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RESEARCH ARTICLE

Managing Work Activities on the Horizon of 2040: Which Challenges for Occupational Safety and Health at Work? A Foresight Study

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Funding: INRS

Potential competing interests: No potential competing interests to declare.

Abstract

Faced with technological change, which has accelerated since the early 2000s, and a world that is increasingly unstable, companies are looking for new ways of organizing their activities to make themselves more agile. At the same time, attitudes to work and career paths are changing: people are looking for a better work-life balance and meaningful work. However, their careers are increasingly fragmented. In addition, the fight against climate change imposes the transformation of production systems. These new trends are leading to the emergence of new ways of managing work activities, which will undoubtedly have an impact on OSH.

This paper summarizes the foresight study conducted by the Research Institute for Occupational Health and Safety in France (INRS) on the evolution of management methods and their possible consequences in terms of health and safety at work. With a multidisciplinary team, the Institute's Watch and Foresight unit first explored the main factors of change underway in order to imagine during the second phase company profiles in 2040 based on the design fiction method. The profiles of these fictitious companies and their employees were then analysed by occupational health and safety experts to identify the main challenges and potential opportunities that could emerge in the domain of occupational risk prevention.

1. Introduction

Through its Watch and Foresight unit, INRS is responsible within the occupational risk prevention system of the French Social Security system for initiating and coordinating reflection on emerging subjects likely to have an influence on workers' health and safety in the more or less long term. Its aim is:

- To provide studies that will help the Board of Directors to develop the Institute's various programs (research, training, information products),

- To encourage collaborations between the different professions and disciplines represented within the Institute.

These foresight results are made public and are therefore accessible to any interested person or organisation, in particular companies, social partners, or any player likely to be directly or indirectly involved in occupational risk prevention in France. It is therefore intended to serve as a basis for initial reflection on new issues in various forms. Depending on needs, it will then be pursued by other players in the prevention system (researchers, experts, etc.) in more or less close association with the governance bodies.

This is why, each year since 2013, the mission deals with a new subject chosen directly by the INRS Board of Directors. Topics that have already been explored include for example: modes and methods of production by 2040[1], platforming 2027[2], the circular economy by 2040[3], etc.

In 2023, noting the proliferation of new models for managing work activities, the INRS Board of Directors asked the mission to investigate the possible effects of these developments on occupational health and safety. As usual regarding any studies conducted by INRS, the field is limited to the French territory as this is the field of investigation and action of our research institute.

The concept of work activity management can be defined as one of the dimensions of management. Henri Fayol[4], one of the first thinkers in the field of business management, distinguished several functions of management, which he described in terms of five types of tasks:

- Forecasting: defining corporate strategy,
- Organising: defining the roles and tasks of each person and the coordination of activities (defining processes),
- Command: decision-making by a designated or elected authority,
- Coordinating: defining the company's structure and its different levels of hierarchy,
- Control: activity monitoring.

The management of work activities, as we have defined it for the purposes of this exercise, excludes the tasks related to the functioning of the organisation as a whole (forecasting, ordering). It focuses more precisely on the various functions which frame the work activities themselves and which aim to organize, control and evaluate the performance of activities with a view to improvement and optimization. Among the steering functions, we have distinguished four main categories:

- Setting collective and individual objectives,
- Defining work organisation, processes, tasks and the resources required to carry them out,
- Leading teams and providing individual support,
- Assessing and monitoring performance (collective and individual).

The field of this study is limited exclusively to the management of activities carried out in the context of paid employment by an employee or self-employed person.

Some studies undertaken by the INRS “Working life” Department have already looked at changes in work organisation in

the past or more recently[5][6]. This foresight exercise falls within the scope of these studies and attempts to offer a long-term perspective on how they might affect workers' health and safety. Its ultimate aim is to provide guidance for OSH professionals on how they can continue to take effective preventive actions in the future.

Broadly speaking, since the beginning of the twentieth century it has been possible to distinguish between two major models of work activity management:

The first refers to the very first organisational theory forged by the engineer Frederick Taylor[7] and fuelled by the entrepreneur Henry Ford[8], who sought to rationalise production processes to make them more efficient. This model, known as the Scientific Organisation of Work, is based on three main characteristics: 1) work activity is broken down into elementary tasks, which become increasingly specialised with the advent of assembly-line working; 2) the performance of these tasks is governed by strict procedures, which prescribe the way in which work is to be done; 3) these procedures are laid down and controlled by a long line of hierarchical superiors, which separate the activities of design and execution: there are those who think (the strategy, the tactical plan, and then its implementation in the production workshops) and those who do (supervised by the foregoing ones).

In contrast to this model, another is emerging which S. Canivenc calls 'new management and organisation modes' (NMOM)[9]. This model opposes the precepts of Taylor and Ford, by outlining a different way of thinking about work organisation and management. The horizontal and vertical division of labour leading to hyper-specialisation is replaced by multi-skilling, which develops in two forms:

- task broadening, where tasks at the same hierarchical level are grouped together and entrusted to a team rather than to an individual.
- task enrichment, which consists of delegating tasks traditionally carried out by the higher hierarchical level (quality control, task allocation and scheduling, definition of work methods), to reconcile design and execution tasks according to a principle of subsidiarity: "it's the person who does who knows".

The model therefore no longer focuses on the obedient individual, but on self-organised work teams that are directly involved in drawing up the procedures they have to implement. This model implies a profound change in the role of management: from command & control to facilitative management.

Much has been written about this alternative approach to work organisation and management since Isaac Getz published his book on liberated companies in 2009[10]. However, this model is far from new. Indeed, its beginnings can be traced back to the 19th century with the thinkers and experimenters of utopian socialism[11]. However, the first real theorisations of this alternative model date from the inter-war period, with the work of the human relations school. The currents defending this alternative concept of work organisation and management followed one another throughout the century (socio-technical currents, Toyotism, agile methods) until they became abundant as we entered the 21st century (liberated, holacratic or opal companies).

In summary, this article describes the use of foresight in a study designed to create a body of thought common to all the

participants in a national and regional occupational risk prevention network, faced with the multiplication of management methods and their impacts on occupational health, safety, and prevention. More specifically, it describes the experiments that were carried out with the design fiction tool to help OSH (occupational safety and health) professionals prepare for future changes in the way work is managed.

2. Materials and methods

To start the project, a working group of eight experts was formed (see table 1).

The time frame of 2040 was chosen in order to:

- be sufficiently distant in time for the experts to be able to imagine significant developments in the subject under study,
- but not too far either, in order for the OSH specialist to be able to assess the possible implications of these developments on the current occupational health and safety landscape.

This exercise was carried out by assembling and combining elements from three components: an analysis of the prospective landscape, a design fiction phase, and reflection on health and safety issues associated with these possible developments.

