own accord, but is made possible by the worker's coming to know the system, making sense of it and naming it.

3. What is decisive is not the number of systems but knowledge of the system

The third finding is directly connected with the second. The strongest factor determining the extent to which a worker experiences digital Taylorism is not how many systems monitor them but whether or not they know how the system that assesses them reaches its decisions. This relationship, however, operates in the direction opposite to what might at first be expected: workers who state that they know how the system operates report a distinctly higher level of pressure than those who state that they do not. The mean level of digital Taylorism among those who say that they know exactly how the system reaches its decisions is 3.23 on the five-point scale, whereas among those who say that they do not know this at all it is 2.04. The means between the two extremes also rise steadily.

This relationship is the strongest connection that we identified in the research ($r = 0.53$; the difference between those who know how the system operates and those who do not is $d = 1.30$). By way of comparison, the effect of the tablet — the instrument with the most marked effect upon experience — is approximately a quarter of this. We also confirmed that the connection is independent of how many systems monitor the worker: when the number of systems is

controlled for, the relationship scarcely weakens at all, and it retains its validity separately within each of the groups of workers working with few and with many systems.

Although this finding appears surprising at first sight, it falls into place when read together with our second finding. There we saw that workers employed in the same workplace diverge as to what it is that monitors them, and that "being monitored" is an experience that begins with the worker's noticing the system. The picture here is a continuation of the same mechanism: the worker who deciphers the logic of the system is at the same time able to see, and to name, the weight of that system upon their own work. The worker who does not know the system merely reports less pressure. This does not mean that there is less pressure upon them.

The conclusion that follows is that the experience of digital Taylorism is fundamentally a perceptual experience: it exists not in the technology itself but in the meaning that the technology carries for the worker, and in the extent to which the worker is able to render it visible.

In presenting this interpretation, an alternative should also be noted. Since the data are cross-sectional, it is equally possible that the relationship operates in the reverse direction: the worker who experiences pressure intensely may have made greater efforts to understand the system that assesses them. Both explanations lead to the same practical conclusion; the visibility of the system and the reporting of the experience are bound to one another.

When we bring the three findings together, a coherent picture emerges. Digital Taylorism is determined not by the number of machines but by their character, by whether or not they target the worker individually, and by whether the worker is able to notice and to name them. The problem is not the mere presence of the machines but whether the worker can see what the machine does and whether they can name it.

According to this picture, digital surveillance operates to a large extent invisibly, and confronts workers individually and one by one. An invisible and individualised pressure can be opposed only by a response that has been rendered visible and made collective.

In interpreting these findings, an alternative explanation should also be noted: a part of the differences of interpretation among workers may arise from the fact that some workers approach working conditions more critically in general. Yet the structure that we observed — that particular types of instrument produce a greater difference than others, and that knowledge of the system is more decisive than the number of systems — shows that experience is shaped not only by individual characteristics but also by the concrete properties of the systems.

Trade Union Policies

The findings of this research offer our union a concrete policy ground arising from workers' own experience and their own expectations.

Transparency: The Worker's Right to Know

The expectation that workers most frequently voice towards the union is transparency. 61 per cent of the participants want the union first of all to establish which data are collected and to explain this to them clearly. This proportion rises to 69 per cent in the group experiencing digital pressure most intensely. The expectation stands in first place in all groups, independently of the

level of experience. Against this, only a quarter of workers say that they know how the systems that assess them reach their decisions.

The ground for this demand is not the assumption that transparency will directly reduce the pressure upon the worker. Our findings do not support such a conclusion; indeed, workers who know how the system operates report the pressure not as less but as more intense. Knowing does not eliminate the pressure; it renders it visible. The basis of the demand lies elsewhere, and it is twofold.

First, the right to know is a right in its own right. That the worker should know which data are collected about them, how and for what purpose these data are used, and according to which criteria the systems that assess them reach their decisions, is a fundamental workers' right in the process of digital transformation. For a worker who is measured, who is scored, and about whose wage or whose employment decisions are taken on the basis of that score, this right must be recognised independently of its consequences.

Second — and this is the more decisive point from a trade union standpoint — knowing is the precondition of objecting. A worker who does not know the criterion of the system that assesses them cannot object to that criterion, cannot make it a matter of bargaining, and cannot give grounds for a decision that they consider unjust. Transparency is therefore not an instrument of relief but an instrument of struggle; it is demanded not in order to lighten the pressure but in order to render the pressure open to contestation.

