



SEAD

Sustainable Employment in the Age of Digitalisation:
challenges, obstacles and opportunities

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Case reports for specific occupations: the case of assembly line workers

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Introduction

The scope of the WP3 is to **study changing occupations** (in connection with the introduction of digital tools) in established organisations. The changes are related to job content, skills and quality of work. Those occupations were found according to two sources of recruitment: 1. individual workers from the selected occupations within the organization of the WP2 (made of 21 case studies); 2. individual workers from the selected occupations outside the organization of the WP2. **The objective** of this work package is to realize in-depth qualitative case-studies of technology-related change in specific occupations (*no matter what the organisational context they are embedded in*). The case study reports are structured according to the conceptual model that is used in this work package. This is discussed in the SEAD Chapter 1 Induction paper.

75 interviews of the five occupations depicted below were held, completed by 3 interviews of middle-managers and recruiters' representatives.

The five considered occupations are:

| Occupations | Assembly line workers | Customer advisors | Middle Managers | R&D Managers | Recruiters |
|--------------------------|---|---|---|--|--|
| Interviews number | N=11 | N=13 | N=21 | N=13 | N=17 |
| Definition | Workstations wherein a product is assembled progressively by different workers or machines, each of them executing a subset of the needed assembly operation (Moreira et al., 2015) | Workers who interact with customers after the purchase of goods/services. Their main aim is usually to provide service and support to clients in order to increase customers' satisfaction (Jasmand, Blazevic, & De Ruyter, 2012) | Managers who typically head a function, team or office and supervise day-today operations (Chen, Berman, & Wang, 2017). | Managers responsible for the research, planning and implementation of new programs and protocols. They also supervise the development of new products from the initial planning phase to implementation or production (Study, 2020). | Workers in charge of recruitment (the act of building a pool of potential candidates for a vacancy) and selection (assessing the capabilities and fitting of those candidates for the said vacancy) (Stone et al., 2015) |

1. Preliminary information

1.1 Overall profile of respondents

11 interviews were realized with assembly line workers. Two of them were also part-time union delegates. One extra interview was realized with 3 union representatives at a car manufacturer (not considered in the demographic information). The interviewees were between 29 and 58 years old (one info was missing from someone soon to be retired), and their seniority in the company ranged from 5 to 38 years. 9 were men, 2 were women.

1.2 Contextual information

Two of the interviewees worked for pharmaceutical groups, assembling, and producing medical components (international groups, around 1000 people working at one of the Belgian sites). Two worked for a small company doing tailor-made sheet metal work (45 workers). One works for a motor vehicle manufacturer (international group, between 500 and 1000 workers). One worked in a company producing tokens. One worked in a beverage company (international group). Two interviewees worked in a construction materials manufacturer (international group, 600 workers). Two interviewees worked for a company manufacturing mechanical mechanisms for sofas (international group, 50 assembly line workers). The 3 union representatives are part of a car manufacturer (international group, around 1000 workers at the local site), and the local site produces only electric models.

2. Type of technology(ies) used

Automation technologies

Some tasks were automated and are achieved by robots. For example, in a pharmaceutical company, they are used to regulate and achieve quality standards:

"They succeeded in creating automatic systems which, in order to meet quality standards, heated the die, so that we always had the same quality standards. So from then on we came up with automatic regulation, I'm going to say, you know? Initially it was by eye, it was the worker's expertise. The expertise of the eye, of the worker, now it's really regulation that's come in" (ALW01).

The logistics division at the automotive manufacturer has also been partly automated since tool transport is now operated by remote-controlled trolleys. Cobots were also introduced to help humans achieve some tasks, in a collaborative way. In the automotive industry, manipulators help workers carrying heavy loads.

Tracking technologies

Tracking technologies are used for inventory and logistics purposes (scanning barcodes to track components), and to monitor the production process in general. For example, in the automobile factory, connected tools are used in the assembly line to control the quality of the work (e.g. a connected screwdriver that supervises if a bolt has

been properly tightened). The exoskeleton¹ was mentioned in the same context, as a device being developed and being tested by scientists.

Collaboration/interaction/communication technologies

The augmented virtuality is being developed in a pharmaceutical company and would be used to project data on the work environment (e.g., instead of using sheets, settings points would be projected on a component through an augmented reality headset) with the purpose of avoiding errors, save time and communicate more efficiently. In addition, screens are omnipresent and display daily objectives, performances and information on the production process. Tablets are sometimes used as support for the training procedures: instructions, timekeeping...

Integrated systems

Integrated systems allow to program machines, track components and the production. The smart assembly line transports components from point A to point B, integrating data about the necessary components and steps. They allow managers to check which machines are operating or not at a specific time.

3. Changes / modifications of work

3.1 Changes in work content

3.1.1 The diversity of tasks

The effects of automation on the diversity of tasks are somehow contradictory and depend on the initial context (the type of task the worker was charge of). In addition, digitalization can disrupt the usual distribution of time allowed to each type of task. In some case workers appreciated that some of their administrative tasks were automated, freeing up time for more essential tasks, like face-to-face training. In other cases, encoding data is considered taking too much time:

"[...] there are some who are less comfortable, so they may need more time to encode. The last meeting was actually a point we'd made, that there was a lot to encode and that it was getting more and more complex. And as it was the folding colleague who was talking, he said that he didn't mind encoding, but that he might spend more time encoding than folding. Because he still has to do his job. There's a happy medium to be found" (ALW02)

¹ <https://blogs.cdc.gov/niosh-science-blog/2020/01/07/industrial-exoskeletons/>

"Exoskeletons used in the workplace are referred to as "industrial exoskeletons." Their purpose is to augment, amplify, or reinforce the performance of a worker's existing body components—primarily the lower back and the upper extremity (arms and shoulders). Despite a lack of research, manufacturers of these devices claim productivity gains, work quality improvements, and a reduction of the risk of work-related musculoskeletal disorders (WMSDs)"

Some workers expressed that using technologies made their job less annoying, modifying the daily routine:

"So that's the only thing I have to do. So when it's routine, it can really create boredom. It's not always the case, but it happens. And boredom is, it's pretty boring. But computer management reduces that a bit because you often have alarms that come on... if I have a limit that appears obviously my PC flashes red, you see, so there are more points of attention, and we can't take that away from them, this system gives you more to do than you had with manual, basically. You have to pay more attention, there's more monitoring of the process, so to speak" (ALW01)

"It's also a bit of a change from day-to-day work. Six years of folding... I like what I'm doing but, well, at some point you get the hang of it. Here, well, it's a bit [...] new, it's office programming too, so it's a bit of a change too" (ALW03)