1. Component 1: prospective analysis of work activity management.

This analysis was carried out in five steps:

a. During the exploratory phase of the study, a literature review was carried out with the aim of mapping the main management methods of the last two centuries. Preliminary bibliographic research was conducted to identify reference works of the main currents of management that have emerged throughout the 20th and 21st centuries.
b. The first step consisted in the identifying the cross-cutting trends that will have an impact on companies in 2040. Eleven drivers concerning the major economic, geopolitical, environmental and societal trends likely to have repercussions on the world of work were identified and were the subjects of an initial analysis, based on previous reports of the INRS watch and foresight mission[1][2][3]. VIGIE reports and prospective notes published by Futuribles[12] and ADEME (French ecological transition Agency)[13] were also included.
c. At the same time, a series of 16 expert interviews were conducted by members of the working group. The main professional qualifications of these experts (mainly management experts) are listed in Table 1, together with the working group members. These interviews lasting approximately one hour, were conducted by videoconference and organized around three objectives:

    - looking back at changes in the way companies have managed their business over the last twenty years,
    - identifying the factors behind current changes,
    - projecting possible changes over a fifteen-year timeframe.

Table 1. List of members taking part in the foresight exercise by their qualification

Working group	Interviews with experts
▪ Historian, OSH, foresight ▪ Historian, OSH, foresight ▪ Historian, Foresight ▪ Scientific communication, Neurosciences ▪ Physiologist, OSH ▪ Economist, Statistician ▪ Specialist in organisational communication, self-managed cooperatives and digital organisations (PhD).	▪ Management & CSR Consultant ▪ Professor of Sociology ▪ Lecturer and researcher in HR management and rights ▪ Sociologist, Head of Studies, ▪ Author and lecturer on the future of work, ▪ Professor of Occupational Psychology, ▪ Labour sociologist, ▪ Doctor of Management Science ▪ Doctor in physical sciences ▪ Doctor in management science ▪ Economist, ▪ Professor of management, ▪ Professor of Ergonomics, ▪ Researcher in management and organisational theory ▪ Ergonomist, ▪ Chemical engineer, foresight

d. the working group members visited six companies, selected for their atypical management model: meetings and interviews were conducted with a self-employed worker and managers of companies with particularly innovative modes of governance and operation. The profile of those companies is described in table 2.

Table 2. List of visited companies

Visited companies	Sectors	Main characteristic of work organisations
▪ Company 1	Insurtech	Full remote
▪ Company 2	IT services	Cooperative
▪ Company 3	Personal care	*Model Buurtzorg*
▪ Company 4	Industry	*Visual performance management*
▪ Company 5	Web developer	Self employed
▪ Company 6	IT services	Permacompany

e. Based on these resources, the working group identified twelve themes, which have been the subject of a short study in the form of a fact sheet identifying recent developments and the outlook to 2040. These may relate to working methods (e.g., teleworking) or organisational dynamics (e.g., platforming).

Finally, this first component enabled the working group to draw up a list of 12 key points defining the main transformations and prospects for changes in the way work will be managed by 2040.

2. Component 2: design fiction "working in 2040”

2.1. Design fiction: definitions and goals

Design fiction is a discipline that has met with great success in the foresight and innovation sectors since its emergence in the mid-2000s[14]. It involves using fiction (stories, characters) and design (the creation of objects or documents) to explore possible futures. When it comes to foresight, design fiction facilitates creative, imaginative and immersive approaches. Indeed, the use of design fiction makes it possible to embody future perspectives in a more concrete way, beyond macro-scale trends and scenarios. Through characters, stories, etc., it allows us to consider in detail the implications of imagined perspectives on people and their attitudes, and on organisations and how they operate.

To date, one of the best-identified and most successful examples of design fiction in France is the Red Team, which has been supported by the French Ministry of Defence since 2020. The Red Team identifies and formalises scenarios that embody possible threats in the 2040-2060 timeframe. These scenarios, some of which are kept secret and others communicated to the general public, enable the army to better prepare for a changing environment, to project itself more concretely into possible future scenarios, to identify weak signals, and to strengthen creativity and imagination in exploring future threats[15].

The use of design fiction in this study has several aims, which are to:

- Embody in concrete terms the trends in tomorrow's work and its management, through characters (workers) and companies.
- Test the trends identified to see how they might actually manifest themselves in organisations.
- Deepen our understanding on issues so that OSH representatives involved in the project can express their views on the basis of fictitious cases that foreshadow tomorrow's OSH risks and how to prevent them.
- Facilitate appropriation: creative designs (worker and company profile sheets) offer an easily identifiable gateway to this prospective work, which facilitates projection into the futures considered, and can in particular help to raise awareness among a public unfamiliar with this type of exercise.
- Open up conversation and debate: the creations proposed offer tangible objects for conversation that can be used as a basis for conversations on OSH issues, or even for workshops or exercises to project work management methods into the future, within the INRS and possibly its wider ecosystem.

2.2. Design of a series of fictional situations:

On the basis of the contextual elements identified during component 1, the working group embarked on a design fiction process to imagine several work organisations likely to emerge between now and 2040, so that they could then be compared with the viewpoints of OSH experts. Ten *persona*e (Fictitious character) and eight fictitious company profiles were designed in workshops conducted by the working group. In addition to each company/worker *personae* combination, descriptive elements on the work and its management were written. The group also ensured that the fictional cases illustrated the diversity of transformations and uncertainties identified in component 1 (see part 3.1.2).

2.3. Component 3: identifying OSH issues

A booklet resulting from the design fiction phase was then submitted to 23 OSH experts for analysis, in order to identify the issues and opportunities raised by these new management methods. To do so, two workshops were held, each bringing together a dozen participants from different disciplines and organisations (see table 3).

Table 3. list of workshop participants by their qualification

Workshop: reacting to the design ficion (Component 3)
▪ Lawyer, OSH ▪ Physiologist, OSH ▪ Physiologist, OSH ▪ Pysiologist, OSH ▪ Sociologist, OSH ▪ Sociologist, OSH ▪ Sociologist, OSH ▪ Sociologist, OSH ▪ Lawyer, european regulatory body ▪ Psychologist, OSH ▪ Ergonomist, OSH ▪ Labour sociologist ▪ Prognostics and health management ▪ Ergonomist, OSH ▪ Ergonomist, OSH ▪ Engineer, chemist, OSH ▪ Safety engineer, OSH ▪ Safety engineer, OSH ▪ Chemical engineer, foresight ▪ Labor inspector ▪ economist ▪ OSH specialist ▪ Agronomist, OSH

To start, the objectives of the study and the result of component 1 and 2 were briefly presented to them during a videoconference.

The experts were then provided with the Design fiction booklet, and invited to draw out the elements that seemed most significant to them, based on a number of questions relating to risks, prevention opportunities and the conditions to be met to make these future situations favourable to workers' health.