It is important that this right be recognised in collective agreements, and that the processes of data collection and assessment be open to the worker and to the union.

Rendering the Invisible Visible

Our findings have shown that digital surveillance operates to a large extent invisibly, and that even workers employed in the same workplace possess different information as to what it is that monitors them. “Being monitored” is in most cases an experience that begins with the worker's noticing the system and naming it. An important function of the union is therefore to transform this dispersed and individually held awareness into common knowledge.

Our third finding directly supports the importance of this function: the worker who knows the system is also able to see its weight upon their own work. Trade union information work is the means of producing this visibility without leaving it to chance.

To this end, which digital systems are present in the workplaces, which data they collect and how they operate should be explained to workers; surveillance systems should be made a regular part of trade union education and information work. When a worker comes to know a system and is able to name it, it also becomes possible for them to develop a collective stance towards it.

A Collective Framework against Individualisation

The research shows that the instruments producing the greatest pressure upon the worker are those attached to them personally: the tablet in their hand and the camera that watches their body. The workstation screen attached to the machine, or the turnstile at the door, do not produce the same effect. The meaning of digital surveillance from the worker's standpoint lies less in the existence of measurement than in the personalisation of measurement.

This personalisation has two distinct faces, and the trade union response must likewise be twofold.

The first is surveillance. The worker's body, location and pace are continuously recorded. The response to be given to this is to make measurement itself a matter of negotiation. The pace determined by digital systems, performance criteria and rules of assessment must cease to be given facts that each worker confronts alone, and must become headings that the union negotiates collectively. How a target is set, what work is expected within what time, and under what conditions these criteria may be changed, are matters for collective bargaining.

The second — and the direction to which our findings point in particular — is the authority to decide. A third of the workers who work with a tablet say that their craft skill has been devalued, and a quarter that they cannot object to the decision of the system. The matter here is not only being monitored but the loss of any say over how the work is to be done. Trade union demands must therefore not remain confined to the negotiation of criteria: the worker's occupational knowledge and their assessment of the situation must be recognised as a legitimate input; where circumstances require departure from the instruction of the system, the worker must be able to do so and must not be subjected to sanction for having done so. Being able to object to a decision produced by the system must be an institutional mechanism operating through trade union representation, and not an individual complaints procedure.

This is what a collective framework means against the isolating logic of digital systems. The system leaves every worker alone with their own score, their own pace and their own screen. The function of the union is to carry these one-by-one encounters onto a common ground of negotiation. When a criterion to which a worker cannot object alone becomes a criterion to which the union can object collectively, the individualising power of the system has been broken.

The most original finding of this research is that a part of the systems installed on the grounds of “occupational safety” are experienced by the worker not as safety but as control. This is the confirmation, in workers' experience, of a concern that our union has carried for years. When our union stood against the wearable tracking devices that were to be introduced on pandemic grounds in 2020, it defended this same principle: occupational health and safety must be a right that protects the worker, and must not be turned into an instrument of control and pressure.

Our union's deep-rooted accumulation of experience in the field of occupational health and safety is a decisive element at this point. Our union holds a definite position on ensuring that occupational safety systems genuinely serve the purpose of safety, and on preventing the data collected by means of these systems from being used to control work pace or to measure performance. It is unacceptable that the safety and health of the worker should be placed at risk for the purpose of raising productivity.

Implications

As the pressure exerted through digital instruments intensifies and becomes part of the worker's experience, the worker's expectations also rise. For the majority of the workers who state that a performance scoring practice exists, these scores directly affect their wage, their bonus or their continued employment. 58 per cent of the workers who experience the pressure most intensely want the use of collected data as grounds for dismissal to be prevented, and 35 per cent want the pace to be reduced.

These expectations are directly connected with our union's 2018 approach to the Acceptable Workload. The measurability of production cannot be turned into an unlimited pressure to the detriment of the worker. Within this framework, keeping the pace determined by the systems within humane limits, the recognition of a right to object to performance scoring systems, and the prevention of the use of data collected through digital monitoring as grounds for dismissal, stand out as concrete headings for the collective bargaining table.

Our union has adopted the course of following, in the process of digital transformation, a line that is evidence-based rather than reactive. Researching the worker's everyday experience on a regular basis, setting out that experience with data, and sharing the findings both with workers and with the public, demonstrate the necessity of trade union intervention. In this context the present study forms part of our union's continuing activity in the field of labour research.