Reversely, automation can lead to repetitiveness when associated with work fragmentation. The spatial confinement of workers can represent an important change in this context:

"It's almost more repetitive than before, a bit... Because before, for each programme I had to go to the workshop, so it varied a bit... I had to go and get my sheet metal, etc., whereas here, well, sometimes I take my parts, I do the nesting [on software], I machine, I cut... I take my parts, tock, tock... There are a lot of parts that don't need much work on them, so it goes by quickly. I pick up my parts, tock, tock... There are a lot of parts that don't need a lot of work on them, so it goes by quickly... It's always more or less the same thing" (ALW02)

3.1.2 The complexity of tasks

The automatization of certain procedures can reduce the complexity of a task. For example, the centralization of data helps with the preparation of orders, reducing the number of steps:

"It's simpler in the sense that... They manage a lot of things for nesting, before in fact we really had the list of parts with the quantities written in front, and I had to follow with my finger "ah yes, it's such and such a part number". Find it in the file, import it into the file, look at the quantity, put in the quantity... Whereas here, I tick. I do 'import', it imports the parts into my file so I don't have to go looking for them in each customer file. Because before [...] I could have 10 different customers with 10 different orders, so each time I'd have to go into 10 different files, find the right part and then put in the right quantity [...] Now I tick. He creates a folder with a copy of all the parts I need, and he changes the name by putting the quantity in front of the part name" (ALW02)

However, using digital tools imply new methods and interfaces that workers have get used to, e.g. programing machines, using tactile screens...

3.1.3 Type of tasks

The automation tends to reduce handling tasks (called “manual” by some workers) and increase tasks such as encoding data in digital programs. The change was even more obvious in some company where they implemented visualisation programs:

"It's much more cognitive. I almost never go into the workshop any more. Before, I used to have to go into the workshop with the clark, lifting the sheets to look for them after I'd fallen, because sometimes they'd be one on top of the other, so I'd have to lift one... take it out, measure it, put it back on the pallet. It was a bit more physical for that. And yes, we worked a bit more in the workshop. I had to go to every programme, whereas here, well, I can do it all day long without having to get up" (ALW02).

Some workers mentioned missing the “physical work” after their tasks were automated.

3.1.4 Fragmentation of tasks

As mentioned above, the automation can result in fragmentation of the work, which can lead to a feeling of repetitiveness. It also decreases the workers' capacity to have a view on the final product and can lead to atomisation (less collaboration with colleagues). Although, fragmentation does not necessarily result in a lack of diversity, depending on the context:

"In fact, what's also going on is that before we had, so our orders were allocated, so sometimes we'd spend 4 days on the same file [...] Now that the parts come in dribs and drabs, we don't spend 3-4 days on the same file, I'd say. It could be just as heavy at times, well the same thing for 4 days" (ALW03)

"We change [orders] more quickly. Because there's nothing to do, each customer has his own area of expertise, so it's always the same parts that come back. It's similar, and yes, the fact of changing customers does allow us to diversify our work" (ALW03).

3.1.5 Predictability of tasks

On the one hand, the predictability of tasks is higher because workers visualize better the workload to come:

"I think there's a better overall view. Given that there are quite a few possible filters, depending on how I filter I can see a bit of the load that will arrive on this or that machine" (ALW02).

On the other hand, when digital tools are dysfunctional, having to adapt the procedures can be a source of frustration and lead to a feeling of wasting time:

"We've had minor breakdowns, because the encoding has changed. We used to scan, check and run a batch. Now we scan the roadmap, look at the parameters, and then we have to go to another machine to validate [...] come back once it's loaded, to

revalidate [...] But it's been very complicated, we've lost a lot of time because of that" (ALW09).

In addition, automation usually means that a large proportion of the problems encountered by the workers can only be solved by technicians, which can also cause frustration:

"...] we know what they generally do, they order a machine, they don't receive the operating instructions, during maintenance days or a shutdown they analyse the machine, there are people, let's say, engineers who are there ... they're not there H24 so when they're not there what do we do? So we ask an operator who was in the technical department during the launch: "ah yes, could you help us? You've seen things, so..." , "oh yes, I'd like to", so he helps, he gives feedback, but... when things don't work, we don't know... we don't have a magic wand" (ALW09).

3.1.6 The variation of the workload or the workspace

Automation often leads to an intensification of the work. The workspace tends to increase and downtime is reduced (occupation rate increases). When the workload increases whereas the time allocated to task doesn't, this leads to an acceleration of the workspace in order to meet the productivity standards:

"If you take my work at the end of the 2000s and my work now, all these things have obviously speeded up my work, because I haven't been given any extra time. All this has added to the content of my work. So all these things, they haven't come to reinforce me with someone next to me or anything, no, it's something I have in addition. Before, I used to do it manually; I had a production report, for example, where I encoded things manually. Afterwards, all these things didn't add anything, on the contrary, it just speeded up the work (ALW01)

In this case, computerised management means that if workers deviate from the prescribed procedure or target, they must justify it immediately, adding to their workload:

"Now if you've got that, you've got to get into the system, a deviation system, and explain it, you know, why you've gone down, yada yada... To tell you the truth, you have to justify everything you do, it's still possible, but you have to justify everything. So what does that create? Well, it creates a workload" (ALW01)

This intensification/acceleration is a source of stress for workers, especially when the machines are dysfunctional:

"[...] It generates stress because... well, if the machine's working well, there's nothing to worry about, but as soon as you find yourself with production hazards, which could be anything, it could be a breakdown, it could be anything... what does having extra tasks generate in the worker? It generates stress, because the guy panics because he

doesn't have time to do that, so he has to carry on doing the tasks but speed them up, so yes, it creates stress" (ALW01).

Another perverse effect of automation on the workload results from the job cuts: when the tools are dysfunctional and the workers have to go back to the manual procedure, they are faced with a heavier workload because the workforce has been reduced:

"The operators used to load things by hand, but in recent years they've come to use articulated arms, you see? And these articulated arms, in the best of all possible worlds, like when [name] bought it, obviously never break down. But that's utopian because obviously it breaks down all the time. So what does that create [...] when the robot breaks down? When the robots were introduced, staff were withdrawn... Obviously, the robot was taking someone's place. And so when it breaks down, the worker today has to do the robot's job, his job, and the person who has disappeared, because the person is no longer there. So these implementations of new technologies that they've supposedly come up with to reduce the ergonomic load... [...] 85% of the time it works, but the 15% of the time it doesn't work it's the worker who's dependent on these machines, so...". (ALW09).