These elements were then discussed during a workshop bringing together the invited experts and the members of the working group. Among the themes highlighted by the preliminary analysis of these fictitious cases, eight issues were given special treatment because of their decisive impact on workers' health.

- Issue 1: OSH responsibilities and the heterogeneous status of workers
- Issue 2: Social and professional dialogue, workers' participation

- Issue 3: Harnessing technology to promote OSH
- Issue 4: Employability and training issues
- Issue 5: The transformation of the management function
- Issue 6: Workers and technological tools
- Issue 7: Monitoring workers' state of health
- Issue 8: Intervention by OSH specialists

For each issue, the experts taking part in the workshops discussed the possible effects of changes in the way business will be managed by 2040, the risks they could generate in terms of OSH, the possible opportunities for prevention, and the changing role of OSH specialists in the face of these changes.

This final component made it possible to draw up a list of the main OSH and prevention challenges associated with possible changes in the way work could be managed over the next fifteen years.

3. Results

3.1. Foresight analysis

3.1.1. Analysis of the major transitions underway

Based on the analysis of developments observed in the past century till today, this study has identified two types of transition to which companies are subject:

- On the one hand, external transitions linked to economic, geopolitical, social and environmental changes in the world. Eleven key factors, referred to here as drivers, were identified, seven of which have an influence on human resources management and four on corporate strategies. These drivers are listed in Table 4.

Table 4. Drivers impacting work organisations

Variables	Description
Corporate strategies	
Automation	The ongoing process of automating and digitising work means that organisations have to adapt constantly (disappearance/creation of new professions, updating of skills, management of associated risks, etc.).
Climate change	The need to take account of climate change, the crisis in resources and the reduction in biodiversity in company strategies: the challenges of decarbonisation, working in extreme heat, natural disasters, the conversion of certain professions to new ones, etc.
Relationship with the local area	New socio-political expectations and the fragility of remote value chains are leading companies to rethink their local roots (attachment to the local area, city of the quarter-hour).
Geopolitical context	Companies need to take geopolitical issues into account in their strategy (economic resilience and image issues with consumers and employees).
HR management	
Relationship to work	Individualising HRM practices have encouraged a rise in employee individualism. Little by little, teleworking and the fragmentation of career paths have weakened work collectives.
Polarisation of the labour market	Polarisation of the labour market, with a well-to-do, well-educated population able to impose its expectations on employers, and a precarious population unable to do so. Social homogenisation of certain professions.
Demanding new generations	New generations are making new demands in terms of work-life balance and environmental and social responsibility. They have a more distant relationship with work. They are the standard-bearers of widely shared aspirations.
Transformations sociétales	Remise en cause de la parole institutionnelle et des organisations verticales : rupture de confiance vis-à-vis de l'entreprise, nouvelles formes d'expression et de mobilisation
Societal transformations	Questioning of institutional discourse and vertical organisations: breakdown of trust in the company, new forms of expression and mobilisation
Inclusion	Difficulties in coping with a phenomenon of archipelitisation of identities: bringing together diverse communities and identities (religion, language, culture, gender, food, etc.) to maintain cohesion.
Ageing of the working population	Longer working careers mean that efforts have to be made to keep ageing people in employment (skills management, arduous work, intergenerational cohabitation).
Migration	The development of climatic and geopolitical migration could meet the needs of sectors in short supply (hotel and catering, health), while activities that can be teleworked could be relocated more (IT, graphic design, customer relations, etc.).

- On the other hand, a host of transitions in management methods, corresponding to the changes in management methods that companies have undertaken to respond to external transitions.

The main chronological stages identified during the literature review phase can be described as follows. A distinction can be made between the development of organisations based on worker control and those built around the principle of autonomy.

Organisational models based on worker control

- With the second industrial revolution and the development of production, a new form of work organisation emerged in response to the need to produce standardised objects on a very large scale. This new form of work organisation is known as the "scientific organisation of work" and was theorised by F.W. Taylor[7] in 1908. The principles of this theory were developed and extended by Henry Ford in his car factories[8]. This form of work organisation is still the dominant model today.
- From the 1960s onwards, the first management software packages, known as ERP (Enterprise Resource Planning), made it possible to organise and monitor work using computer systems. The creation of SAP™ in 1972 was one of the emblems of this trend. Business management was gradually brought under the control of data analysis, which, thanks to the traceability of the indicators it provided, made it possible to monitor the implementation of a company's strategy over 5 to 10 years[16].
- With the financialisation of companies, marked by the Employee Retirement Income Security Act (ERISA) in the United States in 1974 and the ‘Theory of the firm’ theorized by M.C. Jensen and W.H. Meckling in 1976, the management of activities has led to increasing importance being given to profitability indicators[17].
- At the convergence of these two movements towards computerisation and the financialisation of business management, a new form of business emerged in the 2010s: the gig economy platforms (2009: Uber, 2013: Deliveroo), whose use of algorithmic management makes it possible to take worker control to the extreme on the basis of certain indicators designed to optimise labour productivity.

Organisational models based on team autonomy

- From 1927 onwards, the human relations school introduced non-rational emotional factors into management, with the concepts of feelings, motivation, loyalty and leadership. This made it possible to go beyond the notion of the passive control of subordinates, still with the aim of control, but introducing the possibility of acting on emotions to improve efficiency and performance. This trend was theorised by E. Mayo and experimented in the Hawthorne workshops at Western Electric[18]. Following on from this work, Maslow developed the theory in his book ‘Motivation and Personality’ that a person's motivations result from the satisfaction of certain needs. In this model, it is the sum of satisfied needs that creates commitment[19]. Herzberg's work in 1959 continued this line of thought by distinguishing the factors that lead to job satisfaction from those that lead to dissatisfaction[20].
- In parallel with the work of the human relations school, in 1952 the psychologists Fred Emery and Eric L. Trist developed the socio-technical theory[21], which sees the organisation as a system divided into a techno-economic sub-system and a social sub-system. Their thinking focused on analysing the structure of the relationships between these two sub-systems, and then on how to regulate them, with the aim of driving major changes in organisations. These principles were tested at Volvo’s factories in 1975.
- From the 1980s onwards, many new management trends and models have emerged: the learning organisation proposed by Argyris and Schön[22], based on the principle of knowledge sharing; participative management, which advocates management based on the collective intelligence of the organisation[23]; and from the 1990s onwards, the emergence of sociocratic[24] and holacratic[25] systems, the liberated company[10] and Opal organisation models[26].
- The culmination of autonomy corresponds to the status of qualified professionals and self-entrepreneurs. This became

particularly important in France with the introduction of the LME (Law for the Modernization of the Economy)[27] in 2008 and the development of support structures.