Conclusion

In conclusion, this report has aimed to set out, through the workers' own eyes, what digital surveillance and algorithmic management mean within the everyday experience of workers in the metal industry. Our findings show that digital transformation is not solely a matter of technology but directly a matter of labour.

The fundamental conclusion that the research establishes is that the effect of digital Taylorism upon the worker depends less upon the number of monitoring systems than upon whether or not those systems target the worker individually, and upon whether the worker is able to see and to name them. The worker who knows the system is also able to see its weight and to give it expression. The worker who does not know it merely reports less pressure. It is apparent that an invisible and individualised instrument of pressure can be rendered ineffective only by a form of opposition that has been made visible and collective. In this sense the joint effort of trade unions, professional chambers and the developers of information technology applications is of the utmost importance.

Our union will continue to defend the worker's right to know, their collective strength, and the true meaning of occupational safety throughout the process of digital transformation.

The Methodology of the Research

Sample and Data Collection

The data for the research were collected from 665 metalworkers employed in 109 workplaces organised under ten branches of the United Metalworkers' Union, by means of an online survey that opened on 26 March 2026. Participants' ages were calculated on the basis of the survey period (2026). Participation was voluntary and participants' identifying information was kept confidential. A total of 673 responses were received; eight participants, however, answered the informed consent question in the negative, and these records were therefore excluded from the analysis, all analyses being conducted on 665 participants. The sample covers five sectors of the industry; the detailed demographic distribution of the participants is presented at the beginning of the report (Table 1).

Measurement

The survey consists of nine sections. Workers' perceptions of which digital systems they encounter, and of which data the systems collect, were measured by means of questions permitting more than one option to be marked. The worker's experience — work pace, being monitored, occupational safety and the occupational future — was assessed by means of five-point Likert statements (1 = strongly disagree, 5 = strongly agree). The items relating to occupational safety additionally included a “this question does not concern me” option, and these responses were treated as invalid (missing).

Determination of the Dimensions

The factor analysis conducted on the Likert statements showed that the worker's experience gathers into three coherent dimensions: algorithmic discipline, the transformation of occupational safety into control, and algorithmic deskilling. The sample is adequate for this analysis (Kaiser–Meyer–Olkin measure of sampling adequacy = .917). The dimensions consist of five, four and four items respectively, and all three are at a reliable level in terms of internal consistency.

Different statistical criteria may yield different results in the determination of the number of factors, and this is an aspect of the research that must be stated explicitly: parallel analysis indicates that the structure consists to a large extent of a single general dimension. The three-dimensional structure was preferred not because it rejects this general dimension but because it distinguishes theoretically meaningful and interpretable sub-faces of it. The framework we use in the report is therefore hierarchical: a general dimension of digital Taylorism together with three sub-dimensions strongly related to it. This is both a finding and a limitation.

The transparency item (the level of knowledge of how the system reaches its decisions) was deliberately excluded from the factor analysis and from the clustering, since it measures an awareness rather than an experience, and was used instead as a separate independent variable.

Determination of the Worker Types

The worker typology was constructed by means of the k-means method on the standardised (Z) form of the three factor scores. The number of clusters was set at three, and the analysis was conducted on 649 participants; 16 records could not be assigned to a cluster owing to missing data. The cluster shares given in the report are calculated on this base of 649. The analysis divided the participants into three groups distinctly separated from one another: those experiencing digital Taylorism at a low, at a medium and at a high level.

Limitations

The research has three fundamental limitations. First, the data are cross-sectional; that is, they reflect the situation at a particular moment and are not suited to the establishment of cause-and-effect relationships between variables. The relationships conveyed in the report express association, not causation.

Second, the research measures not an objective inventory of the technology installed in the workplaces but workers' perception. The findings should be interpreted within this framework.

Moreover, the possibility cannot be entirely excluded that a part of the differences of perception among workers arises from the fact that some workers approach working conditions more critically in general.

Third, this is a direct consequence of the second point. Both the responses concerning which systems monitor the worker and the responses concerning how they experience those systems come from the same subjective source, namely the worker themselves. When we relate these two measurements to one another, the risk of common-method variance arises, and the relationship may appear stronger than it in fact is. The tablet and camera finding is a relationship of this kind and should be read together with this qualification. The strength of the finding arises from its being comparative: whereas the turnstile and the personnel time-and-attendance system, measured by the same method, produce no difference at all, the tablet and the camera produce a marked difference. Common-method variance alone cannot explain this distinction.