However, in specific contexts, particularly in a smaller company, this intensification wasn't observed. Indeed, by reducing the time allocated for some tasks, automation allowed workers to feel less overwhelmed by the workload:

"Software] it's mainly the time I save. Otherwise I don't think they've added any extra tasks... I have a bit more time to nest [...] there's more, but I go faster. So in the end it all evens out a bit. But I'd say there are more frequent lulls. In fact it often works in waves, you have a lot, then a little dip, then a lot, then a little dip... And I'd say that there are more dips, because we're better at absorbing the excess orders" (ALW02)

The variation of the workload depends on the repartition of the work between the human and the robot, (e.g. does someone need to "feed" the machine, or to monitor it's work?):

"It depends on the machines and the places, because there are machines that have to follow or pick up parts or whatever ... and there are machines where it's a robot that puts it on a trolley, for example... so, I'd say, once the operator has started his machine and it's running well, he can relax [...] when I had to change bins I changed the bins, but in between, when it's running, I mean, you don't have to do anything else, you just keep an eye on it once and that's it...". (ALW10)

Some workers pointed out that this intensification also is an obstacle to socialization between colleagues.

3.1.7 The competences that are needed

As expected, the mobilisation of digital skills increased. Developing them can be a source of valorisation for some workers, even though the learning curve can represent a challenge:

" Allez, before... Like at our place, where I'm standing now, dropping off records... With all due respect, anyone can do that. You don't have to have gone to school for that, so to speak. Now with this automation, yes... Now you can't put everyone to that job either. Some jobs you really have to... You have to think and yet, yes [...] you have to think more. Here nowadays that's also a screen, with touchscreen. It used to be with buttons. You still have to know a bit what to do [...] I do find it a bit more difficult to train someone than it used to be. It used to be just imposing by hand. Laying on slates. That was picking up a slate and imposing it and afterwards scraping them off, so to speak. Anyone could do that, you didn't have to have gone to college for that. Nowadays there is... They have all put robots, they have put a lot of computer-controlled things on the machines. Then you have to get a bit... You have to get a bit of education about that "(ALW08)

" Faut être plus à l'aise avec l'informatique je dirais [...] Avant, le fichier Excel, il suffisait de lire et de cliquer une fois. Ici il faut être plus à l'aise, parce qu'il faut... Des fois c'est fatigant, enfin fatigant, des fois il faut chipoter dans les menus... " (ALW02)

In some cases, the qualifications required for jobs have changed. It happened in the automobile industry, where the level of diploma required has increased and technical skills have become important:

"Without automation, we would say [...] labour was plentiful and unskilled. Nowadays the workforce has to be skilled, because we're talking about ATs, which means technical staff who work on the robots [...] when the robots stop for the first time, they have to be there to see what's going on, so they spend a few minutes looking to see where the fault lies. And then if things don't work, they call the technicians, who are maintenance technicians, electromechanics" (Union representative at a car manufacturer).

The mobilization of more technological skills can result in the development of new training programs provided in the companies. In the pharmaceutical sector, we also observe a growth of IT and desk occupations:

"So somewhere along the line we may have lost some technical jobs, manual jobs I'd say, and replaced them with office jobs, IT jobs [...] The number of jobs hasn't necessarily fallen in the time I've been here, but it has changed. Unfortunately, the front-line soldiers [...] have stayed in complicated jobs, so it's the least qualified people... And things have speeded up a bit for these people. But it still created jobs on the side. But it's still created jobs on the side that didn't exist before" (ALW01)

However, it was also pointed out that not all skills could be reproduced by robots, especially the ones related to perception, manipulation, or hard-to-reach areas:

"...] For example, you're under the car, they're going to make a line of putty, they're going to get there. But in the engine compartment, for example, where it's really put in... you really have to get into the little corners, you have to do it manually, you don't know... the robot [...] It's really a problem of access. The robot will have difficulty accessing certain areas of the engine compartment, for example. The inside of the car" (Union representative at a car manufacturer)

Although, instead of automation, the managers could still think of other rationalization strategies to reduce costs:

"No, it's not possible. No, because you'll always have that little adjustment, that finesse that's needed [...] In my job it would be complicated. But instead of having an operator on one line, we could arrange the production lines completely differently and put one operator for two lines, that would be possible. But the human eye and the human hand would be [necessary]... someone would still have to be there to manage these IT tools... that's impossible from a distance [...] There's still some manipulation, but we could rationalise, that's clear and simple" (ALW01)

3.1.8 The worker autonomy

In some cases, the use of technologies can increase the feeling of autonomy. This happens when it allows workers to be less dependant on other occupations in the factory:

"[...] in terms of performance, we're much more efficient and more autonomous too, I'd say. Because with the new machines, we're less likely to find the draughtsmen because we're better at zooming... We're also better at taking dimensions than before, when in doubt we'd have to go and find the draughtsman, so it was a waste of time [...] and when we had to touch up a programme, quite often it was they who had to do it, because we didn't have the tools to do it I'd say, whereas now we can do it more easily ourselves" (ALW03)

On the other hand, the autonomy is limited by the generalized control (surveillance) performed through digital systems, which is sometimes underestimated by workers because it is not performed by humans:

"[...] when you go out into the field, some people really get that impression, they really feel that they are more autonomous in their work... so remember what I told you 5 minutes ago, for me it was quite the opposite, because for me you're very locked in, you're being watched, you're being spied on everywhere, but people have the impression that they're more autonomous because they're doing a lot of tasks, they have the impression that the quality department isn't behind them any more, they're doing their work, and so they really have this feeling of autonomy" (ALW01)

3.1.9 The learning opportunities

In general, workers are learning to use new technologies "while doing it", and suffer from a lack of training:

"At the start, I didn't have all these tools that have become part of my job, you see [...] obviously we have a little training, but it's a really random thing, you see, it goes very quickly, it's you who has to develop them in relation to the fiddling you do with them, you fiddle with them every day, then you come up with your method [...] even if it's standardised, no one ever came to show us, you see, in broad strokes" (ALW01)

3.1.10 The control

The digitalisation of the production line, especially in big factories, result in an increased control through data capture and tracking, leaving workers less room for manoeuvre. As a worker mentioned, "nothing escapes the system":

"You encode a ton of material, for example you feed the machine PVC at the start [...] you scan the label, it takes the weight of the pallet, and obviously what you spring out has to correspond to what you encode. So if there's a difference... before there wasn't, before if the operator did it manually, for example if he had a failure and forgot to make a note of it, all that waste disappeared [...] Now you really don't, if you have a tonne you have to produce a tonne or you have to justify it. So all this has really put a check on the work too" (ALW01)