The case of Toyotism

- In 1937, K. Toyoda founded the Toyota company, based on the business management method developed by the engineer Taiichi Ono, which aims to reduce waste by avoiding oversupply and maintaining optimum product quality throughout the production chain. This approach, better known as Toyotism or TPS (Toyota Production System), involves all the workers who work in autonomous teams and participate in diagnosing problems and resolving them[28].
- In the 1990s, Womack and Jones developed a new management model inspired by Toyotism, which has been subsequently misused by teams of consultants. They focused on the idea of maximum cost reduction, without taking into account the philosophy of continuous improvement and learning, which implies the active participation of those working in the field[29]. While this neo-Taylorist model, known as ‘lean production’, has led to short-term productivity gains, it has also led to a drastic increase in musculoskeletal disorders and psychosocial risks as a result of the extreme intensification of work[30]. Questioned from 2010 onwards, more participative approaches are beginning to make a comeback.
- The Agile method, theorised in 2001 with the publication of the Agile Manifesto[31], derives in part from Toyotism in the idea of continuous improvement that it pursues, embracing the idea of continuous improvement through incremental and iterative project management methodologies. However, it is also inspired by the human relations school and the currents that have emerged from it, by adopting principles such as the decentralisation of decision-making and the creation of the autonomous team, reminiscent of the socio-technical movement.

The case of cooperatives and start-ups

- Although the law of 24 July 1867 had already recognised the existence of cooperative companies, the framework law of 10 September 1947 defined their status and gave them their full identity[32]. A cooperative is "a company formed by several people who voluntarily come together to meet their economic or social needs through their joint efforts and the provision of the necessary resources. It respects the following principles: voluntary membership open to all, democratic governance, the economic participation of its members, the training of its members and cooperation with other cooperatives. Each cooperative member, known as an "associate" or "member-policyholder" as the case may be, has one vote at the general meeting. Having said that, the cooperative model is primarily concerned with governance, rather than with how the business is run. It remains perfectly possible to run a cooperative along Taylorist lines internally.
- Similarly, start-ups correspond to a business model linked to the notion of experimenting with a new activity in a fast-growing market, where the risks are difficult to assess. They are characterised by the way in which they are financed through fund-raising[33] which does not augur well for the way they are run. As cooperatives, they can be associated with both a Taylorian management style and a more decentralised approach to decision-making.

As a result of this literature review, the working group built a timeline that shows the gradual diversification of

management methods since the beginning of the 20th century to today. The aim is to highlight the proliferation of concepts. It is not intended to provide a quantitative representation, as the different trends presented may affect very different numbers of people.

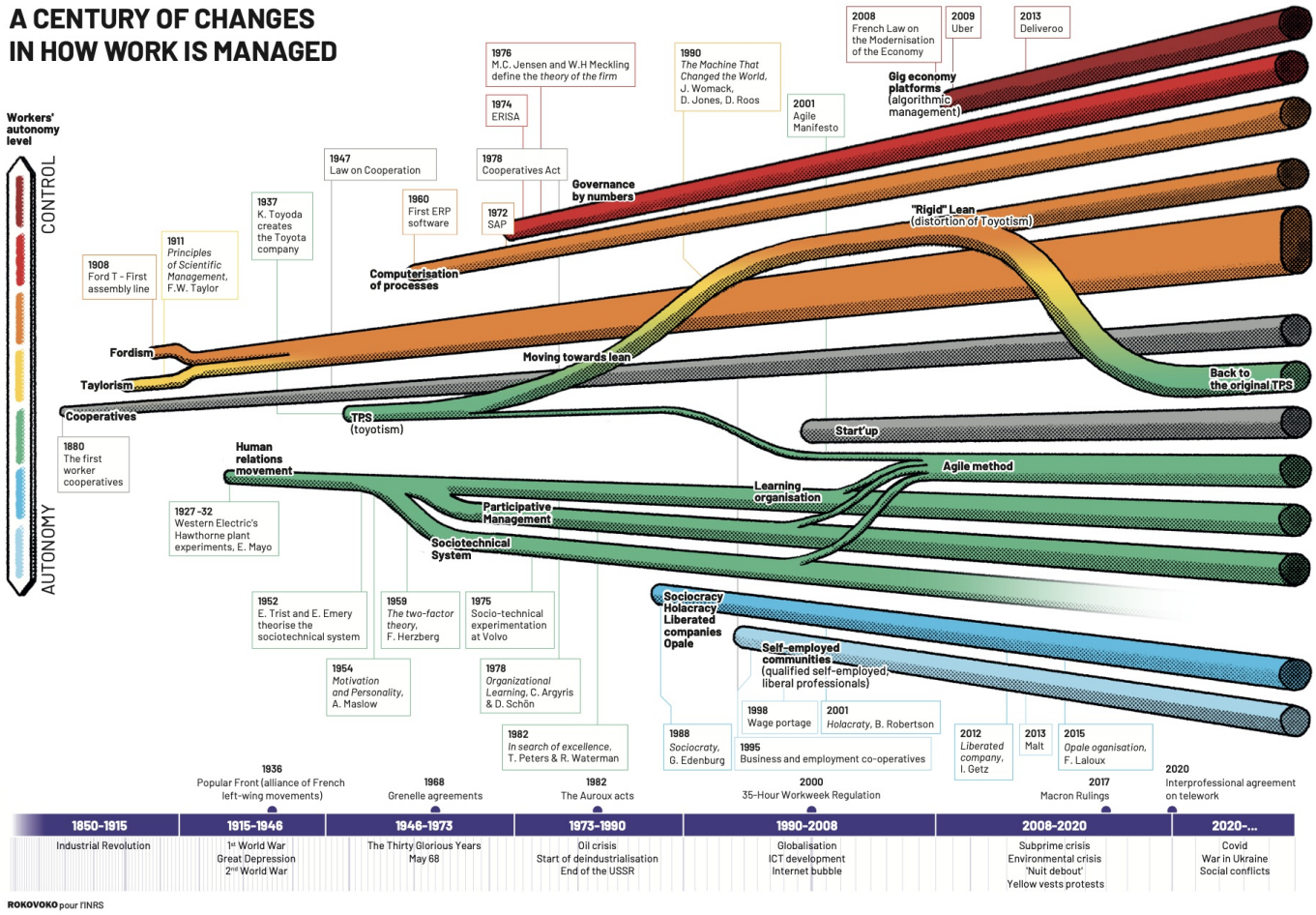

Figure 1. (Timeline)

3.1.2. Exploration of twelve work dynamics

On the basis of these external drivers and transitions of management methods, and with the help of interviews and visits conducted with experts and companies during the exploratory phase, twelve work or organisational dynamics were identified as decisive evolutions regarding issues of work activity management. For each of them, a possible evolution is proposed as well as an obstacle that could slow it down.

These dynamics are presented in table 5.