As a result, the quality control is less performed by direct superiors on site. In the automobile manufacture, control is sometimes performed by manual tool themselves, as in the example of the connected screwdriver:

"Some of the workshops were very physical. Today we still don't have robots, because it's not easy to assemble car parts with a robot, but we do have connected tools. For example, with human handling [...] Before, when we tightened a bolt, we tightened it and that was it. But now there's a connected machine that will tell you whether or not the bolt has been tightened properly, and if it hasn't, digitally, the car will have a digital card that will say "such and such a wheel hasn't been tightened", or "such and such a bolt hasn't been tightened", and the reworker will normally see this, they also have a device that will see the defects for each car and say "I have to repair this car" [...]. And then it automatically stops the line [...] the line will stop, or it will beep and the team leader will have to come and see what's going on, he might say "OK, you let it go, I'll do the touch-up, or the touch-up man will do it". ... there's traceability of all defects" (Union representative at a car manufacturer).

In addition, the display (on screens) of performance indicators is also encouraging self-control among workers. Younger workers, especially those who are in a more precarious employment situation (e.g temporary workers), are said to be more sensitive to those techniques, because they still have to prove themselves and because "that is all they know":

"It's a slightly older department, but we have departments where IT management is more present and where performance indicators are also more prevalent. And so,

obviously, sometimes I go to production areas and see people who are caught up in this system, and who are running around with machine performance indicators, you see? Sometimes it's even timed hour by hour, with colours, so green, red, and so you have people who adhere to... the old operators don't really adhere to it, but some young people do, because these people have been formatted according to these models... they've entered the race for jobs, that's what I call it, as temps or fixed-term contracts, and so they've been used to reacting to these performance indicators... and what do they do, they chase figures, basically. Always being positive, always being in the green... that's it. And all this new technology that's come along to help them, well that creates problems" (ALW01)

The control of training and other administrative procedures also tends to be digitalized:

"I think it's easier for him [the manager] to check that I'm up to date and that everything's in order as far as training is concerned, because obviously if there's something I'm not doing, like with IT, we'll send him an email to say 'look out, such and such an op[eration] hasn't been validated', or 'such and such a girl hasn't signed her new work instructions', 'look out, such and such a person has just come back from sickness and needs to be validated'. So yes, he has a vision... well, it's easier for him to see that everything is fine" (ALW04)

A positive side of the control's digitalization is that it prevents workers from delivering a product that does not comply with quality standards, which could be grounds for a sanction. However, in some case, quality control is impossible to automate. And robots' work is often controlled by humans:

"In fact, there are entire lines that just check. They check for small paint defects, because the robots do have a few small dust defects, etc. And so it's really complete lines where the people are there and all day long all they do is check" (Union representative at a car park). And so it's really complete lines where the people are there and all day long all they do is check" (Union representative at a car manufacturer).

3.1.11 The effective uses of digital tools

In some situations workers need to deviate from, or even bypass the prescribed digital procedure. For example, to save time:

"Sometimes we have to quibble a bit. In fact, in the case of certain relaunches, normally the relaunch as I explained to you, the designer puts it back into cutting, and I have to reprogram it, so reserve some material, re-encode for a while, and so on and so forth. But sometimes we simply rework the part, sometimes there's a hole missing. Sometimes the tool has broken or something. But we're not going to reuse any material, we'll just put the part back and redo the hole. But then, if they put it back into the [software], I have to reserve material that doesn't exist, that isn't used.

So sometimes, we put it in a bit like we say in stoemeling, they send me an email saying 'can you redo the programme', and I redo a little programme without going through the [software], because it's quicker, it's actually a bit special cases as I say, there are so many special cases that it would be complicated to be able to encode them all" (ALW02)

A generational gap is revealed by senior (and older) workers showing resistance to digital tools. This can be explained by the fact that they were used to work differently for a long period of time, which can make it harder for them to accept or to get used to changes. In addition, the younger generation has been socialized to digital tools longer:

"[...] going from paper to digital... It's a big change. Especially as we're, well, we're the generation that's experienced both versions, I'll say. It's not like today's young people where... everything is digital, everything is..." (ALW03)

On the other hand, it seems that this resistance can be mitigated by demonstrating the benefits of digitalization to workers, and by involving them in the process:

"In the end, when you look at it over the long term, encoding it saves time afterwards, so everyone loses maybe 5 minutes but afterwards we save 1 hour. I don't know how to explain it, but it saves time in terms of overall organisation. And that, well, that was a bit complicated to show them, and [name] came up with the idea, she made a little game. So she made little papers with orders. And we had to show the life of an order in the workshop, before and after, the [software]" (ALW02)

3.2 Changes in working conditions

3.2.1 Ergonomic exposures

Automation helps reducing workers' exposure to hard manutention tasks (e.g. heavy loads). For example, visualisation tools can prevent from moving components in a testing phase:

"I don't go into the workshop as much [...] I used to have to work hard, sometimes the metal sheets were quite heavy. So lifting to go and see if there was a big drop could quickly become heavy, you needed two people to lift and look. Sometimes two people weren't enough, because the sheets were already quite large. And here, well, I can tell, so in fact even my colleague doesn't have to exert himself as much. Because when I do my programme, if I cut the sheet in half I already know the fall I'm going to make" (ALW02)

However, when robots dysfunction and workers have to take over manually, their (physical) workload could be greater than before:

"[...] when it breaks down, the worker today has to do the robot's job, his job, and the person who has disappeared, because the person is no longer there. So these implementations of new technologies that they've come up with supposedly to reduce

the ergonomic load [...] sometimes it works, I'll say 85% of the time, but the 15% of the time when it doesn't work it's the worker who's dependent on these machines" (ALW01)

In addition, limiting some ergonomic exposures doesn't mean they are suppressed. On the contrary, repetitive gesture might be amplified with work fragmentation and acceleration. In addition, new ergonomic exposures linked to the use of screens and the seated position have been reported:

"We had a training session recently because some of us had suffered back pain and neck hernia... The position at the screen. And we also had someone from the university, who specialised in this area, come along. It was the first time he'd come to do this and it was really great. He taught us a bit about the positions in the office, depending on your height, etc. " (ALW02)

In the automobile factory, due to the robotization of certain departments (e.g. painting), workers' tasks have shifted towards quality control, which requires visual attention and can be associated with eye strain.

3.2.2. Physical and/or environmental exposure

Robotization has reduced the exposure to dangerous conditions for workers in charge of painting or welding, working in difficult environment in terms of brightness, heat, exposure to chemicals and fumes.

3.2.3 Workplace

Although (most of) the work is still realized on site, digitalisation results in the colonisation of personal devices by institutional communications:

"[...] for me, digitalisation is also on my mobile phone, meaning that I have my emails and my calendar on my phone. So I'm always up to date. And it's true that sometimes at home, I'll automatically receive an invitation and I'll see it" (ALW09)

In some cases, tasks (e.g. programming) can be realized from home. This could be perceived positively, because of greater comfort and better working/private life conciliation:

"In fact, with Covid ben we had to introduce teleworking. I'd already talked about it, but it wasn't possible. And then here they finally made it possible, especially with the [software], which has helped a lot. I don't have to go into the warehouse any more. So I can do it from home. And I really liked that. Because it suits my style of work, since I like computers I have good equipment at home. And what I really liked was that I also saw my partner more often, because she gets up later and I saw her in the morning, I mean I got up at the same time, I mean I got up 40 minutes later to start at the same time, so that's already good" (ALW02)

3.3 Changes in employment conditions

3.3.1 Contractual arrangements

Digitalisation also concerns HR data and procedures: personal information, labour input, holidays and sick leave, trainings, etc.:

"The [platform] is for putting in our holidays, we manage that too [...] it's digital too [...] In fact we encode our holidays, if we have a medical certificate we encode it in there, if we want to check our hours, or we want to change personal data, we know how to do it in there" (ALW09)

"[...] my benefits are managed by computer models too... by a system called [name], and so all the workers have to enter their benefits themselves... as long as you work normally that's fine, if you ask for a day off you manage it. So you see, everything has become computerised from start to finish. And that's led to the disappearance of service secretaries" (ALW01)

A risk associated with the "empowerment" of the worker through auto-declaration was mentioned:

"In the old days, the department secretaries used to say, "Well, the worker is entitled to a multi-skilling bonus, I'll encode it and put it on his pay slip", and at the end of the month the benefits were paid. Nowadays, it's the worker who has to do it. If the worker doesn't do it, well, they don't appear anywhere" (ALW01).

3.3.2 Training opportunities

Many workers underlined that too few training opportunities were provided, which could cause stress among workers, who felt like they were on their own. Some union delegates mentioned that changes happened very fast, and that they had to demand better training and follow-up. As mentioned earlier, this is usually even more problematic for older workers, less used to deal with technologies:

"There are people who aren't familiar with digital tools... you've got workers who didn't have that kind of contact, and they've had to make do with these things. Which isn't always easy... Now it's normal for young people, it's a lot easier, but I've got 60-year-old workers who've had to adapt to these digital tools. And without much training" (ALW01)

As for the HR procedures, we observe a digitalisation of training activities themselves, since workers have to follow online trainings. Although, it seems that the training and follow-up is more personalized in smaller companies, where someone is often designated as a contact person to answer questions, accompanying, checking, giving feedback:

"Everything to do with order management and folding, I'm still swimming, as I don't use it very often. So she trains us in this area, asks us how things are going, we get a

bit of feedback, as we come from each sector. And then when we're OK, she organises training sessions with the rest of the workshop, divided into small groups" (ALW02)

In some companies, continuing education is organized in order for workers to follow technological evolutions:

"[...] Temporary workers have this too [...] At worker level, not yet, there's a discussion about doing it. There's training to keep up with technological developments. There's a lot of training, whether it's for technicians, they go to [company]... There's a lot of training related to that. We have a training centre too. We have a training centre too, with a few workers who train people in quality and logistics... We train people all the time, even on cutting measurements...". (Union representative at a car manufacturer)

3.3.3 Evaluation

The evaluation relies more and more on (real time) quantified performance indicators. The tracking of operations at every step of the line also tends to individualize workers' responsibility. As mentioned above, the impact on young/precarious workers who's place in the company is not secured (yet) could be more important in terms of internalization and formatting:

"When they arrived, these technologies had been implemented, and that was all they knew. They didn't know the manual side... and so there you have it, all the performance indicators we see now, which are computerised management systems, displayed on screens all day long or on media, boards behind them and all that... that didn't exist, and all that also encourages them [...] because of that they've been formatted, and also because of the race for jobs. When these young people come back they want a contract, so what do they do? They give it their all, to say the least... to try and get a contract. And then they get caught... be careful, once they've given up a bit after all that, we come and tell them "yes, but you're not as productive as you used to be! (ALW01)

In addition, the evaluation process is sometimes itself digitalized, e.g. workers receiving their annual evaluation through digital channels.

3.3.4 Remuneration, incentives

Automation can be associated with financial valorisation (salary increase or bonuses). However, this valorization should be put into perspective given the deterioration of the working conditions it led to (intensification of work, less downtime, increase of the workload...):

"We have what we call function classifications. So we evaluate the work you do. And obviously all these little skills are put together, so the use of [software], the use of tatati, the use of this, technical operator on what I explained to you, articulated arm, patati patata... But all that comes into play at some point when the job is re-

evaluated, and so obviously these people get a small pay rise... but when I say a small pay rise, I'm not talking about 500 euros a month, we'll say that if he moves up a grade he earns 25 euros, 50 euros gross a month, and so that gives you 25 euros net a month... but alongside that we may have done away with a colleague, the colleague is no longer there, you're working... If you put a cursor on it, before you might have been busy 75% of the time, now you're busy 85 or 90% of the time. And so they have the impression that they're making progress, but no, we're not giving them anything for free" (ALW01)

There is also an evolution of the criteria taken into consideration within the valorisation system, from (bad) working conditions to qualification:

"In the past, the department was noisy and dark, and the work was dirty and dangerous. Ergonomically, there was virtually no ergonomics, they worked with big time clocks, bent over, so today there is an improvement, of course, in the working environment and working conditions. It's brighter, cleaner and less dangerous. And of course pay used to be linked to the arduousness of the work, meaning that someone who worked in sheet metal had a higher category than someone who worked in assembly. Nowadays, pay is more closely linked to qualifications, because technicians and TAs have higher pay grades than assembly line workers" (Union representative at a car manufacturer).