Table 5. List of the twelve work dynamics underway

Work dynamics	Possible developments	Potential obstacles
Working hours	Densification of working hours and development of multi-activity.	Intensification of work contributing to the deterioration of workers' health
Employment status	Development of self-employment	Precarious income and lack of social protection
Remote working	Further development of teleworking	Problems of work/life boundaries and legal liability for occupational risks
Workplaces	hybridisation of living and working spaces.	Weariness of distancing and "all digital", aspiration to re-socialise workplaces and a clear separation of spaces.
Cooperative model	Development in reaction to that of the platforms and in line with the desire for more democracy.	Competitive shortcomings due to the slowness of decision-making.
Computerisation of processes	Developments: Wider use of algorithmic management. More complex objectives and evaluation systems	Problem of acceptance, social rejection, development of management by trust.
Collaborative economy	Possible support for slashers; craze linked to new generations' quest for meaning	Funding problems, small and unstable communities over time
Industrial management	Industry 4.0 based on AI-based decision-support tools; return to rational lean.	Companies' investment capacity; demand for return on investment leading to work intensification
Subcontracting	Continued subcontracting, in particular through the use of self-employed contractors.	Relocation / Reindustrialisation
Plateformisation	Development conditional on better social protection	Regulatory developments aimed at providing a better framework for service platforms
Social and professional dialogue	renewing local social dialogue in companies	Individual strategies of withdrawal and contestation on social networks
Communication tools	Centralisation of functions within cross-functional, multi-use communication platforms	Challenge of digital sobriety, limited acceptance by employees with little or no involvement in the integration of these tools

3.1.3. Definition of the main transformations and prospects for changes in the way work is managed

By cross-referencing these different components, the prospective analysis phase has enabled the working group to highlight twelve key trends which will influence the way in which work activity is managed. Eight of these trends have already been identified, while the remaining four are hypotheses for development by 2040. They are presented in table 6.

Table 6. List of the main transformations and prospects for changes in the way work is managed **.**

Key trends which will influence the way in which work activity is managed
Current trends
1. An increasingly individual relationship with work: with the diversification of workers' statuses and the development of skills management based on individual assessment, industrial relations and collective bargaining systems have evolved since the 1980s towards a greater role for the individual in relation to the collective.
2. Teleworking, the ratchet effect: teleworking, introduced on a massive scale since the health crisis, has become a requirement for employees whose work can be carried out remotely. Workers who are unable to do so are often frustrated, and this contributes to a loss of interest in non-teleworking jobs. Companies are finding it difficult to return to on-site working, even though teleworking raises a number of issues for them in terms of commitment, innovation, team cohesion and control.
3. “Only results count": as a result of these developments, worker control is now based more on results than on the means used to carry out the work. While work is still prescribed, workers are increasingly organising themselves to carry it out.
4. Increasingly complex objectives: at the same time, there is no let-up in the demands for results, and companies are gradually adding new objectives, particularly in the area of CSR.
5. Deleterious effects on working conditions: at the same time, company management methods have become more complex and rigid ("managerial turnaround", rigid lean, standards, cascading subcontracting), with deleterious effects on workers' health.
6. New alternative management and governance methods are emerging: in the face of these excesses, new methods of work organisation and governance are emerging or being developed with the aim of getting workers involved and regaining a capacity for innovation. However, these new models of management and governance are still in the minority, and their impact on employee health needs to be better documented.
7. The role of the local manager has become more complex: as a result of these changes (individualisation of HR management, teleworking, management by results, teleworking, labour shortages in certain sectors), the role of the local manager is changing in nature. They are increasingly seen as facilitators, responsible for leading the team and maintaining its cohesion. Their role is made more complex by the individuation and distancing of teams, but also because they find themselves at the interface between the new demands of employees and the multiple objectives set by management.
8. The growth of self-employment remains limited: since 2008, the platform economy and the introduction of a simplified regulatory framework have encouraged the creation of individual businesses, which although still in the minority, are attracting interest from workers because of the supposed freedom they offer. However, this development remains limited because of the problems of income and social protection that it poses.
Trends likely to emerge by 2040
9. A hybridisation of self-employed and employee status could emerge, with the introduction of more protective self-employed models or a more flexible subordination model,
10. A proliferation of new management methods: we are seeing a proliferation of new management methods that differ from the traditional Taylorian model. The development of these methods, which are currently in the minority, could become more widespread with the environmental crisis and the quest for meaning that it engenders.
11. Possible development of multi-activity: the new organisation of working hours (e.g. 4-day weeks, 12-hour days) and teleworking could encourage the development of multi-activity and contribute to both extending the effective working hours and intensifying the pace of work,
12. The ambivalence of new technologies, depending on how they are used: the technological communication and production tools currently being developped are, overall, an opportunity to make work easier and less arduous. But the way they are used, determined by the management methods specific to each organisation, could just as well prove beneficial or deleterious, depending on whether or not the workers' point of view is taken into account in their design and implementation.

3.2. Design fiction approach

3.2.1. Humans@work: a fictive professional network

The aim of the design fiction approach was to imagine several types of management system that could develop between now and 2040.

Initially, 8 fictitious company profiles and 10 *personae* were imagined during workshops held by the working group, with a few additional contributors. These creations were developed on the basis of the contextual elements established during the first component of the exercise. The companies and *personae* are presented here in the form of profiles on the professional social network 'Humans@Work', which is assumed to be predominant in 2040, and whose members do not

hesitate to mix the intimate with the professional. Narratives and descriptive elements of work situations specific to each company were then explored, in order to confront them with the points of view of OSH experts.

Each case is presented as follows:

- Presentation page of the fictitious company on Humans@Work;
- Profile page of the fictitious worker(s) on Humans@Work;
- A summary description of how the activity is organised and managed in the company;
- A summary of the relevant OSH issues identified by the experts (cross-functional OSH issues are presented in section 3.3).

These profiles and stories were drawn up using two criteria:

- a sector of activity chosen from a selection defined as a set of priorities for France, during the preparatory phase of the exercise: personal assistance (including the establishment of accommodation for dependent old persons); transport/logistics, recycling/waste treatment/green professions; manufacturing industry (including food processing); small commerce; tertiary sector, office environment; construction and public works/property management (cleaning, security). Obviously, not all sectors could be explored.
- A piloting mode among those identified thanks to the exploratory work of the first component and the company visits.

A description of these eight cases of fictitious companies and ten employees is presented according to these two criteria in table 7.