3.4 Changes in employment relations

3.4.1 Worker's involvement and participation

There is often no or very limited involvement and consultation of workers (or union delegates) upstream when it comes to the implementation of new technologies:

"...] with the delegates it's an obligation, they have to present it to us. But it's just information, it's nothing more than that, we come to the CPPT, the advisory committee... CPPT stands for protection and, yes, work. So we come, we say "well, we're going to implement this, there'll be such and such safety criteria, yada yada", but if your question was "do you think this would be good? do you think...", no. It doesn't happen. There's no exchange, even with the operators, on how best to implement it for everyone, no, we implement it and then we iron out the kinks, you see, we decide to find solutions in the field, at cruising speed we try to find solutions, we try to identify what's good, what's bad... It's done afterwards, but there's no consultation either at the level of the union delegation, or at the level of the workers, it's presented, full stop. Presented, implemented" (ALW01)

Furthermore, there are few interactions between workers and engineers in charge of developing new projects/methods:

"In general, they're very discreet people, you see, they're method engineers, people like that who work on lean methods, in general. So don't dream, they're very discreet

people, you rarely see them, they work on a project, it lasts a while and then... these jobs move around a lot, they're not people who are there... they're people who move around a lot" (ALW01)

However, workers' involvement seems more common in smaller companies:

"So there's an infrastructure group, I think, which monitors a bit... I think it's the workshop manager with... and basically they discuss the projects with each other, with [name of manager], "what do you think?", "what do you think is needed?", so there's feedback to the boss afterwards, of ideas that the employees and workers have had" (ALW02)

3.4.2 The collective representation

Union representatives are informed about the projects, but their concerns are not taken into consideration before their implementation:

"With the delegates it's an obligation, they have to present it to us. But it's just information, it's nothing more than that, we come to the CPPT, the advisory committee... CPPT is protection, that's it, yes, of work. So we come, we say "well, we're going to implement this, there'll be such and such a safety criterion, yada yada", but if your question was is there a sharing, "do you think this would be good?" or "do you think... ", no. It doesn't happen. There's no exchange, even with the operators, on how best to implement it for everyone, no, we implement it and then we iron out the kinks, you see, we decide to find solutions on the ground, at cruising speed we try to find solutions, we try to identify what's good, what's bad? It's done afterwards, but there's no consultation either at the level of the union delegation, or at the level of the workers, it's presented, full stop. Presented, implemented" (ALW01)

They can only give feedback after the implementation:

"It's when they implement it that we react, but not before that, at the level of decisions, installations for example, at the level of models, etc. We have no [decision-making power] at all. We don't have any [decision-making power]...". (Union representative at a car manufacturer)

3.4.3 Social support and contacts at work

Technicians/IT workers have a prevailing role in case of problem with automated systems:

"...] it's when there are new models, he's the one who comes to implement the new program in the machine and then he's there to check that it's going well [...] there are a lot of new models that are tested, he's obliged, we'll say, to modify certain programs to be able to make these models, and that's why we have a fairly close relationship with the computer scientist" (ALW11)

When support procedures are digitalized, it can generate frustration. Indeed, in case of failure, it happens that workers have to complete and send form to the maintenance service which slows down the process. Moreover, maintenance and support services tend to be externalized, sometimes in foreign countries, which can generate a feeling of disempowerment and lack of support among workers.

3.5 Changes in the work organization

3.5.1 Distribution of tasks

Work is still distributed by supervisors but there are less human exchanges when tasks are generated by a program. This is particularly obvious in smaller structures, where workers are closer to managers on a daily basis:

"There are fewer direct human-to-human interventions [...] Now I arrive, I open my computer, there I go, I know I have to do this, that, that. I've got deadlines to meet, I know I'm going to, that's it... There are priority barometers for things that are a bit off schedule...". (ALW03)

3.5.2 Division of tasks

As we saw, technicians have a greater role in the day-to-day operations. The division of task also changes when digital tools allow workers to rely less on other functions in the factory:

"...] when we had to retouch a program, quite often it was they [the draughtsmen] who had to do it, because we didn't have the tools to do it, I'll say, whereas now we can do it more easily ourselves on the folding machine [...] They send the part, we fold it [...] [When it was necessary to make] checks, modifications, yes if there was a problem [...] Before we didn't always know how to change the folding program, but now we know how to do it" (ALW03)

3.5.3 Coordination of tasks

The communication about new procedures, methods and technologies is carried out using online tools instead of oral exchanges (e.g. personal devices, computers, screens):

"But what they're doing now, um, they're doing a lot of quality minutes too, with us, so when there's something new or we haven't applied it because of a lack of feedback, we get a little reminder and it's on the screens too" (ALW09).

"Afterwards, it's the same, if there have been changes to a process, I'll go there as an operator and scan my badge on the computer and there I'll find the assigned changes. Before, it was all on paper - the line-leader would come along with the change and say, "There's been a change, now you have to do it like this, like this, now it's all computerised [...] It may simply be another way of working that has to change,

because maybe we've realised that manipulating the system like this, taking it in a certain way, could damage something, it tells us that we can't take it in such and such a way, it could be something else entirely. Often it's something that's been improved, an improvement to the workstation, then it could be, for example, an area [name] that's changed location, an item in the workshop that's changed location, the IT has to change, because it's no longer in the same place. So it's a change of IT, so the operator has to check that she's read it properly and knows that there's a change at the workstation" (ALW04).

In addition, digitalization and centralization of data helped workers responsible of training spend less time for administrative tasks and that could be allocated to the follow-up:

"I'm not into paperwork. When this came along, I thought, phew, this is great! [...] Of course, the time we spent filling in the paperwork was time we couldn't spend online, or training someone else. Because we always had to get out a line to be able to keep up to date so that we could have a really regular follow-up of the documents. It's the same thing, the instructor has to validate each operator on the workstation once a year. So on the tablet, we have a little application that tells us which operator has to be validated at which workstation. So it's still a bit time-consuming, and before the tablet, it was also done on a PC, but then we really had to go and find the files for each operator, look at when she had to be validated on such and such a workstation and then modify it, re-encode the new arrivals. But now everything is computerised, and she's already entered into the files, not just gone onto this application, and there we have a list of operators to validate (ALW04).

The digitalization of the task coordination can also help avoiding mistakes, by allowing to pass on information more effectively:

"...] to make production instructions, so to say 'here, we've used this tool, be careful with this fold' or 'we need to put inserts before this fold', that saves a huge amount of time. Because you no longer need to "think", in inverted commas. You open it up, you see that there's a production guideline, you know "OK, this is it and that's it". And you can get to work straight away. Before, you'd have to say to yourself "oh yes, no", or someone else would fold it "how did you do it?", "well yes, I did it like this", then you'd have to show him, then... In that respect, yes, we've saved a huge amount of time. And avoided a lot of problems too. If the other person doesn't have the same idea, he folds and then it's too late... Then you have to throw in another piece" (ALW03)

However, it isn't as advanced in all factories. For example, the stock management is sometimes still carried out "manually":

"Frankly, there's one thing I don't understand about a structure like this... It's the stock level... because when we produce, we put everything on paper... After the paper, it's [name] who takes it. So he'll see everything that the operators have done... he'll

see it all in the operators [...] after everything that's on the shelves, it's all still old-fashioned... i.e. they have to count, and then they write it all down on paper [...] Whereas I say to myself, there could be tablets... And then, that's ... and once again, I think it's due to budgetary constraints that they're not making this effort at revolution because it would frankly be better for everyone...". (ALW11)

4. Surprising elements

First of all, even when there is resistance at first, especially when new technologies are sometimes implemented very quickly, workers usually end up accepting the change over time. And the management rarely goes backwards.

Second, in some contexts, automation is justified by quality standards (e.g. pharmaceutical and automotive industries).

5. Digital tools perceptions

Some workers expressed that they regretted the “physical work” after their tasks were automated. Indeed, it was associated with a feeling of accomplishment (“hard work”), of “keeping busy” (time went by faster), as well as vector for socialization with colleagues:

« [...] that was then automated that I no longer found that enjoyable. There at [current employer] that is real manual labour, I have full hands when I come home. I worked, my arms hurt and that gives me satisfaction again compared to [former employer], where you went in clean but left clean " (ALW06)

Others fear a progressive decrease of the unqualified jobs’ quality, because of the working conditions’ degradation:

"There are people who won't be able to do that [move up the corporate ladder] because there are people who are really... they haven't been trained, they haven't been to school, so there they are with basic jobs. And unfortunately these are the people who are going to pay the highest price because they're going to find themselves in very complicated jobs, with crazy work rates, with little downtime [...] we're going to make them more and more insecure. That's loud and clear, and you can also see that flexibility is being demanded, more and more skills development, flexibility and all that. All this is accelerating for these people and their pay isn't going up, quite the opposite" (ALW01)

Indeed, union representatives highlighted the incompatibility between digitalization and career extension:

« It's harder for older workers to adapt [...] it's not easy for an older worker to keep up with the speed of the line. So we're always trying to find solutions outside the chain, whether in logistics or picking [...] but it's not easy. Nor is it... the jobs aren't... hundreds of them. So there's an incompatibility between longer careers and technological change [...] you have to work longer, which is a government measure, but how do you do that? Because a lot of older workers can't necessarily adapt to change" (Union representative at a car manufacturer).

Although ergonomic improvement is put forward as a justification (by managers), this argument is rapidly contradicted by the obvious intensification of work, responding to higher productivity targets:

"It has speeded up my work, because I have more tasks to do for the same amount of time... But basically they didn't come to me and say 'well, there you go, you've got a little extra task, we'll put you with a friend who'll come and do... while you do your tests, who'll monitor your regulation', you see, no... So that means that all these... yes, in the [best] of worlds as they see it, it works well, yes, but it does speed up the work at times and even very often [...] Afterwards the workers adapt, it's always the same thing. They adapt by finding systems that they put in place themselves, they change their working methods themselves [...] And they always come up with "but it's easier, it's more ergonomic, it's more flick, it's more flick..." [...] All this in the name of a better working environment. [...] In general, it's all about squeezing out staff, speeding up work and killing downtime [...] You can see where they're going, that's just the way it is, but they're [...] certain that they're creating well-being at work with these things. But it's quite the opposite, it speeds up work" (ALW01)

Indeed, the fact that the ergonomic is in some ways improved doesn't mean that the workers' long-term well-being is a priority for the employer:

« But now, if the boss does something about ergonomics, it's not just to please the worker. It's because there's something behind it. It's always behind the level of productivity too. And absenteeism" (Union representative at a car manufacturer.)

The change, such as not being able to see the whole picture (fragmentation), can be a source of anxiety at first, but workers usually get used to it:

« [...] That was, yes, a fear of just about everyone in the zone. Of no longer having these global orders. But that's the way the [programme] is, and you have to get used to it anyway. I think we've all got used to it. By force of circumstance, so [...] And as I

said earlier, change is scary, but once you've done it, well, you're glad you did" (ALW03).

However, it happens that workers oppose a digitalization project so strongly that it is abandoned. This was the case with smart glasses in the automobile manufacture, that workers refused to use because they feared waves:

« We tried smart glasses in logistics, we tried them, but at one point we didn't want to use them because of the waves, etc. People didn't want to use them, so no, we managed to avoid that" (Union representative at a car manufacturer)

Another threat identified was the fact that of the whole production depends on digital systems, even though they are way more secure than before (regarding viruses, bugs):

« Before, there were sometimes small breakdowns [...] Now a computer breakdown can completely block the factory" (Union representative at a car manufacturer).

Finally, as already explained above, the age and seniority play an important role in the perceptions on digitalization.

6. Quality of working life

The fit (or not) between family or care responsibilities and work

In one case, the possibility of teleworking was considered beneficial for the work-life balance:

« In fact, with Covid we had to introduce teleworking [...] I'd already talked about it, but it wasn't possible. And then here they finally made it possible, especially with the [programme], which has helped a lot. I don't have to go to the stockroom any more. So I can do it from home. And I really liked that. Because it suits my style of work, since I like computers I have good equipment at home. And what I really liked was that I got to see my partner more often, because she gets up later and I got to see her in the morning, I mean I got up at the same time, I mean I got up 40 minutes later to start at the same time, so that's already good" (ALW02)

The fit (or not) between the desire to develop one's skills and opportunities to do so

Digitalization is stimulating for workers interested in new technologies:

"It's motivating. For someone who likes technology and new things, who likes to learn, it's a source of motivation all the same" (ALW03)

"I'm attracted to new technologies, so... it's not a problem for me" (ALW09)

Feeling (un)healthy and/or (un)happy within the job

It seems that workers' physical and mental wellbeing is more paid attention to in smaller companies. However, those are also the places where there is no union delegation (because there are fewer workers). As we saw, when working conditions are deteriorated, the (long-term) effect on workers also depends how long they will have to stay on the job (seniority). In some case, it was observed that younger workers tend to stay on the job less longer than the previous generations:

« For the moment I still tolerate it. But then I think, someone who's young now has to do this for 30 years [...] it's become exponential, you could say, it's accelerated over the years. But I always say to myself, "But will young people be able to keep up a pace like that for 30 or 40 years? [...] Anyway, I've still got, I'd say 10 or 15 years, yes. But if I had to do it all over again, I'd find it hard to believe that I'd be able to last a whole career like that, because... and fortunately it's been a crescendo [...] you have more and more people coming and less and less staying. When I first joined, you had people who had very long careers in the company and now you see more and more people who are less and less attached to their jobs, "I've had enough, I'm leaving", that's it ... fewer and fewer people are loyal. But I think it's more or less companies that are like that, you see, they're going to get the best out of you and then when they've got the best out of you, either you'll be tired or you'll be worn out or you'll be... that's it, it's a bit like Kleenex eh, you take it, you use it, you throw it away" (ALW01)

The intention / willingness and motivation to stay in the current job.