Table 7. Description of fictional companies

Company name	Sector	Type of management	Employee 1 (name, age & work)	Status	Employee 2 (name, age & work)	Status
Natur.ielles	Cosmetics	Algorithmic management	Gaspar T. Age: 44 Job: ▪ Chief narrative officer	Employee		
MobAgro	Agriculture (Poultry)	Autonomous team	Ludivine C. Age: 32 Job: ▪ mobile chicken slaughterhouse operator	Employee		
France Inclusive	Service	Algorithmic management	Zeeshan R. Age: 32 Job: ▪ Micro jobber	Temporary migrant worker		
Harmoniales	Health services	Autonomous team AND Algorithmic management	Nadia E. Age: 41 Job: ▪ HR coordinator	Employee	Leila B. 55 Nursing / childcare assistant	Employee
FlexCo	Tertiary	Algorithmic management	Jaime Age: 34 Job: ▪ Prompt ingeneer ▪ Watcher ▪ Editor ▪ Live singer	Self employed		
Co'Peint		Cooperative of independant workers	Guillaume M. Age : 63 Job : ▪ House Peinter (working with a cobot)	Salaried entrepreneur		
Cycle2	industry	Industry 4.0 factory AND Autonomous teams		Temporary employee		
Grrreen	Recycling	Autonomous teams	Sebastien C. Age: 52 Job: ▪ Entrepreneur ▪ Handyman ▪ Coach	Entrepreneur	Clara S. Age: 19 Job: ▪ Handyman ▪ Coach ▪ assistant	Apprentice

In addition, each story had to include at least one driver and one work dynamic from among those identified in the first component. The overlap of these drivers and dynamics by the different stories was verified and proposed to readers (see table 8).

	Natur.ielles	MobAgro	France Inclusive	Harmoniales	FlexCo	Co'Peint	Cycle2	Grrreen
Work dynamics								
Remote working	x		x	x	x		x	
Computerisation	x		x		x			
Working time	x	x					x	x
Collaborative economy								x
Workplaces			x	x	x			
Computerisation of processes	x		x	x	x		x	
Employment status	x	x	x	x	x	x	x	x
Communication tools	x	x	x	x	x	x	x	
Industrial management							x	
Outsourcing					x		x	
Cooperative model						x		
Professional and social dialogue	x	x		x	x	x	x	
	Natur.ielles	**MobAgro**	**France Inclusive**	**Harmoniales**	**FlexCo**	**Co'Peint**	**Cycle2**	**Grrreen**
External variables								
Automation		x				x	x	
Polarisation			x				x	x
Climate change	x		x				x	x
Relationship to the land		X		x			x	x
Relationship to work		x			x			x
New generations	x						x	x
Ageing		x		x		x		x
Societal transformations	x							x
Inclusion	x		x					
Migration			x		x			
Geopolitical context			x					

Table 8. Correspondence between external variables and dynamics of work with fictional design narratives

The results of this work are compiled in a booklet available in French in the final report of the exercise[34].

Examples of a company and an employee produced during this workshop are available in Figures 2, 3 and 4.

Figure 2.

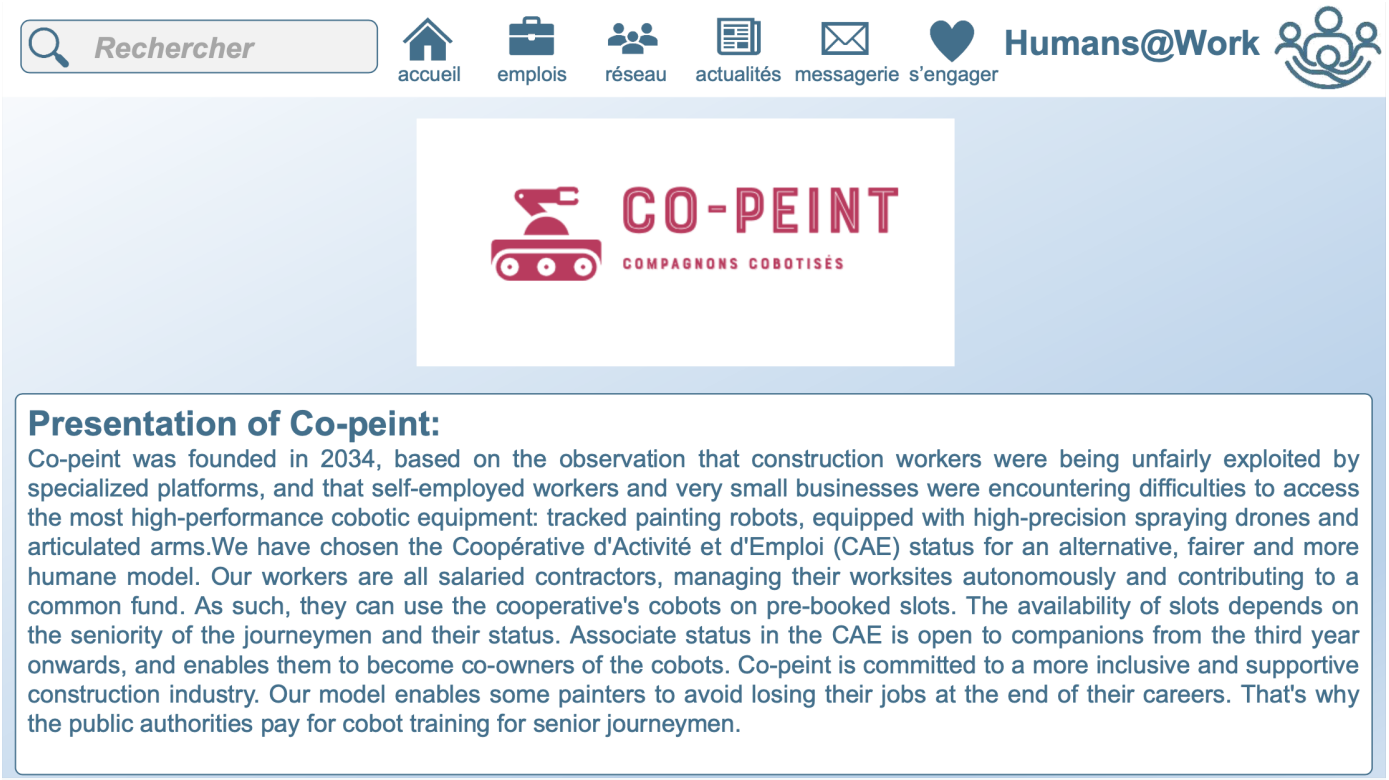

Figure 3.