The motivation depends on many factors, such as the context, the seniority, the (lack of) alternatives, or the interest for new technologies:

« It brings new things, so... New things bring new motivation, so... Ambition, I'm an ambitious person, so I like that..." (ALW03)

What are the characteristics of a "sustainable" job according to the interviewees?

As a deduction from what was discussed above, here are some of the characteristics we can highlight:

- The workers are consulted and involved before and after the implementation of new technologies.
- Proper training to new technologies is provided, as well as follow-up and extra support when needed.
- The digitalization doesn't result in an acceleration of the workplace and an intensification of work. The time and energy saved by automation benefits the

workers and not the performance. Workspace is not dictated by robots and remains sustainable, and downtime isn't constantly reduced.

- Conditions for the constitution and consolidation of working collectives are met (preventing the isolation of workers on the job).
- Hard tasks are taken over by robots, but attention is paid to new ergonomic exposures due to fragmentation, repetitiveness, acceleration, exposure to screens...
- Workers' activity is not constantly tracked through data and indicators, and they still have room for manoeuvre in the work process (preserving the workers' autonomy).

7. "Covid effects"

Teleworking practices have been developed in some companies when tasks could be performed remotely.

8. Conclusions

Different kind of technologies have been identified: automation technologies (robots, cobots, manipulators), tracking technologies (scanning barcodes, connected tools), collaboration/coordination technologies (augmented reality, tablets and screens, visualisation programs) and integrated systems managing the whole production process.

Contradictory effects have been mentioned regarding the task's diversity, depending on the initial context. In some case it resulted in a greater diversity (e.g. when administrative can take less time, in favour of other tasks), but led to repetitiveness in others (linked to work fragmentation). Contradictory effects were also identified regarding the complexity of tasks. Indeed, whereas the automatization of certain procedures can reduce the task complexity, they imply new methods and interfaces workers must learn and get used to. Unsurprisingly, automation tends to reduce handling tasks, whereas encoding tasks increased. When the automation resulted in fragmentation of the work, it affects worker's capacity to have a view on the final product and tend to individualize the work (less collaboration with colleagues). Finally, the predictability of task is increased if digitalization allows for a better visualisation of the workload to come, but it becomes less predictable when the digital tools are dysfunctional.

The workload and the workspace have been impacted as well. Indeed, automation often led to an intensification of the work, especially in big assembly lines, because of an acceleration of the workspace and an increase of the workload. This can lead to stress, isolation, and physical pain. In this context, technology dysfunction result in anxiety. The situation differs in the smaller company, where workers seem to find more balance at work.

In terms of competences, as expected, the mobilisation of digital skills increases with the use of digital tools, which can be a source of valorisation for some workers, as well as represent challenge. The occupational skills have changed too, since the level of diploma required is higher and technical and IT skills have grown.

The effects on the workers' autonomy also depends on the context. In some cases, the use of technologies allowed workers to be less dependent on other functions in the company. However, we also observed that workers are becoming more dependent on technicians to solve problems. In addition, the autonomy is limited by the generalized surveillance performed through digital technologies, even though it might be less visible or perceived differently than human control. A large part of the quality control tasks is nonetheless still performed by humans. On the positive side, when the quality is critical, it prevents workers from delivering products that don't not comply with quality standards.

We saw that the perceptions about digital tools differed according to age and seniority. Resistance to digital tools by senior and older workers reveals a generational gap when it comes to using new technologies at work. But interestingly, this could be mitigated in some case by demonstrating the benefits of digitalization to workers, involving them in the process and providing sufficient training.

The working conditions and environment have been affected in multiple ways. While automation helps reducing the worker's exposure to hard manutention tasks, the work fragmentation and acceleration still result in ergonomic exposures causing musculoskeletal disorders or eye strain. Robotization has however reduced the exposure to dangerous conditions for those who worked in very difficult environment (brightness, heat, exposure to chemicals, fumes...). As for the workplace, even if it is still mainly confined in the factory, we observe the colonization of private devices, and by extension private space, by institutional digital platform (communications, HR, etc.).

Indeed, when it comes to the employment conditions, we noted that HR and administrative procedures were digitalized too, as well as the training procedures. The lack of training accompanying the implementation of technologies was often reported as a cause of stress and anxiety. The workers' evaluation relies increasingly on quantified performance indicators. Robotization is sometimes associated with financial valorisation (salary increase or bonuses), but it should be assessed in the light of the working conditions' deterioration. In addition, the salary level criteria are less linked to (bad) working conditions, and more to (higher) qualification. IT and technician profiles are expanding.

Considering the working relations, we note that there is often no (or very little) involvement or consultation of workers and union delegates upstream in the context of the implementation of new technologies. The dynamics seems quite different in smaller companies, where there is a greater consultation, involvement and follow up of the workers, although no union representation. Moreover, the support/maintenance services are often externalized, and technicians/IT play a prevalent role in case of problem.

Finally, work organization hasn't fundamentally changed, but we still note some evolutions. The work is still globally distributed by supervisors, but the involvement of a digital program in the day-to-day task distribution result in fewer human exchanges, particularly in smaller structures. As mentioned earlier, technicians also occupy an important role in the work division. Communication about new procedures, methods and technologies being carried out using online tools instead of oral exchanges. The digitalization of the coordination helps workers avoiding mistakes by passing on information more effectively. However, it isn't as advanced in all the factories.

Among the risks associated with digitalization, we identified:

- Degradation of the working conditions in general and decrease of the unqualified jobs' quality:
 - acceleration of the workplace and intensification of the work, that results in ergonomic exposures and exhaustion, and is incompatible with career extension.
 - reduction of the worker's autonomy through surveillance/tracking technologies.
 - fragmentation of work, atomization of workers that can lead to individualization and the weakening of the workers' collective.

Among the opportunities associated with digitalization, we note:

- Making the work more stimulating.
- The suppression of some hard work (e.g. carrying heavy loads).
- Helping avoid mistakes (and their consequences), especially when product quality is critical (e.g. in pharmaceutical, automotive sectors)