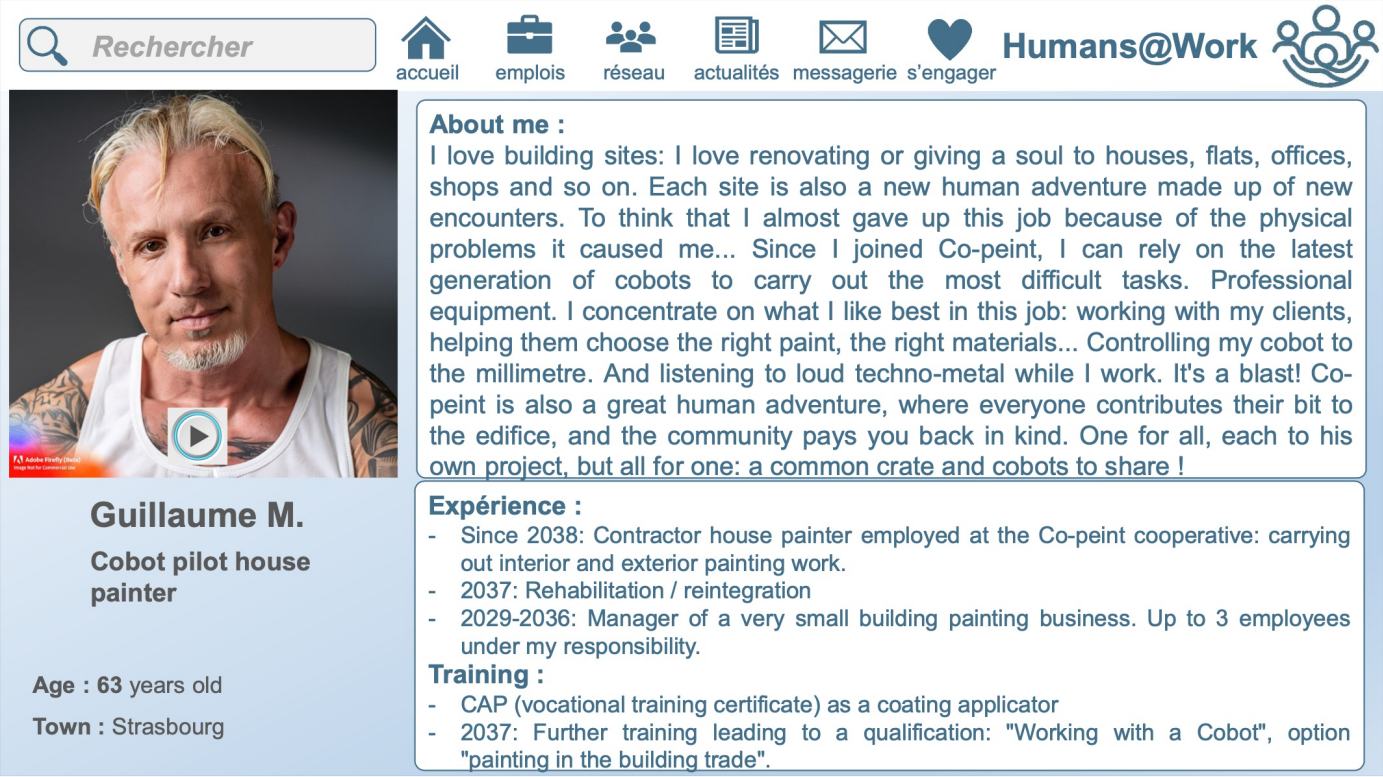

Figure 4.

3.3. Analysis of fictional business cases

The results of component 3 are the fruit of contributions from a group of OSH experts (see table 3.) to whom the fictional design booklet was submitted so that they could put forward their point of view on each fictional case and discuss it in workshops organised by the INRS. The OSH issues specific to each company and their work organisations and conditions are detailed in the design fiction booklet.

Overall, five transversal potentially harmful trends have emerged:

1. Flexibility that isolates workers

The organisations described in this report are often characterised by a search for flexibility to cope with fluctuations in demand and changes in the economic climate. This development can be described as a trend, as it has already been underway for many years, with the growth of subcontracting, temporary work, short contracts, etc. The culmination of this process is the strong growth in one-man businesses, with each worker becoming an economic unit to which tasks of varying degrees of technicality and duration can be entrusted. This quest for flexibility, motivated by the quest for cost reduction and resilience in the face of successive crises, has had a number of consequences in terms of risk prevention management:

- The weakening of collective labour representation and a prevention culture that is difficult to build when teams are constantly changing, working remotely or under different statutes.
- The dilution of responsibilities in certain situations.

- The fragmentation of work into multiple entities with no real working relationship between them.

2. Techno-centric organisations in which the gap between prescribed work and actual work is widening.

The increased use of technology can also be seen as a trend. When they are used to steer activity, these technologies can result in the introduction of algorithmic management and the use of digital tools to monitor and evaluate workers.

The techno-centric use of these tools seems to favour activity management in which technologies can replace middle management by automating instructions and delegating monitoring and assessment to customers, colleagues or users. If this trend becomes widespread, it is likely to widen the gap between prescribed work and actual work, and prove particularly deleterious.

3. A purpose for being that does not always place workers' health at the centre of concerns

The fictitious cases that have been described often highlight the positive impacts that the organisations wish to have: care, environmental protection (circularity), animal welfare, inclusiveness, etc. However, some of these positions seem to allow concessions in terms of working conditions (for example, regarding workspace ergonomics) which can ultimately have deleterious effects on workers' health. In some cases, there may also be new ways of organising work (full remote, four-day week) to promote a better work/life balance. But these changes, which are supposed to meet workers' expectations, can lead to new risks if they are not assessed beforehand. Ultimately, the organisations put in place may even generate effects that run counter to the values put forward (the desire for equal opportunities and inclusiveness, for example, may be counterbalanced by the introduction of algorithmic management leading to the homogenisation of groups).

4. The development of co-activity situations

Another feature of some of the organisations described is the frequency of co-activity. This is linked to the increased use of subcontracting and temporary work, whether by temporary workers or self-employed contractors, as well as to the development of collaboration between stakeholders in the same ecosystem. The working conditions of these workers with different statuses may depend on their interactions, without risk prevention necessarily being a subject taken into account in the management of the activity. This co-activity can exacerbate inequalities between workers according to their status (certain risks may be transferred to a less protected category of workers); it can also lead to more tension between workers and is an aggravating factor in the risk of accidents.

5. Changing expectations in terms of human resources

With the development of automation and artificial intelligence, repetitive and physical tasks are increasingly being transferred to machines. Technological advances are gradually extending this phenomenon to skilled occupations. Workers need to demonstrate new skills: adaptability, ease of learning and understanding to meet the need for flexibility and versatility, the ability to embrace the company's “purpose for being” and its management style are the new skills sought by companies. As a result, we are talking more and more about "soft skills" and less about professional ones. In

the same way that companies are striving to develop their "employer brand", future work situations could increasingly force employees to take care of their image and develop their "worker brand". This phenomenon is being encouraged by the increasing use of platforms for labour relations and the development of self-employment. It is also reinforced by the importance of social networks in the workplace. In this context, there is a risk that professional skills - and with them safety knowledge and know-how - will be devalued in favour of more subjective notions. The resulting emotional demands could be deleterious. This search for profiles with the same system of values and socio-cultural behaviours could accentuate the homogenization of certain workplaces and lead to discrimination against workers who do not have the same social codes despite having a satisfactory level of skills.

The main key messages arising from the discussions on the eight issues have been summarised in 17 key messages and are presented in section 4.4 of this article.

4. Discussion

4.1. Representativeness of fictitious companies and individuals

As described in section 3, the company profiles were drawn up to be as representative as possible of the demography of French companies. To this end, eight sectors of activity were defined as priorities in the preparatory phase of the exercise: personal assistance; transport and logistics; recycling waste treatment and green professions; manufacturing industry (including agri-food); small commerce; service sector; construction and public works, and property management (cleaning, security). Obviously, not all sectors could be explored. Two sectors in particular are missing from the study, namely heavy industry and structural work, which are particularly accident-prone sectors.

4.2. Is design fiction a good tool for supporting a foresight approach?

Confronted with the fictitious cases imagined as part of component 2 of this exercise, the workshop participants, mainly specialists in occupational risk issues, often pointed out that the majority of the situations did not seem desirable to them. However, some also pointed out that many of these cases were simply extensions of developments already observable in current work organisations. The fact that these cases are both undesirable and, in some aspects, already existing in the world of work today, fits in well with the purpose of the exercise, the main aim of which is to envisage the occupational risks that are likely to be prevalent in 2040, in order to better prevent their development today.

Thus, the use of design fiction has highlighted a number of potentially deleterious trends, which are detailed in section 4.5.

However, it is important to note that design fiction is not a self-supporting tool. It can only be considered relevant in terms of the futures it portrays if it is first based on a retrospective analysis stage, which defines the trends and dynamics at work for a given subject (in this case, work situations and conditions), followed by a prospective analysis stage, which proposes several hypotheses and scenarios for possible developments over the next few years. Without this preliminary stage, the imaginary creations of design fiction run the risk of reflecting only the subjective point of view of the participants in the

working group, or of missing a major trend that will determine the future.

4.3. Does the use of design fiction necessarily lead to a dystopian vision of the future of work?

The work situations presented in this exercise have been designed to prompt reactions from prevention specialists. They therefore naturally tend to highlight contexts involving occupational risks, while relying on phenomena that are already emerging. This is why the design fiction booklet built in the framework of this study may give a worrying or even anxiety-provoking picture of the future of work. The authors make it clear that the purpose of foresight is not to predict the future, rather it is designed as a tool to encourage those involved to take action today to collectively build a future for work that is, if not ideal, at least decent. A possible follow-up to this study could be to imagine a fictitious case study favourable to working conditions, based on the same drivers and trends previously identified.

4.5. Key messages of the working group for OSH stakeholders facing changes in work organisations

As a conclusion to this exercise devoted to the evolutions of work management methods, the working group has identified a series of key messages, which are presented below in three parts:

1. OSH issues:

- The increasingly frequent use of information and communication technologies to manage activities raises a number of issues, particularly the reduction in the number of supervisory staff, the widening gap between prescribed work and actual work, and the intensification of work.
- New management methods often introduce assessment systems that make working conditions invisible, in particular affecting the resources available to workers to carry out their tasks: quantitative assessments focused on results based on data collected remotely, ratings by customers, users, colleagues, etc.
- The quest for flexibility in organisations, combined with an increase in worker individuation, is leading to a risk of work collectives breaking down.
- Professional skills associated with initial training could be less and less valued, in favour of more subjective notions of "soft skills" and to the detriment of safety knowledge and know-how.
- Organisations could find it increasingly difficult to align their practices with their rhetoric. Discrepancies between stated values and workers' experiences could pose major psycho-social problems.
- Certain organisational changes run the risk of diluting or even eliminating responsibility for OSH. As this is often a prerequisite for implementing a real prevention policy, maintaining and clarifying responsibilities is an important issue.
- Changes in production methods and future technological developments will increase the need to maintain workers' employability throughout their careers. At the same time, there is a risk of losing professional skills and associated safety know-how, which could prove detrimental.

2. How to build a context favourable to prevention:

- Employers' liability could be used as a lever to encourage and not just to coerce. The “name and shame” practice is

undoubtedly an avenue to be explored in the future to encourage organisations to be exemplary in prevention.

- Bringing all workers under the same occupational injury and disease insurance scheme would facilitate and legitimate the work of external OSH officers and make it easier to monitor workers' state of health.
- Spaces for collective discussion on work should be incorporated into all forms of activity management in order to establish effective social and professional dialogue leading to improved working conditions.
- The importance in terms of prevention of maintaining local management, in daily contact with operators, should be stressed in contexts where organisations may be tempted to reduce the number of hierarchical layers.
- The design and integration of technologies should systematically take account of real work and the impact on OSH throughout the life cycles of products.
- The objective of decarbonising the economy will require changes to production systems, which will provide opportunities to incorporate prevention into the management systems that will accompany them, provided that this concern is present in their design.
- A core of basic knowledge integrating the fundamentals of prevention will be necessary, to maintain workers' employability throughout their careers and limit the risk of losing professional skills and associated safety know-how.

3. Prospects for OSH professionals:

- In these new ways of organising work, OSH officers will see changes in the nature of their work and how they do it. They may be less and less restricted to a purely technical field. They may be called upon more often to:
  - . begin by supporting the establishment of prior social and professional dialogue within the organisations they work with;
  - . support the technical and organisational transformation of companies (introduction of new technologies, decarbonisation of processes, transformation of management methods, etc.).
- Faced with a heterogeneous workforce, OSH officers will also have to seek to use the data collected in workplaces and from workers for collective prevention purposes.
- These developments mean that OSH staff will need to develop their skills, particularly in terms of technology and its implications for work organisation.
- The diversification and increasing complexity of business management methods should encourage the development of monitoring and expertise in technological, industrial and managerial developments and their consequences for OSH.

5. Conclusions

Based on a preliminary analysis of future trends and developments in the way work will be managed in 2040, this project has produced eight profiles of fictitious companies and ten workers’ personae projected in the future. The aim of these productions was to encourage OSH planners to explore the necessary adaptation of their profession in order to continue to effectively prevent the occupational risks that are likely to dominate.

The use of design fiction as a complement to the prospective approach experimented as part of this project proved to be particularly effective in provoking reactions from a group of occupational risk prevention professionals and initiating reflection on the necessary adaptations of occupational risk prevention to changes in work organisations. It has produced a series of recommendations that these players will be able to use in the future to adapt their practices. However, it is important to note that design fiction is not a self-supporting tool, and that it needs to be based on a preliminary phase of prospective analysis to be truly relevant and credible.

Some of the fictitious companies of 2040 that emerged from the design fiction workshops proved to be particularly dystopian. A follow-up project would be worthwhile, the aim of which would be to imagine a company that projects a more positive future, in order to identify the characteristics of a work organisation in 2040 that would be beneficial to workers and their health and safety.

In addition, given that the case of certain sectors could not be explored within the framework of this project, it would be interesting to pursue the work by conducting workshops with the players in the target sectors (particularly in industry and construction).

The players involved in occupational risk prevention are going to have to review their place within organisations that are undergoing transformation and adapt to the changing nature of risks.

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